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Linkage between Organizational Innovation Capability, Product Platform Development and Performance -

The case of pharmaceutical SMEs in Iran

Hossein Dadfar[1], Jens J. Dahlgaard[2], Staffan Brege[3] and Amir Alamirhoor[4]
Department of Management and Engineering, Linköping University, Sweden[1, 2, 3]
MBA ProMA Program, Linköping University[4]

Abstract

This study examines the relationship between organizational innovation capability, product platform development and performance in pharmaceutical SMEs in Iran, an area which has remained unexplored. The intensive literature review has led us to suggest an empirically tested conceptual model consisting of innovation capability, product platform and performance as well as factors/enablers shaping innovation capability in the pharmaceutical firms. Combinations of quantitative and qualitative methods were used for data collection and analysis. Eight Active Pharmaceutical Ingredients (API) companies that produce about 80% of local manufactured API were studied. The results show that the Iranian firms have chosen an imitative strategy in technology and product development. The common pattern for technology sourcing was external. However, although all companies purchased technologies from well-known suppliers, they demonstrated significant differences in the variety of products produced and performance. The failure firms lacked sound absorptive capability. Furthermore, the firms with high performance have used a combination of internal and external sources for technology and product development. The empirical analysis showed a positive relationship between innovation capabilities, technology platform, product platform and performance. The prerequisite to this relationship was found to be an effective innovation management and strength/abilities in strategy, organizational structure, learning, processes and linkage (relationship) with the customers, suppliers and alliances.

Key words: Innovation capability, product platform, technology platform, performance, Pharmaceutical Industry, Iran.

1. Introduction

In globalized markets with a hyper competitive environment, rapid technological changes and shorter product and technology lifecycles many firms, particularly the SMEs, are facing severe challenges on compression of product development times and expansion of product variety (Sanderson and Uzumeri1997, p. 3). In such situation the key to creating and sustaining competitive advantage is likely to lie with those organizations which continuously innovate (Tidd and Bessant 2009). Accordingly, firms with a high degree of innovation capability are, on average, two times more profitable as other firms (ibid). Therefore, most firms competing in the global economy are paying increasing attention to innovation as the key driver of competitiveness (Dervitsiotis 2010).

According to Hage (1999: 599), "*innovation can be a new product, a new service, a new technology or a new administrative practice*." Innovation, strongly rooted in organizational

innovation capability, is creating the required new products, processes and systems for adapting to changing technologies, markets and models of competition (Dougherty & Hardy, 1996). According to Adler and Shenbar (1990) technological innovation capability consists of four aspects: a) the ability to develop new products that meet market needs; b) the ability to apply appropriate process technologies to produce new products; c) the ability to develop and adopt new product and process technologies to fulfill future needs, and d) the ability to respond to the technology and activities created by competitors. According to Dervitsiotis (2010) innovation's key dimensions consist of: The quality, quantity and speed of introducing innovations.

Furthermore, to compete effectively, companies have to fulfill customers' needs better than their competitors by offering a high variety of products (Kahn, 1998; Stalk and Hout, 1990). To produce a variety of products successful firms are choosing product family and product platform design strategies to overcome the problems (Simpson, et al., 2005).

Recent innovation research shows the importance of cultural and country effects across borders. For example, national culture has impacts on process management and technological innovation (Lin, 2009). The author highlighted that cultural attributes positively influence innovation performance. However, there are still few studies performed in developing countries and there is a shortage of research in this area (Hurley and Hult, 1998, Keskin, 2006). Besides, earlier studies are usually focused on large enterprises in developed countries, mainly in North American and Western European contexts, and the study of SMEs in developing countries has been overlooked (Keskin, 2006). Therefore, for being able to generalize the theories to be applicable across different nations or cultures, research on innovation and NPD should be extended to non-Western contexts as well (Song, Kawakami, and Stringfellow, 2010).

Another gap in the literature concerns the industry context which shows that innovation management research has not properly covered non-assembled products such as chemicals, pharmaceuticals, materials, etc. (Meyer and Dalal, 2002). The research has been concentrated on assembled products such as automotives and electronic industries (e.g. Alford, et al., 2000; Bremmer, 2000, Yung and Lai 2012). This paper contextualizes such research and undertakes the study on pharmaceutical SMEs in a developing country.

