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On outsourcing and offshoring:
Challenges facing management and engineering

PhD thesis 18.2011

DTU Management Engineering

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Summary

This study investigates the challenges engineering companies face when globalising the product development process through offshoring and outsourcing. Furthermore, to investigate the solutions the companies took to address these and the impact these had on the organisation, the engineering processes and the engineers.

The research methodology framework developed by Blessing & Chakrabarti (2009) was employed in this thesis. This framework consists of four phases; (1) Clarifying the research area, (2) Illustrating the current situation and the desired situation, and the gap between these (the descriptive study), (3) Illustrating how to close this gap (the prescriptive phase I) and (4) Validating these results (the prescriptive phase II). Two descriptive studies were carried out as case studies with seven Danish multinational corporations. A total of 57 semi-structured interviews were conducted with top managers, daily managers and expatriates. In study 1 four areas were investigated: (1) the global product development process in the investigated case companies, (2) the challenges they experienced, (3) the solutions they implemented, and (4) the impact of these solutions. In the descriptive study 2 the use of expatriates were investigated in relation to their role in the organisation when globalising the product development process.

Through investigating seven Danish multinationals it became clear that global product development had an impact on both management and engineering projects within the companies. The globalisation of the product development process started with manufacturing activities and later more high value adding activities like product design and R&D were added until some companies had globalised the whole product development process.

The globalisation of the product development process consist of four phases:

1. Motivation to move abroad.
2. Preparation phase.
3. Implementation phase.
   ➢ Complications.
   ➢ Operational solutions to complications.
4. Managing the relationship.
   ➢ Complications.
   ➢ Operational solutions to complications.

Only top management was involved in these first two phases. In implementation and managing the new global projects and relationships, the daily managers and expatriates were responsible. In these phases the companies faced organisational problems and complications with the technical and managerial aspects of the engineering projects. The problems within management were similar to those previously reported in literature, mainly related to culture, knowledge sharing and coordination but also change management and organisational structures and processes. The problems within engineering were related to product and process modularity as well as the

knowledge properties of the product. These problems resulted in delays, misunderstandings and quality issues.

The novel aspect of the empirical investigation was the in-depth understanding of how these challenges were addressed in the company to try and maximise the perceived benefits from globalising the product development process. The daily managers implemented a series of initiatives to address these; mainly codification of knowledge, streamlined communication, training, bringing more tasks out to ensure contact between vital elements, make the product development process less complex, make the product less complex and detailed work descriptions.

There was, in other words, a focus on control and minimizing risk. The result of these solutions impacted on the product, the product development process and the organisation. Some of these impacts were positive and some were negative.

The positive impacts of the solutions were related to a better understanding of work processes and the supply chain whereas globalisation itself provided the possibility for an increased product portfolio and products which were better suited to local markets.

The negative impacts were for example, that the product development process became slower and less integrated whereas the organisation became more focused on codified knowledge and written communication. However, complications remained with both many of the original challenges with globalising the product development process and the negative impacts of the implemented solutions. The companies thereby went through an iterative process of facing complications and suggesting operational solutions.

There was a lack of a clear strategy with globalising product development which meant a decoupling between the strategic and the operational level of the organisation. There was furthermore a decoupling between the operational and strategic layers of the organisation due to the task division between these in the globalisation process. As a result there was a focus on operational challenges and solutions in the later phases of this process.

The reason for remaining challenges can be explained on two levels; the operational and the strategic level. On the operational level organisational theory, including change management and cultural studies, indicated a lack of preparation of the organisation for the change globalising product development led to.

Furthermore, there was a lack of an iterative and reflective process within the globalisation process itself. This meant best practices from change management, product development models like the stage gate model and outsourcing/offshoring literature concerning how to conduct the globalisation process had not been followed, in particular in the early phases as these called for extensive preparation.

Knowledge management showed a lack of knowledge sharing initiatives within the headquarters and between it and subsidiaries as well as other stakeholders. Control theories such as organisational cybernetics show a lack of measurable outputs and continuous adjustments according to these

measurements compared to specified goals. Network configuration theory within the operations research area showed a less than optimal global network configuration, which could explain issues with coordination, knowledge sharing and misunderstandings.

On the strategic level the problems can be seen as the result of the approach the companies had to decision-making; (1) a decoupling between the strategic and operational level of the organisation and (2) a focus on symptoms instead of causes. This meant that decision-making and problem solving were single-loop learning and focused mainly on short term gains. This resulted in problems that were not resolved, though the effects of the problems could be minimized. However, as more complex tasks started to move out, the solutions the companies implemented became less and less effective as such tasks in their very nature are hard to resolve using tools such as modularity, work process descriptions and decoupling to other tasks and functions.

A framework was developed which can minimise the negative impact of globalising the product development process and address the challenges the company has today on both an operational and a strategic level; thus ensuring a short term as well as a long term perspective can be taken.

It is proposed that companies who wish to globalise product development go through an iterative process of five stages and see their decision process as being a part of continuous adaptation and improvement to fit the organisation with an ever-changing market. This framework is called the Global Decision Making (GDM) framework. These five stages are (1) strategic goal setting, (2) strategic planning, (3) operational planning, (4) implementation and (5) evaluation.

These five stages have several steps as indicated in the following:

Stage 1: Strategic goal setting
      1.   Clarify the desired/ideal market position for the company.
      2.   Clarify key performance indicators for reaching this position,

Stage 2: Strategic planning
      1.   Clarify the current market position for the company.
      2.   Clarify the gap between the current and ideal market position i.e. the business problem the company seeks a solution.
      3.   Evaluate the best approach to move from the current to the desired position, including which factors encourage using globalisation as a tool to do so and which factors discourages this.

Stage 3: Operational planning
      1.   Select the task to be moved abroad.
      2.   Clarify the possible external changes and impacts due to moving this task and implement any necessary changes.
      3.   Clarify the possible internal changes and impacts due to moving this task and implement any necessary changes.
      4.   Select key performance indicators.

Stage 4: Implementation
1. Move the task.
2. Implement key performance indicators.
3. Implement possible changes due to measurements from the key performance indicators.

Stage 5: Evaluation

The GDM framework relies on going through these five stages and combining the idea of approaching the ideal market position through smaller steps while utilising best practices and considerations from several theoretical fields, including organisational theory, change management, engineering project management like the stage gate model, and network configuration from operational research. The GDM framework uses double-loop learning to ensure causes for problems are investigated and addressed. In this way the challenges seen in the case companies can be resolved or minimised at an early stage through using key performance indicators and a continuous feedback loop so the implemented change matches the strategic plan for the organisation.

This research has therefore contributed new knowledge within this research area by:
- Illustrating the challenges, implemented solutions and their impact on the organisation and the management of engineering projects when engineering companies offshore or outsource product development process activities.
- Analysing these challenges and impacts using different theoretical tools from organisational studies and operations research.
- Demonstrating the disconnection between operational and strategic problem-solving in the organisation when globalising the product development process.
- Showing how offshoring and outsourcing of activities in the product development process can be incorporated into a change management and technical project management perspective.
- Illustrating a Global Decision Making framework which incorporates different theoretical fields in order to view offshoring and outsourcing from both an operational and a strategic perspective.
- Illustrating an iterative and reflective Global Decision Making framework which allows for organisational learning and continued adaptation as markets and conditions change.

The GDM framework is a tool companies can use when globalising the product development process. It utilises methods which are well known in industry. The validation process showed industry partners found the tool understandable and useful although behaviour and results when implementing the framework has yet to be evaluated.

The GDM framework can be customised in each company to fit their specific environment and characteristics. Furthermore, whether to make large or small changes in the organisation is up to each company depending on available resources and the aim for globalising the global product development process.

The framework can help companies address and minimise risks and could thereby help companies reach their goal and lessen the chance of costly mistakes in the globalisation of product development process activities.

Resume

Dette studie har undersøgt de udfordringer ingeniør firmaer møder når de globaliserer produkt udviklingsprocessen igennem offshoring og outsourcing. Derudover er de løsninger firmaerne implementerede for at imødekomme disse udfordringer og den påvirkning disse har på organisationen, tekniske processer samt ingeniørernes arbejde, blevet undersøgt.

Forskningsmetoden som beskrevet af Blessing & Chakrabarti (2009) bliver brugt i denne afhandling. Denne metode består af fire faser; (1) Klargør forskningsområdet, (2) Illustrerer den nuværende og ønskelige situation og forskellen imellem disse (det deskriptive studie), (3) Illustrere hvordan den ønskelige situation kan opnås og (4) Validering af disse resultater. To deskriptive studier blev gennemført igennem case studier med syv danske internationale firmaer. 57 semi-struktureret interviews blev gennemført med ledere, daglige managers samt udstationerede ingeniører. I det første deskriptive studie blev fire områder undersøgt: (1) den globale produkt udviklings proces gennemført i case virksomhederne, (2) de udfordringer de oplevede, (3) de løsninger de implementerede, og (4) den indflydelse disse havde på organisationen, de tekniske processer og ingeniørernes arbejde. I det andet deskriptive studie blev brugen af udstationerede ingeniørerne i relation til global produkt udvikling undersøgt.

Ved undersøgelsen af de syv case virksomheder blev det klart at globalisering af produkt udviklingens faser havde en indflydelse på ingeniør projekter samt management i firmaerne. Globaliseringsprocessen af produkt udvikling startede med produktion og senere blev flere funktioner som produkt design og R&D tilføjet, indtil nogle virksomheder havde globaliseret hele produktudviklingsprocessen. Globaliseringsprocessen ser ud til at bestå af fire faser:
1. Motivation til at globalisere.
2. Forberedelses fase.
3. Implementerings fase.
   ➢ Problemer.
   ➢ Operationelle løsninger til disse.
4. Daglig ledelse.
   ➢ Problemer.
   ➢ Operationelle løsninger til disse.

Ledelsen var involveret i de første to faser. I fase 3 og 4 var det de daglige managers samt udstationerede ingeniører som var ansvarlige. I disse faser blev firmaerne mødt med organisatoriske problemer og udfordringer med den tekniske og managementdelen af ingeniør projekter. Problemerne i management var ens til de der tidligere er blevet vist i litteraturen, nemlig relateret til kultur forskelle, forandringsledelse, vidensdeling samt koordination. Netværk konfiguration var en ny måde at se problemstillingen omkring offshoring og outsourcing af produkt udviklings funktioner og elementer. Ingeniørmæssige problemer var relateret til produkt og proces udviklingsprocessens mulighed for at blive opdelt i moduller samt videns aspekterne af produktet.

Disse problemer resulterede i forsinkelser, misforståelser samt kvalitet problemer. Det nye ved denne undersøgelse er især den dybdegående empiriske undersøgelse og forståelse af hvordan firmaerne prøvede at adressere disse udfordringer så deres indflydelse blev minimeret og de kunne

få mest muligt ud fra globaliseringen af produkt udviklingsprocessen. De daglige ledere implementerede en række løsninger.

Disse var mest fokuseret på kodificering af viden, ensrettet kommunikation, træning af udenlandsk personale, flytte flere funktioner ud for at bevare kontakten imellem vitale dele af produkt udviklingsprocessen, lave produkt udviklingsprocessen mindre kompleks, lave produktet mindre kompleks og at lave detaljerede job beskrivelser.

Der var med andre ord fokus på kontrol og på at minimasere risiko. Resultatet af disse løsninger havde en indflydelse på produktet, produkt udviklingsprocessen og organisationen. Nogle af disse var positive, mens andre var negative. De positive konsekvenser var relateret til en bedre forståelse af arbejdsgange og firmaets forsyningskæde, mens globalisering i sig selv gav mulighed for at opnå en større produkt portefølje og produkter som var bedre tilpasset det lokale marked. De negative konsekvenser var for eksempel at produkt udviklingsprocessen blev langsommere og mindre integreret samt at organisationen blev fokuseret på kodificeret viden og skriftlig kommunikation. Til trods for disse løsninger kæmpede firmaerne forsat med de oprindelige udfordringer samt de negative konsekvenser af løsningerne. Firmaerne gik derfor igennem en iterativ proces af problemer og operationelle løsninger. Globaliseringsprocessen af produktudvikling var derfor opdelt i to dele, den strategiske og den operationelle del, som ikke var integreret. Som et resultat var der en fokus på operationelle løsninger.

Grunden til disse udfordringer kan forklares på to niveauer; det operationelle og det strategiske. På det operationelle niveau kan organisationsteori, forandringsledelse samt kultur studier vise at der er en mangel af forberedelse i organisationen til de forandringer globaliseringen af produkt udviklingsprocessen ville føre til. Der var ingen klar strategi med globaliseringen af produkt udviklingsprocessen, hvilket betød de to niveauer ikke var integreret. Desuden var der en mangel på en refleksiv og iterative proces som en del af globaliseringsprocessen. Dette bevirkede at 'best practices' fra forandringsledelse, modeller fra produktudvikling som stage gate modellen samt outsourcing/offshoring litteraturen omkring hvordan man skal globalisere ikke blev fulgt, især ikke i de tidligste faser. Videns ledelse viste en mangel på vidensdelings initiativer indenfor hovedkvarteret samt imellem dette og datterselskaber og udenlandske afdelinger og til andre interessenter. Kontrol teori som organisatorisk kybernetik vidste en mangel på målbare output samt kontinuer regulering ud fra disse målinger for at sikre den ønskede forandring sker. Netværk konfigurations teori indenfor operations management viste der var et mindre end optimalt netværk konfiguration, hvilket kunne forklare mange af problemerne med koordination, vidensdeling og misforståelser.

På det strategiske niveau kan problemerne ses som et resultat af den beslutningsproces firmaerne fulgte; (1) en frakobling imellem det strategiske og operationelle niveau og (2) en fokusering på symptomer og ikke de underlæggende årsager. Dette betød beslutningstagning og problemløsning var single-loop læring med et fokus på korte mål. Dette bevirkede blandt andet at problemer ikke blev løst, men deres indflydelse kunne minimaseres. Da mere komplekse opgaver blev flyttet ud blev de løsninger firmaerne implementerede mindre og mindre effektive, da sådanne opgaver i sagens natur er sværre at løse med værktøjer som modul inddeling, arbejdsgangs beskrivelser og en frakobling fra andre opgaver og funktioner.

Et framework kan udvikles som minimasere de negative konsekvenser af globaliseringen af produktudvikling og adressere de problemer virksomhederne blev mødt med i dag på bade et operationelt og et strategisk niveau. Dette sikre et korttids samt et langtids perspektiv på globaliseringsprocessen.

Dette framework til globalisering af produktudvikling er en iterative proces med fem stadier, hvor beslutningsprocessen er en del af en kontinuer tilpasning og forbedring af organisationen til markedet. Dette framework kaldes Gobal Decision Making (GDM) framework. De fem stadier er (1) strategisk målsætning, (2) strategisk planlægning, (3) operationel planlægning, (4) implementation og (5) evaluering.

Disse stadier har adskillige trin som vist nedenfor.

Stadie 1: Strategisk målsætning
1.   Klargør de ønsklige/ideelle marked position for firmaet.
2.   Klargør 'key performance indicators' for at nå denne position.

Stadie 2: Strategisk planlægning
1.   Klargør den nuværende marked position for firmaet.
2.   Klargør forskellen mellem den nuværende og den ønskelige marked position; dvs. det forretningsproblem firmaet vil løse.
3.   Evaluer de faktorer som tilskynder at globalisering bruges som et værktøj til at løse denne problemstilling og de faktorer som ikke tilskynder dette.

Stadie 3: Operational planlægning
1.   Vælg den funktion eller opgave der skal flyttes.
2.   Klargør de mulige eksterne forandringer og konsekvenser af at flytte denne funktion eller opgave og implementer de nødvendige forandringer.
3.   Klargør de mulige interne forandringer og konsekvenser af at flytte denne funktion eller opgave og implementer de nødvendige forandringer.
4.   Vælg 'key performance indicators' for at støtte denne flytning.

Stadie 4: Implementation
1.   Flyt opgaven ud.
2.   Implementer 'key performance indicators'.
3.   Implementer mulige forandringer baseret på malinger fra disse 'key performance indicators'

Stadie 5: Evaluation

GDM frameworket går igennem disse fem stadier og kombinere ideen om at gå imod en ideal markedsposition igennem mindre skridt ved at gøre brug af 'best practice' fra mange teoretiske felter som organisationsteori, forandringsledelse, ingeniør projekt ledelse som stage gate modellen, og netværk konfiguration fra operations management. GDM frameworket gør brug af double-loop læring for at sikre årsager til problemer findes. På denne måde kan de udfordringer som virksomhederne står overfor løses eller mindskes tidligt i forløbet ved at bruge key performance indicators og et kontinuert feedback loop som sørger for forandringer tilpasses organisationens strategi.

Dette forsknings studie har bidraget med ny viden indenfor dette forskningsområde ved at:

- Illustrere de udfordringer, firmaernes løsninger og deres påvirkning på organisationen, produktet, de tekniske processer og ingeniørernes arbejde ved offshoring og outsourcing af produktudviklingsprocessen.
- Analysere disse udfordringer ved hjælp af forskellige teoretiske metoder fra organisations studier og operations management.
- Illustrere den frakobling der er mellem det operationelle og det strategiske problemløsningsområde i virksomhederne der blev undersøgt.
- Illustrere hvordan offshoring og outsourcing af produkt udvikling kan indarbejdes i et forandringsledelse og et teknisk projektledelses perspektiv.
- Illustrere et Global Decision Making framework som gør brug af forskellige teoretiske områder for at kunne se offshoring og outsourcing af produktudvikling fra både en operationel og en strategisk vinkel.
- Illustrere et iterativt og refleksivt Global Decision Making framework ved brug af organisatorisk læring som kontinuert tilpasses og forandres som marked tilstande ændres.

GDM frameworket er et konkret værktøj firmaer kan bruge når de globalisere deres produktudviklingsproces. Dette framework benytter metoder som er velkendte i industrien. Valideringsprocessen viste at repræsentanter fra industrien fandt dette værktøj brugbart og let forståeligt selv om adfærd og resultater ved implementering endnu ikke er blevet evalueret.
Dette framework kan detaljeres i virksomheder så det passer til deres unikke miljø og karakteristika. Derudover, hvorvidt organisationen vil lave store eller små forandringer er op til dem ud fra de ressourcer de måtte have til deres rådighed, samt målet med at globalisere produktudviklings processen.
Dette framework kan hjælpe firmaer med at adressere og minimasere de risici som er forbundet med globalisering af produktudviklingsprocessen, og kan derigennem hjælpe virksomheder med at nå deres mål med denne proces og mindske chancen for dyre fejltagelser.

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Declaration

Except where otherwise stated, this thesis contains new and original research conducted by the author.

The research project was carried out at the department of Management Engineering at the Technical University of Denmark from June 2008-June 2011.

This thesis has not been submitted in whole or in part as consideration for any other degree or qualification at this University or any other Institute of Learning.

It contains 124579 words, including the appendix.

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Abbreviations

The following abbreviations are used:

AR approach	Avoid Risk Approach
B2B	Business to business
CR approach	Confront Risk Approach
FDE	Facility design and engineering
FDI	Foreign Direct Investment
GDM framework	Global Decision Making framework
GEN	Global Engineering Network
HR	Human Resources
HQ	Headquarters
IA	International assignment
IDA	Danmarks ingeniørforening (Danish Society for Engineers)
KPIs	Key Performance Indicators
M&As	Mergers and acquisitions
MNC	Multinational corporation
MNE	Multinational enterprise
NGOs	Non-Governmental Organisations
OEMs	Original Equipment Manufacturers
O/O	Offshoring and Outsourcing
R&D	Research & Development
RBV	The Resource-Based View
RDT	Resource Dependence Theory
RET	Relational exchange theory
SECI	The socialization, externalization, combination and internalization knowledge model
SKU	Stock-Keeping Unit
SUB	Subsidiary
TCE	Transaction cost economics
TNC	Transnational corporation
VP	Vice president

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Chapter 1 Introduction

Manufacturing as a worldwide activity is now 70% to 80% outsourced to low-cost countries (Corbett, 2005). Having seen the advantages globalisation of production has been able to achieve, European engineering companies are now increasingly globalising product design, product development, and research and development (R&D). Large, medium and small companies, across different industries, are engaged in the process. Understanding this globalisation of the product development process is therefore vital for both industries and communities.

Offshoring and outsourcing have become options which almost all European engineering companies must consider to stay competitive on the global market. Through the globalisation of the product development process, engineering practice and management functions need to reflect the new environment. However, such a decision is often taken hastily and without knowledge of the likely impacts on the organisation, the engineering processes and the engineers. This increases the likelihood of negative consequences for both engineering and management functions. These can include increased cost, delays, errors and misunderstandings with consequent lost business opportunities and increased customer complaints.

There is therefore a need to bridge the gap between decision making and consequences when it comes to offshoring and outsourcing product development process activities. This needs to be viewed from both management and engineering simultaneously, in order to take the most beneficial decisions.

This thesis describes an investigation to gain an understanding of the decision process and impact that offshoring and outsourcing of the product development process has for management and engineering functions. A framework has been created to assist engineering companies who are considering, or are currently engaged in, the globalisation of the product development process. This framework allows companies to gain an idea of what impact a decision to offshore and outsource elements of the product development process is likely to have.

The research was carried out in collaboration with seven Danish multinational corporations which offshored and outsourced product development process activities. The companies were primarily advanced technology companies involved in the business to business industry.

1.1 Research background

Globalisation has changed the world in recent years. It is often used as an umbrella term to describe a "*…process by which the people of the world are unified into a single society and function together. This process is a combination of economic, technological, sociocultural and political forces.*" (Croucher, 2004: 10).

Globalisation implies not only the geographic spread of economic activities across national boundaries, but also functional integration between internationally dispersed activities. While trade between nations has existed almost since the beginning of nations, the current development is seen as a new approach to globalisation which has escalated in the last 20 to 30 years due to various technological and political factors (Friedman, 2005; Dicken, 2007). These factors include the development of the Internet, fewer trade tariffs within certain regions (for example the European

Union), the fall of the Soviet Union, and the rise of China and India. This development cannot be viewed in a deterministic frame because various political, social and technological changes could slow down or stop the process altogether (Dicken, 2007).

Foreign Direct Investment (FDI) has risen dramatically in recent years and accounts for the majority of resources to developing countries (see Figure 1). Most of this is due to mergers and acquisitions which, particularly in the 1990s, created multinational corporations (MNC) (Colotla, 2003).
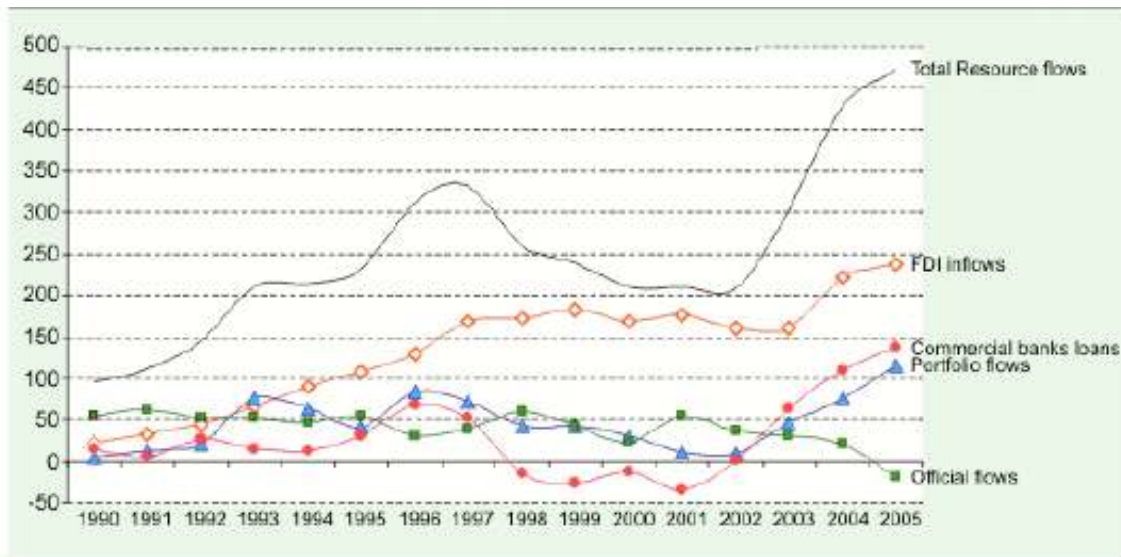
Source: UNCTAD, based on World Bank 2006.
a   Defined as net liability transactions or original maturity of greater than one year.
b   The World Bank's classification of developing countries is used here. It differs from UNCTAD's classification in that it includes new EU member States from Central and Eastern Europe and excludes high-income countries such as the Republic of Korea and Singapore.

Figure 1: Total net resource flows (see def. a) to developing countries (see def. b), by type of flow, 1990-2005. Source: UNCTAD (2006) & World Bank Report (2006)

The interconnectivity of activities due to globalisation has the consequence that global volatility is dramatically affecting the international business society. For example, war in Iraq at the beginning of this century and the following instability in the Middle East, a global economic crisis, greater attention by Non-Government Organisations (NGOs) and media to the ethical behaviour of businesses and their vendors, fluctuating oil prices, and rising wages in developing countries like China and India influence national and international politics and economics as well as organisational decisions for both small and large corporations.

On a corporate level, globalisation is created through – among other things – offshoring and outsourcing of various parts of the company's services, product development, and manufacturing activities. Outsourcing and offshoring occurs when "...*firms relocate their business functions (that were previously performed in-house) to overseas locations. Firms can either embark on offshoring internally, by setting up their own centers or subsidiaries in foreign countries while maintaining full ownership and control or externally, by handing over business functions to independent foreign providers*" (Kedia *et al*., 2009: 250). Companies can relocate activities to five sources: the company's overseas departments (captive offshoring), suppliers, customers, competitors, and strategic alliance partners (Varadarajan, 2009). All the instances of outsourcing this thesis deals with

are offshore outsourcing to suppliers in low-cost countries, and captive offshoring to own centres in low-cost countries. In this thesis the first will be called outsourcing and the latter is referred to as offshoring.

Today's business environment can be said to be characterised by a short time to market, changing customer specifications, global competition, and a demand for local price competitiveness. Outsourcing and offshoring – from manufacturing to R&D - is often the response (Hovit, 2004; The Economist, 2004; Tansey, 2004; Thibodeau & Lemon, 2004; Foremski, 2004). Factors which motivate globalisation are often a combination of the necessity to be close to customers, market access, availability of cheap labour, availability of certain competences, incentives from local governments, reducing transportation costs, and production delivery lead times (Yip, 1992; Ferdows, 1997a; Kedia *et al*, 2009). Cost is one of the most often cited reasons for offshoring or outsourcing business functions and activities (Lewin, 2005).

The history of outsourcing can be traced back almost to the beginning of time when man first started to move tasks and functions to someone else. An example is the use of slaves or prisoners in ancient societies to carry out manual labour and other undesired tasks (Corbett, 2005; Perunovic, 2009). Outsourcing, the way the term is understood in today's business world, has been said to start with IT outsourcing in the 1990s and therefore a lot of research on outsourcing focuses on IT (e.g. Palvia, 1995, Apte, 1991, Lacity, 1993; Bruce, 1998; Pfannenstein *et al*., 2004).

Offshoring has been a part of the economy of the USA since Ford Motor began assembling Model T's at a plant in Trafford Park, England in 1911; the driver was mainly to reduce transportation costs (Sturgeon *et al*., 2005). The process of American companies moving labour-intensive processes to offshore locations to reduce the production costs of goods and services intended for the USA market began in the 1960s. In the late 1990s, the offshoring phenomenon spread from the manufacturing to the service sector. By the turn of the millennium, offshoring services extended to high value services like IT, banking, finance, the medical field, engineering, R&D and product design (Stringfellow *et al*., 2008; Lieberman, 2004; UNCTAD, 2005). Other western countries have followed a similar path although they often started the process later due to the leading manufacturing role of the USA in the early 20th century (Kedia *et al*.; 2009; Ørberg *et al*., 2006; Ferdows, 1997b; Colotla, 2003).

In Denmark offshoring and outsourcing is increasingly a part of the business environment. An investigation showed that Danish companies benefit financially from moving production abroad, and that even more jobs will be moved abroad in the coming years (Springborg & Skovgaard, 2010). Furthermore, approximately 90% of Danish companies have outsourced some of their services (Demoskop, 2006; Dansk Industri, 2004). (For more on the background for offshoring and outsourcing, see Appendix 1.)

Companies can offshore or outsource a product, a service, a process, or a function from the product development process (see Figure 2 on the following page for an example of outsourcing).
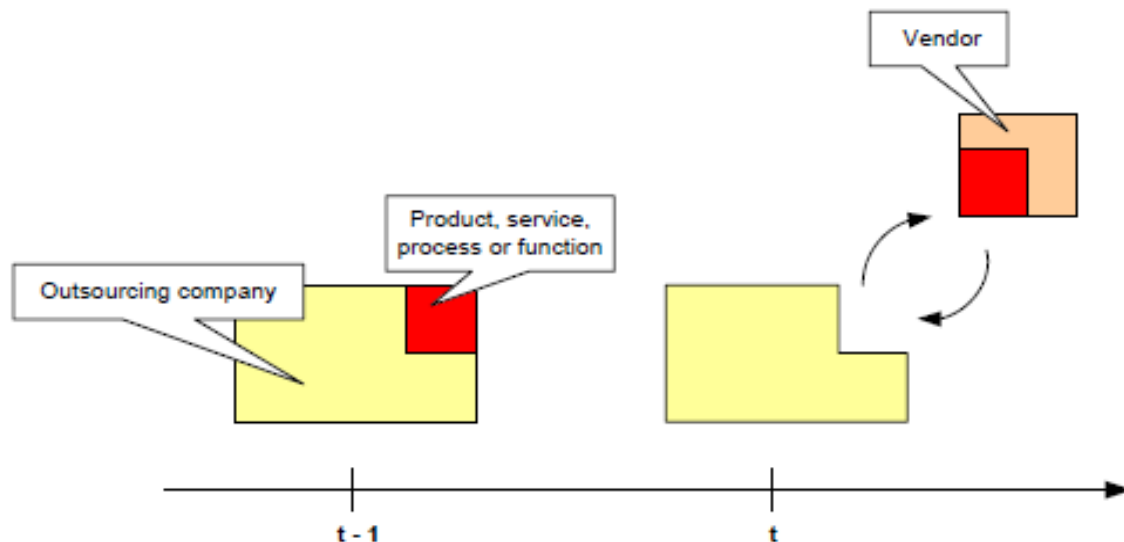
Figure 2: The definition of outsourcing.
Source: Perunović (2009)

These four options to offshore and outsource are in this thesis referred to as 'a task', 'elements' or 'activities', and the four options are defined as follows:

- **Function:** One of the elements which make up the product development process as described by Ulrich & Eppinger (2008) and expanded to include manufacturing (e.g. manufacturing, detailed design).
- **Process:** A collection of related, structured activities or tasks that produce a specific service or product.
- **Product or product module:** A whole product or a part of a product. Examples of product modules are a wind turbine or a module in the development of an interactive webportal.
- **Service:** A service is an activity which does not result in a physical object like knowledge activities or some Human Resource (HR) functions.

Multinational corporations have many options and possibilities to globalise through offshoring or outsourcing product development elements. However, the challenges include; what should be offshored, what should be outsourced, how much of the product development process should be globalised, and what are the consequences? Furthermore, this decision has to be sustainable; by this is meant that it is viewed as a good decision for the company in both the short and long term.

To answer these questions, companies need to be aware of the possible impacts choosing one course of action over another can have. However, previous research within this area has called attention to the lack of literature on how companies deal with offshoring and outsourcing to create potential benefits (e.g. Maskell *et al.*, 2007).

This thesis investigates the challenges and impacts for engineering companies in regard to globalising the product development process, and how they have dealt with them to create potential benefits. A framework detailing the decision process which considers possible impacts is then presented with which companies can make a more informed response to the above questions.

1.2 Connecting management and engineering

Many studies have debated the management of engineering and how this has changed over time (e.g. Robertson, 1960; Thamhain, 1992), but it is rare that engineering and management practices have been combined (e.g. Morse & Babcock, 2010).

However, it is evident that both management and engineering are critical for the successful globalisation of the product development process. These tasks rely heavily on technical knowledge and expertise, while the combination of different technical skills and engineering practices which are globally distributed become a managerial challenge to coordinate. Management of the globally distributed people, the organisation and its routines, processes, and procedures, can influence how engineering tasks are carried out, how problems are viewed, and how solutions are proposed.

1.3 Research objectives and aims

This study investigates the challenges and impact of offshoring and outsourcing product development process activities in order to create a more holistic picture of global product development. The focus is on the organisation, the engineering processes and the engineers. In this way the consequences for the organisation, its management, structure and employees affected by globalising the product development process can be investigated.

The objective of this research is to:

1. Investigate how decisions regarding the globalisation of the product development process are taken today.
2. Investigate the challenges offshoring and outsourcing of product development process activities present for the organisation, the engineering processes and the engineers.
3. Investigate the impact globalisation of product development process activities has on the organisation, the engineering processes and the engineers.
4. Investigate the response companies take in order to handle these impacts.
5. Create a framework which considers these impacts in the decision process.

1.4 Research question

This thesis addresses the following key question:

How can the challenges and subsequent impact of offshoring and outsourcing of product development process activities be addressed in the decision process?

To address this question, the study investigates existing theories and models in the field and conducts an empirical study of the present situation of globalising product development process activities in Danish engineering companies. Based on this, a framework is developed for the decision process which incorporates these aspects of offshoring and outsourcing of product development process activities.

For this study, the *success criterion* is that the globalisation of the product development process more adequately fulfils the goals set for this endeavour in terms of competitive advantage. The *measurable criterion* is the difference between the budgeted negative impacts within a given timeframe, compared to the realised costs and resources spent.

1.5 Scope and assumptions

This project focuses on business-to-business (B2B) manufacturing engineering companies. It is limited to offshore outsourcing and captive offshoring to low-cost countries of product development process activities; although it is assumed the findings could be helpful for domestic outsourcing and offshoring as well (for more on this, see chapter 7).

Empirically investigated impacts are focused on the engineering process (including the product), the engineers, and the organisation.

Low-cost countries are in this thesis China, India, and Eastern European countries due to the geographic of the case companies. The study is further limited by the research approach and other research decisions taken (see chapter 3 for more on this).

A major assumption this study makes is that by having knowledge of likely positive and negative impact factors for management and engineering when outsourcing or offshoring product development process activities already in the early decision phase, the chance of costly mistakes and redesign can be noticeably lessened.

Another assumption is that the decision process is influenced by the organisational context, as well as stakeholders both inside and outside the organisation. In other words it is:

- A complicated process which includes multiple stakeholders.
- Is influenced by many tangible and intangible factors.
- Is influenced by formal as well as informal networks.

This creates the organisational context and how knowledge bears upon both engineering and management practice when offshoring and outsourcing product development process activities.

Therefore, this research has high value for companies as they would probably not have documented and analysed the globalisation process for globalising product development process activities and its impacts as it is a complex process which is challenging to order and make sense of in simplistic models.

1.6 Problem complexity

Globalising the product development process will constitute a change in the organisation and therefore a change in the work and how it is approached by the employees. This change can also affect suppliers, customers and local environments due to the movement of labour and tasks. Stakeholders – defined as anyone the change affects - therefore become relevant to consider.

The complexity of a problem can influence the kind of solutions which can be implemented and the possibility for generalisation of these. As mentioned previously, globalising the product development process can be influenced by many factors (e.g. increased cost pressures, shorter time to market). This interconnectivity inherent in globalisation indicates that the research area is influenced by several knowledge fields, and that investigations should take an inter-disciplinary approach. Furthermore, the involved stakeholders – the leaders, managers and engineers in the multinational and its subsidiaries, its customers, suppliers etc. – have different backgrounds and cultures yet are a part of the same global network through their connection to the multinational. Stakeholders are therefore assumed to have a pluralist view – different interests but the same values

– which means a solution can be reached based on a compromise between these (Hazy *et al.* 2007; Howard-Grenville, 2005, Jackson, 2003; Jackson, 2000; Jackson & Keys, 1984).

The problem researched in this thesis can therefore be expected to represent:

- Interdisciplinary problems.
- Interest conflicts.
- Difficulty to agree on solutions.

The framework presented in this thesis can therefore be expected to be general and present an overall picture of the investigated area. However, detailed solutions are out of scope as it would require individual solutions for each situation as well as involvement of stakeholders so their values and interests can be accommodated. (For details regarding problem complexity see chapter 3.)

1.7 Research approach

This research follows the Design Research Methodology (DRM) as proposed by Blessing and Chakrabarti (2009), which consists of four main phases:

1. Clarifying the research area.
2. Illustrating the current situation and the desired situation, and the gap between these (the descriptive study).
3. Illustrating how to close this gap (the prescriptive phase I).
4. Validating these results (the prescriptive phase II).

The research is built upon existing theories whenever possible, and by using the case study approach the research is kept current and applicable for industry. The DRM framework is covered in detail in Chapter 3 where the research methodology is presented.

1.8 Thesis structure

This thesis has nine chapters (see Figure 3) which are structured according to the DRM framework.
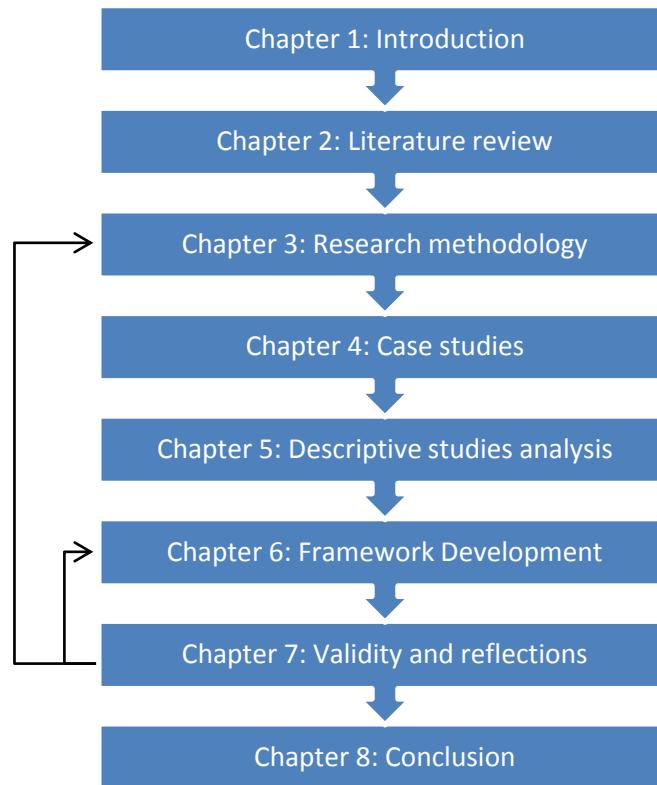
Figure 3: Thesis chapters and direction

The individual chapters are structured as follows:

Chapter 1: Introduction - Introduces the topic, the research aim, the research approach, and the research objectives.

Chapter 2: Literature review - Illustrates current literature on the topic and ends by providing the preliminary framework for this study.

Chapter 3: Research methodology - Details the research method. This thesis employs a case study approach and makes use of the explorative interview method. The criteria for the selection of cases and interviewees are detailed.

Chapter 4: Case studies - Covers the two descriptive studies and details the case companies and the findings from the empirical study. In study one four areas were investigated: (1) the global product development process in the investigated case companies, (2) the challenges they experienced, (3) the solutions they implemented, and (4) the impact of these solutions. In the second descriptive study the use of expatriates were investigated in relation to their role in the organisation during globalisation of the product development process.

Chapter 5: Descriptive studies analysis - Contains the analysis and discussion of the findings in relation to previous literature and case studies. This chapter clarifies the current situation, the desired situation, and identifies the gap between these.

Chapter 6: Framework development - Details the prescriptive phase I and provides the proposed framework which address the research aim and research question, and which is created to help lessen the identified gap between the desired and realised state. This framework is inspired by previous literature and studies but expanded with the findings and conclusions drawn from the empirical part of this study.

Chapter 7: Validity and reflections - This Chapter covers the Descriptive phase II. It details the validation of the research approach and of the developed framework. Included here are reflections on the research results, research approach, the framework and implications of these findings on different levels, including education, national and international communities. Finally, proposals for further research into this topic are presented.

Chapter 8: Conclusion - Presents the answer to the research question and conclusions drawn from the study.

1.9 Summary

This project aims at providing a decision making framework which can address the impacts of globalising the product development process. This includes the development of a new product, or changes to an existing product, a service, a process, or a function.

A dual perspective is taken focusing on both the engineering and organisational aspects of this globalisation process. An empirical investigation of seven Danish B2B companies was conducted to provide empirical information about:

(1) How such decisions are taken today.

(2) The challenges they face.

(3) How these were handled in the companies.

(4) The impact of this process.

The research methodology framework developed by Blessing & Chakrabarti (2009) is used in this research study. This methodology consists of four stages: Criteria, Descriptive study, Prescriptive phase, and Descriptive phase II.
In stage 1, the research aim is specified, the literature review is conducted, and the research question is detailed.
In stage 2 the empirical investigation is conducted. This is carried out through two descriptive studies. It details how the situation is today (based on stage 2), the desired stage (based on stage 2), and the gap between these.
Stage 3 is a framework for closing this gap is proposed.
In stage 4 the findings and framework is tested through workshops with relevant stakeholders.

The next Chapter provides a literature study and supplies the preliminary framework based on the current literature and assumptions taken from this.

Chapter 2 Literature review

This Chapter covers the main theoretical underpinnings of the thesis. It starts with an introduction to the offshoring and outsourcing process. Theories found relevant for this study are illustrated, and the preliminary framework based on the current literature is presented.

2.1 Outsourcing and offshoring

The outsourcing process, or how to outsource, is now well researched and many models are available. Perunovic (2009) presents in his doctoral thesis an overview of seven such models which he combines to create his own model. This model he calls the Outsourcing Circle (see Figure 4). It is a five-stage cyclic model which not only considers what to outsource but includes the full range of outsourcing dilemmas.
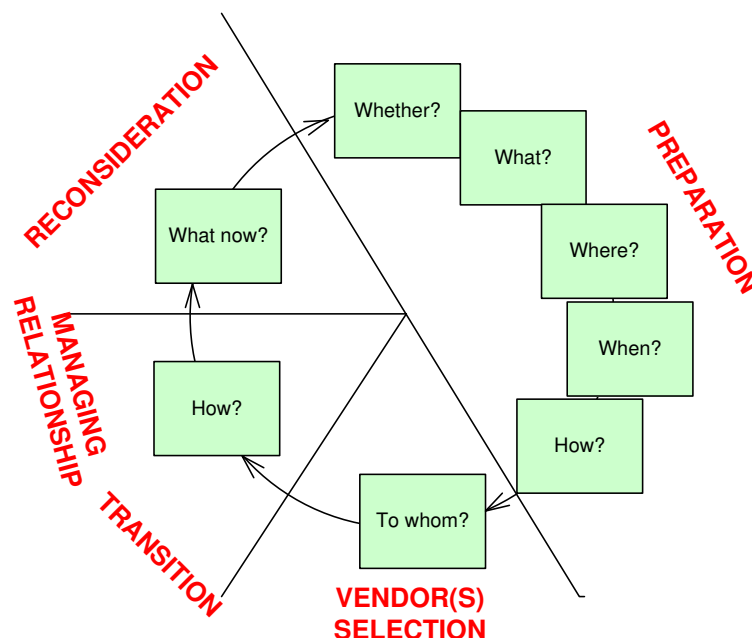
Figure 4: The Outsourcing Circle.
Source: Perunovic (2009)

The five stages are:

1. **Preparation**

   Whether to outsource anything; the company needs to consider if outsourcing presents a competitive advantage, and whether the activity can be performed better in-house, or can be made redundant through automation/technology, or in some other way (Varadarajan, 2009). Business activities which are least likely to be moved offshore need to have at least one of the following characteristics (Farrell *et al*., 2005: 4):

   1) A need for customer contact.

   2) A need for local knowledge.

   3) Contains complex interactions.

If outsourcing is the answer then it needs to be decided what to outsource. Here issues such as IP rights and other control issues as well as knowledge transfer are important. Software has been developed to aid in this choice. An example is the RightShore[R] program in which a 2 by 2 matrix based on the client organisation's capabilities to control the vendor and the complexity of the task considered for outsourcing is used. These two parameters indicate the risk factor the company will take if it outsources the function. The ideal is low complexity and high organisational capabilities as this creates minimum risk (Borgens *et al.*, 2009).

    a. Where to outsource to (country selection).
    b. When to outsource.
    c. How to outsource (what kind of relationship and rights).

2. **Vendor(s) selection**
    a. To whom shall the company outsource?

3. **Transition**
    a. How to manage the process.

4. **Managing relationship**
    a. How to manage the relationship.

5. **Reconsideration**
    a. What to do now (e.g. keep the same relationship, select a new vendor, change the relationship, stop the relationship).

The last stage, reconsideration, can mean the arrangement can change or be dissolved. While most offshoring and outsourcing arrangements start due to cost saving, they can change to have a knowledge gain and later even a strategic focus (Camel *et al*, 2002; Carmel & Tjia, 2005:9; Maskell *et al*., 2006). A study has shown that providers often value long-term relationships. Over time, trust and mutually created capabilities means a long term focus is created. The relationship changes from a cost focus to a trust-based relationship as trust is gained on both sides. When this happens the provider gains more control over the processes being outsourced, and capabilities which contribute to mutual benefits are identified (Vivek *et al*., 2009).

Changing vendor, another option in the reconsideration phase, means a loss of 'learning by doing' knowledge (experiential knowledge). To prevent disruptions in services when transferring to the new vendor, the following elements have been shown to be critical: modularization of work, use of external sources, joint client-vendor collaboration, and personal identities at work (Alaranta & Jarvenpaa, 2010).

Firms can also learn from each outsourcing endeavour. One study has shown that a company which has outsourced IT are more likely to outsource Business Processes (BPO) as they have learned to handle vendors and overcome barriers of cultural distance and communication. Outsourcing experience therefore became a firm capability which can become important for the success of outsourcing (Whitaker *et al.*, 2010).

Each of these five stages has detailed literature which shows how each step should be considered. For a detailed literature review see Perunovic (2009).

Appendix 1.3 show a table which details the options a company has for each outsourcing phase in the Outsourcing Circle and the related literature. The details relating to what type of vendor

relationships can be built and their characteristics are out of scope for this thesis. For an introduction to the topic see Appendix 1.

Offshoring differs from outsourcing on one main point; the employees are a part of the same company. When offshoring the company can choose to:

1) Create a <u>joint venture</u> with a company already operating within the given country/market of interest.
2) Create a <u>Greenfield operation</u> meaning opening a factory or office in a new (undeveloped) site, often an undeveloped piece of land.
3) Create a <u>Brownfield operation</u> meaning opening a factory or office in an existing site.

The company can end up with several subsidiaries if the company buys another company which has subsidiaries. Offshoring offers other advantages than outsourcing. A study has shown that as the offshore centre is a part of the company it can offer advantages of 'knowledge services' which arise from higher levels of quality, trust, and collaboration, and from facilitating knowledge capture and transfer (Penter *et al.*, 2009).

An equivalent to The Outsourcing Circle does not exist. However, an Offshoring Circle could look something like this for a greenfield operation:

1. Preparation
   a. Whether to offshore anything.
   b. If offshoring is the answer, then what to offshore (e.g. knowledge transfer and knowledge sharing).
   c. Where to offshore to (country selection e.g. where are current and new markets, existing locations, tier 1 suppliers).
   d. When to offshore.
   e. How to offshore (what kind of relationship).
2. Transition
   f. How to manage the process.
3. Managing the subsidiary relationship
   g. How to manage the relationship (e.g. leadership, knowledge, autonomy and tasks).
4. Reconsideration
   h. What to do now (e.g. keep the same relationship, change the relationship, change location).

Appendix 1.3 shows a table wherein the options for offshoring have been matched with their proposed "Offshoring Circle" phase and the connected literature.

Viewing offshoring or outsourcing in isolation is limiting, as companies always have the choice of both. Kedia & Mukherjee (2009) developed a framework which considers disintegration advantages, externalization advantages, and location specific resource advantage as key elements to decide whether a given task, function, service or product should be developed in-house, outsourced domestically or abroad (called 'offshore outsourcing' in Figure 5), or if it should be 'captive offshoring' (see Figure 5).
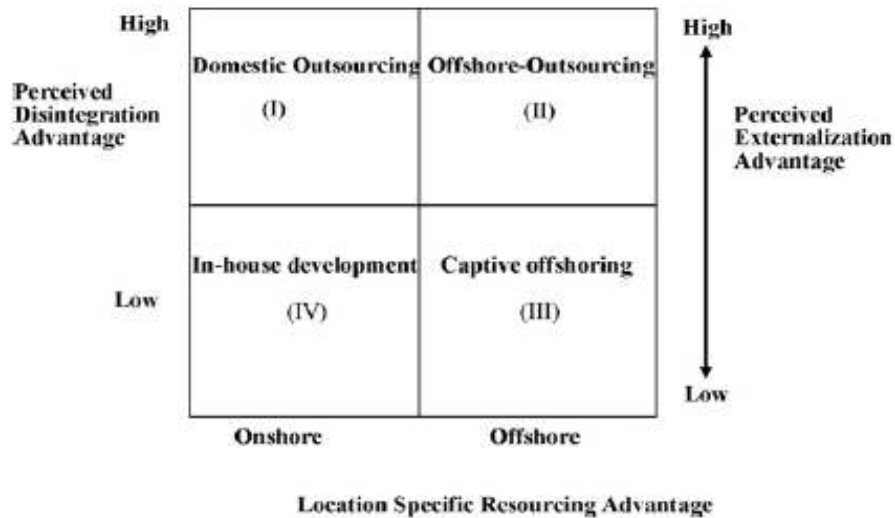
Figure 5: Location selection.
Source: Kedia & Mukherjee (2009)

As mentioned in Chapter 1, the focus of this thesis is on (II) 'offshore-outsourcing' (called outsourcing in this thesis) and (III) 'captive offshoring' (called offshoring in this thesis) in figure 5. The Outsourcing Circle was designed for IT outsourcing, but the elements of the model employed here are also relevant for outsourcing of other types of services and manufacturing.

The Outsourcing Circle is, at the time this thesis is written, judged to be the most suitable for explaining the outsourcing process as it encompasses several models and considers all the phases and stages of outsourcing. To ease comparison, and because no model of similar quality and standard was found for offshoring, the model has also been employed for offshoring. The frameworks presented here is a way to identify and classify stages of the outsourcing and offshoring process and their elements.

2.2 Theoretical frameworks

Four theoretical fields within organisational studies have been used in outsourcing literature to explain why companies outsource (Raj *et al.*, 2009):

- **Transaction cost economics (TCE)** was introduced by (Coase, 1937) and is based on the assumption that transactions are determined by production economics, and organisations are economic actors using the most efficient mechanisms in this pursuit. The assumption is that all humans are opportunistic and that there are limits to human awareness and knowledge (Williamson, 1975). To protect the firm, contracts and strict management control must be exercised.

- **Relational exchange theory (RET)** suggests that only some parts of knowledge can be made explicit in a formal contract and other documentation. Other parts of knowledge are embedded in organisational practices and relationships (Hawk *et al.*, 2009; Blackman & Sadler-Smith, 2009; Lam, 2000; Lave and Wenger, 1991). Trust and interaction is therefore encouraged. It is the opposing theory to TCE.

- **Resource Dependence Theory (RDT)** focuses on the external environment of the firm. The dependency on external resources (labour, resources, technology) depends on the reliance on resources for survival and their strategic importance, and to what degree these resources are controlled by another organisation.

- **The Resource-Based View (RBV)** is a theory which says that a company's competitive advantage is connected to its internal resources. In a review by Colotla (2003), RBV is traced back to early theories of profit and competition as seen in the writings of David Ricardo (1817), Joseph Schumpeter (1950; 1934) and Edith Penrose (1959). The concept was fully developed by authors such as Barney (1986; 1991), Grant (1991), Wernerfelt (1984), Rumelt (1991), Peteraf (1993) and Prahalad & Hamel (1990). An extension of this view is the knowledge-based view of the firm which considers knowledge the most significant resource a company can have (Grant, 1996).
  RBV says that competitive advantage comes from resources and capabilities (Colotla; 2003). These terms can be defined in many different ways. The same definition used by Colotla (2003) is used here due to the similarity of background of his study with this one. Resources are inputs into the production process and form the basic units of analysis.
  Resources are often described by *nouns*, and may be classified into tangible (financial and physical), intangible (technology, reputation and culture), and human (specialised skills and knowledge, communication and motivation) (Grant, 2002).
  Capabilities can then be defined in terms of resources and are a result of complex patterns of interactions and coordination between resources. Capabilities are often described by verbs. Grant (1991) views capabilities as "*organisational routines*", which are "*regular and predictable patterns of activity which are made up of a sequence of coordinated actions by individuals*".
  A company can create economic gain through:
  1) Resource-picking; choosing superior resources (Makadok, 2001b; Ricardo, 1817).
  2) Capability building; being more effective than competitors at deploying resources (Makadok, 2001b; Schumpeter, 1950).
  Using this theoretical perspective it is in the firm's best interest to gather as many and the best resources and capabilities.

  Knowledge resources are complex and socially embedded which makes them hard to copy and therefore a source of competitive advantage. This extension of the resource-based view of the firm is not a theory in itself (Grant, 2002:135). Following this view, it becomes essential as companies globalise that they retain, develop and gain knowledge resources. This theory fits with the knowledge economy view which encourages a focus on production of knowledge, ideas and information. Competences are therefore a key component of value creation in the knowledge-based company (Drucker, 1966).

These perspectives gives a different angle on outsourcing in regard to strategic intent, outsourcing criteria, analysis for outsourcing, impact on value proposition, risks, and the scope for outsourcing as illustrated in Table 1 for TCE, RBV, RDT. As can be seen, the risk rises from TCE to RBV to RDV. However, the impact on the organisation's value proposition also rises as the analysis for

outsourcing comes closer to the core, and the aim moves from cost reduction to gaining resources to building capabilities.

Table 1: Theoretical perspective and outsourcing decisions.
Source: Raj *et al*. (2009) based on Grant (1991) and Tsang (2000)

Outsourcing decisions	Transition cost economics (TCE)	Resource-based view (RBV)	Resource dependency theory
Strategic intent	Operational focus Outsourcing of non-core activities	Resource focus Outsourcing of complementary resources	Focus on all business functions Outsourcing of core activities
Outsourcing criteria	Cost reduction (e.g. transaction costs)	Availability of resources and capabilities (e.g. skills and capabilities) Analysis of complementary resources and capabilities	Availability of resources and capabilities Building capability
Analysis for outsourcing	Non-core activities Frequency of the transaction	Non-core value creating activities	Manage uncertainty Core activities Creation of value across all business functions
Impact on the organisation's value proposition	Operational efficiency Economics of scale Tactical decisions	Sustaining competitive advantage Freeing up resources to focus on other strategic decisions	The development of capabilities across organisational boundaries Survival and growth
Risks	Low	Medium	High
Outsourcing scope	Low	Medium	High

While all of these theoretical perspectives can explain certain aspects of company actions in relation to outsourcing, they cannot explain all as illustrated in Table 2 on the following page. TCE, for example, assumes cost considerations are the overall focus. Comparative advantage literature is only relevant for cross-border outsourcing and does not explain domestic outsourcing, while RBV literature does not consider that increased levels of outsourcing by players in an industry can lead to homogenisation of skills and resources (Porter, 2001).

Table 2: Theoretical perspectives and their limitations.
Source: Adapted from (Varadarajan, 2009)

Theoretical perspective	Company action explained using this theory	Limitations to the theory
Transaction Cost Economics (TCE)	Firms will the choose mode of transaction (market governance versus internal organisation) that minimizes the sum of production and transaction costs. If adaptation costs, performance costs and safeguarding costs are absent or low, firms will favour market governance. If these costs are high enough to exceed the production cost advantages of market governance, firms will favour internal organisation (Rindfleisch and Heide, 1997).	Explanation implies that the outsourcing decision is based on cost considerations to the exclusion of how the decision impacts the overall business strategy of the organisation (McIvor, 2008). TCE overstates the desirability of either integration or explicit contractual safeguards in certain exchange settings. In this stream of literature, trust and its underlying normative behaviours are reasoned as operating as a self-reinforcing safeguard that is more effective and less costly than contracts and vertical integration (Poppo and Zenger, 2002).
Comparative advantage literature	Cross-border outsourcing is a manifestation of the forces of free trade and international specialization in the production of goods and services. If a good or service can be produced at a lower cost in another country, importing rather than producing it domestically allows a country to put its resources to more productive uses. Countries are best off when they focus on sectors in which they have a comparative advantage (Drezner, 2004; Mankiw and Swagel, 2005).	Explanation holds only for cross-border outsourcing.
Competitive advantage/Resource based view (RBV)/Capabilities explanation	Firm focus their efforts towards achieving and sustaining a high level of competence in performing a core set of activities that are critical to being successful in an industry, and outsource activities that are either not critical, or they do not have a distinctive capability.	Increased levels of outsourcing by players in an industry can lead to homogenization of skills and resources (Porter, 2001).
Ability and motivation explanation	For firms with a high level of know-how in a particular area, the relative cost of using the know-how is low. Since the greater ability of a high level of know-how firm translates into lower costs, such firms will have a greater preference for performing an activity in-house as opposed to outsourcing. Firms with a low level of know-how have a motivation to acquire a certain threshold level of know-how in order to be able to assimilate new know-how. Hence, low know-how firms are also likely to have greater preference for performing an activity in-house. Collectively, the ability and motivation considerations lead to a curvilinear relationship. The preference for outsourcing over performing an activity in-house is greater in firms with moderate levels of know-how compared to firms with high or low levels of know-how (Stremersch *et al.*, 2003).	Firms need to guard against falling into the trap of considering as core activities those which are performed in-house and activities performed outside as non-core activities. In other words, activities being viewed as core versus non-core are a consequence of a firm's outsourcing decisions rather than its determinant (Mukherji and Ramachandran, 2007).

Outsourcing relationships are not static and can experience a theoretical shift over time from Transaction Cost (focus on lowering costs), Resource-Based (focus on developing competences), to Relational Governance (focus on continuous learning and commitment and relationship governance with an emphasis on trust) (Vivek *et al.*, 2009).

To summarise, different theoretical perspectives within organisational studies are useful theoretical tools to explain different motivations, actions and stages in outsourcing. However, none of them can

explain all aspects of outsourcing. In this thesis the assumption is made that the same can be said for offshoring. This illustrates the need for a cross-disciplinary approach to decision-making within outsourcing and offshoring, which allows for the dynamics of changing conditions and motivations, and the use of different theoretical perspectives to explain company actions relating to outsourcing and offshoring.

2.3 Product development

Many different product development process models exist; the two used in this thesis are the generic product development process model (stage gate model), and the spiral development process model as described by Ulrich and Eppinger (2008). These are chosen as they are the most commonly used models in engineering manufacturing companies. Figure 6 shows the generic product development process model which has stage gates or reviews after each phase.

Figure 6: The generic product development process (also called the stage gate model).
Source: Ulrich & Eppinger (2008)

The spiral product development process (see Figure 7) is common for electronic consumer goods and is characterised by an iterative process through detailed design, testing and refinement as the product is designed, built and tested, and then adjusted to newly discovered needs or improvement options.
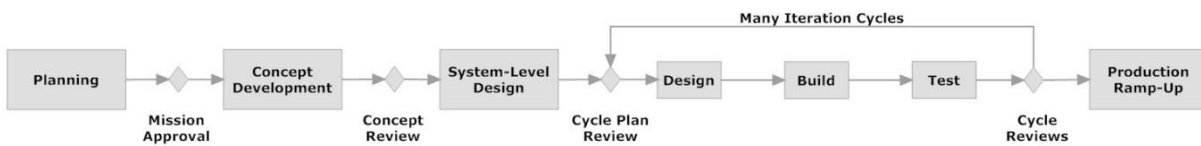
Figure 7: The spiral product development process.
Source: Ulrich & Eppinger (2008)

The generic development process model is characterised by stages or steps, indicating a division between each of these. The spiral development process model is characterised by going through these steps several times.

Neither of these models includes production. However, in this study the entire product development process from R&D to manufacturing is included when discussing the company's globalisation of product development. Whitaker *et al.* (2010) showed the importance of experience when outsourcing, while many previous studies have illustrated that globalisation has now affected all elements of product development from manufacturing to R&D (see Chapter 1). It can therefore be assumed that the globalisation process for different elements of the product development process is important to investigate, including manufacturing.

2.4 Global product development

Offshoring and outsourcing of engineering functions is still a relatively new development. Changes in market, technology and market preference have led to companies seeking to reduce development costs, improve development quality, and shorten development time (Chiesa, 2000; McDonough *et al*., 2001; Sanchez and Perez, 2003). This is increasingly happening by globalising product

development (Gottfredson *et al.*, 2005). Literature focusing on global product development has mainly focused on the design of products, excluding R&D and manufacturing. This section therefore present literature with this specific focus on global product development.

Companies have outsourced individual parts of product development functions (i.e. prototyping) as well as the whole development process to improve their product development performance (Perks *et al.*, 2005; Faems *et al.*, 2005). BusinessWeek Research Services (2006) show two fundamental reasons for engaging in global product development, (1) to get design resources closer to the needs of local markets, and (2) to get design resources closer to distributed manufacturing resources.

However, there are noticeable differences between software and hardware engineering. Software has a shorter implementation time, is easier to move virtually, and has a longer history of offshoring and outsourcing than product development and design of hardware products. Figure 8 illustrates that most hardware desired functions are provided from the start. But when circumstances change, hardware design often requires all sequences in the development to be redone sequentially. For software, however, requirements are often iterative and developed over time. In this manner hardware is therefore often more time-consuming and costly to change while software is faster and easier to adapt as circumstances change. This could indicate that offshoring and outsourcing of hardware would require more interaction, collaboration and communication than in standard software development.
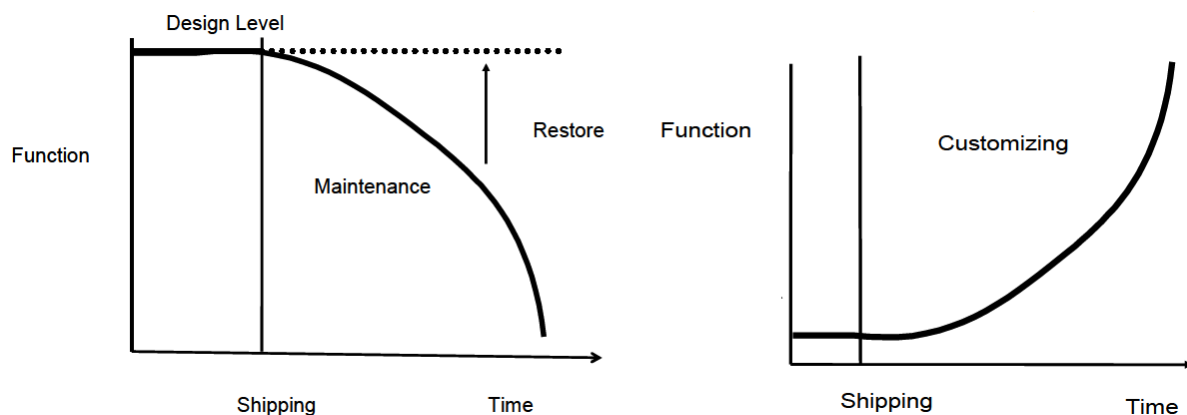
Figure 8: Hardware (left) and software (right) development.
Source: Fukuda (2010)

Global product development started with the offshoring wave in the 1990s and has since grown (Eppinger, 2006). The key difference between conventional and global product development is the increased reliance on virtual collaboration across time zones and cultures as the team is now globally distributed (Eppinger, 2006).

Many companies move from offshoring simple tasks to gradually offshoring more complex tasks like derivate products and new global products (see Figure 9 on the following page). According to Eppinger (2006) this development is a clear strategic move taken by the executives of the companies. Repenning (2001) writes that productivity often falls initially, but then recovers in a 'worse-before-better' scenario during dramatic changes in the product development process such as offshoring.
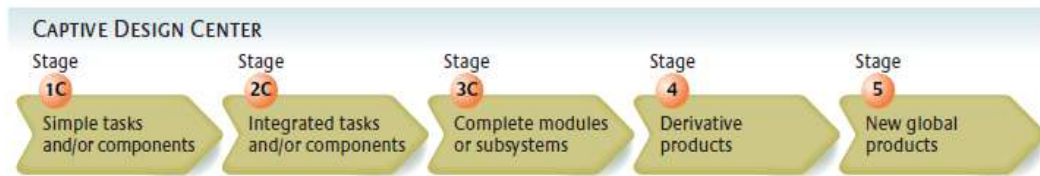
Figure 9: Global product development offshoring process
Source: Eppinger, (2006)

Eppinger (2006) lists 10 success factors for global product development:

1) Management prioritises offshoring.
2) Process modularity so work packages can be segregated.
3) Product modularity so interfaces can be clearly defined.
4) Core competences are identified.
5) Intellectual property is identified.
6) Data quality so one system or database is a 'source of truth' for all the globally disbursed teams.
7) The infrastructure is created in such a way that power, network connections and other technical equipment is up to date and of the highest standard.
8) Governance and project management is needed to coordinate and manage the projects
9) The need for a collaborative culture.
10) Organisational change management is needed to plan, train and educate staff who interact in the now global product development function.

The focus on skills has been supported by, for example, Scheibe and Mennecke (2006) who investigated the skills IT professionals need if they wish to successfully work in a Western country after the corporation has offshored or outsourced. There is a need for a global perspective and strong collaborative skills. Three categories of skills can be created: (1) Strong communication skills including understanding local culture, (2) Business skills including a good sense of business opportunities within the local environment (e.g. local politics and legal issues) and (3) Technical skills and analytical capabilities. Bohemia & Harman (2008) suggest that due to globalisation of manufacturing and product design, design educations should contain a global element so designers learn how to communicate, interact and collaborate in a globally networked organisation where the design teams – as well as manufacturing - are globally disbursed. Other research has focused on distributed teamwork, and cross-cultural collaboration (e.g Von Zedtwitz & Gassmann, 2002; Sheldon, Bharwani, Mitchell, & Williams, 1995; Cheng, 2003; Bennett & Dziekan, 2005). Research into international collaboration has shown how to best support teamwork changes from culture to culture which add a new dimension of complexity to management of distributed teams (Zhang, 2007; Kim & Bonk, 2002). Designers have also been shown to make design choices which have origins in their own culture, creating challenges for cross-cultural development teams (e.g. Lee & Harada, 2000; Leur *et al*, 2006).

A recent study (Tomico *et al*, 2009) has shown that designers from different cultures perceive products differently and thereby take different design decisions influenced by their cultural

background, thus exemplifying the importance of understanding the cultural dimension of cross-cultural virtual design teams.

These studies indicate that process and product modularity is needed to be able to send a task abroad, and that project management is necessary to control the process. It also shows that top management needs to show commitment, and that it is important to train engineers and other technical personal in communication and business as well as technical aspects. Furthermore, virtual collaboration and culture are key areas where complications can develop.

2.5 Risks

In recent years a lot of literature has focused on the risks involved in outsourcing, and the problems companies encounter when they start to globalise. Some of these can be assumed to also be relevant for offshoring.

Gartner (2005) predicted that 80% of organisations that outsource customer service and support centres with the primary goal of reducing cost will fail. ComputerWorld (2010) conducted an investigation which stated that, "*Companies expressed frustration with the quality of work being provided [...] but most businesses still said they chose the cheapest outsourcing option instead of the best quality. Nearly all businesses - ninety-four percent - admitted that the focus on cost was increasing the likelihood of their projects failing.*"

Frequently encountered problems when companies offshore or outsource include cultural differences, time zone differences, knowledge transfer, employee retention, and intellectual property protection (Rottman and Lacity, 2008; Kotlarsky *et al*., 2008; Carmel *et al*, 2009). This is supported by Carmel & Beulen (2005) who found that unsuccessful knowledge transfer is one of the principal reasons for failures in the first few years of outsourcing. Other challenges found in offshoring are to manage local staff and local market needs, as well as culture (Lord & Ranft, 2000).

Table 3 shows the main barriers Danish companies encountered when outsourcing. The most significant were communication difficulties, cultural differences, unforeseen costs, large travel costs, and internal opposition to outsourcing (shown in grey in Table 3 on the following page).

Table 3: Barriers to outsourcing (Top five barriers are highlighted and calculated as a cumulative of small and large barriers).
Source: Ledernes Hovedorganisation (2004)

	Not a barrier	Small barrier	Large barrier
Bad communication	20%	62%	18%
Cultural difference	15%	68%	17%
Time delays	31%	54%	15%
Internal opposition to outsourcing	27%	58%	15%
Bad documentation and specifications	35%	56%	10%
Low quality	46%	48%	6%
Larger travel costs	28%	66%	5%
Unforeseen costs	28%	69%	3%
Bad educational level	61%	37%	1%
Corruption	65%	35%	0%
Bad labour market in the vendor's country	53%	47%	0%
High establishment costs	48%	52%	0%

Due to these difficulties, some Danish companies have started to backsource (i.e. bring activities back in-house), although so far only a small number (Børsen, 2007).

Low quality was also mentioned as a barrier for Danish companies. A study by Kull & Wacker (2010) showed that low quality in manufacturing is common for Asian factories. However, implementing quality management may not always be efficient as these assume certain cultural factors – in particular low assertiveness and low uncertainty avoidance – which do not exist in many Confucian Asian countries like, for example, China.

BusinessWeek Research Services (2006) identified seven key challenges to global product development (GPD); collaboration, IP rights, learning and knowledge management, engineering productivity, innovation and quality, managing organisational change, and management control. Suggestions to counteract these challenges were focused on control and included; never move anything where IP rights are important, document processes, practices, and standards, use expatriates to dissimilate knowledge, set clear quality standards, manage the change by avoiding to change partner/location often and involve top management in the process (BusinessWeek Research Services, 2006).

In a study by Stringefellow *et al.* (2008), the invisible costs of offshoring services were found to be caused by interaction intensity and interaction distance. They are defined as having the following characteristics:

1. Interaction intensity
   a. Service content.
   b. Service process – based on degree of standardisation.
   c. Degree of judgment based on explicit or tacit knowledge.
   d. Degree of interdependence among steps and sequences of the process.
2. Interaction distance
   a. Cultural distance.
   b. Language distance.
   c. Geographic distance.

It could be concluded that offshoring to low-cost countries from Denmark (i.e. high interaction distance) has the lowest risk of running into unforeseen costs if the services in question have a low interaction intensity or, in other words, that the tasks in question are well-defined, standardised with simple judgments involved, and the process steps are sequential (see Table 4).

Table 4: Offshore Interaction intensity and viability of offshore locations.
Source: Stringefellow *et al. (*2008)

	LOW INTERACTION DISTANCE OFFSHORE LOCATIONS	MEDIUM INTERACTION DISTANCE OFFSHORE LOCATIONS	HIGH INTERACTION DISTANCE OFFSHORE LOCATIONS
LOW INTERACTION INTENSITY	COST SAVINGS TOO LOW	COST SAVINGS MAY BE TOO LOW	EXCELLENT FIT
MODERATE INTERACTION INTENSITY	COST SAVINGS MAY BE TOO LOW	EXCELLENT FIT	INVISIBLE COSTS LIKELY TOO HIGH
HIGH INTERACTION INTENSITY	EXCELLENT FIT	INVISIBLE COSTS LIKELY TOO HIGH	INVISIBLE COSTS TOO HIGH

Aron *et al*. (2005) mention three kinds of risks in outsourcing:

1) Operational risks.
   a. Decline in quality, cost, or speed of process execution.
2) Strategic risks.
   a. Examples are protection of intellectual assets, security, and privacy problems.
3) Composite risks.
   a. Long-term risks, such as losing the proficiency to perform such business processes internally in the future because of lacking knowledge of the business processes.

Mahmoodzadeh *et al.* (2009) show the following risks and pitfalls for outsourcing based on Quelin and Duhamel (2003), Prasad (2009), Gilley and Rasheed (2000), Lewin and Johnson (1996), Kakabadse and Kakabadse (2002) and Frost (2005):

1) Dependency on the suppliers.
2) Ignoring hidden costs.
3) Losing touch with new technological opportunities for product and process innovations.
4) Loss of long-run research and development competitiveness.
5) The risk of changing collaboration into opportunistic behaviour by the supplier if the supplier is dishonest and chooses to use their access to knowledge concerning the firm and its products against the client company.
6) The degradation of a product or service because the supplier lack the necessary capabilities or has less attention to devote to them than the client company had.
7) Communication and coordination problems.
8) Cognitive distance between supplier and firm which makes it more difficult to align decisions and exchange knowledge.

Baithelemy (2003) found seven reasons why outsourcing endeavours can fail:

(1) The company has outsourced functions that should not be outsourced.

(2) The company has selected an inappropriate supplier.

(3) A poor contract was written.

(4) Human resource problems were overlooked.

(5) The client company experience decreasing control over the outsourced functions.

(6) The client company has ignored the indistinct costs of outsourcing.

(7) The client company does not have a strategic exit plan for discontinuing the relationship.

These case studies indicate that companies which focus purely on cost are more likely to experience problems with, for example, quality. Furthermore, it can be assumed that companies encounter problems in relation to (1) communication, (2) cultural differences, (3) unforeseen costs, (4) large travel costs and (5) internal opposition to outsourcing. Other problematic areas are likely to be collaboration, IP rights, learning and knowledge management, engineering productivity, innovation and quality, managing organisational change, and management control.

Culture has been shown to influence quality and communication. It can therefore be assumed that offshoring or outsourcing to low-cost countries from Denmark has the lowest risk of running into unforeseen costs and complications if the task in question has a low interaction intensity, or, in other words, that the tasks in question are well-defined, standardised with simple judgments involved, and the process steps are sequential.

These studies also show that while issues within globalisation of services and products have been well documented, the reasons for these have not been fully explored. Furthermore, while previous research has indicated how a company can avoid risk, the issue of how to address risk hasn't been fully explored.

The following sections introduce analytical theories which can be used to analyse the above mentioned risks in more detail.

2.6 Organisational theory

Organisational studies are, among other aspects, concerned with decision making, organisational structures and dynamics, leadership, organisational culture, employee motivation, power relations, organisational learning, and work psychology. Of these, decision making, organisational structures, culture, organisational learning, and power are of interest in relation to this research topic (see, for example, Pettigrew, 1973; Mumby, 1988; Pfeffer, 1981; Hatch & Cunliffe, 2005; Ashby, 1956; Wiener, 1948).

Decision making models include the rational decision-making model, scientific management and the garbage can model. The first assumes a rational process where all relevant information is available, the second assumes decisions are broken down into parts, and the third assumes a chaotic process without full knowledge where the 'best available' solution is selected.

Theories of decision making can be subdivided into three categories:

- Normative (concentrates on how a decision should be made).
- Descriptive (concerned with how the thinker came up with their judgement).
- Prescriptive (aims to improve decision making).

This study is prescriptive as it aims to develop a framework which can improve decision making regarding globalising product development process activities.

An organisation can have many structural formats. These include bureaucracy, matrix, functional, divisional, virtual, team, and project based. Morgan (1986) used eight metaphors to describe the organisation of companies. All companies can be described using these metaphors as well as new ones created by the employees themselves. These eight metaphors are:

1. **Machines:** Characterised by a focus on efficiency, waste, maintenance, order, standardisation, measurement and control.
2. **Organisms:** Characterised by a focus on environmental conditions, adaptation, life cycles, evolution.
3. **Brains:** Characterised by a focus on learning, distributed control, feedback, requisite variety, knowledge and networks.
4. **Cultures:** Characterised by a focus on values, beliefs, rituals, diversity, traditions, history and shared vision and mission.
5. **Political Systems:** Characterised by a focus on interests and rights, power, hidden agendas and back room deals, authority, alliances, censorship, gatekeepers and conflict management.
6. **Psychic Prisons:** Characterised by a focus on conscious and unconscious processes, repression and regression, projection, coping and defence mechanisms and the pain and pleasure principle.
7. **Flux and Transformation:** Characterised by a focus on constant change, dynamic equilibrium, flow, self-organisation, systemic wisdom, chaos and complexity.
8. **Instruments of Domination:** Characterised by a focus on alienation, repression, imposing values, compliance, charisma, maintenance of power, force, exploitation, divide and rule, discrimination and corporate interest.

