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Facilitating and Enabling Global Change: Towards a Model of Knowledge-Based Paradigm Shift

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Abstract

At present, our society is near a tipping point where fundamental change must occur to ensure continued growth and prosperity for future generations. Can this change be managed for future benefit? This paper investigates how knowledge management (KM) principles and practice, exemplified by Holsapple and Joshi's (2004) "KM episode," may yield a set of fundamental strategies for global change. To this end, the notion of a KM episode is extended and supplemented with insights from Thomas Kuhn's theory on the "Structure of scientific revolutions." The resultant model describes and explains the interrelationships between knowledge triggers, resources, activities, influences, and potential outcomes associated with knowledge-based communal change. Moreover, an initial finding of this paper is that knowledge management practices and processes may provide the driving mechanism for required global change.

Keywords

Paradigm shift, knowledge management, change, sustainability

Introduction

Significant natural events such as global warming and extreme weather has heightened public sensitivity to the negative impact of modern society and the reliance we have on our natural environment to sustain life. Scientific evidence overwhelmingly advocates a clear and present danger exists if we continue to act as we have done in the past. The need for reform has been heightened by continued global economic and population growth in an economy that is based on the consumption of non-renewable resources for sustenance.

To this end, humanitarian and environmental organizations have been strong advocates of environmental protection. While many of these initiatives have been partially successful in educating government, business, and the general public of the need for change, short-medium term economic issues have created strong local resistance. At the same time, businesses have acknowledged the important contribution they must make to ensuring sustainability and many larger organisations undertake triple-bottom line reporting to demonstrate this commitment. However, many industrial processes still use hazardous or toxic materials, which are discarded as waste at the end of the process or product life-cycle.

Clearly, a paradigm-shift in thinking on both sides of the debate must take place – where environmental concerns are not addressed at the expense of business profitability and vice-versa. However, unlike other paradigm-shifts, the current global situation is of a magnitude that has never been experienced before in human history. In addition, the required paradigm-shift must be timely to avoid further adverse change becoming irreversible.

We are at a crucible moment in our history when global paradigm shift must occur. However, the window of opportunity is closing and current change is slow and fragmentary. A systemic approach to paradigm shift must be invoked and managed at all levels.

Therefore, the primary intention of this research is to develop theory that invokes a knowledge-based systems approach to paradigm shift. To this end, a theoretical model of knowledge-based paradigm shift is proposed based on KM ontology and the structure of scientific revolutions (Kuhn 1996). It is hoped the theory may provide a basis for future exploration, validation, and use in solving complex societal and industrial issues pertaining to social, environmental, and economic sustainability.

The paper unfolds in the following way: First, the theoretical bases used for the model are justified and described. Second, the primary aspects of the knowledge-based paradigm-shift model are provided. The paper ends with a discussion of the limitations, conclusions, and a brief description of future research.

Knowledge-based View and Knowledge Management

Peter Drucker (1969) first described "knowledge-based economy" as the use of knowledge for economic benefits. Since that time, information and communications technology driven change has propelled knowledge-based economics to become an emergent global industrial paradigm. At the organizational level, Drucker's abstract definition has been described in relation to organizational strategy through the "knowledge-based view of the firm" (Grant 1996, 1997; Spender 1996) and operationalised through "knowledge management" practice (Nevo & Chan 2007; Nonaka & Takeuchi 1995; Snowden 2002). The central axiom of the "knowledge-based view" is that knowledge is the only true source of innovation and competitiveness(Grant 1996). Therefore, strategic knowledge management is essential for sustained advantages at all levels of human organizing.

To this end, a significant body of theory has been generated to explain the KM phenomenon (Alavi & Leidner 2002). For example, in a study of KM frameworks, Timbrell et al. (2005) reported the presence of 18 theory frameworks in the 20 top information systems academic journals. It is expected that similar trends occur in other disciplines where KM research has been undertaken. Clearly, the choice of which KM framework is best in capturing the KM phenomenon and therefore most suitable for this purpose is one based on subjective assessment. After this potential limitation was considered, Holsapple and Joshi's KM ontology (Holsapple & Joshi 2004) was chosen as the framework to inform the model because:

1. The ontology seeks to use semantics that describe KM at high (ontological) level of abstraction to allow interpretation from both taxonomic and collectivist perspectives.