A firm's technological development strategies can be based upon internal sources (in-house R&D or make technology) or external sources (outsourcing R&D or buying technology) or a combination of them (Zhao, et al, 2005, McIvor and Humphreys, 2000). The external sources can be further divided into local, national and international sources. Most of the SMEs in developing countries, due to the lack of resources and weak innovation and technological capabilities, try to acquire technologies from international sources. The Iranian pharmaceutical industry, like other developing countries, uses an imitation strategy for technology development with a focus on producing generic drugs (Cheraghali, 2006). Therefore, to reduce the technological gap, they acquire proper technologies from international sources or from the companies which have already transferred the technology and adapted it to the firm (Zuniga et al, 2007).

The absorptive capability is a prerequisite for technology acquisition and its effective technology adaptation to indigenizing it (Cho & Pucik, 2005; Kamien and Zang, 2000; Katrak, 1997, and Renko, et al, 2009). Moreover, the existing organizational structure influences process and product innovation having a positive impact on individual creativity and organizational innovation (Lin, 2012). Exploration of knowledge from external sources is also a factor influencing a firm's innovation capability (Lee et al. 2012), which is a vital issue for firms in developing countries who need proper knowledge from external sources. The internal ability, innovation capability, and establishment of a new technology platform lead to development of a family of products which serves a variety of market-product platforms (Ulrich and Eppinger, 2008).

Considering the foregoing discussion, the purpose of this study is to examine the relationship between organizational innovation capability, product platform development and organizational performance with a focus on Active Pharmaceutical Ingredient (API) manufacturing SMEs in Iran. For that purpose, a conceptual model has been developed and empirically tested. The database used consists of quantitative and qualitative data gathered from eight pharmaceutical manufacturing companies. These companies produce about 80% of the total API products produced in the country. Therefore, the results can be generalized to existing Iranian API manufacturers.

2. Literature review

2.1 Innovation and Innovation Capability

Innovation acts as the mechanism by which organizations produce new products, processes and systems required for adapting to changing markets, technologies and modes of competition (Dougherty & Hardy, 1996). In other words, there is a positive relationship between innovation capability and business performance (Koellinger, 2008, Tsai and Tsai, 2010) meaning that the better innovation capability the better business performance.

Innovation is a broad topic with various features, including "new", "changes", "opportunities", "creative ideas", "adoption of organization" and "value creation". That is, innovation can be defined as a process of turning opportunities into new ideas (Drucker, 1993, Tidd and Bessant 2009), the adoption of these ideas within the organization (Damanpour, 1991), and successful application of resulting novelties (Pries and Jazsen, 1995) in a way which provides values to the organization. Organizational innovation can be defined as the adoption of an idea or behavior that is new to the organization, where "*the innovation can be a new product, a new service, a new technology or a new administrative practice*" (Hage 1999: 599). Both macro and micro levels of analysis are needed for answering the question: To whom should the "newness" be addressed?

The macro-level concerns product innovation to be new to the world, to the market, or an industry (Lee and Na 1994), and the micro-level deals with product innovativeness identified as new to the firm or the customer (Garcia and Calantone, 2002). This classification is important as it identifies newness of an innovation to whom and from whose perspective. In pharmaceutical

firms producing generic drugs, the innovation most often is at the micro-level - being new to the firm. Based upon the "newness notion" imitative products are often new to the firm, but not new to the market (Grupp 1998: p 20). Imitative innovations, used by the majority of pharmaceutical companies in the developing countries, usually have low technological and low market innovativeness (Cheraghali, 2006 and Zuriga et al., 2007). Another comprehensive classification of the innovation process includes: Radical, incremental, really new, discontinuous, and imitative innovations, as well as architectural, modular, improving, and evolutionary innovations (Garcia and Calantone 2002).

Innovation can take place only if the organization has innovation capability, the appropriate enablers work sufficiently and a sound innovation management is applied. Lack of a sound innovation management may result in malfunctions as the majority of failures in innovation are due to weaknesses in management of the innovation process (Tidd and Bessant, 2009).

The aim of innovation capability is to apply a set of appropriate process technologies to produce new products that meet market needs and at the same time be able to respond to unexpected technology activities and competitive conditions (Adler and Schender, 1990). This ability of introducing a new product quickly and adopting the necessary new processes are central to firms' competitive advantage (Guan and Ma, 2003). For Lawson and Samson (2001) innovation capability is the ability to mould and manage multiple capabilities. They conceive it as higher-order integration or the capability of integrating the firm's key capabilities and resources to stimulate innovation successfully. However, before companies try to improve their processes of innovation and new product development, they must improve the areas of leadership, people, and partnerships and improve organizational capability to learn and innovate (Dahlgaard-Park and Dahlgaard, 2010). Yung and Lai (2012) revealed how processes, positions, and paths of Asus improved its new product development performance. They claim that processes of integration and coordination, learning, practicing and accumulation of core competences have shaped the best practices in the industry.

