



## A Comparative Study of Innovative Models with Emphasis on Application in Educational Organizations

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ARTICLE INFO	ABSTRACT
<p>Received: 29 September 2020            Revised: 28 November 2020            Accepted: 07 December 2020            Online: 13 November 2021</p>	<p>Having creative and innovative employees is one of the characteristics of successful organizations in the contemporary world. Meanwhile, educational organizations have a wider capacity to simultaneously train and hire innovative staff. The aim of study was to compare innovative behavior models for use by planners and managers of educational organizations. The method of research was qualitative exploratory, research population includes all models of innovative behavior and data collection and analysis methods were documentary method and deductive content analysis respectively. The research findings indicate an upward trend in interest of study methods and factors affecting innovation among behavioral scientists and management researchers in both developed and developing countries. Awareness about complexity of recent models compared to previous models and the emphasis on the role of internal and external components of innovation is another research finding. Other findings of the study are that the component of "idea development" is present in ten models of innovation, while the two components of "initial assessment of the status of the organization" and "role of external factors on innovation" are mentioned in only three models. Therefore, the main similarity and difference among innovative behavior models can be seen in these three components. In addition, after the "idea development" component, the three components of idea production (in 8 models), product goods (in 8 models) and marketing (in 7 models) have caused the most similarity between innovation models. Based on these findings, it is suggested that in order to create and strengthen innovative behavior in educational organizations, a model be considered by policy makers and planners that has four main components namely production of new ideas, development of new ideas, production of goods based on new ideas and marketing for new products.</p>
<p><b>KEY WORDS</b></p> <p>Development            Educational Organization            Idea            Innovation            Models</p>	

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## **1. Introduction**

In today's competitive world, organizations and institutions to maintain their power and dynamism must have creative and innovative managers and employees to be able to meet the needs of customers and society. In this regard, many management sciences researchers have found that successful organizations generally have creative and innovative employees (Dorner, 2012; Ghosh 2015; Kim, Hon & Lee, 2010; Martin & Terblanche, 2003; Tasi, 2011; Wang et al., 2015). Therefore, the success of the organization depends on the investment and planning of managers to hire and train innovative and creative employees (Lin & Chen 2007). In this situation, organizations are divided into two groups: First, organizations whose managers and planners seek the key to innovation outside of it and emphasize the role of external factors and second, organizations that consider the necessary investment and arrangements for hiring and training employees (Ferrari, Cachia & Punie, 2008). Innovative behavior indicates the creation of new ideas that lead to the creation of a new product, service, goods or process (Kashefi, RajabiFarjad & Tootian Isfahani, 2019). Research findings indicate that to create an innovative organization and creative staff, various factors play a role. These factors can be divided into two groups i.e. factors within the organization (such as communication structure, knowledge, interaction, integration and leadership, organizational support, reward and motivation) and external factors (cultural, political, religious, economic) (Fagerberg, Mowery & Nelson, 2005; Mat Saat & Abdullah, 2017). The multiplicity of these factors has caused organizational science thinkers to prepare appropriate models to identify and explain the factors affecting innovation according to the goals and tasks of each organization. The purpose of this study was a comparative study of innovative models with emphasis on their application in educational organizations. To explain the necessity of research, first theoretical frameworks and then research background are presented and at the end, sub-objectives are stated.

## **2. Theoretical Framework & Problem Statement**

For first time Schumpeter introduced the concept of innovation in 1934 as a process of creating new brands, products, services and processes (Rastegar & Maghsoudi, 2016). At the macro level and according to the Organization for Economic Cooperation and Development (2005) innovation is the implementation of a new or significantly improved product (good or service) or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations. In a simpler definition, innovation is the means through which

organizations respond to various environmental changes (Hagedoorn & Zober, 2015). Therefore, organizational innovation indicates the desire of an organization to develop its new products and services or improve them to present to the market (Rastegar & Maghsoudi, 2016). At the micro level, innovative behaviors are behaviors that bring about change and job transformation. These behaviors indicate the creation of new and different things in the process of presenting a product, service, thought, procedure and process of affairs (Kashefi et al, 2019). Thus, employees' innovative behavior refers to their contribution to the development of organizational innovations (Duverger, 2012; Messmann & Mulder, 2011).

Historically, the concept of innovation has gone through five evolutionary waves (Sarhadi, 2016). The first wave, according to Schumpeter, represents the introduction of a new combination of production factors and different modes of an organizational system. The second wave, the wave of technological innovation (from 1950 to 1960) focused on the two issues of production and innovative process. The third wave, or industry innovation, was introduced by Freeman between 1970-1980. The characteristics of this wave of upward growth of innovations are influenced by the possibilities of the industrial age. The fourth wave or system of innovation began in the mid-1980s. According to Freeman, the innovation system is a network of organizations to realize technology. Accordingly, the OECD (2014) defines technological innovation as a set of scientific, technological, organizational, financial, and commercial activities. The fifth wave namely "wave of scientific innovation," has continued since the early 1990s.