2. The ontology attempts to provide a complete account of the KM phenomenon, rather than focusing on one particular aspect.

3. The ontology was developed from a synthesis of earlier frameworks,

4. The ontology has been evaluated by means of a Delphi study, which provided favourable results.

Table 1 provides a brief description of the key dimensions and features of Holsapple and Joshi's KM Ontology.

Table 1: Knowledge management ontology (adapted from Holsapple & Yoshi, 2004)

Dimension	**Features**
Knowledge Resources	*Content knowledge resources:* Participant knowledge, artefacts *Schematic knowledge resources:* Purpose, strategy, culture, infrastructure
Knowledge Manipulation Activities (KMA)	A knowledge flow where acquisition, selection, assimilation, generation, emission of knowledge is informed by ancillary knowledge (knowledge flow meaning, relevance, urgency, evaluative mechanisms, etc.) from other KMA knowledge flows.
KM Influences	*Resource context* – Human, material, financial, and knowledge *Managerial context* – Leadership, coordination, control, measurement *Environmental context* – Climate (Governmental, Economic, Political, Social, Educational), fashion, technology, competition, markets, time

Holsapple and Joshi (2004) theorise the existence of "KM Episodes," which occur when a knowledgeable participant (or participants) recognises a knowledge need or opportunity. This motivation leads to the invocation of finite knowledge resources, through knowledge manipulation activities, under the auspices of knowledge management influences for the purpose of learning (increase in knowledge held as memory) or projection (where resultant knowledge becomes visible in activity or product). The time and number of participants are not bounded and a KM episode may be nested in a larger KM episode set of infinite size. Therefore, KM Episodes can be decomposed or recomposed at multiple levels, in sympathy with complex systems models of organisational knowledge (Stacey 2007; Tsoukas 1996) and knowledge creation (Snowden 2002). In practical terms, this means that KM episodes can occur at individual, to global levels of organising. Moreover, KM episodes create either functional (positive change in knowledge for purpose) or dysfunctional (negative change in knowledge for purpose) outcomes, which interact to provide a vector or path of the KM Episode over time.

The KM episode is quintessential to knowledge-based endeavour (Holsapple & Joshi 2004). As such, the KM episode forms the basis of the theoretical model.

Paradigm Shift and the Structure of Scientific Revolutions

The term "paradigm shift" originates from Thomas Kuhn's seminal work on the structure of scientific revolutions (Kuhn 1996). Paradigm shift expresses the way that scientific communities embrace significant changes in their collective understanding of key assumptions that inform theory development and practice within their discipline over time. Kuhn (1996) suggests that paradigm shift occurs in a process whereby:

(i) Members of the community become aware of anomalies between the results of their research and the prevailing theory, which ultimately leads to discovery. Discovery is communally inspired. However, individuals are recognised for the discovery.

(ii) Once a discovery is made, the community needs to assimilate the new knowledge provided by the discovery to assess its impact. Shift requires discarding "previous standard beliefs or processes and simultaneously replacing those components of the previous paradigm with others." The new discovery itself will not drive paradigm shift. Rather, people within the community must assimilate and acknowledge the discord between the established dogma and the enhancements in understanding and explanatory power provided by the new theory. As dissonance intensifies within community members a loss of faith in the prevailing paradigm occurs, and the community itself lapses into chaos. However, the normative community view is still in support of the existing paradigm.

(iii) Chaos leads to a splintering of the community whereby a smaller group of supporters embrace and advocate the new paradigm over the old. New knowledge expressed as theory, technologies, and techniques are developed to enhance and support the new paradigm, members of the splinter group obtain comparative advantage in their ability to solve problems against their entrenched peers.