In short, organizational innovation capability is a multifaceted phenomenon with many aspects that researchers and managers should be aware of. For example, Guan and Ma (2003) and Yama et al, (2004) categorized innovation capabilities into seven dimensions which are 1. Learning capability, 2. R&D capability, 3. Manufacturing capability, 4. Marketing capability, 5. Organizational capability, 6. Resource exploiting and 7. Strategic capability. Further, Tidd and Bessant (2009) suggest the following four characteristics of successful innovations as:

1. Strategy based (Strategy)
2. Dependent on effective internal and external relations (Linkage)
3. Dependent on effective mechanism for making changes happen (Process)
4. Happens in a supporting organizational context (Organizational structure)

2.2 Product and Technology Platform Development

Many companies are adopting the platform approach to develop and produce product families for increasing the variety, fulfilling the customers' needs better, shortening lead time and reducing costs (Simpson, et al., 2005). This approach has been broadly supported by researchers as a way of creating the advantageous variety of products at a cost satisfactory to the consumers (e.g., Jones, 2003; Krishnan and Gupta, 2001; Meyer and Lehnerd, 1997).

A product family is a set of products that share a platform of their design with common components to address customers' demands in different market segments (Simpson *et al.* 2005). In other words, a product platform can be defined as a set of subsystems and interfaces that form a common structure from which a stream of derivative products can be cost effectively developed and produced (Park et al. 2008).

There are various approaches to product platform development and two of them are of our interest: The three-step approach of Robertson and Ulrich (1998), as well as the proactive-reactive approach of Simpson, et al. (2005). The former includes: 1) Product plan – which products to offer and when? 2) Differentiation plan – how products will be differentiated? 3) Commonality plan – which components will be shared?. The latter approach includes: a) *top-down or proactive* platform approach where a company, based on a product platform and its derivatives, strategically manages and develops a family of products and b) a *bottom-up or reactive* approach where a company, for economies of scale, redesigns or consolidates a group of products for standardization of components (Simpson, et al., 2005).

According to Ulrich and Eppinger (2008) a product platform possibly has two modes of derivative product development: 1) Derivative products involved in the initial efforts of platform development, meaning that on the establishment of the platform all of its products are introduced and there is no opportunity to produce new derivative product on the platform; 2) In the second mode, there is the opportunity to develop other derivative products on the already established platform, one at a time.

However, the success of a platform approach depends on how well the firms are able to manage it, the scope of innovation performed, the external linkage, and the organizational structure (Cusumano and Gawer, 2002). That is, to apply the product platform successfully, the managers have to know the important organizational factors and practices that support successful platform-based product development (ibid).

Furthermore, although the ability to introduce new products and adopt new processes in shorter lead times is an imperative competitive tool (Sen and Egelhoff, 2000), in the long run it is the technological innovation capability that builds a major source of competitive advantage (Freeman 1994). Hence, a prerequisite for a successful product platform is a proper technology platform enabling a group of related products to be manufactured by available and preexisting technological subsystems (Ulrich and Eppinger, 2008).

Technology platform refers to the bundles of technologies that increase the chances of penetrating new markets (Kim and Kogut, 1996). It could be defined as *"a set of subsystems and interfaces developed to form a common structure from which a stream of derivative products can*

be efficiently created" (Meyer and Lehnerd, 1997:39). Technology platform can also be conceived as a cluster of technological capabilities in which the potential of the technology generates a variety of new innovations/ applications with advantage to the organization (Wonglimpiyarat 2004:233).

A firm's technological development strategy can be based upon internal (in-house R&D or making) or external sources (outsourcing R&D or buying technology) or a combination of them (McIvor and Humphreys, 2000; Zhao, et al, 2005). Each has some advantages and disadvantages that should be considered. Internal R&D is the most common way for technology acquisition and enhancing the firms' core competencies (Edler, et. al., 2002; Tidd and Bessant, 2009). However, it requires strong technical expertise and large financial investments (Khalil, 2000) which are generally beyond the possibilities of SMEs in developing countries. On the other hand, technology outsourcing reduces time to market (Tidd and Bessant, 2009) as well as R&D costs (Jonash, 1996) and overcomes the shortage of internal capability (Cutler, 1991). Nevertheless, the external sourcing strategy can be helpful for short-term profit but may lead to the loss of the firm's core competencies and the source of competitive advantage in the long-term (McIvor and Humphreys, 2000). As an alternative the combination of internal and external sourcing is recommended (Zhao, et al., 2005).