In this historical process, the concept of innovation has moved from the material and hardware aspects to the mental and software aspects. This conceptual evolution leads to the presence of elements such as the processes of acquiring new scientific knowledge through research and development activities; process of creating knowledge for economic and social benefits; Innovation in the processes of distribution and application of knowledge and establishment of a national scientific innovation system. Accordingly, the role of dirty-necked workers has diminished every day and the role of white-collar workers has increased has increased in creating innovations. Of course, experts have mentioned different meaning for innovation, which can be summarized in three perspectives: At first glance, innovation is more of a "psychological" issue related to individual intelligence and talent. Therefore, the managers of the organization emphasize on the reward system and cultivate the talents and creativity of the employees. The second is the social perspective, which sees organizational innovation as more of a "sociological" issue and related to

providing a conducive environment for talent expression. This attitude recommends enriching the necessary facilities and grounds in the organization to create and continue innovations. In the third or systemic perspective, creating innovation is an organizational issue that goes beyond the influence of individual or environmental factors. In this view, a set of individual and group factors should be provided along with structures, functions, roles, values and beliefs in order to make innovation in the organization as a continuous and comprehensive matter (Soltani Tirani, 1999).

Innovations can come from a variety of sources. According to Drucker (1984), although there are innovations that arise from sparks of instant genius, most of them are the result of purposeful and conscious search. Therefore, the emergence of innovations changes from an individual issue to an organizational mission. In this way, innovation opportunities can be manifested within the organization. Internal factors affecting the occurrence of innovation in organizations include communication structure, knowledge, people interactions, leadership style, organizational culture and rewards and motivation. Extra-organizational factors affecting innovation indicate the organization's ability to communicate with the environment. Intense international competition and change of technology have increasingly revealed the need to pay attention to external factors (Ahmadpour, Salili & Shahraki, 2018). In the meantime, one of the most fundamental variables for creating innovative organizations is the existence of creative employees with innovative behavior. In fact, innovative behavior is considered an interesting opportunity for the development of people's careers (Hosseini & Sadeghi, 2010). In other words, innovative behavior is part of organizational behavior, based on a full understanding of tasks and responsibilities, and the result of motivations to take action (Gogoleva et al., 2016). Innovative behavior also reflects the behaviors through which human resources create or approve new ideas and strive to implement them (Lukes & Stephan, 2017).

Given these definitions, it is clear that in the first step the education system - especially higher education - has the task of training specialized and innovative manpower. In fact, nowadays more than ever, educational organizations need innovation and creativity in preparing the young generation to enter the competitive world (Martins, & Terblanche 2003). In this regard, the OECD (2016) emphasizes "the importance of innovation in educational organizations because Educational innovations can improve learning outcomes and the quality of education provision. For example, changes in the educational system or in teaching methods can help customize the educational process." (p. 13). Despite the important role of the educational system in nurturing innovative

human resources, what has been generally emphasized by universities so far is the attention to the preparation of specialized personnel? Indeed, the transformation of higher education institutions and universities into innovative and creative organizations highlights the need to pay more attention to innovative behaviors - and to identify its dimensions and principles. In other words, one of the challenges of today's higher education system is its weakness to develop students' ability to learn, creativity and innovation. According to research by Gundry et al. (2014) and Vorontsov & Vorontsova (2015) innovation has become a basic need for today's information society, a need that transformation in the higher education system plays an important role. Of course, as the OECD report emphasizes, determining and measuring what innovation is in educational organizations is a difficult task. According to the report of this organization " two broad approaches to measuring innovation in education are: 1) assessing the perceptions of recent tertiary graduates, including those working in education, about innovation in their workplace; and 2) analyzing organizational changes through teacher-student surveys ( OECD, 2016, p.17).

Meanwhile, universities in developing countries face more challenges in training innovative human resources. For example, in Iran many studies indicate the existence of inappropriate habits of students such as memorizing textbooks instead of creative and innovative thinking about them (Ahmadpour et al., 2018). This learning method, which is generally designed to maintain the existing system and the continuity of common lifestyles, eliminates the spirit of curiosity, creativity and innovative activities in students. Also, Iran's higher education system is mainly plagued by problems such as a culture of silence, emphasis on convergent thinking instead of divergent thought, reliance on archives, imitative thought, lack of resources and facilities for development of talent, lack of attention to problem solving and individual differences (Mahboubi & Toure, 2008).