Companies are often described as consisting of formal and informal structures and organisations. The formal structure and processes is what is written down and publically acknowledged. The informal structure and organisation is the personal links between employees and other individuals, as well as the tacit knowledge which results in unwritten rules and work processes.

The organisational structure is assumed to influence how offshoring and outsourcing of the product development process is carried out, while the decision-making process can indicate how the decision was reached. They could therefore be useful tools to use in this study to analyse the empirical findings.

2.6.1 Culture

Culture can be separated into several aspects like professional, ethical, religious, national, group, and organisational culture. For this research, the following three aspects of culture are assumed to be most relevant; professional, national and organisational culture. Culture of a group (which organisational culture falls under) is defined by Schein as *"a pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way you perceive, think, and feel in relation to those problems."* (Schein, 2004:2).

Culture is a "*dynamic phenomenon*" that is constantly evolving and is created by "*interactions with others and shaped by leadership behaviour, and a set of structures, routines, rules, and norms that*

guide and constrain behaviour." (Schein, 2004: 1). Culturally, organisations must deal with two sets of problems: "*survival, growth and adaptation in their environment and internal integration that permits daily functioning and the ability to adopt and learn*" (Schein 2004: 18).

Culture can be analysed at several different levels, with the term 'level' meaning the degree to which the culture phenomenon is visible to the observer. These are artefacts, espoused values and basic underlying assumptions. The foundation of the culture lies in the pattern of basic assumptions; however it manifests itself at the level of observable artefacts and espoused beliefs and values. There is an interconnection between all three levels, so if one level is changed this can influence the other levels in a hierarchical manner (see Table 5).

<div align="center">

Table 5: Levels of Culture
Source: Schein (2004)

</div>

Artefacts	Visible organisational structures and processes (hard to decipher).
Espoused beliefs and values	Strategies, goals and philosophies (espoused justifications).
Underlying assumptions	Unconscious, taken for granted beliefs, perceptions, thoughts and feelings (ultimate source of values and action).

Investigating the third layer of culture requires comprehensive clinical research (Schein, 2004: 207) which is out of scope for this project. However, indications of this layer might be possible to see through investigation of the two higher layers.

Espoused values comes from the theory that separates "theory in use" from "espoused theory", as described by various researches within the field of organisational learning (e.g. Argyris *et al.*, 1996:3-29; Smith, 2001; Anderson, 1997) . "Theory in use" is the theory that actually governs a person's actions and which shows the world view and values implied by peoples' behaviour. "Espoused theory" is the reasons and justifications a person gives for doing a certain action. If the two remain connected a gap between them creates a dynamic for reflection and dialogue. However, too wide a gap can be a problem and requires learning to close (e.g. Smith, 2001).

Schein's model has been criticised for its linearity. However, the theory is used here because the 'layer' idea of culture has been widely used within studies of outsourcing and offshoring.

Hofstede (2004) investigated cultural differences inside IBM departments between 1965-1973. He originally used four parameters to group his cultural findings related to national cultural differences:

1. Power distance (PDI).

2. Individualism (IDV) (the opposite is collectivism).

3. Masculinity (MAS) (the opposite is feminism).

4. Uncertainty avoidance (UAI).

Later a fifth was added:

5. Long-term orientation (LTO).

The cultural dimensions for India, China and Denmark are shown in Table 6, and are used as examples in the following to illustrate Hofstede's parameters.

Table 6: Cultural dimensions
Source: Hofstede (2004)

	PDI	IDV	MAS	UAI
Denmark	18	74	16	23
China	80	20	66	40
India	77	48	56	40

PDI: Is the extent to which the less powerful members of organisations and institutions (like the family) accept and expect that power is distributed unequally. In other words, both leaders and subordinates endorse inequality. India is an example of a country with a high PDI.

IDV: Is the degree to which individuals are integrated into groups. In an individualistic culture, everyone is expected to look after him/herself and his/her immediate family. In a collectivist culture, people are integrated into various groups which will protect them throughout life in exchange for unquestioning loyalty. (Collectivism refers to the groups a person belongs to, not to the state).

MAS: Refers to the distribution of roles between the genders. Denmark is an example of a country with a low MAS.

UAI: Deals with a society's tolerance for uncertainty and ambiguity. It's a measure of how comfortable a society's members are when dealing with unknown, new or unusual situations.

LTO: shows the difference between long and short-term orientation. Values associated with a Long Term Orientation are thrift and perseverance; values associated with Short Term Orientation are respect for tradition, fulfilling social obligations, and protecting 'face'. To date, no LTO investigation has been done for Denmark and it will therefore not be included as a dimension in this thesis.

Hoftstede's cultural dimensions have been criticised for viewing culture as static and not including subcultures and shifts in cultures as well as cultural influences from, for example, other countries. It is however, often used when investigating cultural differences in outsourcing endeavours (e.g. Rai *et al.*, 2009; Reus & Lamont, 2009; Asokan & Payne, 2008; Chen *et al.*, 2010) and is therefore considered a useful tool in this study.

According to Hall (1976: 91) two types of communication cultures exist; low-context and high-context communication, "*...A high-context (HC) communication or message is one in which most of the information is either in the physical context or internalised in the person, while very little is in the coded, explicit, transmitted part of the message. A low-context (LC) communication is just the opposite, i.e. the mass of the information is vested in the explicit code.*" India and China are HC communication countries, while Denmark is a country with LC communication. It is therefore easier to rely on explicit documentation and information as communication forms in Denmark than in China and India.

To summarise, culture affects all aspects of communication and human interaction, including how to transfer knowledge. It is therefore important to consider cultural aspects in communication, knowledge sharing, leadership, organisational structures, and other aspects of the organisation when a company engages in globalising product development process activities (Schneider & Barsoux, 2002).

2.6.2 Change management

Internal opposition to outsourcing or offshoring – one of the main problems companies often encounter - can be caused by ill preparation in the organisation. If outsourcing and offshoring is considered a change management project, then internal opposition can be explained using this framework (Palvia, 1995). How to manage organisational change from a planned change perspective has been illustrated by many different authors (e.g. Kotter, 1999; Lewin, 1947; Schein, 1964). Using Kotter's eight step model for planned change as an example, then this model consists of the following steps (Kotter, 1996):

1) Increase urgency - Inspire people to move, make objectives real and relevant.
2) Build the guiding team - Get the right people in place with the right emotional commitment, and the right mix of skills and levels.
3) Get the vision right - Get the team to establish a simple vision and strategy, and focus on emotional and creative aspects necessary to drive service and efficiency.
4) Communicate for buy-in - Involve as many people as possible, communicate the essentials, simply, and to appeal and respond to people's needs. De-clutter communications - make technology work for you rather than against.
5) Empower action - Remove obstacles, enable constructive feedback and lots of support from leaders - reward and recognise progress and achievements.
6) Create short-term wins - Set aims that are easy to achieve - in bite-size chunks. Manageable numbers of initiatives. Finish current stages before starting new ones.
7) Do not let up - Foster and encourage determination and persistence - ongoing change - encourage ongoing progress reporting - highlight achieved and future milestones.
8) Make change stick - Reinforce the value of successful change via recruitment, promotion, new change leaders. Weave change into culture.

This is in line with the research by Yip *et al*. (1988) on the global company, which says that for a company to have a global strategy it must have a global culture, processes, structure and people which are all key elements to adapt during a change management process (see Figure 10).

Structure

- Centralization of global authority
- Absence of domestic/ international split

Management Processes

- Cross-country coordination
- Global planning
- Global budgeting
- Global performance review and compensation
- International groups and forums

Ability to Develop and Implement Global Strategy

People

- Use of foreign nationals
- Multicountry careers
- Frequent travel
- Actions and statements of leaders

- Global (vs. national)identity
- Worldwide (vs. domestic) commitment to employment
- Interdependence (vs. autonomy) of businesses

Culture

Figure 10: A global strategy need to be visible in the structures, processes, people and culture of the company. Source: Yip *et al.* (1988)

In this framework, opposition to the change is due to a lack of urgency, vision and communication. This model and other planned change models have been criticized for being too simplistic. Other change management theories exist (for example, the emergent change perspective) but this is out of scope for this thesis. The planned change approach can therefore be used as a tool to analyse and address complications with offshoring and outsourcing, and in analysing the preparation the company has undergone to ensure all aspects of the organisation (people, processes, culture and structures) support this.

2.6.3 Power and control
Outsourcing and offshoring activities from the product development process will change power which will lead to some people benefitting from the change, and others losing from it, which could motivate resistance or support for the change.

The post-modern paradigm views conflicts as a result of different perspectives and worldviews. Conflicts can be viewed within several frames; in cybernetics, for example, control can be maintained through goal setting, monitoring and resulting correlating behaviour (e.g. Pettigrew, 1973; Mumby, 1988; Pfeffer, 1981; Hatch & Cunliffe, 2005; Ashby, 1956; Wiener, 1948).

The cybernetic model uses control as a means to identify and adjust for any differences between desired and individual and organisational performance.

Control processes include:

> (1) Set organisational goals as part of an overall strategic plan for the organisation.

> (2) Set work targets or standards at each level of the organisation.

> (3) Monitor performance (individual and group) against these targets.

> (4) Assess the result of these measurements and correct any deviations.

The cybernetic model is flexible and can involve as detailed or as high level control and monitoring as is suited for the culture, organisation and situation in question. It could be a useful tool for companies in ensuring they are working towards a certain goal when they are outsourcing or offshoring product development process activities.

2.6.4 Knowledge management

The knowledge based view of the firm suggests that a multinational corporation consists of physically dispersed knowledge systems with the ability to transfer and exploit knowledge across borders (Almeida *et al*, 2002; Grant, 1996; Kogut & Zander, 1993). An empirical example of the importance of knowledge and knowledge management outside Japanese and western culture is shown by Kiessling *et al*. (2009). Through a study of Eastern European companies it is shown that organisational firm knowledge management positively affected firm innovation, employee improvement and product improvement. It also showed the same positive effect in regard to employee knowledge on firm innovation, employee improvement, and product improvement.

Offshoring or outsourcing often has far reaching consequences on knowledge creation, sharing and retention – also within the units which remain in the original location as these have to learn, grow and share together with the offshored or outsourced units. This can create organisational challenges like those seen in other restructuring and change management projects. A case in point is when Coloplast A/S offshored production to Hungary and encountered organisational challenges such as the transformation of organisational structures (like IT) to facilitate the relocation of production systems, and human resource aspects, such as limiting attrition rates, transferring knowledge effectively, and limiting social hardship (Nielsen *et al*., 2008). Knowledge is different from information in that the person's connection to the information is also relevant, "*[…][A] body of information might consist of facts, opinions, ideas, theories, principles, and models (or other frameworks). Clearly, other categories are possible, too. […] Knowledge also refers to a person's state of being with respect to some body of information. These states include ignorance, awareness, familiarity, understanding, facility, and so on*" (Ramalingam *et al*., 2007). The focus of this research is on knowledge.

Jung *et al*. (2007) have shown knowledge management to have a lifecycle of six points (see Figure 11 on the following page):

1) Knowledge creation.
2) Knowledge formulisation.
3) Knowledge organisation.
4) Knowledge distribution.
5) Using knowledge.
6) Knowledge evolution.
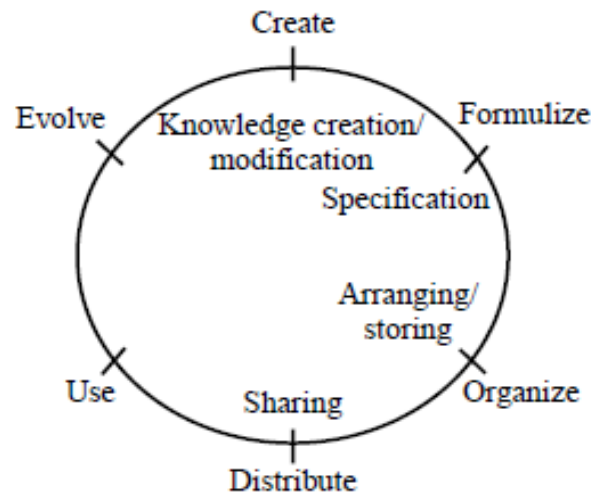
Figure 11: The knowledge management lifecycle.
Source: Jung *et al*. (2007)

This section focuses on core aspects of these six points. First, models and theories related to knowledge creation are illustrated, and then literature related to knowledge sharing is explored.

Models and theories
Knowledge creation can be viewed as an activity which focuses on collaboration and accomplishing certain tasks (Nonaka *et al*., 1995). Knowledge can take different forms.

Explicit knowledge is knowledge which can be documented, categorised, transmitted to others as information and illustrated to others through demonstrations, explanations and other forms of sharing.

Tacit knowledge, also called 'know how', is knowledge which draws on the experience and learning of a person and it's often habits and skills we do not normally recognise as knowledge. It's hard to document and thereby keep in the company beyond the individual. It consequently often has a social and cultural element (Polanyi, 1966; Nonaka & Takeuchi, 1995; Castells, 1996; Debowski, 2006; Hansen *et al.*, 1999). Some researchers suggest that tacit knowledge cannot be explicated but transfer is possible through socialisation (e.g. D'Eredita and Barreto, 2006; Tsoukas, 2003).Tacit knowledge transfer requires extensive personal contact and extensive socialisation (Davenport and Prusak, 2000). However, this also creates significant competitive advantage (Argote & Ingram, 2000).

Some also include implicit knowledge as a knowledge form (Wallace *et al.*, 2004). Implicit knowledge is knowledge which "*…cannot easily be articulated by the person possessing it, but can be elicited and articulated by others. An example of implicit knowledge is the strategy adopted by an experienced designer to undertake a particular task in the design process." (*Ahmed *et al*., 2005:1-2*).*

According to Evbuoimwan (1997), in the field of engineering design, knowledge can be divided into two kinds of knowledge; product knowledge and process knowledge (see Table 7). Product knowledge is related to the product to be designed while process knowledge is related to the activity of designing itself. This separation between product and process knowledge is assumed to also cover other engineering fields.

Table 7: Product and process knowledge.

	Explicit knowledge	Implicit knowledge	Tacit knowledge
Process	Explanations about the process (e.g. rationale)	Understanding about the process (e.g. strategies)	Intuition about the process (e.g. Insights)
Product	Explanations about the product (e.g. rationale)	Understanding about the product (e.g. relationships)	Intuition about the product (e.g. Insights)

Explicit knowledge about the process or product is for example explanations or rationale about the process or product which can be documented and written down, implicit knowledge is for example an understanding about the process or product like strategies or relationships which cannot easily be articulated by the individual but which can be explained by others, and tacit knowledge is for example intuition, insights and know-how about the process or product which cannot easily be explained. A study (Ahmed, 2007a) showed that design engineers find knowledge related to the process as more important than product knowledge.

Lam (2000) operates with four types of knowledge which complements the previous three (explicit, implicit and tacit):

1. **Embrained knowledge:** Individual, explicit knowledge. For example theoretical knowledge.
2. **Embodied knowledge:** Individual, tacit knowledge. An example is practical experience.
3. **Encoded knowledge:** Collective explicit knowledge. An example is written rules and procedures.
4. **Embedded knowledge:** Collective, tacit knowledge. An example is routines and norms.

Table 8 shows these four knowledge types, their dimensions and definitions.

Table 8: Knowledge types based on Lam (2000).
Source: Chen & McQueen (2009)

Knowledge types	Knowledge dimensions	Definitions
Embrained knowledge	Individual-explicit	It is formal, abstract or theoretical knowledge and it is dependent on the individual's conceptual skills and cognitive abilities
Embodied knowledge	Individual-tacit	It is action oriented; it is the practical, individual type of knowledge. It builds upon "bodily" or practical experience ("doing")
Encoded knowledge	Collective-explicit	It is conveyed by signs and symbols, it is knowledge that has been codified and stored in blueprints, recipes, written rules and procedures
Embedded knowledge	Collective-tacit	It resides in organizational routines and shared norms based on shared beliefs and understanding within an organization

In Nonaka *et al*. (2002), a model is proposed which states that new knowledge is created through a cycle of social interaction between these knowledge types through socialisation, externalisation, combination and internalisation (SECI). This model is called the SECI knowledge model and is based on the separation of tacit knowledge and explicit knowledge (see Figure 12).

Figure 12: SECI knowledge model.
Source: Nonaka *et al*. (2002)

As Figure 12 shows, knowledge generation can be illustrated as a continuous circle, in which explicit and tacit knowledge is connected, meaning that knowledge of one kind can be used to create knowledge of another kind. Knowledge generation therefore goes from individual to individual, individual to group, group to organisation, organisation to individual, and then begins over again (Bleischwitz *et al*., 2004).

> **Socialisation:** The sharing of tacit knowledge through face to face communication or shared experience and shared understanding. An example is an apprenticeship.
>
> **Externalisation:** Communication and reflection of tacit knowledge through development of explicit concepts. In this way knowledge can be expressed through various forms of communication (also music and visual art).
>
> **Combination:** The combination of various elements of explicit knowledge. In this phase the concepts are systemised in a knowledge system, which integrates different kinds of explicit knowledge. In this manner tacit knowledge becomes accessible and understandable for all. Through these combination processes adjustments, reorganisation and (re)combinations can be created which can foster new knowledge.
>
> **Internalisation:** The knowledge becomes part of the individual's knowledge base (e.g. mental models) and can hereafter also be accessible to the organisation. From here new knowledge can be created and the process starts all over (the circle arrow on Figure 12).

Examples of each of the four conversions include:

1. Tacit knowledge - individual to individual
   - For example, through experiences which are debated in unofficial communication and meetings.
2. Tacit knowledge - individual to group
   - For example, through unofficial and official meetings, perhaps an option to show the group through shadowing, where the group sees how the other person works by observing him/her in his/her daily routine.
3. Explicit knowledge – group to organisation

- Policies for saving and documenting knowledge and putting it to use in the organisation.

4. Tacit knowledge – organisation to individual

- Work policies loose enough to allow the individual to find a better way to do the task.

The drawbacks of the knowledge model created by Nonaka *et al*. (2002) is that it is based on Japanese companies which have another culture and approach to the employee-employer relationship than in Denmark. Furthermore, the linearity of the model can be questioned as knowledge could also be created by groups, the organisation itself or start off being explicit; or in other words the process might be able to go against the arrow. The model is used despite these points of critique because it is considered one of the most comprehensive models in this field and - together with the other models presented here - gives a comprehensive overview of the field of knowledge management.

Knowledge management is about learning. Learning can therefore happen at various levels;

1. Individual (Tsang, 1999; Von Krogh, Nonaka, & Ichijo, 1997).
2. Group (Lave & Wenger, 1991; Wenger, 1998).
3. Organisational (Inkpen & Dinur, 1998).

As a person learns, he or she goes through four stages; novice, advanced beginner, competence, and proficiency. As a novice the person rely on normative rules and regulations to do things. As an advanced beginner the person can imitate other more experienced people and can apply techniques to similar cases. At the competence level, a person can come up with new rules to resolve new situations but can't resolve unanticipated problems. At the proficiency level the person can apply new rules to new and untested situations and handle unanticipated problems (Dreyfus & Dreyfus,1986; Chen & McQueen, 2009).

In Court *et al*. (1996), it is shown that colleagues are the most used information source. A study of engineering designers (Ahmed, 2001) suggested that novice designers do not know how to ask for what they don't know; therefore knowledge repositories would not improve their skills. The suggestion here was to adopt a question-based approach where novice designers were given generic questions based upon experienced designers' behaviour so they would understand what they needed to know and could gain the competences they needed faster than they otherwise would have.

These findings present a challenge when engineers need to communicate across national and cultural distances – and when in outsourcing arrangements also across corporate boundaries - which may have different work routines and where knowledge sharing through face to face interaction is more difficult.

According to Debowski (2006), a company which wants to encourage knowledge creation and knowledge sharing among its employees needs to foster an organisational culture which encourages the following seven aspects:

Trust: Many definitions of trust exist. The following definition is used: Trusting another person means "... *believing that when offered the chance, he or she is not likely to behave in a way that is damaging to us, and trust will typically be relevant when at least one party is free to disappoint the*

other, free enough to avoid a risky relationship and constrained enough to consider that relationship an attractive option." (Gambetta, 1988: 219). In the case of knowledge sharing employees need to trust relevant information is being shared, appreciated and awarded.

> **Tolerance:** To be able to share information, learn new approaches and learn from mistakes employees need to show tolerance towards other ways of doing things and viewing mistakes as an important part of a learning process.
> **Knowledge sharing:** Information need to be shared freely and openly to foster a collaborative knowledge culture.
> **Cross-boundary communication:** Synergy effect and novel ideas and approaches can often only be developed through cross-boundary communication in order to understand new angles and combinations.
> **Learning as incorporated into the practical work:** If learning is not a part of the day to day business it can easily become a burden, an extra duty to perform which the employees find they do not have 'time' for.
> **Collaboration:** People prefer to work together and actively seek to share and use knowledge with others.
>
> **Encouragement and exploration of new ideas:** Creative support in the form of incentives, leadership support, physical space and time is important to encourage the development and exploration of new ideas.

Knowledge retention is about keeping knowledge in the company. This has three main aspects:

1. **Retaining the knowledge of key knowledge personal:** Emerging markets like India and China has a high employee turnover rate (Weidenbaum, 2005). In western societies white collar workers also rarely stay in the same position for life (Ahmed *et al.*, 2005). Their knowledge therefore needs to be shared through interaction as it is developed and transformed into explicit knowledge and stored as far as possible.
2. **Going through the process of individual knowledge to organisational knowledge as shown in the SECI knowledge model:** Storing knowledge in knowledge repositories and in other ways creating information out of knowledge only makes sense if there is a knowledge culture in place which encourages this information is kept current and is used. However, it was shown earlier that knowledge repositories was not as valued a learning place as colleagues and other face to face interaction. Therefore the latter aspect also needs to be considered.
3. **Embedding the new knowledge in new organisational structures, routines, work methods and – if needed – organisational culture:** This requires a knowledge culture is already in place in the organisation or a change management project is initiated to create this change – under the assumption that changing culture is possible.

This presents a challenge for offshoring and outsourcing as knowledge creation, sharing and retention has to take place over spatial, cultural and for outsourcing also organisational boundaries.

For a company which offshores or outsources knowledge creation and knowledge sharing can take place in three key places; 1) at the corporate headquarters, 2) at the subsidiaries or outsourced

partner and 3) at the interaction between any of these. This knowledge need to be transferred and integrated across cultures and time zones. Knowledge sharing is illustrated in greater detail in the following section.

Knowledge sharing
Offshore offices and factories become subsidiaries to their headquarters. The subsidiary will hereafter be embedded within the multinational corporation's network but also in the local network it becomes a part of (Ghoshal & Bartlett, 1990; Ghoshal & Nohria, 1997; Forsgren *et al*., 2000). These different local networks mean different subsidiaries have access to different knowledge, competences and ideas (McEvily & Zaheer, 1999). Knowledge created inside a company is often cheaper for the company to gain access to and use as it already fits the company's standards. This adds to the knowledge and resource advantages of offshoring (Malnight, 1996).

A company does not exist in a vacuum; it interacts with the outside world and when it comes to knowledge generation this interaction can help create a network of knowledge (see Figure 13).
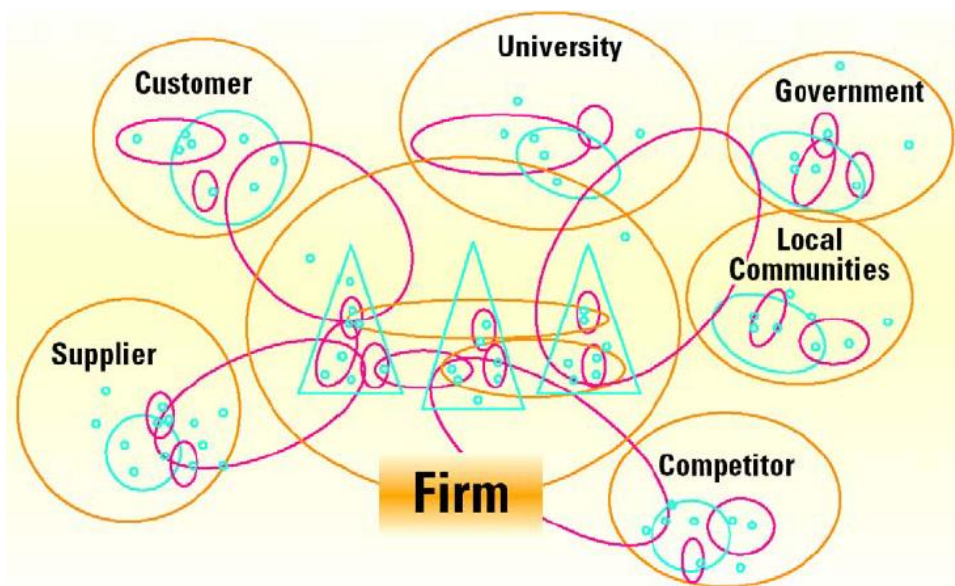
Figure 13: Knowledge networks
Source: Nonaka *et al*. (2002)

A network of knowledge which spans time and place can be beneficial for all parties involved. Access to local networks can impact the competitiveness of the subsidiary within the local market (Anderson *et al*., 2002).Offshoring can be seen in relation to such knowledge networks and it can be derived that a knowledge network can improve the value of offshoring through access to local knowledge, talent, expertise and customer contact (Ferdows, 1997b). By placing high strategic importance on offshored plants these can create a competitive advantage for the company in the market in which it is located – and all other markets the company serves by sharing this knowledge with other parts of the company (Ferdows, 1997b).

The subsidiaries' business and technical embeddedness therefore becomes important (Anderson *et al*., 2002). Embeddedness refers to the degree of closeness in the relationship between the subsidiary and its network contacts be they customers, suppliers or others as shown in Figure 14.
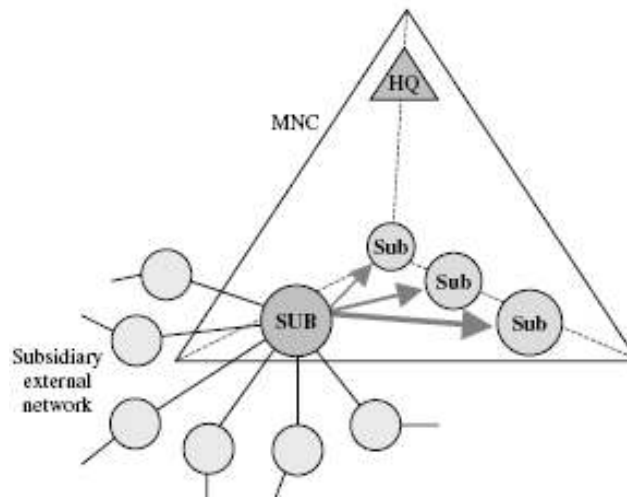
Figure 14: A subsidiary's embedded network structure in regard to its local environment, other subsidiaries, and the headquarters (HQ).
Source: Anderson *et al*. (2002)

An offshored plant or office therefore needs to balance its dependence and relation to other subsidiaries and the headquarters with the knowledge and influence it has within its own external network so knowledge can flow back and forth between all units of the MNC. This flow of knowledge from the subsidiary to the rest of the organisation is called reverse knowledge transfer (Håkanson, 2001). Despite the value placed in literature on knowledge within external and internal networks political power bases within the MNC may influence the position of subsidiaries and what knowledge and which assignments are given and shared (Mintzberg, 1996). This is supported by Rabbiosi (2008) who showed that the level of autonomy in the subsidiary influences the level of reserve knowledge transfer.

A company creates these networks with internal and external actors through formal and informal networks made of individuals. These findings therefore indicate that it is important to consider these aspects in decisions regarding globalising product development process activities.

A major challenge of transferring knowledge in multinational corporations is to manage local knowledge integration (Williams, 2007; Saka, 2004). As mentioned by Gupta & Govindarajan (2000:477), "*developing, exploiting and transferring knowledge across organizational units is critical for the success of multinational enterprises*".

Knowledge in MNCs is classified by varying degrees of complexity (Kogut & Zander, 1993), tacitness (Lam, 1997; Nonaka & Takeuchi, 1995; Spender, 1996), stickiness to local context (Jensen & Szulanski, 2004), ambiguity (Simonin, 1999), and hierarchical levels (Hedlund, 1994; Lubatkin, Florin, & Lane, 2001). These sources can be grouped into three general knowledge types: Technical knowledge, Systemic knowledge and Strategic knowledge (see Table 9 on the following page).

Table 9: Knowledge types and their characteristics
Source: Hong & Nguyen (2009)

Knowledge types	Descriptions	Knowledge-related characteristics[a]				
		Tacitness	Ambiguity	Stickiness	Complexity	Hierarchical level
Technical knowledge	Knowledge of new, specific techniques, such as for quality measurement or for undertaking systematic market research. Knowledge is task-oriented, involving the acquisition and implementation of new concepts, latest production techniques or foreign technology at the frontline operations.	Low	Low	Low	Low	Operational
Systemic knowledge	Knowledge of new organizational systems and procedures, such as performance appraisal. Knowledge is socially complex with a broader organizational focus as it is related to the understanding of structural relationship among different departmental units and the cooperation its collective behavior.	Medium	Medium	High	Medium	Middle
Strategic knowledge	Knowledge involves changes in the mindsets of senior managers, especially their criteria of organizational success and their mental maps of the factors significant for achieving that success. This knowledge relates to how the relationship among different critical factors is constructed and explicated.	High	High	Medium	High	Top

Of these three types, technical knowledge is said to be the easiest to transfer as it has a low level of tacitness, ambiguity, stickiness, and complexity and is on the operational level of the hierarchy whereas strategic knowledge is most difficult to transfer (Hong & Nguyen, 2009).

Knowledge transfer depends on: (1) knowledge value and its characteristics to be able to catch knowledge of the highest value first, and (2) deploy the right transfer mechanisms, to be able to transfer different types of knowledge (Lazarova & Tarique, 2005). Thus the value of knowledge depends on knowledge tacitness and specificity. International knowledge, which is both tacit and specific, would be of the highest internal value to organisation as it would be difficult to imitate by others. Transfer mechanisms for different kinds of knowledge value include:

- **High (both high tacitness and specificity):** focus on team approaches and can, for example, use expatriates on cross-national projects.
- **Medium (various combinations of tacitness and specificity):** focus on individuals and small size groups and can, for example; use tools like simulations, behaviour modelling, case study discussions, or action learning.
- **Low (explicit and generic knowledge):** intensity transfer mechanisms, can use tools like, for example, lectures, presentations, articles in newsletters, and on the intranet

Knowledge sharing can take place in many different ways depending on the type of knowledge shared (tacit, explicit or implicit). This can, for example, be through face to face interaction, 'shadowing', through knowledge repositories, or apprenticeships.

Moving knowledge between locations can be difficult if the needed knowledge is tacit or implicit and therefore tied up in work routines and practices and embedded in a given cultural and social context.

Knowledge transfer between units in a multinational organisation can be divided into two groups; structured and unstructured knowledge transfer (Chen & McQueen, 2009).

1. Structured knowledge transfer
    - A very structured, formal, planned and intentional transfer process.

> ➢ Szulanski (1996) suggests a four step model for structured knowledge transfer: Initiation (search), (2) Implementation (learning), (3) Ramp-up (practice) and (4) Integration (grasp).

2. Unstructured knowledge transfer

> ➢ Spontaneous informal, unplanned and unstructured transfers of knowledge that routinely take place during daily work within and across organisational boundaries (Davenport and Klahr, 1998). Unstructured knowledge transfer is also important to an organisation's success (Davenport and Prusak, 2000).
>
> ➢ Chen & McQueen (2009) identify three types of unstructured knowledge which starts with basic copying and then advances to new knowledge developed in group: 1) Unstructured copy, (2) Unstructured adaptation and (3) Unstructured fusion.

Knowledge in multinationals is diverse and contextually embedded in local environment (Tsang, 1999; Von Krogh *et al.*, 1997)*,* group (Lave & Wenger, 1991; Wenger, 1998), and organisational levels (Inkpen & Dinur, 1998)*.* Knowledge transfer mechanisms need to consider these elements of the knowledge which is to be transferred.

Transferring knowledge can happen in different ways from interaction to formal training depending on the knowledge's characteristics (see Table 10). For example, the mechanisms suggested for transferring technical knowledge which is universal (e.g. technology, languages, basic selling and marketing techniques) are formal training aided by classroom training and documentation.

Table 10: Knowledge types and transfer mechanisms.
Source: Hong & Nguyen (2009)

Knowledge types	Knowledge embeddedness	Examples	Broad mechanisms	Specific techniques	Underlying paradigm	Knowledge source
Technical knowledge	Universal	Technology Languages Basic selling and marketing techniques	Formal training	Classroom training Documentations	Knowledge transfer	Foreign
	Locally embedded	Government regulations Customer relationship management skills Communication skills	Creative application	On-site demonstration Past incidents	Local adaptation	Local
Systemic knowledge	Universal	Quality management and control practices Planning and management systems Workplace improvement initiatives	Interaction	Meetings Job rotation	Knowledge transfer	Foreign
	Locally embedded	Power and politics in organization Cultural differences People management skills	Translation	Systemization Observation Co-participation	Knowledge transfer and local adaptation	Foreign and local
Strategic knowledge	Universal	Successful business models Strategic mindset Industry competitiveness	Sense-making and sense-giving	Experiential learning Reflection	Knowledge transfer and local adaptation	Foreign and local
	Locally embedded	Management of external stakeholders Local institutions and business systems	Integration	Boundary spanning Cultural translators Knowledge exchange	Knowledge transfer and local adaptation	Foreign and local

In a study by Chen *et al.* (2010), it was shown that knowledge tacitness, knowledge gaps, cultural and communication difficulties and weak relationships were the critical barriers to successful knowledge transfer using a structured knowledge transfer process in a cross-cultural knowledge transfer context. However, peer-to-peer help, close relationships and proactive learning may decrease these knowledge transfer difficulties. Barriers to knowledge transfer due to cultural

differences between sender and receiver were also shown in several studies (e.g. Bhagat *et al*., 2002; Gonzalez *et al*., 2006; Lucas, 2006). Furthermore, it has been shown that for communication to function, the knowledge recipient and the provider need to speak a common language or else knowledge transfer will fail (Davenport and Prusak, 2000; Simonin, 1999; Davenport and Prusak, 2000). Grant (1996) showed that a common language among workers in multinational corporations is a significant barrier to knowledge transfer in multinationals.

Hong & Nguyen (2009) showed the limitations of applying a standardised and universal set of knowledge transfer mechanisms without considering local idiosyncrasies and the important contributions of local agents and institutions throughout the process of local knowledge adaptation and development.

In a study by Andersen (2008), it was shown that knowledge embedded in routines can be an obstacle for knowledge transfer if these routines are not challenged, and potentially unlearned if they are obsolete (Sinkula, 2002).

Knowledge in outsourcing situations has additional barriers as it is a transaction between two different corporations. This transaction has a certain work approach and length as well as a certain trust and power relation based on – among other things - the value and knowledge complexity of the task. An arms-length transaction will often have a low level of trust, be on a short contractual basis, and involve a simple task which does not involve close collaboration. At the other end of a scale, a strategic partner would be a company which is trusted and develops the buyer company's products in collaboration, using their unique knowledge and skills to improve the buyer company's competitive advantage (Easton 1992; Lacity & Willcocks, 2003; Kern & Willcocks, 2000; Leimesiter and Krcmar, 2008; Gereffi *et al*., 2005; Hawk *et al*., 2009; Chen & McQueen, 2009; Blumenberg *et al*., 2009; Oshri *et al*. ,2007; Gulati & Sytch, 2007; Casciaro & Piskorski, 2005; Geyskens *et al*., 1996; Cox *et al*., 2004; Caniels & Roeleveld, 2009). The details regarding vendor relationships are out of scope for this thesis but the complexity and influence are useful to keep in mind. For more on vendor relationships see Appendix 1 for an introduction to the topic.

To summarise, knowledge sharing between organisational units is about knowledge integration. This means consideration for the local environment the subsidiary is in, creating structures, processes and procedures for knowledge transfer, and consideration for cultural distance between organisational units. The value of informal knowledge transfer and the limitations of formal knowledge transfer should be kept in mind so both approaches are considered. The characteristics of the knowledge which is to be transferred influences how easy it is to transfer, and what mechanisms can best be used. Expatriates are often used to transfer knowledge between organisational units. It can therefore be assumed that knowledge management is an important element for addressing the research question.

2.7 Global networks

A global engineering company can be assumed to have to coordinate multiple offshoring and outsourcing locations into their product development process. The result would be the creation of a global network. The previous sections have shown the importance of considering networks when a company globalise.

A network is a set of nodes and the relationships which connect them (Fonburn, 1982). A network is made up of nodes (e.g. people, departments, suppliers, competitors, customers) and links (e.g. knowledge, communication, physical exchanges). These can be internal (within the company's control) or external (outside the company's control). In supply chain management the focus is on the external network and the links which connect nodes more than on the nodes themselves whereas manufacturing networks/operations management has the opposite perspective (see Figure 15).
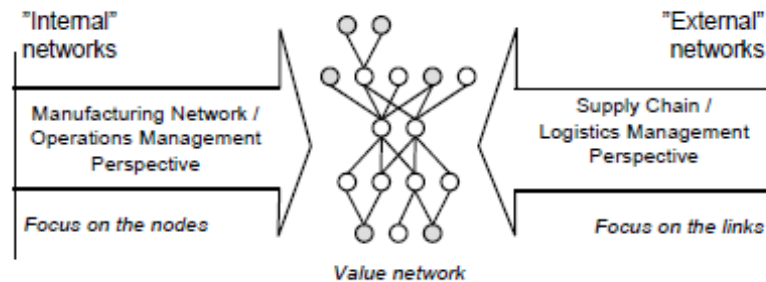
**Figure 15: The global manufacturing and supply chain network perspectives on the network, links and nodes.
Source: Rudberg & Olhager, (2003)**

Within operations management, the network perspective has been used to illustrate global networks within supply chain, service, engineering and manufacturing (see Table 11).

**Table 11: A network perspective.
Source: Srai & Fleet (2010)**

	Engineering Networks	Production Networks	Supply Networks (Srai & Gregory 2008)	Service Supply Networks (Srai 2010)
Configuration Elements	(Zhang *et al*. 2007)	(Shi & Gregory 1998, Christodoulou *et al* 2007)		
Network Structure	Geographic dispersion Resources and roles of engineering centres Rationale for network design	Plant role, characteristics Geographic dispersion Network evolution	Supply Network tier structure and shape Geographical dispersion And Mapping Integrating mechanisms	Multi-organisational network structure Service Archetypes
Operations Flow / Dynamics	Operational processes supporting engineering information flows	Response mechanisms	The flow of materials and information between and within key unit operations Replenishment mode and supply-demand dynamics	Service supply contracting mode Through-life perspectives
Governance and Coordination	Governance, including authority structure and co-ordination mechanisms	Horizontal and Vertical coordination	The role of network leaders Inter-firm governance mechanisms	Service Network governance modes
Support Infrastructure	Support, including engineering tools and IT systems	-	-	Support Systems
Network Relationships		Intra-firm dynamic capability building	The role of key network partners Inter-firm relationships	Partnering modes Firm and Network Value-sets
Product Configuration		Product lifecycle and knowledge transfer	Product Modularity Value Density Stock keeping unit (SKU) portfolio/profile	Service Offering Outcomes/Effects

This research views the configuration of networks as consisting of five dimensions:

1. Network Structure.
2. Operations Flow.
3. Governance and Coordination.
4. Support Infrastructure.
5. Product Configuration.

As this study includes the whole product development process, the manufacturing network, the engineering network, and the R&D network is of interest. However, as the focus is on management and engineering particular focus is on the global engineering network; further emphasised by the fact that global R&D networks are still a very young research topic.

2.7.1 Manufacturing
Drivers for global manufacturing include market access, access to resources, strategic assets, and efficiency gains (Dicken, 2003; Shi & Gregory, 1998, Ferdows, 1997b). Ferdows (1997b) describes the concrete drivers for offshoring of manufacturing (see Figure 16).
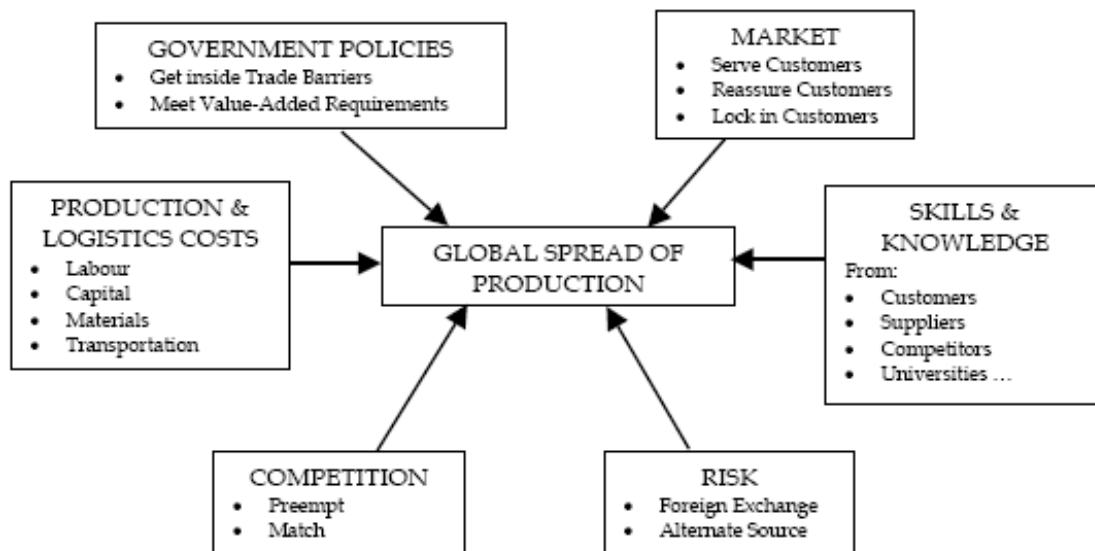
Figure 16: Drivers behind the global spread of production.
Source: Ferdows (1997b)

These drivers include:

1. Skills and knowledge.
2. Risk.
3. Competition.
4. Production and logistics costs.
5. Government politics.
6. Market.

Offshoring and outsourcing in engineering companies started with the manufacturing phase as mentioned in Chapter 1. Research has evolved from focus on one plant to the global manufacturing network. It has shown that few companies have a clear strategy for their manufacturing networks;

they are often an outcome of mergers and acquisitions (M&As) and organic growth (Christodoulou *et al*, 2007). In certain cases co-location of production and design and development can be vital for product innovation (e.g. Chesbrough & Teece, 1996; Christensen, 1997). The decision to move manufacturing is therefore not a trivial one. However, the linkage between manufacturing and other activities like design and R&D has often been a surprise for many companies (IfM report, 2003). Companies have experienced complications related to facilities, suppliers, material control, human resources, knowledge, organisations and relationships, quality and the external environment when globalising manufacturing. There has therefore been a need for the development of a model with which to analyse and improve the manufacturing network.

A few such models exist (see Grallert *et al.*, 2010 for a review). The Global Footprint Strategy of Manufacturing developed at Cambridge University presents such a detailed model for reconfiguring global manufacturing networks. This model details the movement of production as a seven step process (see Figure 17).

In **step 1** the strategy is decided. In this step the need for transfer is discovered and other ways to reach the strategic goal than transferring is discussed. In **step 2** the potential host for the manufacturing process is explored. In **step 3** the fitness for transfer is discovered. This includes how appropriate for transfer the process is (i.e. the target market and host labour characteristics, including cultural differences) and the transferability of the manufacturing process (i.e. the knowledge characteristics, available documentation, and possibility for modularity). In **step 4** the manufacturing process is altered to suit the new host site; this includes considerations for possible changes to facilities, suppliers, material control, human resources, knowledge, organisations and relationships, quality and the external environment or in other words product changes, process modifications, support activities and training and capability development. In **step 5** the item and knowledge which need to be transferred are identified. In **step 6** the manufacturing process is embedded at the new host site and in **step 7** the experiences worth remembering for next time are saved.
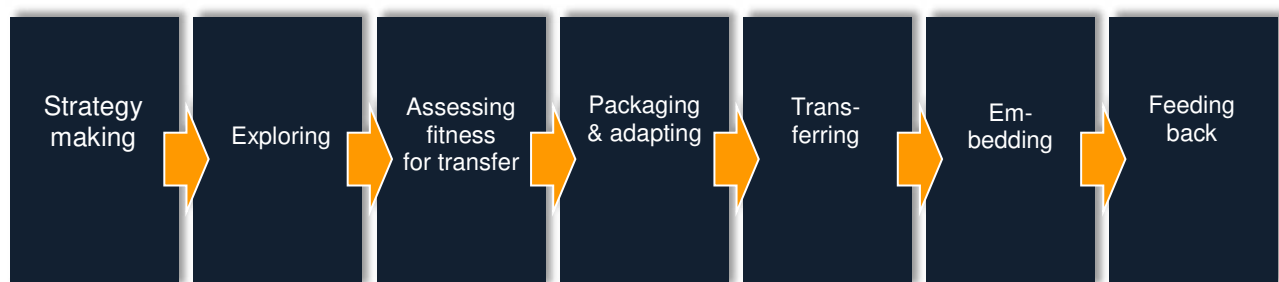
Figure 17: Seven step model for manufacturing mobility
Source: Minshall (1999)

Each step of this model provides the option to go back and revisit previous steps if cost of moving is proven too high. In this manner the model can be used as scenario creation or in the transfer choice and implementation itself.

This model can also be seen as a continuous cycle of asking "why?, what?, where?, and how?". The model thereby covers all stages from strategy to implementation. Because reconfiguration is considered a continuous process the network can be adapted to fit the changes in macroeconomics and technologies and thus ensure transfer of manufacturing is conducted with both short and long

term strategic goals in mind. This includes considering financial as well as none-financial goals and risks.

In the **why** phase the motivation for redesigning the manufacturing network has to be uncovered. In the **what** phase it has to be established what is changed in the network. In the **where** phase it has to be established to where it is moved, and how they are connected. The **how** phase is concerned with how the move itself is carried out and how the success of the decision and the move is measured.

Each stage presents several tools (e.g. Christodoulou, Fleet. & Hanson, 2007, IfM report, 2003; Grallert *et al*., 2010). These are used to discover the current situation for the company so it can be decided what the best strategy is. In the where phase this is done through a flowchart for the 'make or buy' decision (i.e. whether to outsource or keep full or partial control). Furthermore, in later stages concepts like scenario sheets and scenario analysis are used to evaluate the different location choices and how this fit with the product or process being moved, as well as risk assessment.

2.7.2 Engineering
Global engineering networks (GEN) expand on the ideas from the global product development literature and put these in a network perspective. Drivers to globalise engineering and move towards GEN include:

1) To improve market-driven innovation (Eppinger & Chitkara, 2006; von Zedtwitz & Gassmann, 2002).
2) To access dispersed knowledge and skills (Karandikar & Nidamarthi, 2006; Leenders *et al*., 2003).
3) To preserve linkages between functions, e.g. the globalisation of closely linked operations (for example R&D, production, or supply chain) speeds up the globalization process of engineering (Eppinger & Chitkara, 2006; Shi & Gregory, 1998; von Zedtwitz *et al*., 2004).

Zhang (2007) considers global engineering networks to be a natural evolution of engineering based on past development and present drivers. The functional approach to engineering views an engineering system as a closed system (Robertson, 1960). The focus is on the internal operations of an organisation. The goal is the optimisation of individual aspects through personal accountability, vested authority, and singular management control over personnel (Thamhain, 1992). The project approach considers an engineering system as an open system (Rubenstein, 1989). This approach consists of distributed managerial power among managers, dual accountability and shared resources. This approach does not reply on formal authority but more on managers' ability to deal with personnel across functional lines over whom they have little or no formal authority. While this approach is more flexible and adaptable than the previous approach, it still does not focus on a long-term development of the whole engineering network and invests in the creation of many similar projects. The matrix organisation follows from this. Here a team approach is taken to product development and people are pulled together from many different departments when needed. This means one employee can have to respond to many different managers. From here, virtual teams and Centers of Excellence were created around the world, leading to a Global Engineering Network. Figure 18 shows this evolution towards GENs.
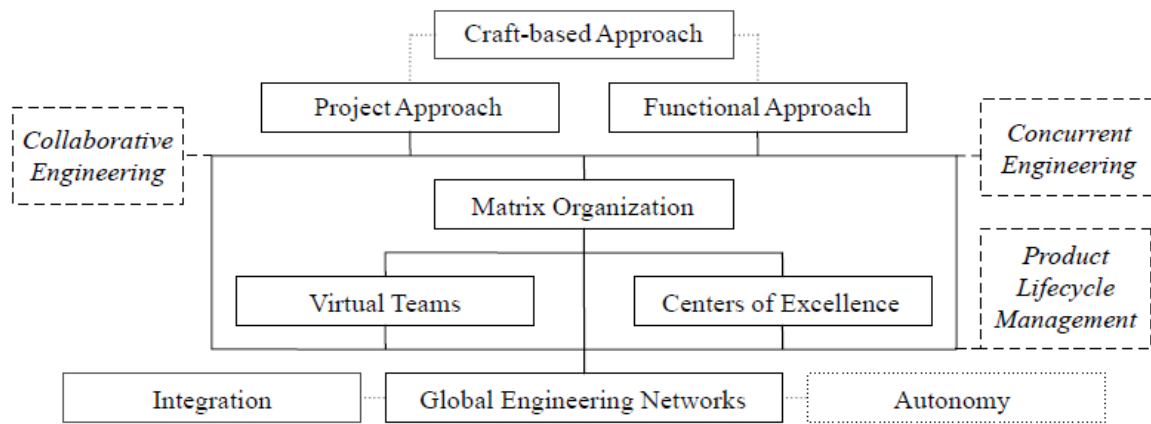
Figure 18: The evolution roadmap.
Source: Zhang *et al*. (2008)

Zhang (2007) showed that GENs can be seen from the perspectives of:

1. The context

- ➢ Mission i.e. the reason for the GEN
- ➢ Drivers for GEN
- ➢ Barriers which limits the efficiency of the GEN

2. The capability

- ➢ Communication and sharing within the GEN
- ➢ Integration and synergising within the GEN
- ➢ Innovation and learning within the GEN
- ➢ Adaptation and restructuring within the GEN

3. The configuration

- ➢ Network structure of the GEN
- ➢ Coordination mechanisms for the GEN
- ➢ Governance system for the GEN
- ➢ Support system for the GEN

These three characteristics are also called the 3C framework.
Using the 3C framework, GEN can be shown to have two types of configuration:

1. Integrated GEN
    - ➢ Concentrated/interdependent engineering centres.
    - ➢ Structured/formal and collaborative mechanisms.
    - ➢ Detailed and operational governance.
    - ➢ Standardised support systems.

2. Autonomous GEN
    - ➢ Dispersed/independent engineering centres
    - ➢ Unstructured/informal and competitive mechanisms
    - ➢ Generic and strategic governance
    - ➢ Customised support system

These can have two types of capabilities:

1. Effective GEN
   ➢ Quick response to business changes.
   ➢ Effective product development for local markets.
   ➢ Customer-driven innovation.
2. Efficient GEN
   ➢ Economics of scale.
   ➢ Leveraging expertise or precious resources on a global scale.
   ➢ Sharing and reusing knowledge or existing solutions.

This means four possible GEN patterns can be shown (see Figure 19):

GEN I: Integrated and efficient GEN (e.g. virtual teams, projects).

GEN II: Autonomous and effective GEN (e.g. functions, centres of excellence).

GEN III: Integrated and effective GEN.

GEN IV: Autonomous and efficient GEN.

Figure 19: GEN patterns.
Source: Zhang (2008)

In this manner the characteristics of GENs can be clarified and their configuration illustrated and analysed, showing a picture of how the company's GEN looks like today.

2.7.3 Research and Development
Today, a majority of manufacturing companies offshore or outsource not only production but also large parts of their product development process, including R&D activities (Von Zedtwitz; 2002). While a complete network configuration analysis for R&D networks hasn't been made and is out of scope for this thesis, a first step towards this has been developed (see Hansen *et al.* (2011). However, several aspects of global R&D have been analysed (see Zhang (2007) for a detailed literature review of international R&D networks).

Motivation for global R&D is to support local markets, to gain resources (e.g. technology, expertise or talents), or to achieve operational synergy on a global scale (De Meyer & Mizushima, 1989; Gassmann & von Zedtwitz, 1998; Granstrand, Håkansson & Sjölander, 1992; Miller & Morris, 1998). Shorter product development cycles, global competition, increased customer expectations and technological risks have also been listed as reasons to globalise R&D (Gassmann & von Zedtwitz, 1998). However, barriers against global R&D include immobility of personnel, language and culture problems, loss of know-how, political risks, and coordination and information costs (Gassmann & von Zedtwitz, 1998). Pearce (1999) identified four trends for dispersed R&D networks and their strategic competitiveness: (i) increasing involvement in product development rather than adaptation, (ii) interdependent rather than dependent position in group technology programs, (iii) increased relevance of supply side influences (e.g. host country technology competencies, capacities and heritage), and (iv) decline of centralising forces on R&D (e.g. economies of scale, communication and coordination problems, or concerns of knowledge security).

The configuration of international R&D networks has been studied from the dimension of geographic dispersion, coordination, or knowledge flow direction (Gassmann & von Zedtwitz, 1999; Kuemmerle, 1997; Miller & Morris, 1998; Westney & Wolff, 1996). Gassmann & von Zedtwitz (1999) classified international R&D organisations into five types by the dispersion of R&D activities and the degree of cooperation between R&D centres; ethnocentric centralised, geocentric centralised, polycentric decentralised, R&D hub, integrated R&D network (see table 12 for their strengths and weaknesses).

Table 12: Types of internal R&D organisation.
Source: Gassmann & von Zedtwitz (1999)

Types of R&D Organisation	Strengths	Weaknesses
Ethnocentric centralised *lack of translational R&D processes as all R&D activities are concentrated at the home base*	high efficiency; low R&D costs (scale effect); short cycle time; protected core technology	lack of sensitivity for local markets; danger of missing external technology; not invented here syndrome; tendency towards rigid organisation
Geocentric centralised *to overcome the lack of market sensitivity*	efficiency due to centralisation; high sensitivity for local markets and technological trends; cost-efficient R&D internationalisation	danger to neglect systematic internationalisation; local content restrictions and local market specifications insufficiently considered
Polycentric decentralised *to overcome the isolation of formerly independent R&D units and integrate them*	strong sensitivity for local markets; adaptation to local environment; usage of local resources	inefficiency and parallel development; no technological focus; problems with critical mass
R&D hub *usually a reaction by centralised companies to the internationalisation of resources*	high efficiency due to coordination of R&D; avoidance of redundant R&D; exploitation of all available strengths; realisation of synergies	high costs of coordination and time; danger of suppressing creativity and flexibility through central directives
integrated R&D network *authority for technology or component development based on individual capabilities of R&D units*	coupling of specialisation and synergy effects; global before local efficiency; organisational learning across many locations; exploitation and refining of local strength	high coordination costs; complexity of institutional rules and decision processes

Von Zedtwitz & Gassmann (2002) separated research and development, listing reasons for location choice for each of these with research being more science and technology driven and development being more engineering and market driven (see Table 13).

Table 13: Drivers for research and for development.
Source: Von Zedtwitz & Gassmann (2002)

Research location decision (Science and technology drivers)	Development location decision (Engineering and Market drivers)
Proximity to local universities and research parks	Local market requirements
Tapping informal networks	Global customers request local support
Proximity to centres-of-innovation	Customer proximity and lead users
Limited domestic science base	Cooperation with local partners
Access to local specialists/recruiting	Market access
Dissipating risks among several research units	Local citizen image
Support of local development projects	Simultaneous product launching
Adhering to local regulations	Use of different time zones
	Country-specific cost advantages

Lewin *et al.* (2009) explain increasing innovation and R&D offshoring with a global race for human resources. Knowledge integration in R&D networks remains a key issue as the specialisation of units can create a tension between specialisation and integration (Erkelens *et. al.*, 2010). Three key areas have been shown to be important to create knowledge integration in R&D networks (Erkelens *et. al.*, 2010)

1. The relative absorptive ability of the different units (i.e. differences and similarities between their knowledge bases, organisational structures and dominant logics) (Lane & Lubatkin, 1998).
2. Relational embeddedness between the units (the interdependence between social relations, exchange of resources, and combination of resources in the relationship between organisational units). A high level of relational embeddedness positively influences knowledge integration (Anderson et *al.*, 2005).
3. Embeddedness of knowledge. The more embedded the knowledge is in people, tools and routines the more difficult it is to move. Knowledge which is partly embedded in the relation between units is easier to integrate and therefore a common context is preferable (Nielsen, 2005).

To summarise, a global company becomes a part of a network of internal and external actors. The characteristics of a network can influence its abilities. Knowing how a network is configured can help a company in ensuring it gains the most from its network. Therefore, using the network configuration approach on engineering networks created through offshoring and outsourcing can provide additional information to the challenges and potential solutions when a company globalises the product development process.

2.8 Expatriation

Globalising product development requires attention to both the tasks and the engineers who carry them out.

Expatriates have become an integral part of a company's globalisation process. They are used to transfer, distribute and gain knowledge about the local conditions in which the subsidiary operates.

In today's fast-paced global business environment, expatriates play a crucial role for MNCs to establish and consolidate their foreign presence. They manage projects, transfer technical and

cultural knowledge, and thereby make communication easier. They have unique insight into the subsidiary and how the company and its globalisation process are viewed outside of the headquarters. Expatriates also help identify local employees in the foreign location so competences and tasks are matched, use their social network in the foreign location upon return to the headquarters, develop the foreign subsidiary, and hire new employees in the foreign location for both local projects and work which is offshored to the subsidiary. Expatriates learn about the local market and can relay this information to the organisation so products can be made to match local needs and customer preferences.

The presence of expatriates may be most useful in the context of growing and developing markets where many uncertainty factors remain, which is the case in offshoring to low-cost emerging markets; the focus of this thesis. Investigating expatriates is therefore an important step in understanding global product development process activities.

2.8.1 The role of expatriates

Caligiuri (2000) defines expatriates as "*employees who are sent from a parent company to live and work in another country for a period ranging from two to several years*" (Caligiuri, 2000:62).

Companies can use expatriates to help transfer knowledge or control the subsidiary. Mendenhall *et al.* (2001:3) mention that "*as globalization continues to increase, expatriates continue to play important roles in MNCs*".

In Denmark, expatriation contracts can range from 6 months to 3 years (IDA, 2009; IDA, 2000). Expatriates are often employees from the company's home location who hold top management or key positions in functional departments of the subsidiary (Harzing, 2001).

Edstrom & Galbraith (1977) suggest expatriates fill three roles:

1. To fill a position which require specific skills which locals are not deemed to have.
2. To develop managers by giving them international experience through overseas assignments as a part of their career development.
3. To further the coordination and control of the subsidiary through social communication and interaction with locals created by the expatriate (e.g. Smale, 2008; Takeuchi *et al.*, 2008, Collings *et al.*, 2007, Reiche, 2007, Evans *et al.*, 2002, Kobrin, 1988).

Tungli and Peiperl (2009) added three more reasons:

4. To set up a new operation.
5. To train and orient local staff.
6. To control the operation.

Expatriates are seen as the most efficient way to transfer the company's critical abilities due to their knowledge of the organisational culture and routines as well as their technical knowledge which they can transfer (Graf, 2004; Paik *et al.*, 2002). Different researchers suggest that even though there is no significant decline in using long-term assignments, there is a growing use of alternative forms of International Assignments (IAs) (Dowling & Welch, 2004; Fenwick, 2004; Mayerhofer *et al.*, 2004; Scullion & Collings, 2006).

Alternative assignments include virtual teams, shorter stays abroad and frequent international business travels (Collings *et al.*, 2007). Due to different types of IAs a standardised approach, usually employed by companies, cannot effectively deal with repatriation problems. This highlights

that it would be necessary to develop HR policies and procedures that reflect differences of assignments (Collings *et al.*, 2007).

2.8.2 Gauging success
The model proposed by Wayne (2004) indicates that (1) situational stressors and social support, (2) organisational commitment, (3) task performance as well as (4) completion of the expatriate assignment have direct relationships with the expatriate success criteria of expatriate adjustment. Situational stressors include lack of language fluency, national culture novelty, lack of promotion expectations, and lack of free choice of IA. Social support factors include leader–member exchange and perceived organisational support.

National culture novelty is defined as the differences between the host-country's and home-country's national cultures (Wayne, 2004). This difference can be measured using Hofstede's (1980) four dimensions of national culture (Wayne, 2004). The bigger the difference, the more different host countries are from their home countries and the greater a stressor this is.

Expatriate adjustment consists of three parts: work, general, and interaction (Black & Stephens, 1989). While work adjustments is in regard to the new working environment, general adjustment is identified with respect to the general living conditions and culture of the foreign country, and interaction adjustment is defined as interaction with the host-country nationals (Wayne, 2004).

Commitment to the organisation, as the second success criterion, is defined as expatriate's effective attachment to the organisation and has been shown to be related to turnover of returned expatriates (Griffeth *et al.*, 2000). The third success criterion is job performance. This is defined in terms of the expatriate's performance on meeting job objectives and technical aspects of the job (Wayne, 2004). Finally, completion of the expatriate assignment is the most basic behavioural criterion used for assessing the success of an IA (Wayne, 2004). Using this to measure success means that success occurs when an expatriate remains on the assignment for the entire expected duration (Black, 1988, 1990).

Collings *et al.* (2007) argue that the key to success for traditional expatriate assignments is a strategic focus, where special attention should be on translating strategic planning to the operational level through the development of HR policies and practices aimed at ensuring congruence between employees' work behaviours and the organisational business strategy. HR managers should, together with line managers, define objectives or goals for the expatriate assignment, the achievement of which should be done through introduction of appropriate selection criteria and techniques that expand on simple measures of technical competence. Appropriate compensation, performance management systems, and repatriation policies will also help to achieve set goals in IAs (Collings *et al.*, 2007).

Measuring the success of IAs is difficult and different researchers used different criteria (Black *et al.*, 1992). The amount of premature return is widely used (Tungli & Peiperl, 2009). Companies can often not give clear reasons for premature return rates of expatriates which may indicate that the companies did not investigate this issue, despite how expensive expatriates are (Tungli & Peiperl, 2009). Another measurement is whether the expatriate's knowledge and experience are further utilized for the company's advantage after the expatriate has returned (Tungli & Peiperl, 2009).

Successful expatriation from an individual perspective is often different from the company view. Expatriates themselves may not see leaving the company soon after repatriation as a failure (Stahl *et*

al., 2002). This should alert companies to take more initiatives to capture their expatriates' knowledge, and to seek more ways to motivate them to stay with the company (Tungli & Peiperl, 2009).

2.8.3 Social support

Supportive relationships at work have been argued as a key way to alleviate the stress associated with working and living in a foreign country (Wayne, 2004). Two work-related sources of social support are supervisor support and organisational support (adjustment, career and financial).

Supervisor support has been researched in terms of leader–member exchange (Kraimer *et al*., 2001; Liden *et al*., 1997) and refers to the quality of the interpersonal exchange relationship between an employee and his/her supervisor, and has been shown to be a significant predictor of expatriate performance (Kraimer *et al*., 2001) as well as numerous work attitudes and behaviours of employees in the home country (see Liden *et al*. (1997) for a review). Leader-manager exchange has been shown to positively relate to expatriate adjustment and job performance (Wayne, 2004).

Adjustment perceived organisational support is defined as the extent to which the organisation cares about the employee's adjustment following a job transfer. This type of support develops through the organisation's policies and practices that ease the actual transition and adjustment to the foreign country and workplace. These practices include cross-cultural training, relocation assistance, and language training (Wayne, 2004).

Career perceived organisational support is defined as the extent to which the organisation cares about the employee's career needs (Wayne, 2004). It develops through the organisation's policies and practices that allow the expatriate to continue to receive career development opportunities while abroad. These practices might include a mentor while on the expatriate assignment, long-term career planning, and career-oriented performance appraisals. This type of support has been shown to be positively related to employees' commitment to the organisation (Sturges *et al*., 2000).

Financial perceived organisational support is defined as the extent to which the organisation cares about the employee's financial needs, and rewards the employee's contributions in terms of compensation and employment benefits (Wayne, 2004). It develops through the organisation's policies with respect to financial inducements, rewards, and benefits for expatriate assignments (Florkowski & Fogel, 1999; Guzzo *et al*., 1994). This type of support relates positively to commitment to the foreign facility (Wayne, 2004).

Lack of language fluency and national culture novelty relates negatively to expatriate adjustment. Lack of promotion expectations negatively relates to expatriate adjustment and commitment to the organisation while leader-manager exchange positively relates to expatriate adjustment and task performance. Adjustment perceived organisational support positively relates to commitment to the parent company, and financial perceived organisational support positively relates to commitment to the organisation (Wayne, 2004).

2.8.4 Selection and preparation

The most important expatriate selection criteria include (1) technical expertise and (2) domestic track record (Brewster & Scullion, 1997). Other important criteria for selection include: (3) expatriate's willingness to go, (4) experience in the company, (5) personal factors (e.g. open mind, flexibility), (6) leadership skills, (7) previous performance appraisals and (8) previous international experience (Tungli & Peiperl, 2009).

Knowledge of the host country's culture and institutions are also important (Black *et al.*, 1991; Garcia-Pont *et al.*, 2009). These selection criteria were supported by several other researchers (Stone, 1991; Fish *et al.*, 2008; Kim and Slocum, 2007; Caligiuri, 2000; Ones & Viswesvaran, 1999; Behling, 1998).

Investigations by IDA support these findings and have shown that engineers being stationed abroad need different skills than engineers working in Denmark. Social awareness, humour and adaptation were found to be key competences for a stay abroad to be successful (IDA, 2009; IDA, 2000). However, as found by Harris and Brewster (1999), most companies did not follow a systematic procedure in their selection.

The desire to stay abroad is often due to a wish for personal development and a belief that this will further their career (IDA, 2000; IDA, 2009). Most of the engineers abroad also work longer hours than in Denmark, but a majority say they have it better, or just as good, abroad (IDA, 2009).

Cross-cultural training is widely accepted as having a positive effect on expatriates' performance (Black & Mendenhall, 1990; Calgiuri *et al.*,2001; Eschbach *et al.*, 2001). During the 1980's companies did not provide their expatriates with such training but the situation changed in the 1990s with 70% of companies reporting at least one such training session (Windham International & National Foreign Trade, 1998).

However, the companies failed to involve the partner of the expatriate into such training which was seen as the most often reason for premature return of the expatriate, as the partner was not able to adjust to the foreign environment (Gates, 1994; Mendenhall *et al.*,1987; Black & Gregersen,1991). The common reason for not providing the expatriates with such training was lack of time (Tungli & Peiperl, 2009). The changing nature of expatriates' origins (and other characteristics, such as age and gender) means HR and training professionals must use a more tailored approach to such training sessions.

2.8.5 Expatriate's psychological contract

A psychological contract in terms of work is made up of expectations (Levinson *et al.*, 1962), promises (Rousseau, 1989) and obligations (Herriot *et al.*, 1997 Pate & Scullion (2010). With the exception of expectations, these terms suggests a degree of agreement between the two parties. It is defined as "*the perceptions of mutual obligations to each other held by the two parties in the employment relationship, the organization and the employee.*" (Herriot *et al.*,1997:151).

Traditionally, expatriates have been managed through the provision of enhanced rewards packages and promised career acceleration (Holt & Wigginton, 2002). In recent years, many organisations can no longer offer the same "deal" due to cost-reduction strategies such as reducing expatriate packages and downsizing (Coyle-Sharpiro & Kessler, 2000). This development implies a disparity between the expectations of expatriates and their employers' institutions, as employees may feel that the arrangements have been changed without their consent (Rousseau, 1995).

This has prompted two particular responses from expatriate employees, resulting in a transactional psychological contract. The first and most common reaction has been anger and resentment. A second response from employees has been to place less emphasis on job security and take more responsibility for their career development by building competences and networks in order to remain employable and attractive to the external labour market (Baruch, 2001).

Paik *et al*. (2002:646) argued that: *"[...] the expatriate accepts the assignment for career advancement, compensation and adventure as opposed to the company who sends an expatriate for the purpose of transferring the home corporate culture and meeting project objectives. This mismatch of perceived obligations clearly has the potential for the breakdown of the psychological contract"*.

Clear and consistent communication is vital to manage the contract, and particular emphasis needs to be put on the personal and job-related communication rather than more general information (Guest & Conway, 2002 & Rousseau, 2001). However, some expatriates are coming to terms with the changing employment deal and are re-evaluating their career on repatriation and increasingly searching for work elsewhere when expectations are not met (Linehan, 2000; Black, 1992).

This follows the notion of the boundary-free career, which suggests that employees are active rather than passive in their career management (Arthur & Rousseau, 1996). The implication of this mindset is that employees do not necessarily wish to remain with an employer on a long-term basis (Pate & Scullion, 2010).

2.8.6 Repatriation
Many researchers suggest that repatriation may be as traumatic an expatriation, or even more difficult (Black, 1992; Linehan & Scullion, 2002; Adler, 1991; Black *et al*., 1992).

The expatriation process in often more successful than repatriation where many people leave the organisation (Black & Gregersen, 1999). Thus, the organisation loses what the expatriates had learned when it does not become organisational learning, and also loses any investments done in their careers (Bertoin Antal, 2001). Furthermore, retaining failures may include difficulty of recruiting key personnel for future IAs due to the perception about career disruption (Allen & Alvarez, 1998).

Coming back home is more difficult than usually expected by expatriates, where changes are faced in both work and private lives. Expatriates often find it difficult to talk to people back home about what they have experienced and often find a lack of interest from the company as well (Bossard & Peterson, 2005).

Job embeddedness and repatriate adjustment are central to the success of IAs and influence the decision of staying or leaving the company (Shen & Hall, 2009). The reasons for leaving the company are in regard to job embeddedness, difficult individual changes (work-related competences, newly learned skills, changes in social networks and cultural identity shifts), and in repatriation adjustment it is the degree of met expectations and perceived organisational support (Black & Gregersen, 1991; Shen & Hall, 2009).

A person changes during the expatriation due to the experiences he or she has. For companies, unawareness and inability to deal with this new person becomes very costly (Hall *et al*.,2002).

Time also affects the chance of a successful repatriation as the longer the employee is abroad the less embeddedness he or she may feel which can make repatriation more difficult (Shen and Hall, 2009).

This is, for example, due to the social network changes that geographic relocation often results in by disrupting community ties and social networks (Noe and Barber, 1993). This issue is made more profound as many career opportunities in companies are created through informal social networks (Burt, 1992, 1997). This is supported by other research which showed that almost a half of

repatriates encountered difficulty in their interpersonal relationships after repatriation (Stroh *et al.*, 1998).

A successful repatriation transition is when a repatriate gains access to a job that recognises any newly acquired international competences, presents minimal cross-cultural readjustment difficulties, and leads to low turnover intentions (O'Sullivan, 2002).

The repatriation process can be improved by (Shen and Hall, 2009:808):

- Minimising the difficulty in repatriation adjustment and detachments from home organisation by using shorter assignments.
- Increasing the perceived person-organisation/job fit by carefully designing a re-entry assessment and career planning process.
- Strengthening the perceived link with the home organisation and increasing the perceived cost of leaving the company by actively providing developmental support (mentoring, coaching, and counselling) to the employee, spouse, and family during the expatriation and repatriation phases.
- Increasing the awareness of the problems described by making sure that the HR executives who are responsible for international moves have IA experiences themselves.

2.8.7 Career prospects

Many companies have introduced the overseas experience as a necessity for the development of high-level executives (Tung, 1998, Yan *et al.*, 2002). However, the positive impact of IA on career is still not clear (Mendenhall *et al.*, 1987). Various studies show that fewer than half of repatriates were promoted and about 2/3 felt that IAs negatively influenced their career, whereas more than half were "warehoused" for some time and more than 75% experienced demotion (Black and Gregersen, 1999; Alder, 1991).

Given the widespread opinion that gaining international experience is often the key to advancement in global firms, repatriates are likely hoping for a job that not only recognises their international experiences, but also rewards them with a better position within their organisations (Carpenter *et al.*, 2001; Suutari, 2003).

If repatriated employees are placed in jobs that represent a demotion or even a lateral move, they are likely to feel that their organisation undervalues and underutilises their newly acquired international competencies (Stroh *et al.*,2000). At the same time, even if employers do not make promises about career advancement following overseas assignments, some expatriates may see their international experience as something that other employers will value, which means that repatriate retention may continue to be a challenge for multinational organisations (Kraimer *et al.*, 2009).

Repatriates are promising target groups for other employers of experienced international managers and more than 60% of repatriates receive job offers while abroad or after repatriation (Suutari & Brewster, 2003).

Expectations expatriates have can include promotion, utilisation of skills acquired or great interest in the work they have done from friends and colleagues (Stroh, 1995). However, less than one forth of all expatriates report the re-entry expectations were fully met (Foster, 1994).

The unmet expectations especially in work-related areas often cause repatriation difficulties and quieting is often done to the lack of for example promotion and other signs of utilisation of skills (MacDonald & Arthur, 2003).

Repatriates are often dissatisfied with the opportunity for advancement following an IA as expatriates feel they have grown personally and they often feel undervalued and underutilised as many companies have no long-term career planning, no job guarantee upon return, and the policy on the topic is often unclear (Kraimer *et al*., 2009; Tung, 2008; Stroh *et al*., 1998; Bossard & Peterson, 2005).

Feldman (1996) defined underemployment as "*the feeling that one is overeducated, overqualified, underchallenged, or working in a lower quality job relative to one's education, experience, or prior jobs. Thus, underemployment occurs when individuals work in jobs that do not fully utilize their education, experience, and skills.*" Underemployment is negatively related to employees' psychological well-being and work attitudes (Feldman, 1996; Feldman *et al*., 2002).

Changes in skills levels also influence repatriation. A study showed that 61% of repatriates encountered a lack of opportunities to utilize their experiences and international skills (Black & Gregersen, 1999; Stroh *et al*., 1998). This is supported by other studies which showed that there is a tendency to return from managerial assignments to non-managerial positions after repatriation (MacDonald and Arthur, 2003).

One study found that the number of IAs within the same organisation has a negative, curvilinear relationship with career advancement upon repatriation due to being so far removed from the headquarters (the traditional power centre), which suggest that repatriates are more likely to get ahead in their organisation when they have been on only one assignment (Feldman & Thomas, 1992; Stroh *et al*.,1998).

Career Support and Employee Retention
Organisational career support facilitates repatriation retention. Turnover intentions have been shown to be lower among repatriates who perceived that the organisation provided career support (Kraimer *et al*., 2009). Perceived organisational support was defined by Eisenberger (1986:501) as "*global beliefs concerning the extent to which the organization values their contribution and cares about their well-being*".

Repatriate's subjective perception of their organisation's support influences the desire to stay in the organisation (Lazarova & Caligiuri, 2001). Organisations that value expatriate experiences and acquired skills and have a career development plan for their repatriates are more likely to retain them (Feldman & Thomas, 1992). If firms want to extract individuals' knowledge for organisation, they can do so by establishing career opportunities corresponding to the individual career needs.

The knowledge transfer will be maximised if organisations will motivate their employees through developing career opportunities, which can be done with the help of mentoring, career counselling, challenging projects and further international exposure (Lazarova & Tarique, 2005).

A study has shown that three repatriation support practices are considered by expatriates as the most important: (1) visible signs that the company values international experiences, (2) career planning sessions and (3) communications with home office about the details of the repatriation process (Lazarova & Caligiuri, 2001).

Another study found seven career development strategies for companies to strengthen the relational ties (job embeddedness) between the employee and the firm. They include: (1) giving employees a choice whether to accept the IA, (2) providing a mentor program, (3) taking steps to be sure that the IA does not hurt the person's career advancement, (4) providing a good job upon person's return home, (5) utilising the person's newly acquired skills upon return, (6) giving realistic job previews to bring expectations more in line with realities, and (7) communicating to the employee that the IA is part of an overall career plan (Feldman and Thomas, 1992).

The more attention the organisation gives to these factors, the stronger job embeddedness to the company is expected to be, and people who are embedded in their jobs have lower intent to quit the company (Mitchell *et al.*, 2001; Shen & Hall, 2009).

2.8.8 Skills gained while abroad
Not all skills expatriates gain was seen as useful in regard to their future career and therefore may not always be of direct use to the individual (Harris *et al.*, 2003).