In summary a technological platform is an integrated system of capabilities, physical assets and know-how which are used in order to develop a category of derivative products. The product platform is a variety of products which are produced in the same technology platform but with new applications.

2.3 A Conceptual Model and Research Questions

Our literature review confirms a gap in innovation management literature, particularly on innovation, product development, product- and technology platform development in developing countries. There is another clear gap in the literature which concerns the study of the product platform in the context of non-assembly industry such as pharmaceutical firms. Therefore, we suggest a conceptual model consisting of innovation capability, product platform, technology platform and performance as well as variables/ enablers enhancing innovation capability in Iranian pharmaceutical firm as illustrated in figure 1.

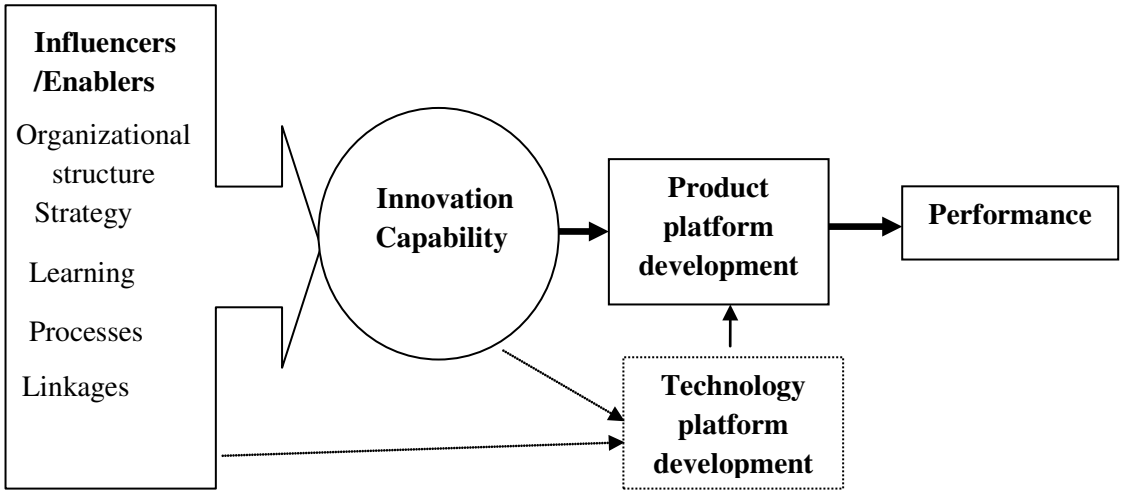

Fig. 1 Suggested relations between innovation capability, technology platform development, product platform development and performance

The model in figure 1 is built upon reviewed literature confirming that innovation is the key driver of competitiveness (Dervitsiotis 2010) and rooted in organizational innovation capability, which is a determinant factor in the innovativeness of a firm. It is an integrated set of components and capabilities creating a constructive environment helping innovations to happen. The successful innovation is based on a clear *strategy,* efficient and effective *processe*s facilitating it and an *organizational structure* supporting creativity and technological changes. The internal and external *linkage* generates opportunities to learn from customers, suppliers and competitors (Cho & Pucik, 2005; Dahlgaard-Park and Dahlgaard 2010; Lin, 2009; Renko, et al, 2009; Tidd and Bessant 2009). Furthermore, exploration of knowledge from external sources and *learning* influence a firm's innovation capability (Lee et al. 2012, and Yung and Lai, 2012).

There is a common agreement on the positive relationship between organizational innovation and performance related to the return of investments - ROI (Damanpour, 1991; Koellinger, 2008; Tidd and Bessant 2009; Tsai and Tsai, 2010). The majority of failures in innovation are due to weaknesses in management of the innovation process (Tidd and Bessant, 2009).

2.4 Research Questions

The main purpose of this study is to examine the relationship between organizational innovation capability, technology and product platform development, and performance in API manufacturing SMEs in Iran.

By considering the literature reviewed and the suggested model in figure 1, the main purpose can be broken down to the following research questions:

1. What are the common product and technology platform development strategies of Iranian API producers?
2. What are the major differences between successful and unsuccessful companies in the product platform development and innovation capabilities?
3. What are the major impacts of innovation capabilities in the product platform development?