While the world is facing many problems, universities should use innovative cognitive and intellectual processes to create solutions to train innovative human resources. Barzegar, Ghorchian & Pourzahir (2019) indicated that the current situation of Iran's universities in creating innovation capacities is lower than average. Turani, Aghaei & Mollainejad (2012) also revealed that the Iran education system lacks the necessary grounds for innovative behavior. Indeed, traditional methods of management and the lack of a suitable model to create innovative behavior in employees (both faculty and administrative staff) have caused a loss of sense of innovation (Zahed Babalan & Seyed Kalan, 2015). Therefore, in order to change the situation from the traditional system to the creative and innovative system, the educational system needs to accept many changes in its human and

structural dimensions (Heydarifard, Zeinabadi, Behrangi & Abdollahi, 2015). This system, while paying attention to crises such as financial bottlenecks, must improve and enhance quality and create an innovative environment (Kobriaei & Rudbari, 2005).

Given what has been said, it seems necessary to state a few points to explain the necessity of the present study: The first point is that to develop innovative behavior in educational organizations, it is necessary to recognize the characteristics and goals of these organizations and consider their obvious differences with commercial, industrial or service organizations. The research literature shows that the majority of researchers have paid attention to innovative behavior in non-educational organizations. The second point is to pay attention to identifying the dimensions, principles and components governing the existing innovative models and evaluating them for use in educational organizations. Again, the research indicates that most models are designed to fit the goals, position and organizational space of non-educational institutions. The third point is that govern the design of innovative behavior models. Most model designers seem to have considered only one of psychological, sociological, or organizational perspectives while no research has been done in this regard so far. The fourth point emphasizes the difficulty of measuring innovation in educational organizations. This difficulty makes the need to examine and analyze innovation models in other organizations and institutions inevitable. The fifth point is that in order to create innovative behavior in educational organizations, innovation models have not been studied from a comparative perspective. The sum of these points demonstrates the need for the present study - as the first step in preparing a new or integrated model - for educational organizations.

### **3. Research Background**

Research literature shows an upward trend of researchers' interest in knowing the methods of creating innovative organizations, factors affecting innovation and dimensions of innovation. For example, in a recent study Hailekiros Sibhato (2018) revealed that the creation of innovation has a positive and significant effect on intellectual capital and innovative performance in small and medium enterprises. Riyadh, Xu & Hussein (2018) research on understanding the innovative behaviors of employees and progress in work in Chinese organizations showed that innovative behaviors have a positive and significant effect on employee progress. They also showed that there is a positive and significant relationship between organizational support for innovation and

innovative behaviors. Don, Xu, Liu, Hu & Ma (2018) revealed that innovative behavior, self-efficacy and employee solidarity can improve job success. Roffeei, Kamarulzaman & Yusop (2017) emphasized that self-efficacy, atmosphere and culture based on innovation have a positive and significant effect on students' innovative behavior. In another study, Roffeei, Kimitaka & Munehiko (2017) found that a culture of innovation would lead to more creative graduates and the production of new goods. Van Lancker, Mondelaers, Wauters & Huylenbroeck (2016) believe that different actors, innovation networks, innovation process and supporting institutions are the factors influencing organizational innovation. Kimitaka & Munehiko (2016) found that innovation in the production of a goods or service of an organization and institution has a significant impact on its competitive advantage. They also showed that cost reduction, attention to international standards and mechanisms for commercialization of new ideas are important and effective indicators on innovation management. In a study conducted in Russia, Vorontsov & Vorontsova (2015) found that the application of innovation in education leads to the development of society, the improvement and expansion of innovative behavior, and acceleration of the provision of basic infrastructure - such as establishing educational institutes and scientific settlements. Stoffers, Neessen, & Dorp (2015) in their study of the behavior of employees in a production center found that organizational culture has a positive and significant relationship with the dimensions of innovative behavior i.e. idea generation, idea promotion and idea realization. To estimate the amount of innovative activities and identify the factors that hinder the development and expansion of innovation in educational organizations, Yesseyeva & Tuyakayeva (2012) found that one of the major barriers to innovation is the mismatch between existing technological facilities and equipment and the acceptance of new ideas. Finally, Lee (2011) examined the effect of innovation training on effective learning and learning satisfaction in one of Taiwan's technical-vocational colleges and found that innovation has a positive but small effect on effectiveness of students' learning and more effect on learning satisfaction.