(iv) When comparative advantage becomes irreconcilable, members of the broader community move to reject the old and embrace the new paradigm. Comparative advantage is connected with the new paradigm being "neater," "more suitable," or "simpler" than the old. The shift drives some members out of the community because they can not span the gap between the old and new paradigm. Paradigm shifts may be evolutionary (building on previous theory to elaborate new) or revolutionary (starting from a completely different set of assumptions).

Table 2 describes the principal inhibitors and drivers that interact to create the paradigm-shift vector. Inhibitors and drivers are constructed socially to buffer against change (old paradigm) or induce change (new paradigm). These constructions may be viewed along social or technological dimensions, with technology being significant in providing instrumentation that provides empirical evidence and comparative problem-solving advantages to fuel the new paradigm.

Table 2: Paradigm shift inhibitors and drivers

Paradigm shift inhibitors	Paradigm shift drivers
Socio-cultural dynamics lead to conservatism and dogma is enshrined. Individuals are more likely to be discredited than the old paradigm they refute.	The development of empirical evidence in support of the new paradigm becomes over-whelming.
The old paradigm is entrenched in professional preparation and education. Texts only profess one view of the discipline and are openly biased to alternative, emergent paths of thought.	Innovation of technologies and instrumentation to empirically assess alternative theories support new theory development.
Individual & communally-supported buffering of large discrepancies and deviations away from expected outcomes leading to interpretive "blind-spots."	Personal comparative advantage in solving problems is obtained by those who embrace the new paradigm because it exhibits "elegant simplicity"

A Model of Knowledge-based Paradigm Shift

Figure 1 describes a process model of knowledge-based paradigm shift. The theory base of the model is the KM Episode (Holsapple & Joshi 2004). The following section describes each input, process, and outcome in the paradigm-shift episode by interweaving KM Ontology (Holsapple & Joshi 2004) and Kuhn's paradigm shift descriptions (Kuhn 1996).

Paradigm Shift Antecedents

Paradigm shift starts many years before any real change occurs. At first, anomalies are explained by inadequate knowledge regarding methods, local variations, or inadequate instrumentation. However, over time, evidence starts to amass showing the limitations of the prevalent paradigm. Limitations may be unanswerable or "wicked" problems, which are so complex that it is a waste of time to try and solve them. At the same time, a critical discovery may be made, which seems to provide promising insights into "wicked" problems, perhaps in a more elegant and simple manner. However, having the new paradigm axioms does not bring about rapid paradigm shift. Rather, the spark that triggers paradigm shift is based on individuals feeling they will be comparatively disadvantaged against others if they do not change their core assumptions and beliefs to benefit from the new paradigm.

Paradigm Shift

Overwhelming evidence and competitive disadvantages spill over into a sense of community confusion reigns because foundational assumptions that have been held strongly and widely as "truth" or "law" in the old paradigm are being disputed and alternative assumptions are becoming widely accepted. Therefore, paradigm shift is a communal process, with individuals and groups working both for and against the old and new paradigm. When there is a huge conceptual gap between old and new paradigms, knowledge-intensive activities take longer as there is a significant mindset change that is required to assimilate new knowledge. Furthermore, confidence to generate, and emit new knowledge supporting the new paradigm may be seen by many to be "too risky," which leads to further refusal and entrenchment.

Knowledge flow is essential to these processes, which are both creative and destructive. Other ancillary flows that travel with the primary flow such as the credibility of the source are also essential for communal members' decisions and actions regarding the new paradigm knowledge.

Eventually, a critical mass of community sentiment regarding the relative uncertainty, risk, and benefits attributable to old and new paradigms leads to a tipping point where the prevalent opinions, beliefs, and communal aspirations are attached to the new paradigm.