3. Research Methodology

The research is based upon a database consisting of both quantitative and qualitative data as well as archival documents. The quantitative data were gathered from eight API producers by using a questionnaire containing 40 statements related to the conceptual model and inspired by Tidd and Bessant (2009) standard questionnaire for auditing a firm's innovativeness. The questionnaire included statements on: Strategy, Processes, Linkage, Organizational structure and Learning (see appendix 1 and 2).

The questionnaires were distributed among managers and experts in marketing, R&D, manufacturing, quality control and quality assurance departments. Out of 200 distributed questionnaires in the eight companies, 168 usable ones were returned.

The respondents were asked to rank the statements on a five point "agree-disagree" Likert scale. The quantitative data were analyzed by SPSS software. The overall reliability evaluation of the questionnaire was calculated by using Cronbach alpha (= 0.903). Likewise, the calculation of Cronbach's alpha on each sub construct *Strategy, Processes, Organizational structure, Learning and Linkage* was respectfully 0.878, 0.892, 0.881, 0.924, and 0.887 which confirms the reliability of the enablers. The qualitative data were collected by 25 in-depth interviews with eight top managers and seven experts who have been involved with technology transfer and product development.

The archival documents were studied for data on product platform development, as well as performance (ROI) of the companies followed by interviews with the CEO, R&D, and manufacturing managers. The financial data sheets of the companies were used to extract the net profit and also their investments in order to calculate the ROI of the companies during 2007, 2008 and 2009. The results are presented in table 1.

Table 1. Return on investment of companies (ROI %)

Year / Company	2007 %	2008 %	2009 %
A	28	-5	-11
B	26	14	17.5
C	13	-8	-11
D	9.5	12	8
E	18.4	15.5	11.92
F	22.4	9.1	8.9
G	12	3.5	9.1
H	18	12	15

4. Data Analysis and Discussion

The empirical data were analyzed along with the research questions and the components of the conceptual model. Kolmogorov-Smirnov Test was used to test for normality ($p>0.05$) and parametric tests were used to study the questions as presented in the following.

Q1: Common technology and product platforms development strategies?

The results showed that most of the companies use a buying strategy to establish their basic technologies. Furthermore, international outsourcing is the main strategy for new technology platforms with an exception of two platforms that were internally sourced (in-house R&D).

The results also showed that, after the establishment of a technology platform, the companies try to develop their product platform internally. Generally, to fill their technology gaps, the Iranian pharmaceutical firms acquire technology from international sources, the same as other developing countries (Zuniga et al, 2007). However, for developing their product platforms, they use a combination of internal and external strategies, which conforms to earlier findings (Kamien and Zang, 2000, Katrak, 1997, Kaiser, 2002, Zhoa, et all., 2005).

Q2: Differences between successful and unsuccessful companies in product platform development and innovation capabilities?

For identifying differences in innovation capabilities based on financial performance, Levene's Test between 2 groups was carried out. The results revealed that high financial performance companies (B, H, F and E) showed a significant higher innovation capability than the low financial performance companies ($p<0.05$).

By using the Chi-square test ($\chi 2$), the relations between financial performance and innovation capability were examined. The results confirm the existence of positive relationships between the firms' financial performance and the innovation capability variables (Asymp. Significanse < 0.05 for all variables - see table 2).

Table 2. Chi-Square Tests for relation between financial performance and innovation capability

Enablers		Pearson Chi-Square	Likelihood Ratio	Linear-by-Linear Association	Number of Valid Cases
Strategy	Value	74.1	93.6	38.9	168
	Df	25	25	1	
	Significance	**0.000**	**0.000**	**0.000**	
Process	Value	63.1	75.8	40.9	168
	Df	23	23	1	
	Significance	**0.000**	**0.000**	**0.000**	
Organization	Value	38.3	47.4	22.1	168
	Df	23	23	1	
	Significance	**0.024**	**0.002**	**0.000**	
Learning	Value	62.3	73.9	30.4	168
	Df	21	21	1	
	Significance	**0.000**	**0.000**	**0.000**	

Linkage	Value	68.1	79.9	48.8	168
	Df	20	20	1	
	Significance	**0.000**	**0.000**	**0.000**	
Innovation Capability	Value	150.8	203.0	49.6	168
	Df	87	87	1	
	Significance	**0.000**	**0.000**	**0.000**	

The differences in technology platform development were further examined by cross tabulation between strategy and performance showing that the companies with low financial performance use a buying strategy, and the companies with high financial performance were using both buying and making strategies.

The studied firms were different in the number of products they develop on the acquired technology platform. A cross tabulation (table 3) showed that most of the high performance companies have developed more products on the acquired technology platform than the low performance companies.