First, international work may enhance the know-how of assignees, but it may also result in skills that are not transferable to the home context by the individual, either through a lack of applicability of the skill in the home organisation context, or through the inability of the individual to translate this learning into practice (Bonache *et al.*, 2001).

Second, a foreign posting may increase an individual's network internationally, but it may also lead to the loss of critical home contacts in a company where the power is maintained centrally. Few organisations are able to identify clearly the international competencies they expect their expatriates to gain as a result of the international assignment (Dickmann *et al.*, 2005; Dickmann & Harries, 2005; Dickmann & Mills, 2010; Schiuma, *et al.*, 2003).

Repatriates who have been sent on assignments that were developmental were more likely to get ahead in the organisation, while those who acquired managerial skills (Kraimer *et al.*, 2009). Also cultural skills were unrelated to career advancement upon repatriation (Gregersen & Stroh, 1997). This could be because organisations are often unaware of the skills that expatriates acquire during their expatriation or does not believe these skills are of an appropriately high level (Kraimer *et al.*,2009). It could also be because any knowledge the expatriates gain are considered to be cultural specific and not relevant other places (Kraimer *et al.*,2009).

The resource-based career view holds that individual career capital consists of three ways of knowing: (1) "Knowing how" career capabilities provide an individual with career-relevant skills, (2) work-related knowledge and (3) understanding that is needed for performance (DeFillippi & Arthur, 1994). These consist of explicit knowledge, implicit experiences, soft skills, and technical expertise. "Knowing whom" career capabilities consist of a range of intra-firm, inter-firm, professional and social relations combined in a network. "Knowing why" career capabilities are seen to provide the owner with energy, sense of purpose, motivation and identification with the world of work and are linked to confidence, motivational energy and self-assurance to pursue a desired career path (Inkson & Arthur, 2001).

Berthoin-Antal *et al*. (2000) described five types of knowledge gained while abroad: (1) knowledge about what (e.g. differences about customer preferences), (2) why (e.g. understanding how culture differences affect cross-cultural understanding), (3) how (e.g. management skills such as delegating responsibilities), (4) when (e.g. knowledge about the effect of timing), and (5) who (e.g.

relationships created over the life of the assignment). In addition, they point out that the expatriate also brings insight of the subsidiary, which can generate ideas about how to improve the business in general. Another type of knowledge that expatriates develop, is knowledge about the world-wide business structure of the company and a network of business contacts (Calgiuri & Santo, 2001).

Knowledge Transfer upon Repatriation
Expatriates have served as facilitators of intrafirm knowledge transfer and application for a long time (Lazarova & Tarique, 2005). Usually, expatriates play a role of knowledge senders, who are teaching others rather than knowledge recipients. However, several researchers mention reverse diffusion, which draws attention to the role of expatriates to acquire knowledge while being stationed abroad and to bring it back to the organisation or share it among other subsidiaries (Bronache & Brewster, 2001; Hocking *et al*., 2004; Welch, 2003).

Expatriation offers to acquire knowledge abroad, whereas repatriation gives the opportunity to transfer and apply this knowledge in the home organisation (Kamoche, 1997). Successful knowledge transfer, however, is not automatic due to (1) not all knowledge is equally easy to capture and (2) individuals and organisations do not necessarily have coinciding goals for using knowledge as a basis for developing their competitive advantages (Lazarova & Tarique, 2005).

A lack of adequate local and contextual knowledge can greatly impede global managers' effective decision making and threaten their performance in foreign markets, particularly in dynamic emerging economies (Lord & Ranft, 2000; Makino & Delios, 1996).

Local knowledge *is knowledge that is specific to a host country regarding its language, culture, politics, society, and economy* (Lord & Ranft, 2000). Local knowledge in a specific country or region, particularly in emerging markets may have a higher tacit nature than in other countries or regions, making it more difficult to capture (Eriksson *et al*., 1997; Harvey *et al*., 1999). Unlike corporate knowledge transferred to emerging markets which is fully codified, widely available, and controllable, local knowledge in these institutionally distant economies is highly tacit, undiffused and fast-changing. Some embedded tacit cultural knowledge may not be transferable (Li & Scullion, 2010).

Different types of expatriate assignments create different types of knowledge which also have to be taken into consideration when debating the gain of an IA (Hays, 1974; Caligiuri, 2005).

2.9 Preliminary framework

The literature review shows that a cross-disciplinary approach is needed in order to fully illustrate the complexity of globalising the product development process. When globalising, a company creates a complex situation which can be explained by using different theories, models and approaches. The literature review also shows the importance of context and validity for a company to use different methods to resolve a situation.

This complexity can be assumed to be due to the added interconnectivity globalisation brings to the external and the internal environment the organisation operates within.

➢ **The external environment**
  o Drivers for globalising product development process activities.
    ▪ E.g. open borders, IT technologies, cost pressures, increased competition, new markets.

- o Barriers for globalising product development process activities.
  - ▪ E.g. IP rights, government stability, cultural differences, communication issues, lack of face to face interaction.
- o Specific industry conditions.
  - ▪ E.g. short time to market, long production cycle.

➢ **The internal environment**
- o Organisational structures.
  - ▪ Company metaphors.
  - ▪ The formal and the informal organisation.
- o Organisational culture.
- o Decision making.
- o Control and monitoring of processes in the organisation.
- o Change management projects.
- o Engineering project characteristics: product modularity and product development process modularity.

➢ **Spanning both**
- o Networks
  - ▪ E.g. With customers, competitors, suppliers, strategic partners
  - ▪ E.g. The network configuration for the company
- o Culture
  - ▪ E.g. National, local, professional
- o Knowledge management
  - ▪ E.g. Between organisational units, to strategic partners
  - ▪ Including the use of expatriates

The literature review shows that a company goes through four sequential stages when globalising, with outsourcing going through an additional phase (selection of vendors):

1. Preparation. (Vendors selection)
2. Transition.
3. Managing relationship.
4. Reconsideration

It was also shown that to succeed the company needed to follow a clear strategic plan and send more value-adding tasks abroad as it learns to control the globalisation process. Cybernetics can be one way to ensure the company is moving towards the desired goal by measuring outputs and initiating correcting actions.

Manufacturing engineering companies often started their globalisation process with manufacturing. It was shown that few companies have a clear strategy for their manufacturing networks; they are often an outcome of M&As and organic growth. The same can be assumed to happen as engineering and R&D is moved abroad, indicating a need for companies to clarify their network configuration in order to create the most advantageous network. Motivations to globalise the product development process vary but can be assumed in large part to fall within three categories; (1) cost reasons, (2) to gain access to competences and (3) to gain access to markets.

Four theoretical fields within organisational studies have been used to explain why companies globalise:

- Transaction cost economics.
- Relational exchange theory.
- Resource Dependence Theory.
- The Resource-Based View.

Each can explain certain actions a company can take, but not all.

Research has so far focused on minimising risk and reducing complexity by avoiding certain high risk situations. The ideal is low task complexity and high organisational complexity as this creates minimum risk. This includes low interaction distance and low interaction intensity to minimize cultural difference and communication. Process and product modularity is needed to ensure a clear separation of tasks and processes and thus minimise interaction. There is in other words a focus on low complexity products and functions in what is sent abroad.

However, today when companies globalise elements from the whole product development process complexity may be unavoidable, indicating a need for a framework which can address the risks and challenges in the global product development process. Furthermore, the linkage between manufacturing and other activities like design and R&D have often been a surprise for many companies; indicating even tasks which may be considered less complex may be harder to move abroad than first anticipated.

Studies have shown that companies encounter several barriers when moving tasks abroad. These include communication difficulties, unforeseen costs and internal opposition. Others include collaboration, IP rights, learning and knowledge management, quality, managing organisational change and management control. Culture influence many of these, including communication and knowledge management.

These challenges can be analysed using different aspects of organisational theory, knowledge management and network configuration in operations management. By using each theoretical framework on different aspects of the company's globalisation of the product development process it is assumed a more holistic picture of the companies' actions can be described.

Decision-making models can give an idea as to how the company takes a decision while organisational structures influence how an organisation operates and views itself and its surroundings. Globalising product development is an organisational change which makes it relevant to include theories from change management.

Knowledge management is vital in order to complete and coordinate tasks. The type of knowledge needed where and when, how and in what format become important issues. Furthermore, using more than one approach and tool when transferring knowledge which varies depending on context, will likely be most successful. This includes the role of expatriates in knowledge transfer and generation.

A global company creates networks with internal and external actors through formal and informal networks made up of individuals. Using the GEN framework on the engineering networks created through offshoring and outsourcing additional insight into the reasons for complications with global product development process can be found through exploring five dimensions of the network configuration:

1. Network Structure.
2. Operations Flow.
3. Governance and Coordination.
4. Support Infrastructure.
5. Product Configuration.

By combining these different models and theoretical approaches, a more holistic picture can be painted of the challenges engineering companies experience in relation to outsourcing and offshoring of product development process activities and how these can be addressed.

In Chapter 4 the findings from the descriptive studies case studies are presented. These different theories and models are used to analyse these findings in Chapter 5 in order to expand and enrich this preliminary framework in Chapter 6.

2.10 Summary

Current research has focused on selected aspects of outsourcing and offshoring, with a focus on minimising the risks associated with this development.

Issues shown through case studies to present difficulties when a company offshores or outsources are culture, virtual communication and coordination and internal opposition. Others include IP rights, learning and knowledge management, quality, managing organisational change, and management control.

Expatriates are often used to transfer knowledge and control the subsidiary. They therefore play an important role in the globalisation of the product development process. Expatriates go through three stages; (1) Preparation, (2) Stay and (3) Repatriation. Although it has been shown that selection and training is important to ensure success during an IA, few companies have a clear selection and training process. Furthermore, during the stay abroad it has been shown that it is important that the company supports the expatriate and that the expatriate maintains contact with a supervisor and others in his or her own department. However, such support is often not well organised.

Expatriates gain skills in several areas while abroad and can therefore become a vital source of knowledge and information for the company. However, most companies do not know how to manage such knowledge or how to manage the career expectations of expatriates. As a consequence many expatriates leave the company upon repatriation and their knowledge is thereby often lost to the organisation.

To gain the most from expatriates a company therefore need to include them as part of a strategic plan to ensure their knowledge and skills are fully utilised.

A cross-disciplinary approach is needed in order to fully explain and address these complications of globalising the product development process as such an approach can encompass several different methods and tools. Key theoretical fields are organisational studies and operational management. Organisational studies reveal that organisational structures, power and control, offshoring/outsourcing process models and change management are relevant theories to use while the GEN framework and network configuration from operations management are relevant tools from this field.

The findings from the descriptive studies are presented in Chapter 4. These different theoretical tools and approaches are used here to analyse these in Chapter 5. A framework which can expand upon and enrich the preliminary framework presented here is introduced in Chapter 6.

The next Chapter explains the research approach for this thesis.

Chapter 3 Research methodology

The problem formulation takes industry and current market trends as a starting point. The research approach therefore needs to compliment this. This Chapter presents the research approach based on the research aim and research question shown in Chapter 1.

3.1 Philosophical paradigms

The underlying philosophical position to research will influence the research approach. According to Gibbons *et al*. (1994) there are two different research modes, designated Mode 1 and Mode 2.

> Mode 1 is traditional academic science with clear boundary conditions.

> Mode 2 is "*socially distributed, application-oriented, trans-disciplinary, and subject to multiple accountabilities*" (Nowotny *et al*., 2003:179).

This research is conducted in Mode 2 because it investigates a problem from industry and the surrounding society, is trans-disciplinary, involves multiple stakeholders, and aims at providing a framework which is applicable for industry.

There are also different research paradigms – ways of looking at the world – which influence how a research study is undertaken (Kuhn, 1962). Two which are very different are the positivistic and hermeneutic (also called social constructionism) paradigms (Easterby-Smith, *et al*., 2002). Table 14 summarises these in regard to the approach they take to the observer, human interests, explanations, research process, concepts, units of analysis, generalisation, and sampling size.

Table 14: Characteristics for positivism and social constructionism
Source: Easterby-Smith, *et al*. (2002: 30)

	Positivism	Social constructionism
The observer	Must be independent	Is part of what is being observed
Human interests	Should be irrelevant	Are the main drivers of science
Explanations	Must demonstrate causality	Aim to increase general understanding of the situation
Research progress through	Hypothesis and deductions	Gathering rich data from which ideas are induced
Concepts	Need to be operationalized so they can be measured	Should incorporate stakeholder perspectives
Units of analysis	Should be reduced to simplest terms	May include the complexity of 'whole' situations
Generalization through	Statistical probability	Theoretical abstraction
Sampling requires	Large numbers selected randomly	Small numbers of cases chosen for specific reasons

Positivism originates from natural science and assumes all knowledge is external and reached through logic or our senses. This approach favours objective and quantitative methods like surveys and models (Meredith, 1998).

Hermeneutics involves cultivating the ability to understand things from somebody else's point of view, and to appreciate the cultural and social forces that may have influenced their outlook. Hermeneutics is the process of applying this understanding to interpreting the meaning of texts or spoken language (Collis & Hussey 2003).

Although these two paradigms seem mutually exclusive, a dual approach which mixes elements from more than one paradigm is possible (Easterby-Smith, *et al.*, 2002).

From social constructionism comes participatory constructivism, while the post-positivism paradigm borrows many features from the positivistic paradigm. Table 15 shows the approach to ontology, epistemology and methods for these three paradigms.

Table 15: Three paradigms to view the world and the research
Source: Rasmussen (2011)

Item	Positivism	Post-positivism	Participatory constructivism
Ontology	Perfect apprehendable reality	Imperfect apprehendable reality	Constructed realities by stakeholders
Epistemology	Objectivity is ideal and possible	Objectivity is ideal but not possible	Objectivity is not ideal nor possible
	Findings are value-free	Findings are probably value-free	Findings are always value mediated and created as the approach proceeds
	Verified hypotheses	Non-falsified hypotheses	Not possible within this paradigmic framework
	Replicated findings are true	Replicated findings are probably true but can always be falsified	Findings cannot be replicated but used to solve problems
Methods	Controlled experiment	Controlled experiment	Dialogue/workshop
	Quantitative methods	Quantitative and qualitative methods	Qualitative methods

The post-positivistic paradigm encourages the use of controlled experiments as well as quantitative and qualitative methods. However, the ontology is still that there is an apprehendable reality. Participatory constructivism assumes constructed realities and assumes value-added findings based on dialogue.

3.1.1 Problem complexity

The complexity of a problem can influence how a problem can be addressed and what kind of solutions can be implemented.

The level of problem complexity is determined by two dimensions: the number of parameters and knowledge fields related to the problem, and the number of different values and interests among the stakeholders. These two parameters are interrelated (Hazy *et al.* 2007; Howard-Grenville, 2005; Jackson, 2003; Jackson, 2000; Jackson & Keys, 1984).

Table 16: Types of Problems.
Source: Rasmussen (2011)

PROBLEM	CHARACTERISTICS
TYPE A PROBLEM	- ONE OR TWO PARAMETERS - ONE FIELD OF KNOWLEDGE - INTERVIEWS / WORKSHOPS
TYPE B PROBLEM	- SOME PARAMETERS - ONE FIELD OF KNOWLEDGE - INTRA-DISCIPLINARY APPROACH
TYPE C PROBLEM	- A MULTITUDE OF PARAMETERS - SEVERAL FIELDS OF KNOWLEDGE - INTER-DISCIPLINARY APPROACH

Table 17: Domains of interests and values.
Source: Rasmussen (2011)

DOMAINS OF INTERESTS AND VALUES	CHARACTERISTICS
UNITARY	*STAKEHOLDERS HAVE SIMILAR INTERESTS AND VALUES*
PLURALIST	*STAKEHOLDERS HAVE SIMILAR VALUES BUT DIFFERENT INTERESTS*
DISPARATE	*STAKEHOLDERS HAVE DIFFERENT VALUES AND DIFFERENT INTERESTS*

Table 16 shows the three types of problems which can be investigated. The investigated problem is a type C problem because it involves several fields of knowledge within management and engineering and requires an inter-disciplinary approach. This can be seen from the various research areas drawn upon in the literature review in order to understand the complexity of global product development (e.g. organisational studies, network configuration within operational management).

Table 17 shows the possible domains of interests and values the stakeholders in a problem can have.

By interests are meant "*defined personal and social motivations of stakeholders*" (Rasmussen, 2011:4) and by values "*underlying assumptions determining the stakeholder's way of perceiving the quality of knowledge and justice*" (Rasmussen, 2011:4). This problem has a pluralist approach to interests and values due to the difference in culture and background the stakeholders have (e.g. engineers and managers within the multinational and its subsidiaries, customers, vendors) while still operating with an official or unofficial global network.

The stakeholders' values may differ on a personal level, but in regard to the research aim they are assumed alike. However, it should be kept in mind that interests can change over time, and so can values although this often happens more slowly. In other words, an organisation can be assumed to be able to be explained as both being in flux and fixed. Organisational structures and departments are fixed in regard to budgets, formal responsibility, and when credit and discredit is handed out. On the other hand, the organisation is in flux during the daily work as stakeholders create networks and act across formal decision lines and often formally or informally belong to several projects and/or departments. Globalising the product development process therefore disrupts both the status of flux and fixed position which exemplifies the importance of understanding the complexity of the problem.

A type C problem can therefore be expected to represent:

- Interdisciplinary problems.
- Interest conflicts.
- Difficulty to agree on solutions.

The framework presented in this thesis can be expected to be general and present an overall picture of the situation. However, detailed solutions are out of scope as it would require individual solutions for each situation as well as involvement of stakeholders so their values and interests can be accommodated.

3.1.2 Philosophical position

Which philosophical position to take depends on the research aim and research question. This thesis deals with how leaders, daily managers and engineers in a given company perceive the decision process and the impact of globalising the product development process on the organisation, its engineering processes and the engineers. This can only be uncovered through some kind of dialogue. It is also the aim of this study that the results can be used to reach an understanding among the involved stakeholders. The research therefore lies within the participatory constructivism paradigm and research mode 2. However, this study also aims to create a framework in which to describe the results which fall towards the positivistic and post-positivistic paradigms. This study therefore draws on aspects of more than one paradigm and takes a dual approach. However, while the results are meant to inspire other companies they cannot be generalised due to the unique situations and complexity surrounding the topic of globalising the product development process.

3.2 Research methods

The philosophical research approach and the research question largely determine which method is appropriate for the study. Main research methods include experiments, surveys, archival analysis, history, and case studies. Table 18 describes each method in relation to the form of research question they address, and whether the approach requires control over behavioural events and whether the focus is on contemporary events.

Table 18: Research strategies.
Source: Colatla (2003); Yin (1994).

Strategy	Form of research question	Requires control over behavioural events?	Focuses on contemporary events?
Experiment	How, why	Yes	Yes
Survey	Who, what, where, how many, how much	No	Yes
Archival analysis	Who, what, where, how many, how much	No	Yes/no
History	How, why	No	No
Case study	How, why	No	Yes

Research methods which require control over behavioural events are not suited for the participatory constructivism paradigm because they do not allow for dialogue and a constructed reality.

Case studies have traditionally been used in social science but have since spread to other fields (Tellis, 1997). This development has placed case studies among several empirical methods which are useful in the field of management and engineering studies (Flyvbjerg, 2006). The case study research method is defined as "*…an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used.*" (Yin, 1994: 23).

According to Yin (1989; 1994) case studies are used when:

- The research question starts with 'how' or 'why'.
- The researcher does not have full control over events.
- The focus is on several simultaneous events.
- The focus is on the real-world environment.

The case study method is well-suited for studying the overall picture of a research object (Yin, 1994). It allows for in-depth identification of a variety of contextual factors when the phenomenon studied is dependent on a large number of factors (Verschuren *et al*., 1999). Furthermore, the case study method may be able to explain a decision which would have been too complex for a survey or other methods to reveal (Yin, 1994). The unit of analysis for a case study is the case itself; it is the core of what is studied within the bounded context (Yin, 1994, Miles *et al*., 1994).

Case studies can be used to develop theories which can be built into a model (Eisenhardt, 1989). According to Wacker (1998), a theory can take different abstraction levels ranging from high to low. A theory with a high abstraction level is a general theory which can be used in almost any situation for the defined actors. A theory with a middle level of abstraction explains a limited part of a phenomenon and can be used as the building blocks to build other theories, or theories with a higher level of abstraction. Theories with a low level of abstraction have a very limited applicability and are used to identify relationships. According to Wacker (1998) a theory has four elements (1) Definitions of variables, (2) Limiting the domain, (3) Relationship (model) building and (4) Theory predictions and empirical support (see Table 19 on the following page).

Table 19: Building blocks in a theory.
Source: Wacker (1998)

	Purpose of this step	Common question	'Good' theory virtues emphasised
Definition of variables	Defines who and what are included and what is specifically excluded in the definition	Who? What?	Uniqueness, conservation
Limiting the domain	Observes and limits the conditions by when (antecedent event) and where the subsequent event are expected to occur	When? Where?	Generalizability
Relationship (model) building	Logically assembles the reasoning for each relationship for internal consistency	How? Why?	Parsimony, fecundity, internal consistency, abstractness
Theory predictions and empirical support	Gives specific predictions. In order to do so conditions need to be set for where the theory can predict something. Tests the model using certain criteria in order to give an empirical verification of the theory. The riskiness of the test is an important consideration.	Could the event occur? Should the event occur? Would the event occur?	Empirical tests refutability

Another consideration when selecting research methods is the format the needed knowledge takes. External information can be extracted using document analysis, interviews, discourse analysis, observations, participant observation, and protocol analysis. Information stored in humans explicitly, implicitly, or tacitly, has more limitations in regard to the methods which can be used to extract this information (see Table 20).

Table 20: Research methods mapped against information and knowledge.
Source: Ahmed (2007b)

Research method	Information stored externally	Information stored internally in human memory: explicit knowledge (which is not yet explicated)	Implicit knowledge	Tacit knowledge
Document analysis	✔		✔	
Interviews	✔	✔		
Discourse analysis	✔	✔	✔	
Observations	✔	✔		
Participant observation	✔	✔		
Protocol analysis	✔	✔	✔	✔

3.2.1 Employed in this thesis
The research has the following characteristics:

- Nature of research question: use of *why* and *how*.
- Little or no existing theory in the area.
- A desire to understand issues in context.
- Develop new theory instead of testing or validate existing theory through the development of a framework.

This means experiments, history and case studies are the preferred methods. As control over behavioural events is not possible within the scientific paradigm employed in this study, only history and case studies can potentially be used.

As the research focuses on contemporary events, case studies are the preferred option. Hence, this research study primarily employs the case study method but uses some archival data (e.g. webpages, company history, official statements, internal documents) to gain a retrospective view of current events and strengthen the case studies (Meredith, 1998).

Given the nature of the research question and the focus on a specific type of company and industry (as well as nationality) of the companies, the framework developed in this thesis will have a middle-level of abstraction.

The literature review indicated globalising the product development process is a complex and ill-defined concept in most companies. This indicates that most of the information needed from the cases is assumed to be explicit – to some degree implicit – but in general stored internally in human memory (see Table 20). This means that even information which could be made explicit is not

documented but remains internal. This is based on an assumption that few companies have explicit descriptions, guidelines and tools which can answer the research question as detailed in Chapter 1. Therefore, for this study, the following methods can be appropriate:

1. Interviews.
2. Discourse analysis.
3. Observations.
4. Participant observations.
5. Protocol analysis.

Of these, the interview method is employed, with additional information in the form of documents through company webpages, internal documents, and official statements. Observations of any kind were not possible as the researcher did not become a part of any of the companies, and a longitudinal study was not possible in the limited time period this research ran. The other methods were not applicable in this study due to its explorative nature.

There are several ways an interview can be used, for example therapeutic, argumentative, or as a learning experience. Here, the latter is the case. There are two kinds of interviews: exploratory or hypothesis testing (Kvale, 1996). These interviews will mostly be exploratory, due to the aims of the study and the chosen research methodology.

The open qualitative interview is used to gain a deeper understanding of the informant's behaviour, motives and opinions (Kvale, 1996). Considerations in regard to confidentiality, anonymity and informed consent as well as how to structure an interview guide, keep records, and create transcripts are followed in accordance with Yin (1994) and Kvale (1996).

As the interview method is the main method employed in this study it is detailed in the next section.

3.2.2 Interview method

Conversation as a mode of knowing is particularly strong within post-modern and hermeneutical philosophy. The social, power, and material aspects of the conversational interaction are prominent in post-modern and dialectical understandings of conversations (Kvale, 1996). A post-modern approach focuses on interrelations in an interview, on the social construction of reality, on its linguistic and interactional aspects including the differences between oral discourse and written text, and emphasises the narratives constructed by the interview (Kvale, 1996). Knowledge in post-modern philosophy is seen as language, conversation, narrative, context and interrelational (existing between the person and the world and not outside or inside people) (Kvale, 1987). The interview method as a mode for gathering information is therefore well suited to this philosophical approach.

The interview method has been selected as the main data collection method due to its depth and explorative nature. An interview has two dimensions:

1. **Answer range:** This goes from open (the range of answers are limitless) to closed (a limited amount of answers is possible).
2. **Structure:** The structure of the interview can be structured (follows a guide precisely) or semi-structured (allows for exploration of new themes and ideas).

The interview method is also well documented for research projects. The method can - besides being flexible and give insight into the interviewee's life – easily be combined with other methods. Kvale separates interviews into case or people orientated interviews, with the first focusing on a certain topic or area and the latter on certain people (Kvale, 1987).

In connection with the theoretical approach to the method, twelve points which are characteristic for the life world orientated interview can be described as follows (Kvale, 1996):

1. Life world – the topic of qualitative interviews is the everyday lived world of the interviewee.

2. Meaning – the interview seeks to interpret the meaning of central themes in the life world of the subjects.

3. Qualitative – the interview seeks qualitative knowledge expressed in normal language.

4. Descriptive – obtain nuanced descriptions of different aspects of the interviewees' life worlds.

5. Specificity – descriptions of specific situations and action sequences.

6. Deliberate naiveté - the interviewer exhibits openness to new and unexpected phenomena.

7. Focused - the interview is focused on particular themes; it is 'semi-structured'.

8. Ambiguity - interviewee statements can sometimes be ambiguous, reflecting contradictions in the world the subject lives in.

9. Change – the process of being interviewed may produce new insights and awareness.

10. Sensitivity – different interviews on the same theme can produce different statements depending on the subjects' sensitivity and knowledge of the interview topic.

11. Interpersonal situation – the knowledge obtained is produced through the interpersonal interactions in the interview.

12. Positive experience – a good and enriching experience for the interviewee.

The interview method can be divided into seven stages (Kvale, 1996):

1. Thematising: The why and what of the investigation.
2. Designing: The how, the method. The seven stages have to be designed to make sure the intended knowledge is found, and the moral implications of the study are considered.
3. Interviewing: Conducting the interviews based on interview guides to gain the knowledge sought and with consideration for the interpersonal relation.
4. Transcribing: The interview recording is transcribed to make it ready for analysing. Considerations include the difficulties with transforming oral language to written as they have different rules. The transcript is not the source material; the spoken interview is; this is important when making a qualitative interpretation of opinions.
5. Analysing: Deciding which methods to use when analysing the material, based on the purpose, nature and topic of the interviews.
6. Verifying: Ascertain the reliability (consistency of results) and validity (what is intended to be investigated is investigated).

7. Reporting: Communicate the findings of the study in a format which lives up to scientific criteria and considers ethical aspects.

The interview method has to address ethical issues in all seven stages, in particular confidentiality. Because an interview is similar to a therapeutic session and because information given can be sensitive, ethical considerations, such as giving informed consent to the interview and having permission before using real names on statements and quotes, need to be made. Making sure quotes are written down precisely is also important.

The interviewer can misunderstand the information, or put it in a wrong context, because the interviewer can lack insight into the informant's world and culture. This could be social, national or some other difference which means that things can be misunderstood. By having the researcher visit/stay for some time in the world of the interviewee this risk is lessened. Another method is to use the same questions to all interviewees, asking clarifying points, and contacting the interviewee for confirmation on points which could be interpreted in different ways. An experienced interviewer will also ask clarifying questions to prevent any misunderstandings in such a way that the interview ideally has already been verified and clarified when the interview session is concluded.

In an interview it is demanded that the interviewer is constantly 'on' – as it's important to be able to catch small details which can reveal a deeper meaning. At the same time the interviewer needs to do a lot of things simultaneously such as keeping track of time and other small details. The interviewer also needs to ask all the questions which have to be asked to investigate the research themes, and to ask for elaboration of interesting points and so on. This makes the method more complex as it demands both familiarity and objectivity as the interviewer cannot ask leading questions or otherwise try to manipulate the informant. This can be lessened by having two interviewers present so each can focus on various tasks. In the case of only one interviewer, the demands and considerations the researcher has to fulfil are higher so that these things will not become sources of concern.

The method means that for the interview to work most efficiently it must be based on dialogue. The informant needs time to answer the questions and then the interviewer responds to this and builds on the informant's response. This condition for a successful interview has the disadvantage that the informants' answers are hard to standardise, and the option for comparisons is made more difficult as it is hard to systematically interview according to opinions. There are often underlying and indirect opinions in an informant's answers, and the importance of getting confirmed or denied interpretations is essential for the further use of the interview (Kvale, 1996).

The disadvantages with using this interview method are that the quality of data being collected is very dependent upon the individual interview, and high demands are put on the researcher's competence. A qualitative interview cannot be repeated, among other things because the interviewer and the informant will have gained increased knowledge since the original interview. Another disadvantage is that the systematisation and analysis of the collected data is very labour-intensive.

The strength of using the interview method is the possibility to get an in-depth and detailed understanding of the theme being studied. Interviews can illustrate complex areas and the researcher can gain insight into the informant's life world. During a structured interview with detailed questions and firm boundaries for answers, the gathered knowledge will be limited by the

researcher's expectations of what and how various things are relevant to ask for in relation to the field of study, and what types of answers will be relevant for the informants to give (Kvale, 1996).

The disadvantages of the method can be avoided with careful planning and due diligence. The interview method therefore presents the best way to gain the empirical data sought in this research study.

3.3 Research approach

Blessing and Chakrabarti (2002)'s Design Research Methodology (DRM) framework is employed as the methodological approach in this study (see Figure 20). This methodology was specifically created for design research studies, but the framework is general enough to be usable for this research study. The DRM is appropriate for this study due to its explorative nature with both a descriptive and a prescriptive phase so that the present situation and possible improvements are uncovered which are key elements of the research aim and research question.
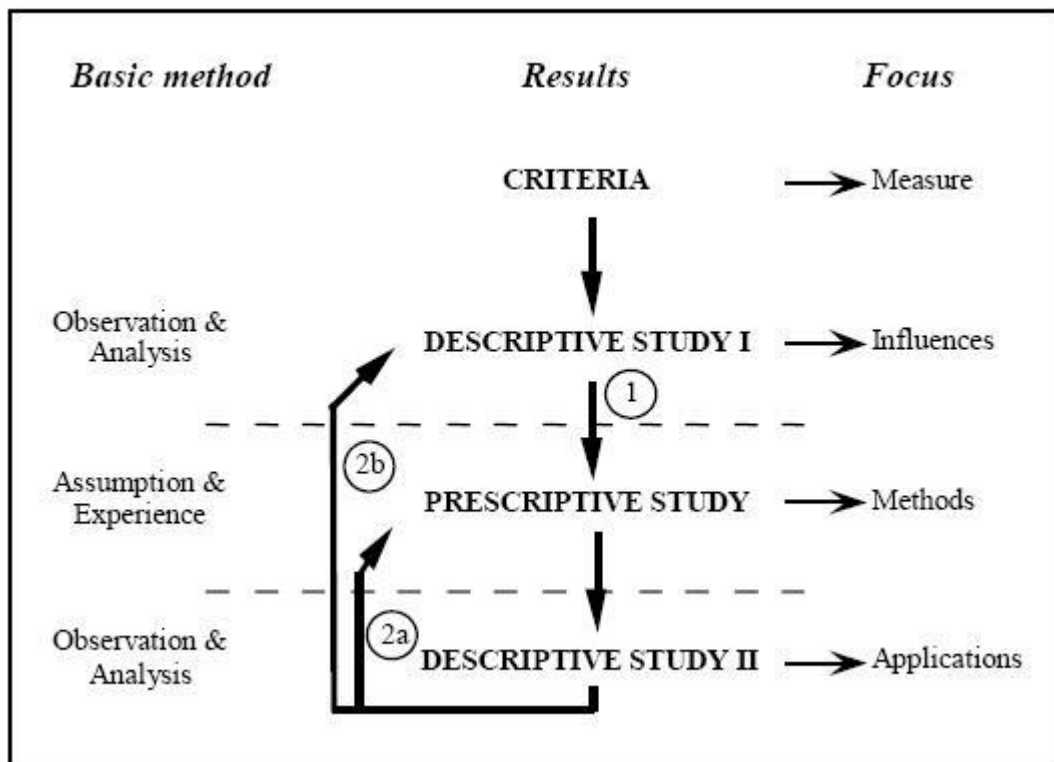
Figure 20: Design Research Methodology framework.
Source: Blessing & Chakrabarti (2002)

The methodology consists of four stages: Criteria, Descriptive study I, Prescriptive study, and Descriptive study II.

Criteria definition

This phase creates the specific context wherein the research study takes place. Herein lays the definition of the project aim, literature study, and the creation of a preliminary framework based on the literature (if any). These will be used to guide the data collection. In this manner a link can be identified between the measurable criterion and the success criterion which can later be used to evaluate the validity of the research.

Descriptive study I

Descriptive studies can, according to Yin (1994), be:

- Exploratory, answering 'what', to provide more research focus when the understanding is still inadequate.
- Descriptive, describing 'what, who, where, how many, how much', to find frequencies or incidence.
- Explanatory, describing the 'how' and 'why' – to find the operational links.

In this framework the term "descriptive" is used to cover all of these.

In this stage data is gathered, for example through case studies, in order to clarify the current situation. From this a scenario of the desired situation is created.

Prescriptive study

The outcome of the descriptive study is used (link 1 in Figure 20) to create a method and tools to lessen a potential gap between expected and realised results.

Descriptive study II

In this phase the developed methods and tools need to be tested empirically. However, due to the long time span needed to test the implementability of these, in particular for PhD research projects, no final conclusion on the implementability of the developed methods and tools can be made. Instead, the usefulness and implementability can be reasoned using the identified link between the measurable criterion and the success criterion.

Blessing and Chakrabarti's (2002) framework allows for different focus on the different stages (see Table 21 on the next page). In PhD studies, the descriptive study II is often missing or initial due to the short timeframe of this type of research study.

Table 21: Different types of design research derived from the methodology.
Source: Blessing & Chakrabarti (2002)

CRITERIA FORMULATION	DESCRIPTIVE STUDY I	PRESCRIPTIVE STUDY	DESCRIPTIVE STUDY II
Review → Detailed			
Review → Detailed →	Initial		
Review → Review →	Detailed →	Initial	
Review → Review →	Review / Initial/ Detailed ←	Detailed ⌐	
Review → Detailed →	Detailed →	Initial	
Review → Review →	Detailed ↑------------⌐	Detailed ⌐	
Review → Detailed ↑	Detailed ↑	Detailed ⌐	

3.3.1 Criteria definition

The literature aim and research question are given to specify the study. A literature review is completed to obtain a theoretical reference frame. For this study the *success criterion* is that the globalisation of the product development process more adequately fulfils the goals set for this endeavour in terms of competitive advantage. The *measurable criterion* is the difference between the budgeted negative impacts within a given timeframe, compared to the realised costs and resources spent.

The literature aim and research question are given in Chapter 1. A literature review is completed to obtain a theoretical reference frame. The literature review can be seen in Chapter 2.

3.3.2 Descriptive study I

In this stage the case studies are carried out and the preliminary framework presented in Chapter 2 is enriched, refined and expanded. In this stage the current situation and desired future situation is detailed. Two descriptive studies were carried out. In study 1 four areas were investigated: (1) the global product development process in the investigated case companies, (2) the challenges they experienced, (3) the solutions they implemented, and (4) the impact of these solutions. In the descriptive study 2 the use of expatriates were investigated in relation to their role in the organisation during globalisation of the product development process. The data from the case studies can be seen in Chapter 4 where they are separated into these two descriptive studies. The analysis which also details the gap between the current and the desired situation can be seen in Chapters 5.

3.3.3 Prescriptive study

This stage details the framework suggested for closing the gap between the current and the desired situation, or said differently, a way to address the difficulties the case companies are currently

encountering within globalising the product development process. This framework builds on the case study findings and the preliminary framework from the literature review in order to suggest a framework which can close this gap. This is presented in Chapter 6.

3.3.4 Descriptive study II

In this stage the validity and applicability of the framework developed in the previous stage is carried out. Due to the time constraints on a PhD project, a full validation process is not carried out. However, the framework is tested by conducting workshops with industry representatives. Additionally, the stakeholders from the cases will be involved continuously as the framework is created, ensuring their input in regard to implementability throughout the development of the framework. The quality of the research approach itself will also be explored to ensure the findings are valid and reliable through all stages. This is described in Chapter 7 as are reflections on the wider context and implications of the research and possibilities for further research. Conclusions and answers to the research question are given in Chapter 8.

This study is a review-detailed-detailed-initial study, meaning the criteria formulation is reviewed, and the descriptive study and prescriptive study is detailed, while the descriptive study is initial. This is due to the explorative nature of the study and the time constraints of a PhD research project.

3.4 Empirical research

This section describes the data collection process.

3.4.1 Number of cases

The number of cases needed in a case study depends on the context. Few case studies allow for in-depth investigations (Voss*, et al.*, 2002; Leonard-Barton,1990).This feature needs to be balanced against generalisability; the higher the number of cases used the higher the degree of generalisability of the findings (Leonard-Barton, 1990; Eisenhardt, 1989; Voss*, et al.*, 2002). A single case study is therefore useful when a phenomenon is studied in detail (e.g. a new field) whereas multiple case studies are useful when there is some knowledge about the phenomenon but certain specific aspects remain unknown and these are then investigated (Eisenhardt, 1989). There is no ideal number of cases within a given context. However, multiple case studies of two to eight cases are considered reasonable numbers for theory building (Eisenhardt, 1989). The workload involved in case studies means there is a natural upper limit to how many cases one can research; Eisenhardt (1989) puts this to ten. For this study seven different case companies have been used. However, not all of them were studied to the same depth – some were used to investigate in depth a very specify area (see the following section).

3.4.2 Case study research

Conducting case studies can be challenging in several areas:
- ➢ Practical matters
    - o Accessibility to the company and its employees.
    - o Width, depth and length of the case study.
- ➢ Validity
    - o Understanding of the organisational context and culture.
    - o Getting detailed statements which reflect the informants' true beliefs, interests and values.
    - o Maintaining objectivity as a researcher while still understanding the context and motivations of the informants.

While validity can be ensured through the design of the case studies (for details see Chapter 7), practical matters can often delay the study. In this study it took several months to get access to the desired type of companies, for example. As a result one of the case companies, X4, can be described as both a B2B and B2C company as it sells to big toy chains but also directly to customers. Furthermore, some of the case companies were not as far ahead with globalising their product development process as others. However, despite these difficulties, the selected case companies gave good insight into how Danish companies globalise their product development process.

The next problem which arose was access to interviewees. As some were out of the country a few interviews were conducted by phone when necessary. It would have been desirable to get access to more informants from both managerial and engineering functions in many of the case companies to get a more detailed picture of the global product development process which was balanced equally between these two fields. However, within the constraints to which all case studies must submit, the study produced enough findings to draw conclusions and create a framework. The challenges with this type of research were thereby overcome so the research question and research aim could be addressed. For detailed reflections on the research approach and its validity see Chapter 7.

3.4.3 Case selection

Cases were selected based on the following criteria:

1. Employed engineers in main value creating functions.
2. A B2B company.
3. Had or were in the process to offshore or outsource elements of their product development process to India, China or Eastern Europe.
4. Were Danish owned with headquarters in Denmark.

These criteria were due to practical issues (e.g. time, finances, and travels) and to fulfil the project scope and aim.

Seven case companies were investigated. All companies are made anonymous as per their request. Table 22 presents an overview.

Table 22: Overview of the case companies

Case	Industry	Revenues (in 2009)	Employees
X1	Electronics	DKK 1.227 million	Ca. 4100 employees worldwide, ca. 900 in DK.
X2	Mechanical	DKK 19.4 billion	Ca. 26000 employees in 25 countries.
X3	Mechanical	ca. 1.2 billion USD	5800 worldwide.
X4	Goods	DKK 11.661 million	8000 employees worldwide.
X5	Pharma	Turnover of DKK 1.488 million	Ca. 1600 people in 25 locations worldwide.
X6	Raw materials	DKK 23.13 billion	10500 worldwide.
X7	Energy	Ca. 6000 million Euro	20000 employees worldwide.

To gain a detailed view of how globalisation of product development process activities through offshoring and outsourcing was perceived, top managers, engineers working in the headquarters and

expatriated managers – Danish engineers and managers employed in the foreign subsidiary - were interviewed. In this manner a more detailed and full picture could be gained of the global product development process. In some companies it was only possible to get access either to expatriated managers or to the top managers and daily managers in the headquarters. However, by having access to several case companies the spread of informants became large enough to ensure the necessary conclusions could be drawn to address the research question.

1. Access to interviewees concerning the management of the offshoring and outsourcing process of product development. This meant access to interviewees with knowledge concerning motivation, process management, and daily management of global product development elements.
    ➢ To a larger or smaller degree all the case companies belonged to this category depending on access to interviewees (see the next section).

2. Access to interviewees and data concerning expatriated engineers and their perspective on the subsidiary's role – and their own - in the company's knowledge network in relation to globalisation of the product development process.

The following case companies belong to this category:

   ➢ X3: The Electronics department
   ➢ X5
   ➢ X6
   ➢ X7

X5 was chosen to focus on the role of engineer expatriates in relation to offshoring in regard to knowledge and communication in the Danish multinational. The informants from X3, X6 and X7 were used to support the information from X5.

The other case companies also had expatriates but this angle was not investigated in these companies due to practical reasons. For example, X2 had expatriates (the plant manager, experts and top managers) for their operation in Poland which was the focus of the investigation with X2; while X1 had had expatriates in China but had stopped when they outsourced instead of offshoring to gain cost advantages. X4 had several expatriates around the world – mostly in sales and marketing functions – and so had X6. The interviewees in all the expatriated companies provided details on the decision process and the motivations for moving out seen from their perspective as previous managers in the headquarters and as current expatriated managers. In this manner many of the cases provided data for both the perspective of the headquarters and the subsidiary the expatriate was stationed in.

3.4.4 Interviewees selection

To answer the research question it was important to interview top managers as well as lower level managers to gain a multi-perspective view. These were selected based on their influence and involvement with the decision process and their daily involvement with global product development process activities, and included the CEO, vice presidents from different departments (e.g. procurement, manufacturing, engineering, sales and marketing), and daily managers.

Table 23 illustrates the case companies with regard to the position of the interviewees, and the number of interviewees.

Table 23: Description of interviewees

Company	Interviewees' positions	No. of interviewees
X1	Vice presidents, daily managers	3 interviewees
X2	CEO, vice president, daily managers	4 interviewees
X3	Vice president, daily managers, expatriates	9 interviewees
X4	Vice presidents	5 interviewees
X5	Top level managers, daily managers, expatriates	24 interviewees
X6	Vice presidents, daily managers, expatriates	9 interviewees
X7	Expatriated top level managers, daily managers	3 interviewees

The second descriptive study focused on X5 to gain an in-depth study on the theme. Expatriated engineers were selected based on country. The focus was China and the interviewees were all currently, or had been, stationed in China. For comparison, some Danish expatriates for X5 to the USA were also interviewed. All were engineers or architects stationed as experts, project or plant leaders, or another kind of high level manager in the subsidiary. All expatriates had by Danish standards long term expatriation contracts (6 months to 3 years).

For X5 nine expatriates who had been stationed in China were interviewed; five were expatriated in 2006, one in 2007, two in 2008, and one in 2009. Attention should be paid to the year IA started because the large pharma company which used to own X5, helped X5 with some of its HR tasks until 2006, including the organisation of expatriation. When expatriation packages became different in the two companies, it influenced the services offered to the expatriates by X5. Thus it can be assumed that the answers of interviewees can differ depending on the year of IA start. Moreover, at the time when the interviews were conducted (in 2009 and 2010), five interviewees were stationed in China and four had already returned to the Danish HQ. For USA expatriates, two were stationed in USA and four had already returned to Denmark. Therefore not all interviewees could address the issue of repatriation. Due to a lack of resources some interviewees who were not in Denmark were interviewed by telephone. However, the majority of expatriates who were in China were interviewed on location. Of the expatriates stationed in China, three were stationed abroad for the first time and five had been stationed abroad before, while one interviewee preferred not to answer the question. Out of five expatriates who had been stationed abroad before, four were previously stationed abroad by X5; three to China and one to USA. Seven of the interviewees were stationed with families while two were stationed abroad alone. Four had expanded their contract while being in China, but none of them ended the original contract early. However, some interviewees were still stationed in China at the time of the interview.

Six interviews with US expatriates in X5 were carried out. Five of them had been stationed abroad before, and five expatriates were stationed with their family while one was stationed alone. Three of the expatriates expanded the length of the original contract, but for two of them the contract was shortened due to the financial crisis, and one spent the precise contract time in the USA.

To support the findings in X5, Danish expatriates currently in China for X3, X6 and X7 were also interviewed. From X7 it was three interviewees, for X3 it was five interviewees and for X6 it was

two interviewees. As all interviewees were still in China when interviewed data on repatriation was not possible from these companies.

For confidentiality, all interviewees were made anonymous.

3.4.5 Interview process

For this study the interviews are semi-structured and have a mostly open format. The open qualitative interview was chosen because the interviewer did not know the important points before the interview began, and needed the option to explore new areas if any arose. Because the interview needed to touch upon certain topics and themes (as detailed in the following section), it was semi-structured to allow for an iterative interview process. The interviews were used as a learning experience to explore the research aim. Interviews were explorative due to the lack of consistent theory in this area, and were case focused through careful selection of interviewees with related knowledge. The interview thereby followed the 12 steps from Kvale (1996) as a life world orientated interview; it was open for change, explored the everyday world of the interviewee, deliberate naiveté was expressed to get the interviewee to explain more of his or her life-world, the focus was on specific situations and actions and to get detailed descriptions on these and the interview process was sensitive to the experiences and knowledge the interviewee had on the topic.

An interview guide was made for each of the descriptive studies before the interviews were conducted to ensure all interviews had consistency, although the interview was conducted as a free conversation between the informant and the interviewer. The interview guide functions as a kind of question frame and should not contain too precise questions. The interview guide contained themes and topics to ensure all relevant points were covered. The questions were phrased around these themes to avoid the most common errors in the formulation of the questions (e.g. leading questions). Even though the interview guide was very detailed and thorough it was still only a guide, a checklist to see if all relevant points were covered, so that the interviews fulfilled the requirements for being semi-structured. The interview guide covered overall points and relations which were relevant to know from all informants. The same interview guide was used for all informants to ensure validity in the process, although if new but relevant points were discovered during one interview this theme was explored in all subsequent interviews.

The interview guide for the first descriptive study had two topics inspired by the overall aim of the research; engineering and management. The themes were inspired by the literature review. For management there were six themes; motivation, decision, implementation, impact, realised versus envisioned outcome, and lessons learnt/improvement suggestions. This included positive and negative impacts of outsourcing and offshoring product development process activities, including coordination, knowledge management, and culture. The positive and negative impacts were furthermore explored. For the second descriptive study there were four themes, preparation, challenges during the stay, repatriation, and knowledge management. Within each theme, a series of assumptions were developed based on the literature review. These were validated through meetings with representatives from the Danish Society for Engineers (IDA) who advise their members on expatriation.

Each theme was investigated in accordance with the literature review on the topic. Furthermore, they were related to the research question to ensure these would be answered. (This can be seen in the interview guides, Appendix 2 and 3.)

Two interviewers were present during the first interviews conducted for the first descriptive study. These were all the interviews from X1, X2 and the Solar energy department of X3. The researcher had then gained experience with the interview process and the guide, and the subsequent interviews with X3's Electronics department, X4, X5, X6 and X7 were carried out with one interviewer. All but four of the interviews were conducted in English (the four others were in Danish and translated by the author into English). All the interviews lasted between one to two hours. In a few cases additional information was needed after the interview to clarify certain points which were done through repeated interviews, e-mails, or by telephone. Some interviews were conducted by telephone due to travel costs and scheduling conflicts. While this can have certain limitations – for example the lack of body language and face-to-face communication – it is believed that by interviewing Danes who were used to virtual interaction these impacts would not influence the data. All the interviews with employees from X4 as well as four interviews from X5 were done by telephone due to costs related to traveling if they had been conducted face-to-face.

The interviews were audio-recorded and transcribed. Recording may limit interviewees' replies or make them feel uncomfortable; so the option to say no was offered. Three interviewees were uncomfortable with being recorded, so in these cases detailed notes were taken and used as the transcription source.

An interview can be analysed using various methods, for example these five (Kvale, 1987):

- Condensation
    - Reducing longer statements into shorter ones which contain the same meaning.
- Categorisation
    - The interview is coded into categories. Long statements are reduced to simple categories like +/- to indicate occurrence/non-occurrence of a phenomenon, or to a number scale (1-5 for example) to indicate the strength of the phenomenon.
- Narrative
    - Focuses on the stories told during the interview and works out their structure and plot.
- Interpretation
    - Makes speculative interpretations of the text. Often seen in analysis of literature.
- Ad Hoc
    - Uses a variety of common sense approaches to the interview text as well as textual or quantitative methods which can focus on the whole text or certain passages. Methods can be: noting patterns and themes, seeing plausibility, clustering, making metaphors, counting, contrasts/comparisons, partitioning variables, subsuming particulars under the general, factoring, noting relations between variables, finding intervening variables, building a logical chain of events, and making conceptual/theoretical coherence. Outcome of meaning generation can be in words, numbers, flow chats, figures, or a combination hereof.

The interviews in this project were analysed using these methods as these were most relevant to the method and research question of the study:

- Condensation.

- Categorisation.
- Ad hoc.

The interview guide already divides the interview into themes and to compare statements condensation and categorisation was used. Ad hoc methods were used for the data where this helped to clarify the information. As a part of the categorisation the transcripts were coded using a coding scheme; a method described in detail in Blessing and Chakrabarti (2002, 2009). To do so, condensation and ad hoc methods like creating new coding categories from the dataset were employed. The codes were based on the interview guide and followed the themes from this. Each category was a theme in the interview guide, while each code – and subcodes if it was needed to divide the codes further - was the range of possible answers received. Table 24 on the following page shows the coding scheme used in this study which includes the details for the interviewee and what he or she is talking about, motivation, decision phase, implementation, encountered problems and good experiences as well as the impact on the product, the product development process and the organisation.

Table 24: Coding scheme used in the first descriptive study

Number	Categories	Definition	Literature
1	Interviewee	The identity of the interviewee	N/A
2	Company	The identity of the company	N/A
3	Overall reference frame	Whether the statement is a current or desired future state	N/A
4	Offshoring	Whether the statement was in relation to offshoring	N/A
5	Outsourcing	Whether the statement was in relation to outsourcing	N/A
6	Motivation to outsource or offshore	The motivation to move abroad	Ferdows, 1997a
7	Involvement in decision process	Which levels of management were involved in the decision to offshore or outsource	Kotter, 1996
8	Issues debated doing decision process	Key issues which were relevant in the decision process	Cramer, 2006
9	Point of contact with the outsourcing supplier/subsidiary	How the company kept in contact with the outsourcing supplier or the subsidiary	Emerged from the dataset
10	Positive experiences of offshoring or outsourcing	The positive experiences the interviewee had had with offshoring or outsourcing	Emerged from the dataset
11	Negative experiences of offshoring and outsourcing	The negative experiences the interviewee had had with offshoring or outsourcing	Emerged from the dataset
12	Choosing suppliers	The motivation for choosing a certain outsourcing supplier	Ferdows, 1997b
13	What functions to move abroad depend on (needs to have a high degree of)	What the interviewees felt was important in order to be able to move a function successfully abroad	Emerged from the dataset
14	Unforeseen issues	Unforeseen issues the company had when they had offshored or outsourced	Emerged from dataset
15	Culture (perceived differences in)	Cultural differences the company encountered	Hofstede, Hofstede & Minkov, 2010
16	Product features	The changes the company did to the product development process to counteract perceived difficulties	Emerged from dataset
17	Product Development process (needs to be more)	The changes the company did to the product development process to counteract perceived difficulties	Emerged from dataset

18	Knowledge gain due to offshoring or outsourcing	Whether the interviewee felt there was a knowledge gain by moving abroad	Ferdows, 1997b Emerged from data
19	Knowledge transfer type	The type of knowledge the interviewee is addressing	Hansen, 1999
20	Moving from offshoring to outsourcing	The reason the company moved from offshoring to outsourcing	Emerged from dataset
21	Moving from outsourcing to offshoring	The reason the company moved from outsourcing to offshoring	Emerged from dataset
22	Future strategic approach to outsourcing and offshoring	How offshoring and/or outsourcing will be handled in the future	Emerged from the dataset

The second descriptive study followed the same process as for the first descriptive study; after each interview it was transcribed and coded. The coding scheme for the descriptive study 2 is based on the assumptions from literature from which the literature guide was also created. These can be seen in Table 25.

Table 25: Interview themes and literature assumptions used in the second descriptive study

Theme	Assumptions	Literature
Theme 1: preparation	**S1: Agreement to work abroad:** *Most engineers stationed abroad have agreed to this because they believe the skills and competences they gain will further their career and personal ambitions.* **S2: Practical issues:** *Expatriates will often be left to resolve practical issues (house – home and abroad, salary, allocation of spouse and/or children, visa and permits, social network etc) in regard to the stay abroad on their own which resolves in stress and sometimes mistakes.* **S3: HR programs:** *Only large companies will have an educational program for engineers which are to be stationed abroad.* **S3.1: HR programs:** *Only a few large companies will have an educational program for the family of the engineer who is to be stationed abroad.* **S4: Career plans:** *Only large companies have developed career plans for their expatriates.* **S4.1: Career plans:** *Expatriates will have an informal talk with their manager about career prospects before going abroad* **S5: Selection:** *Companies will often not have a clear strategy for selecting which engineers are stationed abroad.*	IDA, 2000, 2009, 2010; Harris & Brewster, 1999

Theme 2: challenges during the stay	**S6: Cultural clash:** *Offshoring can create misunderstandings and/or conflicts between expatriates and the employees from the local environment due to cultural dissimilarity.*
	     S6.1: Lack of empathy: *Danish expatriates are facing difficulties to understand and respect the local values and norms.*
	     S6.2: Work and time pressure: *Danish expatriates have a tendency to feel a greater pressure in regard to work time and responsibility when stationed abroad than when working at home. However, the work pressure (efficiency) will be lower than in Denmark.*
	     S6.3: Social and professional class: *Danish expatriates will find it easier to interact with and trust locals who have the same educational background and social class as themselves.*
	     S6.4: Job shopping: *Foreign engineers will job shop more than Danish engineers, leaving the expatriates feeling frustrated and feeling the foreign employee is being disloyal.*
		IDA, 2000, 2009, 2010; Fish *et al*., 2008; Lii & Wong, 2008; Fukuda & Chu, 1994; Harvey, 1985; OCED, 2011

Theme 3: knowledge sharing	**S7: Knowledge gains:** *Expatriates will gain a lot of knowledge while stationed abroad.* **S7.1: Knowledge gains***: Expatriates gain soft skills* **S7.2: Knowledge gains***: Expatriates gain hard skills*	IDA, 2000, 2009, 2010; Lazarova & Tarique, 2005;

Theme	Assumptions	Literature
	S8: Transferring knowledge back: *Transferring knowledge back to the headquarter (HQ) will be hindered by the low strategic importance for real two-way knowledge collaboration and sharing.*	Berthoin-Antal *et al.*, 2000; Black *et al.*, 1992; Tungli & Peiperl, 2009; Harzig, 1995; Tung, 1998; Tungli & Peiperl, 2009
Theme 4: Repatriation	**S9: Success criteria:** *The expatriate will have few, vague or no clear measurable criteria with which to judge whether or not they are doing a good job. Ambiguity and insecurity can result.*	Mercer Consulting, 2010a, 2009/2010b, 2003; Black & Gregersen, 1999; Bossard & Peterson,2005; Shen & Hall ,2009; Black & Gregersen ,1991; Hall *et al.*,2002; Shen & Hall ,2009; Noe & Barber ,1993; Stroh *et al.* ,1998; Burt,1992, 1997; O'Sullivan ,2002; Allen & Alvarez ,1998; Bertoin Antal ,2001; Shen & Hall,2009
	S10: Preparation: *Only a few large companies will have prepared for when the engineer stationed abroad returns home.*	
	S11: Personal knowledge: *The knowledge expatriates are gaining is not fully explored while they are abroad nor when they return.*	
	S12: Conditions for success / failure experiences of expatriates: *The experience expatriates gain of whether their stay abroad is successful depends on the following conditions and competences:*	
	S12.1: *the company's career planning for the expatriate*	
	S12.2: *The expatriate´s own career planning*	
	S12.3: *education/preparation in the company prior to the stay abroad*	
	S12.4: *Network with colleagues at home/stationed abroad and other people stationed aboard, the local population as well as family relations*	
	S12.5: *Personal expectations and abilities to adjust to the new society and new challenges*	
	S12.6: *Personal abilities like socially outgoing, flexible, empathic, quick adjustment time, leadership abilities, communication abilities, the ability to create trust*	
	S13: Stationed abroad and career development: *While most HR employees feel a stay abroad improves the engineer's career in the company, a majority of engineers will feel the reverse. They will, however, feel the stay improved their career overall.*	
	S14: Improvements: *Companies will often not have a clear educational program for engineers who are to be stationed abroad, or how to use their knowledge.*	

Seven categories were created from the above assumptions in order to group them according to the topics. These categories were: Preparation Phase, Cultural Issues While Abroad, Knowledge Sharing and Communication in Virtual Networks, Use of Knowledge When Engineers Return Home, Improvements for Engineers Stationed Abroad, Personal Issues, and an additional category named Found from the Dataset, which included issues that were found during interview coding and were assumed to be an important addition for the research and were added to the coding scheme. The additional codes which were added to the assumptions listed above were the following:

1. Personal motivators to move abroad were a key factor to agree to be expatriated (Issue 1).
2. Coming back home after expatriation was more difficult than being expatriated (Issue 2).
3. Satisfaction of stay professionally and personally (Issue 3).
4. Difficulties upon repatriation (Issue 4).

The coding was performed by matching each statement from the interviewer to one of the developed assumptions and evaluating whether the statement supported or rejected the assumptions.

The abductive research approach as it has been extended by C.S. Pierce (2004) was also employed to analyse the interviews. Abduction is a way of processing data which consists of assembling or discovering new combinations of features in the data for which there doesn't already exist a rule or explanation. The researcher must then find or invent such a rule. When something new is discovered in the dataset a new rule is made and at the same time, it also becomes clear what the case is. *Abduction* 'proceeds' from a known quantity (result) to *two* unknowns (the rule and case). Hereafter, model building can begin based on these results. Abduction is an intellectual act that brings together things which have not been associated with one another before.

3.5 Summary

The study follows the participatory constructivism paradigm to investigate people's point of view and includes cultural and social parameters. The study also aims at creating a framework, a representation of reality, in which to describe the results which fall towards the positivistic and post-positivistic paradigms, and thereby employs a duel approach to scientific paradigms. However, the framework is meant as inspiration to other companies but not as a detailed solution guide as the assumptions drawn from the participatory constructivism paradigm show the importance of the social and cultural embeddedness within each organisation.

The selected research approach was case based with semi-structured interviews as the primary data source. The Design Research Methodology (DRM) is employed as the methodological approach in this study. The methodology consists of four stages: Criteria, Descriptive study, Prescriptive study, and Descriptive study II.

In the first stage the research aim, research question, literature review, and the preliminary framework are created. In the next stage, two descriptive studies are carried out. In study 1 four areas were investigated: (1) the global product development process in the investigated case companies, (2) the challenges they experienced, (3) the solutions they implemented, and (4) the impact of these solutions. In the descriptive study 2 the use of expatriates were investigated in relation to their role in the organisation during globalisation of the product development process. These descriptive studies are based on case studies and interviews in order to present a picture of the current situation and current gaps between the current and desired situation of globalising the product development process. Seven case studies were conducted with a subsequent analysis of the interviews using condensation, categorisation, and ad hoc methods using a coding scheme of the transcribed interviews. In the third stage, a framework is created to close this gap, and in the last stage this framework is tested to ensure validity and applicability. The validity process and further details on ensuring quality of the research approach are illustrated in Chapter 7.

The next Chapter describes the case companies in detail and presents the results from the empirical investigation from the two descriptive studies.

Chapter 4: Case studies

This Chapter presents the empirical data in relation to the two descriptive studies.

The Chapter is structured into 3 sections;

A) Company presentations.

B) Findings from the descriptive study one.

C) Findings from the descriptive study two.

In the descriptive study one four areas were investigated; (1) the global product development process in the case companies, (2) the challenges they experienced, (3) the solutions they implemented, and (4) the impact of these solutions.

In the descriptive study two the use of expatriates were investigated in relation to their role in the organisation during globalisation of the product development process. Each of the case companies contributed different areas of interest within the research area to explore and therefore these areas are highlighted for each case company.

For the descriptive study one, this chapter divides the findings into sections based on the case companies. For each of these, first a description of the globalisation process within the product development process is detailed, thereafter the challenges the companies experienced are illustrated. The solutions the companies implemented to address these challenges are then shown, followed by the impact these had on three key areas; the organisation, the people in the organisation and the engineering processes.

For the descriptive study two, the findings from X5 are first detailed, sorted according to HR information and findings from expatriates. Hereafter findings from Danish expatriates sent to China are shown, followed by a comparison between expatriates in the USA and China from X5. Finally, findings from three of the other case companies regarding expatriation are shown.

4.1 Company presentations

4.1.1 Case company X1
X1 was created in 1869 as a telegraph company and has its headquarters in Denmark. It is now a headset company (X1), and a hearing instruments and audiological diagnostics equipment company. X1 is listed on NASDAQ OMX Copenhagen. The company has c. 4100 employees, with c. 900 employed in Denmark. Other locations are in Australia, New Zealand, several places in China, India, Saudi Arabia, North and South America and several locations in Europe, including Russia (X1, 2010).

X1 headsets are marketed globally under one brand, and X1's hearing instruments are marketed under 3 other brands. X1's vision is to be the world's leading provider of communications solutions that enable people to communicate more easily and effectively. This study focuses only on X1 and in the remainder of this thesis X1 refers only to the headset part of the company.

X1 have experienced global growth through M&As. At the onset of the new millennium, X1 had to address inefficiencies in its global operations after the acquisition of several smaller competitors,

and changing patterns of global demand. Production was relocated to China in 2001 which is also an emerging market. The decision to move manufacturing to China had been taken on the executive level. Thereafter the process was more adhoc with product design and R&D following. Specific issues included the reorganisation of production worldwide, the establishment of new facilities in China, the reorganisation of global supply chain management, and the entry into China as a market. Offshoring of R&D and other elements of the product development process followed mainly to gain cost advantages in relation to engineering salary and administration costs.

The office in China has 40 people and can run complete products, including mechanics, software, hardware, and acoustics. R&D activities in China started in 2002. During the first two years Danish engineers were stationed there to ensure knowledge transfer, quality and easier communication. R&D and design centers for X1's brands takes place in India, China, Denmark and USA.
To gain flexibility and lower costs, X1 outsourced all production instead of offshoring it to its own factory in China. This was completed in 2006. X1 now outsources all production mainly to Chinese suppliers in a clustered electronics area to avoid delays caused by bureaucracy and transport difficulties between Chinese regions. The top managers and daily managers view supplier selection and the strategic aims of suppliers differently as can be seen from the vignettes below.

Vignette from top managers' perspective:
Global competitors, increasingly also from the developing countries, are pressuring X1 on price and time to market. Chinese suppliers are eager to gain contracts with X1 and will often offer a very low price on the first contract. Therefore, to gain maximum cost advantages, a new supplier can be selected each time. In this way X1 always gets the lowest possible price and by hinting the supplier may get more business – while it is known they likely will not if they don't repeat the low introductory price – the supplier is kept focused and hard working in the belief the relationship will continue.

Vignette from the daily managers' perspective:
While price is important due to global competition, other factors like quality and know-how are also important. There are also many hidden costs which make the true cost of switching supplier more complicated than simply comparing price. By switching supplier often, the suppliers do not gain an in-depth knowledge of X1 and its operations. This can mean that X1's personnel need to spend substantial time explaining details and specifications to the supplier. Furthermore, because suppliers rarely get repeat contracts many are starting to ask for overhead in their introduction price to make up for the additional time they need to spend to learn the new business for the sake of only one contract. Knowing that there will not be any repeat business can also mean quality and service might be lower than for long term clients of the supplier. Even if the supplier believes the relationship will continue, they sometimes offer the contract so cheaply that they lose money which can mean problems with quality, communication etc.

In contrast to this, X1 have a long term relationship with an outsourcing partner in India which produces embedded IT for their products.
X1 follows the spiral product development process model to ensure an objective and controlled process and to ensure knowledge transfer and learning. This also helps to reduce risks and functions

as an activity and delivery check list. A spiral product development process means many iterations and therefore more communication and collaboration between each step. The most difficult thing in X1's product development process is to manage **interfaces**. This includes discipline-to-discipline people interfaces, interfaces between company and suppliers, team members' internal/external interfaces, technical interfaces to other equipment, user interfaces, and interfaces to market and internal sales organisation.

X1's strategy for the future includes five main areas:

1) Outsource some of the design tasks sent to China to Chinese suppliers (thereby downsizing the Chinese office), and let personnel in the Chinese office keep control to gain lower cost and greater flexibility. The plan is to keep some offshoring to ensure close control with the Chinese outsourcing vendors. The motivation is lower cost, increased scalability and flexibility, and tight control and pressure as this is believed possible with outsourcing vendors to a larger degree than at the company's own offices.

2) Hand over more responsibility to suppliers. Transfer, control of production, and transfer of new products will be outsourced to the companies that are going to produce the products.

3) Decrease number of suppliers (one stop shopping), to outsource all handling of sub suppliers to that single assemble factory. This process has already started.

4) Same or smaller headcount in Denmark due to the labour cost advantage in China.

5) X1 plans to keep what they have already sent abroad and improve on the process to gain the full advantages of offshoring and outsourcing but do not plan to move anything new out at this time.

4.1.2 Case company X2

X2 is a result of a merger between a German mechanical company and the Hydraulics department of X3 in 2000. Shares are publicly traded on the New York Stock Exchange. A majority of shares are held by X3 (c. 76%). The company's primary products include hydrostatic transmissions, open circuit products, valves, steering components, agricultural products like construction, road building, turf care, and speciality products.

Main customers are global original equipment manufacturers (OEMs). The company has its headquarters in Denmark and employs 1200 people here. Globally the company employs 5800 and has a yearly turnover of c. 1.2 billion USD (X2, 2010). Greatest market is Europe (43%), then North and South America (42%), and finally Asia (15%).

As a global company, X2 has strategically located facilities to maximise product development and production capabilities while serving customers at a local level. The X2 family today consist of more than 20 engineering and manufacturing facilities, approximately 280 distributors and Authorized Service Centers, and more than 20 sales companies. The engineering and manufacturing facilities this study paid special attention to were in Poland (one site with manufacturing and one site with manufacturing and engineering facilities).

4.1.3 Case company X3

X3 is a family owned company with headquarters in Denmark. X3 A/S is an international Group which conducts research, development and production of mechanical and electronic components and

solutions, mainly to OEMs. The company has 26000 employees worldwide and has 93 factories in 25 countries.

The company have four divisions: X3 refrigeration and Air condition division, X3 heating division, X3 motion controls division, and a majority share in X2. X3 services division is shared by all of them.

Two departments in X3 were investigated; X3 Solar energy and X3 Electronics.

> X3 Solar energy

Focused on developing energy conversion and management systems for the global energy generation market, X3 Solar energy began life as a venture project in 2001 within X3 Drives - a global supplier of frequency converters. Due to its rapid growth, the venture became an independent company in 2002, partly owned by X3. The company has succeeded in building a strong position in the solar energy private label market by offering a unique product and support concept. In the spring of 2007 the company became a fully integrated part of the X3 Group.

The headquarters for the department is in Denmark. Production and production engineering was outsourced to a Chinese supplier but the relationship failed and production was moved back to offshore facilities owned by X3 in Denmark and Europe.

> X3 Electronics

This section operates globally as a supplier of compressors and automated solutions to the refrigeration and air conditioning industry. The products are used within a number of business areas, ranging from household-, commercial-, food retail and industrial refrigeration to air conditioning and products for the wholesale refrigeration market to automation in specific industrial sectors.

X3 Electronics produce some of these products and have headquarters in Denmark. The focus of this study is on the manufacturing and engineering tasks which take place in Beijing, China (X3, 2010).

4.1.4 Case company X4

The X4 Group was founded in 1932. The company is family owned and has its headquarters in Denmark. It has 8000 employees worldwide and is the world's 5th largest producer of toy elements. X4 products are sold in more than 130 countries. Revenue in 2009 was 11.661 million DKK.

It is X4's ultimate purpose to inspire and develop children to think creatively, reason systematically, and release their potential to shape their own future. X4's vision is "*Inventing the future of play*".

The X4 Group has seen continued growth over the previous five years, and sales have increased by double-digit growth rates in the last few years. This has happened in a global toy market characterised by stagnation throughout the last decade. The X4 Group expects continued growth in sales in the years ahead. The foundation for this growth is a constant focus on the company's core products and markets. On this basis, seven growth initiatives have been defined for the future (X4, 2010):

1. Increase market share in USA.
   > USA is the world's largest market for toys, and the X4 Group has dramatically increased its market share in recent years, to approximately five per cent. The X4 Group believes this share can be further increased in the coming years.

2. Increase market share in Eastern Europe.
    ➢ The toy market in Eastern Europe is experiencing rapid growth, and the X4 Group aims to continue to expand its strong position in these markets.
3. Invest in emerging markets.
    ➢ The X4 Group does not yet enjoy a strong market position in markets such as China, Mexico, Brazil and India. These markets are expected to see strong growth in the future, and the X4 Group plans to invest in developing them.
4. Develop innovative new products.
    ➢ In addition to ongoing product development based on the existing core portfolio, the X4 Group will develop innovative new products which are ideally suited as X4 products, yet never seen before. An example of such new products is the X4 Games board-game series launched in 2009.
5. Expand "direct to consumer" activities.
    ➢ The X4 Group currently has direct contact to consumers through its own sales channels, clubs, collaboration programs etc. The aim is to get even closer to consumers through greater contact and by expanding offers available direct to consumers.
6. Expand X4 Education.
    ➢ The aim is to create growth in the area of educational materials for preschools, schools and educational institutions all over the world.
7. Expand electronic activities.
    ➢ The X4 Group currently operates on electronic platforms through its website and video games. X4's electronic presence will be further expanded, in particular through X4 Universe – the first massively multiplayer online game (MMOG) from the X4 Group, to be launched in the second half of 2010.

X4's top management consist of the CEO, the CFO, and four Vice Presidents each with their own business area (X4, 2010):
1. Markets and products
    ➢ Markets & Products has global responsibility for development of new products, for retail customers, development of marketing materials, global marketing and sales to retail customers worldwide.
2. Community, education and direct
    ➢ Community, Education & Direct is responsible for direct contact with consumers as well as sales via brand retail stores, online sales and mail order. In addition, this business area is responsible for digital business. And CED is also responsible for the Group's development, marketing and sale of educational materials.
3. Corporate center
    ➢ Corporate Center covers a combination of strategic and supportive functions: IT, Human Resources, Corporate Communications, Corporate Governance & Sustainability, Service Center, Continuous Improvement and Corporate Legal Affairs.
4. Global supply chain
    ➢ Global Supply Chain is responsible for the Group's supply chain, from procurement and production – including moulding, decoration and packing – to shipping and distribution to the retail trade.

5. Corporate Finance
   ➢ Corporate Finance is responsible for financial management and controlling as well as follow up on business planning and strategic initiatives.

Concept and product development takes place primarily at the company's headquarters in Denmark – but the X4 Group also has listening posts in Munich, Los Angeles and Tokyo in order to monitor the latest trends. The creative core is made up of 120 designers representing about 15 different nationalities. Most of the designers have trained at design or art schools in various parts of the world. X4 has manufacturing factories in Denmark, Hungary, Czech Republic and Mexico. The locations have been selected in order to be close to the Group's most important markets in Europe and the USA. In addition, elements and finished products are procured from external suppliers.

X4 had a generic product development process with stage gates after each function which meant less communication back and forth between design and production engineers. Clock-speed on product changes was lower than in most other markets wherein consumers are the end customer.
The study focused on X4's global development with a focus on the establishment of their latest global production facilities in Hungary.

4.1.5 Case company X5
X5 is a consulting and engineering company in the complex field of pharma and biotech. It focuses solely on these areas and is the largest company in the world which does this. Initially, the company was created as an engineering department of a large pharma company to supply the companies within this Group with engineering solutions. In the early 1990's this large pharma company decided to split the engineering company from the Group, in what they call "arms' length principle", to make it an independent company. A pharma consultancy company was acquired in 2007, creating X5. X5 A/S is 100% owned by this large pharma company. As such X5 has over 80 years of experience in the pharma and biotech industries. Services include consulting and engineering on new production facilities, and restructuring and upgrading. The headquarters is in Denmark. X5 employs close to 1600 people at more than 20 locations around the world. Of these 800 are in Denmark, 400 in China (Tianjin), and 100 in India (Delhi and Bangalore). X5 also has facilities in the rest of Europe and Asia, including a significant German hub in Frankfurt. In addition, X5 has five offices in the US market (X5, 2010).

X5's vision is to be the leading international supplier of projects, engineering and consulting services to the pharmacy and biotech industries, to achieve competitive and sustainable business results, and to be an exciting and rewarding place to work. X5's mission is to improve the lives of people by enabling pharma and biotech companies to bring products to market with fast, innovative and reliable solutions.
Turnover in 2009 was DKK 1.488M. The company's activities cover the entire pharmaceutical supply chain, from product development to manufacturing. The company's main source of income is new production facilities followed by consulting and then restructuring and upgrading (Karjakina & Semtsenko, 2010).

Engineering services include: fast-track greenfield facilities, "Pit Stops" (minimum-impact revamps), feasibility studies and master planning, conceptual and front end studies, basic design, engineering, procurement, construction management, clean room installations and services,

conventional and pre-fabricated modular facilities, automation specifications and facility integration.

Consulting services include among others operations management, lean compliance, operational excellence, bio processing and process excellence.

The company employees mainly engineers and architects. X1's main customers are from the Group which owns X5 with 35% of business from the Group's largest company and 15% for another. The company has direct and captive competitors (captive meaning they are a division or company owned by a larger group and mainly serve this customer base).

X5 has started to offshore to their Chinese location with the expectation that more will follow. The company employs Danish expatriates in several of their offshore locations as experts or project leaders to ensure quality, facilitate knowledge, and ensure control.

X5 has a project activity model they follow when conducting projects. This includes project management activities, quality management activities and engineering activities. Offshoring is a young initiative which has a top priority in their agenda for 2010. X5 offshores engineering activities to China from all offices. Offshoring is defined by X5 as "*a transfer of a well-defined work package internally in the company, where the office sending the task maintains full control and responsibility of the work package*."