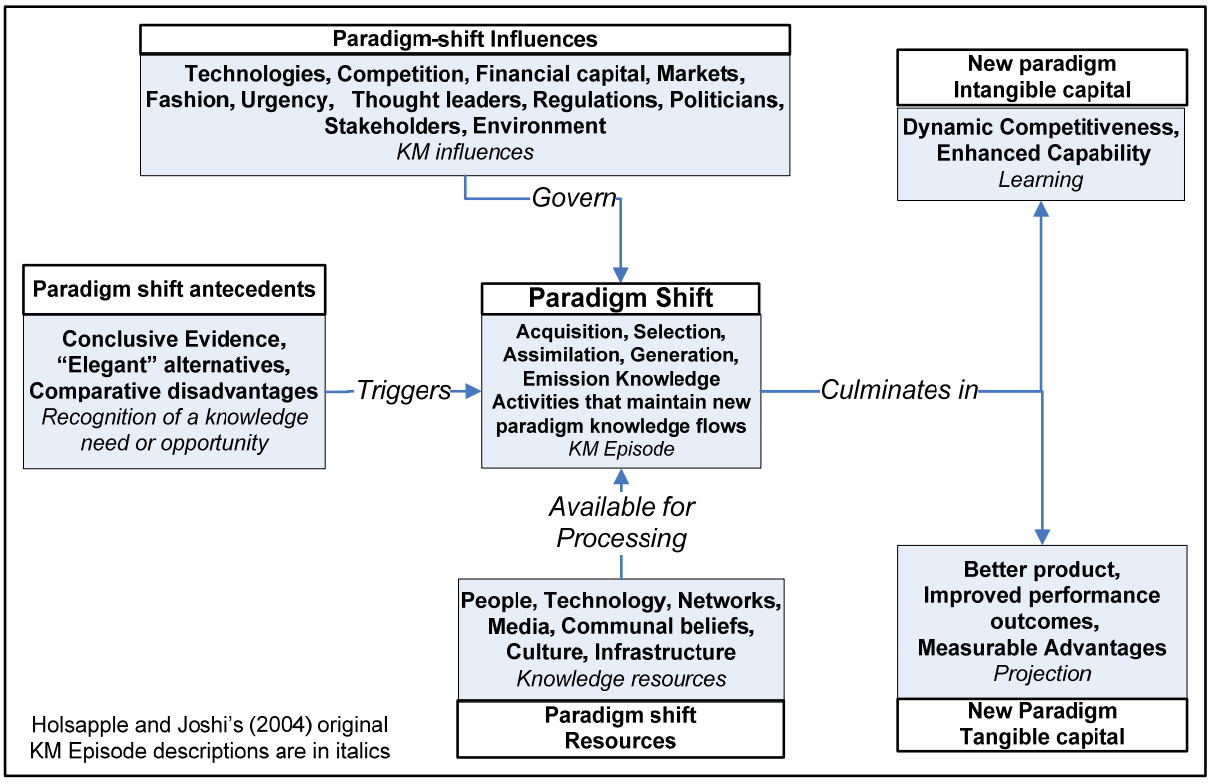

Figure 1: A model of knowledge-based paradigm shift

Paradigm-Shift Resources and Influences

Interactions knowledge resources and influences produce knowledge manipulation activities and associated knowledge and ancillary flows (Holsapple & Joshi 2004). The archetypical knowledge resources in paradigm shift are the individuals that make up the community. Individuals possess unique tacit knowledge or experience, which is the basis of all learning and activity. Individuals also possess socially constructed knowledge and normative beliefs that are either systemic (institutionalised through signs, symbols, artefacts, methods, formal ceremonies, etc.) or ideational (shared beliefs, ethics, values, behaviours, culture etc.) All new knowledge in the community is created by individuals. Knowledge and information sharing within a community is mediated and moderated by individual. Technology infrastructure and services (information technology, books, videos, facilities, etc.) that transfer, store, and present information on various media over networks to facilitate knowledge creation are designed, built, and maintained by individuals. Information technologies also have a particular role as an ancillary participant in creating new knowledge, which means they share information processing tasks with individuals to improve their knowledge and the communication of that knowledge with others. Therefore, paradigm shift is essentially a cognate activity. Individuals in the community act at various levels as participants and "processors" in a complex ideational system of individual cognitions and psychological states, normative beliefs, and culture where learning is both input and output of activity.