Table 3. Cross tabulation of financial performance and number of developed products

Company	**Performance**	**Number of internally developed products on the acquired technology platform**	
		First technology platform	Second technology platform
C	Low	**1**	**-**
A	Low	1	0
G	Low	2	-
D	Low	0	-
B	High	5	5
H	High	5	6
F	High	3	4
E	High	0	-

E company was an exception having high financial performance but lacks any internally developed products. The reason for this exception can be found in the type of product platform. Since the company does not have any opportunity to develop new derivative products, it can be justified that the company produces all derivative products based on the initial establishment of

the product platform (Ulrich and Eppinger, 2008). Such a strategy may work to achieve short term high performance but for long term it may turn to low performance if the technology and product platforms are not further developed. This issue was verified by the company's managers as well.

In short, the results of the analysis revealed that there is a positive relationship between innovation capability and the firms' financial performances. The high performance companies are better in innovation capability and the related variables/ enablers than the low performance companies. This finding supports earlier views claiming that the firm's innovation capability is a determinant factor of its performance (Cho & Pucik, 2005, Renko et al, 2009).

The results also substantiate the positive relationship between the firm's product innovativeness capabilities in terms of product family/product platform and their performance. The successful companies could produce more products on their platforms. Although all firms used almost the same technology sourcing strategy for acquiring their basic technologies, their performance in producing a variety of products was different. The high performance firms, by improving their processes and systems, could use their technology platform efficiently to develop and produce more new products. This confirms the importance of improving processes and systems (Dahlgaard-Park and Dahlgaard, 2010). Furthermore, the high performance firms' were innovative in product platform development. This finding is also in line with earlier work (e.g. Kleinschmidt and Cooper,1991; Cho & Pucik, 2005).

Furthermore, the results showed that firms which are good in innovation capability have well communicated visions and missions, clear organizational purpose, long term commitment to the main projects, effective mechanisms to implement innovations, systematic problem solving, proper organizational context, and proper working structure and reward systems. They have effective internal and external organizational systems, close relationships with customers, suppliers and partners, commitment to training and development. They have changed their organizational culture from blaming others to a problem solving and collaborative culture (Dadfar and Brege, 2012). Such firms have great opportunities to have a superior organizational innovation capability, to develop their product platform, to offer a variety of products and to achieve excellent performance. This means that the innovation capability is not something to be improved by just a few factors, but it requires a more holistic approach. It should be conceived as a collection and integration of various capabilities in the organization.

Q3: The impact of innovation capabilities in the product platform development?

To answer the third question, we excluded firm E which lacked the possibility of developing more derivate products on the existing product platform as all possible products were developed at the initial product platform establishment. Hence, we focused on the seven companies which had the opportunity of developing more products on the existing platforms. As the number of developed products varied across of the companies, we used ANOVA Test for variation between

the groups. The output of One Way ANOVA Test between the innovation capability variables/ enablers and the number of developed products are presented in Table 4.

The results of the analysis showed significant relationships between the innovation capability enablers and the number of developed products. The significance level for all variables is less than 0.05, which supports a hypothesis of the existence of a positive relationship between innovative capabilities and the number of developed products produced.

Table 4. The One Way ANOVA output

		Sum of Squares	Df	Mean Square	F	Sig.
Strategy	Between Groups	13.296	4	3.324	14.474	0.000
	Within Groups	31.691	138	0.230		
	Total	44.986	142			
Processes	Between Groups	20.136	4	5.034	24.452	0.000
	Within Groups	28.411	138	0.206		
	Total	48.546	142			
Organizatio n	Between Groups	8.788	4	2.197	8.523	0.000
	Within Groups	35.573	138	0.258		
	Total	44.361	142			
Learning	Between Groups	9.388	4	2.347	12.490	0.000
	Within Groups	25.932	138	0.188		
	Total	35.321	142			
Linkage	Between Groups	15.378	4	3.845	16.962	0.000
	Within Groups	31.279	138	0.227		
	Total	46.657	142			
Innovation Capability	Between Groups	11.703	4	2.926	19.884	0.000
	Within Groups	20.306	138	0.147		
	Total	32.009	142			

When it concerns the relationship between innovation capability, the enablers and performance, the results confirm that all have positive relationship with the firms' performance (see Figure 2). The highest correlation coefficient (0.545) was between the innovation capability and performance showing that improving innovation capability is a very important pre-requisite for improving performance. The figure also shows that each enabler had a positive correlation with performance. The Pearson correlation coefficient for the relationship between strategy and performance was 0.483, for learning and performance 0.426, for organizational structure and performance 0.364, for processes and performance 0.495, and for linkage and performance 0.541 as presented in figure 2.