In Iran and over the past two decades many researchers have paid attention to the role of innovation in increasing the effectiveness of organizations and employee efficiency. For example, Barzegar, Ghorchian & Taghi Pourzahir (2019) have collected the opinions of 212 heads of departments, heads of faculties, and faculty members on the pathology of creating innovation capacity in Iran's universities. Their findings showed that the current situation of universities in Iran to create innovation capacities is lower than average and less than expectations. Ahmadpour et al. (2018) found that four factors of organizational culture, training, motivation and personality

have a positive and significant impact on innovative behavior of students but organizational, managerial and technical structure factors have a negative impact on innovative behavior. Ghafourian Shagardi, Aybaghi Isfahani & Fattahi (2018) emphasize that there is a positive and significant relationship between flexibility and psychological capital with innovative job behaviors. In this regard, the findings of Ismailpour & Aram (2018) indicated the positive impact of intra-organizational factors such as learning, strategic flexibility, and information and communication technology on innovation. Findings of Khamseh & Sardashti (2018) and Zanjirchi et al. (2018) also show that benefiting from employee creativity, creative organizational atmosphere; attracting qualified employees and appropriate technology infrastructure have a great impact on creating innovative organizations. In addition, Khamseh & Sadeghi Marznaki (2018) showed that innovation management has a general dimension (including economic, organizational and regulatory factors) and a specific dimension (technological, marketing and systemic factors). Findings of Khodam Abbasi, Shahriaripour & Amin Beidakhti (2017) revealed that in Semnan University, learning culture has a positive and direct effect of 0.80 on organizational innovation and 0.50 on knowledge management.

Findings of Khosravi & Arman (2015); Movahedi, Samian & Mohammadi Mehr (2017); Rahmazadeh (2016); Sabet Meharlooei et al. (2015); Sakhdari, Jalali, & Sidamiri (2015) and Solhdoost & Jafarzadeh Kermani (2016) indicated the role of intellectual capital, structural capital, reward system, motivational factors and social policies in the emergence of innovative organizations. In addition, Movafaq et al. (2014) found that five factors of investigate of opportunity, production of idea, idea promotion, and idea realization and thought are the dimensions of innovative work behavior. Sabet Maharloui et al. (2014) also found that among the exogenous variables, self-efficacy and among the intermediate variables, resource availability and support for innovation, had the greatest impact on innovative behavior. Mosleh et al. (2014) also point out cultural factors (human-centered, specialty orientation, culture of teamwork and collaboration), managerial factors (management commitment, management support, management risk-taking) and human resource management factors (performance evaluation, rewards system, training, career path) have a significant impact on innovation.

Parhizkar et al. (2013) collected the opinions of 300 faculty members of Tehran universities and found that the core competencies of human resources, strategic thinking, spiritual orientation, organizational climate, and market access rate are effective on the development of innovation.



Saeeda Ardakani et al. (2013), and Dehghan et al. (2012) revealed that three categories of structural factors (strategy, research and development, processes and methods, performance appraisal, information technology, organizational structure, financial resources), behavioral ( Characteristics of managers, employee motivation, organizational culture, employee training, leadership style, employee characteristics) and context (relationship with client, political and governmental environment, social and cultural environment) are effective on organizational innovation and entrepreneurship. Findings of Sabet Meharlooei, Efthagari & Shirazipour (2014) emphasize the role of management style, organizational culture, knowledge management, information technology, and planning on innovation in universities. Aghadavad, Hatami & Hakiminia (2010) and Hosseini & Sadeghi (2010) believe that the role of organizational culture and individual factors (such as motivation, expertise, intellectual abilities and temperament) on innovation in organizations cannot be ignored.

The summary of these research findings indicates several important issues: First, the growing interest of managers, policy makers and researchers in organizational behavior sciences in the role of employee innovation and creative and innovative organizations in the contemporary world; Second, research show that innovation is interrelated with many factors within and outside the organization that both affect and influence these factors; Third, increase in components of innovation and reflection of these factors in organizational innovation models. Also, a review of the research literature revealed that many researches and models in industrial and governmental organizations and companies have been done and less attention has been paid to educational organizations. In view of the above, it seems that two main goals should be considered by researchers in the fields of educational management and organizational behavior: First, the systematic review and analysis of existing models of innovation and second, expanding research related to educational organizations and preparing an appropriate model of innovation according to the culture and missions of educational organizations. According to the first goal, the present researchers tried to identify the appropriate dimensions and components for educational organizations and identify the strengths and weaknesses of each model by comparatively examining the existing models of innovation. Accordingly, the sub-objectives of the research are:

- Identify and describe the features and dimensions of existing innovation models
- Identify similarities and differences between existing models
- Explain and provide guidelines and suggestions for preparing a suitable innovation model for educational organizations