X5 has a matrix organisational structure. The departments which offshore are (Karjakina & Semtsenko, 2010):
1. Program management (within Facility design and engineering (FDE) and Automatisation)
2. Project management (within Structural engineering, Ventilation & building utilities, Electrical engineering, Architectural engineering and Mechanical engineering)

As an example, the FDE department went through a process of offshoring which started in 2006 with a trial project and - after being stopped by the recession - is now continued with new projects and a dedicated coordinator to coordinate the offshored tasks (see Figure 21).
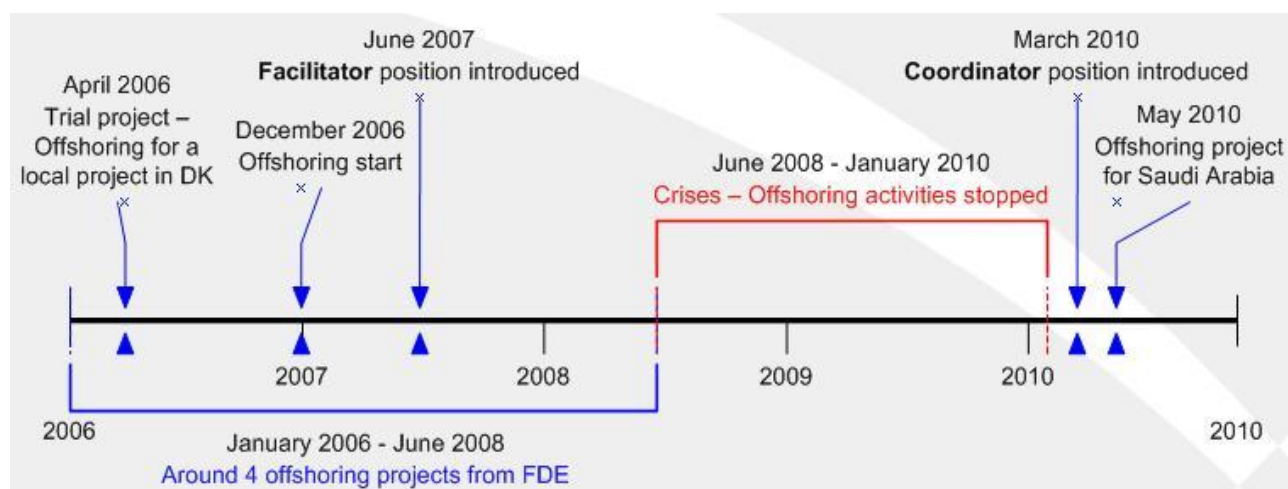
Figure 21: The process of offshoring in FDE.
Source: Karjakina & Semtsenko (2010)

The future plans for X5 include:
- Offshore more activities within global projects to China; *"That is absolutely a part of the strategy of this company for going forward in order to be competitive [to offshore work to the Chinese office],"* a top manager explained.
- Make offshoring more structured.
- Investigate in depth more tasks and assignments which can be sent to China
- Use less expatriates.

The focus for the case with X5 was to investigate the interaction between the product development facilities in:
- Denmark (800 employees).
- China (400 employees in Tianjin).
- Five offices in the USA.

Expatriates were used heavily as intermediate between departments and they therefore became a key focus in the descriptive study two.

4.1.6 Case company X6

X6 has been the leading supplier to the global cement industry since its foundation in 1882, and has its headquarters in Denmark. The company also has a smaller minerals department, and is active in the building materials industry. X6 was family owned until 2002 (first directly and later through majority shares). The company employs about 10500 people worldwide in more than 40 countries. In-house resources are primarily engineers who develop, plan, design, install and service equipment, with most of the manufacturing is outsourced to sub-suppliers. X6's revenue was 3.107bn Euros in 2009, and 99% of that is from business outside of Denmark (cement = 59% of revenue, minerals = 39% and building materials = 5%). Customer Services is a key focus area as it offers growth potential in the future and is believed to be more resilient in economic downturns.

Most of X6's global growth is through M&As and to reach markets. Over the years, the company had expanded non-core activities and in 1989 the entire X6 Group consisted of some 125 companies covering areas such as cement engineering, plastic, aerospace, and cement building materials. Around 2002, the Group began to sell off non-core activities. As a part of this, the building materials part of the company is not a part of the long-term strategy of the Group and X6 is looking to sell it. To strengthen X6's international appearance, a global branding strategy was adopted in 2009 – "One Company - One Name - One Source" – with the aim of streamlining all external communication and marketing at a global level, and to support X6's strategic position as a supplier of the whole value chain to the cement and minerals processing industries.

X6 have major project and technology centres in India, Germany, USA (two locations), and in the headquarters in Denmark. All of these locations conduct engineering tasks which include R&D assignments. The Indian office was bought in the 1990s and has continued to grow due to X6's strategic focus on offshoring work to this office.

X6 has a matrix structure and is divided into three departments; cement, customer service (including the building materials part of the organisation) and Minerals. Departments like R&D and Technology which all departments use are common for them all. All of X6's engineering offices

offshore to the Indian office. However, the minerals department – which is mainly centralised in the USA – has been less eager to do so. In the cement department offshoring to the Indian office was heavily employed. To illustrate, the amount of offshoring to the Indian office in the cement department for each product step is illustrated in the following:

- R&D: 15% offshored to the Indian office.
- Basic general engineering: 40% offshored to the Indian office.
- Proposal sales: low to none.
- Plant specific engineering: 50-75% offshored to the Indian office.
- Equipment production: 95% outsourced to foreign providers.
- Shipment: 100% outsourced to foreign providers.
- Installation: Less than 10% outsourced, 50% offshored to the Indian office.
- Commissioning: Less than 10% outsourced, 50% offshored to the Indian office.
- Handover to the client.

The future plans for X6 include having 15% of all R&D and 75-80% of all engineering work offshored to the Indian office in 2011, as well as to offshore more of these tasks from the minerals department. As a consequence of this no new engineering positions will be created in other countries than India. Furthermore, the company is implementing an integrated supplier approach and a narrower supplier base. X6 believes that potentially everything but Proposal Sales and project handling could be offshored to the Indian office, so new tasks are being considered for offshoring (X6, 2009). The company uses what it calls 'opportunistic buying' for many component suppliers.

Today X6 has a very diverse approach to suppliers with each division procuring their own equipment, which is a legacy from X6's history of consisting of more than 125 companies. A vice president from X6 explained it as follows, "*So far we have had a very diverted supplier approach where each division were procuring their own equipment and another division bought the same equipment at the same supplier not having a real close cooperation [between the departments]. Now, what we are doing now is taking all this key categories that we are working with on a group level and making sure that supplier understand our group way of doing procurement and we are now starting off with having a much closer relationship to some of the suppliers. First of all to get better cost, better labour time and to get capacity.*"

The focus on X6 was on their cement department. This department had engineering and R&D facilities in Denmark (at two separate sites), in the USA (at two separate sites) and in India. The interaction between these locations was investigated with particular focus on the offshoring activities.

4.1.7 Case company X7

X7 A/S began in 1898 as a steel windows producer for industrial buildings. It is now a worldwide wind energy equipment supplier and develops wind turbines. The company has its headquarters in Denmark and has over 23000 employees worldwide. Revenue is around 1.722 million Euro. Global market share in 2009 was 12,5 per cent (X7, 2010). X7 has an ambition of making wind an energy source on a par with fossil fuels. At the end of 2009, wind power accounted for less than 2 per cent of the world's combined electricity production (X7, 2010).

As the world's largest supplier of wind power solutions, X7 is proactively seeking to influence tomorrow's political decisions to ensure stable and predictable markets for wind energy. This includes policy recommendations, analyses, reports, and research focusing on regulatory frameworks in X7' largest markets.

X7 is organised into several departments based on geographical locations (e.g. China, Americas, Northern Europe, Central Europe, Offshore) as well as functions (e.g. blades, control systems, towers, technology R&D) which each has a president (X7, 2010). Corporate functions cover several functions and each of these have a president (e.g. IT, forecasting and planning, treasury) (X7, 2010). X7 has sales and production offices worldwide. Engineering and research facilities are located worldwide as well. X7 Technology R&D is located in six different locations in Denmark, Germany (two locations), the UK, India, Singapore, and the USA (four locations).

X7 has several production facilities in China, and the Chinese office is also starting to do low-level development tasks for local projects. The focus in this project was on the development the Chinese office in Beijing was undergoing from being a sales office with focus on suppliers and production sites to contain more engineering functions.

4.2 Descriptive study 1

In the first descriptive study the following aspects of globalising the product development process were investigated:
1. The globalisation process the company went through.
2. The challenges the companies faced.
3. The solutions the companies implemented to address these challenges.
4. The impact these changes had on the organisation, the engineering processes and the engineers in Denmark.

The case companies were selected to give a detailed picture of these aspects. Therefore, some case companies were used to shed more light over the first issue while others could be used to get more details regarding the second, third or fourth issue.

This section starts with an overview that presents the common features from these four areas for all the case companies. Hereafter the findings from each of the case companies are described in detail. The section ends with a summary of the findings from the descriptive study 1.

4.2.1 Overview

The globalisation process for the seven case companies is shown in Figure 22 in comparison with the stage gate product development process model[1] (dotted line indicates outsourcing while a full line indicates offshoring and the time line indicates that the globalisation process started backwards in the product development process).

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[1] While not all case companies followed this product development process model it provides a good overview of the aspects of the product development process which the companies had offshored or outsourced.
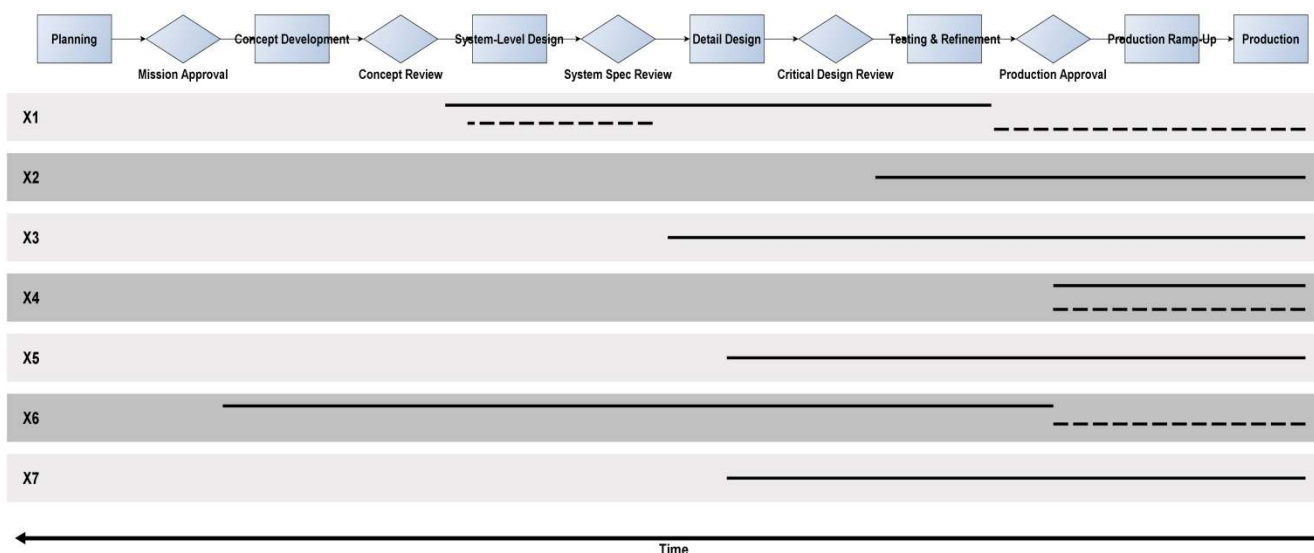
Figure 22: The globalisation process in the case companies (outsourcing marked by dotted line, offshoring with a full line)

As can be seen the companies globalised backwards in the product development process (the time line on Figure 22), starting with production and then moving inwards. The exception was outsourcing for competences which happened independently of this (e.g. outsourcing for competences in X1). The case companies which were furthest with globalisation were X1 and X6, while X2 and X3 were more cautious in their globalisation approach. X4 was an interesting case because even though the company kept design features in Denmark they purposely had a multi-cultural team to make use of cross-cultural knowledge synergies.

The case companies had several trends and characteristics which were similar in regard to the globalisation process. The companies saw the globalisation of the product development process on a project basis; the whole globalisation process from manufacturing to R&D was not debated which meant there was no overall goal or evaluation of this development. It was a result of an emergent process on the managerial level as slowly large offshoring/outsourcing projects had resulted in other activities moving out as well.

When the case companies started to globalise activities from the product development process it was in the form of large offshoring/outsourcing projects. The decision to move out had been taken on the executive level. The preparation process was often brief and focused on desired outcomes from the endeavour. Implementation was on the managerial level as was the daily management. In these two phases challenges occurred which the managers attempted to address. There was no detailed evaluation phase of these large projects but the daily management often included detailed reports, status updates and weekly meetings in relation to the offshored or outsourced task. The globalisation process for large offshoring/outsourcing projects therefore had 4 steps as shown in Figure 23. During the last two phases more activities were often moved out to make the phase easier to manage.

Decision making	•Executive desicion for large offshoring/outsourcing projects •Focused on short term gains
Preparation	•Executive level •Brief •Focused on desired outcomes
Implementation	•Managerial level •Challenges •Solutions to these
Daily management	•Managerial level •Challenges •Solutions to these
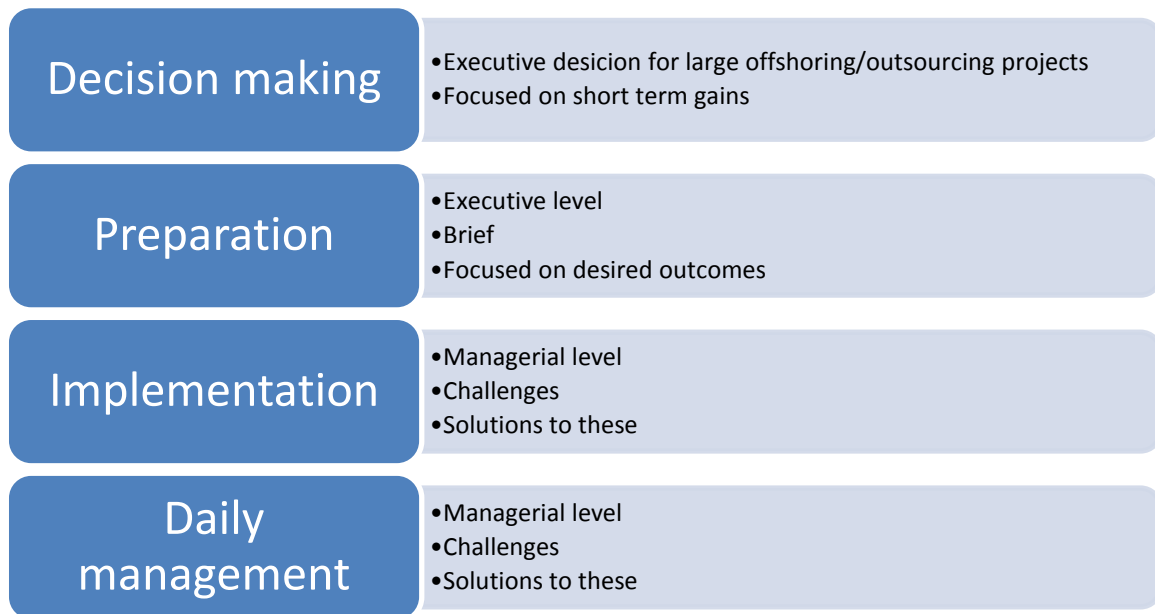
Figure 23: A four step globalisation process for large offshoring/outsourcing projects

For all the case companies challenges were found in interfaces and was mainly due to coordination, communication and knowledge sharing. The solutions the managers implemented were related to three key areas:

➢ Focus on employees.
➢ Focus on work processes.
➢ Focus on knowledge and communication.

The impacts of these solutions were in two areas:

1. Organisational aspects.

2. The engineering project (including engineering practice and product features).

Each of the case companies will be detailed in the following regarding the globalisation process, challenges, solutions and impacts of these.

4.2.2 Case company X1
Globalisation process
The decision to move manufacturing to China had been taken at the executive level. Thereafter the process was more adhoc with product design and R&D following. "*There was no documentation, or a formal procedure for moving anything after the initial decision. It was trial and error. Very person related. But the initial decision to go to China was based on the strategy developed by the business unit manager,*" a General Manager explained.

The evolvement of the globalisation process to include more high value adding activities was a consequence of moving manufacturing due to its interconnectivity with other areas which X1had been unaware of. "*The fundamental decision was to move production [...] to China. That was the key decision. The main reason for choosing China was cost. The hourly cost is significantly cheaper in China than in DK. It has been a learning process to utilise the Chinese employees as we did with Danish employees. [...] [Production and tooling] happened first, and then the next step was to gradually move some R&D resources to China as well. We started out having mainly a production*

site in China and then to support that production site we established an R&D function in China. So without production in China we would not have gone so far as to have engineers from R&D in China," a director explained.

The main motivation for moving production as well as engineering work was cost savings. However, secondary motivators were to gain access to the Chinese market which is a growing market for X1, to gain local market knowledge, and because many of X1's western customers had moved to China.

All manufacturing is outsourced to mainly Chinese suppliers in a clustered electronics area to avoid delays caused by bureaucracy and transport difficulties between Chinese regions. The company chases the 'lowest price' which not everyone in the company agrees with as they felt it would impact negatively on quality, *"We are an opportunistic company. It's really creating a lot of problems for us, but we do change too often, at least... that's what everybody thinks, except for the guys making the decisions. It's for cost hunting; we hunt the lowest, cheapest part cost and that's always new suppliers because they would like to get a new customer, so they offer it cheap and we take the bait,"* a General Manager explained.

X1 is increasingly outsourcing engineering functions and tasks to Chinese suppliers they previously offshored to their own office. The motivation is lower cost, increased scalability and flexibility, and because tight control and pressure is possible on outsourcing vendors to a higher degree than on the company's own offices. An interviewed VP explained how the outsourcing process was unstructured but since X1had started to outsource the offshored development in China this had lowered their fixed costs. However, quality was a concern, *"The good thing is that you have no fixed costs. This is the next optimisation step that you are not using your own people, I am not sure that the results are so positive but we are trying now. I am not sure they can live up to western standards. It would require a lot of quality insurance and quality control. In engineering – what they consider quality we do not. So it is easier to control that in your own facility to ensure a culture of quality is developed. When we consider what we should outsource next there are no certain procedure. It is not structured; it is driven by need of resources and market. We start on a small scale and if it works we scale it up. That is the approach that is working [for us]."*

X1 also outsourced embedded IT to get technical competences not found in-house to a specialist company in India. X1wishes to keep a long term relationship with this vendor as they feel they can gain more knowledge from the vendor in this way and because they feel the Indian culture encourages long term engagements. A reason why the lowest cost strategy was not followed with this vendor was because the competences the vendor had were perceived to be more valuable since they had never been held in-house unlike the manufacturing and product design tasks which were being outsourced to Chinese suppliers. Furthermore, a long term relationship enabled X1 to develop the IT area of their products in collaboration with the supplier, and thus gain advantage of the vendor's core competences by giving them insight into the needs of X1and their customers.

X1 plans to keep growing the offshore facility and not hire new engineers to the Danish office due to the labour cost advantage in China. While X1continue to outsource what they have offshored in China, including engineering functions, they plan to keep some offshoring to ensure close control

with their Chinese outsourcing vendors. X1 plans to improve on the process to gain full advantages of offshoring and outsourcing, but at this time do not plan to move anything more out.

X1's positive experiences with moving abroad were mainly related to outsourcing where the product portfolio and the product's functionality were increased. A positive though unexpected outcome of offshoring design to China had been that unnecessary product complexity was reduced. A manager from X1 stated, "*[A positive thing about how] very different the culture is, is that the whole culture is 'get around'. So when you see a problem and you cannot solve it, you just get around it. [...]. That is in many cases very positive, they just find some way and solve it. [...]. It is the same for design of course. They [the Chinese colleagues] can make much more simple setups.*" For both offshoring and outsourcing the low labour cost was an expected positive outcome.

Challenges

X1 experienced some challenges with offshoring to China and outsourcing to Chinese suppliers. These were difficulties with quality, rework and delays in the design and development of some of their products by their engineers in China. A manager illustrated this when he explained how the communication to their Chinese office was, "*We have nothing else but [cultural issues with communication]. The thing about, that you need to only outsource/offshore well defined assignments. Erm... it is a really big thing, it is key that everybody understands this. We also have training in Chinese culture, once in awhile.*"

The motivation for offshoring had mainly been cost savings by having a large engineering staff in China where salaries were much lower than in Denmark. However, these difficulties had meant an increase in time and cost of offshoring engineering tasks.

Solutions and impacts

The daily managers and general managers in the headquarters who had the daily responsibility for the development projects had implemented several changes to the product, the product development process and the management process which had later spread through the organisation to counteract the negative impact of offshoring outsourcing to Chinese suppliers in an effort to keep errors, rework, and resource overrun to a minimum.

Product changes included changes to design and composition. In China, this meant a less complex design which was easier to communicate. A manager explained, "*I would say that [...] we are a little withholding, we are reluctant to implement very complex methods [for products developed in China]. That's a consequence of dealing with the Chinese suppliers and offshoring, yes. There are some specific mechanical methods that we do not implement because we know this is going to be produced in China and it is going to be handled in China and it will not work. So we are reluctant to use some advanced technologies.*" Changes were also done to increase decomposition/modularity. In China, this meant a given task was easier to communicate to both suppliers and their own offshore engineers. In India, using the outsourcing vendor had meant more complex products could be developed due to additional skills.

A top manager gave the following example of how outsourcing had led to sub-assembly of products and a need for improved sales forecasts, "*I think we still struggling with getting our own act together – in terms of providing forecasts to our contract manufacturers so that they at least get a chance to react. Even though we say it is set up to our supplier to be flexible to our needs, then of course there are limits to what they can do and we have to give them some reasonable conditions to work with*

and that has hit back to our organisation and sales areas, that they have to give good estimates because otherwise we cannot get the products manufactured – there is a reaction time. That has also fed back to R&D thinking of products as sub-assemblies that can be put on stock and assembled according to for example final customer needs. We can make final assembly when the order comes in the door. Our manufacturers can do that – so you decide in the last minute what configuration you want to sell, and then put it together as you have the sub assembly on stock. So that is how it has affected R&D that products have to exist at sub assembly levels."

Changes were also made to the product development process through increased documentation, developing clear standards, giving better sales forecasts to suppliers, and creating a more controlled (less flexible) process. However, the increased number of product interfaces X1 now employed could make the process more complex as interfaces were where X1 often experienced challenges. A top manager explained the actions the company had taken to improve offshoring and outsourcing to China, "*It requires a certain adjustment on our side to make specifications. The impact here is that we had to get some more structure and that is not bad.*" He explained how implicit knowledge had now become explicit as a part of this process, "*You have to make requirements and specifications. We had 10 unspoken requirements that we never discovered and never talked about. [Now, we have to manage that process].*"

Documentation and standards also became more important. A top manager went on to explain, "*We changed our product development procedure and people are more aware that they have to be more precise. The new products are much more complex, because we can make use of the competencies in India. In China their competence level is not high enough to take the complex parts of the development but in India they have helped us to make more complex parts.*"

Using more outsourcing and thus involving more external partners also meant the development process had become more formal, "*We have a product development process as all manufacturing companies have, where we go through different phases – and at the point in time when we had our own manufacturing site the phases that were connected to the initial bills - the pre-production phases - they of course involved only internal people. Now with the contract suppliers, the counterparts in production compared to R&D has to work together to bring this product to production are external to our company. We still try to follow the same procedures – but the real work is quite different. The relationship becomes more formal – more driven by deadlines and agendas – if production cannot start up when planned then it costs the manufacturer money because he has an idle production line standing, so it also calls for more strict manufacturing procedures. The entire product development project becomes less flexible because so many people internally and externally become dependent on that we following a certain schedule. So it is fair to say that it has become more formal. On the other hand you try harder to get things finished on time and that is not such a bad thing.*"

The globalisation process also meant changes in the organisation, including bridging the distance between production and design and R&D by moving more activities out than was originally intended, outsourcing of manufacturing and increasingly also design in China, and increased quality controls of all work done by suppliers and subsidiaries. To facilitate learning and knowledge sharing, all Danish employees involved with China were offered Chinese culture courses, and

Chinese engineers came to the Danish headquarters for one to three months. The general manager gave this example on communication and knowledge sharing between Denmark and China, "*Our collaboration with R&D in China happens on knowledge sharing, for example sharing guidelines, sharing processes. And also we hand over as soon as we have the business case. We make the product concept development and as soon as that is done we hand it over to China. And in that handover there is also a lot of communication. We do not work on projects together. To transfer a big project the Chinese managers sometimes come here for a few months.*"

Also, the company used expatriates at the start, although this is now no longer done due to the high cost.

Despite these initiatives and changes challenges remained.

Findings summary

Market pressures made X1 offshore manufacturing to China in order to save costs and enter a new market. Through an ad hoc "learning by doing" process, engineering work was sent to China as well. Hereafter X1 started to outsource manufacturing and engineering tasks, which had been offshored to China, to Chinese suppliers. There is a difference between the perceived value of the skills employed by an outsourcing partner in India who possesses skills never held in-house and those which has previously been held in-house. In this manner a lowest cost strategy was pursued with manufacturing and engineering suppliers in China, while a long-term strategic partnership was created with the supplier in India which possessed skills related to IT embeddedness which X1had not possessed.
By moving more tasks and functions abroad X1ensured the connection between manufacturing and engineering design was simplified when the physical and cultural distance lessened again. Main challenges in relation to engineering were differences in engineering practice across physical and cultural boundaries and managing product interfaces. This meant the engineering practice within X1 became diversified. This caused miscommunication and misunderstandings as the engineers had different frames of reference. Communicating virtually made these challenges more significant. This caused delays and low quality.

Main changes in regard to management was the physical distance which meant management and leadership had to happen across time-zones and cultures in a virtual environment. This meant changes to how the work could be approached and conducted. As the engineering challenges happened in the boundaries (e.g. when a task was handed from one functional department to another, from one team to another) managers tried to limit these boundaries. This happened by moving more functions to the same area and team (e.g. move product design and development to China together with the manufacturing for a given product).

Expatriation of Danes to China and Chinese engineers to Denmark had been used to try and improve the understanding between engineering practices in an effort to ease communication. The management process were also changed by limiting interaction and making it more routinized and codified in an effort to make global product development projects easier to manage. Furthermore, products produced in China were designed in a less complex fashion than previously. However, a

spiral development process meant a large deal of interaction was needed which made it difficult to successfully avoid a lot of interaction which could cause complications.

Despite these solutions the challenges remained.

4.2.3 Case company X2

Globalisation process

X2 offshored parts of production, production ramp-up, testing and refinement as well as redesign of old products and product development for local market products to a new facility located near an existing plant in Poland. Besides expected lower costs by going to an already developed site, X2 followed the Global Footprint Strategy of Manufacturing which the company employs in order to select further sites for manufacturing (see Chapter 2). In total, more than 300 blue collar and around 20 white collar engineering jobs are lost in Denmark and are now being moved to the new site in Poland. At the moment the company has a Danish manager in charge of the subsidiary, but the plan is to hire a local manager after the transaction is over. The company employs a limited number of Danish expatriates as experts or plant/project leaders to facilitate knowledge sharing and quality.

The decision to offshore was taken by top management but with involvement from the local community and union leaders. The reason was that the movement of so many jobs would affect the local community as X2 is one of the major employers in the area. The offshoring process was seen as an emergent process where first production and slowly more high value adding activities were moved. Over time more products will be moved to be produced there. The motivation to move abroad had in this case been cost savings on labour. Secondary motivators were market knowledge and access as Eastern Europe is an emergent market.

The decision phase had been brief and had mostly been based on expected cost savings. During the implementation phase the managers who were responsible for implementation had to specify how these expected cost savings would be reached.

The move to Poland was at the time of data gathering not yet completed but X2 felt that positive experiences so far with the Polish workforce was their speed, hard work, and the lower cost. Furthermore, the quality level was not as low as feared.

Challenges

X2 had a stage gate product development process which made it easier to ensure process and product modularity. However, they still experienced complications.

Challenges with offshoring were related to cultural differences, communication, quality, and knowledge sharing. This resulted in delays and increased rework. A vice president from the company explained that it was hard to use the same methods abroad as in Denmark as these methods were not known there; "*[...] There is a lot of infancy [...]. So this is a very long and troublesome process of actually explaining what you need. It is a negative experience; it takes more time that you really think. [...]Trivial things that need to be in place to have good quality, they slip.*"

Solutions and impacts

X2 implemented several actions to counteract the negative impact of offshoring. Process changes did not affect the product so X2 made no product changes. The products sent to Poland for manufacturing were mature and changes were smaller design changes.

The product development process was codified more, and work processes which had not previously been documented were now documented in detail to make knowledge transfer easier. All documentation was more closely monitored to ensure it was kept up to date. This had the benefit that current work-arounds could be uncovered. Starting from 'a blank page' also enabled new and better ways of doing things which could be implemented at the other sites. One of the vice presidents of X2 gave the following example, "*....the engineers had a tolerance that no one could meet and we had our silent workarounds that worked, and all this "dirt" now comes to the surface. So there will be some changes to engineering.*" X2 felt they had become locked in routines, and offshoring provided an opportunity to break out and redesign the production and development processes more efficiently.

To lessen the chance of complications in production, complexity was lowered by using less machinery. This also utilised the cheaper workforce available.

The Polish factory workers were less well trained and did not have the know-how of their Danish counterparts. To counteract this, Polish production workers come to visit the Danish factory for a few weeks, being trained by the production workers they are replacing. Furthermore, X2 expatriated a Danish manager to lead the new plant and most project managers were also Danes. This was believed to make it easier to transfer knowledge and make communication easier. Due to the high cost of expatriates this was considered a temporary solution until the local managers could take over.

The main challenge for the engineers at X2 was the amount of know-how which went into their production. The following vignette illustrates this:
Peter, a production worker who has worked on the Danish plant for over 20 years, knows that when machine A stops it can often be solved by pulling a series of different handles. Everyone knows Peter solves this issue quickly so no one reports it. When Machine A is moved to Poland it stops and no one can figure out how to quickly get it started again.

The cost of moving manufacturing rose as this know-how had to be moved somehow. The problem was that not all of it could be made explicit and the 'shadowing' method with some of the Polish workers was an attempt to address this.

The second challenge was the reliance several product design functions had on the connection to manufacturing. The engineers used the access they had to production to talk with the production engineers to understand current production challenges and how these could be addressed in the design. As a consequence some design functions were also moved to lessen the distance between these functions and lower interaction and communication necessary between Denmark and Poland. Another challenge was how to move knowledge between the plants and how to keep connectivity between functions which would be physically separated. At the time of the study the move was not yet completed but resources – both time and money – had gone over budget. The approach taken to address these challenges was to attempt to codify knowledge and document all work processes; which had been the main causes for the budget overruns as this had not been done before and had not been included in the project plan. However, while the challenges had been lessened they still remained.

Findings summary
It had been decided to move production for some of the mature products as well as local products to Poland as the company already had some manufacturing facilities there. Key challenges had been the amount of know-how which went into production, and connectivity between manufacturing and other functions. Managers were faced with the challenge of moving this knowledge between plants. At the time of the investigation 'shadowing' to transfer knowledge as well as codification and documentation of work processes and knowledge were key tools to address these challenges, as was the additional move of some low level product design functions to locations in Poland and the use of expatriates to ease communication and knowledge transfer. However, so far the offshoring project had run over budget and the challenges – while lessened - remained.

4.2.4 Case company X3
Globalisation process
X3 Solar energy was an independent small company which outsourced all of production, production ramp-up, and low level design to a Chinese supplier. Recently, the company was acquired by a large multinational cooperation; X3. Due to unexpected issues with the supplier, X3 Solar energy decided to end the relationship. The plan for the future is to instead offshore production, production ramp-up, and low level design to facilities X3 own in or near Denmark. In the future X3 Solar energy plan to offshore backwards in the product development process, and slowly start to offshore more high value adding functions, and to offshore these for more products. The main motivation to outsource had been lower production costs abroad and the flexibility not investing in their own production equipment would bring. The decision to outsource had been a top management decision and several interviewees expressed a desire to bring functions not only back in-house but also back to Denmark.

X3 Electronics moved production from Slovakia to China to get cost advantages. The plant owner explained chasing the lowest manufacturing price was a key motivator, "*It is the same process that will go over, over and over again. That means this factory is right now built partly to serve the Chinese market, and partly for export. And this will change in the future because even though the salaries will not increase that much the salary rate will increase. It will [take longer], [we] will stay a longer time [here], compared to Slovakia, for example. But still, it will become more expensive, and you will find other countries where it is cheaper.*"

However, product development and R&D is also being moved to the Chinese location. The company employed a Danish plant manager and Danish expatriates as project managers to ensure knowledge transfer and to make communication easier. The motivation to move engineering and R&D was cheaper resources which meant more ideas could be pursued. The Danish plant manager explained it like this, "*We are focusing a lot on R&D. You can afford to have a lot more people here [than in Denmark]. And that means if you are in Denmark and are sitting in the R&D department and you have 20 ideas coming out, you will pursue maybe one or two. And you are quite sure from the beginning that they will be okay. They will be good, but there will be more or less not that high risk because it is quite expensive to have these kinds of projects, if they fail. So, you will not take the ideas that had high risk, but also high potential. Whereas here, you can basically start out by maybe choosing the top 10. Some of them will fail, yes, but you also gain a lot of knowledge, and maybe some of this knowledge you gain from the failures, you can use that in some other products. […] Having this cheap labour on R&D means you can actually expand, and you can have even more R&D.*"

They had positive experiences with the Chinese engineering staff which they found well educated and hard working.

Challenges
X3 Solar energy had a spiral product development process which meant close communication and interaction between different phases in the product development process. The product sent abroad was young and still under development which further increased the level of interaction and communication. The department had had very few positive experiences with outsourcing. They had experienced challenges relating to miscommunication, misunderstandings and cultural issues which caused delays, increased rework and quality issues with their Chinese supplier. A manager explained, "*Production has become more complex. We did not consider the long shipping time which added to the cost of producing in China. We had no positive experiences with outsourcing to China. The physical distance meant transport and communication took more time. There was a big cultural difference. We did get a report [about the status of our production in China from the supplier] but it did not help; there were no concrete conclusions. They did not get much documentation from us as it was in Danish so we also had big quality problems; they didn't have any knowledge of the processes we used. When we sent a Danish engineer down there to 'hold their hand' things worked ok but when he went back home everything fell apart again.*" [2] In this case motivation to outsource was cost savings but these challenges had increased the overall product development costs.

X3 Electronics had challenges with cultural differences and misunderstandings. Furthermore, some Danish engineers in the headquarters were reluctant to let go of tasks to the subsidiary which had made it difficult for the subsidiary to work on global projects.

Implemented solutions and impacts
X3 Solar energy implemented several actions to counteract the challenges of outsourcing. Product development process changes included gathering product changes in bundles before they were sent to the outsourcing supplier to lessen interaction. Clear and written communication was used whenever possible as English on both sides were difficult, and misunderstandings often happened in verbal interaction. X3 Solar energy also started to document all work processes carefully and started to write all documentation in English and ensure this was up to date so they could refer to this when the vendor had questions.

As the product was young and still being improved upon, no product changes were made in response to the challenges of outsourcing.

X3 Solar energy found it difficult to manage the vendor relationship over a great distance. They required small batches and felt they were not always a priority for their supplier. They therefore sent a top manager who was also an engineer regularly to China to check up on the supplier's progress and status and to ensure they understood the assignment correctly.
The final result was as mentioned that X3 Solar energy stopped using the supplier and manufacturing was moved to offshore facilities in Europe and Denmark.

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[2] Translated from Danish by the author

X3 Electronics made changes to the product to fit the local market and its requirements but did not otherwise adjust it.

Product development process changes for X3 Electronics included that all documents, e-mails, activity plans etc. should be in English so the offshore engineers who did not speak Danish understood all communication. Clear and written communication was used whenever possible to avoid language complications. As for X3 Solar energy, the decision to offshore manufacturing and product design had meant all documentation was now kept up to date and available in English. In the daily work virtual aids were now used extensively. However, at the start of projects and during important milestones physical meetings were arranged with the global team to better facilitate knowledge sharing and communication.

However, complications still remained with communication, coordination and cultural differences.

Findings summary

X3 Solar energy had outsourced manufacturing and low level design to a Chinese supplier. However, due to complications with communication, quality, clock-speed and knowledge transfer, the relationship was terminated. This was influenced by the iterative product development process and the fact that it was a new product the department was developing. This meant many continuous product changes with an increased reliance on communication and knowledge sharing between the engineers. It also meant that it was more difficult to have design and manufacturing physically separated, as many of these product changes came after engineers within R&D and product design had seen how the prototype was functioning or being produced, which the Danish engineers felt would be quicker and easier with a plant nearby.

X3 Electronic Controls had mainly experienced managerial challenges caused by the changes the company was going through in order to globalise, including knowledge transfer, English as communication language and division of power through global distribution of high value development tasks. Some engineers back in the Danish headquarters felt that the Chinese engineers were not good enough, and that the subsidiary down there was not ready to take on more of the high value adding work for global products. However, the unique market insight had meant the development for local products had been given to the subsidiary, under the management of Danish expatriates, and slowly more global products were starting to be designed and produced there. Furthermore, using expatriates extensively at the Chinese plant meant control and communication from the headquarters to the plant was easier, as these problems were pushed further down to the expatiated experts and high level managers at the Chinese plant (see descriptive study 2 for more on the role of expatriates).

Managing product development across cultural and physical boundaries was a challenge to many of the engineers in X3 who had been used to a centralised management in the Danish headquarters where all R&D and product design was done. Furthermore, changing communication language from Danish to English in companywide mails and communications had also been a challenge as had changing product descriptions to English.

However, while changes within management and engineering had addressed some of the challenges the company faced, they had not been fully resolved.

4.2.5 Case company X4
Globalisation process
X4 has manufacturing sites around the world to get competences (e.g. a tool shop in Germany) or reach markets (e.g. Korea). By the start of the millennium X4 had branched out into many different fields from toys to theme parks and had suffered heavy losses. In 2006, as a part of X4's restructuring plans to refocus on its core competences, the company accounted that up to 1200 people in production would be losing their jobs over the next three years because X4 would outsource "*the greater part of the company's production*" (Forbes, 2006) to an electronics manufacturing company based in Singapore. X4 said it was the "*last major step in our process of restructuring of the group's supply chain.*" (Forbes, 2006). The vendor had been selected due to its technical skills and secondarily on location and price.
X4 therefore outsourced all of production, parts of production ramp-up and testing, and refinement for new products and product changes for the European market to Eastern Europe. The main motivation was cost savings on labour and the opportunity to gain a flexible resource. Market considerations were secondary, as the vendor was placed strategically in the middle of Europe with access to all of Europe which is a key market for X4.

X4's positive experiences with outsourcing had been the expected cost savings, speed and flexibility they had desired. Furthermore, they found that it was motivating for their employees back in Denmark to know that they had competition. However, while the theoretical calculations showed X4 could save money it turned out not to be the case. They found that most of their processes could not be made explicit as they were embedded in routines and the organisational culture. They therefore had difficulty transferring knowledge to the vendor. Furthermore, they discovered that this embeddedness meant that the whole product development process, also the moulding process within production, was a key competence.

The executive board, who had also taken the decision to outsource, then decided to buy back the facilities and offshore instead and started to develop their organisational culture there. They transferred their processes through employee exchange programs, training programs, and site visits. X4 has some Danish engineers stationed abroad in Hong Kong, Mexico, Hungary and the Czech Republic to "*spread the knowledge about how we do things and to ensure the right quality,*" as a vice president of the company put it. After this change from outsourcing to offshoring no layoffs were found necessary.

In the future X4 wishes to produce more products at their Eastern European site and follow the Global Footprint Strategy of Manufacturing which the company employs to select further sites for manufacturing.

Challenges
X4 had a generic product development process with stage gates after each function which meant less communication back and forth between design and production engineers. Clock-speed on product changes was lower than in most other markets wherein consumers are the end customer. This made it easier for X4 to have higher level activities mainly focused on Denmark with production and low level design globally distributed and X4 therefore had less changes related to the interconnectivity between manufacturing and higher level functions than seen in other case companies.

Communication between the Danish headquarters and the outsourcing vendor suffered from misunderstandings and miscommunication, resulting in delays and quality issues. In this case it was mainly the organisational culture which was different. The vendor had skills and quality levels which should have ensured a satisfactory production. However, quality was low and not up the standards X4 had. The main reason was the difference in organisational culture where in X4 how the production process was carried out was a part of the organisational culture and therefore tacit knowledge which they could not transfer to the vendor. The result was that X4 took the facilities back as an offshore site.

Implemented solutions and impacts
X4 implemented several actions to counteract the negative impact of outsourcing. No product changes were implemented as the products had few interfaces and were in that regard simple to develop.

Product development process changes included using the same manufacturing equipment worldwide, use more manpower and less machinery, prepare each product as a 'mainpack' to be sure all the pieces are there, use clear and written communication whenever possible to avoid language complications, and ensure all documentation is up to date and available in English.
A vice president of the company gave an example of the need for documentation, "*You learn to document much more than in an internal environment, and you learn how much is in the heads of people; not written down. And that there are ways of doing things different than we are doing.*" He went on to elaborate on the importance of explicit knowledge and documentation, "*We need to start writing everything down. When we started to train the outsourcing partner we saw that we did not have enough paper to show them regarding how to do it. So we needed to first do the internal before we could go external.*"

He also explained how using more manpower and less technology in manufacturing had made the production simpler which could be included in the product design, "*I would say that it has become less complex, but now I talk about the different products and some of the special products we have made in China – in the past you had to make a product that run on a full automatic line to not use so much labour. But today we can use labour in Hungary or China and there we can do a lot of manual handling and we are designing for that.*"

Organisational changes included using manual labour as much as possible to take advantage of the lower labour costs and make as much of the knowledge transfer to the outsourcing vendor explicit. However, as the core knowledge was tacit and a part of the organisational culture it was hard to document. X4 concluded it was a part of their core competences which they did not wish to outsource. They therefore bought the facilities from the outsourcing vendor and instead offshored, developing their own organisational culture at the sites.

This focus on offshoring meant that the cost of product development is going down and X4's competitiveness is increasing.

Findings summary
A multi-cultural R&D and design team located in the headquarters as well as engineers stationed around the world ('listening posts') ensures a current and innovative product development process.

X4 has manufacturing in several locations. During an attempt to outsource manufacturing to a supplier in Hungary it was discovered that while the products themselves have few interfaces the later parts of the product development process is highly complex and tacit. This meant X4 discovered many of these processes in the last stages of the product development process were a part of their core competences and could not easily be moved. Challenges had been delays and quality issues due to misunderstandings, miscommunication and difference in organisational culture. The company had responded with increased documentation, making more knowledge explicit - if possible - and using more machinery in production. However, challenges remained and the plant was thereafter turned into an offshore facility. Today, products to be manufactured outside Denmark are designed with the greater use of manpower in production in mind.

While these changes has improved the situation for X4, the challenges remains if such a situation can arise again and how it can be avoided as it was a very costly mistake to make.

4.1.6 Case company X5
Globalisation process

X5 has global offices to reach different markets where some of these are a result of M&As. The main motivation for offshoring to China was cost savings on local and global projects.

The company went through the following four phases when offshoring which will be detailed in the following:

1. Tasks choice.
2. Location choice.
3. Organisation and first trial project.
4. Establishing Supportive roles.

1. Tasks choice.

What tasks could be moved out was first investigated. This included:

- o Creating a Task List.
- o Comparing each task with the Suitability for Offshoring Model.
  - ▪ Parameters inspired from literature (Carmel *et al.,* 2009):
    - Client interaction.
    - Tasks complexity e.g. describability, standardization.
  - ▪ X5's own parameters:
    - Transformational potential e.g. development potential.
    - Size of tasks offshored.
    - Risks: Operational and strategic.
    - Compiled Suitability.

The company is now developing a "Standard Catalogue of Services" for offshoring which is a list of all services with initially determined tasks suited for offshoring. However, it is a relatively broad tool which is only now being developed.

2. Location choice.

X5 used a "Scenario Filter" Approach to find the best offshore location. The company had decided on three potential locations: X5 offices in India and China or an external provider in India. The

following parameters were used to choose between them (1) language skills, (2) experience of labour, (3) country costs, (4) employee turnover and (5) training required. Additional parameters included that a well-established organisation already existed in China as well as already established communication. In the end the internal office in China was selected even though the Indian office X5 had scored highest on the five parameters. This was due to market access.

3. Organisation and first trial project.

Hereafter the company started a series of trail projects from selected engineering departments (see company presentation for details on these).

4. Supportive roles.

X5 is now creating a series of support roles to support the offshoring process. A **line manager** position was created. The line manager looks into the initial choice of tasks (using and creating the Standard Catalogue of Services). A **coordinator** position was also created. The coordinator helps in identifying people and additional tasks suitable for offshoring to China. The coordinator also helps with the specification of work packages. It is a new position created for a person with experience of working in China. The **facilitator** is another new position created to support the offshoring process. The facilitator performs supervision of the offshored activities and ensures communication between the HQ and China. The facilitator is located in China but flies to the Danish HQ often. Supportive roles were also carried out by Danish engineers in the headquarters and Chinese engineers in the offshored location. The Danish engineers in the HQ are meant to specify the work packages and conduct external review of the work received back. The Chinese engineers in the offshore location perform the offshored tasks and conduct an internal review.

Another support feature for offshoring is IT tools. The company has recently created a series of tools meant to assist in offshoring of tasks.

- **OurBook**

This tool is currently in use. It is a knowledge sharing platform and is created to better exchange information with the Chinese office. *"In OurBook we are able to ask each other questions, something like more special problems, that we can ask each other – do you know how to do this, what do you do in China, what do you do in Denmark, USA or wherever,"* Top Manager 1 explained.

- **OurModel**

OurModel is being developed. It is to be a common platform for engineering approach but is firstly a management tool. It ccontains project tasks, deliverables and interdependences and interconnects disciplines and offices. *"It was developed to have a common platform to all offices, but when we are doing offshoring it is simply necessary to have a tool like that. Otherwise you have to define it every time,"* Middle Manager 2 explained.

- **OurWiki**

This tool is also being developed. It is meant to store and share standard documentation and templates.

Challenges

Offshoring enabled X5 to offer cheaper global projects. However, X5 experienced problems with knowledge transfer, communication and quality. The Chinese engineers did not always know the same methods or had the same concepts concerning quality as the Danish expatriates. Communication was complicated due to culture and at times also by poor English skills. Culture in communication and work processes was something X5 had become aware of, "*It's very important to make sure that you feel that they actually understand what you have given them [the Chinese engineers]. It is very easy to get confused and misinterpret information when you send it from Denmark all the way to China,*" an engineer in Denmark explained.

After it was decided to offshore some activities from Denmark to China, little was done to routinise the process and no new working procedures, approach or structure, which would contain tools to use offshoring, were given to line managers.

Main challenges involved the organisational processes and routines currently employed in the headquarters and the organisation as a whole. These include:

1. Lack of motivation/reasoning for managers to use offshoring activities.
2. A contradiction with other important targets set for the line managers.
3. The absence of new work structures.
4. A high turnover (utilisation) of Danish employees.
5. Changing types of tasks.

Detailed description of the challenges is presented below.

1. Lack of manager's motivation

As was mentioned before, offshore activities are a very young initiative in the company. When offshoring was introduced to the line managers as a possible tool in their work most of them were sceptical about it and many feared that most of the tasks from their department will be offshored, as stated by one of the top managers, "*They [line managers] were first afraid that we are gonna offshore it all.*"

This drew a picture of possible lay-offs and created tensions between line managers and top management. In order to resolve this problem a Suitability Model for Offshoring was created. It demonstrated to the line managers which tasks are possible to offshore and which are not as well as providing reasonable explanations for decisions. This partly reduced the resistance to offshore tasks. An interviewee explained, "*[...] from a governmental point of view we have failed completely until now to give our line mangers reasons for offshoring. Every time they offshore they put at risk that they will not be able to meet their own targets for turnover.*"

However, offshoring activities gained a higher priority in the company's agenda for the year 2010 as it is currently seen as one of its success criteria. Due to this, line managers will be much stricter measured on how actively they are using offshoring. In addition to that an introduction of a Performance Execution Unit puts additional strain on line managers, as they would need to use offshoring activities to be able to deliver the project within the given financial limitations.

But these new incentives create a radical change in the way line managers used to work for many years and as noticed by some interviewees would demand a big change management project to make it work properly.

Introduction of a strict measurement system and lowering the level of financial resources for project accomplishment would demand line managers use offshoring more and more. However, some of the interviewees suggested a softer approach as illustrated in the following, *"The best way to do it I think would be to say that line mangers would be rewarded if they used 20% Chinese hours for any project"*. Some interviewees felt such a soft approach could help the adaption of using offshoring activities as a usual practise instead of just using it when forced to.

2. Contradiction of targets

Another issue hindering the development of the offshoring process was that the use of offshore activities caused a contradiction with another important target set for the line managers - to provide a high turnover of Danish employees, meaning that employees should be utilised to the fullest, as illustrated in the following quote, *"A line manager has got an annual goal regarding turnover, e.g. if he 'buys' [offshores] 1000 of hours to China instead, then he will have a lower turnover in Denmark and he will not make any money on the hours from China"*. This causes confusion in target prioritisation. Moreover, when comparing the two goals, top manager 2 mentioned: *"a goal saying that you should have this turnover this year is a much higher priority for the line managers [than the offshoring goal]."* This negatively influences the line manager's performance regarding offshoring, as s/he is evaluated based on turnover target which therefore takes precedence. That is why just setting a numerical goal for managers (e.g. have to offshore 10% or 100 000DKK of your work) or introducing strict measurements on the use of offshoring activities does not improve the situation. Another challenge was the contradiction between knowledge sharing and the target for client billing hours as shown in the following quote, *"We have a [knowledge sharing] academy in house [...], but we have a lot of focus on the hours we invoice. If they sit in the academy for 2 hours, it is 2 hours they do not invoice to a client. [...] So there are [...] limits to sharing [knowledge]."*

3. The absence of new work structures

One challenge is the absence of concrete and well defined tasks to be offshored. As was mentioned earlier, today line managers use the Standard Catalogue of Services to initially decide what tasks should be offshored. However, this tool only gives a general and a very broad overview of offshore possibilities as described by an interviewee, *"It is a very broad definition right now and we try to break it up to some more useful packages so that every time we meet this type of work we know we can offshore it."* After that a definition and specifications of the chosen task should be done by Danish engineers and a lot of communication with the Chinese office should be performed to ensure that the task is correctly understood and is correctly executed by Chinese colleagues. Due to such procedures the process is very time and resource consuming what could be improved by further development and detailed elaboration of Standard Catalogue of Services.

Another challenge is to hire new local employees in China to perform the offshoring job, as now the company faced a lack of qualified Chinese employees. It takes time to find a well-educated and dedicated staff. In addition to that different cultures can pose additional difficulties to employees' search and hiring.

Another complication was to allocate time and Danish resources for proper preparation to offshoring activities, e.g. preliminary meetings, choose and standardise packages etc. In addition to this the company lack time and resources for the continuous communication with the Chinese office. This is due to a lot of activities are not standardised and a lot of procedures needs to be discussed, advised and supervised from Danish to offshored office.

Another challenge is to level out the quality of the performed tasks outside the HQ. Currently there is no specific procedure for how the internal quality review of an offshored task should be done. At the moment just a simple check by a Chinese colleague is performed. Due to this the task can be sent back to the Chinese office several times for additional quality revision as it does not correspond to the Danish quality standards as illustrated by an interviewee, *"Though we are the same company they do not necessarily use the same standards… it is our job to tell them: try to use CAD manual and go that page and so on. Then it is ok. But there is a lot of communication back and forth to get that work done in a proper way."*

4.   Changing types of tasks

The size of the tasks suitable for offshoring depends on the project type. Currently there is a tendency that huge greenfield projects in the European market that X5 used to do many of is decreasing and more minor projects are coming in as revamps become necessary. This demands the company to be able to offshore also smaller tasks as illustrating by an interviewee, *"We have to be better at offshoring individual tasks and then it does not work if it takes a lot of administration around sending one little task to China"*. At the same time tasks cannot be too small as then they are not well suited for offshoring. This is because small projects normally demand local knowledge and as a consequence more descriptions and communication is needed to offshore the task.

Implemented solutions and impacts

X5 implemented several actions to counteract the negative impact of offshoring. These included the support functions and IT tools mentioned earlier. Furthermore, the company employed expatriates to assist with communication. Top Manager 1 illustrated this, *"We have been in China for many years so we have a well-established organisation there, we have the structures implemented and we have quite a lot of expatriates who can facilitate the communication."*

Product development process changes including being able to separate the product development process into smaller pieces which could be moved abroad. Communication and knowledge transfer were key challenges. As a result a greater degree of documentation and process descriptions were carried out. Main challenges were also within management and were related to the organisational processes and structures.

Despite these changes, challenges within offshoring remained.

Summary of findings from X5

X5 has offices around the world and uses Danish expatriates as project leaders and expects on local projects when needed. Recently they started to offshore engineering tasks to their Chinese office as a way to lower costs.

Main engineering challenges were communication and knowledge transfer. These were lessened by the use of expatriates though still remained (for details on expatriation see the findings from the descriptive study 2). Organisational challenges were related to structures and processes. These included low motivation for managers to use offshoring due among other things to a contradiction

with other important targets set for the line managers. Furthermore, there was an absence of new work structures in relation to offshoring which included difficulty with allocating resources and difficulty with making well defined tasks.

X5 implemented new IT systems and new positions to lessen these challenges. They also tried to standardise offshoring and only offshore well-defined and well-described tasks. However, many of these challenges remained.

4.2.7 Case company X6

Globalisation process

Global growth has been organic to reach markets and as a result of M&As (for example the engineering locations in the USA). The strategic plan for the future is to offshore more to the Indian subsidiary. As a part of this plan the Danish headquarters does not create any new engineering positions. The motivation is lower labour costs for engineers, and greater market understanding of the Indian market which is an emergent market for X6.

The company plans to create a more integrated approach to sourcing as the current divided approach is a legacy from the past. In this manner 'low cost' sourcing is sought for components and more complex parts are to be sourced from a few strategic suppliers.

X6's positive experiences with offshoring included the expected cost savings on white collar labour in India which they find to be hard working and good at following procedures. The ability to create work-arounds which the Indian engineers had was also a useful skill even though it did not resolve problems then it ensured speed in the transaction.

Challenges

X6's challenges with offshoring were related to communication, quality, and knowledge sharing. This meant delays and increased rework. A top manager from X6 explained the communication difficulties, "*It is very difficult to start something very big and very new when you're talking to this guy and he's talking to this guy and so on. It's too fragmented. […] So, it is like being an interpreter who translates from one to the other.*" He elaborated on the issue, "*The guy who is fronting this [in our Indian office] is a bright guy [and he understands what I want when I explain it to him]. But [the lower level engineers in India might not understand]… We don't know how the [information flow is in the Indian subsidiary].*"

The information flow at X6 is mainly horizontal across organisational units; managers speak to managers and at times the top managers speak with the top managers but very little other interaction takes place. In other words, communication takes place horizontally across the different locations but vertical communication is isolated in each location. While the managers at the Indian site in theory could also facilitate contact they rarely did this unless something very urgent came up. Communication was mainly initiated by the Danish headquarters and was mainly related to division of new tasks or checking up on tasks as well as status reports for current projects; often done at least once a week at different levels of detail depending on how complex and valuable the offshored task is perceived to be by the headquarters. The communication and information initiatives, procedures and processes were created in and by the Danish headquarters.

While the contact manager in India would understand the rules and assignments given, it was unknown to the Danish headquarters how the further communication channels in the Indian subsidiary were. As a result the work they got back could contain mistakes that the manager in the

Danish headquarters had thought had already been resolved. Communication with the USA R&D office was also complicated though this was due to the USA departments having been previous competitors and they therefore did things differently.

At the moment internal communication to all procurement offices could be a challenge because of the legacy of a divided company. *"The challenge is that you think that you have reached every office and you have reached the right people and you send [all relevant material] to them and asked that they give feedback if anyone is missing from the distribution list.[Still problems remain and] you find suppliers coming back to you and saying [we are getting different signals from your subsidiaries],"* a vice president explained.

Solutions and impacts
X6 implemented several actions to counteract the negative impact of offshoring. These included changes to the product, the product development process and the organisation.
Product changes included making the product design simpler, thereby reducing complexity and functionality in the product. While there is a risk of functionality loss there is also the option of entering new markets which want lower functionality (for example some emerging markets) and exploring the synergy effect of different cultural backgrounds. Furthermore, it is easier to communicate a simpler design which addresses one of the challenges X6 had.

Decomposition/modularity was another approach. This happened through a clear separation of tasks so that no or limited connectivity to tasks in other locations was created. This would make communication easier and would limit cross-cultural and cross-functional communication and collaboration.

As for many of the other companies, product development process changes included introducing more written material (e.g. standards, processes, procedures) as well as documenting work processes in engineering. The company had introduced a stage gate model which allowed for regular progress checks. A top manager within R&D illustrated this use of a stage gate model, *"Yes, we do need more precise procedures and that is why we need a state gate model. The stage gate model puts it in a frame. We ourselves can say what are the deliverables at each stage but also the rest of the organisation can now get in and read how we do it and when they are required to give input and so on. That is the main reason for them."*

Regular virtual meetings and other status reports were organised with the Indian office, and one to one communication and well as written communication was preferred to avoid misunderstandings. Organisational changes included bridging the distance between engineering functions by moving more functions out, introduction of the stage gate model which presented a new way of communicating and working between departments in regard to projects, introducing increased quality controls, having Indian engineers work in the Danish office for a few months to facilitate knowledge transfer and use expatriates in key positions abroad (due to the high cost of this and that few Danes wanted to go abroad the company was attempting to move away from this).
Using explicit knowledge was a main challenge. A vice president illustrated this, *"When you have engineers you do not have a machine that can tap their knowledge and make it explicit. We have to accept a high degree of knowledge is based in their heads so we need to ask [ourselves] ... this guy*

will soon go on retirement, or be laid off etc. how do we retain the knowledge? How do we work around that?"

Findings summary
X6 had outsourced manufacturing to several suppliers and were struggling with coordinating a common supplier approach. They also had engineering and R&D in three different countries. Issues with communication had meant a one-way and more explicit approach with focus on product and process modularity had been attempted to avoid complications in communication and interaction as much as possible. However, the inherent tacit nature of engineering knowledge as well as the different engineering practices in the different locations meant this approach had not been entirely successful. The approach had also introduced an additional problem in regard to a loss of transparency between locations. Furthermore, while X6 wished the Danish organisational culture to be global it had so far not been entirely successful in achieving this.
In an attempt to enter new markets like India some products had reduced complexity which could threaten the brand image but could also make the company gain many new customers in for example emerging markets like India.

4.2.8 Case company X7
Globalisation process
X7 has grown globally over the years through M&As and organically as markets have opened up and developed.

The office in Beijing, China started with sales and then production and development projects in China. Lately, the office has also started to receive engineering tasks. The office now does product development projects which have been defined in Denmark. The projects focus on redesign; an existing product which is redesigned (i.e. based on old technology). New technology is kept in Denmark. Projects are among others redesign of modules. The office also has sales functions and is responsible for keeping contact with Chinese suppliers. The company employs a limited number of Danish expatriates in their offshore locations as experts or project leaders, for example in their office in Beijing. The majority of decisions are still taken in Denmark with very limited decision power in the subsidiary which some of the Danish leaders in the subsidiary feel is unwise. *"Too many [decisions are taken] in Denmark. We want to decentralise but we centralised decision making. That makes [many things] hard. Of course there are some [things] we can do [on our own] but the centralisation aspect is too heavy if you really want to be more market oriented,"* a project manager explained.

Security was a big concern for X7 and the Danish managers were told to routinely screen the Chinese engineers' computers and the local engineers also had fewer rights in regard to copying of drawings, what material could leave the building, and so on. While the Danish managers felt this was not motivating they also felt it was necessary in the current Chinese market.
Collaboration with Denmark is high on engineering projects as Denmark has final say on almost all project related decisions and all leaders in the Chinese office are Danish expatriates. *"We collaborate a lot with Denmark. Too much I think. A lot of the experts and specialists sit in Denmark and not here. If you are an expert in Denmark and everyone asks the same questions and you are very busy then you may be reluctant to answer another newly hired Chinese person,"* an expatriated engineer with managerial responsibilities explained.

X7 found the Chinese engineers hard working and engaged and they gained the cost savings on salaries they desired.

Challenges

X7 have a stage gate model and not an iterative process as the company need a light version for smaller changes so they do not need to go through all steps every time. The company has a system in Denmark for how to use the model which is also used in China. As X7 want one global culture the model is implemented the same way globally.

The company experienced quality issues and increased rework in the development and design phases when they offshored work to their Chinese office. A top manager from X7 explained that this was mainly due to miscommunication, cultural differences and misunderstandings, "*The biggest challenge is to keep everybody informed about everything, because all the informal communication will not happen when people are not there. [...] Written communication can be difficult with all these details and misunderstanding can easily occur. And then if their English is different from our English it can also be a challenge.*"

Implemented solutions and impacts

X7 implemented a series of changes to try and counteract the challenges they had with offshoring. They did not make product changes. However, the product development process was changed and was more explicit. However, moving parts of the product development process abroad was also a chance to increase efficiency in the product development process. A manager from X7 explained it like this, "*Some of the routines, if everyone have worked with them for a long time, it takes a lot to start changing them. But new eyes say this is not a clever way, why do I have to type the same information twice on two different spread sheets and well, maybe you do not.*" In this example the use of different knowledge repositories meant the information had to be written into different spread sheets. The Danish employees had become used to this method until the Chinese colleagues drew attention to the procedure.

The organisational structures were changed through more documentation and tighter quality and security checks. The Chinese office in particular had more internal as well as external (done in Denmark) quality and security checks due to fears of IP breaches. As decision power and control remained in Denmark virtual communication was heavily used contrary to the previously localised (in Denmark) product development process.

Summary

X7 has engineering facilities around the world and has recently opened an office in Beijing. IP rights and security is a major concern and expatriates are used, together with IT and organisational procedures, to ensure control. Other challenges included cultural differences, misunderstandings and miscommunication which could cause quality issues and delays.

Main decision power remains in the headquarters which has meant limited innovative abilities for the subsidiary, also in regard to adjusting designs to local market needs.

Despite these changes complications remained. A key unresolved challenge is how to ensure security while still gaining maximum benefit from the local knowledge and innovation from the new Chinese office.

4.2.9 Findings summary from descriptive study 1

The case companies followed a similar path when globalising the product development process. Large offshoring/outsourcing projects were decided on the executive level followed by a brief preparation phase. Implementation and daily management was handled by top level managers. In these phases the organisation experienced several challenges and as a result the managers who worked with the offshored or outsourced task implemented a series of solutions. The impact of these could mean that more activities was moved abroad. The globalisation of the product development process was thereby emergent.

The companies experienced challenges with cultural differences, coordination and communication which resulted in quality issues, misunderstandings, delays and miscommunication. Challenges were also felt with organisational structures including conflicting targets and a lack of organisational structures which encouraged the globalisation of the product development process.

The companies implemented a series of solutions. These were mainly related to organisational processes and structures (e.g. more documentation, explicit knowledge, increased security checks, increased quality checks, increased status reports, the use of expatriates, key decisions remaining in the headquarters and less communication and interaction) as well as engineering changes in the product and the product development process (e.g. increased modularity and less complexity, more manpower in manufacturing resulting in product designs reflecting this manufacturing process). These actions were an attempt to avoid high risk situations (i.e. interaction and collaboration) resulting in a more segregated and less transparent inter-organisational process.

This also meant the companies with a product development process model which required low interaction, like the stage gate model, or had a low clock-speed in changes, found it easier to implement modularity in management and engineering areas. Some of the case companies also tried to implement the Global Footprint Strategy of Manufacturing shown in Chapter 2.

However, challenges remained.

This suggests these solutions have not suitably addressed the challenges or were not fully implemented (e.g. the Global Footprint Strategy of Manufacturing). Despite this, offshoring gave several benefits, including lower salaries, a way to try more ideas in R&D with low risk, and a way to reach new markets and increase product portfolio if outsourcing was done to gain competences, or products which could be made to better suit local market needs.

4.3 Descriptive study 2

In the descriptive study 2 the role of expatriates were investigated. This was in relation to:
➢ Their role in the organisation.
➢ Their role in knowledge management.

While the focus was on expatriates in China for X5, the investigation supported these findings through comparing expatriates in China with expatriates in the USA for X5 as well as Danes expatriated for three other Danish companies in China.

First the findings from X5 are presented; the HR issues, the expatriation process, expatriates to China, expatriates to the USA and then a comparison of expatriation between these two countries. Hereafter, these results are supported by findings from three other Danish multinationals regarding expatriation of Danes to China.

4.3.1 HR expatriation issues
In 2010, X5 had 40 expatriates in China and 10 in the USA. Every year the HQ send around 20 new expatriates to China, but no new expatriates have been sent to the USA in recent years due to the financial crisis. In general China is considered a growing market which demands more expatriates, as the client would like to have a western manager to guide the project, and the company currently has a big community of expatriates there. USA is on the contrary a declining market, where clients do not see having an expatriate as a benefit, local employees are considered to have better understanding of the culture, and are cheaper than Danish expatriates. It was assumed by HR that in the future the amount of expatriates in the USA would decline further.

There are no special selection criteria for choosing employees for expatriation tasks. The people who would like to go and possess the needed knowledge to carry out the task are selected.
The number of married employees in X5 is around 50-70% and as a consequence approximately the same amount of employees can be assumed to go for expatriation with their families.
In regards to social community organisations, the USA and China differ significantly. Social communities and social networks are very developed in China, due to the number of expatriates there. However, it is not formal but an initiative from some expatriates' spouses. Moreover there is a special HR representative who every month travels to China from Denmark, and is responsible for ensuring that various practicalities are well-organised. Concerning USA, no special person is dealing with finding a social network for expatriates, however at the same time there should be a similar social network as in China among the expatriates which are there.

The company does not have career planning sessions before an IA or upon return. In general, HR representatives are responsible for finding a position for an expatriates upon his/her return, however whether an expatriate should get a promotion or how his/her career will develop further is the responsibility of his/her manager.

When an employee agrees to go for the expatriate assignment, the company makes a contract. Employees normally do not have a separate lawyer to check the contract, as they believe it is enough for the company to take control of this aspect. There is no difference in cash takeout whether the expatriate is travelling with or without his/her family. However, the ones with families require bigger houses, more house goods etc. and are therefore considered to be more expensive to send out. The wife will also get some small financial support while abroad. The usual length of expatriation contracts is 2 years for both China and USA, but for China the contract is also usually prolonged for 1 year. Around 10-20% of expatriates stationed in the USA, are coming back earlier than planned due to the financial crisis. Contracts were standardised 2 years ago, which means that all expatriates travelling to the same country have the same contract. The company is executing its expatriation activities independently from its mother company since 2006, which includes having own packages, own systems and different calculation of salaries. It normally takes 2 months from an expatriate signs a contract till he/she is send abroad.

In both USA and China there is a local HR person to support expatriates whenever they have some problems or questions. In China there are 20 HR personal fully dedicated to expatriation issues, from which two are assigned to only receive expatriates when they are coming to China. In the USA there are two HR employees as the country receives fewer expatriates.

The local HR personal handle all practicalities, like getting credit cards, getting car insurance, leasing a car, registration with the authorities etc. Local HR in China should be able to provide expatriates with answers to any issue they may have. However, the employees in the USA are not able to provide their expatriates with the same broad support as the Chinese ones, so the expatriates there have to handle some aspects themselves.

When sending expatriates to China many specific conditions to enter the country need to be fulfilled. However, to cope with this challenge the HR organisation in China has developed well-established connections and a structured approach. As there are few HR representatives in the USA HR in the HQs need to take on more responsibility regarding these issues, especially in the preparation phase. Currently there are no significant changes planned in the expatriation processes. However, X5 is planning to make some academy seminars for the Danish employees in Denmark to learn about Chinese culture in the spring of 2010. Another such seminar is planned for fall 2010 for the USA employees to learn about Chinese culture. Currently the Danish HR department is trying to collect data about cultural differences and ways to handle them based on the training sessions they have already carried out.

In general expatriates are considered to be quite expensive for the company and, when it comes to the USA and other European countries, the expatriate model might be changed to some other models in the future, e.g. expatriates hired on local conditions.

Throughout this thesis, Danish expatriates in China are referred to as Chinese expatriates while Danish expatriates in the USA are referred to as American expatriates.

4.3.2 Expatriation process

The preparation of expatriates mainly includes a pre-visit to the country both for the expatriate and his/her family. In 2009 four expatriates refused to go to China after the pre-visit; the main reason was pollution. For USA cases of refusal were not identified. Cultural training and language courses are not provided by the company.

A discussion about coming organisational challenges is held for expatriates travelling to the USA, which includes: preparation to the change in organisational aspects of being expatriated and reversed cultural shock of coming back home, but nothing in regards to cultural issues. It also includes a coaching session for the spouse and is about how it is to be following the expatriate, what should be considered in regard to children, and career paths for the spouse. In regards to China, there was no information about such discussions, however a discussion about reversed cultural shock when coming back home is provided; also for the spouse.

When a company sends an expatriate abroad, it provides him/her some benefits, which is called a benefit package. Standard packages provided by X5 include housing, car, medical insurance, a higher salary and other benefits as shown in Table 26.

Table 26: Standard Benefit Packages for Expatriates Stationed in China and USA

Benefit Packages:	China	USA
Higher salary	YES	YES
Mobility allowance	YES	YES - 15% added to the net salary
Spouse support and allowance	YES	YES - 2000 EUR per year
Pension in Denmark	YES	YES
Housing	YES, provided by the company	YES, housing support
Goods transportation	YES	YES
Car	YES	YES
Medical insurance	YES	YES
House insurance	YES	YES
Travel insurance	YES	YES
1 annual trip home with the family	YES	YES
Help with taxes	YES	Depends on expatriates' position

As can be seen from the table the packages are fairly similar although the amounts often differ. A difference between the countries is that the housing for expatriates going to China is fully provided by the company; however for those going to USA it is only housing support that is provided. Tax issues also differentiate for China and USA as for China expatriates will get tax preparation while this service for the USA depend on the employee's position where more senior employees are expected to handle these aspects themselves.

Repatriation processes are the same for all expatriates. Around 6 months before expatriates are being repatriated a discussion with the host manager should take place about whether there is a prolongation of the expatriation contract, or whether the expatriate is returning back as planned. If it is decided that the expatriate is coming back, HR in Denmark starts to search for a position the expatriate should have upon repatriation.

A new initiative is to prepare for reversed cultural shock for the expatriate and the spouse. This session lasts several hours, and is a discussion with an HR representative before repatriation. In addition to that expatriates can get leave upon return if they want, which is 1 month leave on their own account. The company also gives a relocation leave, which is 2 days in the host country and 2 days upon return that expatriates can spend only on relocation. X5 would like to have a coach/contact person in Denmark for an expatriate to guide him/her while abroad. However, HR in Denmark has difficulty finding sponsors for such an initiative.

Finding a position for an expatriate when they return back to Denmark has been challenging for the last couple of years due to the company's downsizing during the financial crisis. HR finds a position for around 95% of repatriates. However, not all repatriates are satisfied with the position they get when they return. The amount of repatriates coming back to a higher position than before is not known but only few repatriates are coming to a higher position; usually they come to the same position as they had before going abroad. The number of repatriates leaving during their first year of return to Denmark is listed by HR to be either 8-10% or 21-22% in 2010. However, several managers referred to 50% leaving.

Knowledge Sharing and Communication upon repatriation

There is no special system created for recording expatriates' performance, tasks etc. The company uses a People Development Process system (MUS in Danish), which is used for annual talks with employees' managers as well.

There is an "academy in house", where the company encourages its repatriates to share their experience of being abroad. However, there are some limits to knowledge sharing, as the company is very restricted on how much time repatriates can spend on knowledge sharing instead of working for a client. Usually the repatriate is immediately put into some project upon return, where the manager is more focused on "selling hours" to a client then holding knowledge sharing academies.

Not all expatriates get an opportunity to share their knowledge on expatriation; only the ones that have positive experiences and are good at expressing themselves. Among skills that HR in Denmark recognises in employees upon repatriation were named the following: developed managerial skills, higher professional competences, broader understanding of the world, international perspective and ability to act more independently. In other words that the expatriate have gone from having only specialist skills to developing skills as a manager.

4.3.3 Expatriates in China

For many the preparation time from deciding to go to leaving was brief and hectic; a majority were stationed abroad in less than three months. An interviewee said that "*My personal story about leaving Denmark for this job was very hectic. And it's been like that, with this company […].*" Six interviewees were expatriated to handle an offshore move of a plant, product or office, one as a specialist on a project/ product the company is working on from the offshore location, and two to set up or develop a new department. Six interviewees agreed that they changed their work position, when arriving in China, to a higher level and higher responsibilities; four expatriates said that they became project managers and three expatriates said that they became department or office managers. The following results relates directly to the statements listed in table 25.

S1: Agreement to work abroad: All nine expatriates agreed to be stationed abroad because they believed that the skills and competences they would gain would further their career thereby confirming S1. There was a difference between future career advancement desires, as stated by an interviewee: "*If I have to continue my career in Denmark, I definitely think it is a big advantage […]. It will give me a boost and also an advantage for going forward*" and personal ambitions such as "*experience, meeting new people, challenges*" (interviewee 9).

S2: Practical issues: This was supported by three and disproved by six interviewees. It should be noted that the three interviewees who supported the assumption were all expatriated in 2006 when X5 broke off from their mother company in regard to expatriation as illustrated by an interviewee, "*I think the biggest problem when we went out in 2006 was that when the company had said we want to manage on our own, it was not prepared for the tasks and was not professional enough. Suddenly it was new people sitting with things that people from [our mother company] have done for many years.*" The four expatriates sent abroad since 2007 disagreed with S3 and were in general satisfied with the help provided by the company in practical issues, as illustrated by an interviewee, "*the company, they helped me with tax […], they have been taking care basically of everything in terms of getting contracts to moving companies, insurance companies. […] the entire visa application and work permit registration. […]I would say that it was a very high level of service for me to get out here.*" Besides those answers, two expatriates expatriated in 2006 disagreed with S2 and gave a

contradicting opinion, like interviewee 4, "*We got help with everything from finding home to schools, to insurance, even where we could shop.*" In general it can be noted from these results that the satisfaction level with practical issues has increased with years and that individual experience vary. However, several interviewees mentioned that they were dissatisfied with the assistance with taxation matters offered by the company's advisers; also interviewees stationed in China since 2007.

S3: HR programs: Three expatriates agreed and five disagreed with the statement, while one interviewee did not provide a clear answer to the question. An interviewee, who was expatriated in 2006, made a comparison of how it was previously organised when X5 was using the mother company's program, "*First time we were out, it was also the first time that [our mother company] sent people to China, so there was a very big preparation with language training in Chinese half a year before, two weekends of training in culture shock and differences, one with your wife and you and all the other that were going out, and one where all the children participated to get to know each other. At that time there was really done a lot. This time there was done more or less nothing. [...] Only a pre-visit to the county for a week. So there was no longer preparation of families or anything, it was pre-visit, see something out there, talk to the manager, go back, take your decision.*" Some interviewees, however, were more proactive in preparing themselves for expatriation or were visiting China on business several times before and had some knowledge about China as noted by interviewee 5, expatriated in 2009: "*The best preparation that I had [...] was that I was out to China several times before in relation to starting up the company. [...] I had the advantage of coming out here and working for almost 2 years before I came here, so in that sense that was the preparation.*" Another important note is made by interviewee 6, "*At that time, there were some culture courses, and some courses planned [...]. But in my case, and this happened often, the decision was taken very quick, so I did not participate*". Interviewee 7, however, mentioned the importance of the manager's encouragement instead of HR help: "*I didn't have any HR preparation, or anything, but I did have a manager who encouraged me a lot to go here, and send me here for the different task.*" Two interviewees agreed and three disagreed with S3.1 and said that no preparation for the families was provided and only a pre-visit was arranged. It has to be remembered that only seven engineers stationed with the families could answer the question. Interviewee 4 commented that some training had been offered but he had not felt it was needed, "*There were some offerings where we could get some training but actually the best preparation was on the visit trip out here where we visited other Danes and other families that were stationed out. That was the best preparation to get to know about the culture.*" The families of the expatriates received a one week pre-visit trip to China. However the response to the offering was different, while some expatriates considering it to be "*the wrong way to do it*" (interviewee 3), others commented as above that it was the best preparation.

