

**IDENTIFICATION AND EVALUATION OF FACTORS AFFECTING THE MANAGEMENT OF
INNOVATION IN IRANIAN PHARMACEUTICAL INDUSTRY
(Case study: SOHA Pharmaceutical Company)**

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ABSTRACT

Today, innovation and creativity is one of the inevitable principles for an organization survival. In this regard, any organization should evaluate its position in achieving a sustainable development in terms of innovation abilities. Evaluating the innovation ability is the introduction of policymaking in this area; therefore, several extensive studies have been done and different models have been proposed in this area. Since the pharmaceutical industry is of strategic importance for our country, so, it can be very useful to evaluate the factors affecting innovation management capabilities in formulation of future strategies. In present study, we have initially discussed about the theory of innovation evaluation and in continue, we have assessed the factors affecting innovation management in SOHA Pharmaceutical Company. We have identified the Company position in each factor affecting the innovation management and determined the rate of existing gaps and also provided the proposed solution in each factor affecting innovation management.

KEYWORDS: Innovation, Innovation management, Innovation system, Technology.

INTRODUCTION

Innovation in practice has a history as old as human life; but in theory, innovation theory has emerged in industrialization era and emergence of economic schools. Since 1960s, innovation has been considered as an independent research area and more of all, economists have paid attention to it in field of business. Today, innovation is discussed in many different areas (Fagerberg, 2003). However, we cannot ignore the role of innovation in development whether we consider the economic propellant as a need for innovation or technical propellant (technological) or organizational reasons. But, nowadays, innovation is often done by organizations. In case of productive and technological innovations, mostly industries are engaged in innovation and it has caused that organizations feel more need to achieve and perform innovation abilities (Tushman & Anderson, 1997). In our country, innovation indicators should be placed in the first rank in perspective zone according to a twenty-year perspective of 1404 horizon. Accordingly, there should be an appropriate picture of innovation capability and its influencing factors in the country (Ghazi Nouri, 2013).

Innovation evaluation in firm level is required for making decision about allocating resources to innovative activities and also selecting areas in which innovation promise a high economic efficiency. It is also required in managing intera firm innovation strategies. In addition, at the national level, policy makers need the information obtained from the innovation evaluation in order to identify the current status, future developments and getting feedback from the negative and positive effects of appropriate policies (Archibugi and Pianta, 1996).

Definitions of innovation in various studies include following notions:

- Novelty
- Commercialization
- Implementation

In other words, an idea will not be an innovation unless it is developed and converted to a product, process or service or it is commercialized (Popadiuk and Choo, 2006). Innovation is often the root of success in organizations. Competitive advantage may be due to the size and the assets ownership. But, this point often changes in profit of organizations that

can use technological skills and knowledge to create innovation in products or services and their development methods (Tidd and Bessant, 2009).

Innovation involves creating a product, service or a process which is new for an organization.

Innovation is introducing something new to the market or its application is new for the organization or marketing and its commercialization (Taregh Khalil, 2004).

Innovation capability is the potential ability of a firm in performing innovative activities which include introducing and offering products and new services, procedures and processes or new ideas related to the organization (Arasti, 2008).

Generally, there are two views for innovation evaluation in firm level:

The first view is evaluating innovative achievements of the firm such as new products, technological and scientific publications, registering patent, etc. The second view, which is related to the evaluation of innovation capacity or potential of the firm, evaluates the firm readiness for innovation (Boushehri, 2003).

The five generations of innovation model and its key features include:

- First and second generation: technology push model and market pull model (simple linear models)
- Third generation: hybrid model (considering interaction between different components and feedback loops between them)
- Fourth generation: parallel model (integration inside the company with key suppliers in upstream and with active clients and applicants in downstream, emphasis on connections and treaties)
- Fifth generation: systems integration and extensive networking, flexible and special response, continuous innovation (Rothwell, 1983)

INNOVATION MODELS

Extensiveness of the concept, the nature complexity and variety of different approaches to the innovation has led to have many subjects about innovation, processes and its models. Innovation models are divided into two categories of static and dynamic:

1. Static model: the firm's ability and knowledge which is used in a specific time at a particular point.
2. Dynamic model: the approach of dynamic models is in the way of innovation, discovery and expressing its subsequent changes. These models consider the technology as a stream which contains both gradual changes and mutation changes and both of these changes effect on the firm success (Afuah, 1998).