#### **4. Research Method**

The method of the present study is exploratory qualitative according to the approach of Theisen, and Adams in the classification of comparative research. They believe that the goal of exploratory comparative studies is to discover relationships and functions for capacity building in-depth research and its main question is to determine appropriate models, paradigms and methods for future research (Theisen & Adams, 1990). Therefore, exploratory study is a preliminary study mainly formed through library studies, observation, or interviews. After reviewing the research literature and analyzing the components of the models, the present researchers reached a theoretical saturation in the fourteenth model. Also documentary method and deductive content analysis method were used for data collection and data analysis respectively. In deductive analysis, the test of previous theories in new conditions was considered by researchers (Elo, Satu & Kyngas, Helvi, 2007). To collect documents, data from various international and Iranian scientific databases such as ERIC database, Google Scholar, Database ProQuest, and Academia were used. The data consensus method - the use of multiple sources - was used to determine the validity of the findings. After analyzing the data, the components of innovation models were extracted and then the results were presented in two parts of description and comparison of models.

#### **5. Findings**

For more than half a century, various models for innovation have been designed by various researchers. Accordingly, Rutwell (1994) outlines five generations of innovation models namely technology-push, demand-pull, coupling, integrated and simultaneous model. Despite this diversity, the present researchers, considering the generality and popularity of each model, try to identify their main components and compare them with each other. The present section includes four stages of description, interpretation, juxtaposition and comparison to present the results. In the description section, information about the designers, the year of presentation, the organization for which the model was designed, and the components of each model are provided. In the interpretation section, the characteristics of the studied models are examined in terms of components. In the juxtaposition section - by presenting tables - the components of each model are placed next to other models. In the last section, the models are compared with each other in terms of type and number of components.

## **A) Description of Models**

The present researchers have considered priority of time to describe each model. Also, the name of each model is selected based on the names of its designers or presenters:

### *1. Cooper Model (1990)*

One of the well-known models of the innovation process is the Cooper Model (Cooper 1990). This model divides the innovation process into steps that must pass through designated gates as decision points. In fact, every step or process must pass through checkpoints that have been set up for quality control. Quality criteria determine whether an idea can go from one stage to the next. Each step also includes a list of actions. For example, the "Validation" stage might entail a list of mandatory or optional activities such as inhouse prototype tests, field tests with customers, pilot or trial production, and test marketing. Usually stage-gate systems involve from four to seven stages and gates, depending on the company or division. Each stage is usually more expensive than the preceding one. Concurrently, information becomes better and better, so risk is managed (Cooper 1990, p. 46). Cooper's innovation model has 5 dimensions or stages of initial assessment, detailed investigation, development, testing and evaluation, and full production and market launch.

### *2. Rottwel Model (1994)*

This model represents the process of producing a new product in Nissan, which was introduced by Rottwel (1994). Rottwel's goal is to show fourth-generation innovation models that essentially emphasize two internal aspects of the process (parallel and integrated nature). In fact, today the world is witnessing the great growth of new knowledge and technologies and the constant change of production systems. Creating new goods and processes involves the use of different sciences and sources of information such as corporate internal resources such as internal research (such as development, marketing and production units) and external resources (same as customers and suppliers). Knowledge is also obtained through the development of science and technology and attention to the initiatives of competitors. However, this model has 5 components: Marketing, research & development, Product development, production engineering, suppliers, and manufacture.

### *3. OECD Model (1997)*

Researchers from the Organization for Economic Co-operation and Development (OECD) have tried to design models for the growth and development of innovation in member countries over the years. The result of these efforts was the design of a general concept namely "innovation policy terrain". Based on this model, ability to determine the scale of innovation activities, the characteristics of innovating firms, and the internal and systemic factors that can influence innovation is a prerequisite for the pursuit and analysis of policies aimed at fostering technological innovation (Galanakis, 2006). According to Galanakis (2006) four general domains of the innovation policy terrain are:

- The broader framework conditions of national institutional and structural factors (e.g. legal, economic, financial, and educational) setting the rules and range of opportunities for innovation;
- The science and engineering base – the accumulated knowledge and the science and technology institutions that underpin business innovation by providing technological training and scientific knowledge, for example;
- Transfer factors are those which strongly influence the effectiveness of the linkages, flows of information and skills, and absorption of learning which are essential to business innovation – these are factors or human agents whose nature is significantly determined by the social and cultural characteristics of the population; and
- The innovation dynamo is the domain most central to business innovation – it covers dynamic factors within or immediately external to the firm and very directly impinging on its innovativeness (P. 19).

### *4. Goffin & Pfeiffer Model (1999)*

This model was first introduced by Goffin & Pfeiffer (1999) in a book called "Innovation Management in British and German Manufacturing Companies". According to this model, in order to

achieve success in innovation management, institutions must have high performance in five areas. These five areas are: Innovation Strategy, Creativity and Ideas Management, Selection and Portfolio Management, Execution Management and Human Resource Management (Basnet and Ted, 2015).