Furthermore, participants interact with physical structures and information technologies that are facilitate, enable, or limit their activities and communications.

Paradigm shift influences determine how knowledge manipulation activities unfold over the change process. Holsapple & Joshi (2004) suggest that KM influences can be categorised as resources, management, and environment. Here we see the complexity of knowledge systems emerge, where an individual can play either resource or influence roles depending on the knowledge manipulation activity undertaken. Moreover, complexity increases exponentially as more resources and influences are added to the system. However, in paradigm shift, significant influence is garnered by influential thought leaders who are well respected and charismatic in their beliefs. These thought leaders may be scientists, business men, professionals, politicians, etc. Competitiveness is also a strong driver of paradigm shift. Relative competitive advantages ascribable to the new paradigm will have influential effects on the rate of change. The broader set of ecological, social, and economic conditions can also be significant drivers. Fashion, which tends to be ephemeral, may begin the change process leading to personal, group, and communal experiences that forge change. In large scale economic systems, the nature of the market will provide strong motivations for change. If consumers decide to buy one product over all others because of its 'green' features, then other competitors will act to maintain market share through similar initiatives. Financial resources are important at every level. Today, unprecedented economic affluence means consumers are more likely to make ecologically-sensitive product choices rather than low-cost product choices. The regulatory environment is also a significant influencer and will become more dominant. However, executive powers need to ensure that change is facilitated with as little impact on the public as possible, unless significant events force governments to change because of popularly held beliefs of the public have changed. Finally, the nature of the paradigm shift is predicated on the perceived urgency (or time) of the need to change.

New-Paradigm Intangible Capital

New paradigm intangible capital is the experiential learning that occurs as a result of the KM episode. This learning is tacit and stored within the participants who interact within the informal social network of connections that make up the greater community.

Paradigm shift creates a wave of new knowledge as individuals, groups, organisations, nations, etc. adapt and apply the new rubric to their requirements. The "elegant simplicity" (Kuhn 1996) of the new paradigm allows participants to provide better answers, solve more difficult problems, and make better predictions. Therefore, the emergent "capability" of the community increases through better assumptions and more accurate theoretical insights.

Increased communal capability increases its ability to satisfy requirements (effectiveness) while reducing process overheads (efficiencies) through enhanced innovation capacity. Improved communal capability also increases resilience because capability enhances competitiveness, dynamism, and agility. At the same time, some community participants are unable to make the perceptual transformation from the old to the new paradigm and find it more difficult to compete, until they are forced to exit.

Ironically, the knowledge that creates the new paradigm is the basis for its own demise. As intangible capital accrues, the paradigm continues to mature until the cycle begins with a new theory or approach that counters the existing perspective, leading to the next paradigm change.

New-Paradigm Tangible Capital

New-paradigm Tangible capital are observable manifestations such as products, services, activities, or participant behaviours developed from new-paradigm knowledge. New knowledge developed from paradigm shift will solve traditionally "wicked" problems to create improved solutions and deeper insights.

The "elegant" simplicity of new paradigm knowledge leads to less-complex, more-efficient processes, better-integrated designs, new avenues for innovation (effectiveness) and overall performance improvement to make better use of existing resources. The promise of improved effectiveness and efficiency facilitated by new paradigm knowledge is better resource management, allocation, and use in a social and technical environment which is more competitive, dynamic, and agile.