The list of innovation models are showed in table 1.

Other current innovation models include:

- innovation funnel model (open and close)
- innovation risk route model
- Circle process model of innovation
- Twiss or ovate model (Nazari Zadeh, 2012)

Some approaches in innovation evaluation in table 2 are as following:

Table 1: Innovation models

Innovation Static models		
Quality & quantity of knowledge model	Henderson Clark model	Incremental – radical model
Familiarity matrix model	Innovation value added chain model	Strategic incentives model
Teece model or Appropriability and complementary assets	Strategic leadership view model	Abernathy Clark model
	Strategic choice model	Local Environment model
Innovation dynamic models		
Foster's S curve model	Tushman- Rosenkopf technology life cycle model	Utterback_Abernathy dynamic model

Table 2: Different approaches in innovation evaluation

Different approaches		Specific feature	Description
First	Tidd et al, 1998	- Strategic perspective - Innovation evaluation in organization level	The concept of measuring organization success is in fact a kind of survey on history status of the organization in terms of innovation and just evaluating the results and outputs of the organization. However, evaluating innovation capacity in fact represent the organization weaknesses and strengths in each of the basic innovation parameters and it is a guide for improving the organization status and change it to a strategic advantage.
Second	Cebon et al, 1999	Formulating indicators of innovation evaluation	They have pointed some key differences between innovation concepts; they show the difficulties of formulating simple indicators for innovation evaluation.
Third	Nevasan and Narayana	Help to identify the firms strengths and weaknesses	They separate the research and development stage from innovation. These people are very careful in formulating innovation criteria and indicators. In addition, these researchers have presented useful contents in case of pathology and innovation development.
Fourth	Arasti et al, 2008	Categorization as a factor of forming innovation capacity	Innovation capacity is divided into five dimensions: creating a good work environment through leadership of innovative activities, having systematic procedures for processes and organizational inside-outside communication, strategic management of knowledge, collecting and producing new ideas, managing human resources based on innovation.
Fifth	Boushehri et al, 2003	Creating two inside and outside organizational environments	In the external organizational environment, they evaluate the industrial relations with customers, suppliers, competitors, markets and scientific and specific communities. Internal organizational environment is made of three basic and balanced systems which are: idea generation system, system of supplying resources and product development system. In fact, these three categories compromise the innovation system of organization.

Key factors affecting innovation:

Some of the most important identified factors are:

- Personal factors such as creativity, expertise, motivation, job satisfaction, etc.
- Organizational factors such as innovation budgets, organizational learning, researches, risk-taking, etc.
- Environmental factors such as future needs, technology changes, etc. (Nazari Zadeh, 2012)

Innovation success depends on two key factors:

Sources including individuals, tools, knowledge, money and some like these and also the ability of managing these sources in organization (Arasti, 2008).

Studies on innovation success in firm-level have led to present a definition for innovation success: “innovation success is an organization’s ability in creating a steady stream from real incomes due to the efforts in innovation fields.”

There are three categories for success dimensions:

- Financial performance including indicators of profitability, volume of orders and cash flow
- Market position including indicators of sales volume, market share and customer satisfaction
- Preparation for the future including indicators of technological infrastructures for developing future products, infrastructure of human resources in case of designing, producing, marketing and achieving adopted strategic objectives (Nazari Zadeh, 2012).

Introducing the model used in this study

Figure 1 indicates the conceptual model of the research and classification of the factors affecting innovation management. We prepared the research questionnaire based on the design model and applied it for collecting information; its’ reliability was determined by Cronbach’s alpha 0.92. Its’ validity was also confirmed by the judgment of experts.