#### *5. Koen et al. Model (2002)*

Innovation models include the model proposed by Kevin et al. (2002) entitled "New Concept Development" (NCD). The NCD model consists of three key parts: the core area which includes the management, culture, and business strategy of the organization. The inner cycle area, which includes the five key elements of the organization's activities namely identifying opportunities, analyzing opportunities, generating ideas and enriching ideas, selecting ideas, and defining concepts. The third area includes three general components of organizational resources and capacities, the external environment of the organization (distribution channels, law, politics, government, customers, competitors and economic and political conditions) and empowering sciences (internal and external).

#### *6. Sandmeier, Jamali & Kobe model (2003)*

Sandmeier et al. (2003) have proposed a model for the innovation process by combining two approaches of market pull and technology pressure, which consists of three steps:

- **Market and technology opportunities:** In this phase, innovation strategies and goals are the center of all activities. This phase is divided into four sub-components: future needs analysis, innovation commitment, identifying company potential and identifying and analyzing research areas. The output of this phase is the discovery of future opportunities that enter the development and evaluation stage of the idea after screening and selecting outstanding ideas.
- **Idea development and evaluation:** This phase consists of three sub-processes. First, the idea is analyzed from a technical and commercial point of view, so that opportunities to develop outstanding ideas are extracted from the output of phase one, and the technical and commercial dimensions are examined and a complete description of the ideas is prepared. At this stage, the details of the ideas generated are collected and finally checked for feasibility. The team must write a description of the ideas in sequence and present it to the idea

screening team. The result of this phase is the ranking of ideas that make it easy to select them for the next phase.

- **Concept design and business and product plan:** In this phase, the focus is on turning business ideas into a business plan. This phase consists of three sub-processes: The first process is definition of the main functions and basis of the future product. The next process is to extract the needs of the product from a technical, market, commercial point of view. The third process involves approving the technical concept and business plan. The result of this phase is the conceptual design of the product and its determination in the business plan.

#### *7. Bernsteina & Prakash Model (2006)*

In the integrated model of Bernsteina & Prakash (2006) four steps are presented for the innovation process: First, product of ideas (including gathering internal and external resources). Second, supporting innovation (introducing innovations to management which are in line with the goals of organization). Many ideas are lost at this stage due to insufficient support of the organization. Third, the development of innovation, in which the formal structure of the project is determined and the organization supports the idea by providing adequate capital and other resources. The fourth stage is implementation of innovation. In this step, a test sample of the final product is prepared for presentation to the market. During these stages, two external factors of market pull and technology drive and four internal factors of management, communication, structure and control also affect the success of the innovation process.

#### *8. Galanakis Model (2007)*

Kalanakis introduced a new model for the innovation process entitled "creative factory concept" by publishing his valuable article in the Journal of Technovision (Galanakis, 2006). This model has at its Centre the firm (enterprise) which is generator and promoter of innovations in the market, the industrial sector and the nation. The model's overall innovation process is constructed of three main innovation processes: 1. the knowledge creation process from public or industrial research; 2. the new product development process, which transforms knowledge into a new product, and 3. the product success in the market, which depends on the product's functional competencies and the organizational competencies of the firm to produce it at a reasonable price and quality and place it adequately in the market. This process is affected by internal factors of the

firm (e.g. corporate strategy, organizational structure, etc.), as well as by external factors in the National Innovation Environment (e.g. regulations, national infrastructure, etc.).

#### *9. Caraça, Ferreira, & Mendonça Model (2007)*

This model was developed by Caraça, Ferreira and Mendonça at the University of Lisbon and published in 2007 as “chain-interactive innovation Model” . These researchers suggested existence of three interfaces that are essential for the effective implementation of innovative open systems. In this model, interfaces represent the ability to communicate and communications are the key to setting up new learning cycles. Interfaces include technical awareness (systematic observation of external developments), cooperation of technology (partnership with other institutions and organizations with the aim of sharing technical and scientific information and joint development of products), processes (scanning, monitoring & forecasting) , technology (systematic measurement of technology opportunities) and future research efforts (relationship between technologies Emerging and new products). According to this model, the innovation cycle includes the following components:

- New users: observation and analyze potential customers and new markets
- Poor Signal Analysis: Special understanding of indicators of future change
- Intellectual property: Using the facilities of the intellectual property to protect, absorb and disseminate ideas
- Inner creativity: Procedures that raise strategic awareness of the company's opportunities and threats
- Innovative friendly governance: The organizational structure that benefits innovation
- Organizational Capabilities: A strategic view of organizational structures that are interested in innovation
- Knowledge management: production, validation, coding and dissemination of internal knowledge and management of knowledge needs