S4: Career plans: Two interviewees supported the assumption and seven disagreed with it, while one interviewee did not answer. From this finding can be concluded that the company usually does not have career plans for expatriates, which was supported by interviewee 5, "*I was debating, you could say, with myself. [...] I have not made any career plans with my manager back home*", and the statement of interviewee 2: "*[...] this company is not very good at long-term planning. [...] We do make some sort of long-term planning, but basically our planning horizon can span 6 months as that is the time it takes to make a project phase. We are not really good at anything beyond that, which meant that having any kind of plan for what I should do when I return after two years in China, well, that was beyond the horizon.*" Interviewee 1, however, provided an opposite opinion, "*Yes, there*

were some briefings [...], so there was discussion about how you want to use [the expatriation period]."

S5: Selection: No interviewees agreed with S5 that there was a selection strategy for expatriates and five disproved it as illustrated by interviewee 1: "*I have a feeling that they actually choose by looking at personality, like leadership, easy to fit into a new environment, easy to talk with other people, more soft issues and being able to work alone, be able to handle stress. For the actual, technical knowledge I think it was of course something important, but I do not think [...] that was a very important issue.*" In addition interviewee 4 said, "*So at that point they were looking for a person who had a huge network, who had been in the company for a long time and had been in all of the areas to be able to comprehend different technical areas and be able to pick up the phone and talk to whatever person to make things happen.*" All the expatriates provided different answers depending on the assignment they were on. However, by combining several answers the following picture can be drawn: the company is looking for people who have both soft and hard skills, are able to lead and work independently, have good communication skills to be able to easily communicate with people back in Denmark and China. An additional advantage could be to have previous experience of expatriation to China, preferably the same office, as then the social network would be already established with colleagues. Also personal initiative play an important role for being stationed abroad.

S6: Cultural clash: Experiencing communication problems due to culture was supported by three expatriates and disproved by two expatriates, while the other four interviewees did not mention the issue when talking about culture. Opinions about that issue differed. Interviewee 8 who agreed with the assumption explained, "*First of all communication is a big problem. And that is a mixture of a bad speaking English the Chinese people use and a cultural difference.*", and interviewee 6 added, "*[...] sometimes we [Danes] like to bring something up for debate, or to talk a little bit about it first, before we take the decision, [...] that can be very dangerous in China, because if you say it in a meeting, this is the agenda, [...] then we are working on this one.*", while interviewee 4, who disagreed with the assumption, said, "*I have not experienced it as more different than if I take upon a new responsibility for a new department or new division in Denmark. [...] Our Chinese colleagues are not very different compared to our Danish colleagues. [...].*"
S6.1, that it was difficult to understand local values and norms, was supported by two and disproved by four interviewees; others did not comment on it thus it can be assumed that the issue was not found relevant by them. Interviewee 8, who supported the assumption, said "*[...] we actually tell people that it is allowed to fail. [...] They are shocked when they hear that you admit you have made a mistake; that is against the Chinese culture. [...] It is important to not lose face. I think it is a rather negative thing, because you can never learn from your errors, if you will never admit them.*" Another interviewee added another example, "*I would say time period and making an exact meeting time and things like that is different. It is not regarded as strict as it is here in Europe and Scandinavia. We still have problems [with culture] but it is getting better.*". Nevertheless, the majority stated the opposite, e.g. interviewee 5, "*I think they (Danes and Chinese) are pretty similar in a lot of ways*" and interviewee 4 added that, "*highly educated Chinese are behaving more or less the same way as our Danish colleagues and they also expect good things like a good manager and good working life and challenging work, career path and good salary and so on*".

S6.2, increased work pressure, was supported by six and disproved by two interviewees. However it has to be noted that when interviewees supported the assumption, they were mainly agreeing about working longer hours abroad and not about efficiency being higher in Denmark compared to the offshore location. Another interesting note to make is that interviewees were citing different reasons when saying that they worked more or harder, e.g. coming to China without family makes it easy to take up many tasks, the need to be "*all over the place*" as a manager (interviewee 4), having to work with less experienced colleagues takes longer time when doing a project (interviewee 3) and the need for travelling long-distance within China on business (interviewee 6).

S6.3, interaction with locals from a similar background and social class, was supported by six interviewees and disproved by none, while two people did not mention that issue. Most interviewees mentioned the language barrier as the main reason for not being able to interact with people outside the office, but social class or educational background was not mentioned. It was also noticed that people could become friends at work but being friends out of the office was difficult. However, as the results indicate, expatriates were nevertheless interacting with mainly Danish and international people. Interviewee 3 explained, "*[…] We know the importance in meeting other people, starting up the networking very fast both in the national and also in the Danish community. In Tianjin where we were in the start, it is a smaller community through the school, through your work, you very fast find each other […]*" and interviewee 6 added, "*[…] to meet Chinese, and be friends with Chinese, that is quite difficult. There are very few. Even I who have been here 7½ years and there are only a few I would call my Chinese friends. Professionally you can meet them, you can also be friends at work, but the next step, to be friends outside, that is difficult.*"

S6.4, a high degree of job shopping in China, was supported by two interviewees and disproved by six interviewees. It is interesting to mention that the majority said that job shopping is not a serious issue in X5 in China because as an interviewee said, "*it is more a challenge for the production companies in China*". In addition, another interviewee said when comparing production and service companies, "*In our company it was not so much […]. It is because they have a lot of workers where we have higher educated people and they are maybe more satisfied with that job because they see the possibility to grow.*" Talking about the salary as a serious reason for job shopping a third interviewee added: "*I have an idea that we are paying a salary that is OK. We are not in the lead, but our benefits, and the Danish culture we have here, for the people who enter the company, they like it. We do have turnover, but it is not that high.*"

S7: Knowledge Gains: This was supported by all nine interviewees. Six interviewees agreed that they gained soft skills, (sub-assumption 7.1), and two interviewees specified that they gained hard skills (sub-assumption 7.2). Interviewee 1 supported the idea of both soft and hard skills as can be seen from this quote, "*Of course you get a lot about culture, a lot about communication, technical knowledge sharing and what other people are capable of doing, a lot about collaboration.*", while several expatriates stated that they gained different skills. E.g. interviewee 2 stated on gaining hard skills: "*I learned more during the first 6 months in China, than I have learned during the last 6 years in Denmark. Because it is a smaller company, because you will have to deal with a lot of things, because I am a project manager here […].*" Moreover, interviewee 4 commented on gaining soft skills: "*[…] in 3 years, I gained a lot of experience in communication and I think also about being tolerant and patient.*" While interviewee 8 said on gaining both soft and hard skills: "*Culture*

knowledge, the knowledge that gives us a possibility to understand how people from different cultures actually work and do engineering... That is the biggest advantage."

S8: Transferring knowledge back: Two expatriates agreed while three disagreed that transferring knowledge back to the HQ was difficult. A good point was made by interviewee 6, when discussing the issue: "*The question about sharing my knowledge [...] that is up to myself. I want to sell what I have learned out there. We have to change, because we could benefit much more from people coming back. [...] that is also [a course for] frustration for people coming back. They cannot, what can I say, deliver. They are filled up with new experiences, and new thoughts, and have no place to give it. And that is also, I guess, why many people, not only here but in many companies leave when they come back.*" Thus the interviewee mentions the issue of high expatriate turnover in the company and says that inability to share expatriates' newly gained knowledge can cause a problem. He also makes a point in regard to being more proactive when coming back to the Danish office and trying to sell knowledge he gained abroad.

S9: Success criteria: That few success criteria exist was supported by two interviewees and disproved by five. Expatriates said that among the main success criteria were the need to educate Chinese managers who can take over the expatriate's position when he/she goes back to Denmark, as this quote from interviewee 5 shows, "*I am heading the HR, quality assurance and finance departments. And the success criteria is that when I am done here in 3 years, then no other Dane should come and take over, it should all be locally managed afterwards. I have to build it up so it can stand by itself.*", and the success of the projects they participated in (interviewees 6 and 3). Thus it can be seen that expatriates envisioned there were different success criteria depending on the assignment and the goals they had in regard to it. E.g. interviewee 3 said: "*We managed well because we came home in time and on budget. So it was a success, no doubt about that.*"

S10: Preparation: One expatriate agreed while six expatriates disagreed with S10 which indicates that the company is not prepared for when expatriates return home, as commented by interviewee 2: "*repatriation is simple; it is a non-existent thing in any formal way. We have no policies, we have no actions.*" Moreover, interviewee 1 added that, "*not something formal*", no meeting was organised when he returned home. And interviewee 8 said, "*it seems that the home organisation is always surprised when people come back*" what was also the case in his situation.

S11: Personal knowledge: Two expatriates agreed and two disagreed with S11, that the company does not fully exploit the knowledge they gained, while the others did not mention this issue when talking about the return home. Thus from the results provided it is hard to make any conclusions as opinions regarding the issue were divided. While some interviewees disproved the assumption saying that "*I have this link about still working with offshoring, [...] I have a task linked to the global organisation, and are still linked to China*" (interviewee 6), others stated that they could not find full application of their new knowledge back home (interviewee 2).

S12: Conditions for success / failure of expatriation: Regarding criteria for a successful stay, two expatriates agreed with sub-assumption 12.1, four expatriates agreed with sub-assumption 12.2, as illustrated by interviewee 4 "*I expected a lot of change and exciting challenges and that has been fulfilled [...] This freedom and responsibility of building up something new has been a very exciting*

challenge and has been the most exciting job I have had.", two expatriates agreed with sub-assumption 12.3, four expatriates agreed with sub-assumption 12.5, and six expatriates agreed with sub-assumption 12.6. Regarding this point, some interviewees mentioned that their expectations were fulfilled and especially that they were able to be a part of building a completely new organisation or factory and that they could transfer their responsibilities to Chinese managers (interviewee 8), while others mentioned their ability to adjust to new challenges. Notice that one expatriate agreed with the last sub-assumption 12.7. As can be seen from the results, especially sub-assumption 12.2, 12.5 and 12.6 (own career planning, an extensive network and own expectations and abilities to adjust to new conditions) were most mentioned by the expatriates, while no one disagreed with any of the seven sub-assumptions. At the same time interviewees did not comment on some of the sub-assumptions, presumably they did not consider the issue important in regard to their conditions for a successful expatriation.

S13: Stationed abroad and career development: That the stay abroad harmed their career was supported by two interviewees as illustrated by interviewee 2, *"[...] career wise, I've shot myself in the foot, no doubt about that."* and disproved by three interviewees as illustrated by interviewee 1 *"I got promoted to be a manager, so yes, there was a promotion."*, while some of the expatriates could not comment on the issue as they were still expatriated during the time when the interviews were conducted.

S14: Improvements: Three expatriates agreed and one disproved regarding the need for improvements to preparation, while others did not refer to the issue. The interviewees felt this could be an improvement point as they either got no courses or that the courses did not give sufficient information. Pre-visits, however, which are a part of an educational program, gave a good insight into the life abroad.

Two expatriates agreed and one disagreed that improvements are needed to make it less difficult to use knowledge gained upon return, while the majority, six interviewees, did not refer to the issue when talking about improvements. Interviewee 2, who agreed with the assumption stated: *"I am not sure that my boss, which is the same boss that I had when I left, can give me the job I should have. It does not mean that it has to be higher, but it just has to be somewhere else."*

Several supplementary issues were added to the coding scheme during the process of interview coding (see Chapter 3). Issue 1, that the stay abroad was to expand personal horizons, was supported by the majority of interviewees, where seven expatriates supported the statement as illustrated by interviewee 5, *"[...] I wanted to try something different than Denmark, live in a country different from Denmark, work in a working environment that would be very different from Denmark to get new challenges."* Four expatriates agreed with issue 2, that it was harder to be repatriated than to go abroad, while six interviewees agreed with issue 3, that they were satisfied with their expatriation, while additionally two expatriates agreed with sub-issue 3.1 that they were especially satisfied on the professional issues.

4.3.4 Expatriates in the USA
Five of the six expatriates moved to the USA less than three months after the decision. All the expatriates mentioned that when they were expatriated they got a higher position and/or higher responsibilities. Two expatriates mentioned that they were sent to set up or develop a new department in the expatriated location.
The following results relates directly to the statements listed in table 25.

S1: Agreement to work abroad: That career advancement was a key reason to go abroad, was confirmed by five expatriates and one disagreed that it was the main reason for his expatriation, and said that the reason was personal growth.

S2: Practical issues: S2, that the company helped with practical issues, gave more contradictory responses, where two expatriates partly agreed and partly disagreed, three disagreed and one agreed with it. The company helped expatriates mainly with social security, medical insurance, taxation, and a place to live when first arriving. But such practical issues as apartment search for constant living, schools for children, rental car etc. expatriates did not really get help with and is illustrated by an interviewee, "*We had HR persons in USA only to support us in matters of doctors, insurances, social security numbers, and everything like that. But everything about money and getting in, it was extremely difficult for them to help us, because they did not have the experience. That was quite surprising for me*". Interviewee 1 commented that preparation can be improved as it can be "*a bit more organised, a little bit more streamlined but I do not think it is only USA, I think it is a general X5 issue because I also know some of the expatriates in Asia, sitting in China, and they face the same issues so therefore I think it is a company issue*". A recommendation from another interviewee on this issue was that HR needs to "*prepare people for going out. It is very much about how are they gonna cope, what is their everyday situation going to be like […] be more open about how the situation is going to be over there*". It can be noticed that HR in the USA lacks experience and contact for good organisation of practical issues.

S3: HR programs: The majority disagreed that there was an educational program. The reason for agreement or part agreement with S3 was that HR provided expatriates with a book about cultural shock in the USA, and no other courses were offered. However, not all the expatriates mentioned the book about American culture. The majority also supported that no educational support was given to the family.

S4: Career plans: All interviewees felt there had been no career planning before going out. Three of the expatriates pointed out that the company should have a career plan for expatriates, as after being expatriated they gained a lot of knowledge and the company should utilise it when they come back. This is illustrated by a quote from interviewee 4, "*They have a yearly career conversation in this company, where you are looking into what kind for development you need to adapt. I think they need to do it if you go abroad because if you go abroad you learn a lot. You have to keep in mind that you have people around the world with different skills, and maybe they need to be developed in a certain direction.*"

S5: Selection: Half of the interviewees felt there was no selection criteria for expatriates with the remaining expatriates supporting possible selection criteria they thought had been employed similar to those illustrated by the Chinese expatriates.

S6: Cultural clash: Only one expatriate agreed that there were cultural difficulties. The majority agreed with S6.4; that they worked harder and longer. The point is illustrated by interviewee 3, "*The tendency there (in the USA) is work, at least to spend, more hours in the office but not necessarily to*

work harder." Three expatriates agreed that job shopping was a greater issue in the USA than in Denmark (S6.4).

S7: Knowledge gains: All six expatriates agreed with S7, that they gained a lot of knowledge while abroad. This can be illustrated by interviewee 4, *"[…] you are kind of expanding your knowledge. If you go abroad, you will meet new cultures, new ways to do things. […] when you go abroad, you are challenged in a new way. […] You have nobody to ask, you just do what you think is right. […] So you learn a lot, about how to carry out a project, about yourself and you are getting much more experienced, you grow faster when you are abroad. You get a lot of knowledge and tools."* However, through differentiation with sub-assumption 13.1 for soft skills and 13.2 for hard skills, three of the expatriates mentioned that they gained soft skills, three mentioned that they gained hard skills and one disagreed that he could gain hard skills while being expatriated to the USA.

S8: Transferring knowledge back: Three of the expatriates agreed that knowledge transfer back to the headquarters was hindered by the low strategic importance of the subsidiary, one disagreed, and two did not agree or disagreed with it. Interviewee 6 also highlighted that his knowledge of being expatriated to USA was not used upon repatriation and were thereby wasted; *"Make people talk about it. Force people to use it. If you want to do something in the USA you should talk to the people who have been there before, before you start changing things or travelling there […]. It is not used, which is a bit strange. There is a lot of knowledge wasted there".*

S9: Success criteria: Five expatriates agreed that there were no success criteria and one disagreed as illustrated by the following quote, *"You need to be very careful what stories you tell. […] It is more an indirect evaluation and especially with the people travelling around, you need to be very careful what story is told about you. That is the way things are evaluated – the story that is created".*

S10: Preparation: One expatriate agreed that the company had been prepared when he returned home and that X5 had used his knowledge when he returned, and five expatriates disagreed, highlighting that X5 is not prepared when expatriates are coming back from expatriation. There were different reasons named, such as no job, badly organised repatriation due to visa problems or other practical issues, no place to sit in the office etc. This point is very well illustrated by the following quote from an interviewee, *"When I came back there was no seat for me, people did not know who I was. […] So it was very difficult for me to, for first 6 months at least, to find myself. It was like starting over in a new job in a position that was very different and much lower than the one I came from. That was very tough".*

S11: Personal knowledge: Three expatriates agreed and three disagreed with S11, where some interviewees said that they are using the knowledge they gained abroad now, and some said that the gained knowledge was not used, or only partly used, in their current job.

S12: Conditions for success / failure of expatriation: Two expatriates agreed with S12.5; that networks in the HQ and in the subsidiary was a key success criteria, whereas two expatriates agreed with 12.6 (that success depends on personal expectations and abilities to adjust to the new society and new challenges).

S13: Stationed abroad and career development: Three expatriates agreed with S13 (that going abroad had damaged their career).

S14: Improvements: All six interviewees agreed that preparation was poor or completely lacking and that this was a key area needing improvement. The usual answer was "no" or as illustrated by interviewee 4, "*No [I got no courses or anything], not at all, it was like, tomorrow you are in USA, and here is your ticket.*" A majority of interviewees felt that improvement could be made regarding using knowledge gained abroad when expatriates had returned home.

Regarding additional issues, a majority of the interviewees agreed with issue 1, that going abroad was also to expand personal horisons. Furthermore, a majority agreed with issue 3, that they were satisfied with their expatriation period, mainly due to professional challenges and growth.

4.3.5 Findings: Expatriation to China and USA

Percentage ratio is introduced in order to make it easier to compare the findings as the number of interviewed expatriates to China and USA was not the same (9 and 6 accordingly). For details see Appendix 5.

Similar results

There were many similar results from both locations, in particular in regard to preparation and repatriation.

A lot of respondents from both China and USA mentioned that they have been stationed abroad before, namely 56% and 83% respectively and only 33% and 17% respectively have never been stationed abroad before. A majority of both Chinese and American expatriates were stationed with families, 78% and 83% respectively. Expansion of the original expatriation contract took place in almost half of the cases for both countries, namely 44% for Chinese and 50% for American expatriates. A majority of expatriates in both countries had only a few months between agreeing to go abroad till they were there. 67% for Chinese and 100% of American expatriates mentioned that when expatriated their position was changed to a higher level or got higher responsibilities. 22% of Chinese and 33% of American expatriates were sent abroad to set up or develop a new department with a majority going abroad as experts or managers.

When comparing preparation phases for the two countries the biggest similarity was agreement with S1, which says that most agree to go abroad because they believe the skills and competences they gain will further their career and personal ambitions, resulting in 100% agreement from Chinese expatriates and 83% of American expatriates. Similarly, 67% of Chinese and 50% of American expatriates disagreed with S2, meaning they had to resolve many practical issues themselves; more so in the USA than in China. S3 - a lack of educational programs - was also confirmed by 56% of Chinese and 67% of American expatriates. S4 – no developed career plans – were confirmed by 78% Chinese and 50% of American expatriates. While many expatriates from both countries thought they knew what selection criteria existed in X5, this was all speculation and no official selection criteria existed. Therefore expatriates from both countries showed similar results regarding this issue. In regard to S6.4, increased work and time pressure, the same number of Chinese and USA expatriates agreed, namely 67%.

S7- that expatriates gained a lot of knowledge while stationed abroad – was something all the expatriates from both countries agreed with. S13.1, saying that knowledge gained was mainly soft skills, 67% Chinese expatriates agreed and 50% of American expatriates agreed.

For S9, regarding the existence of measurable success criteria for expatriates in the company, the situation was similar as for selection criteria. This meant that many agreed that such existed (11% of Chinese expatriates and 83% of American expatriates). However, these were overall criteria based on the reason for expatriation (e.g. a successful project, a successful department) and not specific criteria. As a result 67% of the Chinese expatriates and 17% of American expatriates clarified that no success criteria existed. Overall, it can therefore be concluded that no specific success criteria exist besides fulfilling whatever task the expatriate had been sent to do.

S10, that companies are well prepared regarding repatriation, 67% of Chinese and 83% of American expatriates disagreed, indicated X5 is not prepared when expatriates come back.

The interviewees from both countries responded relatively similar to S14 about difficulty for expatriates to use their knowledge when they come back home, namely 11% of Chinese and 33% of American expatriates disagreed with it, while 22% and 33% accordingly agreed with it.

Expatriates from both countries agreed with issue 1, saying that they went abroad to expand personal horizons with 78% Chinese and 83% American expatriates agreeing with the issue. A majority of expatriates, 67% of Chinese expatriates and 83% of American expatriates agreed that they were in general satisfied with their stay abroad, in particular professionally.

Different results

Differences between the countries were mainly in cultural challenges while abroad and changes caused by the different economics and growth for X5 in the two countries, with China being the biggest and growing market.

None of the Chinese expatriates had ended their contract early, but 33% of American expatriates had done so. Another issue different for Chinese and American expatriates was that more Chinese than American expatriates had a brief period from being asked to go abroad to leaving, namely 44% of American and 83% Chinese expatriates. Expatriates were often sent abroad to handle an offshore move of a plant, product or office in China (67%) though this were not the case for the USA. S4.1 - having informal discussions of career plans with ones' manager before going abroad – was something none of the Chinese expatriates had done while 33% of American expatriates had done this.

One of the differences seen in cultural aspects was in the amount of disagreement with S6.5 saying that it is easier to interact with and trust locals who have the same educational background and social class as themselves, where 67% of Chinese expatriates agreed with the assumption, whereas American expatriates did not refer to this issue.

S7.2 about gaining hard skills also differed between the two countries where 22% of the Chinese expatriates and 50% of the American expatriates agreed that they had gained hard skills.

S8- saying that knowledge transfer to HQ is hindered by several obstacles - gained different results as well with 22% of Chinese expatriates and 50% of American expatriates agreeing with it. 22% of

Chinese expatriates and 50%.of American expatriates felt that the knowledge they gained while abroad were not fully exploited when they returned home (S14).

Many Chinese expatriates (44%) felt that expatriation success depends on their own career planning (S12.2) while none of the American expatriates mentioned this point.

S13, that most engineers will feel the move aboard did not improve their career, 50% of American expatriates agreed that going abroad had harmed their career and nobody disagreed with it, indicating the majority felt expatriation at best had kept their career at the same level as before expatriation. 22% of Chinese expatriates felt this was the case as well while 33% felt expatriation had helped their career.

Issue 2 stating that coming back home after expatriation was more difficult than being expatriated also differed among Chinese and American expatriates, where 44% of the Chinese and 17% of the American expatriates agreed with it.

4.3.6 Findings in other companies

Danish engineers stationed in China from three other case companies – X3, X6 and X7 - were interviewed in relation to expatriation to support the findings from X5.

Preparation

In X3 there was not a clear selection process but how to go abroad differed. Some went abroad as experts, some actively sought to go abroad, and some had applied to the specific job in China through job advertisements. X3 helped with some practical things; mainly schools. However, some expatriates and their spouses had also been offered classes on Chinese culture. The Danish expatriate community in China, many from X3, helped with many practical things in daily life. All expatriates had actively wanted to go abroad to get the experience and improve their careers. The time from signing a contract to going out is in general around 6 months.

In X6 there was not a clear selection process either; often managers and project leaders asked to go to lead a project abroad. Expatriates had often been abroad on such assignments for X6 before around the world. All the interviewees believed going abroad would improve their career, and one gave an example that the person who had managed the subsidiary before him had gained an executive position in the Danish headquarters afterwards. Preparation was in regard to practical issues and this functioned smoothly due to X6's experiences with expatriation over many years. All expatriates had actively wanted to go abroad to get the experience and improve their careers. The time from signing a contract to going out is in general very brief; in average around 3 months.

In X7 there was not a clear selection process; often specialists had been asked to go to China to aid with a product being developed there. All the interviewees believed going abroad would improve their career. Some of the interviewees were out on shorter assignments (about 6 months). However, all expatriates said that there had been no preparation from the company and no practical help either. All expatriates had actively wanted to go abroad to get the experience and improve their careers. The time from signing a contract to going out is in general very brief; on average around 3 months.

All three companies had a pre-visit as the main preparation before the stay abroad. All companies had promised a job upon return from the expatriation but not a specific position.

Stay abroad and success factors

Several difficulties were present for these companies as they had been for X5; mainly language fluency and cultural differences. However, all expatriates felt they had a very supportive international community of expatriates in China and it was within this community that the Danish expatriates had their social circle. All the expatriates had actively wanted to go which made many of them feel the cultural differences were interesting more than challenging. In X6, for example, the HR department in China made sure to hire Chinese engineers with good English skills to improve the communication at the office.

As for X5, support and contact with the HQ during the stay abroad was very limited. Also, career planning was more or less missing from all the companies and while most expatriates assumed something would happen when repatriation drew closer, this was mainly in terms of practical issues arranged through HR.

S19 regarding no clear success criteria was confirmed by a majority of the interviewees. When asked what they thought would be a successful stay most mentioned job success.
However, all interviewees felt they had had a good stay and did not regret going abroad. The most problematic stay had been those on shorter stays or other assignments which were not the usual expatriation contract the HR office handled.

Knowledge sharing

All expatriates felt they had gained new knowledge while aboard which could be useful both in the subsidiary and in the global organisation as illustrated by an expatriate from X3, "*For sure, they could probably use [my knowledge], because we do have people in different places of the world, and the know-how you build about how to communicate with other cultures and learning across cultures, could be useful.*".

An expatriated manager from X6 explained how he had gained knowledge that could improve the organisation in regard to technical improvements for the products they were handling, as well as administrative things related to communication between the organisational units, "*Yes, [we have suggested changes to] technical things [for our products] [and] we have recommended some changes in administering things [too]*". Another expatriate from X6 explained that the current way of handling knowledge made it difficult to take the ideas further as the culture and organisational structures in the Danish headquarters did not allow for input, "*It is quite human that people are sitting in specialties in Copenhagen that have done things, technical things and are convinced that what they have done is the right thing and the best thing. [To suggest changes requires] a certain way of getting that into the system [which is not easy].*" An expatriated manager from X7 explained how he had learnt a more speedy decision process while in China and that this could improve the organisation and make it more agile, "*[You need to] believe in a decision and stand behind it. I have seen an example of this not happening [but here in the Chinese subsidiary] it is possible [to do speedy decision making]. That is an eye opener on how speedy things can be done if you really put in the effort and just get focused and not having every door open along the way [as we do in X7] but being focused on your target.*"

In X7 fear of loss of IP rights meant the Chinese engineers did not have the same access and rights as Danish engineers. Furthermore, the Danish expatriates were asked to check to ensure the Chinese

engineers did not copy or steal material. This created a barrier in terms of knowledge sharing both within the subsidiary and to the headquarters as it meant the Danish headquarters felt entitled in assuming the Chinese subsidiary were not able to add value to the product development process or the product.

4.3.7 Findings summary
The findings from X5 and three other Danish companies are very similar. There are no clear selection process or success criteria for expatriates. The preparation phase is in general brief with focus on practical issues with few companies providing educational programs. There is no clear career planning though all expatriates go abroad to improve their career. Support to the expatriate while abroad was limited. All expatriates felt they gained knowledge which could be useful for the organisation but also felt it was difficult to share this knowledge outside the subsidiary. Despite this, expatriates in general felt the stay abroad had been successful and a good experience though many would like more practical help and support from the headquarters so knowledge could be shared both during and after the expatriation period.

In X5 repatriation was often poorly prepared and many expatriates felt dissatisfied because they ended up in the same position as before although they felt they were now more skilled. As a result some expatriates felt going abroad had harmed their career. On the other hand, many expatriates felt it was important to make their own career planning and that if X5 could not offer a suitable position upon repatriation then another company might be able to do so. In this manner the companies could lose valuable knowledge the expatriates possessed.

4.4 Summary

This chapter detailed the findings from the two descriptive studies.

The first descriptive study aimed at illustrating four areas; (1) the globalisation of product development process activities, (2) the complications the companies encountered, (3) the solutions the companies implemented and (4) the impact of these solutions. The seven case companies were all Danish multinational corporations with production, development and R&D globally dispersed to various degrees. The global product development process included offshore facilities, outsourcing partners and suppliers. Positive results from globalisation had been a product which better fitted local needs, lower direct costs or an increased product portfolio if going abroad to gain competences.

Main findings from the seven case studies in relation to these four areas showed that (1) the case companies had a brief preparation phase and that globalisation was mainly a 'learning by doing' process. (2) Challenges were mainly related to controlling technical and managerial interfaces including communication, knowledge sharing, coordination, quality and security. Challenges were also felt with organisational structures including conflicting targets and a lack of organisational structures which encouraged the globalisation of the product development process. (3) Solutions to counteract these challenges included managerial and engineering changes. These were mainly related to organisational processes and structures (e.g. more documentation, explicit knowledge, increased security checks, increased quality checks, increased status reports, the use of expatriates, key decisions remaining in the headquarters and less communication and interaction) as well as

engineering changes in the product and the product development process (e.g. increased modularity and less complexity, more manpower in manufacturing resulting in product designs reflecting this manufacturing process). These actions were an attempt to avoid high risk situations (e.g. interaction and collaboration) resulting in a more segregated and less transparent inter-organisational process. (4) Implementing these solutions had some positive consequences for the company in regard to a better understanding of their own product development process, a better understanding of work processes and a way to redesign internal processes and the supply chain for greater efficiency. Several negative or unexpected impacts were also observed. These included time and resources used on knowledge transformation, security and quality check-ups, the encouragement of a traditional organisational setup to focus on control and task division and that not all knowledge can be codified provided the company with continuous challenges as did the fact that not all products or tasks could easily be separated into subcomponents. However, while some of the challenges were reduced by the actions the companies carried out, many challenges remained.

The second descriptive study aimed at illustrating the role expatriates play within global product development. Offshoring of product development process activities often results in expatriation of engineers. These engineers have to work in a new environment and in a new function. They often work abroad as project managers, top managers in the subsidiary, or experts to ensure the project follows the company's standards and ensures that communication and knowledge sharing is simplified to and from the subsidiary. Furthermore, they transfer the way things are done in the headquarters to the subsidiary and ensure control. They often become the 'gate' to the new subsidiary, and a translator between the needs and desires of the Danish headquarters and the local engineers working in the subsidiary.

The findings showed that preparation of the expatriates before going abroad was brief and often completely lacking. During the stay abroad the expatriates had limited contact with the headquarters and carried out most tasks in the subsidiary autonomously. While abroad expatriates often gain a better understanding of their organisation as a global unit and gain knowledge in several areas, including knowledge in how to work and share information virtually, and knowledge related to efficiency gains and knowledge handling. While expatriates feel they gain knowledge which can be useful for the organisation and they wish to share this it is often difficult for them to do so. While the espoused values in the company can support knowledge sharing several elements hinder it. Furthermore, most expatriates believe they will be rewarded for their additional skills gained while abroad through challenging tasks and advancement of their career back in the headquarters. However, this is rarely the case and as a result many expatriates leave the company upon return. Poor or lacking repatriation management further encourages this.

The next Chapter analyses these findings in order to determine why complications remained in the case companies.

Chapter 5: Descriptive studies analysis

This Chapter first presents an overview of the findings from the two descriptive studies. Then, the first descriptive study is analysed using different theoretical perspectives and operational implications are debated. The findings from the second descriptive study are hereafter related to known literature and connected to the findings from the first descriptive study. Operational implications for the second descriptive study are debated. Finally, an approach on how to build a decision making framework for globalising the product development process is addressed.

5.1 Observed globalisation process

The case companies followed a similar process for globalisation of the product development process. They saw the same challenges with offshoring and outsourcing product development process activities, but interpreted them differently and therefore focused on different solutions to address them. Some focused on using expatriates, some on tacit knowledge sharing through for example bringing engineers from the subsidiaries to the Danish headquarters, some focused on explicit knowledge sharing through documentation and others focused on control. X5 for example focused on the employees as a way to resolve the challenges, X2 and X3 focused on explicit knowledge sharing while X6 focused on making the product development process more explicit. These different approaches can be explained as the context-specific nature of the problem area described in previous chapters (e.g. the difference in company's characteristics and the external context for each company).

Inspired by the Outsourcing Circle (Perunovic, 2009) the process of globalising the product development process observed in the case companies can be presented as consisting of four phases:
1. Motivation and strategy.
2. Preparation phase.
3. Implementation phase.
   a) Complications.
   b) Operational solutions to complications.
4. Managing the process.
   a) Complications.
   b) Operational solutions to complications.

The rest of this chapter follows this section and investigate each of these phases in depth. Stage a) and b) are iterative as new problems are found and need to be addressed. Therefore, for each activity moved abroad this process come into play. All these stages are influenced by the company's characteristics and the external context the company operates in (see Figure 24 on the following page).
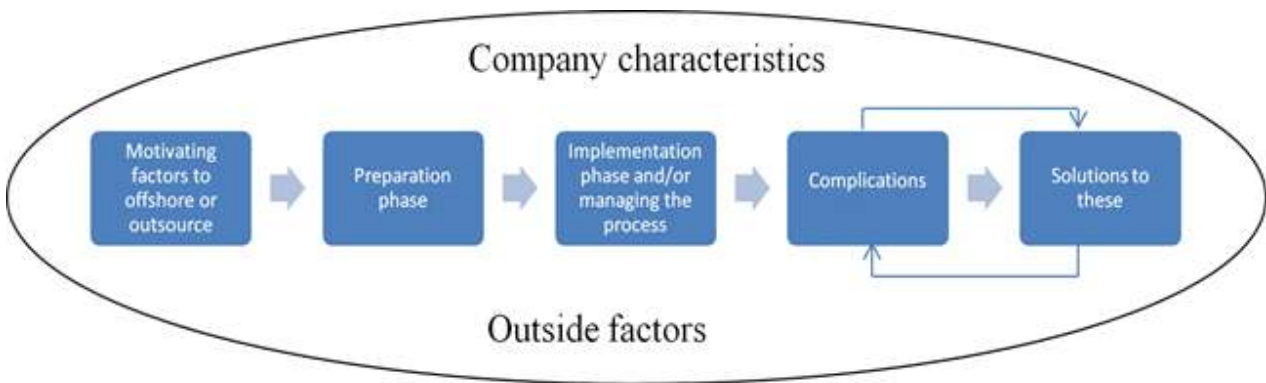
Figure 24: The phases in the offshoring/outsourcing process of product development process activities.

The company characteristics which are the most influential on this process are:

1. Organisational factors
   a. Experience with offshoring and outsourcing.
   b. Organisational culture.
   c. Organisational structure, including processes and leadership.
2. Engineering project factors
   a. Product modularity.
   b. Process modularity.
   c. Knowledge properties of the product.

Motivation and strategy phase

The motivation to move abroad is cost, market access, and access to new competences as will be detailed in the next section. This phase involved top management.

The motivation for globalising the product development process played a key role in how the globalisation process was approached. If the company outsourced or offshored to gain competences not found in-house a strategic relationship was created, often with a focus on high value adding functions in the product development process. In this case where both companies agreed on the type of relationship to create as well as roles and responsibilities there were not many problems with making the relationship work. In this unique situation there therefore was not an iterative process of problems and problem-solving. The companies offshored or outsourced backwards in the product development process, starting with production. The exception from this was outsourcing for competences which was done independently from this. Large offshoring/outsourcing projects went through the process shown on Figure 24. Many functions and tasks were however moved as a result of these projects.

None of the companies had an overall strategy for globalising the product development process; it was a 'learning by doing' process. Strategic goals were either generic (growth in developing markets for X3 and X2), or very specific (offshore 15% of R&D in X6 and 10% of engineering tasks in X5), but did not directly address the future of the global product development process.

Preparation phase

The preparation phase was often brief and mostly considered hard facts such as financial predictions and current geographical locations for subsidiaries and markets. In this phase department heads and other top managers were involved. The preparation phase went through four stages which were all handled by the company's top management team:

Step 1: Select the function or task to be sent abroad

- This could, for example, be detailed design for certain products, a certain pro cent of all R&D or production of all or some product lines.

Step 2: Country selection

- This was based on current geographic positions, market strategy, and the motivation for moving (e.g. low cost, access to resources or markets).

Step 3: Estimated costs
- Estimated costs of conducting the task or function in Denmark and in the selected country, and the expected saving. Estimated cost of moving based on known data from the company and estimates.

Step 4: Facility selection

- Selection of own facilities or foreign facilities. The first is often due to core knowledge, IP issues, ownership structure, or complexity of the task. The latter is often due to access to resources or to gain flexibility. This step is often taken together with step two or from the beginning when the task to move is decided.

Implementation phase

During implementation the daily managers followed the instructions from the previous phase to move out. In this phase they often encountered several challenges which had not been considered in the preparation phase. They responded by implementing a series of solutions which had some positive and negative impacts.

Managing the relationship

Hereafter, when implementation was finished, the daily managers had to manage the relationship and make it work as part of their daily activities. As the challenges during implementation had not been fully resolved and the solutions had some negative impacts, the same happened during this phase, meaning they had to handle these challenges and implement solutions to address them. These will be detailed in the following.

Encountered problems

During implementation and the managing the relationship phase several problems emerged and solutions were implemented to counteract these. All of these problems and solutions were handled

on the operational level by the daily managers. These problems can be separated into two categories; managerial and engineering project challenges (see Table 27).

Table 27: Encountered problems

Category	Problem	Seen in
Management	Culture	Communication style.
		Work approach.
		Leadership style.
		Technical methods and use of tools.
	Knowledge	Difficulties with sharing knowledge that is not codified.
		Hard to share knowledge virtually.
		Hard to develop new knowledge/innovation virtually and across cultures.
		Difference in how knowledge is communicated.
	Coordination	Different to ensure everyone have the same information at the same time.
		Different procedures.
		Delays due to time difference, misunderstandings, difference in access or control over data and databases.
	Communication	The English language is a foreign language for all.
		Culture can affect communication style.
		It is hard to communicate virtually.
		More misunderstandings can happen.
	Organisational structures	Difference in work culture with regard to written material, communication, leadership.
		Changes to work processes caused by globalising the product development process can be in contradiction to the structure and processes of the company.
Engineering project	Product features	Level of complexity in the product.
		Unexpected changes to the product and its development. Experience with the product and its features and development (i.e. its maturity).
	Process features	Difference in the use of design methods and other technical methods, including difference in the process of developing and designing a product.
		Different approaches to what quality is.
		Difference in work approach and engineering practice; e.g. how to resolve technical problems.

Organisational challenges included collaboration, cultural differences, knowledge transfer, and handling the organisational change. Many of these were therefore similar to complications illustrated by other case studies (e.g. Rottman & Lacity, 2008; Kotlarsky *et al*., 2008; Carmel *et al*, 2009; Carmel & Beulen, 2005; Lord & Ranft, 2000; Ledernes Hovedorganisation, 2004).

The main challenge was that organisational structures, processes and culture often still supported the way of working which had been the norm before the task or function had been moved abroad. Examples include (1) contradiction of offshoring targets with turnover goals, (2) absence of new work structure to fit the new work environment, (3) absence of preparation of the workforce for the new work environment in the Danish headquarters, including expatriates and (4) absence of organisational structures to integrate the knowledge expatriates gain.

Engineering project challenges included many of the challenges mentioned in the global product development literature (e.g. Eppinger, 2006) and added another dimension to those often illustrated in offshoring and outsourcing literature. These showed challenges related to the product and the product development process.

These challenges resulted in rework, delays, misunderstanding and miscommunication.

In other words, globalising the product development process was not completely embedded in the organisations, its structures, routines, governance systems, reward systems and strategies on all levels of the organisation. However, when addressing the challenges with globalising the product development process these aspects of the organisation was not addressed as illustrated in the following.

Implemented solutions

The complications were analysed on the operational level by the daily managers and therefore solutions were also on the operational level. Solutions employed by the daily managers were focused on employees, work processes or knowledge and communication. Examples were:

- Focus on employees
    - Train engineers and workers in the foreign office by having them come to Denmark and 'learn by doing'.
    - Use of expatriates as leaders and experts, to transfer knowledge and to supervise vendors or foreign employees.
- Knowledge and communication
    - Codification of knowledge.
        - As much information as possible is documented.
        - Processes and procedures are documented.
        - Several IT systems are made for storing and sharing knowledge.
        - As much knowledge as possible is transformed into explicit knowledge and documented.
        - Existing documentation is detailed and kept up-to-date.
    - Written and simplified communication.
    - One to one communication at the manager and top manager level only.
- Work processes
    - Increased control and quality checks.
    - Make a less complex product design.
    - Simplify production by using more manpower and less machinery.
    - Move more functions and tasks out to bridge the distance between functions in the product development process.
    - Make the product development process more explicit.

The solutions thereby focused on minimising risk and tightening control. These solutions had positive and negative impacts as shown in Table 28 on the following page.

Table 28: List of positive and negative impacts of the implemented solutions

Positive impacts	Negative impacts
The risks of knowledge loss related to employee turnover are reduced through greater reliance on explicit knowledge.	Unexpected product changes.
Current workarounds can be discovered, thereby reducing unnecessary complexity in production and the product development process in general.	Unexpected changes to the product development process.
Processes and procedures can be made more efficient.	Time and resources used on knowledge transformation.
The supply chain network can be redesigned for greater efficiency.	Time and resources used on security and quality check-ups.
Increase the product portfolio and functionality (when outsourcing to a strategic partner). Product functionality can be reduced to fit local market needs.	Cultural implications of reliance on written communication and codified knowledge.
Process descriptions and work documents can be kept up to date, making it easier to share and find mistakes.	The risk of more human error in production.
Encourages a traditional organisational setup with task division and top-down control which can make complexity easier to manage.	Lack of transparency between the headquarters and the subsidiaries.
	Not all knowledge can be codified.
	Not all products or tasks can be separated into subcomponents.
	Encourages a traditional organisational setup with task division and top-down control which may not be suited for all tasks or situations.

The positive impacts were related to increased efficiency, while the negative impacts were related to increased time and money spent on the endeavour as well as unexpected changes to the product, development process and organisation.

The companies kept experiencing problems with the original challenges with globalising the product development process and with the negative impacts of the implemented solutions.
The rest of this chapter will analyse this globalisation process with specific focus on the challenges and implemented solutions as well as the reasons for these challenges and the failure of the solutions, as specified in the project aim in Chapter 1.

5.2 Analysis of descriptive study 1

This section will analyse the globalisation process the case companies went through and investigate why the solutions they implemented to address challenges with globalising the product development process did not resolve them.

5.2.1 Globalisation process
This section analyses the globalisation process the case companies went through.

The globalisation process overall
The Outsourcing Circle (Perunovic, 2009) proposes a company goes through five phases when outsourcing which are cyclic:
1. Preparation

2. Vendor(s) selection
3. Transition
4. Managing relationship
5. Reconsideration

In phase five the company should reconsider whether the relationship should continue, be changed or be discontinued as circumstances change, thereby potentially starting the Outsourcing Circle again from phase one.

Best practice within change management encourages involvement and communication from the start of the project (e.g. Kotter, 1996). A product development process model like for example the stage gate model, encourages clear goals and regular evaluations of whether these smaller goals have been reached (Ulrich & Eppinger, 2008).

The globalisation process in the case companies can therefore be said to have two main problems; (1) it was not a reflective process and (2) it did not follow best practice from change management and engineering project management (e.g. product development process models).

As mentioned in the previous section, in the first phases of the globalisation process only top level management was involved. It was a brief phase where the strategy for employing offshoring or outsourcing was focused on short term gains. The decision-making process at this stage resembled a rational view on decision-making where it was assumed all relevant information was readily available and therefore few contingencies or uncertainties were included wherefrom also the time it took to reach the decision was relatively brief. However, the decision-making process regarding the complications and connected solutions the case companies implemented indicate a decision-making process which resembled the garbage bin model where full knowledge was not available so an overview of the problem area could not be reached, solutions and issues were matched as these appeared, and the best available solution was chosen (Cyert, March & James, 1963; Elster, 1983; Gigerenzer & Selten, 2002; Hayek, 1948; Kahneman, 2003; March, 1994; Rubinstein, 1998; Herbert, 1957).

The best practice advice from change management, project management like the stage gate model and offshoring/outsourcing literature were not followed for the overall globalisation process though the product development process models were used for each engineering project. The closest any of the case companies came to addressing challenges for the globalisation process instead of on a project to project basis were X5 who were building an IT program for global project management (OurModel). It was the first approach at viewing offshoring and outsourcing within the context of project management for the whole organisation instead of on an individual project basis.

There were no reflective actions across the organisation regarding what should happen next. The only iterative action took place on the operational level when the daily managers had to handle problems and challenges the offshoring or outsourcing process presented. This meant the first phases of the globalisation process were difficult to reconsider or re-evaluate as new knowledge was discovered. As a consequence of this separated involvement between the organisational layers and lack of reflective action, a disconnection between strategic and operational action was created. The first phases of the globalisation process, including strategy and preparation thereby became almost static concepts which could not be changed as quickly as changes in circumstances and markets

might dictate. The operational changes therefore had to work within these predetermined parameters. As a result, the operational changes could be in conflict with the current parameters for the organisation and the globalisation process (i.e. organisational structures, organisational culture). Therefore, as later phases in the globalisation process relied on information from previous phases, when the first phases of the globalisation process were insufficiently executed, later phases would also experience difficulties.

The 'learning by doing' globalisation process in the companies resembles the outsourcing strategy called "hard-way" (Willcocks *et al.*, 1995). This theory says that the organisation is pressed to go into a large-scale outsourcing arrangement without having experience and a clear picture of how to manage the process. This results in many unsuccessful endeavours. However, next contracts are often more successful because of the learning effect (see appendix 1.3). However, while some of the case companies felt the challenges they faced had lessened after such a learning period, many challenges remained which can indicate that when companies globalise throughout the product development process learning has to take place on many different levels; both when it comes to managing the overall globalisation process, each stage in this and in managing the relationship and the now global product development process.

Motivation and strategy

The relationship between the headquarters and the subsidiary shifted over time from Transaction Cost (focus on lowering costs) to Resource-Based (focus on developing competences) for several of the case companies in a similar development as the one reported in outsourcing situations (e.g. Vivek *et al.*, 2009). They started by globalising manufacturing and low-level tasks, and only later expanded with design and R&D. The connectivity between production with other functions were often a surprise and as a result moving production pulled other activities with it as indicated in previous studies (IfM report, 2003). Examples are X1, X2, X3, X5, X6, and X7.

In addition to lowering costs, market access was also a key motivator especially when brown-field operations were already in place in suitable locations (e.g. X2, X3, X5 and X6). For X4, however, the process mainly meant refocusing on core competences. Relational Governance (focus on continuous learning and commitment, and relationship governance with an emphasis on trust) was mainly in outsourcing situations where specific competences were sought (e.g. X1 had such a relationship with their supplier in India). However, some companies did not experience such shifts even with more high value adding tasks being globalised. In X7, there was a focus on transferring knowledge to the subsidiary, but the strong security measures indicate a lack of trust more fitting the Transactional Cost approach. This mismatch between the theoretical approach and the value of the task could explain some of the challenges with knowledge sharing and communication as the used methods did not fit the characteristics of the task. The reason for this mismatch could be due to the gap between the strategic and operational level of the organisation. For example, in X6 and X7 the subsidiaries are considered on equal terms with their engineering counterparts in the headquarters on the strategic level. However, the operational approaches to the relationship indicate a more hierarchical relationship, with power centralised in the headquarters.

When the motivation was to gain additional competences, outsourcing to a specialist company was often the choice (e.g. X1). In this case the company often encountered fewer complications than

when other factors were the main motivation. This can be due to the nature of complications which were often misunderstandings, communication and coordination issues. When outsourcing to gain competences the case companies knew what they were looking for so they knew what they wanted from the vendor and what they themselves would control and contribute. There were therefore fewer uncertainties and less knowledge transfer was needed. Outsourcing was also used to gain greater flexibility and lower fixed costs (e.g. X1, X6).

As shown in Chapter 2, transition cost economics (TCE) can explain the motivation for low cost, and the Resource-based view (RBV) can explain the motivation to gain resources and competences. In some of the companies (e.g. X1) a mixture of motivations was present depending on what activity in the product development process is globalised. This can be due to different worldviews, or paradigms, being in force within the organisation and the perceived value of the activity.
The company's background also influence motivation and strategy. Mature (more than 50 years old), and traditionally family-owned companies were slower and more cautious with globalisation (e.g. X2, X3, X4), although it was often followed through into higher level tasks like R&D if this period of caution passed (e.g. X1, X6).

Preparation
When the decision had been made by the top executives to send tasks abroad, the preparation phase started. In the Outsourcing Circle (Perunovic, 2009) the preparation phase has five elements;

(1) Whether to outsource anything.
(2) What to outsource.
(3) Where to outsource to (country selection).
(4) When to outsource.
(5) How to outsource (what kind of relationship and rights).

As the first part, 'whether' to move anything, had already been decided, the preparation phase in the case companies focused on selecting tasks to move abroad and selecting the country. 'When' was decided at the same time as the 'whether' on the executive level to fit in the move with budget planning and other strategic plans for the company. 'What' to move was often decided at the same time on the executive level as well; sometimes with consultation from top managers. When the decision to move abroad had been taken, it was also decided whether to offshore or outsource the given task. The details on 'how' to move were often taken by the managers who had to supervise the implementation. The phases and their tasks as described in the literature regarding outsourcing or offshoring were therefore not employed in the case companies; it was a more dynamic and organic process.

Implementation and management of the relationship
Implementation of moving a given element from the product development process abroad was done according to a loosely defined plan from top managers. Challenges were addressed as they arose by the daily managers. This created a gap between the strategic and the operational level of the organisation.

Implementation thereby became an iterative process of operational problem solving as problems arose. However, as these were kept on the operational level the underlying causes for the problems

were not addressed which meant the problems would often persist in some form. Some case companies finished implementation but in the management of the relationship phase this iterative problem-solving process continued as it had not been resolved during the implementation phase.

5.2.2 Why complications remained
There is two ways to address the complications; one is why they arise and another is why the solutions failed to adequately address them.

As mentioned in 5.2.1, some of the complications can be explained due to the lack of (1) following best practice advice from change management and engineering project management and (2) a reflective process within the globalisation process itself.

The solutions the companies implemented were all on the operational level. The reasons for why the solutions did not resolve the complications can be explained due to the companies' focus on single-loop learning (Argyris, Putnam & Smidth, 1985). The companies' tried to cure symptoms but not the underlying reasons for them; the 'illness' so to speak. Therefore the complications remained even if some of the solutions could have benefits on the operational level.

These aspects of explaining the complications within globalising the product development process will be analysed in further detail in the following sections.

Organisational theory
The challenges can be explained using the theories within organisational studies.

Organisational structures, processes and methods were, for example in X5, in conflict with the goals for offshoring as illustrated in Chapter 4. These organisational aspects still supported a way of working which excluded offshoring. Using Morgan (1986)'s metaphors then many of the case companies implemented solutions fitting the machine metaphor (efficiency, order, standardisation, measurement and control) in an effect to gain control and minimise risk but the complex tasks sent abroad, for example R&D in X6, required learning and interaction similar to the brain metaphor (learning, distributed control, knowledge and networks). This mismatch between organisational features and the goals with and characteristics of the task, could therefore explain the complications. The problems can also be explained as being an example of different subcultures existing within the same organisation (e.g. professional, departmental, engineering) (see for example Schein, 2004) or national differences (e.g. India and China score very differently than Denmark on Hofstede's dimensions) (e.g. Schein, 2004; Hofstede, 2004). Different power bases can also explain some of the organisational challenges (Mintzberg, 1996). Some people, departments and projects benefit from certain actions and will promote these and fight against those which lessened their power position (see for example Pfeffer, 1981).

Using the organisational cybernetics model, there is a lack of control in the globalisation process due to a lack of measured key performance indicators and a continuous reflection and correction of actions to follow an overall goal (e.g. Pettigrew, 1973; Mumby, 1988; Pfeffer, 1981; Hatch & Cunliffe, 2005; Ashby, 1956; Wiener, 1948). This is likely due to the before mentioned decoupling of the different layers of the organisation and a lack of an overall goal and plan for globalising the product development process which meant that implementation as well as control were only on the

operational level. Using this approach miscommunication observed in X5 and X6 could be because the communication process is not correctly measured and therefore control actions cannot be implemented to correct errors. This is something the lack of transparency of the process to the headquarters indicates, as does the lack of clear performance measures for both subsidiaries and the globalisation process itself as well as for expatriates. However, the individual product development projects were often highly monitored and controlled with regular virtual meetings, status reports and check-ups (e.g. X6). That complications remained indicate it was not the right key performance indicators which were measured. This was likely because of the before mentioned decoupling between the operational and strategic level of which on the project level key performance indicators only measured on the operational level.

The challenges can also be explained using change management (e.g. Kotter, 1999; Lewin, 1947; Schein, 1964; Kotter, 1996). Employees were not involved and not kept informed of why, how and when the product development process was globalised, which created resentment and fear among many of the employees (e.g. X5, X6). Furthermore, a burning platform and top management focus were not created. This could be due to the before mentioned focus on short term and operational goals and solutions in relation to challenges within the globalisation process of product development process activities.

Problem complexity
The research area was in Chapter 3 classified as a type C problem with a pluralist approach and can therefore be expected to contain interdisciplinary problems and interest conflicts which would make it difficult to agree on solutions. However, a solution is assumed in such situations through compromise.

Therefore, viewing the challenges to globalising product development within this frame, internal resistance and differences in culture are to be expected and a compromise needs to be reached between the different stakeholders. An example is the challenges found in many of the case companies in relation to the difference in engineering practice across the different organisational units in the global product development process. At each of the interfaces, whenever communication and knowledge sharing needed to take place, these different practices created complications (see Figure 25 on the following page).
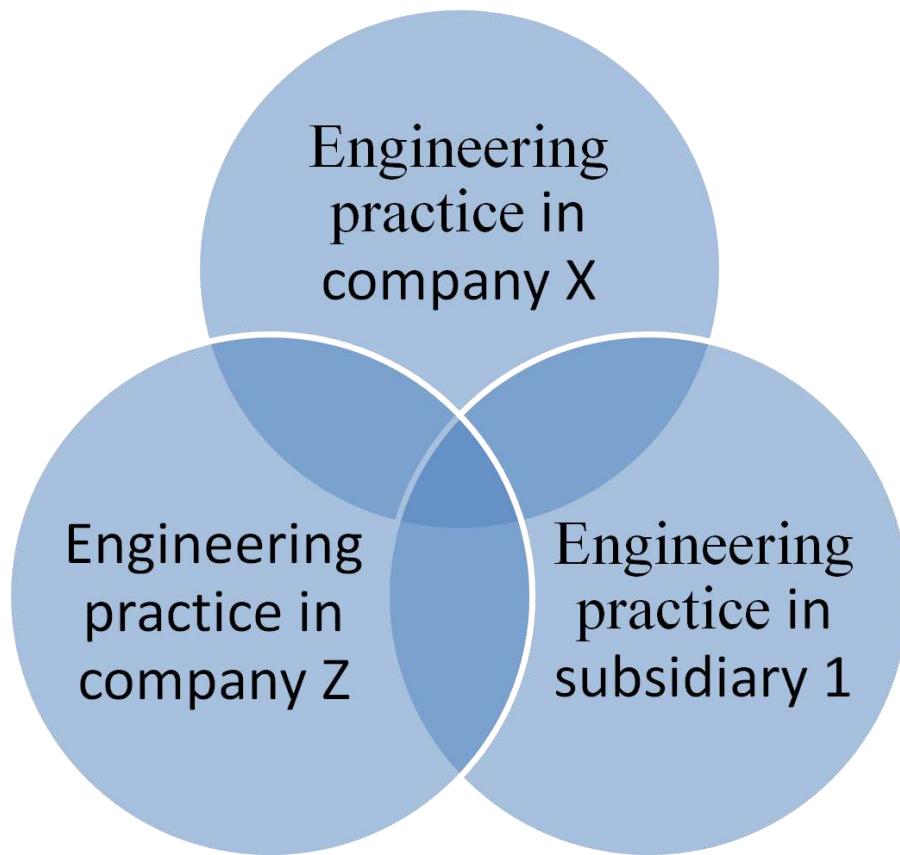
Figure 25: An example of interfaces which created complications.

The case companies often chose to try and implement the same engineering practice throughout the global product development process in all engineering activities (not just the ones in use in interfaces). This practice was often the one used in the Danish headquarters. However, complications remained. Within this frame, this can be explained as due to a lack of a compromise between the different stakeholders (e.g. one common engineering practice consisting of some aspects from each of them, different engineering practices but a common 'language' in interfaces to translate between them).

The framework which is to be developed therefore needs to follow these aspects concerning the problem complexity it is to address in order to create a framework of reality which all the involved stakeholders can accept.

Global product development
Eppinger (2006) listed 10 success factors for global product development (see Chapter 2). Some of these were missing in the case companies and could help explain the challenges. This includes a lack of identification of core competences (e.g. X4), a lack of a collaborative culture (e.g. X5), and a lack of training of the staff (e.g. X3 and X2).

However, this alone is not enough to explain the challenges. First, the companies attempted to implement process and product modularity as advocated as a success criteria by Eppinger (2006) but this was not always possible. Furthermore, the challenges show other factors are important to

consider such as knowledge properties and softer issues like culture and organisational structures and processes.

Therefore, there are different approaches to globalising product development process activities. Though many in between strategies exist, there are two fundamentally different approaches;
1. Minimising the chance of negative consequences by limiting the tasks and functions considered for offshoring and outsourcing and thereby avoiding high risk situations.
2. Minimising the chance of negative impact from offshoring and outsourcing through considering engineering and management aspects on the operational and strategic level.

These two approaches can be compared to the traditional outsourcing focus and the transformational outsourcing focus. In traditional outsourcing there is a handing over of legacy systems to the vendor in order to enable in-house focus on building the new systems (Heywood, 2001; Cullen & Willcocks, 2003). Transformational outsourcing is a long term relationship where the vendor assists in stimulating continuous business change while also achieving operational effectiveness. In other words, the relationship changes/transforms the organisation (Click & Duening, 2005; Linder, 2004; Heywood, 2001).

The findings showed that a company should look for the following engineering and organisational characteristics in a task before moving it abroad.
Engineering project related

- ➢ The product development process.
  - o The product
    - ▪ Maturity of the product affected by offshoring.
      - • A more mature product is likely to require less interaction.
    - ▪ Requirements for the product in regard to which features can be altered and which cannot to be competitive in different markets in order to determine its complexity.
    - ▪ Modularity of the product.
  - o Product design
    - ▪ A design which uses detailed design methods known to all the globally disbursed engineers and a simple setup with few complexities (for example a low level of interacting mechanical parts) is easier to send abroad as it requires less explanation and knowledge sharing.
  - o Knowledge
    - ▪ What knowledge is needed, its format and where it is. Explicit knowledge is cheaper and easier to transfer.
    - ▪ Amount of knowledge which is or can easily be documented. Knowledge with a low degree of tacitness, ambiguity, stickiness to local context, and complexity is easiest to transfer (Hong & Nguyen, 2009).
    - ▪ How to ensure knowledge sharing needed between key personal for the task to be carried out successfully takes place.
  - o Strategic importance of the task or function and the product and process knowledge involved in its development as this can influence how the task is moved.

- o Knowledge of all interfaces (e.g. input, communication) to internal and external stakeholders and the ease with which these can be changed, moved or ignored.
- o Likely cost of transferring knowledge which is not documented.
- ➢ Modularity of the product development process
  - o How easy it is to separate the product development process into smaller, clearly defined and separate tasks.
- ➢ The product development process
  - o Interconnectivity of the task (e.g. amount and degree of interfaces).
    - ▪ If the task is not dependent on input and knowledge from many sources (e.g. customers, other departments, suppliers) it is easier to separate a clearly defined task which has limited interaction with other parts of the product development process.

Organisational characteristics

- ➢ The company's history with global tasks, in particular engineering tasks.
  - o Experience with globalising product development process activities brings awareness of possible negative impacts such as coordination, communication and culture and the success of previously implemented actions to counteract these.
- ➢ Culture
  - o Likely cultural differences between the organisational units which needs to communicate, including differences in engineering practice.
  - o The communication cultures of the units involved.
    - ▪ If these are different this needs to be considered when deciding upon how to communicate, share information and transfer knowledge. Procedures and processes developed for communication, information and knowledge sharing therefore need to balance according to the different communication cultures.
- ➢ Communication
  - o Available documentation and written procedures.
  - o How communication, coordination and knowledge sharing can continue virtually.
    - ▪ If the task considered for offshoring can be documented and the work processes detailed step by step it lessens the reliance on oral communication and a common frame of reference can be used when debating the task in later communications.

Some of these elements are mentioned in the literature review in Chapter 2 e.g. product and process modularity (Eppinger, 2006), while some are new additions based on the findings (Chapter 4) and the analysis in this chapter.

In the first approach, called the Avoid Risk (AR) approach, the company can attempt to avoid situations which can cause difficulties by limiting the tasks and functions considered for offshoring or outsourcing. This means choosing a task to be moved abroad which has a high degree of modularity and a low level of complexity and thereby requires little interaction. This is similar to the approach advocated by Stringefellow *et al.* (2008) who investigates interaction intensity and interaction distance as key parameters to decide whether a given task should be moved to a given location.

In the second approach, called the Confront Risk (CR) approach, a complex task which requires a high degree of interaction can be sent abroad. This could, for example, be R&D tasks, conceptual design, and embedded functionality of the product or other complex elements of the product development process. A task or function which was deemed too interrelated or complex for the AR approach can be selected under this approach. This second approach assumes that process and product modularity cannot be reached for all tasks and functions companies move abroad. In the case studies a key factor for failure with implementing the solutions were that they all followed the AR approach whereas the task in question belonged to the CR approach. This meant the task could not achieve full product and process modularity and hence there was not a clear division of tasks and interaction which the AR approach encourages.

The AR approach, by limiting situations which can cause the negative impact of globalising product development process activities, also limits the way communication, knowledge sharing and collaboration take place. The concern is mainly with making the product in a more efficient way so it is mostly product knowledge which is moved. Moving abroad for cost reduction and in some cases for market access could fit the AR approach. The focus is therefore on input to the foreign office.

The CR approach focuses on developing strategies for handling the challenges and thus allows for collaboration and interaction. The CR approach is needed when companies go abroad to gain new or additional competences. In the CR approach not just product knowledge but also process knowledge needs to be moved so the new knowledge which comes from the foreign office can be incorporated. The focus is here on output. Figure 26 illustrates this point. The AR approach strives towards low risk but also provides little possibility for learning across the organisational units. The CR approach relies on collaboration and knowledge sharing across borders. The more process and product knowledge the organisation shares and collaborate on across borders, the greater the possibility for organisational learning and growth. However, the risks will also be greater because the desired learning synergies might not develop and the headquarters could risk losing control over the process knowledge they send abroad.
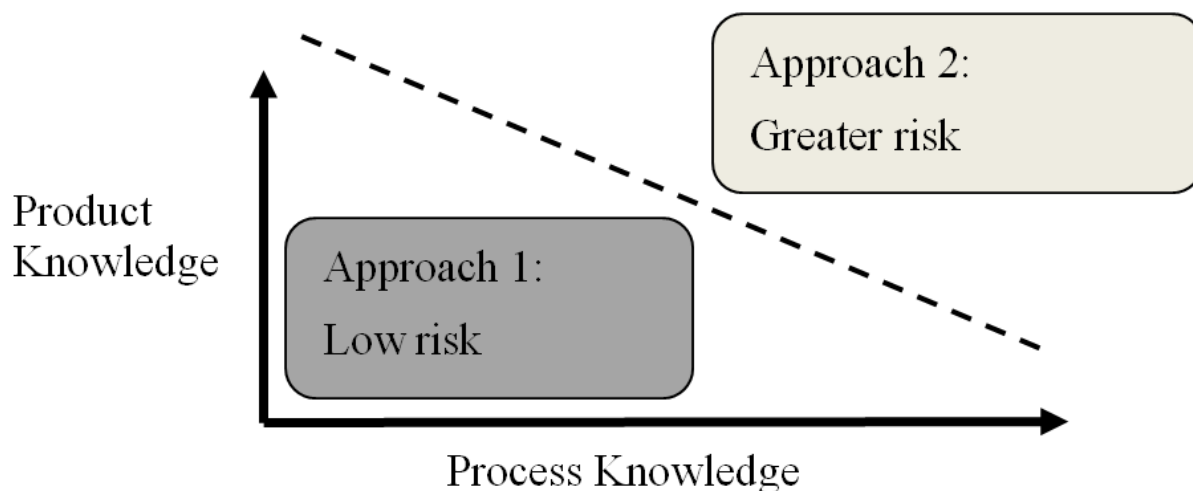
Figure 26: Risks and benefits of moving simple or complex tasks abroad.

A company could change approach due to changes in external circumstances like new market needs or that the change, which has now been completed in the product development process, opens up for new possibilities in the organisation.

A framework therefore needs to be developed which show how success in globalising product development process activities can be achieved when following the CR approach and how to ensure the right functions and tasks are selected for the AR and the CR approaches.

Viewing the challenges in a network perspective
A new way to view the challenges within offshoring and outsourcing of product development process activities is to use the GEN framework which includes the network configuration approach (Zhang *et al.*, 2007, 2008).

The GEN framework says that there need to be a match between context, capabilities and network configuration. The capabilities are a result of 4 elements (1) Communication and sharing within the GEN, (2) Integration and synergizing within the GEN, (3) Innovation and learning within the GEN and (4) Adaptation and restructuring within the GEN. Configuration is a result of the following 4 elements (1) Network structure of the GEN, (2) Coordination mechanisms for the GEN, (3) Governance system for the GEN, (4) Support system for the GEN. Using X1, X5, X6 and X7 as examples, the mismatch found in these case studies between the capabilities and the configuration characteristics can explain the challenges the companies faced (see Table 29 on the following page).

Table 29: Findings from the case studies mapped to the GEN framework

	Capabilities characteristics according to the *GEN framework elements*	Configuration characteristics according to the *GEN framework elements*	Cause for complications
X1	Communication and knowledge sharing is a mixture of documentation and exchange programs and visits. Integration is done through top-down management from the headquarters. Innovation and learning is sought to be worldwide but is currently mainly from the headquarters to each location.	The network structure consists of several engineering locations in the USA, China and Denmark. Coordination is mainly through documentation, portals and telecommunications. Governance is through project run-throughs after they have completed. Support systems are telecommunications and online document sharing.	The current coordination mechanisms are well suited to the situation. However, governance is again project-based and local. Furthermore, knowledge sharing structures are still mainly one-way from the headquarters to the other engineering locations. This limits innovation and learning. Furthermore, the current support system is more oriented towards check-ups than two-way knowledge sharing.
X5	Communication and knowledge sharing is through documentation and expatriates. Integration is done through top-down management from the headquarters, often via expatriates. Innovation and learning is sought to be worldwide but is currently from the headquarters to each location.	The network structure consists of engineering locations in the USA, China and Denmark. Coordination is mainly through documentation, portals, telecommunications and expatriation. Governance is through stage gates through the project. Support systems are telecommunications, online document sharing and exchange programs.	Using expatriation ensures knowledge transfer and control over the project. However, it does not fulfil the company's desire to reduce costs through the use of Chinese engineers. Governance systems are project based which limits the company's desire for global knowledge sharing.
X6	Communication and knowledge sharing is increasingly being documented and streamlined. Integration is done through top-down management from the headquarters. Innovation and learning is sought to be worldwide but is currently mainly isolated to each location.	The network structure consists of several engineering locations in the USA, India and Denmark. Coordination is mainly through documentation, portals and telecommunications. Governance is through stage gates for each project. Support systems are telecommunications and online document sharing.	There is a lack of transparency between the engineering units due to the separation caused by the heavy reliance on documentation and top-down management. The current coordination mechanisms are therefore not suited for a situation where complicated knowledge has to be shared virtually. Furthermore, the governance system is not global or unifying which further emphasises this point. Finally, the support system does not allow for innovation and sharing in its current use with a top-down focus from the headquarters.
X7	Communication and knowledge sharing is through documentation and expatriates. Integration is done through top-down management from the headquarters and several security and control mechanisms are in place. Innovation and learning is sought to be worldwide but	The network structure consists of engineering locations in 7 countries. Coordination is mainly through documentation, portals, telecommunications and expatriation. Governance is through stage gates throughout the project. Support systems are telecommunications, online	Project based governance and heavy top-down control from the headquarters limits learning and innovation. Furthermore, the current coordination mechanisms are top-down which limits integration.

	Capabilities characteristics according to the *GEN framework elements*	Configuration characteristics according to the *GEN framework elements*	Cause for complications
	is currently from the headquarters to each location.	document sharing and expatriation.	

For X1 the needed capabilities are global innovation and learning as well as integration between the engineering units. They are similar to X6 but the current configuration is better matched. Communication and knowledge sharing is a mixture of documentation, exchange programs and visits which encourages knowledge transfer and learning. However, coordination is still mainly top-down and controlled from the headquarters and governance is project based and local. Adaptation and restructuring was often rare and slow. It was often made difficult due to the network structure where most of the network were still centred around the headquarters. Furthermore, the current support system is more oriented towards check-ups than two-way knowledge sharing. The current configuration therefore does not fully support the desired capabilities.

In X5 there is a growing market in the developing world as well as cost pressures to deliver cheaper projects. The company wishes to develop capabilities to address local needs using one global approach, address cost pressures and share knowledge globally. The physical location is well suited for each market need with the Chinese office expanding. Communication between locations is limited and is on a project basis. Communication and knowledge sharing is through documentation and expatriates. The company is increasingly creating IT tools for knowledge sharing and coordination; however these are rarely used. Organisational structures encourage a focus on 'billing hours' to the client and on possessing valuable knowledge. The current configuration therefore does not deliver the needed capabilities.

For X6 the needed capabilities included global innovation and learning as well as integration between the engineering units. However, the current configuration consists of global distributed units where coordination is mainly done through documentation and top-down communication in each unit. Furthermore, the governance system is project based and the support system is oriented towards one-way communication. The company's current configuration therefore does not support the desired capabilities which can explain the challenges the company faced in engineering offshoring.

In X7 the company desires a global product development process with collaboration and integration and has opened new product development centres in key upcoming markets. Support systems like IT tools are not accessible to the Chinese engineers due to fear of losing IP rights, which makes knowledge sharing difficult. Communication is mainly from the headquarters and out, making it difficult for the subsidiaries to participate actively in innovation and learning.

From these cases if the desired capabilities can be delivered using modularity and an arms-length transition, the organisation finds it easier to create the configuration. However, a truly integrated approach can be hindered due to organisational structures encouraging other capabilities.

Using the GEN framework, the difficulties the companies faced can be explained as a result of a mismatch between the contextual features, critical capabilities needed to succeed in a contextual

circumstance, and the company's configuration characteristics to deliver these capabilities. Mainly the contextual features, the market needs and customer requirements had changed quickly in recent years. This has meant that new capabilities were needed. However, the companies were slow in changing all the configuration characteristics. The network structure often fitted the capabilities in size, number and location. The role division was often out-dated with main power lying with the headquarters and subsidiaries which were previously in strong markets but were now in secondary markets (for example the US offices for X5 and X6). The operations processes were often a critical point. Information was frequently one-way and focused on input. Governance systems were often also not suited to the new capabilities and reflected old structures. Furthermore, it was often that clear performance measurements were lacking and the main focus was only on the given project. Support infrastructure in terms of IT and other technical tools were well developed in the cases. However, the organisational culture and behaviours would often result in these not being used as intended. External relationships were also well matched with case companies working with suppliers, customers and other external stakeholders.

These findings indicate that the GEN framework can be used to explain aspects of the challenges with globalising product development process activities which the other analytical methods did not catch. (For a detailed analysis using the GEN framework see Hansen *et al.* (2011) and Hansen *et al.* (forthcoming))

Knowledge management

Many of the challenges are related to knowledge management. This was both in relation to how knowledge was managed in the organisational units and the global organisation, and how it was transferred between locations.

Knowledge management has three key areas which can be the source of problems:

1. Knowledge management in the global organisation.

2. Learning.

3. Knowledge transfer between locations.

Knowledge management in the global organisation

The organisational infrastructure determines ease of knowledge management (Debowski, 2006). This includes managerial, technological and social elements of the organisation. For example, reward structures should encourage knowledge sharing, and managers should actively promote such behaviour. In X5, this was complicated by conflicting reward structures and as the important performance goals were related to clients. This resulted in a culture which officially praised knowledge sharing, but, in practice, it rarely occurred if no client could be billed for the hours. In many of the other case companies, for example X6, this was also complicated by a focus on limiting communication by focusing it on a manager who would then pass the message on to the engineers in his group which made knowledge sharing less transparent and more focused on the individual rather than on the group or organisation. In X6 legacy structures also made organisational learning more difficult as each unit was used to following their own procedures, which could still be seen in individual supplier selection in the different departments.

Sharing knowledge across a global organisation requires a focus on technical aids (Debowski, 2006). However, it is important these aids fulfil the users' needs and not give too little or too much information. In X5 there was a problem with information overload as illustrated in the following statement from a top manager in X5, *"Yes, let's be honest about it. I think one of the things we suffer from and very much in the Danish office is overload of information and new systems, new procedures. Each year we introduce something new and then we believe this is gonna solve it."* X6 was also implementing new IT systems as a way to resolve communication and knowledge sharing issues. However, as these cases illustrate, IT can be a tool to solve a problem but not the solution itself.

A collaborative culture which encourages knowledge sharing is important (Debowski, 2006). This includes group work, collaboration, interdisciplinary knowledge sharing, and long-term priorities (Debowski, 2006). To promote this in X5, all project members in the Danish office are located together when working on a project even though they are from different departments as illustrated in this statement by a top manager in the company, *"When we start a new project we usually relocate people to one area, then we do all kinds of team-building activities, but the most important is that they work next to each other on a daily basis".* Interdisciplinary knowledge sharing is considered to be one of the core competences in X5. However, when it comes to sharing knowledge across units or between projects, performance goals discourages this as the work hours cannot be billed to a client. In X7, the problem with knowledge sharing in the Chinese subsidiary has been complicated by the rules and regulations regarding security imposed on the Chinese engineers.

Finally, the type and structure of the organisation is also considered to influence the way knowledge transfers across the organisation. All the case companies operated in matrix or functional organisations. A matrix organisation, where functions are carried out both within projects and along functional lines, benefit by providing the possibility of *"cross-fertilisation of ideas"* (Debowski, 2006:116). However, organisational structures and the culture can hinder this as seen in X5, X6 and X7. The format of the knowledge can also influence this as seen in X2, X3 and X4 where a lot of the needed knowledge was tacit in nature and therefore difficult to move due to its embeddedness in culture and routines (Polanyi, 1966; Nonaka & Takeuchi, 1995; Castells, 1996; Debowski, 2006; Hansen *et al.*, 1999; D'Eredita & Barreto, 2006; Tsoukas, 2003; Davenport & Prusak, 2000).

Learning

Learning can happen at various levels; (1) Individual (Tsang, 1999; Von Krogh, Nonaka, & Ichijo, 1997), (2) Group (Lave & Wenger, 1991; Wenger, 1998) and (3) Organisational (Inkpen & Dinur, 1998). The SECI knowledge model (Nonaka *et al.*, 2002) shows how individual knowledge can become organisational knowledge. However, organisational knowledge can also become individual knowledge as this is how employees learn organisational routines as seen in the case companies through training of local staff in the subsidiary.

Individual learning was strong in the case companies as was group learning. Expatriates gained many skills like cultural and local market understanding (see Chapter 4 for details), as did the engineers who sat with the daily global development projects in terms of challenges and solutions (see Chapter 4). In some cases these became organisational or group knowledge through the development of documents and processes. The global teams also learned how to interact and to make the daily communication function.

However, in many cases learning at the individual and group level did not transcend the levels in which it was discovered. The companies therefore did not gain full advantage of the knowledge available in its own people, networks and systems.

In other words, double or triple loop learning in regard to the problems was not carried out. Therefore the solutions could counteract actions implemented on the strategic level (Arguris, Putnam & Smith, 1985).

The governing variables of the case companies were to maximise winnings and minimise losing (see Table 30). Therefore the solutions the managers implemented were concerned with control and supervision. As a consequence there was little knowledge sharing and learning across groups and functions. This meant single loop learning was a key component of the organisation (Arguris, Putnam & Smith, 1985).