Conclusions and Further Work

Paradigm shift and KM are learning theories. Learning can be "single loop" or incremental where the learner reuses the same assumptions or theories to guide their problem solving or "double loop," where the learner goes back to the basis of their understanding to try and re-interpret or reformulate the assumptions to guide their decision making (Argyris & Schon 1974). Changes in beliefs and habits requires "double loop" learning, where core assumptions are stringently reconsidered, discarded, or re-conceptualised to create the required shift in understanding. KM provides both information for single loop reuse and knowledge through network

collaboration to aid double-loop innovation. Paradigm shift requires individuals to access competitive information to create motivational states for change. KM can provide real-time information feeds to individual participants at particular times for them to assess their relative advantage. KM can also connect people together in communities that foster positive learning opportunities through thought leaders and mentors. Paradigm shift requires information and knowledge to be dispersed widely and continually across large distribution areas. KM can provide access to ICT network infrastructures and internet services that can be accessed anywhere around the globe. Therefore, KM and ICT are facilitators and enablers of paradigm shift.

This theoretical study provides a model of knowledge-based paradigm shift. The model extended the concept of the KM Episode (Holsapple & Joshi 2004) as a theoretical basis for framing paradigm shift (Kuhn 1996). The motivation behind the development of this model was to explore the synergies between KM and paradigm shift as a basis for understanding paradigm shift mechanisms that may be facilitated or enabled through the use of KM and ICT on a global scale. The results of the study show that KM and ICT have a critical role to play in informing and educating individuals, organisations, and nations about the requirement for change. Furthermore, KM and ICT has the ability to provide conditions that gather knowledge resources together and influence their behaviours and interactions for strategic purposes.

The motivation behind the development of this model is to provide a theoretical lens to explore how knowledge management may contribute to the development of macro-environmental conditions that initiate profound and lasting change with regard to global sustainability and climatic change. The research undertaken thus far shows interesting relationships between organisational-level knowledge management theory and paradigm shift, which is often attributed to a large scale change in communal beliefs and behaviours. Future research will focus on gathering empirical evidence for this relationship through a study of “cradle to cradle” industrial design and engineering. The aim of this study will be to provide an account of the processes involved in individual, organisational, and proposed national transformation, seen through a knowledge-based paradigm shift theoretical lens.

References

Alavi, M & Leidner, D 2002, 'Knowledge management systems: issues, challenges and benefits', in S Barnes (ed.), *Knowledge Management Systems*, Thomson Learning, London, pp. 15 - 35.

Argyris, C & Schon, D 1974, *Theory in Practice. Increasing professional effectiveness*, Jossey-Bass, San Francisco.

Drucker, P 1969, *The age of discontinuity: Guidelines to our changing society*, Harper Rowe, New York.

Grant, R 1996, 'Towards a knowledge-based theory of the firm', *Strategic Management Journal*, vol. 17, no. Winter special issue, pp. 109-22.

---- 1997, 'The knowledge-based view of the firm: Implications for management practice', *Long Range Planning*, vol. 30, no. 3, p. 450.

Holsapple, C & Joshi, K 2004, 'A formal knowledge management ontology: conduct, activities, resources, and influences', *International Journal of Information Science and Technology*, vol. 55, no. 7, pp. 593-611.

Kuhn, T 1996, *The structure of Scientific Revolutions, 3rd Edition*, University of Chicago Press, Chicago.

Nevo, D & Chan, Y 2007, 'A delphi study of knowledge management systems: Scope and requirements', *Information & Management*, vol. 44, no. 6, pp. 583-97.

Nonaka, I & Takeuchi, H 1995, *The Knowledge Creating Company*, Oxford University Press, New York.

Snowden, D 2002, 'Complex acts of knowing: paradox and descriptive self-awareness', *Journal of Knowledge Management*, vol. 6, no. 2, pp. 100-11.

Spender, J 1996, 'Making knowledge the basis of a dynamic theory of the firm', *Strategic Management Journal*, vol. 17, no. Special Issues, pp. 45-62.

Stacey, R 2007, *Strategic management and organisational dynamics: the challenge of complexity to ways of thinking about organisations*, Prentice Hall, Sydney.

Tsoukas, H 1996, 'The firm as a distributed knowledge system: a constructionist approach', *Strategic Management Journal*, vol. 17, pp. 11 - 25.

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