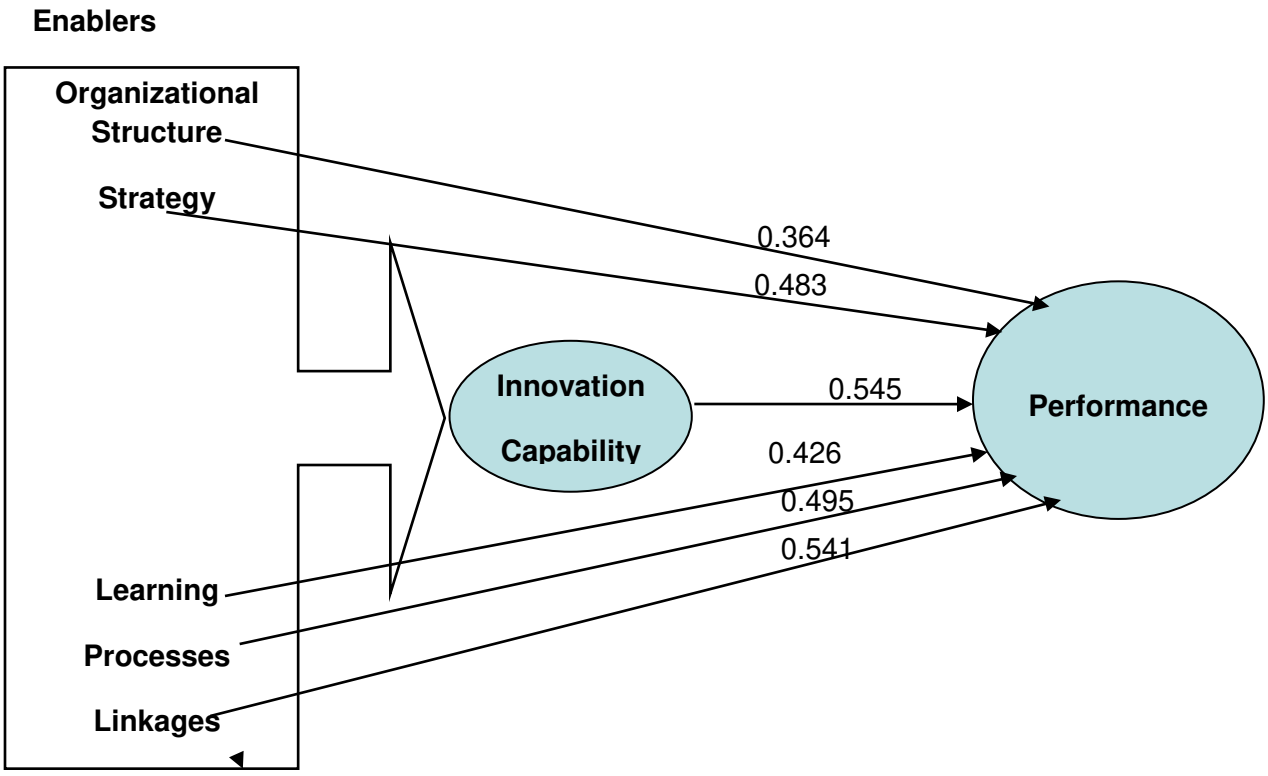

Figure 2. Correlation coefficients between Enablers, Innovative Capability and Performance

According to the correlation coefficients high performance companies ranked implicitly the innovation capability variables/ enablers in the following order: 1) Linkages, 2) Learning, 3) Strategy, 4) Processes, and 5) Organizational Structure.

Conclusions

This study aimed to examine the relationship between organizational innovation capabilities, technology-/ product platform development and performance in pharmaceutical SMEs in Iran. The empirical analysis and pertinent findings were discussed in the preceding section from which we recapitulate the following conclusions.

- The Iranian API companies, regardless of being successful or unsuccessful, use external sourcing strategy (buying) for their basic technology to establish their product platform. This is the same as in most of developing countries (Zuniga et al, 2007). However, they are different in developing derivative products internally upon the acquired technology.
- All Iranian firms, regardless of being successful or unsuccessful, used imitative product development and innovation and their products were "new to the firm" not new to the market (Grupp, 1998). This is the nature of generic drug manufacturing as said by one manager.
- The successful firms (high financial performance) used a combination of internal (R&D) and the external sources for product platform development and new NDP. They have

stronger absorptive capability, could indigenize their purchased technology and make further development in their technology platform, a good strategy for firms in developing countries which lack a strong internal innovation capability.