#### *10. Rohrbeck, Hölzle, & Gemünden Model (2009)*

This model, known as the German telecom model, was developed by three researchers in 2009. Based on this model, three market perspectives (customer feedback and customer voice), interoperability (communication within the organization between idea designers and idea developers) and technology (recognition and evaluation of new technologies) should be considered by organization managers. The ideation steps according to this model are determined in four steps:

- Creating ideas: Includes any resources and activities that help develop a new idea
- Research: A tool to facilitate collaborative research or provide technical resources for technologies
- Development: activities aimed at interacting with partners to create new products or services,
- Commercialization: Activities that foreign partners are involved in to bring technologies or products / services to market

#### *11. Berkhout, Hartmann & Trott Model (2010)*

First introduced by three Dutch researchers, this model is known in the research literature as "Berkhout's Cyclic Innovation Model (CIM)". Based on this model, innovation process as more than just technical invention and describes the innovation arena by a 'circle of change' linking changes in science , industry, technology and markets. In addition, the model portrays a system of dynamic processes –with four 'nodes of change': scientific exploration, technological research, product creations and market transitions and between these nodes there are 'cycles of change'. The changes in these elements are cyclically interconnected.

#### *12. Turani, Aghaei & Mollainejad Model (2012)*

By examining the obstacles to supporting innovations in the Iran's educational system, these three researchers tried to design a suitable model for the establishment of the innovation system (Turani, Aghaei & Mollainejad, 2012). According to the proposed model, the two basic areas of innovation are creating innovation and acquiring innovation. Creating innovation includes components such as generating or creating an idea (idea generation) , selecting a superior idea ( sifting an idea), generating an idea sample, and acquiring innovation including target community planning (market), survey of target community (market traction), survey consumers of the product and mass production (commercialization). To facilitate the innovation process, it is necessary to pay attention to various structural, legal and attitudinal dimensions, increasing the capabilities, motivation and interest of innovative people.

#### *13. Stoffers, Neessen, & Dorp Model (2015)*

In a study in New Zealand, these researchers examined the relationship between innovative behavior and organizational culture (Stoffers, Neessen, & Dor, 2015). To evaluate innovative behavior, Stoffers et al. discuss the three dimensions of idea generation, idea promotion, and idea



realization. The results of their research also indicate a positive and significant relationship between innovative behavior and organizational culture.

#### 14. Barzegar, Ghorchian & Pourzahir Model (2019)

The aim of these three Iranian researchers was to identify the challenges of creating innovation capacities in Iran's university management (Barzegar, Ghorchian & Pourzahir 2019). In this study, first two hard and soft dimensions of innovation were extracted. Then the components of organizational organization and structure, organizational culture, resources and equipment, organizational processes, training and scientific advancement, leadership and strategic knowledge management, human capital management, and research & technology were determined. Also, the current and favorable situation of the university was determined. The findings showed that the creation of innovation capacity in academic management can be measured with 2 dimensions, 8 components and 106 indicators (in both soft and hard aspects). The research findings also indicated that the current situation of Iran universities in innovation is lower than average.

### B) Comparison of Models

The study and analysis of innovation models reveals similarities and differences among them. To compare innovation models, we first examine the structures or components that make them up. Table 1 shows the names of the designers and type and number of components in each model:

Table 1: Separation of models by year of design, number and type of components

No.	Name	Year	No of components	Components
1	Cooper	1990	5	initial assessment, detailed investigation, development, testing and evaluation, and full production and market lunch
2	Rottwel	1994	5	Marketing , research & development , Product development , production engineering , suppliers , and manufacture
3	OECD	1997	4	national institutional and structural factors, science and engineering base, human agents, external factors
4	Goffin & Pfeiffer	1999	5	Innovation Strategy, Creativity and Ideas Management, Selection and Portfolio Management, Executive Management and Human Resource Management
5	Koen et al.	2002	3	Identifying opportunities, analyzing opportunities, generating ideas and

				enriching ideas, choosing an idea and defining it conceptually
6	Sandmeier, Jamali & Kobe	2003	3	Market and technology opportunities, idea development and evaluation, concept design, and business and product planning
7	Bernsteina & Prakash	2006	4	Idea production, innovation support, innovation development, innovation implementation
8	Galanakis	2007	3	knowledge creation process new product development process product success in the market
9	Caraça, Ferreira, & Mendonça	2007	7	New users, Poor signal analysis, Intellectual property, Internal creativity, Friendly governance of innovation, Organizational capabilities, Knowledge management
10	Rohrbeck, Hölzle & Gemünden	2009	4	Idea creation, research, development, commercialization
11	Berkhout, Hartmann & Trott	2010	4	scientific exploration, technological research, product creations and market transitions
12	Turani, Aghaei & Mollainejad	2012	2	Creating innovation and acquiring innovation
13	Stoffers, Neessen, & Dorp	2015	3	Generate ideas, promote ideas and realize ideas
14	Barzegar, Ghorchian & Pourzahir	2019	8	Organizational organization and structure, organizational culture, resources and equipment, organizational processes, scientific training and promotion, strategic leadership and knowledge management, human capital management, and research and technology