Table 30: Governing variables and actions leading to single-loop learning
Source: Argyris, Putnam & Smith (1985)

Governing Variables	Action Strategies	Consequences for the Behavioural World	Consequences for Learning
Maximise winning and minimise losing	Own and control the task (claim ownership of the task, be guardian of definition and execution of task)	Defensive interpersonal and group relationship (dependence upon actor, little additivity, little helping of others)	Single-loop learning

Using single-loop learning meant the solutions addressed symptoms and not causes. The underlying causes for the challenges were in other words not investigated (i.e. double-loop learning) and the same challenges and complications could often reappear in new global product development projects (e.g. Argyris *et al.*, 1996; Smith, 2001; Anderson, 1997). This was not a conscious decision from the daily managers or from the top managers to address challenges in this manner. This is an example of the difference between "theory in use" (the theory that actually governs a person's actions) and "espoused theory" (the reasons and justifications a person gives for doing a certain action). In other words, the strategic level might indicate knowledge sharing as a key goal for the organisation but if operational conditions encourage another kind of behaviour this is the one which is followed (e.g. X5). There was therefore a need for double-loop learning in the organisations on several levels; in regard to the globalisation process itself, in its implementation and in the daily management of the global product development process.

Knowledge transfer between organisational units

A key challenge when transferring knowledge was the format it was in (e.g. Polanyi, 1966; Nonaka & Takeuchi, 1995; Castells, 1996; Hansen *et al.*, 1999; Chen & McQueen, 2009). The tacit nature of knowledge in production (e.g. X2) and engineering (e.g. X6) made it difficult to transfer it in its current format. The case companies therefore used different tactics to either transform it to a format which was easy and cheap to transfer (e.g. explicit knowledge in for example the form of documents) or in its current format (e.g. tacit knowledge sharing through socialisation by bringing up foreign workers and engineers to Denmark or using expatriates).

Universal technical knowledge can easily be mapped into a series of steps or components of basic technology, and is the easiest to transfer (e.g. Child & Faulkner, 1998); Brown & Duguid, 1991).

This is due to low scores on tacitness, ambiguity, stickiness to local context, and complexity (Hong & Nguyen, 2009). However, not all engineering standards for technical knowledge are the same around the globe due to difference in engineering practice (e.g. X5). X6 had similar issues with different standards being used in the offices in the USA. The reason was that the divisions felt their work needed to reflect local conditions. It can be concluded that technical knowledge is not always easy to transfer, and that its format and how it can be transformed are important. Furthermore, young subsidiaries may more easily accept the headquarters' way of doing things, but subsidiaries which have existed for a long time – or are the result of an acquisition – have already developed their own practices which make it more difficult to standardise the engineering approach.
All the companies used different kinds of knowledge transfer mechanisms; 'shadowing' and expatriation for tacit knowledge, and written procedures and protocols for explicit knowledge (e.g. X1, X2, X3, X5 and X6). However, this was due to a 'learning by doing' process and not a clear definition of each knowledge type and the best way to transfer it as shown in Hong & Nguyen (2009). As the globalisation process was a 'learning by doing' process an unstructured knowledge transfer took place in all the case companies with very little knowledge transfer planned at the time of implementation. For example, in X2 where work processes were written down as they were discovered and moved, and in X4 where core competences were only discovered after the move, resulting in the outsourcing endeavour turning into an offshore facility.

When transferring knowledge *"the overall effectiveness depends on the appropriate choice of mechanisms that help distribute, modify, and develop knowledge relevant for the local environment"* (Hong & Nguyen, 2009:354). The subsidiaries in, for example, X6 and X7 indicated that they needed knowledge relevant for the local environment and transfer mechanisms which were appropriate for the local environment, but the Danish headquarters wanted to streamline the knowledge transfer. The headquarters' solutions were based on Danish culture with regard to how engineering practice, communication, and knowledge sharing should take place. However, other engineering practices and cultures often encourage another way of communicating, sharing knowledge, and practicing engineering (e.g. Hall, 1976). This could be one of the reasons for the different approaches in the organisational units. It suggests an unstructured copying approach where adaptation and fusion may have been more advantageous as it considers the local context as illustrated by Hong & Nguyen (2009).

Knowledge links

The challenges the companies faced can also be seen as being caused by the changes in the links and nodes in the knowledge network (Rudberg & Olhager, 2003).

An example can be when a given engineering task done within a R&D department in Denmark has to be moved to a subsidiary abroad, as was the case for X6. The move affects how knowledge can be shared to employees in the new location, within the global R&D department and with other departments, as well as with other stakeholders inside and outside the company.
The challenges the companies face in regard to knowledge sharing can be viewed as exemplified by these severed links which have resulted in knowledge transfer vital to carrying out the task not having taken place. The short term focus and brief preparation phase as well as the decoupling between the organisational layers, meant the companies did not investigate which links would be affected by the move and thus did not compensate for this development.

Such links can be official or unofficial meaning that some of these would be written down and be a part of organisational processes and procedures. These would be easiest to find and evaluate in terms of a move. However, some of these would be unknown and as such would, like tacit knowledge, be more difficult to find and recreate during a move.

5.2.3 Operational implications
Using the theoretical perspectives on the case companies the following operational suggestions can be made to improve the situation:

> Changing some of the technical and organisational interfaces to better fit with global product development process activities.
> Changing organisational structures to better facilitate global knowledge sharing and a global product development process.
> A communication plan with clear communication lines and responsibilities.
> A plan for how to move knowledge, when, to where and who has responsibility for this.
> A plan for how the collaboration can take place; the technical tools, the human factors like development of trust, educational differences and cultural considerations.
> Include key people affected by the change both in the foreign office and in the home country in creating these plans to ensure commitment, transparency and cultural considerations.

However, it should be noted these changes are based on single-loop learning and do not address the key difficulties regarding the need for double-loop learning mentioned previously, nor do they address the gap between the strategic level of the organisation and the operational solutions. Implementing these changes will therefore not be a "quick fix" for the complications the case companies encountered.

There is therefore a need for a framework which can ensure this connection between the operational and the strategic level of the organisation with a focus on double-loop problem solving when globalising the product development process.

5.3 Analysis of descriptive study 2

This section analyses the findings presented in Chapter 4 with specific focus on the most interesting findings related to expatriates. It is divided into a section that confirm previous findings and literature, and one which either contradicts previous findings or presents new findings.

5.3.1 Findings consistent with literature
Preparation
The findings indicate that, as proposed by Edström & Galbraith (1977), Collings *et al*. (2007) and Tungli & Peiperl (2009), there are several reasons for expatriation.

In X5 the main reasons were filling positions where there is a skill gap, organisational development, setting up a new operation, and training and hiring of local staff. Regarding the reasons to fill positions with a skill gap, X5 sends project management professionals (specialists) to deal with project management in China, as there is a lack of qualified Chinese project managers. It is generally considered to be the most common reason for using expatriates. Moreover, the company send

expatriates to China to ensure the same engineering practice is conducted there as in Denmark. Project managers try to bring the Danish organisational culture to the Chinese office to encourage this. 95% of all projects in China, especially technically complex projects, are managed by a Danish project manager, which allows transferring of project management skills to the Chinese office. This tendency is also observed in the office in the USA.

Regarding the reason that it is for organisational development then it was found to be highly relevant for the Chinese office as the office there was still being developed. While this is needed for the fast growing Chinese office it is not needed for the American market as it is a declining market. Therefore setting up a new operation was also found to be relevant for the company, especially in China. Another reason mentioned in literature, training and orienting local staff, is closely connected to organisational development and setting up a new operation as these tasks also include recruiting working personnel, and thus is found more appropriate in the Chinese office.

All reasons listed in literature - except managerial development – exist in X5. However, the expatriates and top managers believed the top executives in X5 would need international experience as stated by a top manager that "*expatriation is a part of the strategy of the future leaders*". The reason is that the company tries to become international and therefore it wants to have top managers with international work experience. There is clearly a gap between the lack of ability to grow internally through expatriation at lower levels and the ideals for top leaders as detailed in the following sections.

The expatriates believed selection criteria in X5 were those also mentioned in the literature (e.g. Brewster & Scullion 1997; Tungli & Peiperl, 2009), in particular technical expertise, expatriate's willingness to go, experience in the company and leadership skills. However, consistent with the proposition by Schiuma *et al*. (2003) and Harris & Brewster (1999), X5 did not have a clear selection strategy for the expatriates and these parameters were speculations from the expatriates and differed depending on the assignment they had been sent on.

Stay abroad and success factors

The findings indicate that, in accordance to the model by Wayne (2004) regarding influences on the success of expatriation, lack of language fluency and high level of national culture novelty make China a more challenging expatriation location compared to USA. This was because all the Danish expatriates spoke good English but none spoke any of the Chinese dialects and few Chinese outside of the office spoke English. National culture novelty is also large in China but less in the USA when compared to Denmark based on an absolute difference score regarding the difference in Hofstede's (1980) four dimensions of national culture between the home-country and host-country. According to his dimensions Denmark and China are faced with a huge cultural difference while the difference between Denmark and USA is significantly lower. Thus it can be said that it is more difficult for the expatriates to adapt to life in China than in USA. The mismatch in responses regarding cultural differences in China where some claimed there was a small cultural difference could be explained by the fact that several interviewees only considered the locals they interacted with, whom were all highly educated Chinese and mainly from the same company and same educational background as themselves, when comparing the two cultures.

At the same time high promotion expectations and a free choice of taking up IA, for the majority of expatriates, positively affects the overall success of expatriate experience (Wayne, 2004). Supervisor support to the expatriate, has been shown to be a significant predictor of expatriate performance (Kraimer *et al*., 2001), but is not present in X5, as the expatriates are not provided with a mentor during their IA. However, several expatriates expressed the desire to have this. Perceived organisational support also influence success of expatriation and has three parameters: adjustment, career and financial (Wayne, 2004). In X5 adjustment assistance consisted of relocation assistance and limited training. The company has improved the services offered to expatriates considerably during the last years though no cross-cultural training or language training is provided. Current organisational policies therefore ease to some extent transition and adjustment of expatriates and their families, however several practices, like cross-cultural and language trainings, are not yet implemented which could ease expatriate adjustment to the new culture. According to the findings, X5 does not have career planning sessions before sending employees on IAs or upon return, nor is there any long-term career planning. It can therefore be said that perceived organisational support regarding career is underdeveloped in the company at present. Perceived organisational financial support in X5 includes higher salary, mobility allowance, spouse support, pension in Denmark, housing, car, insurances, good transportation, one annual trip home and leave upon return if desired. The company also gives a relocation leave which is two days in the host country and two days in the home country. However, it was mentioned by HR managers focusing on China, that expatriates in X5 were used to comparing themselves with expatriates from the mother company who got more financial support. However, the expatriates did not mention this issue as a problem. The financial support can be concluded to be beneficial but that expatriates would like to see some improvements in the area.

Lack of leader–member exchange negatively relates to expatriate adjustment and task performance; while perceived organisational support adjustment, and especially lack of cross cultural and language training, negatively relates to commitment to the parent company and insufficient career support has negative influence on commitment to the organisation. In this way, several factors can be identified that require improvement in order to increase the level of expatriate adjustment, organisational commitment, and task performance of expatriates in X5.

The company does not have any clear measurable criteria for performance evaluation on IAs which is consistent with the finding by Black *et al*. (1992). Moreover, Black *et al*. (1992) mentioned that different researchers used different criteria for measuring the success of IAs, which was also consistent with the findings from the study, where different success criteria were named by expatriates depending on the assignment's goals (e.g. educating Chinese employees and project success). The different criteria were assumed by the expatriates but were not official and were based mainly on their personal perception. Using premature return as success criteria, X5 would need to investigate the reasons for premature returns of American expatriates and why many leave the company after returning home. The reasons for these high numbers are not investigated which could indicate the company could benefit from investigating these factors more fully (Tungli & Peiperl, 2009).

Collings *et al*. (2007) also point out the importance of the existence of a performance management system, and highlights that it helps in achieving the set goals for expatriation assignment. While X5 has a performance measurement system (the Danish MUS system), it is used for general evaluation

of employee performance through yearly conversations with the supervisor and goal-setting and not specifically for evaluation of expatriation assignment which could leave room for improvement in regard to such assignments.

Companies can develop seven career development strategies and the more attention the organisation gives to these factors, the stronger job embeddedness to the company is expected to be (Feldman & Thomas, 1992; Shen & Hall, 2009). Job embeddedness between X5 and the expatriates is middle to low, as the company provides a choice for accepting or rejecting the IA and provides a job upon return in 95% of cases, although many expatriates are not satisfied with the offered job. It was also noted that it became more difficult during recent years due to downsizing to find appropriate jobs for repatriates. Also, the company does not provide a mentor program nor does it take steps to be sure that IAs do not hurt the person's career advancement, as it does not provide promotion upon repatriation, does not utilise the person's newly acquired skills upon return nor does it give realistic job previews to bring expectations more in line with realities, while several expatriates mentioned that this would be an advantage in order to avoid dissatisfaction of expatriates when promotion is not provided upon return. Communicating to the employee that IAs are part of an overall career plan was also not provided. This increases the risk of expatriates leaving the company upon repatriation (Feldman & Thomas, 1992).

Knowledge Sharing
The expatriates gained knowledge in several areas as described by Berthoin-Antal *et al*. (2000); (1) knowledge about what (e.g. differences about customer preferences), (2) why (e.g. understanding how culture differences affect cross-cultural understanding), (3) how (e.g. management skills such as delegating responsibilities), (4) when (e.g. knowledge about the effect of timing), and (5) who (e.g. relationships created over the life of assignment).

However, that expatriates develop skills individually only benefit the organisation if the knowledge can become organisational knowledge as mentioned previously. To share knowledge globally there needs to be managerial and technical interfaces in place to encourage this (Debowski, 2006). In regard to managerial infrastructure, then the HR department is responsible for supporting employees in the development of knowledge-intensive competences and for rewarding their achievement (Debowski, 2006). These responsibilities however, were not mentioned either by expatriates of X5 or by HR managers themselves, which would indicate that these are either not clearly expressed or lacking in the company. In X5 the technological infrastructure is currently represented by such systems as OurBook, Communities of Interests, and in the upcoming systems OurWiki and OurModel. While the top managers of X5 emphasis usability and benefits of these systems, none of the expatriates have mentioned them. This could indicate that these elements of knowledge management can be improved.

X5 are currently working on improving the technical aspects of knowledge sharing (e.g. OurBook, OurModel and OurWiki) and having knowledge sharing as a key vision for the company. These tools allow for bilateral knowledge sharing but to use them the managerial aspect needs to be improved as well. This would allow not only the Chinese colleagues to make their impact in the organisational knowledge development, but could also help to include knowledge of expatriates. Currently, there could be several challenges to the use of these systems. For example, it could be assumed that due to differences in cultures it may take longer for the Chinese office to actively start

using these systems in addressing their knowledge questions since they were developed solely in the Danish headquarters. This fact might also hinder the American office to use it if they see this as a change in power (for example due to being forced to change from their own systems). Another challenge, which was also noticed by some interviewees in regards to previous systems, is that the company should pay attention to the structure and the amount of information storable in these systems so it remains useful and does not suffer from information overload as described in previous sections (Debowski, 2006).

Expatriates can therefore be said to lack the managerial support and technical tools needed to share their knowledge during and after the IA (Debowski, 2006).

Currently, knowledge sharing in X5 is unilateral, namely from the HQ to the offshored location. Thus the main knowledge flow was mostly "top-down" through training, development and coaching of Chinese employees in methods and standards that are used in the HQ. At the same time the HQ did not pay attention to the point that there could also be something that can be learned from their foreign colleagues, in particular the Chinese colleagues as illustrated by top manager 2: "*They [in China] gained a lot of training [...]. We have not had the possibility to get much in return. But that is our fault here in Denmark, certainly our fault.*"

One of the reasons for such an omission could be a stereotypic attitude towards the Chinese office, which casually were mentioned by interviewees and include the opinion that the employees in the HQ are better at performing their tasks than the Chinese employees, and assumptions of the Danish employees that the Chinese office could not be used in other instances, than purely cost cutting goals. As referred by one of the HR representatives: "*One of the challenges in regards to the cultural issues in our company is overall prejudgment of each other based on cultural backgrounds. [...] for example [...] we look upon Chinese work [...] differently than we look on our Danish and US' colleagues work, we think it is not the same standard as we have, that is the prejudice we have to their work.*"

Other reasons can be a shift in power should the Chinese office be regarded on an equal footing, as well as a challenge to current work processes and work practices if the Chinese colleagues and way of working had to be fully integrated in X5. Another challenge is that currently there is not a knowledge sharing culture inside the Danish HQ or globally as hours have to be billed to clients. Furthermore, there has been little managerial or technical support for this as illustrated previously. It can be assumed that these factors hinder the organisational development of the company in general through holding it back from getting the full benefit of having an offshored location, which could be gained in a bilateral way of knowledge sharing and help in acquiring and developing best practices through inter-firm cooperation (Dyer & Nobeoka, 2000; Grant & Baden-Fuller, 2004).

A company can motivate their employees to share knowledge in different ways (Lazarova & Tarique, 2005). In X5's case this is done through challenging projects and international exposure. At the same time it could be concluded that mentoring and career counselling are currently absent which, according to Lazarova & Tarique (2005), can hinder knowledge sharing from individual to the organisation. Challenges to knowledge sharing were also that there was no plan to use the knowledge expatriates had gained abroad when returning home, and many also found it hard to use

their knowledge back home. The reason for expatriates agreeing that knowledge is difficult to use upon repatriation can be explained by the type of knowledge they gain and the possibility to transfer it. Local knowledge, for example, in a specific country or region, particularly in emerging markets, which can be connected to cultural skills and individual knowledge gained while being in that county, may have a higher tacit nature than in other countries or regions, making it more difficult to capture (Eriksson *et al*., 1997; Harvey *et al*., 1999). For the Chinese expatriates the Chinese environment is continuously changing which could make their knowledge obsolete faster than in the other countries. Furthermore, any global competencies gained may not always be of direct use to the individual (Harris, Brewster, & Sparrow, 2003). There are several reasons for that. For X5 this could be a case if the person who worked in another country comes back to a position where skills about culture and specificities of that country are not involved, which often happens if expatriates come back to the position they were in before they went abroad. Second, from a 'knowing whom' perspective, a foreign posting may increase an individual's network internationally, but it may also lead to the loss of critical home contacts in a company where the power is maintained centrally. For example, as mentioned by some of the expatriates, if you are not visible to your manager, he tends to forget you and then it is difficult to get any kind of promotion as you have to explain what new skills you gained (DeFillippi & Arthur, 1994; Bonache *et al*., 2001). Another reason for why knowledge sharing is difficult to use upon repatriation can be explained by the fact that as mentioned above only a few expatriates in X5 are getting promoted upon return, which results in underemployment (Feldman, 1996; Feldman *et al*., 2002).

In the case of X5, the only transfer mechanism was sessions, which are organised by the company where expatriates can share their knowledge about expatriation experiences. However, these sessions are focused mainly on experiences about general expatriation issues and only good practices are chosen to be shared. There is not a conscious choice or fit between how to transfer different knowledge types, nor many options to transfer knowledge which could result in knowledge spillage (Lazarova & Tarique, 2005; Kamoche, 1997).

From another perspective, that some expatriates felt they could use some of their knowledge upon repatriation can be explained by expatriates gaining different types of knowledge as different types of assignments create different types of knowledge. The case when the expatriates can use that knowledge can be explained as being because at that moment when the expatriate came back home this knowledge was needed in the company or it was easy to transfer (Hays, 1974; Caligiuri, 2005).

Another reason could be that those expatriates who felt they used their knowledge upon repatriation were promoted after they came back home, which gave them the opportunity to use their gained knowledge in their new position in the company.

It can be concluded that while X5 has started to address the issue of knowledge sharing it is not done with expatriates in mind and it is not done in a holistic way meaning that the culture, the processes and the procedures in X5 still encourages billing hours to clients and solving tasks in the department instead of sharing knowledge. Addressing knowledge sharing could thereby be seen as a change management problem which needs to be handled by ensuring the whole organisation supports it, and all processes and procedures support it as well (e.g. Kotter, 1996).

Repatriation

In X5 many expatriates re-evaluated their career options in the company and some left to find work elsewhere as also supported by Black (1992) and Linehan (2000). The reason for people leaving the company can be due to job embeddedness (Mitchell *et al.*, 2001). As mentioned earlier, in X5 job embeddedness between X5 and the expatriates is middle to low which means there is a high risk of expatriates leaving the company upon return. In the case companies the expatriates were in general active in regard to their career management, supporting the findings by Arthur & Rousseau (1996). This is seen in the expatriates taking on more responsibility for their career planning and in the number of expatriates leaving X5 within the first year upon repatriation (between 10-50%). Thus it can be concluded that expatriates are increasingly searching for work elsewhere when expectations are not met as indicated by Linehan (2000). Several expatriates indicated a desire and will to consider several companies as a possible future employer as also indicated by Pate & Scullion (2010). The findings suggest that expatriates felt that IAs helped them to grow personally, but not with career advancement in their company, which is consistent with the finding by Bossard & Peterson (2005).

The finding that repatriation was a difficult experience for many expatriates is consistent with previous research (Adler, 1991; Black *et al.*, 1992). The findings also suggest that repatriation in X5 is complicated by unmet expectations of the expatriates about career development, which is consistent with the finding that promotion upon repatriation is quite rare and usually repatriates felt that IAs were more interesting than their new work (Bossard & Peterson, 2005).
Expatriates experience many of the same problems upon repatriation as those mentioned by Lazarova & Tarique (2005) in both work and private lives. For example, that it was difficult to talk to people back home about what they (expatriates) had experienced accompanied by a lack of interest from the company. To lessen these difficulties and prevent people from leaving the organisation, job embeddedness and repatriation adjustment is important (Shen & Hall, 2009). Additionally, as mentioned by Lazarova & Caligiuri (2001), the repatriate's subjective perception of their organisation's support influences the desire to stay in the organisation.

In 2009 more than 10% (20% according to another source) of expatriates left X5 after repatriation, whereas the number for several previous years was even higher, more than 20% (50% according to one source). The decrease could be connected to the financial crisis as well as the company becoming more experienced in general expatriation. In X5 expatriates who came from ordinary (specialist) positions who were sent to managerial positions in China or USA, were placed back in their previous status when they returned, thus making them experience demotion, confirming previous findings (Mendenhall *et al.*, 1987; Alder, 1991; Black & Gregersen, 1999). This can likely lead to dissatisfaction and unmet expectations (Kraimer *et al.*, 2009; Stroh *et al.*, 2000). In X5, unmet expectations of expatriates about career development were often a reason to leave, which confirms previous findings (Bossard & Peterson, 2005; Shen & Hall, 2009). Furthermore, knowledge gained abroad was not utilised in the company, which can also be a reason to leave the company (Bossard & Peterson, 2005). In X5, expatriates pointed out that quite a big part of knowledge they gained on IA was soft skills or managerial skills. HR managers also confirmed that expatriates mostly gain professional competences, managerial skills, navigation in a smaller organisation, broader understanding of the world, and an international perspective. This data only

underlines the less likeliness of expatriates' promotion according to Kraimer *et al*. (2009), as such skills are often not valued in regard to promotions.

More American expatriates felt expatriation had harmed their career than Chinese expatriates. Such contradictory opinions can be partly explained by 56% of Chinese and 83% of American expatriates being stationed abroad before, as multiple expatriations has been shown to be harmful to career making in the same company (Kraimer *et al*., 2009).

In recent years many organisations can no longer offer enhanced rewards packages and promised career acceleration, due to implementation of cost-reduction strategies (Coyle-Sharpiro & Kessler, 2000). This development implies a disparity between expectations of the expatriates and their employers' institutions as employees may feel that the arrangements have been changed without their consent (Rousseau, 1995). This statement is particularly relevant for X5's situation. No information was available in regard to the company trying to cut costs on IA, however, it was identified that when expatriation was organised by the mother company before 2006, a much bigger variety of services was offered to the expatriates before and after IAs, which left many Chinese expatriates stationed abroad in 2006 to be particularly dissatisfied with the organisation of the practical issues. It could therefore be assumed that many expatriates experienced resentment after they did not have a chance to share their knowledge upon repatriation and did not get a relevant job position. In X5 a majority of expatriates stated that personal career ambitions and new experiences were the main motivation for going abroad, while X5 used expatriates to transfer organisational culture, staffing local employees etc. Thus it can be concluded that there is a mismatch between the expectations and obligations of the parties, which leads to the psychological contract being transactional, and moreover can lead to the breakdown of the psychological contract (Paik *et al*., 2002). This can cause anger and resentment and can lead expatriates to take more responsibility for their career development which were the case for some of the expatriates in X5 when they discovered their expectations upon repatriation were not met (Baruch, 2001).

5.3.2 New and inconsistent findings

Preparation

One of the unexpected findings was in regard to reasons for expatriation. Sending expatriates abroad for management development purposes was not mentioned in the case studies although it is featured in literature (e.g. Tungli & Peiperl, 2009). However one additional reason which was not found in the literature and that was customer preference as described by top manager 1: *"[…] we still have a lot of the customers in China, they are international clients. They also expect to see international people there […]"* and also highlighted by HR, *"I think the reason why we have success with our expatriates to China, is that there are many clients asking for and willing to pay a high billing hour for a western expatriate because our clients in China would like to have a western contact. In the USA it is not the same."* Thus, as the client would like to have a western manager to guide the project, particularly in China, it creates favourable conditions for more expatriates and causes interest for future expatriates. As for USA, clients do not see having a Danish expatriate as a benefit, as local managers are considered to have a better understanding of the local business environment and are less expensive than expatriates.

From the list of selection criteria none of the expatriates believed domestic track record or previous performance appraisals would matter (Brewster & Scullion, 1997; Tungli & Peiperl, 2009). This

could be because of the difference in cultures and leadership styles between Denmark (X5) and the background of the authors of those articles. At the same time, a selection criteria not named in the literature, but noted by expatriates included a big network in the HQ in order to contact people from different disciplines, something which is mentioned in knowledge management literature (e.g. Debowski, 2006). HR managers explained the current informal system as *"[…] few want to be expatriated and then there is not an issue of having 10 people wanting the same job. In relation to competences, our profile is such that there will be only 2 people that [fit] the role."* It was also added that, "*We sometimes put an advertisement up on the internal knowledge board for expatriation […] [Sometimes it is more the way that it is decided] who is going […] and then the negotiations start from there.*" This indicates that few people wishes to go, few people can fill the positions, that some expatriate jobs are distributed informally and that people are not informed about the possibilities of IAs in any official capacity.

The findings indicate that there is no different preparation for expatriates travelling to China or USA, which contradicts the finding by Tungli & Peiperl (2009) that MNCs offer longer training for assignments in those countries where there is a big difference between the cultures of the home country and the host country. However, given the findings for X5 regarding their brief preparation process and organisational structures which hinders knowledge sharing, the finding is not unexpected for X5. However, the findings also indicated such difference in preparation could help improve efficiency and gain from expatriation for both the company and the expatriate.

Stay abroad and success factors
Only 22% of Chinese expatriates and none of American expatriates supported S12.3 which said that preparation was important for a successful stay abroad. This contradicts the research that a lack of local and contextual knowledge can negative influence global managers' effective decision making and threaten their performance in foreign markets, particularly in emerging economics (Lord & Ranft, 2000; Makino & Delios, 1996; Li & Scullion, 2010). This could be because of the transactional contract where the expatriates does not expect training but instead takes it upon themselves to gain the necessary skills to succeed.

One finding that contradicted the literature was that Chinese expatriates in general did not find cultural values and norms different and difficult to accept, while according to Hofstede's (1980) four dimensions of national culture between the home-country and host-country, China is considerably different from Denmark. A possible explanation can be that expatriates communicated mainly with Chinese colleagues of the same educational background and social class as themselves and here cultural differences may be less than in other situations.

Knowledge sharing
In addition to the before mentioned knowledge areas, the expatriates gained knowledge in how to work virtually and share information virtually and knowledge related to efficiency gains and knowledge handling which could benefit the whole organisation. These findings would indicate that knowledge sharing to and from expatriates is important for the whole organisation and not just the efficiency of expatriate contracts.

In relation to improvements to virtual knowledge transfer and communication the stay abroad enabled the expatriate to look at the HQ in another way and find new ways to communicate and

transfer knowledge between units which considered the difficulties he or she had encountered in the foreign subsidiary. An expatriate from China for X5 explained that a key challenge to virtual communication was the lack of attention and organisational structures in place to ensure they were heard in the HQ, "*When you are getting so far away from Denmark, then there is a tendency that you would be out of eye, out of mind, that they are focused on their local projects and problems and forgetting mine.*"

In relation to efficiency gains and knowledge handling for the multinational, the stay abroad could also give the expatriates knowledge about how work processes and procedures could be made more efficient for the whole company. An expatriated manager explained how he felt efficiency could be improved by avoiding misunderstandings and mistakes if networking face to face was possible in decision times – mainly at project starts and project stages through development - so alignment and expectations could be adjusted, "*The biggest challenge is the fact that we are not sitting face to face. A lot of the work we do [...] is very technical, so they talk technical but a lot of alignment and expectations and so on… normally when I was in Denmark I would do that informally by going to different stakeholders and people all the time, so more like in a network to ensure that all the expectations are aligned. You cannot do that [...]. You have to do it via e-mail and e-mail is not the best communication means for that type of informal alignment. So that can sometimes be misunderstood or maybe not ready or....*"

Repatriation
While repatriation was the phase which caused the most difficulty for X5, these difficulties could be explained using known theories within knowledge management and organisational theory in relation to expatriation management and knowledge utilisation.

5.3.3 Overview and parallels to the first descriptive study
The analysis showed that many of the findings confirm previous literature. This includes no selection criteria and no evaluation of success, little preparation, and a poorly organised repatriation period. However, the findings also showed new data relating to the reasons for using expatriates, less cultural challenges than expected, and knowledge developed by expatriates within virtual organisation and efficiency gains for the whole organisation.

It can be concluded that there is a gap between the viewpoints of the HR staff and expatriates. While the company has the goals of organisational development or filling the skills gap at the subsidiary, expatriates go on IAs with the desire of future promotion and of getting new experiences. This mismatch can lead to a breakdown in the psychological contract (Pate & Scullion, 2010), where employees' and employers' perceptions of the other party's obligations are not agreed upon, which leads to resentment from expatriates' side and little understanding from the company's side. While from one side companies try to cut costs on expatriation, expatriates expect promotion and challenging jobs upon return. Thus the goals have to be aligned in order not to have dissatisfied expatriates and HR personal who misunderstand expatriates' needs.

The complications the companies experienced in relation to expatriates can be seen from two angles; (1) on the operational level and (2) on the strategic level. Or put differently, there is a difference between espoused values and the actual way the organisation works. X5 states in its vision and

mission statements and in interviews from HR and top managers that the organisation values knowledge sharing and a challenging workplace; however this is not how the expatriates see it in practice.

The complications on the operational level were the ones the companies were becoming aware of and tried to resolve (e.g. a large employee turnover, difficulties with repatriation). However, expatriates were not considered on the strategic level and their work were therefore not an integrated part of the company's structures, culture or knowledge sharing processes. Expatriation therefore need to be connected to strategic goals as an important element in order to be able to carry out operational improvements (Collings *et al.*, 2007). On the operational level these complications can be viewed is as a reflection of power; changing routines regarding expatriates would challenge existing power structures. Finally, the organisational structure and culture in X5 might not, despite the espoused values, encourage the kind of knowledge sharing nor recognise the kind of knowledge expatriates gain as valuable. This would mean that even though X5 officially values knowledge sharing, the current power structures and organisational structures do not encourage this.
This can be explained as a disconnection between expatriate management and the development of a strategy for globalising the product development process. Expatriates were added later, to solve a specific problem, and had not been considered from the start. Therefore, when expatriates were sent out and nothing else in the organisation was changed it became problematic for them to be an integrated part of the company and not just a part of the local community they were expatriated to.

5.3.4 Operational implications
Expatriates were an important element of globalising the product development process for many of the case companies. However, it became clear that expatriate management were largely viewed separate from the rest of the organisation's development. This disconnection between expatriates and the strategic and operational development for the whole organisation meant the organisational structures and practices, including knowledge sharing and career development, was not supporting expatriates. Therefore, to gain the most from expatriation companies need to connect expatriation with the strategic and operational plan for the organisation regarding globalising the product development process.

Based on previous literature the organisations could implement some operational changes. However, as with the operational changes derived from the literature used in the first descriptive study, these suggestions will have the same underlying problems as previously which are a disconnection between the organisation and its global product development process and expatriates. Therefore, for these operational changes to be successful, the framework developed in this thesis and presented in Chapter 6 which addresses this issue would need to be utilised.

These operational suggestions are focused on Danish companies expatriating Danish engineers to China and secondly to the USA as a way to lessen conflicts and gain more from the expatriation period for both the company and the expatriate. Some of these may be generalisable to other host countries and other type of professionals while some are unique to these circumstances.
- It is recommended for the companies to find a way to align the expectations of the expatriates with the packages and conditions offered in the company, in order to avoid unmet expectations and disappointments.

- Increasing expatriates' job embeddedness and repatriation adjustment can improve retention and repatriation, as these two parameters are central to the success of IAs and influence the decision of staying or leaving the company (Shen & Hall, 2009). This can be done by many different means, for example by:

    - Providing employees with the possibility to utilise their gained skills and competences upon repatriation.

    - Helping them to adapt to the new culture both abroad and back home.

    - Making expatriates feel welcome in the HQ in work related situations, having work position prepared in the home country before repatriation.

    - Making changes in social network and cultural identity smoother upon return (Shen & Hall, 2009).

    - Make tests for expatriates upon return to see what new capabilities and skills they possess so their knowledge can be used in the best possible way and a job can be provided which is suitable for their competences. It should also be considered that cultural skills gained as a result of IAs, including employees being more sensitive to cultural differences, being able to work across international boundaries, and having a broader worldview for making business decisions, are all qualifications required for managers in multinationals (Stahl *et al*., 2002).

    - Consider opening new lines of work/ work positions, specifically aimed at utilising the skills and knowledge of repatriates after these skills and knowledge have been clarified.

    - Meeting expatriates' expectations by communicating to the expatriates clearly what is awaiting them and placing particular emphasis on personal and job-related communication rather than more general information (Guest & Conway, 2002; Rousseau, 2001).

    - Improving subjective perception of organisational support as this impact the desire to stay in the organisation (Black & Gregersen, 1991; Lazarova & Caligiuri, 2001).

    - Having an expatriate's manager work together with the HR department to find the most appropriate position for the repatriate, as usually the manager cannot provide the proper position to the expatriate based on the skills the expatriate possess (suggested by a top manager in X5).

    - To assure that when expatriates come back their new competences would be used in company, it is advised to use repatriates on offshoring tasks, so it would not be a specific department where they would be placed but in the complete organisation (suggested by a middle manager in X5).

    - Knowledge transfer will be maximised if organisations motivate their employees through developing career opportunities, which can be done with the help of mentoring, career counselling, challenging projects, further international exposure (Lazarova & Tarique, 2005). Thus, from a practical point of view the expatriate should be a part of the network in the HQ, as then the expatriate would get more chances of receiving the right position when more people would know what he/she did during the IA (suggested by a top manager in X5).

- The repatriation process can also be made less difficult by minimising the difficulty in repatriation adjustment and detachments from the home organisation by using shorter assignments. This may create other challenges though (Shen & Hall, 2009).
- The perceived link with the home organisation can be strengthened by actively providing developmental support (mentoring, coaching, and counselling) to the employee, spouse, and family during the expatriation and repatriation phases (Shen & Hall, 2009).
- Increase the awareness of the problems in expatriations by making sure that the HR executives who are responsible for international moves have IA experiences themselves (Shen & Hall, 2009).
- Introduce IAs as one of the management development goals in order to create a positive image for expatriation, due to the fact that many expatriates who left the company during the last years could have harmed its image in the company (Shen & Hall, 2009).

To implement these changes on the operational level would mean changes to HR policies and practices as well as organisational structures and carrying out these changes using best practices from change management (e.g. Kotter, 1996). Again, implementing these suggestions will not be a "quick fix" for the complications the case companies encountered; for these operational changes to be successful expatriation needs to be an integrated part of the organisation's strategic and operational goals. This is detailed in the framework in Chapter 6.

5.4 Building a framework

The complications the companies experienced can be seen from two angles; (1) on the operational level and (2) on the strategic level. The complications on the operational level were the ones the companies were aware of and tried to resolve (e.g. quality, cultural differences for the descriptive study 1, repatriation and a high employee turnover for the descriptive study 2). These could be explained using best practice from disciplines like change management and aspects from organisational studies as well as operations research as illustrated above. The strategic challenges were not visible to the case companies. The reason for this focus on the operational level is likely because of the very nature of these challenges which were:

1. A decoupling between the strategic and operational level of the organisation.
2. A focus on symptoms instead of the causes.

Moving a task abroad was often viewed in isolation from how this would affect work processes and the organisational structure. Furthermore, how the move would fit into a long term plan was often lacking. This resulted in a constant 'fire fighting'. This could be due to a lack of 'fitness' between how the task is conducted and the surroundings. For example if the organisational structures, the organisational culture or the complexity of the task does not match how the task is organised and the work is carried out a conflict is likely to arise.

The decoupling between the different organisational layers meant that complications were resolved at the operational level by the engineers and managers working with the task. There was therefore a

focus on curing 'symptoms' and not finding the underlying courses as solutions had to be fast and remain on the operational level.

A framework therefore needs to be able to address challenges on both the operational and the strategic level in order to ensure success in both the long and the short term.

5.4.1 Desired outcome

From the empirical data the desired position in the marketplace resulting from globalising the product development process was a process which fulfilled the following criteria:

- o Overall cost for the product development process is less than before the process was globalised.
- o The process is easy to manage and require little time from Danish managers.
- o Offshore assignments are managed and lead by locals.
- o If expatriates are needed then their knowledge is fully integrated into the organisation.
- o Globally designed and developed products have the same standards and quality as when they were produced, designed and developed in Denmark or other Western countries.
- o There is a smooth re-integration process in all interfaces of the product development process.
- o Diversity inside the organisation is kept to a minimum to ensure the process is easy to handle.
- o Globalisation will improve profitability, attract more customers, and open up new markets.
- o The process of moving a task abroad will not significantly overrun the budget.
- o Moving product development process activities abroad will not be noticeable to customers.

In summary, the companies wish to see their motivation to move out fulfilled and avoid the challenges and pitfalls identified during this research project. However, some of these desires reflect the perspective or worldview of the interviewed personal. Having less diversity to avoid complexity indicates that complexity can and should be avoided. If the end goal is a good product, diversity may be beneficial under the right circumstances.

The main goal of globalising the product development process can therefore be said to be: Exploiting global opportunities within the product development process to increase market position and overall profitability for the company.

5.4.2 Illustrating the gap

The framework to be developed has to close the gap between the current and the desired position in the marketplace by developing the desired capabilities in the firm to reach this goal.

The companies experienced complications that were unexpected and they often did not get the full benefits from globalising the product development process that they initially expected.

This gap between expected and realised results can be explained as a lack of focus on both the strategic and the operational level of the organisation. The solutions focused on efficiency and reducing resources spent on the endeavour. However, the focus on short-term gain and operational

solutions meant the problems were not resolved even though the negative impact could be reduced through tighter control and avoiding high risk situations (e.g. resolving communication problems by communicating less and communicating more through written protocols and processes).

On the operational level the main area of complication was a lack of change management as well as engineering project management of the change caused by globalising product development process activities:

1. Change management
   i. A lack of overview of the knowledge links and networks the affected task have with different functions, services, products and processes and how these can be moved.
   ii. A lack of preparation of the organisation for the new situation.
   iii. A lack of clarity regarding how the move is prepared, planned and implemented.
   iv. A lack of clear goals and performance measures for the new situation.
   v. A lack of continuous adaptation of the globalisation strategy to match changes in internal and external factors.
   vi. A lack of a thorough internal and external investigation to decide whether globalising product development process activities will encourage the desired goals for the organisation and in what way.

2. Engineering project management
   i. A lack of understanding about the engineering practices in the different locations which are to interact.
   ii. A lack of overview of the ease of product and/or process modularity and knowledge properties of the task.

On the strategic level the following areas need to be addressed:

1. Market
   ➢ A lack of considering the external context in a short as well as a long term perspective when deciding upon globalising product development process activities.

2. Organisational
   ➢ A lack of connection between the different organisational layers to ensure all tasks and processes encourage the company strategy and work towards the same goals.
   ➢ A lack of a learning perspective and a cross-disciplinary approach to globalising product development process activities, which makes it difficult to evaluate the globalisation process and potential problems using different theories like the ones shown in this chapter.
   ➢ A lack of a long term strategy for globalising the product development process.
   ➢ A lack of understanding of the company's network configuration and whether it fits the desired capabilities.

A framework to improve decision making therefore needs to address these areas on the operational as well as the strategic level. Furthermore, it needs to follow best practice advice from outsourcing/offshoring literature, change management and engineering project management. The

framework therefore needs to incorporate an iterative and reflective nature so that the globalisation process can be continuously adapted to the short and long term goals.

Viewing an organisation engaged in globalising product development process activities as consisting of an external context with a given network configuration, enables a more broad view on globalising the product development process and its impact on the organisation. It is within these boundaries the company initiates, conducts and adapts the global product development process.

The example in Figure 27 on the following page shows a company where production is outsourced to several suppliers (shown as factories on Figure 27), system-level design is conducted in collaboration with a strategic partner (shown as an office building) and conceptual design is conducted with several offshore locations as well as in the headquarters (the office buildings). There are different communication and knowledge sharing links inside and outside the department, the task, and the organisation (the arrows on Figure 27). These can take different formats (in Figure 27 a one way arrow shows a more hierarchical relationship from the company to its suppliers whereas there are a more collaborative approach with the strategic partner and subsidiaries shown as two-way arrows). The engineering activity can be a part of several networks, both internal and external (the orange circle with the strategic partner is for example one and the big blue circle is an example of another – larger - network). The company exists within an organisational culture and operates within different cultures, has a strategy wherein globalising the product development process is one element, it has certain organisational structures, certain power relations, certain technical features relating to its products, and operates in a global marketplace where certain market trends can be observed. This creates certain desired capabilities, a certain network configuration, a certain organisational structure, and certain technical elements.
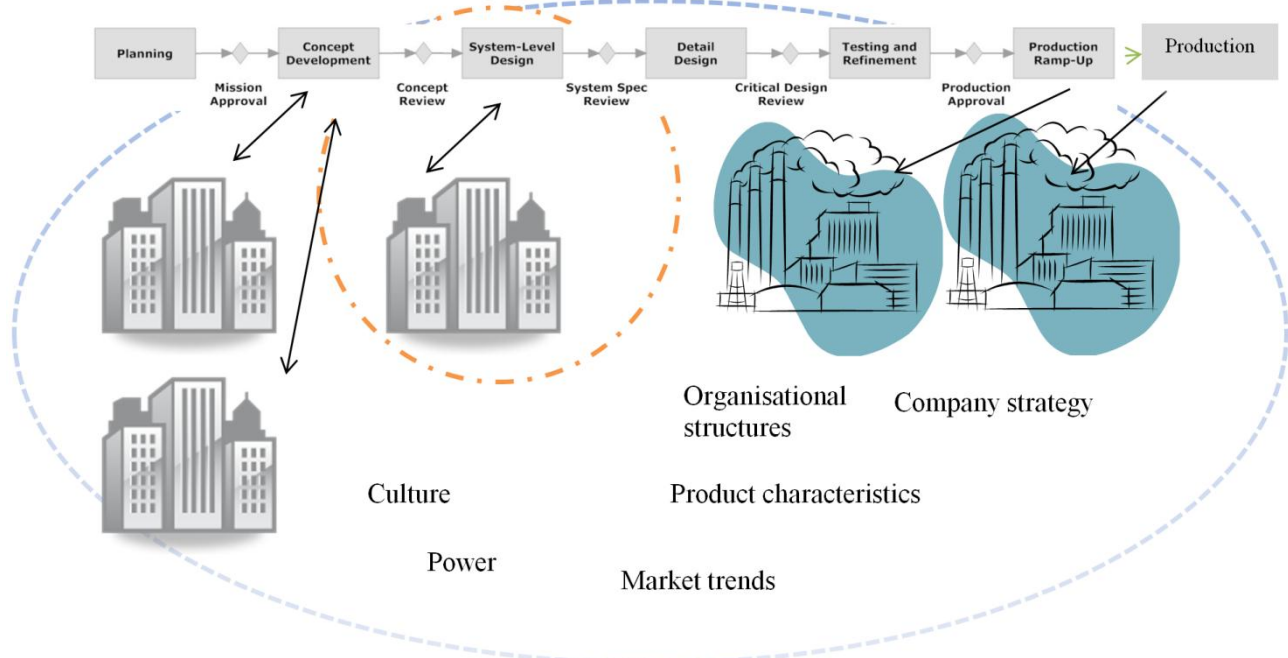

Figure 27: An example of networks and knowledge sharing links when a company offshore and/or outsources elements from its product development process.

Success in globalising the product development process can therefore be said to be influenced by (1) the process of globalisation and (2) the different perspectives used to analyse the organisation, its context, and its networks.

A framework is suggested which considers the key areas found to cause complications with globalising the product development process. These included:

> ➢ The current organisational structure, processes and procedures.
> ➢ The current network configuration.
> ➢ The underlying long term goals and desired capabilities to which globalising the product development process is considered a solution.
> ➢ Market trends, current locations and other physical parameters.
> ➢ Current networks, within and outside the organisation.
> ➢ Knowledge properties for what is considered for offshoring or outsourcing.
> ➢ The product development process – including modularity.
> ➢ Product features – including modularity.
> ➢ A reflective and iterative nature to measure the organisation's progress towards the desired goals and make corrections if needed.

In other words, the framework for globalising the product development process needs to consider aspects from different research fields and thereby take a cross-disciplinary approach. The ability to enrich problem-solving by viewing it through different 'lenses' compliments the interconnected nature of globalisation issues. In this manner, a more holistic picture can be created and the challenges the case companies faced can be addressed at an early stage. By having an iterative framework, the product development process can be continuously adapted to compliment the strategic goals and operational plans.

5.5 Summary

The challenges the case companies face can be explained as a lack of cohesion between the operational level and the strategic level of the organisation in regard to globalising the product development process. Difficulties could at the operational level be explained using theories within organisational studies and operations management. On the strategic level the challenges can be explained as a result of decoupling the organisational layers of the company and as a result of this a focus on finding solutions to symptoms and not the underlying causes is created; or in other words a focus on single-loop and not double-loop learning. The case companies and literature thus far have focused on addressing the operational challenges by avoiding or minimizing risk and increasing control (an Avoid Risk approach). However, many engineering tasks which are now globalised may not be suited for this approach due to their interconnected nature and reliance on knowledge from many sources. They, on the other hand, would encourage cross-cultural knowledge sharing of both process and product knowledge and thus create higher risk but also the possibility for greater organisational learning. For this approach to be successful the challenges the case companies faced first need to be addressed (a Confront Risk approach).

The analysis of the descriptive study 1 was reflected in the second descriptive study. The challenges with expatriation were related to repatriation and a high employee turnover. These challenges can also be viewed on the operational and strategic level. On the operational level changes to HR

processes and organisational structures could be initiated. However, solutions implemented on the operational level so far – including IT tools and more practical help from HR – had not resolved the challenges. The reason for this is a disconnection between expatriate management and the development of the whole organisation, including the development of globalising the product development process which the expatriates are a part of. Changing the situation so the knowledge expatriates gain can be fully integrated into the organisation so both the organisation and the expatriates gain the most from the stay abroad would require the company consider expatriates as an integrated part of the strategic and operational development of globalising the product development process.

To address the challenges the case companies faced a framework need to be developed which consider both the operational and the strategic level. This means consideration for long term gain, increased focus on preparation and on the potential impacts of moving a task abroad. A cross-disciplinary approach needs to be taken throughout this process in order to gain a more holistic view of the needed changes. This includes a focus on organisational aspects of change management as well as engineering project management aspects to ensure the right approach is chosen to manage and conduct the given activity. Furthermore, this framework would need to be iterative and reflective so that the current progress towards the desired goals with globalising the product development process can be tested against the strategic goals and operational plan. In order words, double-loop learning would need to be an integrated part of the globalisation process in order to investigate underlying causes for problems and situations. Implementing such a framework would in some of the case companies likely result in a transformational change (i.e. a change in how the organisation's members view themselves) and thereby would require triple-loop learning (Argyris *et al*., 1996; Smith, 2001; Anderson, 1997).

The next Chapter presents a framework wherein to view offshoring and outsourcing of product development process activities which considers these aspects.

Chapter 6: Framework development

To close the gap between the current and the desired outcome of globalising the product development process, the company needs to focus on the operational and strategic level of the decision. This has to be viewed as a change management project containing organisational and engineering projects in both a long-term and a short-term perspective. A framework titled the Global Decision Making (GDM) framework is suggested as a way to do this.

This framework consists of five iterative stages; (1) strategic goal setting, (2) strategic planning, (3) operational planning, (4) implementation and (5) evaluation (see figure 28).

Stage one is concerned with the motivation and background for actions, and for creating a long-term strategic goal and long-term desired position in the marketplace for the organisation.
In stage two the current position for the organisation in the marketplace is clarified. If the desired position will take many changes and therefore a long time to achieve or the desired position for the organisation is placed many years into the future, it is suggested to develop milestones and smaller change management projects to reach it.
The third stage clarifies the changes the organisation, engineering projects, technical processes and the engineers need to undergo in order to achieve the first big milestone.
In stage four these changes are implemented in the organisation and adjusted continuously through measuring key performance indicators (KPIs).
In stage five the first big milestone is reached and an evaluation is made regarding the outcome of this change project and its connection to the strategic plan. If circumstances have not changed and the recent change has not made any changes necessary, the next change project is implemented (going to stage three). Otherwise stage two is redone in order to adjust the strategic plan to fit the recent changes in markets and opportunities. The first stage, the strategic goals and desired market position for the organisation, is reconsidered less regularly, for example once a year. This is done in order for the organisation to remain flexible yet still move towards a common goal (see figure 29). The GDM framework is described in detail in this chapter.

6.1 Globalising the product development process

Globalising the product development process needs to be viewed from two levels; operational and strategic in a short as well as a long term perspective. For the framework to be able to do this it need to be flexible enough to view the situation from many different theoretical perspectives in order to understand and find solutions to the challenges encountered in globalising the product development process as illustrated in the analysis in Chapter 5. Furthermore, the framework needs to reflect best practice from change management and include engineering project management aspects as well. As have been shown in the previous chapters, global product development is a complex endeavour with many interrelating factors. Therefore, to ensure the organisation is moving towards the desired goal with offshoring or outsourcing product development process activities, this decision process need to be iterative and reflective. Using the language from organisational cybernetics then there need to be a reflective feedback loop so progress can be compared with the desired outcome and corrections can be made if deviations are found (Beer, 1959). Using the organisational learning theory, this

means that double-loop learning has to be employed on all challenges and problems the organisation faces in order to ensure the causes for them can be identified (Argyris & Schön 1974).

It can be suggested that a successful globalisation process of the product development process consists of five iterative stages (see Figure 28):
1) Strategic goal setting.
2) Strategic planning
3) Operational planning.
4) Implementation.
5) Evaluation.
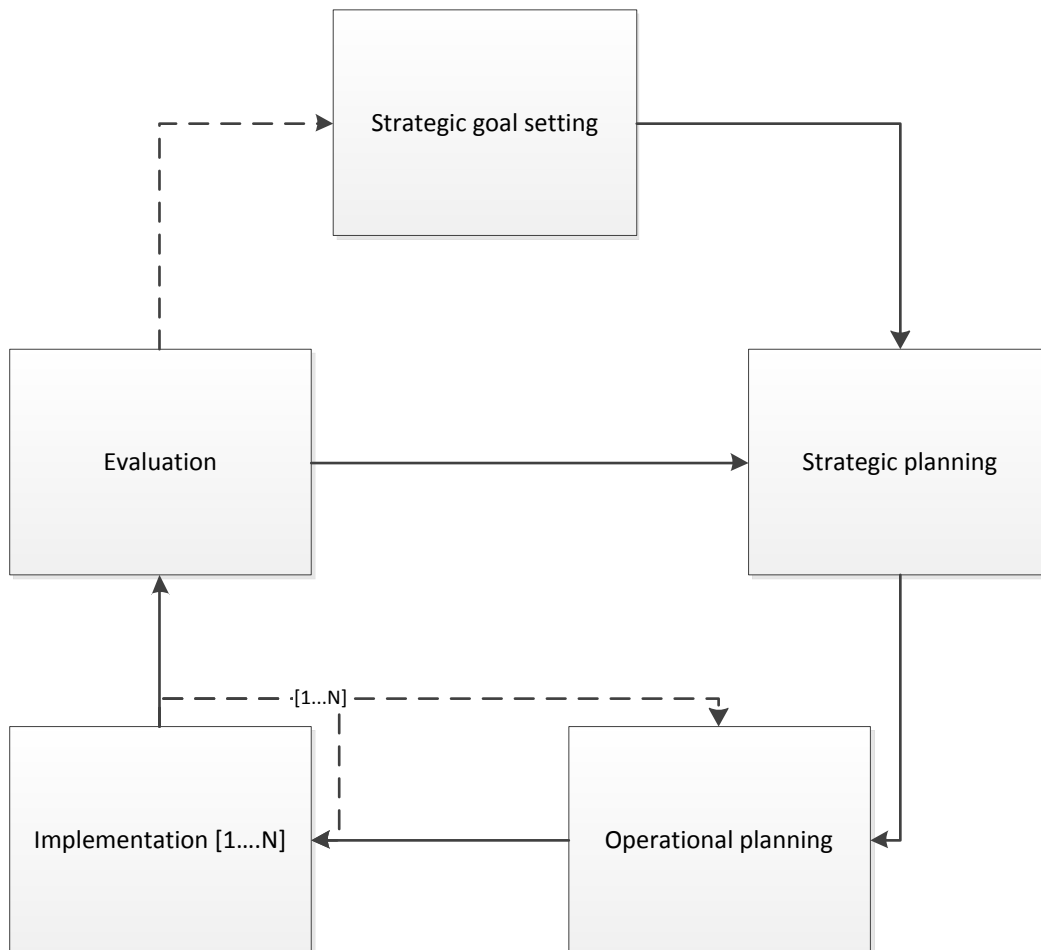
Figure 28: An iterative 5-step decision-making approach to globalising the product development process.

This framework is called the Global Decision Making (GDM) framework. The five stages in the GDM framework each have multiple steps:

Stage 1: Strategic goal setting
    1.   Clarify the desired/ideal position for the organisation in the marketplace.
    2.   Clarify key performance indicators for reaching this position.
Stage 2: Strategic planning
    1.   Clarify the current position for the organisation in the marketplace.

2.   Clarify the gap between the current and ideal position i.e. the business problem the company seeks a solution.
3.   Evaluate the best approach to move from the current to the desired position, including which factors encourage using globalisation as a tool to do so and which factors discourages this.

Stage 3: Operational planning

1.   Select the task to be moved abroad.
2.   Clarify the possible external changes and impacts due to moving this task and implement any necessary changes.
3.   Clarify the possible internal changes and impacts due to moving this task and implement any necessary changes.
4.   Select key performance indicators.

Stage 4: Implementation phase

1.   Move the task.
2.   Implement key performance indicators.
3.   Implement possible changes due to measurements from the key performance indicators.

Stage 5: Evaluation

Depending on the strategic goals and the strategic plan one or several implementation phases may be needed (1-N on Figure 28). Each implementation phase will be a change management project and will thus need operational planning in order to carry it out.

The GDM framework is based on the empirical research and analysis conducted in this study and inspired by several theoretical fields and models as shown in the preliminary framework (section 2.9). The five stages are inspired by the Global Footprint Strategy of Manufacturing (Minshall, 1999) with a focus on strategy, operations, implementation and evaluation/learning. Also some of the steps in the stages are inspired from here, including the focus on the impact of a move (step 3 in the Footprint Strategy; stage 3 in the GDM framework). However, the stages start with clarifying strategic goals, and have become iterative which allows for a framework which can be used throughout the process of moving stepwise towards the strategic goals and adapt the goals, the strategic plan and the operational plan if there are changes in the marketplace. In this way the GDM framework allows for decisions regarding globalising the product development process to become an integrated part of the company's strategic and operational thinking and decision-making instead of 'one off' decisions taken from time to time. Actions to be taken within many of the phases are inspired by offshoring/outsourcing models, in particular the Outsourcing Circle (Perunovic, 2009) (for example in relation to location decisions) while the focus on finding the current position for the organisation is inspired by the network configuration and GEN framework within operations management (e.g. Zhang, 2007). The implementation approach was inspired best practices within change management (e.g. Kotter, 1996) and product development models like the stage gate model (e.g. Ulrich & Eppinger, 2008). The iterative nature of the framework was inspired by the SCRUM product development model, extreme programming and design thinking which all present iterative product development models (see for example Ulrich & Eppinger, 2008 or Toye *et al.*, 1994).
By going through these five stages and combining the idea of approaching the ideal position for the organisation through smaller steps utilising best practices and considerations from multiple

disciplines and theoretical approaches the challenges seen in the case companies can be avoided or minimised early in the decision-making process. By using key performance indicators (KPIs), a continuous feedback loop and double-loop learning the change can be made to comply with the long-term goals and short-term planning for the organisation by discovering deviations early on and resolving causes for problems when they arise.

The following sections detail each of these five stages of the GDM framework.

6.1.1 Stage 1: Strategic goal setting
This stage consists of two steps:
1. Clarify the desired/ideal position for the organisation in the marketplace.
2. Clarify KPIs for reaching this position.

1) Desired position
The company first need to clarify the desired position for the organisation in the marketplace in order to determine how globalising the product development process can best fit into this.
A Future Creating Workshop can be a good tool to discover these desired future capabilities of the organisation as it allows the participants to dream up future scenarios without considering current resources and other restrictions (see Alexander & Maiden (2004) for more on the Future Creating Workshop). To keep with the best practice advice from change management, employees from all departments need to be involved to ensure their future support of the change in the organisation and to get their input.
There may be many possible desired future positions for the organisation and it needs to be decided which one to pursue over time while it develops the capabilities it desires (see Figure 29).
These strategic goals can often be seen reflected in the organisation's vision and mission statements and can for example be to become the largest organisation within a given sector, the most efficient, most customer-friendly etc.
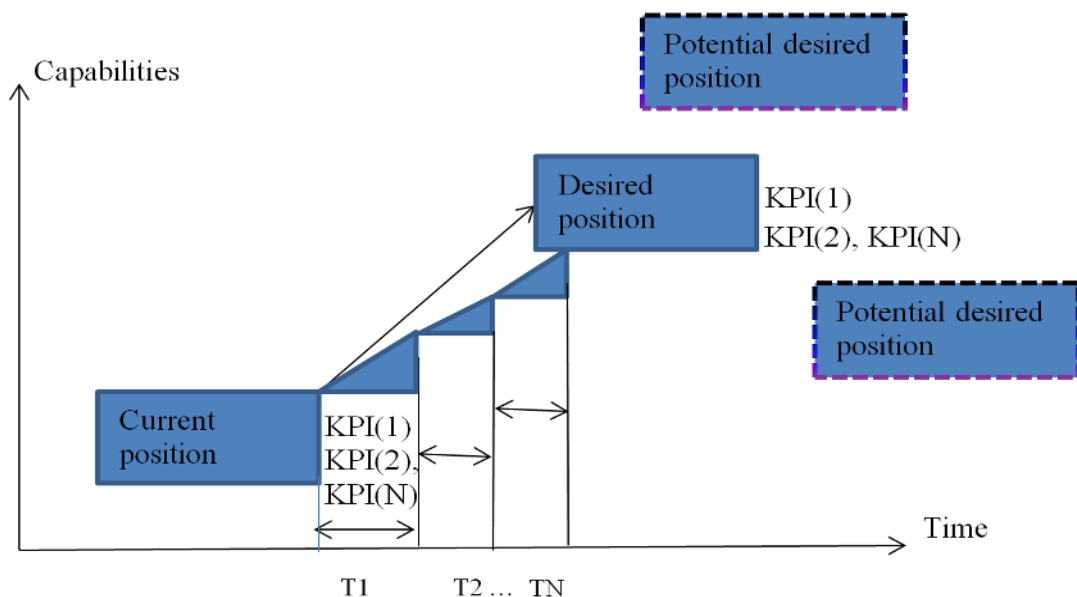
Figure 29: The current and desired market place position for the organisation over time.

2) Clarify key performance indicators to reach this position

These will be large KPIs which encourage the move towards the desired market position. Examples of these KPIs can be a certain market share, a certain % of errors or returns, a certain amount of satisfied customers or a certain amount of extension into emerging markets (KPI(1) to KPI(N) on Figure 29). KPIs borrow from the organisational cybernetics mindset, with feedback loops and continuous adjustments to changes based on an evaluation of measured KPIs with the desired. The organisation is therefore seen as being in a stage of flux, always moving towards the ideal market position.

6.1.2 Stage 2: Strategic planning
This stage consists of three steps:

1. Clarify the current position in the marketplace for the organisation.
2. Clarify the gap between the current and ideal position i.e. the business problem the company seeks a solution.
3. Evaluate the best approach to move from the current to the desired position, including which factors encourage using globalisation as a tool to do so and which factors discourages this.

It will rarely be possible for the company to easily go from the current to the desired market position; often it has to be done by changing a few things at a time and, when they are in order, then change something else (the 'steps' T1, T2…TN shown in Figure 29 corresponding to implementation phase 1…N on Figure 28). This is similar to the 'learning by doing' process of the case companies except that this is a planned and measured learning curve with a clear goal. To do this, companies need to make 'milestones' for each change towards the desired position and be sure that they measure the KPIs underway to see how far they are from the desired outcome.

To determine the current position in the marketplace, the internal and external context the organisation operates within has to be investigated. This process is iterative as external context factors and internal factors can influence each other and thereby how to reach the ideal position for the organisation (shown as arrows on Figure 30). The outcome of this stage will be a strategic plan which includes a business case and a project initiation document for how to reach the long term goal for the company as illustrated in Figure 30.
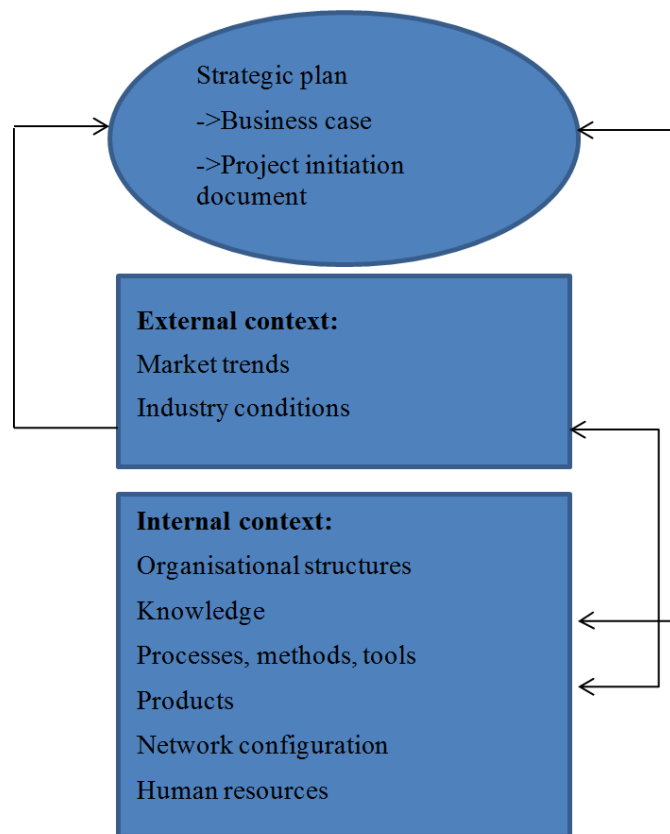
Figure 30: The iterative process in the strategic planning stage

1) Current position

To find the current position for the organisation the external and internal context for the company need to be clarified. The external context includes industry conditions and market trends as illustrated in Figure 30. Here sales and marketing divisions are likely to be helpful, and tools like a SWOT analysis. The internal context include to clarify the company's current network configuration structure to get an overview of its current physical operations and interactions between these as this knowledge can be useful in strategy development, location section etc. This requires information from several departments in the company as well as outside stakeholders. Other areas to clarify are (1) knowledge management, knowledge sharing and knowledge properties used in the product development process, (2) technical processes, tools and methods used in the product development process, (3) the products' specifications in terms of modularity and interfaces, (4) organisational structures and (5) location and skills for the organisation's human resources.

To get information about the network configuration, the company need to clarify the following five elements for which employees in all departments and locations will be useful:

a) Network structures: Referring to the physical footprint of resources, including the size, number, types/roles of network members, and the rationale behind this particular network structure.

b) Operations processes: Referring to the flow of material and information between network members to create valuable output to customers.

c) Governance systems: Referring to the mechanisms to direct and control the network, including authority structures, performance measurement and coordination mechanisms.

Figure 1: The iterative process in the strategic development stage

    d) Support infrastructure: Referring to enablers for network members to work together, including information systems, tools, resources, cultures and behaviours.

    e) External relationships: Referring to the interaction with external partners, including suppliers, customers, users and collaborators.

To keep with best practice advice from change management, key employees from all departments need to be involved in this stage to ensure their future support of the change in the organisation and to get their input on how the organisation acts today (for this Morgan's (1986) metaphors for organisations could be useful). Also, employees from subsidiaries can be included to get their perspective on markets and the organisation's current position to ensure their support in the later process.

In this stage the company needs to clarify the time horizon in relation to reaching the ideal position for the organisation. It also needs to consider whether reaching the ideal position all the way is financially feasible. If, for example, the last 5% is very expensive to reach it might not be worth it and the realised ideal position will then be to reach 95% of the envisioned ideal position.

2) Clarify the gap
In this step the gap, the difference, between the current position and the desired market position need to be clarified. It needs to be clear what parameters of the organisation need to be changed and what the desired outcome for them are.

3) Approach
In this stage the approach used to go from the current to the desired market position need to be developed. To uncover this double-loop learning is needed throughout this stage to ensure the causes for the gap is investigated. Globalising the product development process can here be considered as an option. If the time horizon and resources encourages globalisation then this is part of the change to reach the desired market position. If not, then another way to reach the desired position has to be developed. Examples could be efficiency gains, focus on core competences and markets, or another market strategy (for example focus on a niche market segment).
Globalisation is often chosen:
> ➢ If bringing in competences not found in-house can improve the company's products and competitive advantage and thereby be a tool to reach the desired market position.
> • Prerequisites which would make globalisation less resource-intense:
> > o The company has experience with offshoring and outsourcing.
> > o Affected employees have skills in virtual cross-cultural communication and leadership, language skills etc.

6.1.3 Stage 3: Operational planning
In this stage the first step towards the ideal position needs to be prepared and planned for (T1 on Figure 29 and implementation phase 1 on Figure 28). This means determining the time horizon, the KPIs for this first step, roles and responsibilities, and other aspects of the first change initiative. Changes to the organisation when implementation occurs need to be considered so potential negative impacts can be lessened. In the following it will be assumed that the previous stage

indicated globalising product development process activities is a key part of reaching the desired market position. In this case the details concerning what should be moved, how and to where needs to be specified.

This stage therefore contains four steps which will be detailed in the following:
1) Select the task to be moved abroad.
2) Clarify the possible external changes and impacts due to moving this task and implement any necessary changes.
3) Clarify the possible internal changes and impacts due to moving this task and implement any necessary changes.
4) Select key performance indicators.

These steps are iterative as the possible external and internal changes can impact whether the task in question is moved or not and KPIs will depend on these possible changes as well in order to be able to monitor them (the arrows in Figure 31 on the following page).
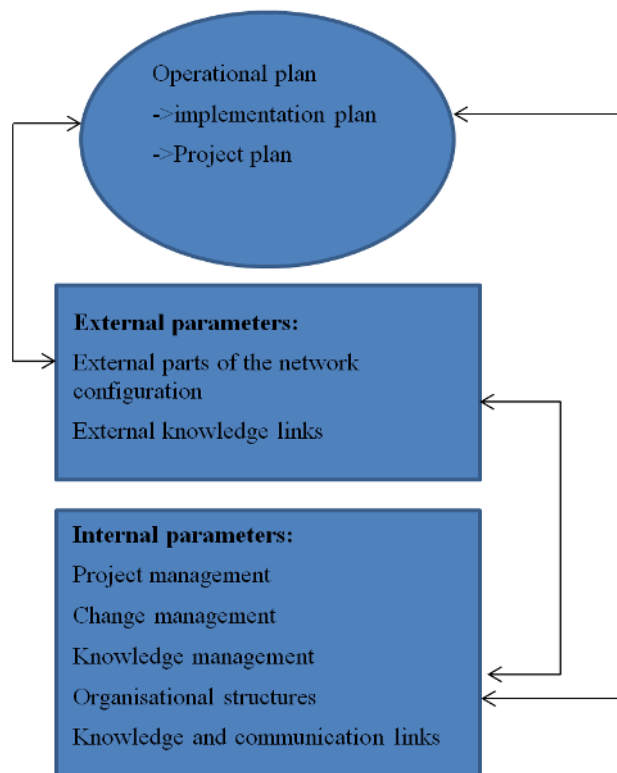
Figure 31: The iterative process in the operational planning stage

The outcome of this stage is an implementation project plan for the first step (T1 in Figure 29 and implementation phase 1 in Figure 28) through a detailed project plan as shown in Figure 31. As the figure shows, this process is iterative as external parts of networks and internal preparation will often impact each other and therefore the best solution for implementing the change in the organisation. Programs like, for example, Prince2 for project management (Prince2, 2011), might be helpful to ensure all the needed information is ready before any changes are made. This includes roles, responsibilities, timeline and other important deadlines for implementing the first change project.

1) Select the task to be moved abroad

This step relies on double-loop learning to ensure potential implications of moving a task and the causes for this is investigated. This task needs to fit into the company's strategic plan developed in stage 2. The engineering project and organisational considerations for selecting the task or function to move abroad as mentioned in Chapter 5.2 can be used here depending on which of the two approaches – AR or CR – the company implements in stage 2. Key considerations are product features (for example maturity and modularity), product development process features (for example modularity) and organisational features like communication, cultural differences, organisational structures and network configuration. Furthermore, external features like target market for the product, key suppliers and collaborative partners also have to be considered. From this information a cost-benefit analysis which considers direct as well as hidden costs in a short and long term perspective need to be developed. Furthermore, possible changes and impacts on the organisation and outside stakeholders need to be considered. This means changes to the organisation, technical aspects of the task or function and consideration for inside and outside stakeholders. These aspects are detailed in point 2) and 3) below.

2) Clarify the possible external changes and impacts due to moving this task and implement any necessary changes

The current network configuration needs to be considered as well as market trends in relation to the strategic plan and the desired position. The role of subsidiaries in the change is important as location decision affects the budget and likely the ease of moving the task or function; a green-field operation is often more resource-heavy than a brown-field operation. Also, in selecting country it needs to be considered what type of operation should be created based on the characteristics of the task (use of core competences and sensitivity concerning IP rights could for example indicate full ownership instead of joint-venture or outsourcing). As power relations between subsidiaries may change if a current subsidiary receives new tasks or a new subsidiary is created (or sourced out), as many stakeholders as possible should be involved to ensure knowledge of local conditions as well as support of the change initiative which is taken. If stakeholders from outside the organisation need to be involved confidentiality need to be considered so an appropriate arrangement is reached regarding how much information to share and how.

A key way to understand possible changes and impacts due to moving a task is to develop scenarios. Several management tools and methods for scenario development exist (e.g. Rasmussen, 2011; Rasmussen, 2005; Alexander, 2004). Scenarios can be created as computer aided scenarios, for example using statistic simulation could be one of several options in computer aided scenario creation (e.g. Hansen *et al.*, 2010) or as descriptive scenarios which often involve detailed stories. An example is the future creating workshop (e.g. Rasmussen, 2005; Alexander, 2004). Scenarios for external as well as internal changes could for example be:

- What stakeholders are involved in the task today?
- How will globalisation affect their involvement in terms of knowledge and communication? Here an actor-network diagram of communication channels could be created.
- How will knowledge be shared with the global units, in what way and how often?

- If new knowledge is discovered about the product or the product development process either aboard or at home are there mechanisms in place to encourage and handle the spread and use of this information?
- Are innovation and new ideas possible and how is this encouraged?

3) Clarify possible internal changes and impacts due to moving this task and implement any necessary change

A key way to understand possible changes and impacts due to moving a task is to develop scenarios as mentioned above. Organisational structures need to be changed so they match the desired capabilities for the organisation and the tools used to reach these (as shown in Chapter 4 and Chapter 5, for example, using expatriates is most beneficial if organisational structures encourage using their knowledge both during and after the stay). Knowledge management also needs to be considered depending on the product, the knowledge sharing processes, and the knowledge type. Expatriates should be considered according to what knowledge is needed and how it can be transferred as well as how the organisation needs to change (if at all) in order to fully utilise expatriates and their knowledge.

Knowledge and communication networks are important to consider. This includes formal and informal networks to internal and external stakeholders. When something is changed or moved, it needs to be clear what happens when these knowledge links breaks and how the needed knowledge can be provided in the new context. As mentioned above an actor-network diagram showing current communication links and knowledge sharing could aid in this. By involving employees from as many departments and locations as possible the issue of local conditions in transfer techniques, engineering practice and communication can be considered early on. If at this point it becomes clear these links are too important to change or that what needs to be changed is too resource-intensive, another task needs to be considered for globalisation instead. If no other task can be moved for these same reasons, another way than globalising the product development process may need to be considered in order to reach the desired position (going back to stage 2).

Clarifying the communication and knowledge links which will be affected during a move and whether they can be moved with the task, can be changed, or can be ignored (i.e. other functions which depend on this one for knowledge or interaction) is therefore important. This means investigating a) What knowledge is shared and how? And b) What communication is done, how, to whom and in what format? This involves uncovering both the formal and informal communication and the structured and unstructured knowledge sharing between individuals, departments and stakeholders outside the company. The formal and structured knowledge sharing and communication will the easiest to uncover. Knowledge of informal knowledge and communication resides among all the employees who work with the task or function every day. It is therefore important to involve all relevant stakeholders in this process. During this phase it may be discovered that the task which is meant to be offshored relies heavily on informal communication or knowledge which is tied to the routines and culture of the current location. In this case it may be difficult to move the task abroad without encountering problems, and the company needs to reconsider whether it is willing to take such a risk and if so how to best address this risk.

These knowledge and communication links needs to be investigated on three levels;

- ➢ Inside the task (the work process).
- ➢ Between the task and the rest of the organisation.
- ➢ Between the task and the surrounding community.

To do so it needs to be clarified how the communication and knowledge links will function after the move and address potential complications. In other words, the company needs to consider how the communication and knowledge which is needed for the task to be successful can work in the new location. This means consideration for the local context, i.e. culture, local government and the local employees. However, for communication and knowledge sharing between the task and the rest of the organisation a compromise often needs to be reached as several local contexts need to interact. Official and unofficial communication needs to happen mainly through virtual means like online conferences, virtual meetings, and interactive portals and databases. This needs to happen in an environment which is acceptable for all, which embraces each communication culture and engineering practice which is involved and finding a way for these to collaborate. Involving as many as possible of the employees who have to interact across distances in how to create these links, as well as educating all staff on each other's cultures and engineering practices, can be helpful to ensure support for the links which are created.

Examples of considerations regarding knowledge and communication can be:

- ➢ If the move is not done to gain competences: where does knowledge resides which needs to be transferred?
- ➢ If the move is not done to gain competences: The cost of moving knowledge in its original form.
- ➢ If the move is not done to gain competences: How easy is it to transform this knowledge into explicit knowledge?
- ➢ If the move is not done to gain competences: The cost of transforming knowledge to codified knowledge which is cheap to move.
- ➢ Make more unofficial communication and knowledge sharing official or vice versa so it is in accordance with the local communication culture.
- ➢ Transforming implicit knowledge to explicit knowledge with clear documentation if this is suited for the local communication culture and the strategy for moving the knowledge.
- ➢ Creating possibilities for unofficial knowledge sharing in an environment which considers the local culture and context.
- ➢ Work processes, work procedures and official communication adjusted to the local culture, size and function of the organisational unit which will now handle the task.