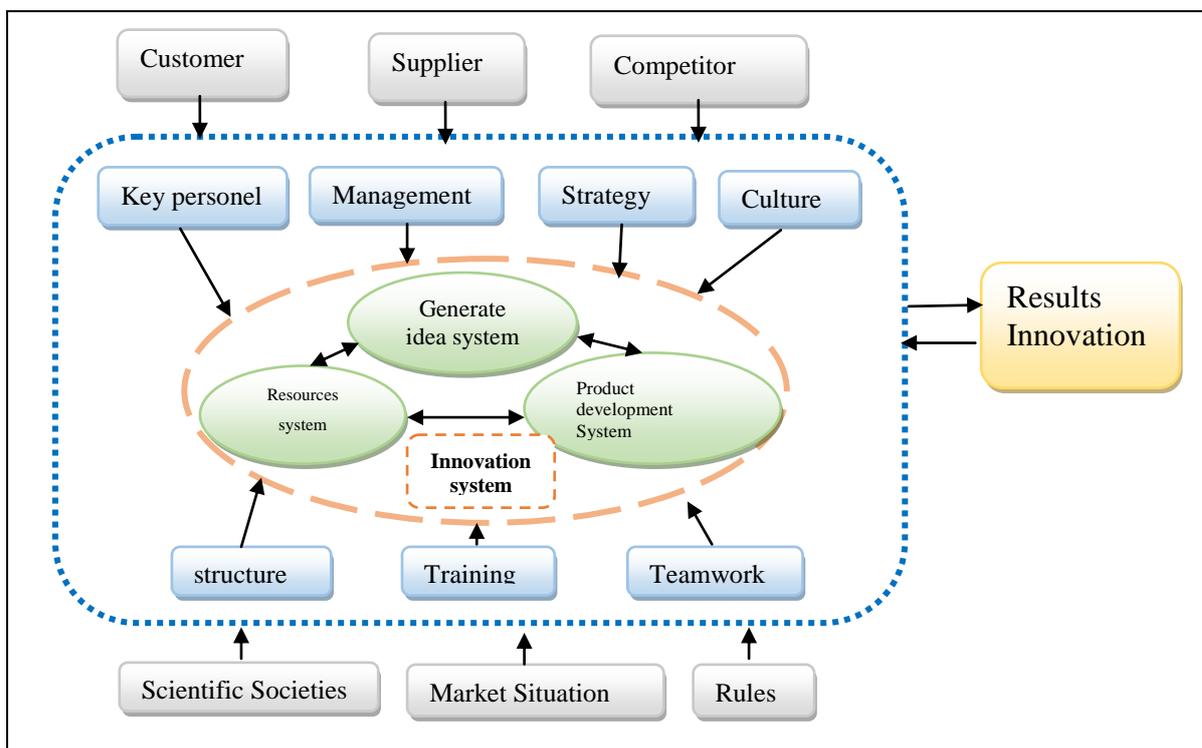


Figure 1: Conceptual model of the research (Boushehri, et al. 2003)

Objectives and research questions

This research aims to determine the capability level of the factors affecting innovation management in SOHA Pharmaceutical Company and through it, identify the existing innovative gaps in each level. Objective term of this research is applied and it is from the type of survey method. The research questions are:

- 1- At which level is each of indicators affecting innovation management in SOHA Pharmaceutical Company?
- 2- What is the level of the factors affecting innovation management in SOHA Pharmaceutical Company and what is the rate of the gap existing in each dimension of innovation capabilities in SOHA Pharmaceutical Company?
- 3- What are the improvement strategies in each factor affecting innovation management in SOHA Pharmaceutical Company?

Statistical Population

SOHA Pharmaceutical Company came into operation in 2008. This company has two sites in Chaharbagh and Vardavard in Alborz province. Some prominent points of this company are the high ability to export products, cooperation with global companies for co-producing the drug and achieving humanitarian goals of Red Crescent.

The products of this company are human drugs in various forms of tablets, capsules, syrups and suspensions, etc. which are produced according to GMP laws and WHO latest standards.

This company is made of research and development unit, quality control unit, development unit, formulation design unit, analytical unit, documenting unit, warehouse, support, production, and planning, financial, marketing, laboratory and so on.

Middle and senior managers and experts of SOHA Pharmaceutical Company who have bachelors, master and doctorate degrees with more than one year working experience make the research statistical population as experts. The research statistical population is determined according to the company status at research time (table 3).