- There was a positive relationship between the organizational innovation capability and product platform development as well as the financial performance in the studied firms.
- The firms with superior innovation capability are prone to develop a larger product variety in their existing product platforms.
- There was also a positive relationship between NDP and performance of the companies as well as their innovation capabilities.
- There was a positive relationship between technology platform and product platform. However, those firms that develop their technology platform, by a combination of internal (make) and external (buy) sourcing strategies were more successful.
- There was a positive relationship between the innovation capability variables/ enablers and the number of products as well as the firms' financial performance.
- The empirical evidence shows that innovation capability is not something to be improved by just a few factors - it requires a more holistic approach. It should be conceived as a collection and integration of capabilities in the organization and changes in the organizational culture. Particularly in Iran the culture of blaming others should be changed to a problem solving and collaborating culture (Dadfar and Brege, 2012).
- Finally, this study is an attempt to extend the research on innovation capability and product platform development as well as technology platform development to a non-western context.
- Another contribution is the process industry context and empirical evidence from the non-assembly industry (Ulrich and Dall, 2002). The conceptual model (fig. 1) is suggested to be used for similar studies in other developing countries and in the context of other industries.

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Appendix 1 : Self-assessment Questionnaire

Section A: Background information
Name of Company: ……..
Name of respondent: …….
Position of respondent: …….
Years of experience: …….
Level of education: ……...

Section B: Please assess the following statements on a scale from 1 (= completely disagree) to 5 (= completely agree)

	Statement	**1**	**2**	**3**	**4**	**5**
1	People have a clear idea of how innovation can help us to compete					
2	We have processes in place to help us manage new product development effectively from idea to launch					
3	Our organization structure does not stifle innovation but helps it to happen					
4	There is a strong commitment to training and development of people					
5	We have good 'win-win' relationships with our suppliers					
6	Our innovation strategy is clearly communicated so everyone knows the targets for improvement					
7	Our innovation projects are usually completed on time and within budget					
8	People work well together across departmental boundaries					
9	We take time to review our projects to improve our performance next time					
10	We are good at understanding the needs of our customers/end-users					
11	People know what our distinctive competence is – what gives us a competitive edge					
12	We have effective mechanisms to make sure everyone (not just marketing) understands customer needs					
13	People are involved in suggesting ideas for improvements in products or processes					
14	We work well with universities and other research centers to help us develop our knowledge					
15	We learn from our mistakes					
16	We look ahead in a structured way (using forecasting tools and techniques) to try and imagine future threats and opportunities					
17	We have effective mechanisms for managing process change from idea through to successful implementation					
18	Our structure helps us to take decisions rapidly					
19	We work closely with our customers in exploring and developing new concepts					
20	We systematically compare our products and processes with other firms					
21	Our top team have a shared vision of how the company will develop through innovation					

22	We systematically search for new product ideas					
23	Communication is effective and works top-down, bottom-up and across the organization					
24	We collaborate with other firms to develop new products or processes					
25	We meet and share experiences with other firms to help us learn					
26	There is top management commitment and support for innovation					
27	We have mechanisms in place to ensure early involvement of all departments in developing new products/processes					
28	Our reward and recognition system supports innovation					
29	We try to develop external networks of people who can help us – for example, with specialist knowledge					
30	We are good at capturing what we have learned so that others in the organization can make use of it					
31	We have processes in place to review new technological or market developments and what they mean for our firm's strategy					
32	We have a clear system for choosing innovation projects					
33	We have a supportive climate for new ideas – people don't have to leave the organization to make them happen					
34	We work closely with the local and national education system to communicate our needs for skills					
35	We are good at learning from other organizations					
36	There is a clear link between the innovation projects we carry out and the overall strategy of the business					
37	There is sufficient flexibility in our system for product development to allow small 'fast-track' projects to happen					
38	We work well in teams					
39	We work closely with 'lead users' develop innovative new products and services					
40	We use measurements to help identify where and when we can improve our innovation management					

Appendix 2:

Form for classification and scoring of questionnaire statements for each enabler

	Q. no.	Score	Q. no.	Score	Q. no.	Score	Q. no.	Score	Q. no.	Score
	1		2		3		4		5	
	6		7		8		9		10	
	11		12		13		14		15	
	16		17		18		19		20	
	21		22		23		24		25	
	26		27		28		29		30	
	31		32		33		34		35	
	36		37		38		39		40	
Total Score	Strategy:		Process:		Organization:		Linkage:		Learning:	