4) Select the key performance indicators

KPIs need to measure elements which indicate the development of the desired capabilities the organisation needs in order to reach the desired market position to ensure the project is continuously realigned with the strategic and operational plan. The KPIs need to measure not only hard factors like deadlines and quality but also soft values like work culture, innovation and collaboration.

The KPIs also need to measure that the needed communication and knowledge takes place internally within the task which was moved out. Several tools can be used. For example someone from the rest of the organisation can visit the site at random intervals and check the status. Furthermore, quality controls and customer satisfaction are also key indications. Statements from the local management and employees can also be helpful but outside control is important to minimize subjectivity. Soft values are the hardest to measure and the best way to evaluate these is by measuring surrounding factors through workplace surveys, regular employee development conversations between supervisors and employees, and regular contact to unions and other interest groups and organisations.

To ensure communication and knowledge links are maintained between the task and the rest of the organisation someone who is not involved in the communication and knowledge sharing could ask the involved employees from both sides how they evaluate the interaction at regular intervals through surveys and interviews. Furthermore, departments and functions using input from the offshored task, but who are not directly involved, can be asked to evaluate whether they get the input they need compared to before the task was moved and, if not, what input is missing.

To ensure knowledge and communication links are maintained between the task and outside stakeholders these links can be evaluated by getting regular input from the outside stakeholders and clarifying what input they may be missing.

To ensure the KPIs are used as part of a continuous feedback loop for improvement in the organisation clear roles and responsibilities for measuring KPIs needs to be devised. This could be one of the key functions in relation to offshoring that the company's HR, sales and/or quality department need to carry out. Furthermore, these measurements need to be a part of a continuous improvement effort, i.e. feedback loop which has full support throughout the organisation, meaning that organisational culture, structures and leadership encourage this and that it is an integrated part of the change process. A part of this process can be to develop scenarios to check whether the KPIs are likely to catch all important deviations from the plan so these can be addressed.

6.1.4 Stage 4: Implementation
In this stage the company implements the changes to the organisation and sets up the KPIs so modifications can be implemented according to the results from the KPIs.

This stage has three main steps which will be described in more detail below:
1. Move the task.
2. Implement key performance indicators.
3. Implement possible changes due to measurements from the key performance indicators.

These steps are iterative as moving the task and implementing KPIs can mean some changes have to be made to the organisation or maybe to the implementation plan itself (the arrows in Figure 32). Such changes must still be in line with the strategic plan developed in stage 2 as illustrated in Figure 32.
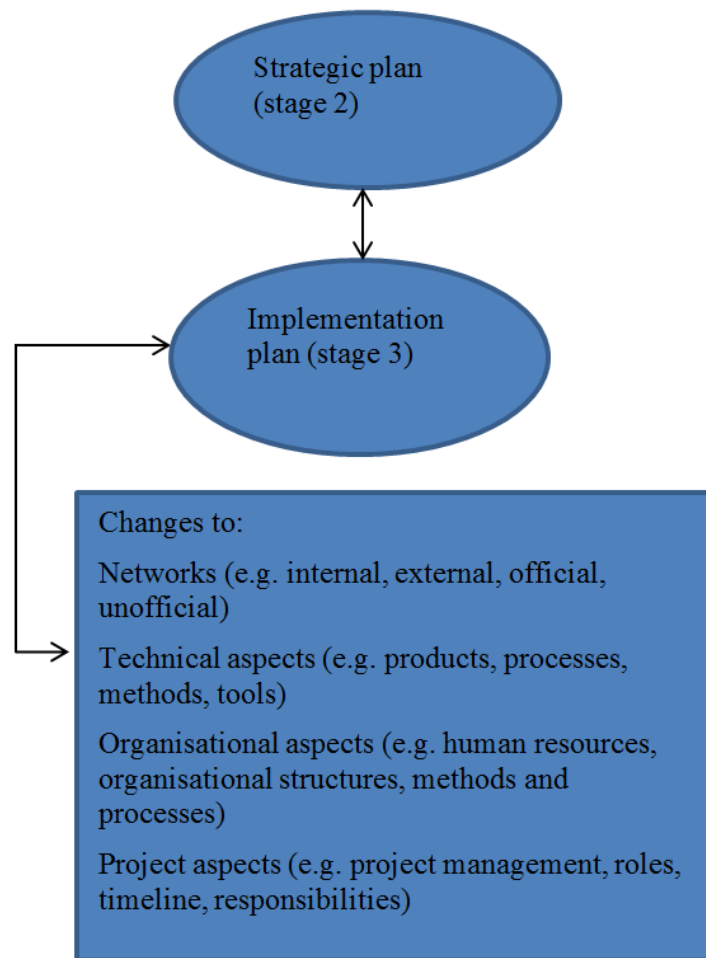
Figure 32: The iterative process in the implementation stage.

The outcome of this stage is that the first step, the first change and the first big milestone towards reaching the desired market position, has been completed.

1) Move the task

Moving the task is done according to all the prepared material from the previous stage. The change process should follow best practices from project management and change management (e.g. transparency, stakeholder involvement, communication, developing a burning platform, showing management support). Any unforeseen problems should be handled by following the GDM framework, meaning their impact need to be considered and how to implement a given solution is evaluated in accordance with the strategic plan, maybe resulting in going back to stage 3 before continuing with stage 4.

2) Implement the KPIs

To be most efficient the KPIs need to be a part of a feedback loop to evaluate if there are problems with implementation. The KPIs therefore need to measure that the implementation plan is followed and that the new structures are used to their fullest potential which includes sociological and organisational aspects. To ensure this the KPIs need to be evaluated from time to time to ensure they are still relevant and current.

3) Implement possible changes due to measurements from the KPIs

When the KPIs have been measured this can cause changes to tools, methods or processes according to the data. This can include changes to HR procedures, creating new types of collaboration tools, changes to the product development process and technical processes and changing how knowledge is shared and viewed.

6.1.5 Stage 5: Evaluation

Before starting to implement the second implementation step towards reaching the strategic goals (T2 on Figure 29, implementation phase 2 in Figure 28) it needs to be considered whether the first step has been implemented successfully, and whether it can be improved. Thereafter, reflections on whether the strategic plan developed in stage 2 is still valid are needed, as many global markets are very dynamic and volatile. The measured KPIs may help in this assessment as well. The next step towards the ideal market position can be implemented if the strategy from stage 2 is still valid (going back through stages 3,4 and 5) and, if not, then the company needs to redo stage 2. The strategic goals, stage 1, need to be checked less regularly, for example once a year, to ensure flexibly yet also allow the organisation time to move towards the agreed goals.

6.2 Summary

Globalising the product development process needs to be viewed in conjunction with strategic development and organisational change. The organisation can employ the Global Decision Making (GDM) framework when consideration globalising the product development process. This framework is based on the empirical findings and analysis conducted in this study and inspired by the theoretical fields and models presented in Chapter 2, including the Global Footprint Strategy of Manufacturing, change management models, offshoring/outsourcing process models and product development models. This framework consists of five iterative stages;

1. Strategic goal setting.
2. Strategic planning.
3. Operational planning.
4. Implementation.
5. Evaluation.

In each stage potential problem areas need to be analysed using different theoretical approaches as illustrated in Chapter 5; organisational theory, knowledge management and the GEN framework from operational research literature were all shown to be key components in order to analyse and thereby address the challenges observed in the descriptive studies on globalising the product development process.

By using the GDM framework the company develops strategic goals and a strategic plan which consider globalising the product development process as a way to reach these goals. Furthermore, it becomes apparent what the desired position for the organisation is, i.e. the overall goal or outcome within a certain timeframe. The current position for the organisation needs to be discovered, including current capabilities, organisational structures, knowledge properties, external context like market trends, and the organisation's network configuration. KPIs need to be developed which

measure whether the organisation is following the strategic and operational plans for the organisation.

This long term goal needs to be broken down into smaller change management projects with measurable KPIs and a feedback loop which ensures continuous change according to the measured outcomes against those desired. The task to be moved abroad need to be selected based on the potential impact it will have on the internal and external context and a detailed plan for implementation which include roles, responsibilities, knowledge and communication links is made, and how these can be implemented in the new situation is clarified. During implementation KPIs and a feedback loop need to be set up to ensure the move is in line with the strategic plan. New knowledge need to be used so the KPIs can be changed if it is discovered the right elements are not measured. In the last phase the organisation reconsiders the outcome from the first big milestone, the first change project, and whether internal or external circumstances have changed which would require changes to the strategic plan. Hereafter the second step or milestone towards the long term strategic goals is implemented, going through stages 3, 4 and 5 again. The organisation should reflect less frequently on stage 1, for example once a year, to ensure flexibility yet also to allow a change initiative to take hold.

Depending on resources, timeline for the desired position for the organisation and organisational characteristics, an organisation can choose to use the GDM framework to avoid or minimise risks and make few organisational changes (the AR approach 1 in Chapter 5.2) or confront risks by minimizing the negative impacts on the organisation (the CR approach in Chapter 5.2).

The GDM framework connects the strategic and operational level of the organisation and ensures the change the organisation is going through is monitored and continuously adjusted. However, the framework also relies on organisational learning and continuous reflection as well as distributed control which provides agility and adaptability.

The GDM framework is therefore suggested as a tool for decision-making regarding globalising the product development process.
In the next Chapter the validity of the research approach is demonstrated and the GDM framework is validated through two workshops with industry stakeholders. Furthermore, reflections and further work based on this study is detailed.

Chapter 7: Validity and reflections

This Chapter covers four areas:

1. Validity of the research approach.
2. Validity of the proposed decision-making framework.
3. Reflections on different aspects of the research study, the findings and the framework.
4. Future work and the research implications on research within this field. Furthermore, the implications for engineering education, industry, Denmark and the global society are debated.

First the validity of the research approach is detailed. This shows validity of the findings. Thereafter the validity of the Global Design Making framework is illustrated. This was obtained through conducting two workshops with a focus on the reaction and learning the stakeholders had in regard to the framework.

7.1 Validity of the research approach

The quality of the research approach depends mainly on the validity and reliability of the case studies. Yin (1994) lists a series of tests for these two areas (see Table 31).

Table 31: Case Study Validity and Reliability Tests.
Source: Yin, (1994)

Tests	Case study tactic	Phase of research in which tactic occurs
Construct validity	Use multiple sources Establish chains of evidence Have key informants review draft case study report	Data collection Data collection composition
Internal validity	Do pattern-matching Do explanation-building Do time series analysis	Data analysis Data analysis Data analysis
External validity	Use replication logic in multiple-case studies	Research design
Reliability	Use case study protocol Develop case study database	Data collection Data collection

Several of these approaches were employed in this thesis, in particular:

1) Triangulation.

There are four types of triangulation (Flick, 2002; Yin *et al*., 1994):

- Data triangulation.
- Investigator triangulation.
- Theory triangulation.
- Methodological triangulation.

In this study several case studies are involved with multiple stakeholders, and different methods are used to analyse the data. This ensures all four types are employed.

2) Multiple case study using mixed methods.

> By combining a contemporary in-depth case study (X5) with short retrospective case studies a synergy is created which enhances external validity, construct validity, and internal validity (Leonard-Barton, 1990).

3) Replication logic.

> In multiple case studies there can either be (1) similar results (called literal replication) or (2) opposing results for a predictable reason (called theoretical replication) (Voss, *et al.*, 2002; Yin, 1994). In case studies, findings are generalised to a broader theory (Yin, 1994: 36). Already developed theory is used to compare the results of a case study. If two or more cases support the same theory, replication (literal or theoretical) can be claimed. The empirical results can be strengthened if two or more cases support the same theory but do not support an equally plausible, rival theory (Yin, 1994: 31). In this thesis literal replication occurred and was generalised towards a framework as shown in Chapter 6.

4) Protocols for research approach.

> Protocols were used in this study to describe each step the researcher took in regard to the case studies (e.g. Yin, 1994:63-65). This will enable another researcher at another date to – given the same conditions – replicate the dataset. As reliability in a dataset is about minimizing errors and eliminating biases, this strengthens the reliability of the findings (Yin, 1994:36).

5) Validation with academics and practitioners.

> a) Validation with academics
>
> This was ensured through presentations at conferences. In total, seven papers were accepted and presented at six different conferences:
> 1) Design conference in May 2010 with the paper "The Impact on the product development process when offshoring or outsourcing".
> 2) R&D management conference in June 2010 with the paper "Offshoring R&D: The relationship between transparency, communication structures and knowledge".
> 3) APMS conference in October 2010 with the paper "The sustainable utilization of human resources in global product development".
> 4) ICoRD conference in January 2011 with the paper "Product Implications of Design Offshoring".
> 5) EurOMA conference in July 2011 with the papers "Network configuration of global R&D networks: Extending OM configuration concepts" and "Viewing engineering offshoring in a network perspective: Challenges and key patterns".
> 6) ICED conference in August 2011 with the paper "Addressing the risks of global product development".
> Articles based on this research were submitted to several journals. At the time of writing, the following paper have been accepted for publication with revisions (revisions underway); "*Global product development: The impact on*

the product development process and how companies deal with it" in Internal Journal of Product development (Hansen & Ahmed-Kristensen, forthcoming). Several articles have been submitted to academic journals and are in review. These papers and presentations suggest interest, novelty and ensured feedback from this community.

b) Validation with practitioners

The results were validated with practitioners in many different ways. First, all interviewees approved the transcription of their interview. Thereafter any papers or articles based on their data also had to be approved. A feedback session was held with X6 to further validate the findings. Finally, two workshops were conducted to validate the results and the framework (see Section 7.2).

Validation was achieved in all seven stages of the interview process:

1. Thematising: The soundness of the choice of case studies and explorative interviews was based on the nature of the research question and research aim as detailed in Chapter 3.
2. Designing: The reasons for using the interview method were due to the nature of the research aim and research question as detailed in Chapter 3.
3. Interviewing: Ensuring the meaning of statements was understood correctly through clarifying questions during the interview and later if needed.
4. Transcribing: This step was done so everything was written down precisely as it was said. Interviewees were given the option to read the transcript afterwards to further ensure the interviewees were quoted correctly.
5. Analysing: The soundness of interpretations was validated through the validation of the framework as described in the next section.
6. Verifying: This was built into the interview process through clarifying questions and details as described in Chapter 3 and further enhanced through the methods listed above.
7. Reporting: This was done concurrently during the writing of the thesis.

7.2 Validity of the developed framework

The final stage in Blessing & Chakrabarti's (2002) research methodology framework is the descriptive study. In this study the validity of the proposed framework developed in the prescriptive stage must be tested. For this purpose Kirkpatrick's model is used (Kirkpatrick, 1959). This model has been proved to be a valid way to test results in industry and academia (Kirkpatrick, 1959; Boyle, 1997, Phillips, 1990). The model has also been used successfully in product design research (Ahmed, 2001).

Using Kirkpatrick's engineering model, validation can take place by investigating four levels of impact when the proposed framework is implemented:

1) Reaction

How the participants respond to the framework.

2) Learning

Investigate what the participants learnt from the framework and also, how easy the framework was to learn and use as intended.

3) Behaviour

Investigate the change in the participants' behaviour after they started to use the framework.

4) Results

The impact of employing the framework and the change of behaviour upon the whole organisation.

Level 4 – results - would require longitudinal studies of a magnitude this PhD study does not allow for. Using the GDM framework requires an in-depth investigation from the company's side. This would require considerable time and resources (likely at least one month of due diligence before a company can start on the first stage of the framework in order to have all the information they need about their environment and their own current position). For the same reasons, level three – behaviour - was not possible to observe during this research study. The descriptive study will therefore be performed through the first two levels. These levels – reaction and learning – will be investigated through feedback from industry practitioners in two workshops.

Ahmed (2001) added a fifth level of impact investigation:

5) Validation

Changes and improvements to the framework after going through the earlier levels.

Level 1 (reaction), 2 (learning) and 5 (validation) will be detailed in the following. level 1 and 2 will first be detailed followed by the validation level (stage 5).

Background for the validation process

The GDM framework was validated through two workshops. One was open for all companies, and one was exclusively for WS4 who had expressed specific interest in carrying out such a workshop. The first workshop allowed for comments from several companies who compared it to their own experiences. The workshop with WS4 allowed for employing the GDM framework in a company which was new to globalisation unlike the case companies and the companies who took part in the first workshop. In this manner the workshops gained both breath and width in terms of validation of the usability of the framework.

After carrying out the workshops and gathering the results from the participants, changes and improvements were made to the framework in accordance to their feedback.

From Chapter 1 it was shown that for this study the *success criterion* is that the globalisation of the product development process more adequately fulfils the goals set for this endeavour in terms of competitive advantage. The *measurable criterion* is the difference between the budgeted negative impacts within a given timeframe, compared to the realised costs and resources spent.

As this requires a longitudinal study, the measureable parameters are from the results shown in Chapter 4 a believed better:

1. Evaluation of possible pitfalls before implementation of a given action.
2. Knowledge of possible implications of implementing certain actions.

Furthermore, a believed decrease in the following issues:

3. Quality issues.
4. Misunderstandings.

5. Communication difficulties.
6. Delays.

Workshop 1

The first workshop took place on the 24th of March 2011 and lasted six hours. Table 32 shows the companies which were represented.

Table 32: Description of workshop participants

Company synonyms	Industry	Interviewees' positions	No. of participators
WS1	Electronics	Vice president	1 participant
WS2	Electronics	Engineer	1 participant
WS3	Mechanical	Engineer and researcher	1 participant
WS4	Energy	Daily manager, engineer and researcher	3 participants
WS5	Raw materials	Daily manager, engineer	2 participants
WS6	Pharma	Engineer and researcher	1 participant
WS7	Consultancy relating to management in China (e.g. culture, communication)	CEO	1 participant

Besides industry representatives the workshop also attracted several industrial researchers as indicated in Table 32. WS4 and WS7 were different from the other companies which had all been offshoring and outsourcing functions and tasks from their product development process for many years. WS4 was first starting to do so now. This company therefore brought a new perspective on the GDM framework which was detailed in the second workshop. WS7 was a consultancy company which helped Danish companies set up operations in China in relation to policy issues, culture and communication. Their participation meant the experiences of their clients could be utilised.

The workshop started with an introduction to the research area and the results. Thereafter the framework was introduced. The findings from the case companies were debated in plenum in order to validate these. The participants were asked to mention the major challenges they had encountered to globalising the product development process, the actions they had implemented to address these, and what challenges remained. Hereafter to comment on the usefulness of the framework and its stages.

Workshop 2

The GPD framework was introduced at a workshop with WS4 on the 27th of April 2011 where six participants from the company had expressed an interest in taking part. Three of them had also taken part in the first workshop. The other participants were all project owners and project managers. The workshop lasted 4 hours.

WS4 is very young when it comes to globalisation and is only now starting to explore options. This is contrary to the case companies who were all engaged in global activities. This gave an opportunity to explore the usefulness of the framework on companies in different circumstances than the case companies.

The workshop started with an introduction to the research area and the results. Thereafter the GDM framework was introduced. Subsequently the framework and how it could be used in WS4 was debated.

Level 1 (reaction)
During the two workshops the participants were asked to comment on the developed framework overall in terms of its usability for them in their work and reflect on the workshop in general. Unlike the companies at the first workshop who were already engaged in globalisation and who could see the framework as a useful tool to use right away (preferably with even more details and a 'how to' guide), WS4 found the framework useful as a basis for reflection and debate, and as a kind of check list of what to remember to explore and reflect on.

During the second workshop with WS4 it was clarified that there is a difference between how the framework can be used depending on the company's level of maturity with globalisation (i.e. their position on the s-curve regarding globalisation). WS4 and the case companies have been drawn on the S-curve for maturity related to globalisation (see Figure 33). Even though WS4 found the framework allows for the contextual differences this result in, it indicates companies on different levels on the S-curve will focus on different aspects of the GDM framework.
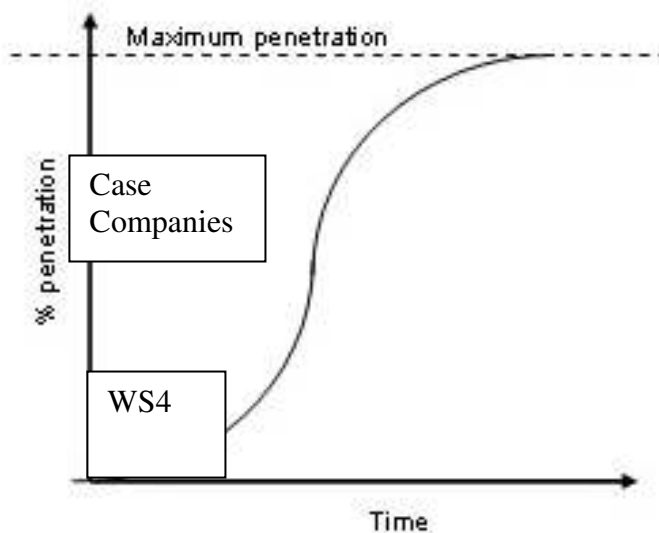
Figure 33: WS4 and the case companies placed on the S-curve for maturity.

For young/immature companies they will have many possible market positions to aim for (ideal market positions) and will spend a lot of resources on the first stage of the framework, whereas they will spend little time on identifying the current market position. The reverse may be said of mature companies (e.g. the case companies).

Participants from WS4 furthermore had the following suggestions for improvements:

- It might be useful to have a small first stage added to the framework called 'initial construct' as some companies read strategy and strategic considerations as something which is very hard to change and very detailed.

- The changes globalising products and services have on Danish society can be severe and a reflection on such impacts would be useful.

The first suggestion can be implemented by using the framework to implement many small changes. As further detailed in section 7.3.4 it is a prerequisite to implement the GDM framework that the company is able to think about itself and how to conduct strategy as well as how offshoring and outsourcing fit into this in a way which is adaptive, reflective and iterative. The second improvement suggestion is out of scope for this thesis but the topic is briefly debated in section 7.4.

During the first workshop the participants had detailed comments on the overall usefulness of the framework and its stages. These will be illustrated in detail in the following.

The participants had the following comments on the usability of the framework which confirmed its usability:

➢ The framework is useful and gives a nice overview on what to do.
➢ The framework is a good overall guide and cannot be much more specific as such a guide is context dependent and will therefore change from company to company.
➢ Some of the companies present can see in hindsight they used elements from the framework but not the whole framework.
➢ The framework supports the experiences of the practitioners.

The workshop participants therefore felt the GDM framework would be useful to them.

The participants confirmed the findings and added the following challenges they had experienced with globalising the product development process (grouped according to the main challenges found in the case studies):

➢ Coordination
   o Using the same tools everywhere can be hard.
   o Work approach is different around the world.
   o Timing interactions is difficult due to physical distance.
➢ Delays
   o Physical distance and IT infrastructure can cause delays.
➢ Communication
   o Cultural differences are a big problem.
➢ Quality
   o Difficult to find qualified staff abroad; in particular in China
➢ Knowledge management
   o There are few people left in the company with core knowledge after globalising the product development process which means they will be costly to lose.
   o Having knowledge reside outside the firm can be expensive if the relationship with the supplier breaks down.
   o It can be hard to integrate local market knowledge into global product development.

- o Some knowledge is context specific or exists only in unwritten rules; this makes them hard to move abroad after the decision to move an activity has been made.
- o Exchange employees between subsidiaries are a good way to learn but expensive.
- o It is important to take small steps but learning by doing is costly.
  - ➢ Additional challenges mentioned
    - o Management issues
      - ▪ Perceptions regarding the reasons to globalise the product development process can make it hard to utilise its full potential as decision makers as well as engineers and the daily managers can have prejudices regarding how and why such a development can take place.
      - ▪ There is a focus on short term financial goals which can make it difficult to focus on other aspects, like learning.
      - ▪ It can be hard for the Danish headquarters to 'let go of work'.
      - ▪ Market development vs. cost efficiency can mean cost is valued higher and market options are not fully explored.
      - ▪ Best practice from change management is rarely followed, in particular in communications, which can create internal resistance to globalising the product development process.

As can be seen the challenges found in the case companies were confirmed (Chapter 4). The additional challenges relating to management issues were among those illustrated in the analysis (Chapter 5) and thereby confirm these aspects of the analysis as well.

The participants were then asked to comment on the proposed framework in terms of what was missing in each step (if anything) and what was good about it.

The participants had the following comments on what a framework would need:

- ➢ Networks need to be maintained with universities, stakeholder groups, and others.
- ➢ Often subsidiaries have no real identity of their own; they need to get more responsibility so the focus is on the goal and not the process they carry out.
- ➢ There is often a focus on alignment and not synergies and this means the company loses out on a lot of knowledge. A framework therefore need to allow for a focus also on synergies.
- ➢ To change things for the better there need to be a new kind of leadership which considers culture and divides responsibilities with a focus on self-management for employees, groups, departments, and subsidies.
- ➢ The framework needs to be reflective so a proactive and not just a reactive strategy is developed.

The GDM framework allows for these aspects providing the context the company operates in encourages it.

The participants had the following comments on stage 1 of the GDM framework (strategic goal setting):
- ➢ Good things about this stage:

- o It is good this stage is iterative; market conditions change quickly so goals need to be re-evaluated from time to time though not too often.
- o Good that the framework is developed in such a way that feedback loops are an integrated part of it as the entire globalisation process becomes proactive and not just reactive (reacting whenever problems arise).
- ➢ To be kept in mind when going through this stage of the framework:
  - o It should be kept in mind what mindset/perspective the stakeholders are operating from when deciding on the ideal position for the company.
  - o The motivation for doing a given action will likely influence everything else (e.g. how it is carried out, when, where). Therefore the stakeholders employing the framework need to be aware of motivations and ensure all decisions are reflected upon.

The participants had the following comments on stage 2 of the GDM framework (strategic planning):

- ➢ Good things about this stage:
  - o It is good this stage is iterative; market conditions change quickly so the strategy need to be re-evaluated on a regular basis.
  - o Good that before trying to reach the ideal market position using globalisation, other solutions and scenarios has also been given adequate thought.
  - o It is also good that companies reach for the ideal market position in small steps due to this rapid change so that each small change project can be fitted to the conditions in the given market.
  - o It is important to utilise the ability the framework gives to provide a holistic picture of the consequences and impacts of globalising the product development process as the workshop participants felt this would be an important factor in lessening the negative impacts of globalising product development.
- ➢ To be kept in mind when going through this stage of the framework:
  - o The degree of uncertainty regarding information about internal and external conditions.
  - o The strategy should be made in such a way that utilising engineering talent around the world is a key outcome as the workshop participants felt this would be a key competitive factor in the future.

The things the participants mentioned should be kept in mind when going through this stage fit well with the framework and are important issues to consider when using the framework.

The participants had the following comments on stage 3 of the GDM framework (operational planning):
- ➢ Good things about this stage:
  - o Following the best practice from change management is important for the whole organisation; in particular communication.

- o The framework supports investigating knowledge networks in depth both internal and external to ensure the organisation can tap into that knowledge which is vital for its competitive position.
- ➢ To be kept in mind when going through this stage of the framework:
  - o It should be kept in mind that it can be hard to know work processes and knowledge and communication links for products which are not yet mature so the people working on developing this stage must be comfortable with proceeding with imperfect information.
  - o When deciding on how to move a given task or function abroad the following aspects should be considered: building trust, tacit knowledge sharing, innovation possibilities, creation of personal relationships, and confidentiality.

The things the participants mentioned should be kept in mind when going through this stage fit well with the framework and are important issues to consider when using the framework.

The participants had the following comments on stage 4 of the GDM framework (implementation):

- ➢ Good things about this stage:
  - o The framework supports that the changes are carried all the way through so top management support is clear and involved.
  - o The framework supports that KPIs are updated so that possible 'pain points' can be caught early.
  - o It is good that data used to measure KPIs needs to be utilised in a streamlined fashion so KPIs are always re-evaluated and the data is always used.
- ➢ To be kept in mind when going through this stage of the framework:
  - o It is important that responsibilities are clearly divided and that the headquarters does not maintain all responsibility but that subsidiaries and local employees get more ownership and responsibility when KPIs – developed in collaboration - have shown they are competent to do so.
  - o Tools and methods, also embedded in people and routines, need to be updated according to the results from the KPIs.

The things the participants mentioned should be kept in mind when going through this stage fit well with the framework and are important issues to consider when using the framework.

The participants had the following comments on stage 5 of the GDM framework (evaluation):
- ➢ Good things about this stage:
  - o It is good that the framework and its methods encourages that before the next step is taken all stakeholders are involved in evaluating what has happened and in preparing the next step (also stakeholders in subsidiaries).
  - o It is good that the framework allows for an acknowledgement and utilisation of different perspectives on changes and approaches to implementing changes.
- ➢ To be kept in mind when going through this stage of the framework:
  - o It is important to ensure all knowledge networks are utilised.

      o It is important to celebrate small victories when evaluating the last changes against the desired goals.

The things the participants mentioned should be kept in mind when going through this stage fit well with the framework and are important issues to consider when using the framework.

It can therefore be concluded that the framework has been found relevant for companies at different levels of maturity, but that they will use the framework differently and focus on different aspects of it.

Level 2 (learning)
The participants felt the GPD framework was easy to use and gave a good overview. It was helpful that the framework used terms known to industry (e.g. change management tools).
To make the framework even easier to use and learn the participants suggested the following work should be done:

➢ A list of 'mistakes to avoid' should be described in more detail than just the results from the case companies.
➢ Detailed best practice examples.
➢ Develop an industry 'how to' guide with more 'story telling' on how to do each stage.
➢ A detailed guide on how a company can ensure it will develop a strategy which utilises global engineering talent when globalising the product development process.

A detailed industry guide based on the GDM framework will be developed during an industrial research project due to start in June 2011. These concerns will be addressed through this project.

7.2.1 Level 5 (validation)
The feedback from the first workshop meant that the framework was described in more detail and with suggested methods for each stage well known to practitioners like SWOT analysis. Furthermore, more figures were used to explain the framework. A detailed industry guide will be created during a research project based on the data in this thesis (for more details on future work see section 7.4).

Changes from the workshop with WS4 meant that it was made clearer that the process was iterative and that each cycle could focus on different parts of the framework so resource usage varied. It was also emphasised that the framework was created from the results from the case companies who were all already engaged with global product development of some kind.
Due to the iterative nature of the development of the framework, the final framework is shown in Chapter 6 as it was continuously updated and improved based on input and feedback from academics and practitioners as new knowledge was gained and new areas of interest was uncovered.

7.3 Reflections

This section presents reflections made regarding different aspects of the research study, the findings and the framework.

7.3.1 Role of the researcher

The research study has been explorative and inductive through an interactive cycle of learning. The knowledge management lifecycle (Jung *et al.* , 2007) can be used to describe the continuous learning process which the researcher went through during the study by going through (1) Knowledge creation, (2) Knowledge formalization, (3) Knowledge organisation, (4) Knowledge distribution, (5) Using knowledge and (6) Knowledge evolution.

Furthermore, by suggesting a new approach to decision making regarding offshoring and outsourcing within companies, this study encourages action research by encouraging companies to go through a change process where they find a better way to resolve problems (Lewin, 1946, Argyris, & Schön, 1996, Flyvbjerg, 2001).

7.3.2 Literature

The theories and models introduced in the literature review had some limitations as shown in Chapter 2. However, they could, when taking a cross-disciplinary approach as shown in Chapter 5, provide a more holistic picture of the research area.

The case studies gave a good introduction to globalising the product development process and the difficulties companies encountered. However, the findings may be influenced by the culture and nationality of the cases. While these limitations should be kept in mind, the literature provided an overview of the challenges and impact globalising the product development process can have.

7.3.3 Findings

The findings show a picture of the case companies as viewed through the eyes of the interviewees in a given timeframe. They may therefore reflect certain cultural views as well as existing power formations in the company.

It was interesting that none of the case companies saw the challenges they encountered from both an operational and strategic angle as debated in the previous chapters. The reasons for this therefore remain unknown. However, one could speculate that it could be because if the complexity of offshoring and outsourcing had been acknowledged it would also mean an acknowledgement that starting such a project would affect the organisation, its processes and its people as seen in this study. It would therefore require more preparation, planning and consideration than what was done in the case companies, all of which would require more time and resources. It might therefore have been easier to take the decision and handle the situation by ignoring its inherent complexity.

Another interesting thing about the findings is that the areas which were influenced by globalising the product development process reflect the five Ps mentioned in Strategic Knowledge Management (Debowski, 2006); People, Planning, Performance, Processes and Products. This could highlight the importance of knowledge management when globalising the product development process.

7.3.4 The GDM framework

The GDM framework is inspired by the research methodology framework by Blessing & Chakrabarti (2002) by introducing an ideal market position (called 'ideal stage' in the framework by Blessing & Chakrabarti), the current market position, and focussing on the gap between these.

Furthermore, the iterative approach is known from several product development models as described in Chapter 6. It is also inspired by the outsourcing/offshoring literature and the Global Footprint Strategy of Manufacturing (Minshall, 1999). By combining various aspects from these fields, the GDM framework provides a new way to approach globalisation of the product development process which builds upon previous models and results. It is an approach to decision making which is close to the bounded rational decision process model (e.g. Cyert, March & James, 1963; Elster, 1983; Gigerenzer & Selten, 2002; Kahneman, 2003). Because of the uncertainty assumed in this decision model, the decisions are broken down into steps and the use of KPIs and double-loop learning as well as collisions – a key element of change management – is important to ensure the decision is followed through. The Outsourcing and Offshoring Circle (Perunovic, 2009) and the Global Footprint Strategy of Manufacturing (Minshall, 1999) are the closest to a decision-making framework for globalising the product development process which exist. The Outsourcing Circle more present an overview of the options a company has when outsourcing than a framework for making a decision and carrying it through. The Global Footprint Strategy of Manufacturing shows a decision making process but only for taking one decision (whether to globalise a given manufacturing process) and not how to handle the process after it has been sent out. The models presented in the Outsourcing Circle and in the Global Footprint Strategy of Manufacturing could, however, be useful in several of the choices which have to be made throughout the stages of the GDM framework (for example for location selection, see appendix 1.3 and Chapter 2.7). However, the vital element the GDM framework brings is its ability to address the challenges when a company globalises the product development process through incorporating many different theories, including organisational theory and the GEN framework from operations research literature.

While the GDM framework can be used for both small and large changes, in order to follow the framework the organisation needs to have an organisational culture and approach to changes which allows for a reflective and iterative approach to organisational changes and therefore also the changes globalising the product development process produces. This implies a view on organisations as being able to learn and adapt and encourages flexibility and decision-making throughout the organisation which indicates a view on the firm similar to the brain metaphor (Morgan, 1986). This indicates that certain firms might never consider using the framework as it would not match the image they have of themselves and the context in which they operate. In this manner the framework may only be useful for companies already operating within a paradigmic structure which allows for implementation of this framework or which are willing to change and adapt such an approach.

The GDM framework is a result of an inductive study and is based on findings from companies who have already started to engage in global activities. The framework may therefore be most useful for them, while companies who are less mature regarding globalisation options may use it as inspiration for debate and considerations as they start to explore global options. This also means that the time it takes for one iteration through the stages of the GDM framework, and what stage is the most resource heavy, will vary. For mature companies, finding out what the current market position is may be very resource intensive whereas finding a desired future market position may be quick compared to this. For a company just starting to explore globalisation options there may be many possible desired future market positions, although the current market position may be very easy to describe.

The GDM framework may be useful in different ways depending on whether the company produces physical products or services, as the latter often have short development times and can be based on relationships and other network relations. WS4, a producer but also service provider of energy, indicate they could use the framework in a different way than the other investigated companies which all produced physical products. However, they were also a very immature company regarding globalising activities which were the more dominant feature regarding their approach to the framework. Investigating a possible difference in how the GDM framework could be used between service and physical product companies could further validate the framework. However due to resource constraints this was not possible during this project (see Further Work, section 7.4).

The GDM framework may be useful also for other types of outsourcing and offshoring than those this study focused on. It can be assumed there would be a difference in what stage of the GDM framework would need most time and other resources depending on the type of offshoring and outsourcing the company engages in. For example, domestic outsourcing would likely be faster and easier to set up than offshore outsourcing.

7.4 Further work and implications

This section covers implications of the findings and the proposed framework in relation to further work.

7.4.1 Research

Further research is needed to confirm these findings in other companies both in Denmark and abroad to test their global validity. Furthermore, it would be interesting to test the GDM framework in more service companies and less mature companies when it comes to globalising the product development process.

In response to the request from the industry stakeholders regarding a more detailed framework, it was decided to apply for funds for a research project to make it. This detailed industry guide would describe all the tools which are most likely to be used in the framework in detail. During such a study it would also be possible to further test the framework by starting to implement it in a company. This study will be started in June 2011.

It could be interesting to explore the third and fourth validity test – behaviour and results - and see how companies use the framework in practice and whether the expected benefits are apparent after the five stages in the GDM framework has been completed the first time, and thereafter when it has been completed several times when using the framework for large organisational changes. How the different companies use the framework to globalise the product development process, and the methods they employ in each stage, may also be interesting to investigate.

The framework might be used for other organisational changes than globalising the product development process. It could be interesting to see what type of organisational change it could be used for in companies who use the GDM framework, and if companies could use the GDM framework as an overall guide for all changes they implement.

7.4.2 Education

These findings indicate that Danish engineers in the future need to develop much more than technical skills. They need to learn to work in virtual cross-cultural teams both as team-members and as team leaders. While in the foreseeable future the key value adding activities like customer sales and idea generation were scheduled to stay in Denmark, the findings also indicate this will change in the future as Danish companies grow more experienced in managing global networks with their own organisational units abroad as well as outsourcing partners.

Furthermore, engineers need to develop skills which allow them to act in a holistic way with regard to their work on global engineering projects. They need to be able to consider the implications of their actions on both technical and organisational features, and make continuous corrections to these aspects of their work based on KPIs as well as to update these when needed to ensure the work is aligned with strategic and operational plans.

7.4.3. Industry

Almost all engineering fields today have to accept globalisation as a fact. This create a more complex organisation which requires double-loop learning in planning and management activities. However, it is important to note that these findings also indicate that moving tasks abroad does not necessary pay off, and in some cases may never do so due to the higher complexity in the global organisation. The GDM framework is created to ensure such situations are discovered early on so costly mistakes can be avoided.

It is also interesting to speculate if increasing global complexity where an organisation has multiple connections to multiple stakeholders both inside and outside the company, can ever fully be understood, planned for, or managed. Also, if this is the case what impact this has in regard to leadership and management. While it may encourage some to employ more strict management – as many of the case companies did - what may be needed is more leadership; a reliance on implicit values (e.g. trust, a leader's charisma) and the validity of an overall strategy developed in collaboration with all the stakeholders in the global network which can be continuously adjusted as circumstances change (Kotter, 1996).

7.4.4 National

Politicians in Denmark often refer to Denmark becoming a knowledge society so that as a nation it should live off its innovative abilities in product design and core knowledge within R&D. However, this research suggests one has to wonder if this is possible if design and R&D is starting to move abroad as well. Under these circumstances what then, should sustain Denmark? That may prove the greatest challenge to the Danish labour and educational market in the years to come. While this research does not give the answer to these questions it contributes to the debate so that Denmark politically can start preparing for this situation.

7.4.5 Global

This research indicates that globalisation has enabled and encouraged mobility between countries, though only for the best educated. While this can have positive impacts it also means countries need to be aware that high earners will 'shop around' and settle in the country with the most tempting job

offer and social package. This mobility encourages a change in border policies and employment laws.

Globalisation of higher value tasks like engineering, R&D and product design can be beneficial for the receiving countries. It gives low-cost countries a chance to advance in the value chain. However, it also throws cultures together in a long distance working environment which makes it more complicated to develop trust and relationships. Furthermore, this quick development could end up being too fast, leaving some low-cost countries as recipient of host companies which do not obey rules and regulations regarding the environment and working conditions which could weaken the ties between the host country and the recipient country.

Also, the fast growth in economies like China and India has already put a huge environmental and social strain on these countries as people start to migrate towards the cities, demanding more and better infrastructure and ever more energy consumption. A consequence of globalisation is that a crisis is rarely contained to one area or one country so while a social and environmental crisis may start in the developing countries it would not be contained there. These are global challenges and could have severe environmental and social implications.
Harmonising this development will be a key challenge for the future of all nations.

7.4.6 Practical
The case companies were currently in different stages of globalising their product development process and employed different methods to control this process, including work descriptions, quality checks and expatriates. The case companies could use the GDM framework to specify their ideal market position and analyse how to get there, and how globalising the product development process figures into this. For many of the case companies finding the current market position in the first stage of the GDM framework may prove the most resource-intense part of using the framework.

The case companies which were most involved with globalising the product development process (e.g. X6) were very interested in using the framework. The case companies which approached globalising the product development process very cautiously and with strict headquarter control, were more reluctant to make larger changes in how globalising the product development process is addressed (e.g. X2, X7). This could be because the current operating paradigm within the organisations does not allow for using the framework, or that the current power structures discourage it. It could therefore be assumed that implementing the framework would be easier in some of the case companies than in others, as also described in section 7.3.4.

7.5 Summary

The validity of the research approach was achieved through (1) triangulation, (2) multiple case study using mixed methods, (3) replication logic, (4) protocols and (5) validation with academics and practitioners throughout the project through meetings, approval on interview transcriptions and academic papers.

Due to the resource constraints for this PhD research study, validation of the GDM framework was through (1) reaction, (2) learning and (5) validation.

This was achieved through two workshops. The results showed that companies found the identified problem areas reflected their own reality and that the framework could be useful for them, though many desired an industrial 'how to' guide with more examples and detailed descriptions and method suggestions for each of the stages in the framework. Company maturity with globalisation was shown to influence how the framework is used and which stage is most resource-intensive for the company.

Further research is needed in regard to the two other validity levels – behaviour and results - and usability of the framework in companies from different sectors and with different maturity levels. This research study has indicated that engineers in the future need to develop skills not only in technical areas but also in organisational areas. Furthermore, they need to develop holistic problem-solving in regard to globalising the product development process to ensure problems are addressed using double-loop learning so that the cause for the problem can be uncovered.

The next Chapter presents the conclusion to this research study and illustrates the academic and industry contributions.

Chapter 8: Conclusion

This Chapter presents the research conclusions, including answers to the research question, and pinpoints this study's main academic and industrial contributions.

8.1 Research approach

This study investigates the challenges engineering companies face when globalising the product development process through offshoring and outsourcing. It also investigates the solutions the companies took to address these challenges, and the impact this had on the organisation, the engineering processes, and the engineers.

The research methodology framework by Blessing & Chakrabarti (2002) was employed in this thesis. Two descriptive studies were carried out. Case studies with seven Danish multinational corporations were conducted, and a total of 57 semi-structured interviews were carried out with top managers, daily managers and expatriates. In the descriptive study 1, four areas were investigated in the case companies; (1) the global product development process, (2) challenges they experienced, (3) solutions they implemented and (4) impact of these solutions.

In the second descriptive study, the use of expatriates was investigated in relation to their role in the organisation during globalisation of the product development process.

8.2 Main empirical findings

Through investigating seven Danish multinationals it became clear that globalising the product development process had an impact on both management and engineering projects within the companies.

The globalisation of the product development process started with manufacturing. Over time the companies had started to globalise more value-adding activities, including product design and R&D so that for some companies the whole product development process was now global.

The globalisation of the product development process consist of four phases:
1. Motivation to move abroad.
2. Preparation phase.
3. Implementation phase.
    ➢ Complications.
    ➢ Operational solutions to complications.
4. Managing the relationship.
    ➢ Complications.
    ➢ Operational solutions to complications.

Motivation was to cut costs, enter markets or gain competences. The preparation phase to move tasks abroad was often brief and tended to focus on short term gains. Only top management was involved in these first two phases. In implementation and managing the new global projects and relationships, the daily managers and expatriates were responsible. In these phases the companies

faced organisational problems and complications with the technical and managerial aspects of the engineering projects.

The problems within management were similar to those previously reported in literature, mainly related to culture, knowledge sharing and coordination but also change management and organisational structures and processes. The problems within engineering were related to product and process modularity as well as the knowledge properties of the product. These problems resulted in delays, misunderstandings and quality issues.

The novel aspect of the empirical investigation was the in-depth understanding of how these challenges were addressed in the company to try to maximise the perceived benefits from globalising the product development process. The daily managers implemented a series of initiatives to address these; mainly codification of knowledge, streamlined communication, training, bringing more tasks out to ensure contact between vital elements, make the product development process less complex, make the product less complex, and detailed work descriptions.

The result of these solutions impacted on the product, the product development process, and the organisation. Some of these impacts were positive and some were negative. The positive impacts of the solutions were related to a better understanding of work processes and the supply chain whereas outsourcing and offshoring in itself provided the possibility for an increased product portfolio and products which were better suited to local markets. The negative impacts were, for example, that the product development process became slower and less integrated whereas the organisation became more focused on codified knowledge and written communication.

However, complications remained with many of the original challenges with globalising the product development process and the negative impacts of the implemented solutions. The companies thereby went through an iterative process of facing complications and suggesting operational solutions.

There was a lack of a clear strategy with globalising product development which meant a decoupling between the strategic and the operational level of the organisation. There was furthermore a decoupling between the operational and strategic layers of the organisation due to the task division between these in the globalisation process. As a result there was a focus on operational challenges and solutions in the later phases of this process.

The reason for remaining challenges can be explained on two levels; the operational and the strategic level. On the operational level organisational theory, including change management and cultural studies, indicated a lack of preparation of the organisation for the change globalising the product development process led to. There was also a lack of an iterative and reflective process within the globalisation process itself. This meant best practices from change management, product development process models like the stage gate model and outsourcing/offshoring literature concerning how to conduct the globalisation process had not been followed, in particular during the early phases as these called for extensive preparation. Knowledge management showed a lack of knowledge sharing initiatives within the headquarters and between it and subsidiaries as well as other stakeholders. Control theories such as organisational cybernetics show a lack of measurable

outputs and continuous adjustments according to these measurements compared to specified goals. Network configuration theory within the operations research area showed a less than optimal global network configuration, which could explain issues with coordination, knowledge sharing and misunderstandings.

On the strategic level the problems can be seen as the result of the approach the companies had to decision-making;

> (1) a decoupling between the strategic and operational level of the organisation, and
>
> (2) a focus on symptoms instead of causes.

This meant that decision-making and problem solving were single-loop learning and focused mainly on short term gains. This resulted in problems that were not resolved, though the effects of the problems could be minimized. However, as more complex tasks started to move out, the solutions the companies implemented became less and less effective as such tasks in their very nature are hard to resolve using tools such as modularity, work process descriptions and decoupling to other tasks and functions.

8.3 Proposed framework

A framework was developed which can minimize the negative impact of globalising the product development process and address the challenges the company has today on both the operational and strategic level; thus ensuring a short term as well as a long term perspective can be taken on the globalisation process.

It is suggested that companies who wish to globalise the product development process go through an iterative process of five stages and see their decision process as being a part of continuous adaptation and improvement to fit the organisation to an ever-changing market. This framework is called the Global Decision Making (GDM) framework.

These five stages are (1) strategic goal setting, (2) strategic planning, (3) operational planning, (4) implementation and (5) evaluation.

These five stages have several steps as indicated in the following:

Stage 1: Strategic goal setting
    1.   Clarify the desired/ideal market position for the company.
    2.   Clarify key performance indicators for reaching this position.
Stage 2: Strategic planning
    1.   Clarify the current market position for the company.
    2.   Clarify the gap between the current and ideal market position i.e. the business problem the company seeks a solution.
    3.   Evaluate the best approach to move from the current to the desired position, including which factors encourage using globalisation as a tool to do so and which factors discourages this.

Stage 3: Operational planning
1. Select the task to be moved abroad.
2. Clarify the possible external changes and impacts due to moving this task and implement any necessary changes.
3. Clarify the possible internal changes and impacts due to moving this task and implement any necessary changes.
4. Select key performance indicators.

Stage 4: Implementation
1. Move the task.
2. Implement key performance indicators.
3. Implement possible changes due to measurements from the key performance indicators.

Stage 5: Evaluation

The GDM framework relies on going through these five stages and combining the idea of approaching the ideal market position through smaller steps while utilising best practices and considerations from several theoretical fields, including organisational theory, change management, engineering project management like the stage gate model, and network configuration from operational research. In this way the challenges seen in the case companies can be resolved or minimised at an early stage through using key performance indicators and a continuous feedback loop to ensure the change matches the strategic as well as the operational plan for the organisation, thereby facilitating double-loop learning in the globalisation process.

Using the framework a company can focus on smaller and less resource-intense changes, or larger changes which change the whole organisation. Though many "in-between" strategies exist, there were two fundamentally different approaches to globalising the product development process;

1. The Avoid Risk (AR) approach: Minimising the chance of negative consequences by limiting the tasks and functions considered for offshoring and outsourcing.
2. The Confront Risk (CR) approach: Addressing potential risks through considering the engineering projects and organisational aspects of offshoring and outsourcing and likely creating a bigger organisational change than using the AR approach.

In the AR approach, the company can attempt to avoid situations which can cause difficulties by limiting the tasks and functions considered for offshoring or outsourcing. This means sending out clearly defined tasks with a high level of product and process modularity, minimising collaboration, focusing on using codified knowledge, and avoiding situations which require complex explanations and collaboration.

In the CR approach, the first stage of the framework can consider a long term horizon and multiple steps to reach an ideal market position for the company which could change and impact the whole organisation and its network configuration. This allows for more complex tasks to be moved abroad.

The case companies all tried to implement the AR approach. However, they did not succeed in implementing this approach for several reasons. Besides the causes mentioned in the previous

section, then for some of the case companies this approach failed because the AR approach did not match the task or function sent abroad as these were often more suited for the CR approach due to their complex nature. It is therefore important that the task, the technical aspects and its management are well-aligned.

The AR approach strives towards low risk but also provides little possibility for learning across the organisational units. The CR approach relies on collaboration and knowledge sharing across the units in the global organisation as well as with its stakeholders by making use of synergies in cultural differences and viewing a problem from many different angles. The more process and product knowledge the organisation shares across borders, the greater the possibility for organisational learning and growth. However, the risks will also be greater as the desired learning synergies might not develop and the headquarters could risk losing control over the process knowledge they send abroad. It is believed that by following the stages and steps in the GDM framework, and by developing and implementing appropriate key performance indicators and feedback loops so this data can be fully utilised and double-loop learning can take place, this risk is lessened.

The framework is therefore flexible and can be used by both companies seeking larger changes in the organisation and companies which seek to minimise risk and resource use.

The framework was validated through two workshops with representatives from industry as well as academically through feedback on conference papers and articles.

This investigation has shown a close connection between global engineering projects - including management of such projects – and organisational aspects. These elements need to complement each other as the management approach to global engineering projects and organisational elements like structures, culture, and network configuration, influences the best suited tasks and functions to globalise and the best way to do so. The reserve is also the case. If a complex engineering task or function is globalised the management approach and organisational elements need to encourage certain aspects for it to be successful like knowledge sharing and interaction and collaboration which facilities this.

This project has hereby addressed the research aim, research objectives and research question as these were described in Chapter 1.

8.4 Main academic contributions

The principal academic contributions are:

1. Specifying the challenges, implemented solutions and their impact on the organisation and the management of engineering projects when engineering companies offshore or outsource product development process activities.
2. Viewing these challenges on both an operational and strategic level.

3. Analysing the operational challenges companies' face when globalising the product development process using theories and best practice within research fields from organisational studies and operational research.
4. Developing a framework that addresses these complications which allows for different approaches to globalising the product development process.
5. Developing a framework which views globalising the product development process as an integrated part of organisational change and thereby addresses organisational, managerial and engineering challenges and implications of this development.

This research has expanded on existing studies within organisational studies, operations research, as well as offshoring and outsourcing studies. This research enables the challenges with globalising the product development process to be addressed and minimized, which is a significant shift from the previous focus on avoiding risky situations.

This research has therefore contributed new knowledge within this research area by:

- Illustrating the challenges, implemented solutions and their impact on the organisation and the management of engineering projects when engineering companies offshore or outsource product development process activities.
- Analysing these challenges and impacts using different theoretical tools from organisational studies and operations research.
- Demonstrating the disconnection between operational and strategic problem-solving in the organisation when globalising the product development process.
- Showing how offshoring and outsourcing of activities in the product development process can be incorporated into a change management and technical project management perspective.
- Illustrating a Global Decision Making framework which incorporates different theoretical fields in order to view offshoring and outsourcing from both an operational and a strategic perspective.
- Illustrating an iterative and reflective Global Decision Making framework which allows for organisational learning and continued adaptation as markets and conditions change.

8.5 Main industrial contributions

The GDM framework is a concrete tool which industry can use when globalising the product development process. The framework utilises methods which are well known in industry. The validation process showed industry partners found the tool understandable and useful although behaviour and results when implementing the framework has yet to be evaluated.

The GDM framework can be customised in each company to fit their specific environment and characteristics. Furthermore, whether to make large or small changes in the organisation is up to each company depending on available resources and the aim for globalising the global product development process.

The framework can help companies address and minimise risks and could thereby help companies reach their goal and lessen the chance of costly mistakes in the globalisation of product development process activities.

Glossary

The following terms and definitions are used in this study:

Term	Explanation	Reference
Brownfield (factory or office)	Factory or office established in an existing (manufacturing) site.	Colotla (2003)
Competences	➢ Competence must have a context. ➢ Competence is an outcome and describes what a person does. ➢ In order to measure ability there must be clearly defined standards through which performance is measured. ➢ Competence is a measure of what someone can do at a particular point in time.	UDACE (1989)
Decision process	1. Rational decision process model Assumes: Full knowledge. Cost-benefit analysis. Top management decisions. Clear and the same goals for all in the organisation. 2. Bounded rational decision process model Assumes: Unclear and unstable goals. Conflicting goals. A solution which satisfies. Enough knowledge to get an overview. Coalitions are needed. 3. Garbage bin model Assumes: Not enough knowledge to get an overview. Solutions and issues are matched as these appear. Influence of politics and power. Decisions happen; they are not planned or controlled.	Cyert, March & James (1963) Elster (1983) Gigerenzer & Selten (2002) Hayek (1948) Kahneman (2003) March (1994) Rubinstein (1998) Herbert (1957)
Engineering practice	The different ways of practicing engineering, including which models and methods to use and how to apply and use these models and methods.	Own definition
Engineering process	A process which involves engineers conducting engineering activities (e.g. designing a product, doing product calculations)	Own definition
Epistemology	The branch of philosophy that deals with knowledge, especially with regard to its methods, validity, and scope.	The Compact Oxford English Dictionary (2009)
Expatriate	*"...employees who are sent from a parent company to live and work in another country for a period ranging from two to several years"* (Caligiuri, 2000:62).	Caligiuri (2000)
Function	One of the elements which make up product development as described by Ulrich & Eppinger (2008), e.g. production, detailed design etc.	Ulrich & Eppinger (2008)

Term	Explanation	Reference
Globalisation	"*…process by which the people of the world are unified into a single society and function together. This process is a combination of economic, technological, sociocultural and political forces.*" Croucher (2004: 10)	Croucher (2004)
Globalisation process	The process the company went through in order to globalise the product development process. An example of a globalisation process is the Outsourcing Circle (Perunovic, 2009) which shows the stages the organisation goes through in order to outsource a given task or function.	Perunovic (2009)
Global product development	The globalisation of the product development process from planning to manufacturing	Own definition
Greenfield (factory or office)	Factory or office developed in a new site, often an undeveloped piece of land.	Colotla (2003)
Highly engineered products	Products wherein engineering services are heavily used.	Own definition
High-skill services	"*the most creative and skill-intensive end of offshored services*" (UNCTAD, 2004, p. 151). The term can be described using two dimensions which complement UNCTAD's definition (Peter D. Ørberg Jensen, 2008:44); ➢ *The level of complexity* (or "advancedness") of the tasks offshored (can go from high to low). This refers to the level of technical/professional sophistication of the tasks. ➢ *The degree of discretionary judgment and decisions* required by the host firm. This is concerned with the degree of codification and thereby the ability of the destination firm to take decisions alone. Embedded in this dimension is also the level of managerial control applied by the home firm in the day-to-day operations of the host firm. These dimensions are also used for offshoring when the destination firm becomes the subsidiary. Engineering tasks and R&D are considered high-skill services.	UNCTAD, (2004: 151) Jensen, (2008:44)
High value-adding activities/functions	Functions or services which contribute a significant amount of value to the end product.	Own definition
Methodology	System of methods used in a particular field.	The Compact Oxford English Dictionary (2009)
Multinational corporation (MNC), transnational corporation (TNC) & multinational enterprise (MNE)	"*A multinational corporation (MNC) or transnational corporation (TNC), also called multinational enterprise (MNE), is a corporation or enterprise that manages production or delivers services in more than one country. It can also be referred to as an international corporation.*" Christos & Sugden (2000: 72)	Christos & Sugden (2000)

Term	Explanation	Reference
Network	A network is a set of nodes and the relationships which connect them (Fonburn, 1982). A network is made up of nodes (e.g. people, departments, suppliers, competitors, customers) and links (e.g. knowledge, communication, physical exchanges). These can be internal (within the company's control) or external (outside the company's control).	Fonburn (1982)
Offshoring	"...*firms relocate their business functions (that were previously performed in-house) to overseas locations. Firms can either embark on offshoring internally, by setting up their own centers or subsidiaries in foreign countries while maintaining full ownership and control (captive offshoring) or externally, by handing over business functions to independent foreign providers (offshore outsourcing)*" (Kedia *et al.*; 2009: 250). Offshoring in this thesis covers only the first option (captive offshoring), as the second is part of the definition for outsourcing. Captive offshoring is achieved through: (1) greenfield, or (2) through mergers and acquisitions (M&A) where the company buys an established company which has plants and offices in desired locations. Joint venture is a third option where a company buys a share in an established company; however this does not provide captive offshoring as control and ownership is shared. Joint ventures are often used to lessen risk and investment for political reasons (both country specific as some countries do not allow foreign companies 100% ownership for political reasons and for image protection). Joint ventures are beyond the scope of this thesis.	Kedia *et al.* (2009)
Organisational processes aka business process	"*a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer.*"	Hammer & Champy's (1993)
Ontology	The branch of metaphysics concerned with the nature of being.	The Compact Oxford English Dictionary (2009)
Outsourcing	"...*a contractual relationship for the provision of business services by an external provider.*" (Belcourt, 2006:269). A term normally used to describe the process of work traditionally done in-house shifting to an external provider. Outsourcing when handed over to providers in the same country is called *domestic outsourcing,* and when handled by providers in offshore locations is called *offshore outsourcing.* In this thesis only offshore outsourcing is covered and the term outsourcing is used for this option.	Belcourt, (2006) Kedia *et al.* (2009)
Process	"*Sequence of interdependent and linked procedures which, at every stage, consume one or more resources (employee time, energy, machines, money) to convert inputs (data, material, parts, etc.) into outputs. These*	The Business Dictionary (2009)

Term	Explanation	Reference
	outputs then serve as inputs for the next stage until a known goal or end result is reached.”	

Product development process	The development process for a product can be described as having six stages;
	  1. Planning
	  2. Concept development
	  3. System-level design
	  4. Detail design
	  5. Testing and refinement
	  6. Production ramp-up
	In this study manufacturing is included as a seventh stage.
		Ulrich & Eppinger (2008)

Product development process activities/ Product development activities/product development process tasks/ product development tasks	These four options to offshore and outsource are in this thesis referred to as 'a task' or 'activities', and the four options are defined as follows: • Function One of the elements which make up the product development process as described by Ulrich & Eppinger (2008) and expanded to include manufacturing, e.g. manufacturing, detailed design etc. • Process A collection of related, structured activities or tasks that produce a specific service or product • Product or product module A whole product or a part of a product. Examples of product modules are a wind turbine or a module in the development of an interactive webportal. • Service A service is an activity which does not result in a physical object like knowledge activities or some HR functions.	Own definition
Stakeholders	Anyone the change globalising product development activities affects	Own definition
Sustainable decision	A decision which is considered beneficial for the company when viewed in both a short term and a long term perspective.	Own definition
Trust	Trusting another person means "... *believing that when offered the chance, he or she is not likely to behave in a way that is damaging to us, and trust will typically be relevant when at least one party is free to disappoint the other, free enough to avoid a risky relationship and constrained enough to consider that relationship an attractive option*." Gambetta (1988: 219)	Gambetta (1988)
Virtual team	A virtual team are *“...groups of geographically and*	Jarvenpaa &

Term	Explanation	Reference
	organizationally dispersed knowledge workers brought together across time and space through information and communication technologies on an (as needed basis) in response to specific customer needs or to complete unique projects." (Jarvenpaa & Leidner 1999:792).	Leidner (1999).

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Appendix

Appendix 1: Additions to the literature review

Appendix 1.1 Background for using offshoring and outsourcing
Kedia *et al*. (2009) argue that there are some overall factors in a company's environment which encourages offshoring and outsourcing no matter which business segment the company is in (see Figure 32).

Macro-environmental drivers
- Globalization
- Technological advancements
- Liberalization of emerging economies
- Hypercompetition

Changes in the internalization advantages
- Increase in overhead costs to coordinate vertical integration
- New information and communication technologies have reduced cost of coordinating cross-border activities
- Hypercompetition is compelling the firms to become more flexible and increase focus on their core areas
- Cooperative organizational forms have reduced need for internalization

Changes in the global resource market
- Institutional reforms in emerging economies have resulted in a better developed product, labor and capital market with a reduction in market imperfections
- Economic liberalization has reduced trade and tariff barriers
- Emergence of new firms from emerging economies implies more players with superior resources/capabilities
- Huge human intellectual capital base spread around the globe

Changes in firm strategy leading to disintegration and externalization of value chain activities
- Unbundling of value chain activities
- Increased focus on core activities
- Increased flexibility and decrease in coordination costs associated with hierarchical governance
- Increased usage of cooperative interorganizational forms
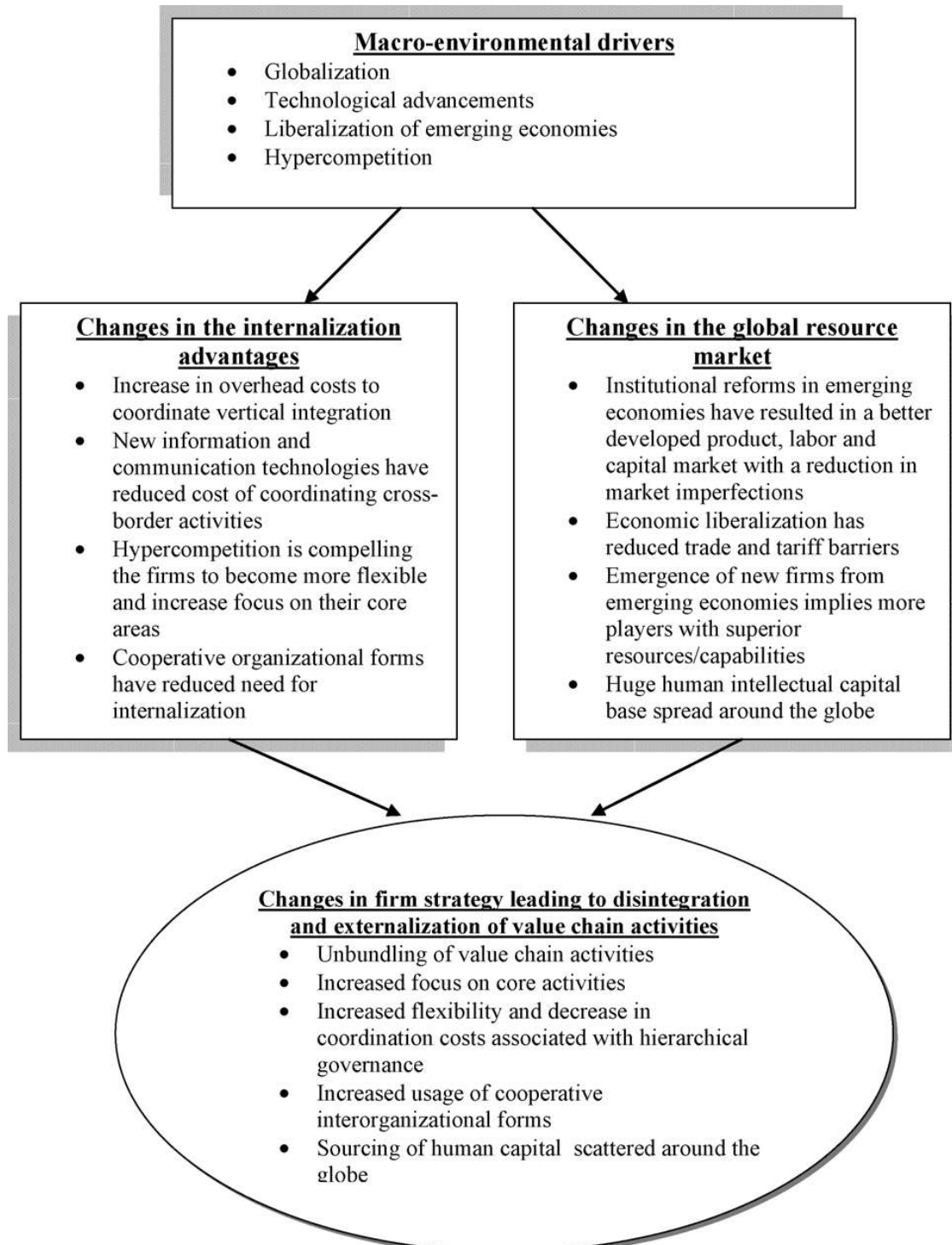- Sourcing of human capital scattered around the globe

Figure 32: Factors encouraging offshoring to either own subsidiaries or to external providers (outsourcing).
Source: Kedia *et al*. (2009)

The overall drivers are:
1) Globalisation
2) Technological advancements (e.g. telecommunication)
3) Liberalisation of emerging economics (e.g. India and China)
4) Hypercompetition

These overall global changes are seen as having created various incentives to offshore and outsource. These include:

Changes in the internalization advantages
➢ Increase in overhead costs
➢ Reduced cost of coordinating cross-border activities
➢ Need to become more flexible and increase focus on core areas
➢ Reduced need for internalization due to cooperation throughout the supply chain

Changes in global market
➢ Reforms in emerging markets
➢ Reduction in trade barriers and tariff barriers
➢ Companies from emerging markets become global players
➢ Human capital accessible all over the globe

These changes are seen as the main factors which have led to companies changing their strategies in regard to their value chains and choosing to employ disintegration and externalisation which include;

- Unbundling of value chain activities
- Increased focus on core activities
- Increased flexibility and decrease in coordination costs associated with Hierarchical governance
- Increased usage of cooperative interorganisational forms
- Sourcing of human capital scattered around the globe

Appendix 1.2 A brief history of offshoring and outsourcing

The history of outsourcing can be traced back almost to the beginning of time when man first started to move tasks and functions to someone else. An example is the use of slaves or prisoners in ancient societies to carry out manual labour and other undesired tasks (Corbett, 2005; Perunovic, 2009). Outsourcing, the way the term is understood in today's business world, has been said to start with IT outsourcing in the 1990s and therefore a lot of literature on outsourcing focus on IT (e.g. Palvia, 1995, Apte, 1991, Lacity, 1993; Bruce, 1998; Pfannenstein *et al.*, 2004). Further literature details and highlights the importance of a structured approach to vendor selection and the bidding process when outsourcing (e.g. Nam, 1995; Greaver, 1999). Another angle has been geography and supply chain management where the movement and network of labour, finances and other resources are in focus (e.g. Croucher, 2004; Friedman, 2005; Dicken, 2007; Gereffi *et al.*, 2005). There has also been focus on the impact on local and foreign communities (e.g. Seuring *et al.*, 2008). Finally, the organisational impact on productivity, work routines and efficiency has been investigated from a management and financial perspective (e.g. Elmuti *et al.*, 2000; The economist, 1991; Gambetta, 1988; Belcourt, 2006). Lately, also the vendor's perspective on outsourcing has been investigated (e.g. Perunovic, 2009).

Offshoring has been a part of the United States' economy since Ford Motor began assembling Model T's at a plant in Trafford Park, England in 1911; the driver was mainly to reduce transportation costs (Sturgeon *et al.*, 2005). The process of American companies moving labour-intensive processes to offshore locations to reduce the production costs of goods and services intended for the United States market began in the 1960s. In the late 1990s, the offshoring phenomenon spread from the manufacturing to the service sector. By the turn of the millennium offshoring services extended to high value services like IT, banking, finance, the medical field, engineering, R&D and product design (A. Stringfellow *et al.*, 2008; Lieberman, 2004; UNCTAD, 2005). Other western countries have followed a similar path though they often started the process later due to United States' leading manufacturing role in the early 20th century. The focus has been on many of the same issues as for outsourcing like motivation, organisational impact on work, communication and knowledge sharing, efficiency and geography. Business and management literature have often focused on optimization and cost benefits for businesses when they offshore (e.g. Kedia *et al.*; 2009), social factors – particular the movement of labour (e.g. P. D. Ørberg *et al.*, 2006) and production and factory optimization (e.g. Ferdows, 1997a; Ferdows, 1997b; Colotla, 2003).

Palvia (2003) writes that at least 3.3 million white-collar jobs and 136 billion dollars worth of salaries will leave the USA and go to low-cost labour countries by 2015. 14% of these 3.3 million will be related to Information Systems (IS) work.
Approximately 90% of Danish companies have outsourced some of their services, in comparison to 70% of Swedish and 50% of Norwegian companies (Demoskop, 2006). In a study by Danish Industry almost 70% of participating companies have outsourced at least one business process or function within the last three years (Dansk Industri, 2004). Both large, and medium and small companies, across different industries, are engaged in the process. The activities outsourced present 10% of the companies' overall activities. Approximately 40% of the companies have outsourced to so-called low-cost countries, with the number projected to rise to 75% in 2007.

The majority of Danish companies are small to medium size companies (SME). A recent study of Danish manufacturing SMEs showed that one third of manufacturing SMEs have outsourced part of their production in the last 3 years, while 75 % of them expect to do the same in the next 3 years. 10% of companies have outsourced more than 75% of their activities (Knudsen and Cederquist, 2006). An investigation showed that Danish companies benefit financially from moving production abroad and that even more jobs will be moved abroad in the coming years (Springborg & Skovgaard, 2010).

Appendix 1.3 Phases in outsourcing and offshoring
The first table details the options for outsourcing and the second for offshoring in each phase as these has been defined in the Outsourcing Circle (Perunovic, 2009).

Table 33: Table of outsourcing terms. Adapted from Perunovic (2009)

Outsourcing phase	Options	Definition
Preparation phase: what to outsource The strategic impact of outsourcing	Strategic	Strategic policy concerning outsourcing and considering to outsource core activities (Alexander and Young, 1996)
	Business process outsourcing	Outsourced mix of non-core activities (Heywood, 2001; Cullen and Willcocks, 2003)
	Transformational	Long term relationship. Vendor assists in stimulating continuous business change while also achieving operational effectiveness (Click and Duening, 2005; Linder, 2004; Heywood, 2001)

Outsourcing phase	Options	Definition
	Transitional	Handling over legacy systems to enable in-house focus on building the new systems (Heywood, 2001; Cullen and Willcocks, 2003)
	Value-added	Client and vendor combine strengths in order to market products or services commercially (Cullen and Willcocks, 2003)
Preparation phase: what to outsource The amount of work	Total	More than 80% of function or process outsourced (Willcocks and Choi, 1995)
	Selective	Less than 80% of function or process outsourced (Willcocks and Choi, 1995)
Preparation phase: How to outsource	Incremental	Starting with small portions with discrete contracts, evolving over time with larger contracts (Willcocks *et al.*, 1995; Cullen and Willcocks, 2003)
	Hard-way	The organisation is pressed to go into a large-scale outsourcing arrangement without having experience and clear picture how to manage the process. Next contracts are more successful because of the learning effect (Willcocks *et al.*, 1995)
	Big bang	Significant portions of all activities are outsourced at one time (Cullen and Willcocks, 2003)
	Piecemeal	Each activity is outsourced independently over time combining the variety of vendors (Cullen and Willcocks, 2003)
Vendor(s) selection phase: Number of vendors	Single vendor	One vendor
	Multiple vendors	Several vendors
Transition phase: How to manage the outsourcing relationships Level of commitment	Transactional	One-time or short-term projects (Oates, 1998)
	Relational	Long-time partnerships (Oates, 1998)
Preparation phase: Country selection Choices	Domestic (On-shore)	Domestic vendor (Smith *et al.*, 1996; Click and Duening, 2005)
	Near-shore	Geographically and culturally close country (Smith *et al.*, 1996; Click and Duening, 2005)
	Off-shore	Geographically and culturally distant country (Smith *et al.*, 1996; Click and Duening, 2005)

Outsourcing phase	Options	Definition

Preparation phase: Country selection How to select	Model for the location decision	Many models exist. One such model is by Graf and Mudambi (2005). In this model the location decision can be viewed as a combination of factors. These are:
		  1. Infrastructure
		  2. Country risk
		  3. Government policy
		  4. Human capital
		Moderating factors are
		  1. Firm specific factors
		  2. Situation specific factors
		In a case study by Rai *et al.* (2009) it was shown that there is a relationship between cultural differences at the organizational and team level, and offshore IS project success; the greater cultural distance the greater risks. This should be considered when selecting a location.

Managing relationship phase: What type of relationship to have	Equity holding	Either the outsourcer or the vendor takes an equity stake in the other (Kakabadse and Kakabadse, 2000; Heywood, 2001; Cullen and Willcocks, 2003)
	Co-sourcing	Supplier takes over an activity, or works with a client on it, and gets paid for improvements in the client's business result (Kakabadse and Kakabadse, 2000; Heywood, 2001; Cullen and Willcocks, 2003)
	Spin-offs	Creating a separate company out of an effective IT function, and allowing it to sell its services on the open market, as well as back to the original host company (Kakabadse and Kakabadse, 2000; Heywood, 2001; Cullen and Willcocks, 2003)
	Joint venture	Setting up a new company to exploit a perceived business opportunity (Kakabadse and Kakabadse, 2000; Heywood, 2001; Cullen and Willcocks, 2003)

The following table shows the phases in offshoring, the options and relevant literature.

Table 34: Terms used in offshoring.

Offshoring phase	Options	Definition
Preparation phase: How to offshore	*Greenfield (factory or office)*	Factory or office developed in a new (undeveloped) site, often an undeveloped piece of land. (Colotla, 2003)
	Brownfield (factory or office)	Another factory or office established in an existing (manufacturing) site. (Colotla, 2003)
	Buy-up/merger & acquisition	The company buys a company or makes a merger which has a factory or an office in a given

Offshoring phase	Options	Definition
		location In a study by (Reus & Lamont, 2009) it was shown that the performance of an M&A is influenced by the cultural distance to the newly acquired company. Cultural distance impedes constrains communication and understanding of the capabilities which needs to be transferred. However, it also gains an opportunity for learning. If the negative effects can be overcome performance gains can be made.
	Joint venture	The company creates a joint venture with a company already operating within the given country/market of interest
Preparation phase: Country selection	Model for the location decision	Many models exist. One such model is by Farrell (2006). In this model the location decision can be viewed as a combination of factors. These are: • Cost • Market potential • Availability of skills • Environment • Risk profile • Quality of infrastructure
Managing relationship phase: Level of autonomy for the subsidiary	Full control by the parent company on decisions on (1) definition of R&D issues, (2) changes in products/services, (3) HR issues (hiring/firing) and (4) introduction of new technologies	The parent company decides alone (Ghoshal, S. *et al.*, 1994; Ghoshal, S *et al*, 1989; Rabbiosi, L, 2009)
	Full control by the parent company with consideration to the subsidiary on decisions on (1) definition of R&D issues, (2) changes in products/services, (3) HR issues (hiring/firing) and (4) introduction of new technologies	The parent company decides but considers the subsidiary's input

Offshoring phase	Options	Definition
	Equal control on decisions on (1) definition of R&D issues, (2) changes in products/services, (3) HR issues (hiring/firing) and (4) introduction of new technologies	Both parent company and subsidiary has roughly equal influence
	Full control by the subsidiary with consideration to the parent company on decisions on (1) definition of R&D issues, (2) changes in products/services, (3) HR issues (hiring/firing) and (4) introduction of new technologies	The subsidiary decides but considers parent company's suggestions
	Full control by the subsidiary	The subsidiary decides alone on (1) definition of R&D issues, (2) changes in products/services, (3) HR issues (hiring/firing) and (4) introduction of new technologies
Managing relationship phase: Subsidiary role	Receptive They carry out few value chain functions (including only marketing and sales, or purely manufacturing) and are highly integrated within their parent MNC's network but less responsive to the local host country environment.	Subsidiaries can have 4 strategic roles depending on which value chain functions they carry out (Taggart, 1997). These roles influence coordination and configuration (what activities in the value chain the subsidiary undertakes). The extent to which a subsidiary fits the ideal profile associated with its strategic role is positively related to the subsidiary's performance (Lin, & Hsieh, 2010). Ideal implementation variables for receptive subsidiaries: Configuration: concentrated Coordination next high Integration: high Responsiveness: low
	Active They perform many value chain activities, and these activities are integrated with similar or different activities in different parts of the	Ideal implementation variables: Configuration: dispersed Coordination high Integration: high Responsiveness: high

Offshoring phase	Options	Definition
	worldwide network. They highly integrate some activities through the network but may focus on local requirements for some others.	
	Autonomy Perform most of the value chain functions in a way that is relatively independent of their headquarters and other subsidiaries, and focus mainly on local requirements.	Ideal implementation variables: Configuration: dispersed Coordination low Integration: low Responsiveness: high
	Quiescent A temporary role; will soon be shifted to one of the other three subsidiary roles or be followed by closure. They produce and sell some of the parent's products or related product lines in the local country.	Ideal implementation variables: Configuration: concentrated Coordination moderate Integration: low Responsiveness: low

Appendix 1.4 Vendor relationships
To even debate knowledge sharing in outsourcing situations the relationship between client and provider first need to be debated.