Table 3: View educational level and number (questionnaire)

Educational level	No.	No. percent
Bachelor	11	58%
Master	5	26%
PHD	3	16%
Total	19	100%

RESULTS

First question of the research: what is the level of each indicator affecting innovation management in SOHA Pharmaceutical Company?

We determined the current status of the factors affecting innovation management in each indicator in SOHA Pharmaceutical Company according to data collected by questionnaire and summarizing them which are given in table 4.

Table 4: current status of the factors affecting innovation management in each indicator in SOHA Company

Dimensions	Indicator	Average(%)	Gap (%)
Strategy	How much innovation has been considered in the strategy of your organization?	71.11	28.89
	How much the managerial levels of the organization are aware of innovation status in the strategy of organization?	80.28	19.72
	How much the workers of the organization are aware of innovation status in the strategy of organization?	55	45
Structure	How much the current organizational structure can help to extend and develop the innovation?	45.56	54.44
	How much the current organizational structure can facilitate teamwork and groups of problem solving?	80.83	19.17
Dimensions	Indicator	Average(%)	Gap (%)
Culture	How much the organization can bear failures and mistakes of its workers?	80.56	19.44
	How much the environment of organization can encourage workers to innovate?	51.39	48.61
Management	How much the managers of the organization support innovators and their activities?	80.83	19.17
	How much the managers of the organization have supportive and positive view towards the workers who take risk and innovate?	83.61	16.39
	How much the managers try to generate more ideas related to the customer current and future needs?	70.28	29.72
	How much the managers try to accelerate the process of generating ideas?	63.06	36.94
	How much managers try to provide the required financial resources for generating new ideas?	83.33	16.67
Training	How much the training programs of your organization pay attention to the subjects related to innovation such as technology and innovation management, entrepreneurship, marketing, techniques of communicating with customer and...?	71.67	28.33
	How much the provided trainings have had positive effect on innovation?	64.17	35.83
	How much the training facilities "like library, internet, participate in courses and special training seminars" in case of study, research and learning is in hand of employees in order of organization goals?	73.89	26.11
Teamwork	How much the teamwork and creating cross-sectional teams in order of innovation is common in the organization?	55.28	44.72
	How much the mechanisms and problem solving teams are used in the organization regarding the innovation issues?	63.33	36.67
Employees	How much the organization has been successful in absorption and retention of innovative workers in its required fields?	48.61	51.39
	How much the policies of supporting innovative workers (job promotion, financial and non-financial encouragements and...) are used?	73.89	26.11
	How much of the innovations have been from the workers inside the organization?	63.06	36.94
	How much your organization uses the workers new ideas?	45.56	54.44
Regulations	How much the organization regulations facilitate the innovation?	31.67	68.23
	How much the governmental regulations can motivate and stimulate the organization for innovation?	46.39	53.61
Dimensions	Indicator	Average(%)	Gap (%)

Innovation system	To what extent the identified mechanisms (participation system, definition mechanism, approving a project, etc.) are used to attract the employees' innovative ideas?	41.94	58.06
	To what extent different techniques (problem solving methods, concurrent engineering, cross-functional teams and QFD, etc.) are used to create new ideas?	56.94	43.06
	To what extent the research and development unit of the organization (in case of existence) has been effective in provided innovations?	55.28	44.72
	To what extent different organizational units interact with each other in order of performing and developing innovations?	61.11	38.89
	How much the time spent to provide required resources for innovation projects has been on time and suitable?	43.06	56.94
	Do the innovation projects have required speed for reaching their goals on time?	35	65
Market and external beneficiaries	To what extent the decisions related to innovation are made based on market researches and awareness of competitors in your organization?	75.56	24.44
	How much of innovations are due to interacting with customers and noticing their needs?	76.94	23.06
	How much was the sales and marketing unit effective in organization innovations?	58.06	41.94
	To what extent the innovations have been due to awareness of products and processes of competitors?	82.5	17.5
	To what extent the innovations are due to communicating with suppliers?	46.86	53.331
Organizational capabilities	How much is the ability of your organization in creating technology or improving the current technology substantially?	56.57	43.89
	How much have you been successful in providing new products (innovative) with quality and standard in your organization?	81.67	18.33
	How much the experience of previous innovations are used in current and future innovations in the organization?	88.33	11.67
	How much the provided ideas were proper and practically useful in creating innovation?	67.22	32.78
	How much the innovation projects have been completed and provided to the market on time?	50.83	49.17
	What is your idea about the ability of organization in performing processing innovations in order to reduce the organization costs and improve efficiency?	81.67	18.33

Second question of the research: what is the level of the factors affecting innovation management in SOHA Pharmaceutical Company and what is the rate of the gap existing in each dimension of innovation capabilities in SOHA Pharmaceutical Company?

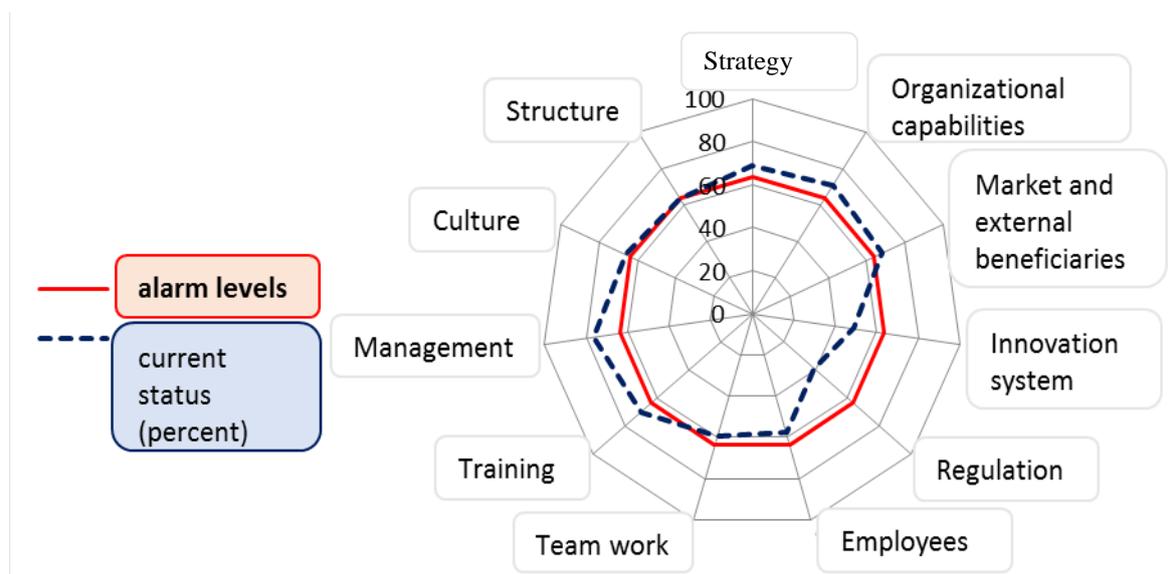


Figure 2: Comparison of the current status of each of the factors influencing innovation alarm levels (average total)

Table 5: current status of the factors affecting innovation management in SOHA Company

The factors affecting innovation management	Existing capability (%)	Gap(%)
Strategy	68.80	31.20
Structure	63.19	36.81
Culture	65.97	34.03
Management	76.22	23.78
Training	69.91	30.09
Team work	59.31	40.69
Employees	57.78	42.22
Regulations	39.03	60.97
Innovation system	48.89	51.11
Market and external beneficiaries	67.94	32.06
Organizational capabilities	70.97	29.03
Average(percent)	63.56	36.44

Table 5 and diagram 2 indicate the comparison of the current status of each factor affecting innovation management and also the current gap. We can classify the companies in 4 categories according to table 6 based on the results of evaluating the factors affecting innovation management.

Table 6: classification of companies according to the capability levels of technological innovation (Innosupport, 2007)

Firm Classification	Score	Total Evaluation Results
Passive (A)	0-25	The company is weak and not efficient in all important zones, gaining benefits, developing technology strategy and innovation.
Reactive (B)	26-50	The company has developed weakly in most areas of strategy, research, achieving and creating technology and innovation capabilities; the company need much capabilities for recreation of these areas.
Strategic (C)	51-75	The company is fairly capable in internal capabilities and it has a strategic view to the technology and innovation but in most areas it is below the national technology.
Creative and innovative (D)	76-100	The company has some completely developed technological capabilities and can identify the border of national technology.