Gereffi *et al*. (2005) operate with three deciding parameters related to which type of governance is employed:

1) Complexity of inter-firm transactions, including information and knowledge transfer. This includes the complexity of the knowledge and goods moved between the companies, as well as the complexity of sharing this and maintaining the relationship. Factors could be technology, product complexity, physical distance, cultural difference, and how easy it is to make the needed knowledge and information explicit.
2) The degree to which this information can be simplified through codification. In other words, how easy is it to separate the end product into sub-parts and describe each part explicitly and in sufficient detail to put them together again later?
3) The extent to which vendors have the necessary capabilities to meet the buyers' requirements. Depending on the complexity of the task, the vendor needs a higher or lower degree of capabilities.

These three factors can vary in strength, as will be described later in this section.

Gereffi *et al*. (2005) expands on these findings by operating with five types of value chain governance: market, modular, relational, captive and hierarchy (see
). The higher the degree of power asymmetry and explicit coordination, the more the relationship will develop towards a captive or hierarchical relationship. By power asymmetry is meant economic power (e.g. switching costs), which manifests itself as managerial control through coordination in which one of the parties is dominant.

Asymmetric power relations result from uneven dependency relations (Easton 1992; Lacity and Willcocks, 2003; Kern and Willcocks, 2000). They first become noticeable if the impact of one party dominates the relationship and this leads to opportunistic behaviour (Leimesiter and Krcmar, 2008). According to Gereffi, if the degree of power asymmetry and explicit coordination is low, the relationship will move towards a modular or market relationship. In such relationships, switching costs are low for both parties and they work with other companies as well; thus creating a more equal power relationship.
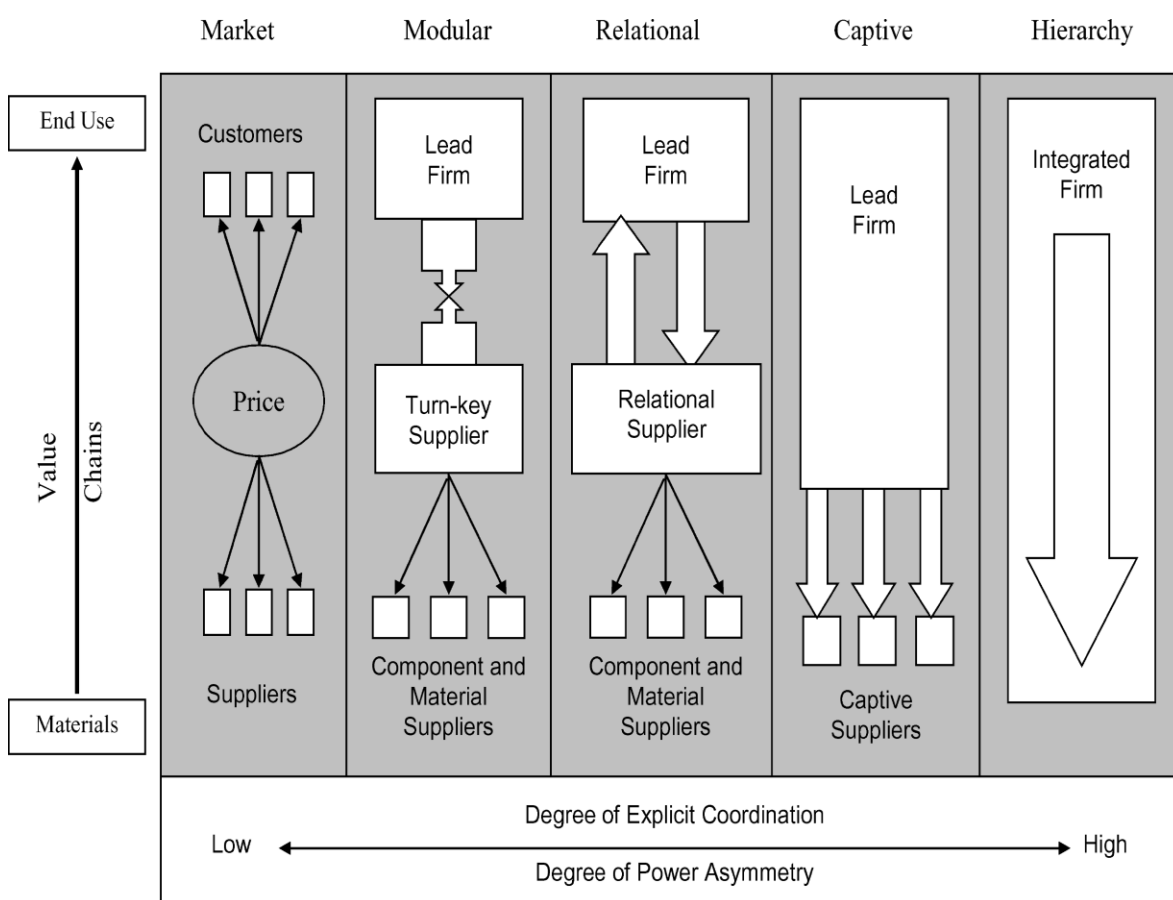

Figure 33: Five global value chain governance types. Source: Gereffi *et al*. (2005**)**

The five governance types have the following characteristics (Gereffi *et al*., 2005:83-84):
  1. Markets

Market linkages do not have to be completely transitory, as is typical of spot markets; they can persist over time, with repeat transactions. The economic cost caused by switching to new partners is low for both parties. When selecting who to work with, price is the deciding factor for both customers and vendors. The market relationship is characterized by a low degree of complexity with regard to products, a high degree of codification, and a high degree of capability of the vendors to make these products, thus requiring no input from the buyers. The result is a low degree of explicit coordination and power asymmetry, since switching costs are low on both sides.

2. Modular

Vendors in modular value chains often make products to a customer's specifications, which can be more or less detailed. However, when providing 'turn-key services', vendors take full responsibility for competencies surrounding process technology; they use generic machinery that limits transaction-specific investments; and they make capital outlays for components and materials on behalf of customers. The vendor is assumed to have key competences that the lead company needs, whereas the vendor invests in the lead company's business and creates products specifically for them. Both vendors and customers are assumed to work with other clients and switching costs are relatively low for both – although it becomes more expensive to do this, the more responsibility and knowledge the vendor is assumed to hold. In this case, the relationship is likely to start developing towards a relational relationship. A modular relationship is characterized by a high degree of complexity with regard to product specifications, where a high degree of codification is possible; a high degree of capability of the vendors to make these specific products; and a low degree of explicit coordination and power asymmetry.

3. Relational

The complex interactions between buyers and sellers often create mutual dependence and high levels of asset specificity. The vendor has knowledge and competences that the buyer uses in its business, whereas the vendor invests heavily to be able to fulfil the buyer's specifications and needs. This relationship can sometimes be managed through reputation or family and ethnic ties. A relational relationship is characterized by complex transactions where product specifications cannot be codified, a high degree of capability of the vendors, and a low degree of explicit coordination due to the amount of tacit knowledge. Due to mutual dependency, the power asymmetry is high since switching costs are high for both parties.

4. Captive

In these networks, small vendors are transactionally dependent on much larger buyers. The product specification is complex and the ability to codify is high, whereas vendor capabilities are low. Therefore, lead companies must transfer knowledge to the vendors. To prevent other companies from gaining the benefits from the lead company's investments, the vendors are 'locked in' and become captive to that company. Such networks are frequently characterized by a high degree of monitoring and control by the lead firms. Since the power these lead companies have means that they can dictate terms – including price and other conditions – such a relationship is therefore characterized by a high degree of explicit coordination and power asymmetry.

5. Hierarchy

In this relationship, the vendors have become a part of the company and therefore operate as part of it. Differences in knowledge and influence between the new subsidiaries and between them and headquarters are therefore due to internal power relations. Vertical integration is high; the dominant form of governance is managerial control, flowing from managers to subordinates or from headquarters to subsidiaries and affiliates. A hierarchy relationship is characterized by a high degree of complexity in product specifications, a low degree of codification, and a low degree of capability of the subsidiaries. With regard to captive relationship, the result is a high degree of explicit coordination and power asymmetry.

To summarise: Gereffi *et al*. (2005) operate with five types of value chain governance – market, modular, relational, captive and hierarchy. The higher the degree of power asymmetry and explicit coordination, the more the governance type develops towards a captive or hierarchy relationship. If the reverse is true and these factors are low, then the relationship develops towards a modular or market relationship. In addition, the governance type changes, if any changes occur in the complexity of the transaction, codification of the transaction, and capabilities of the vendor.

Knowledge sharing mainly takes place in relational relationships while in the hierarchy the knowledge sharing will be closer to an offshoring situation.

The relationship between the client and the vendor has been investigated in several case studies and from several of the theoretical perspectives shown above which have resulted in recommendations ranging from relationships based on strict contracts to strategic alliances based on trust and mutual benefits. Rai *et al*. (2009) found that a relationship based on information exchange, joint problem solving, and trust reduce project cost overruns and improve client satisfaction. Sharing strategic knowledge from supplier to buyer and vice versa has been shown to yield performance gains for both (Klein & Rai, 2009).

Offshoring partnerships have furthermore been shown to create learning environments for both partners (Kedia & Lahiri, 2007). The importance of organizational learning in the context of strategic alliances, joint ventures and other types of interorganizational relationship is highlighted in (O'Dwyer & O'Flynn, 2005).

Knowledge sharing from client to outsourcing provider demands pre-contract priority and consideration for the ability and complexity of what knowledge is to be moved and post-contract activities to ensure the knowledge is transferred through communication and a visible approach to knowledge transfer (Hawk *et al*., 2009).

A study showed that knowledge transfer is more difficult if the knowledge provider and recipient are located in different cultural contexts. Special "tuning" of knowledge transfer processes may be required to overcome this barrier. The study showed that knowledge gap, communication and cultural difficulties hampered knowledge transfer from the client to the outsourcing vendor (Chen & McQueen, 2009).

Transfer processes for explicit knowledge in an outsourcing context consist of two dimensions: The content dimension and the sender–receiver dimension of transfer processes. The content dimension embraces mechanisms such as trainings and standards that define how content has to be interpreted, whereas the sender–receiver dimension of explicit knowledge defines explicit, documented interaction structures between the parties. Furthermore, high levels of shared knowledge positively influence outsourcing performance (Blumenberg *et al*., 2009).

Oshri *et al.* (2007) identified 8 practices Tata Consultancy Services in India used to manage dispersed experience and which they encourage other outsourcing providers to following in order to gain advantage of to successfully manage knowledge;

1. implement an organisational structure which is a mirror image of the client's structure on each project
2. Implement a knowledge transfer methodology
3. Implement a knowledge retention methodology
4. Monitor expertise development and retention at project and organisational levels
5. Make expertise development a key organisational value
6. Offer mechanisms to search for expertise at project and organizational levels
7. Implement a reuse methodology at the global level
8. Continuously measure the contribution of reusable assets

Knowledge sharing in outsourcing therefore seems to be dependent on the relationship between the provider and the client, processes and procedures in place for transferring knowledge and cultural distance between them.

Appendix 1.5 Virtual collaboration and integration

Offshoring and outsourcing has a structural impact on how work practices can be conducted and knowledge can be shared most optimally. The product development process will need to be

organised and maintained around the offshored and outsourced elements and functions so the geographic disintegration does not have a negative impact on the end product produced.

The engineers working together will no longer share time/space and often not the same cultural frame of reference. Instead a cross-cultural virtual team is created. A team is "*...a small number of people with complementary skills who are committed to a common purpose, performance goals, and approach for which they hold themselves mutually accountable.*" (Kazenbach *et al.*, 1993:45). A virtual team are "*...groups of geographically and organizationally dispersed knowledge workers brought together across time and space through information and communication technologies on an (as needed basis) in response to specific customer needs or to complete unique projects.*" (Jarvenpaa & Leidner 1999:792). The main reasons for the reliance on technical aids in virtual teams are to lower costs, reduce project schedules, improve decision making time and improve communication (Gould, 2004). Such a team needs extra effort to feel like a group, including group exercises, cultural understanding and more communication.

Duarte and Snyder (1999) lists 7 factors which need to exist to make a virtual team effective; technology is one of them. The others are human resource policies, leadership and member training and development, team and organisation processes, the underlying institutional culture, leadership and finally leader and team member capabilities (Duarte *et al.* 1999:11). To this can be added that cultural understanding is needed because electronic communication removes the option to 'read' people's expressions and body language. Therefore this communication needs to be clear and understandable for all. A way to do this can be for the leader of a virtual team to hold more than one cultural (potentially conflicting) perspective in his head at a time, allowing him to view any potential issue from several cultural perspectives simultaneously – often these are the one the person grew up with and the foreign one (the one of the offshored or outsouced location) and use elements from them as appropriate (Schneider *et al.*, 2002:190). Also, both the manager and team members need some cultural background knowledge of each others' cultures. The manager also needs personal capabilities which enable him to be considered a good manager by all members of his team, no matter their cultural background. Some preferences in regard to work methods or communication style may have been influenced by cultural and educational background. Understanding this would help find a work method and communication style the whole team feels comfortable with.

Cascio and Shurygailo identify some key areas which impact virtual teams (Cascio *et al.*, 2003). These are:

1. The importance of mapping the roles and responsibilities of each member
   - ➢ Working isolated makes it important that each member know what to do and what others do. This will encourage coordination.
2. Recognising the limitations of an individual's contributions
   - ➢ Various tasks may be suited for different group members and it's important that the group feels it can express this as well as say no to an assignment if another member is more suited to handle it.
3. Monitoring outcomes to meet quality expectations
   - ➢ Debating progress and issues concurrently through communication is important in relation to this. Furthermore, a culture where open and honest communication as well as seeing mistakes as learning opportunities facilitates this.
4. Recognising that management of important records is vital
   - ➢ Some procedures and structures are important when the team meet virtually to keep the team together and focused on the given task. This could include an agenda for virtual meetings. Such an agenda can include casual discussion as well as detailed points on deadlines and progress.

Agreement on communication channels and methods, interaction and problem resolution need to be established (Cascio *et al.*, 2003). This agreement can be reached with the learning organisation's minimum specs and redundancy in mind to encourage learning and knowledge sharing (Rasmussen, 2009; Marion & Uhl-Bien, 2007; Morgan, 1986). Other factors are regular communication and meetings to ensure accountability and to maintain group cohesion. Zigurs (2003) notes the importance of training team members in team building strategies to make sure they contribute to maintain the relationship (Zigurs, 2003). To help develop trust and group relations the group could meet for physical group bonding exercises when the team is first formed and at special occasions. Time to talk about issues not directly related to work in the virtual meetings could also be a way to facilitate group bonding.

Segal-Horn & Dean (2009) proposes that competitive advantage is gained by multinational enterprises (MNEs) if they have a meaningful integration within and across the firm so that an 'effortless' experience is delivered or in other words that the customer is unaware of the physical disintegration of the company but receives the same service globally.

Successful implementation of a globalisation strategy requires cross-border integration and coordination (Bartlett & Ghoshal, 1993; Ghoshal & Nohria, 1993; Porter,1986). According to Child (2005: 389) organizational coordination depends on:

- The common use of standardized protocols and specifications for transactions between differentiated units;
- The use of information and communication technology to enable instant and precise communication of market-led requirements between members of the value chain;
- Direct personal relations based on trust between the members of teams and networks especially to handle non-routine matters requiring negotiation, problem solving and the like.

Virtual coordination is therefore a work form which requires special attention to group formation and group cohesion, cultural elements of work methods, leadership style and communication methods and which facilities coordination between the different units though trust, standardized procedures for transactions and regular communication through virtual means.

Appendix 2: Interview guide to managers

The interview will be grounded in one example, called example A.
<u>Example A: R&D offshoring to China</u> - a high value adding function offshored to Greater China
Last updated: 6/18/2009
General questions:
1) What parts of your engineering operations are offshored or outsourced?
2) Where are these offices located?
3) Did you first offshore or did you first outsource? Did you see a connection between these?
4) Which function was first offshored and which followed thereafter (e.g. first low value adding functions and then higher value adding functions)?
5) How many people are employed in these offshored facilities? About how many of these are white collar workers?
6) Were any employees from Denmark sent there? If so how many and why?
7) Were any employees laid off as a consequence of offshoring (or outsourcing) this function? Has this had any impact on the organisation?

Decision process
8) Why is this function offshored?
9) Was it part of a larger strategic plan for the company (e.g. downsizing, focus on core competences, M&A or a joint venture to reach a certain market)?
10) Are there documentation, formal procedures, a strategy or model which are to be followed when debating functions which could be offshored? (if yes: please elaborate on the details of this, who is involved, their roles and how the selection of these stakeholders were done)
11) Were any external stakeholders involved? In what way? Why these?
12) What issues were considered in your decision making process in regard to whether or not to offshore this function? (e.g. economical, physical distance, cultural distance, knowledge gains/knowledge loss, corporate social responsibility, reputation)
13) Did you debate any social, cultural or ethical issues (in China and/or Denmark) in regard to offshoring function A before or during offshoring it?
14) Who took the final decision to offshore?
15) How was the location selected?
16) What were your expected results from offshoring this function (your targets)?

Experiences
17) Can you describe your positive experiences with offshoring of this function?
18) Can you describe your negative experiences with offshoring of this function?
19) Has culture been an issue? Can you give examples?
20) Did you reach your set targets? What do you think influenced that you did/didn't reach them?
21) If no what was the result of offshoring (how did it differ from your targets?)
22) Based on your experiences which issues should be considered when debating which functions to offshore? (Has it changed from what you did?)
23) Has offshoring this function had an impact on your product development process in regard to how it's structured, managed etc.?
24) Has offshoring this function had an impact on the product itself (e.g. complexity or other features)?

Strategic approach to the subsidiary
25) What main type of tasks and assignments are handled by the subsidiary? Can you give examples?
26) What collaboration is involved with the offshored work and with whom?
27) Who has contact with employees at the offshoring location and why?

28) Does the subsidiary have a complete organisational structure or is it shared (does it have its own sales, marketing, finance, IT departments etc.)?

29) Is there any documentation/procedure about the autonomy and structure for an offshored location?

30) Who takes decisions in regard to

(i)   the definition of R&D projects, planning, resources, etc.;

(ii)   introduction of new technologies;

(iii)   changes in products/services; and

(iv)   hiring and firing of the subsidiary management.

31) What future plans are you considering in regard to the subsidiary? (E.g. more high value adding work, withdrawing work, outsourcing assignments)

Competences

28) Which competences were transferred to the offshored location – if any? Please give examples

29) Was there a formal procedure/competence evaluation involved in regard to which competences could be offshored?

30) What impact – positive or negative - has offshoring these competences had on the organisation? Is anything done differently now compared to before the company offshored (or outsourced)?

31) How can the offshoring (or outsourcing) process be improved in regard to which competences to offshore and/or outsource and which to keep in the home country/in the company?

32) What does the subsidiary do better than you (wherein lies the subsidiary's core competence)?

Appendix 3: Interview guide to expatriates

There were 5 elements of expatriation investigation:

Managers, human resource personal, engineers expatriated to the USA (for NNE) and engineers expatriated to China (for NNE and other companies)

Appendix 3.1 Interview Guide to Managers
Offshore Strategy
1. What is your current position and work related tasks/responsibilities?

2. How do you define outsourcing and offshoring in NNE?

3. Why does NNE use offshoring?

4. Does NNE have an offshore strategy? What is it?

5. What role does offshoring play in the corporate strategy of NNE?

6. What challenges does it pose for your department/for NNE to offshore?

7. What are the main countries you use for doing offshore?

8. Is there any difference between offshoring to China or to any other country?
   - What are the differences?

9. How do you see the development of offshoring in the future?
   - Would it become more/less strategically important?

10. Do you plan any changes to offshoring?

11. How dependant is NNE offshoring on other NN Group companies (in terms of sales)?
    - Do you have several main customers or a lot of different?

12. What do you consider as core knowledge/competitive advantage in NNE?
    - How do you ensure that it is shared and applied in the organization?

13. How do you decide what to offshore?
    - Do you have any specific target for offshoring activities?

14. Do you see any connection between expatriation and offshoring?

Knowledge Sharing
1. How knowledge sharing process is organized between HQ and expatriates in USA while being stationed abroad?
   - What could hinder this knowledge sharing?
   - What challenges does it pose for the HQ and expatriates?
   - What could be improved?

2. How knowledge sharing process is organized upon repatriation?
   - Do you have a special program for this?
   - What could be improved?

3. How the knowledge gained by expatriates is used further in the company when they come back?
   - If "no", what could be the reasons?
   - If "yes", how?

4. Do you consider knowledge gained by the expats as competitive advantage for the company as a whole?
   - Do you consider it to increase company's general competences?

5. What do you think should be done in order not to loose the competences gained by expats upon repatriation?

General

1. Whom do you consider your biggest competitors? Why? Their disposition? – What industry? Main names?

2. How dominant is NNE on the market? How company is placed on the market against its competitors?
   - How does NNE consider competitive environment?
   - Why is it leading? On what parameters? – leading engineering and consulting company? Why?
   - How does it compare itself to others?

3. Does only NNE provide total solutions or also some of their competitors do?

4. Do you have risk management/special department, employees who are dealing with risk avoiding for the company? (embed your risk management article)

5. Changing types of tasks, from big greenfield projects to mostly small revamp projects, is it a global trend on the market? On Asian market? In Europe? Or just in the company?

6. Did the company use Scenario Filter for choosing location for offshoring, or was it created after the decision was made?

7. Why they started to make Scenario Filter?

8. Have you created Scenario Filter for choosing outsourcing location (from the beginning)? Can we see you diploma?

9. When using Scenario Filter, who fills it out? Is it based on some research or just on individuals' assumptions/ personal knowledge vs official sources?

10. Why other parameters were not considered in the model/ why they didn't use additional parameters from the beginning, the ones that are important for the company, like market growth, well-established organization in China and a previous training of Chinese colleagues.

11. Strategic Risks (from Suitability for Offshoring Model), what are they? How does NNE cope with these risks?

12. When the company was founded? 1991? But experience over 80 years?
    a. Was it a department of Novo Nordisk before?
    b. How did they become a company then?
    c. How many people in India and China in total?

13. Organization is matrix structured?

14. Global project governance and global discipline management, what are they doing?

Multidisciplinary knowledge:
1. How do you do interdisciplinary knowledge sharing?
2. How do you plan it? (how is it formalized, formal procedures for this)
    a. How do you create project groups
    b. How do you integrate disciplines
3. Do they have to implement more disciplines in the future?
4. Does it create some obstacles to use it (multidisc. knowledge)?
5. Why multidisciplinary organization/groups are competitive?
    a. It is time consuming
    b. Less time to focus on your area
    c. There must be a limit for multidisciplinary work, too much multidisciplinary work can have negative impact on productivity
6. Does it have any negative impacts?
    a. Does it create any obstacles?
7. How are they able to develop these groups? (any development of a group)
    a. E.g. add mechanical – more competences in a project
8. Is it different multidisciplinary disposition (of competences) in China?
    a. If yes, then these disciplines can relate to offshoring – the same way in DK and CH. *Now they send independent tasks to China, so no need for project work in China when performing offshoring tasks for DK.*
9. From theoretical perspective it is not clear why multidisciplinary work is more competitive. They claim to be more interdisciplinary knowledge focused, but why multidisciplinary cooperation is more competitive (compared to working inn silos/separate disciplines)?

Appendix 3.2 Interview Guide to HRM
1. Could you start with your position and current responsibilities?

2. How many expats do you currently have in the US?

3. Is it a standard contract that all US expats get?
    a. If "not", what do you consider when making individual contracts?

4. How the **expatriation** process is prepared and proceeding for USA, for expats and the family?
    a. What support can they receive before and during expatriation?
    b. Do they get a pre-visit?
        i. Do you have situations when people go for a pre-visit and then come back and say: we are not interested in going?
    c. What does benefit package for the US include?
    d. Who is taking the responsibility for expats while they are abroad, Danish or local HR?
    e. Is someone responsible for finding the social network for the expats?

5. Do you think it would be beneficial to have a contact person in DK for the expat besides his department manager, like a coach, while being stationed abroad?

6. How the **repatriation** process is prepared and proceeding for USA, for expats and the family?
    a. What services are provided to them upon repatriation?
    b. Do expats have career planning when they come back?
    c. Can they have leave upon return?

7. Do you have a system recording what activities an expat was performing and how well did he manage while being stationed abroad?

8. How exactly is the academy for knowledge sharing working in Denmark?
    a. How do you select people to share their experience?

9. What are the main differences of expatriation processes for USA and China?
    a. For expats
    b. From HR perspective

10. What could be improved in ex-, repatriation?
    • What problems can arise in ex-, repatriation processes?

11. Is or was there a tendency of expatriates leaving the company within few years after coming back? (Comparison of US vs. China)
    • Why?

12. Do you keep any statistics regarding expatriation/repatriation? Statistics about people leaving from X5.

13. How difficult is it to find a position for a person when he comes back?

14. What could be done in order to make employees stay in X5 upon repatriation?

15. Do you think something could be done so that expats could use the knowledge they gained abroad when they come back?

16. Why is it more difficult/easier to send expatriates to some countries than the others? (Comparison of US vs. China)

17. If comparing expats travelling by themselves and with the families, is there a big difference in the contract from the point of view of what is offered?

18. How did the expatriation process change during the years? What are the reasons behind it?

19. How do you see expatriation to the US will develop in the future?

20. Do you consider starting any new programs or initiatives for expatriation in US?

21. Do you plan to have more or less US expats in the future?

22. What are key criteria for successful expatriation processes?

23. Are you also involved into offshore activities in your everyday work?
    a. In what way?

Appendix 3.3 Interview Guide to Engineers (USA)

1) Personal data
   - Education
   - Current position

2) General questions
   - Are you here alone or with your family? If children - what age?
   - Have you ever been stationed abroad before?
   - How long is your contract? Was it prolonged?

EXPATRIATE PREPARATION

3) What is the reason/motivation that you agreed to be stationed abroad?

4) How long time passed between you were given a contract to you were abroad?

5) Did you have anyone to look over your contract, like a lawyer?

6) Has your company offered you courses before you decided to be stationed abroad?
   - If "yes": which ones / content?
   - If "no": would you have liked such an offer?
   - What about your family?

7) Which kind of services did you receive from your company (before you went and when you arrived)?
   - Practical (salary and tax paying, house abroad, other services)
   - Taxation (in home country and work country)
   - Social (social networks abroad, other services)
   - Cultural (local behavior, language, norms and values….)
   - Legal (local laws and regulations, pension, contracts…..)
   - Professional (change working conditions, upgrading of skills…..)
   - Other kinds of services?
   - What about your family?

   - What worked well?
   - What did not work well?

CAREER PLANNING

8) Have you discussed with your company about your career perspectives/plan before being stationed abroad?
   - If "yes": with whom and how?
   - If "no": why not?

9) Did you consider that expatriation could help your career?

10) Which qualifications do you believe your company is looking for when making the selection?

POSSIBLE PROBLEMS/ DIFFICULTIES ABROAD

11) Have you ever had problems understanding the time management (keeping deadlines, being on time for meetings, etc.) of your foreign coworkers?

12) Have you changed your leadership style since coming here? In what way?

13) Does foreign engineers job shop more than Danish ones?

LOCAL NORMS AND VALUES

14) Which kinds of local values and norms surprised you, when you first came to this place?
  - Were you prepared for American culture?

15) Could the learning about these issues have been mediated in a more appropriate way?

COMPARISON OF WORK WITH DK

16) Do you feel you worked more or less or the same in US compared to DK?
  - How do you feel about this change?

17) How your tasks change during your stay in US?
  - *Are these different from the tasks you had in Denmark?*
  - *How/in what way?*

18) Did you feel that the level of difficulty for tasks and assignments was the same in comparison to DK?
  - How do you feel about this change?

19) Do you think the (company) culture at your US location is different from DK?
  - If "yes": In what way?

20) Do you follow the same quality standards as in Denmark?

SOCIALIZING WITH LOCALS

21) Did you have Americans in your social network?

22) Was it easier for you to communicate with people of the same educational background or job position level?

POSSIBLE COMPANY PROBLEMS

23) Has your company ever had any security breaches or knowledge leakages?
  - If "yes": what are you doing to prevent this happening in the future?

24) What does corruption mean in US setting for a foreign company/citizen?

FAMILY EXPERIENCES

25) Spouse
  - If you can speak on behalf of your wife, could you explain a little about how she felt about going abroad?
  - What was difficult for her and how does she feel about it now?
  - Did she work before in DK?

26) Children
  - If you can speak on behalf of your children, could you explain a little about how they felt about going abroad?
  - What was difficult for them and how do them feel about it now?

27) What do you do as a family to ensure the move has been as easy as possible for you all?
  - Do you talk about the problems, when they occur?
  - Does the company offer any contact person you could contact in case of personal issues?

For singles:
28) If you compare your contract with contracts of expats in NNE travelling with families, do you feel any differences?
  - And with other companies?

SUPPORT OF EXPATRIATE FROM HQ
29) Who are your primary contact persons at your company at home?
  - HR wise?
  - Work wise?

30) Which kind of help or support can you get from these persons?
  - Do you feel a need for improvement?

VIRTUAL COMMUNICATION WITH HQ, KNOWLEDGE SHARING
31) How do you feel about communicating by virtual network? What challenges/problems does it create?
  - Time difference between DK and subsidiary?

32) Does it make it more difficult to share knowledge this way? How? Why?

33) Did you feel that it was more difficult to trust new people you haven't met in person when working with them only virtually?

34) Which kind of knowledge cannot be so easily shared in the virtual team?

SOCIALIZING WITH DK COLLEAGUES, RELATIVES
35) Did your relationship to your family/friends change during your stay abroad?

RETURN TO HQ
36) When you were to return home, how was that?
  - Was there any kind of preparation for that?
  - Did you find it very difficult to come back home?

37) When you returned to HQ, how was that?
  - The first day in DK, was it prepared for you?
  - Do you feel you prepared much of it yourself or the company arranged/helped you?

38) In general do you think you could have been done better prepared for going abroad and for going home?

39) How is your performance evaluated? Are there any short term and long term measurable criteria set?

COMPETENCES AND KNOWLEDGE SHARING UPON REPATRIATION
40) Have you gained any new competences/knowledge while you have been stationed abroad?
- Could you spread this knowledge further in the company?

41) How the knowledge is shared when you come home? Could this be improved?

42) Do you think/know if knowledge gained while expatriation is used in the company afterwards?

43) What do you think should be done in order not to loose the competences gained by expats upon repatriation?

44) Did staying abroad help your career?

FOR EXPATS STATIONED IN US AND CHINA
45) In general expatriation process to US and China, what could be the main differences/challenges?
- Professionally
- Culturally
- Personally
- Organizationally (how well everything was organized?)

GENERAL
46) Do you think the company will use more or less expatriates in the future for US?

47) Were your expectations regarding your expatriation fulfilled?

THANK YOU!
- **Another contact in NNE** - someone who also was expatriated to US before

Appendix 3.4 Interview Guide to engineers (China)
Codes:

1) Engineers stationed abroad due to offshoring: Expatriates
2) Engineers within Denmark working with expatriates: EH
3) Chinese engineers working for or with Danes: CE
4) Practical decision makers in relation to HR issues: PDM-HR
5) Practical decision makers in relation to implementation of strategic decision making: PDM- SD

Overall

➢ Personal data
- o Age
- o gender
- o nationality
- o civil status

- o educational background
- o employment background
- o current job description
- ➢ Company specific data
  - o stats (size, locations, turnover, country of ownership, industry)
  - o structure (departments, organization, organizational diagrams and chats)
  - o offshoring stats (what, to where, how much (number of functions, number of locations, number of employees stationed abroad, average value for the subsidiaries), when was the first function offshored)

Issue 1: How have the engineers been informed and prepared before they are stationed abroad?

H1: Agreement to work abroad: *Most engineers stationed abroad have agreed to this because they believe the skills and competences they gain will further their career and personal ambitions (source: IDA, udlandsrundspørgen 2007)*

Questions to expatriates:

48) What is the main reason that you agreed to being stationed abroad?
49) What is the secondary reason?

H2: Work processes: *Expatriates will often not be prepared to working virtually and other organizational changes to their work processes before being stationed abroad*

H3: Practical issues: Expatriates *will often be left to resolve practical issues (house – home and abroad, salary, allocation of spouse and/or children, visa and permits, social network etc) in regard to the stay abroad on their own which resolves in stress and sometimes mistakes.*

H4: HR programs: *Only large companies will have an educational program for engineers which are to be stationed abroad*

Questions to expatriates:

1) Has your company offered you courses before you decided to be stationed abroad?
1a) If "yes": which ones / content?
1b) If "no" : would you have liked such an offer?
1c) which topics?
2) Which kind of services did you receive from your company?
2a) professional (change working conditions, upgrading of skills…..)
2b) cultural (local behavior, language, norms and values….)
2c) legal (local laws and regulations, pension, contracts…..)
2d) taxation (in home country and work country)
2e) practical (salary and tax paying, house abroad, other services)
2f) Social (social networks abroad, other services)
2g) other kinds of services?
3) What worked well?
4) What did not work well?

H4.1: HR programs: *Only a few large companies will have an educational program for the family of the engineer who is to be stationed abroad*

Questions to expatriates:
1. Has your company offered your family courses before you were stationed abroad?
1a) If "yes": which ones / content?
1b) If "no" : would you have liked such an offer?
1c) which topics?
2. Which kind of services did they receive from your company?
2a) professional for spouse (new job, upgrading of skills…..)
2b) cultural (local behavior, language, norms and values….)
2c) legal (local laws and regulations, pension…..)
2d) taxation (in home country and work country)

2d) practical (school, other services)

2f) social (social networks abroad, other services)

2g) other kinds of services?

    3.   What worked well?

    4.   What did not work well?

H5: Career plans: Only large companies have developed career plans for their expatriates

Questions to PDM-HR:

1) Do you discuss career perspectives with SE, before they are stationed abroad?

    1a) If "no", why not?

1b) Do you plan to change procedure regarding this issue in the future?

1c) If "yes", how and why?

2) Does the company demand / expect that their engineers stay abroad for while, if they want to get a leader position above a certain level?

Questions to expatriates:

1   Have you spoken with your company about your possible career perspectives before being stationed?

    1a) if "yes": with whom and how?

1b) if "no": why not?

3) Do you have a concrete plan for your continued career, including how the stay abroad can help you?

2a) if "yes": how?

4) Was a possible advancement a decision parameter, when you made the decision to become stationed?

5) What other decision parameters were important to you?

H6: Selection: Companies will often not have a clear strategy for selecting which engineers are stationed abroad?

Questions to PDM-HR:

1) How do you select which engineers are to be stationed abroad?

2) What main traits and qualifications do you look for? Choose from this list: selvtillid, fleksibilitet, tolerance, empati, respekt, interesse I værtkulturen, initiativrig, social begavelse, sprog, professional kompetence, andre. (Source: Dansk Management Forum)

2a) Why?

2b) is it an easy or difficult task to find a suitable candidate?

3) Has it ever happened that a person was selected which was not comfortable with the task?

3a) If 'yes'; how was this situation resolved?

Questions to expatriates:

1) Were you asked to stay abroad or did you ask the company?

2) Which traits and qualifications do you believe your company is looking for, when making the selection?

3) Does the company sometimes make mistakes regarding selection of SE-candidates?

3a) if "yes" what kind of mistakes?

3b) how often?

Issue 2: How do the expatriates experience the cultural challenges abroad?

H7: Cultural clash: *Offshoring can create misunderstandings and/or conflicts between expatriates and the employees from the local environment due to cultural dissimilarity*

H7.1: Nonocronic-polycronic thinking: *Danish expatriates are used to thinking and acting mono-chronic from their work in Denmark but will in offshoring situations often be confronted with poly-chronic thinking employees.*

Questions for <u>expatriates</u> (give the same questions to CE):

    1) Have you ever had problems understanding the time management of your foreign coworkers?
1a) examples?
    2) Have you ever had problems making your foreign coworkers understand your way of time management?
2a) examples?
    3) Have you changed your time management since coming here?
3a) examples?
    4) Has this change been difficult?
4a) examples?
    5) Were you prepared for this?
5a) How?
    6) Has the situation improved during your stay here?
6a) examples?

H7.2: Participative-authoritarian management: *Danish expatriates start using a 'soft' leadership style, but after a while they are be forced to take a more top down approach, because this is expected from the local employees.*

Questions for <u>expatriates</u> (give the same questions to CEs):

    1) Did you encounter any unforeseen management challenges (for you to lead others)?
    2) Which of these would you consider most common for someone in a similar situation to your own?
    3) How did you resolve these challenges?
3a) examples?
    4) Have you changed your leadership style since coming here?
5a) examples?
    5) Has this change been difficult?
    6) In what way?
    7) Were you prepared for this?
8a) if "yes":How?
    8) Has the situation improved with time?
9a) examples?

H7.3: Lack of empathy: *Expatriates are facing difficulties to understand and respect the local values and norms*

Questions for <u>expatriates</u> (give the same questions to CEs):

    1) Are the local norms and values different from the Danish ones?

1a) examples?

    2) Were you prepared for this?

    3) Has the situation improved with time?
3a) Examples?

H7.4: Work and time pressure: *Expatriates have a tendency to feel a greater pressure in regard to work time and responsibility when stationed abroad than when working at home. However, the work pressure (efficiency) will be lower than in Denmark (source: OCED report on work time and efficiency)*

Questions for <u>expatriates</u> (give the same questions to CE with emphasis on the difference in working style):

     1) Has your work time increased, lessened or remained the same since your move aboard?
1a) examples
     2) How do you feel about this change?
     3) Has your work pressure increased, lessened or remained the same since your move aboard?
1a) examples
     4) How do you feel about this change?
     5) Has your responsibility area changed?
3a) examples?
     6) How do you feel about this change?

H7.5: Sense making problems: *Expatriates misunderstand- in particular in the beginning of their stay - the meaning the locals are trying to get through. This happens in particular when the locals are trying to give a negative message through a formally positive statement*

Questions for expatriates (give the same questions to CE):

     1) Have you encountered problems to understand what your foreign coworkers mean??
1a) if "yes": examples?
     2) How did you resolve them?
     3) Were you prepared for this?
     4) Has the situation improved during your stay here?
4a) examples?

H7.6: Social and professional class: *Expatriates will find it easier to interact with **and trust** locals who have the same educational background and social class as themselves.*

Questions for expatriates (give the same questions to CE):

     1) Which types of locals are easiest to interact with?
     2) Which types of locals are easiest to trust?
     3) What is the reason for this?

H7.7: Job shopping: *Foreign engineers will job shop more than Danish engineers, leaving theExpatriatesfeeling frustrated and feeling the foreign employee is being disloyal*

    1. Does foreign engineers job shop more than Danish ones?
1a) examples?
    2. What are the implications of this?
2a) examples?

    3. Do you know of Danish SE, doing jobshopping?
3a) if "yes": their reasons and main reason?

    4. Have you been asked by other companies?
4a) if "yes" did you consider it seriously or not?
4b) which offer could convince you to shift company?

H7.8: Corruption: *Offshoring can mean a pressure from local authorities to take part in corruption if this is expected behavior in the area offshored to.*

Questions for expatriates (give the same questions to <u>PDM-HR to compare</u>):

1) What does corruption mean in a Chinese setting for a foreign company/citizen?
2) Has the issue of corruption ever been debated in your company?
3) Have you heard any stories or anyone talk about situations where certain actions were deemed necessary within this cultural setting which would be viewed differently from a Danish context?

3a) examples?

H8: Negative ethical reputation: *Offshoring can mean an increased risk for negative ethical public either at home or in the offshored country – or both. Reasons can be the company's exploitation of easier laws and regulations in the area offshored to or a lack of cultural insight into the norms and behaviours of the area offshored to.*

Questions for expatriates:

1) Has your company ever had any negative publicity due to their offshored activities?
1) If "yes": examples?

H9: System security breakdown: *Offshoring means an increase in the risk for a break on the system and data security due to ignorance or opportunistic behaviour with the local employees – or because theExpatriatescannot see which local employees will be loyal and who will not. Another reason can be due to an increase in the dependency on electronic communication.*

Questions for expatriates:

1) Has your company ever had any security breaches or knowledge leakages due to offshoring?

1a) If "yes": what are you doing to prevent this happening in the future?

H10: 'learning by doing': Expatriates learn local values and norms by informal communication and 'learning by doing' rather than by formal information / courses

Questions for expatriates:

1) Which kinds of local values and norms did surprise you , when you first came to this place?
2) Could the learning about these issues have been mediated in a more appropriate way?

2a) if "yes": how?
2b) if "no": why not?

H11: Family: *The wife and the children experience various problems and obstacles to adapt to everyday life in another culture*

Questions for expatriates (and if possible to the partner too)

1) Are you here together with your spouse?

1a) if "yes": how did s/he change his/her everyday life?
1b) examples of positive experiences?
1c) examples of negative experiences?
1d) any change during the stay?

2) Are you here together with your children?

2a) if "yes": gender and age?
2b) examples of positive experiences?
2c) examples of negative experiences?
2d) any change during the stay?

3) Do you talk about the problems, when they occur?

3a) if "yes": examples?
3b) if "no": why not?

Issue 3: Obstacles and new challenges regarding knowledge sharing and communication in virtual networks

H11: Virtual network: *As a consequence of lack of preparation of the work situation abroad engineers often it difficult to work virtually*

Questions for expatriates:

    1) How do you engage in a virtual network?
1a. examples
    2) Where you prepared for this?
2a) If 'yes'; how?
2b. If 'no'; would you have liked some preparation? If yes which kind?

H11.1: Lack of trust: *Lack of trust between participants in virtual networks has negative consequences on work productivity and efficiency. Lack of trust can occur due to negative experiences on earlier projects, cultural differences in thought patterns and work habits, a lack of encouragement to create trust, work pressure and stress at work*

Questions for expatriates:

    1) Which are the main obstacles against creating trust when working in virtual networks?
1a) examples?
    2) How do you cope with these obstacles?
2a) examples?

Questions for HE:

    1) Which are the main obstacles against creating trust when working in virtual networks?
1a) examples?
    2) How do you cope with these obstacles?
2a) examples?

H11.2: Knowledge sharing: *Inexperience with working in a virtual network, technological framework as well as lack of trust create lack of necessary knowledge sharing*

Questions for expatriates:

    1) Which kind of knowledge / information can not be so easily shared in the virtual team?
1a) examples?
    2) Have you experienced lack of necessary knowledge sharing due to:
2a) lack of experiences working in virtual teams?
2b) insufficient technological framework?
2c) lack of trust?
2d) other reasons?
    3)   How do you cope with these obstacles?
    4) Does lack of professional knowledge sharing impact the quality of work?
4a) if "yes": examples?

Questions for HE:

    1) Which kind of knowledge / information can not be so easily shared in the virtual team?
1a) examples?
    2) Have you experienced lack of necessary knowledge sharing due to:
2a) lack of experiences working in virtual teams?
2b) insufficient technological framework?

2c) lack of trust?
2d) other reasons?
    3)   How do you cope with these obstacles?
    4)   Does lack of professional knowledge sharing impact the quality of work?
4a) if "yes": examples?

H11.3: Work assignment: *The virtual setup encourages certain assignments and a certain way of resolving them which are different from assignments done in a traditional network due to spatial, cultural and other differences between the parties in the virtual network.*

Questions for expatriates:

    1)   Have your work assignments changed (not the setup but the task itself) since you were stationed aboard ?

1a) If "yes"; how?

1b) Which are the most important lesson for you regarding these changes?

H11.4: Time zone differences: *Time zone differences can mean failing productivity if not UI learns to restructure their way of working by among other things exploring different synchronal and a synchronal tactics and communication technologies.*

Questions for expatriates:

    1)   How do you cope with the time zone issue when working with your colleagues in the headquarters/in Denmark?
    2)   Does it create problems sometimes?
2a) if "yes": examples?

Questions for HE:

    1)   How do you cope with the time zone issue when working with your colleagues in the headquarters/in Denmark?
    2)   Does it create problems sometimes?
2a) if "yes": examples?

H12: Cohesion obstacles: *Offshoring can create barriers for or dissolve close professional and social working relationships between expatriates and work colleagues in DK. The effect can be that Expatriates feel isolated and play a smaller role in the informal knowledge sharing and knowledge development network.*

Questions for expatriates:

    1)   Do you feel you are a part of the same *professiona*l network you were a part of at home?
1a) if "yes": examples?
        1b)if "no": does It influence your professional performance somehow?
    2)   Do you want the professional cohesion to be stronger or weaker?
3a) if "yes": why and how?
    3)   Do you feel you are a part of the *social* network you were a part of back home?
4a) examples?
    4)   What are the consequences of this?
5a) examples?
    5)   Do you want the social cohesion to be stronger or weaker?
6a) if "yes": why and how?

H13: Knowledge gains: *Expatriates will gain a lot of knowledge while stationed abroad.*

Questions for expatriates:

   1) Have you gained any new competences while you have been stationed abroad?
1a) if " yes"; which ones and how?
1b) if "no": why not?
   2) Which are the most important competences and knowledge you have learned at this place?
2a)personal?
2b)social?
2c)professional?

H14: Transferring knowledge back: *Transferring knowledge back to the headquarter (HQ) will be hindered by the low strategic importance for real two-way knowledge collaboration and sharing.*

Questions for expatriates:

   1) Do you feel that HQ is really interested in your knowledge and experiences gained abroad?
1a) examples?
   2) What hinders it?
2a) examples
   3) Do you believe that there is a need for more acknowledgement in the HQ towards SE?
3a) how?

H15: Coordination breakdown: *Offshoring makes smaller continuous adjustments difficult and thereby create greater delays which are expensive to catch up with compared to keeping things inshore*

Questions for expatriates:

   1) Who is the coordinator at home in relation to your section and job?
   2) Do you experience difficulties sometimes regarding coordination from home?
2a) examples?
2b) why?
2c) possible improvements?

Questions for PDM-SD:

   1) Do you believe the offshored location makes continuous adjustments to the market and to the overall company strategy as effortlessly as when the function was inshore?
1a) if "yes": How is it achieved ?
1b) can it be improved somehow?
1c) if "no": why not?
1d) can it be improved somehow?

H16: Infrastructural communication breakdown: *Offshoring means vulnerability in regard to reliance and efficiency on infrastructure in regard to communication technology which may have a lower quality than those employed inshore.*

Questions for PDM- SD:

   1) Has telecommunication or other kind of infrastructure ever been an issue in regard to your offshored locations?

Questions for expatriates:

1) Has telecommunication or other kind of infrastructure ever been an issue in regard to your offshored locations?

H17: Control breakdown: *Offshoring increases the risk of the correct control procedure failing among other things as a condition of the absence of an informal working relationship between the expatriates and geographically separated colleagues*

Questions for PDM- SD:

2) Does your offshored location(s) offer the same quality level as your department here (in Denmark)?
3) How do you ensure control measures and quality tests are the same standard in the offshored location as here (in Denmark)?

Questions for expatriates:

1) Does your offshored location(s) have the same quality level as your department in Denmark?
2) How do you ensure control measures and quality tests are the same standard in the offshored location as in Denmark?

H18: Work expectations: *As a consequence of the above means engineers often find the work situation abroad different than expected. This can affect their work as well as their personal life*

Questions for expatriates:

3) Which professional expectations did you have before being stationed aboard?

1a. Which of these have come true?

1b. Which have not?

4) Have you experienced unforeseen experiences in connection with your current job?

2a) examples

H19: Success criteria: *The expatriates will have few, vague or no clear measurable criteria with which to judge whether or not they are doing a good job. Ambiguity and insecurity can result.*

Questions for PDM- HR:

1) How is the performance of theExpatriatesevaluated?
2) Are any short term and long term measurable criteria set?

2a. if 'no'; why not?

2b. if 'yes': how are these set?

3) Are these known to the expatriate?

3a. if 'no'; why not?

3b. if 'yes': how are these communicated?

Questions for expatriates:

1) How is your performance evaluated?

2) Are any short term and long term measurable criteria set?

2a. if 'no'; would you like there to be?

2b. if 'yes': how are these set?

Issue 4: How is the gained knowledge used when expatriates return home?
H20: Preparation: *Only a few large companies will have prepared for when the engineer stationed abroad return home*

Questions for PDM- SD:

1) How is the return home of a Expatriates prepared?
1a) professionally (new job function, new tools etc.)?
1b) culturally (cultural shock; Cinderella syndrome)?
1c) Socially (new leaders, new co-workers etc.)?
1d) Company strategy (where is the company now compared to when the Expatriates left)?
2) Can this be improved?
2a) examples?
3) When is the first MUS conversation held with the returned SE?

Questions for Expatriates now back in Denmark:

1) How were you prepared for the return home?
1a) professionally (new job function, new tools etc.)?
1b) culturally (cultural shock; Cinderella syndrome)?
1c) Socially (new leaders, new co-workers etc.)?
1d) Company strategy (where is the company now compared to when the Expatriates left)?
2) How was your first day back home?
2a) examples?
3) Did you have a MUS conversation or otherwise debate your future within the company upon your return?
3a. if 'no'; would you have liked to?
3b. if 'yes': do you now know where you stand in the company and in your career?
4) Can this 'sending home process' be improved?
3a) examples?

H21: Personal knowledge: *The knowledge expatriates are gaining are not fully explored while they are abroad nor when they return.*

Questions for PDM- SD:

1) Do you feel the knowledge and competences Expatriates have gained while abroad are vital for the company?
1a) examples?
2) How are Expatriates debriefed when they return home?
2a) examples?
3) Can this be improved?
3a) examples?
4) Is the knowledge Expatriates gain abroad saved and accumulated for later use, so it won't be lost if the person leaves?

Questions for expatriates:

1) How do you believe you can/will use your knowledge when you return home?
2) Do you believe that someone in your company will listen to and learn from your experiences staying abroad?
2a) if "yes": who and how?
2b) if "no": why not?

H22: Tasks: *The greater cultural distance from the headquarters the harder it is for the subsidiary to get important tasks and be acknowledged for its competences and local knowledge network*

Questions for expatriates:

1) What kind of tasks do you accomplish in your current job?
2) Has these tasks changed over the last few years?
3) Are these different from the tasks you had in Denmark?
4) How/in what way?
5) Do you think you should receive other/more value adding assignments?

5a) why?

H23: Integration vs. disintegration: *There will be strategic disintegration coupled with physical disintegration when companies offshore. This leads to subcultures, different responses to the same overall strategy and duplicate efforts*

Questions for PDM- SD:

1) How is the organisational structure of a subsidiary?
2) Does each subsidiary have a complete organisational structure (sales, marketing, finance, IT etc.)?
3) Does your company explore their subsidiaries to their full potential?

3a) if "no": How could this be improved?

4) Would you think the (company) culture at your offshored location in for example China is different from here?

4a) if "yes": In what way?

5) Does each subsidiary develop their own local strategy ?
6) What would you see as the benefits or pitfalls of having this?

Questions for expatriates:

1) How is the organisational structure of a subsidiary?
2) Does each subsidiary have a complete organisational structure (sales, marketing, finance, IT etc.)?
3) Does your company explore their subsidiaries to their full potential?

3a) if "no": How could this be improved?

4) Would you think the (company) culture at your offshored location in for example China is different from here?

4a) if "yes": In what way?

5) Does each subsidiary develop their own local strategy ?
6) What would you see as the benefits or pitfalls of having this?

H24: Conditions for success / failure experiences of expatriates: *The experience expatriates gain of whether or nor their stay abroad is successful depends on the following conditions and competences:*

H24.1: *the company's career planning for the SE*

H24.2: *The SE´s own career planning*

H24.3: *education/preparation in the company prior to the stay abroad*

H24.4: *Work pressure and time pressure in accordance to competences while stationed abroad*

H24.5: *Network with colleagues at home/stationed abroad and other people stationed aboard, the local population as well as family relations*

H24.6: *Personal expectations and abilities to adjust to the new society and new challenges*

H24.7: *Personal abilities like socially outgoing, flexible, empathic, quick adjustment time, leadership abilities, communication abilities, the ability to create trust*

Questions to PDM-HR:

1) Does Expatriates often get a higher position when they return home?
2) How many percent (%) of Expatriates leave within the first 2 years of returning home?

2a)Why?

3) What makes a successful stay abroad?
4) How could this be improved (at your company)?
5) Why does Expatriates return home?
6) Why do Expatriates stay out?
7) What impact – if any – has the financial crisis had on send engineers abroad?

Questions to expatriates:

1) Has your stay so far been overall successful or not?

1a) Can you give positive and negative examples?

2) Will you be returning home?

2a) Why or why not?

Questions to expatriates who are now back in Denmark:

1) Did anyone introduce you to new colleagues employed since you were stationed?

1a) If "yes": who and how?

1b) if "no": would you suggest that it should have happened?

2) Did anyone spend time to update you about the section or company?

2a) if "yes": who and how?

2b) if "no": should it have happened?

3) Did you went home to settings in which all technical facilities were prepared so you could just start to work immediately?

3a) if "yes": who did it?

3b) if "no": should it have happened?

4) Did your family receive any services from the company when back in DK?

4a) if "yes": from who and how?

4b) if "no": should it have happened?

5) Has the work pressure (efficiency) changed now that you are back in DK?

1a. How/in what way?

6) Has the work time changed now that you are back in DK?

2a. How/in what way?

7) Have you kept your earlier network in the company and/or have you gained a new network after your return to DK?

8) If you lost your old network: what were the consequences of this for your professional development and working environment?
9) What makes a successful stay abroad?
10) How could this be improved (at your company)?
11) Was your stay overall successful or not?
7a) positive and negative examples?
12) Have you addressed the expectations to the stay you had which has not been fulfilled after your return?
8a) In what way?
13) Why did you choose to return home?
14) Would you ever agree to be stationed aboard again?
10a) Why/why not?

H25: Stationed abroad and career development: *While most HR employees feel a stay abroad improves the engineer's career in the company a majority of engineers will feel the reserve. They will, however, feel the stay improved their career overall. (Source: Mercer investigation for the USA)*

Questions to expatriates who are now back in Denmark (same questions to PDM-HR to compare):

1) Would you say your stay abroad has improved your career in this company?
1a) if 'yes'; in what way?
1b) if 'no'; why?
2) Would you say your stay abroad has improved your career in general?
2a) if 'yes'; in what way?
2b) if 'no'; why?

H26: Learning curve: *With time, as trust and knowledge about the local environment and culture grows, companies will send fewer and fewer expatriates.*

Questions to PDM-HR:

1) Do you think you will use more or less Expatriates in the future?
1a. Why?
2) What is your goal/strategy in regard to Expatriates in the future (more, less, none, case by case etc.)?

Questions for PDM- SD:

1) Do you think you will use more or less Expatriates in the future?
1a. Why?
2) What is your goal/strategy in regard to Expatriates in the future (more, less, none, case by case etc.)?

H26a: Relationships: *Expatriates' relationships to the primary family in not changes, but secondary relationships are becoming reduced or disappear during the stay abroad.*

Questions to expatriates:

Did your relationship to your parents change during your stay abroad?

1a) if "yes": how and why?

1b) if "no": why not?

Did your relationship to your siblings change during your stay abroad?

2a) if "yes: how and why?

2b) if "no": why not?

Did you lose contact to some of your friends when staying abroad?

3a) if "yes": how many and why?

3b) if "no": how did you manage to keep the friendship intact?

5. Issue: Improvement for engineers stationed abroad

H27: Responsibility: *Only large companies have a section or group which has HR responsibilities to the unique situation of engineers stationed aboard*

Questions to PDM-HR:

1) Who has HR responsibility for your Expatriates before, during and after their stay abroad?
2) If it is the home HR office, who is responsible while the Expatriates is abroad?
3) How is the relationship maintained?
4) Do you see a need for improvement?

4a) if "yes"; why and how?
4b) if "no": why not?

Questions to expatriates:

1) Who are your primary contact persons at your company at home?
2) Which kind of help or support can you expect from these persons?
3) Do you feel a need for improvement of the support from home?

3a) if "yes": examples?

4) Other institutions at home that could improve their support?

4a) If "yes": who and how?

Questions only to expatriates who are now back in Denmark:

1) Who should provide you with the skills and tools to be better prepared for what being stationed abroad means?
3) How could your stay abroad have been made easier on a day to day basis?
4) Who should take the responsibility and implement this improvement?
5) Could your return home have been made better prepared?

5a) if "yes": how?
5b) Who should ensure this improvement?

H28: Knowledge: *Companies will often not have a clear educational program for engineers which are to be stationed abroad or how to use their knowledge*

Questions to PDM-HR:

1) How should the engineers be educated to best be prepared for and learn during their stay abroad?
2) Who should educate them?
3) How can the companies' best be prepared and organized to use the knowledge the engineers' gain while abroad?
4) Who should be responsible for best conditioning knowledge sharing from the company to the engineer before, during and after the stay abroad (the engineer, IDA, the company etc.)?
5) Who should be responsible for best conditioning knowledge sharing from the engineer before, during and after the stay abroad (the engineer, IDA, the company etc.)?

H29: Career: I*t is difficult for expatriates to use their knowledge when they are back home*

Questions to PDM-HR:

1) Does expatriates gain unique skills and competences abroad, which can be useful at home?

1a) if "yes": examples?

2) Should the career options for engineers who have returned home be improved?

2a) If "yes": why and how?
2b) if "no": why?

<u>Questions only to expatriates who are now back in Denmark:</u>

    1)   Does expatriates gain unique skills and competences abroad, which can be useful at home?
1a) if "yes": examples?
    2)   Should the career options for engineers who have returned home be improved?
2a) If "yes": why and how?
2b) if "no": why?

Appendix 4: Coding scheme for managers

The following shows an excerpt from the coding scheme with a part of a transcribed interview being coded. For the full coding scheme in this coding scheme the statement was used as agreement. The file with the full coding scheme is available upon request.

Appendix 5: Coding scheme for expatriates

The first expect shows a part of the coding scheme for expatriates in China. A similar one was made for Danish expatriates in the USA. For these numbers were used to show agreement (1 for agreement, if agreeing several times this number rose). The second is the comparison between expatriates in China and USA. The full coding scheme is available upon request.

The following is the comparison between USA and China based on the coding scheme for each of these.

Appendix 6: Expatriate findings – tables

Table 35: Preparation Phase, China

Preparation Phase	Total: Agree	Total: Disagree
H1: Agreement to work abroad: Most SE have agreed to this because they believe the skills and competences they gain will further their career and personal ambitions	9	0
H2: Work processes: SE will often not be prepared to working virtually and other organizational changes to their work processes before being stationed abroad	0	4
H3: Practical issues: SE will often be left to resolve practical issues in regard to the stay abroad on their own which resolves in stress and mistakes	3	6
H4: HR programs: Only large companies will have an educational program for engineers which are to be stationed abroad	3	5
H4.1: HR programs: Only a few large companies will have an educational program for the family of SE	2	3
H5: Career plans: Only large companies have developed career plans for their SE	2	7
H6: Companies will often not have a clear strategy for selecting which engineers are stationed abroad	0	5

Table 36: Cultural Issues While Abroad, China

Cultural Issues While Abroad	Total: Agree	Total: Disagree
H7: Cultural clash: Offshoring can create misunderstandings and/or conflicts between SE and employees from the local environment due to cultural dissimilarity.	3	2
H7.1: Monochromic-polychromic thinking: Danish SE are used to thinking and acting mono-chronic from their work in Denmark but will in offshoring situations often be confronted with poly-chronic thinking employees.	2	1
H7.2: Participative-authoritarian management: Danish SE start using a 'soft' leadership style, but after a while they are forced to take a more top-down approach, because this is expected from the local employees.	2	1
H7.3: Lack of empathy: Danish SE are facing difficulties to understand and respect the local values and norms.	2	4
H7.4: Work and time pressure: Danish SE have a tendency to feel a greater pressure in regard to work time and responsibility when stationed abroad than when working at home.	6	2
H7.5: Sense making problems: Danish SE misunderstand - in particular in the beginning of their stay - the meaning the locals are trying to get through. This happens in particular when the locals are trying to give a negative message through a formally positive statement.	6	0
H7.6: Social and professional class: Danish SE will find it easier to interact with and trust locals who have the same educational background and social class as themselves.	6	0
H7.7: Job shopping: Foreign engineers will job shop more than Danish engineers, leaving SE feeling frustrated and feeling that the foreign employee is being disloyal.	2	6
H7.8: Corruption: Offshoring can mean a pressure from local authorities to take part in corruption if this is expected behavior in the area offshored to.	2	1
H8: Negative ethical reputation: Offshoring can mean an increased risk for negative ethical public either at home or in the offshored country — or both.	0	1
H9: System security breakdown: Offshoring means an increase in the risk for a break on the system and data security due to ignorance or opportunistic behaviour with the local employees — or because the SE cannot see which local employees will be loyal and who will not.	4	3
H10: 'learning by doing': SE learn local values and norms by informal communication and 'learning by doing' rather than by formal information/ courses.	8	0
H30: The wife and the children experience various problems and obstacles to adapt to everyday life in another culture.	4	0

Table 37: Knowledge Sharing and Virtual Communication, China

Knowledge Sharing and Communication in Virtual Networks	Total: Agree	Total: Disagree
H11: Virtual network: As a consequence of lack of preparation of the work situation abroad engineers often it difficult to work virtually	1	6
H11.1: Lack of trust: Lack of trust between participants in virtual networks has negative consequences on work productivity and efficiency.	2	1
H11.2: Knowledge sharing: Inexperience with working in a virtual network, technological framework as well as lack of trust create lack of necessary knowledge sharing	1	2
H11.3: Work assignment: The virtual setup encourages certain assignments and a certain way of resolving them which are different from assignments done in a traditional network due to spatial, cultural and other differences between the parties in thevirtual network.	2	0
H11.4: Time zone differences: Time zone differences can mean failing productivity if not SE learns to restructure their way of working by among other things exploring different synchronal and a synchronal tactics and communication technologies.	1	1
H12: Cohesion obstacles: Offshoring can create barriers for or dissolve close professional and social working relationships between SE and work colleagues in DK.	3	2
H13: Knowledge gains: SE will gain a lot of knowledge while stationed abroad.	9	0
H13.1: Knowledge gained - soft skills (e.g. leadership and communication skills)	6	0
H.13.2 Knowledge gained - hard skills (e.g. technical expertise)	2	0
H14: Transferring knowledge back: Transferring knowledge back to the headquarter (HQ) will be hindered by the low strategic importance for real two-way knowledge collaboration and sharing.	2	3
H15: Coordination breakdown: Offshoring makes smaller continuous adjustments difficult and thereby create greater delays which are expensive to catch up with compared to keeping things inshore	1	0
H16: Infrastructural communication breakdown: Offshoring means vulnerability in regard to reliance and efficiency on infrastructure in regard to communication technology which may have a lower quality than those employed inshore.	2	2
H17: Control breakdown: Offshoring increases the risk of the correct control procedure failing among other things as a condition of the absence of an informal working relationship between SE and geographically separated collogues	1	0
H18: Work expectations: As a consequence of the above means engineers often find the work situation abroad different than expected.	0	1
H19: Success criteria: The SE will have few, vague or no clear measurable criteria with which to judge whether or not they are doing a good job. Ambiguity and insecurity can result.	1	6

Table 38: Return of Expatriatesfrom China to Denmark

How is Knowledge Used When the Engineers Return Home	Total: Agree	Total: Disagree
H20: Preparation: Only a few large companies will have prepared for when the SE return home	1	6
H21: Personal knowledge: The knowledge SE are gaining are not fully explored while they are abroad nor when they return.	2	2
H22: Tasks: The greater cultural distance from the headquarters the harder it is for the subsidiary to get important tasks and be acknowledged for them.	1	0
H23: Integration vs. disintegration: There will be strategic disintegration coupled with physical disintegration when companies offshore.	2	0
H24: Conditions for success / failure experiences of SE:The experience SE gain of whether or nor their stay abroad is successful depends on:	–	–
H24.1: the company's career planning for the SE	2	0
H24.2: the SE´s own career planning	4	0
H24.3: education/preparation in the company prior to the stay abroad	2	0
H24.5: Network with colleagues at home/stationed abroad and other people stationed aboard, the local population as well as family relations	4	0
H24.6: Personal expectations and abilities to adjust to the new society and new challenges	6	0
H24.7: Personal abilities like socially outgoing, flexible, empathic, quick adjustment time, leadership abilities, communication abilities, ability to create trust	1	0
H25: Stationed abroad and carreer development: While most HR employees feel a stay abroad improves the engineer's career in the company a majority of engineers will feel the reserve.	2	3
H26: Learning curve: With time, as trust and knowledge about the local environment and culture grows, companies will send fewer and fewer stationed engineers.	1	2
H26a: SE's relationships to the primary family in not changes, but secondary relationships are becoming reduced or disappear during the stay abroad.	3	4

Table 39: Improvement Points for expatriates (SE), China

Improvements for SE	Total: Agree	Total: Disagree	Total: Partly Agree
H27: Responsibility: Only large companies have a section or group which has HR responsibilities to the unique situation of SE	0	2	0
H28: Knowledge: Companies will often not have a clear educational program for engineers which are to be stationed abroad or how to use their knowledge	6	0	0
H29: Career: It is difficult for SE to use their knowledge when they are back home	2	2	1

Table 40: Additional Information from the Dataset, USA

General Issues	Total: Agree
1. More documentation is needed	2
2. More codified knowledge is needed	2
3. The move abroad has been a "learning by doing" experience	2
5. No lawyer or other checks of the expat contract	2
6. Went abroad to expand personal horizon and learn about new cultures, get new experiences etc.	7
9. Social networks with other expats helped with many practical advice	2
10. Being expat in China is easier than in other places	1
11. Don't socialize due to a lot of work and personal reasons	2
13. Social network was set up for SE upon arrival abroad	6
14.1. mainly other expatriates, but not locals	5
14.3. mainly locals	2
15. Coming back home after expatriation was more difficult than being expatriated	4
16. An expatriate is in general satisfied with the stay abroad	6
16.1. Satisfied professionally	2
18. SE finds it difficult to go back to a specialized job after having a management position while being expatriated	1
19. SE will often explore the possibility of making more decisions on their own while stationed abroad due to less bureucracy and positioning on management level	4
20. Strong language barrier between the locals and SE	9

Table 41: Preparation Phase, USA

Preperation Phase	Total: Agree	Total: Disagree	Total: Partly Agree
H1: Agreement to work abroad: Most SE have agreed to this because they believe the skills and competences they gain will further their career and personal ambitions	5	1	0
H3: Practical issues: SE will often be left to resolve practical issues (house – home and abroad, salary, allocation of spouse and/or children, visa and permits, social network etc) in regard to the stay abroad on their own which resolves in stress and sometimes mistakes.	1	3	2
H4: HR programs: Only large companies will have an educational program for engineers which are to be stationed abroad	1	4	1
H4.1: HR programs: Only a few large companies will have an educational program for the family of the SE	1	1	0
H5: Career plans: Only large companies have developed career plans for their SE	0	3	0
H5.1: Informal discussion of SE further career with his/her direct manager	2	0	0
H6: Selection: Companies will often not have a clear strategy for selecting which engineers are stationed abroad?	3	2	0

Table 42: Cultural Issues While Abroad, USA.

Cultural Issues While Abroad	Total: Agree	Total: Disagree	Total: Partly Agree
H7: Cultural clash: Offshoring can create misunderstandings and/or conflicts between SE and the employees from the local environment due to cultural dissimilarity	1	2	0
H7.1: Nonocronic-polycronic thinking: Danish SE are used to thinking and acting mono-chronic from their work in Denmark but will in offshoring situations often be confronted with poly-chronic thinking employees.	0	2	0
H7.2: Participative-authoritarian management: Danish SE start using a 'soft' leadership style, but after a while they are be forced to take a more top down approach, because this is expected from the local employees.	2	2	1
H7.4: Work and time pressure: Danish SE have a tendency to feel a greater pressure in regard to work time and responsibility when stationed abroad than when working at home.	4	2	0
H7.5: Sense making problems: Danish SE misunderstand - in particular in the beginning of their stay - the meaning the locals are trying to get through.	1	0	0
H7.7: Job shopping: Foreign engineers will job shop more than Danish engineers, leaving the SE feeling frustrated and feeling the foreign employee is being disloyal	3	1	0
H7.8: Corruption: Offshoring can mean a pressure from local authorities to take part in corruption if this is expected behavior in the area offshored to.	0	3	0
H8: Negative ethical reputation: Offshoring can mean an increased risk for negative ethical public either at home or in the offshored country – or both.	1	0	0
H9: System security breakdown: Offshoring means an increase in the risk for a break on the system and data security due to ignorance or opportunistic behaviour with the local employees – or because the SE cannot see which local employees will be loyal and who will not.	0	6	0
H10: 'learning by doing': SE learn local values and norms by informal communication and 'learning by doing' rather than by formal information / courses	3	0	0
H30: The wife and the children experience various problems and obstacles to adapt to everyday life in another culture	0	2	0

Table 43: Return of expatriates from USA to Denmark

How is Knowledge Used When the Engineers Return Home	Total: Agree	Total: Disagree
H20: Preparation: Only a few large companies will have prepared for when the SE return home	1	5
H21: Personal knowledge: The knowledge SE are gaining are not fully explored while they are abroad nor when they return.	3	3
H24.5: Network with colleagues at home/stationed abroad and other people stationed aboard, the local population as well as family relations	2	0
H24.6: Personal expectations and abilities to adjust to the new society and new challenges	2	0
H25: Stationed abroad and carreer development: While most HR employees feel a stay abroad improves the engineer's career in the company a majority of engineers will feel the reserve.	3	0
H26: Learning curve: With time, as trust and knowledge about the local environment and culture grows, companies will send fewer and fewer stationed engineers.	4	2
H26a: SE's relationships to the primary family in not changes, but secondary relationships are becoming reduced or disappear during the stay abroad.	5	1

Table 44: Improvement Points for expatriates (SE), USA

Improvements for SE	Total: Agree	Total: Disagree	Total: Partly Agree
H27: Responsibility: Only large companies have a section or group which has HR responsibilities to the unique situation of SE	0	2	0
H28: Knowledge: Companies will often not have a clear educational program for engineers which are to be stationed abroad or how to use their knowledge	6	0	0
H29: Career: It is difficult for SE to use their knowledge when they are back home	2	2	1

Table 45: Additional Information from the Dataset, USA.

General Issues	Total: Agree	Total: Disagree	Total: Partly Agree
5. No lawyer or other checks of the expat contract was done	5	0	1
6. Went abroad to expand personal horizon and learn about new cultures, get new experiences etc.	5	0	0
9. Social networks with other expats helped with many practical advice	2	0	0
10. Being expat in China is easier than in other places	1	0	0
12. Offshored project was not priorized and HQ resources was taken away from it	2	0	0
14.1. mainly other expatriates, but not locals	2	0	0
14.2. both other expatriates and locals	4	0	
14.3. mainly locals	0	0	0
15. Coming back home after expatriation was more difficult than being expatriated	1	0	0
16. An expatriate is in general satisfied with the stay abroad	5	0	
16.1. Satisfied professionally	2	0	0
16.2. Satisfied in practical issues//organization of expatriation stay	1	0	0
17.2. Not satisfied in practical issues/organization of expatriation stay	1	0	0

Appendix 7: Transcribed interviews

Expect from transcription of an interview with a top level manager from X1:

[Female2]: Why did you decide to outsource your offshore production?

[Male1]: Why?

[Female2]: Yeah.

[Male1]: Err.. scalability flexibility. Too high cost. We.... yeah. And also I believe it was because that we had found some partners that we meant could handle this instead of our [unintelligible]. In my opinion it is much easier to press suppliers than it is to, I mean the, the engineering interface it is easier to force suppliers instead of colleagues in China.

[Female2]: Ok, when you offshored your product development, did you already have something in China at that point or like why was it.....

[Male1]: Yeah, We had, we had the erm... new product, I mean the ... if you look at the end of. The way we started and the way it started, is that we develop the products here and then we said now you can implement them into production.

[Female2]: Uh-hmm.

[Male1]: NPI engineering we call it, or manufacturing engineering. We started at that, but then they actually went backwards and they said ok lets take more and more. So in general they took more and more, so we concept developed and made the specification and they made the rest or... we sent it into prototype stage and then they took it over. So it went from, say if you look at the erm... in the process, in the standard stage-gate model, we went from the backside. We went from production into new product introduction into finishing, fire fighting, correction and then into design and then into product start.

[Female1]: But you still have the business case built here still?

[Male1]: Yep. That's right. And concept development I would say.

[Female1]: and concept development?

[Male1]: or at least product concept development.

[Female1]: Yeah.

[Male1]: If you differentiate between product concept development and,, lets say... hardcore engineering concept development.

[Female1]: Yeah, so the detailing is over there?

[Male1]: Yep, yeah.

[Female2]: So how did you select which of these functions you wanted to offshore, like first you said you started from the back cause you offshored production?

[Male1]: Yes.

[Female2]: And then you started to move to other functions....

[Male1]: I think it... Yeah, please continue.

[Female2]: So how did you select this functions? That you want to offshore this com.....

[Male1]: Its what you believe they can handle.

[Female2]: ok.

[Male1]: So... I mean they are good at production. They are good at makings things cheap, they are good at .... erm.. they are good at producing cheap, and then of course the level raises so they can also design things. They had to learn, erm....

[Female2]: So this was why you started with production.

[Male1]: Yeah. Actually there is quite much hand waving in producing such a headset it cannot be made very automated. You can produce a mobile phone with a robot, but it is quite difficult to produce a headset with a robot.

[Female1]: This suggests a question that we haven't got here. Do you stick with the same suppliers? Or would you change your manufacturing suppliers?

[Male1]: We change alot.

[Female1]: Why do you change?

[Male1]: We are an opportunistic company. Its really creating a lot of problems for us, but we do change too often, at least... that's what everybody thinks at least, except for the guys making the decisions.

[Female2]: Who is the guy taking the decisions?

[Male1]: That is a European in [unintelligible], either it's for cost hunting; we hunt the lowest, cheapest part cost and that's always new suppliers because they would like to get a new customer, so they offer it cheap and we take that bait.

[Female1]: But this is when you are buying components?

[Male1]: Yes

[20:37]

All transcriptions are available from the author upon request to ensure anonymity of the interviewees.

Appendix 8: Details for validation workshops

PowerPoint presentations and all written material developed during the workshops can be obtained from the author on request.

Companies are increasingly globalising their product development process from manufacturing to R&D through offshoring and outsourcing to gain competitive advantages. However, this has created new challenges as tasks and activities have to be coordinated across cultures and vast distances. The project goal was to present a framework for decision making in relation to globalising the product development process which addresses the risks with this process.

Data collection was through case studies of 7 companies. 57 interviews were carried out. The Global Decision Making (GDM) framework was developed based on these findings and the subsequent analysis. This iterative framework ensures continuous adaptation to market changes. It has five stages: (1) Strategic goal setting, (2) Strategic planning, (3) Operational planning, (4) implementation and (5) evaluation.

This research project has contributed to academia and industry through the empirical study and the GDM framework which uses cross-disciplinary methods in a new way and is a concrete tool companies can use to address and minimise the risks associated with globalising the product development process.