Since the total level of technological innovation in SOHA Pharmaceutical Company is equal to 63.56%, so the company will be put in category of strategic companies or group C according to classification of mentioned table.

Third question of the research: What are the improvement strategies in each factor affecting innovation management in SOHA Pharmaceutical Company?

Table 7 indicates improvement solutions in each factor affecting innovation management according to the results of questionnaires.

Number	Dimensions	Gap (%)	Improvement solution
1	Strategy	31.20	Creating justifying sessions, implementing training workshops, creating executive teams in innovation field
2	Structure	36.81	Using encouragement tools, professionalizing, developing activities boundaries, exchanging information with environment, concentrating, specializing, appropriate control gamut
3	Culture	34.03	Pay attention to the spiritual motivation, increasing sense of security, conflict management, a better system for evaluating performance
4	Management	23.78	Management attitude to change, increasing the speed of decision making, internal and external relations and using expert individuals, optimizing decisions, creating profitability motivation
5	Training	30.09	Organizing more applicable and targeted courses, organizational training and learning, effective relation with resources of scientific and technical experts
6	Teamwork	40.69	Specialization (gathering different specialties together) and promoting the culture of teamwork, reducing risks
7	Employees	42.22	Creating the mechanisms of financial and spiritual encouragements, motivation system, knowledge
8	Regulations	60.97	Greater emphasis on facilitating regulations and changing the laws in order of increasing the motivation in employees, liberalization, leadership
9	Innovation system	51.11	Continuity of management, facilitation in idea comprehension, disseminating the idea and create interactive ideas, liberalization, leadership, increasing services, modeling from similar organization
10	Market and external beneficiaries	32.06	Environmental scanning and exchanging information with environment, power of more adaptation with market, marketing based on economic calculation, obtaining exact and updated information, understanding the customers' needs, effective relation with market
11	Organizational capabilities	29.03	Reviewing the organization processes, creating a certain process for register and develop the trains, increasing expert individuals in organization, communicate with similar foreign organization

CONCLUSION

Considering that this organization is a governmental and pharmaceutical company and also follows a series of certain standards and has some obligations due to sensitivity of pharmaceutical section in the country. It is also facing the issues like sanction, etc. the results obtained in table 5 “the status of each factor affecting innovation management and the rate of gap” include:

- According to table 5, among the factors affecting innovation management, the “management” dimension is the most capable with score of 76.22% which shows the high importance of the organization managerial levels towards the innovation position and financial-spiritual support in innovation field.
- The dimensions of “market and external beneficiaries” with 67.94% , “strategy” with 68.8% and “training” with 69.9% ,which have negligible difference with each other, show a harmonic growth in the organization and it has led to have a suitable performance in “organizational capability” dimension with 70.97% and has increased the organizational capabilities.
- Dimensions of “structure” with 63.19% and “culture” with 65.97% show the extension and development of innovation in the organization environment and the organization has required infrastructure.
- “Teamwork” with 59.31% and “employees” with 57.78% have fairly supportive policies for innovators.
- Besides dimensions mentioned previously which had fairly harmonic performance, but “regulation” dimension with 39.03% and “innovation system” with 48.89% were weak which show the existence of a series of

regulations that prevents on time accomplishment of innovation projects in the market and reduce the motivation. In this case, managerial levels should perform required practical solutions in this case so that to have significant growth in future.

- Also according to the results in table 4, among the indicators, the indicator of “Do the innovation projects have required speed for reaching their goals on time?” with 35% has the lowest score and indicator of “How much the experience of previous innovations are used in current and future innovations in the organization?” with 88.33 has the highest score among all indicators of the factors affecting innovation management.
- On the other hand, SOHA Pharmaceutical Company is placed in category of strategic companies or group C according to table 6. These companies are well aware of improving their technological and innovative capabilities; they have strategic view and high ability in performing innovative projects and have a strategic view to making capability. They can slowly be able to move towards the companies type D (a company which is very creative and innovative).

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