According to Table 1, the following can be inferred: First, the growing interest of behavioral science and management researchers (in both groups of developed and developing countries) in studying the methods and factors affecting innovation and its components; Second, increasing the complexity of new models compared to previous models and emphasizing the role of internal and external organizational components affecting innovation; Third, increasing the number of components affecting innovation from 2 components (Turani , Aghaei Aghaei & Mollainejad, 2012) to 8 components (Barzegar, Ghorchian and Pourzahir models, 2019 ) ; Fourth, separation and demarcation of components from each other in some models (Caraça, Ferreira, & Mendonça, 2007; Barzegar, Ghorchian & Pourzahir, 2019) and the emphasis of some researchers on the integration of components into two or three main components (determination of other components as micro components) (Sandmeier, Jamali & Kobe, 2003; Turani, Aghaei & Mollainejad, 2012; Stoffers,

Neessen, & Dorp 2015) ; Fifth, all designers emphasize a key component namely “idea generation”. According to these points, it is now possible to identify similar and different aspects of the models (Table 2).

Table 2: Similarities and differences of models in terms of innovation components

Models/ Component s	Co op er	R ot tw el	OE CD	Go ffi n et al	Ko en et al.	Sand meie r et al	Bern stein a et al	Gala naki s	Car aça,	Rohr beck,	Berk hout,	Tu ran i	Stof fers	Barz egar
Initial evaluation	*				*				*					
Research	*	*						*		*	*			
Generate ideas				*	*	*	*	*		*		*	*	
Developme nt	*	*		*	*	*	*	*		*	*		*	
re- evaluation	*	*			*	*								
producing product	*	*		*		*	*	*			*		*	
Marketing	*	*	*			*		*		*	*			
Human resources managemen t			*	*					*					*
Organizatio nal Culture			*				*		*			*		*
External factors			*					*						*

The results of Table 2 show that the component of “development of idea” is mentioned in ten models of innovation and more than other components have been considered by designers. Also, the two components of “initial assessment of organizational status” and “the role of external factors on innovation” were mentioned in only 3 models and therefore the biggest difference between the models can be seen in these two components. Also, after the “development of idea” component, the three components of idea production (in 8 models), creation of production (in 8 models) and marketing (in 7 models) have caused the most similarity between innovation models. According to

these results, to increase innovative behavior in educational organizations, a model can be considered that has at least important components such as producing new ideas, developing new ideas, producing goods based on new ideas and marketing for new products.

## **6. Conclusion**

The idea of innovation is not a new concept in the field of organizational behavior and management sciences. Research literature shows that in developed countries at least six decades ago researchers tried to define the concept of innovation, factors affecting the growth or cessation of innovation, impact of innovation on various organizational variables, main components of innovative behavior and interrelationship of effective internal and external factors based on innovation. However, many developing countries - such as Iran - have so far only been able to take the first steps in training innovative manpower and creating innovative organizations. A review of the research literature shows the fundamental weakness of Iranian educational organizations, especially at the level of higher education to create a suitable environment for innovative behaviors (Dehghan, Talib & Arabiun, 2012; Sabet Maharloui, et al, 2015; Zahed Babalan & Seyed Kalan, 2015). The research findings also reveals that there are two main gaps facing the officials and planners of Iran's educational organizations: First, the lack of innovation models that are compatible with the conditions, goals, space and organizational culture of educational institutions and Second, lack of a comprehensive and comparative knowledge about dimensions of innovative behavior in existing models. The present study is a small step towards solving these two challenges. Findings also indicated that a wide range of innovation components have been considered by designers. Nevertheless, the commonalities of innovation models outweigh the differences. This finding is consistent with research findings of Adams, Bessant & Phelps ( 2006) ; Bulbul, (2012) ; Denyer & Neely, (2004); and Hipp, & Grupp, (2005). According to the findings of the present study and considering the situation of Iran educational organizations - especially at the level of higher education - the following items are suggested to educational policy makers:

- Investigate barriers to creating innovative ideas in educational organizations,
- Anticipate the necessary arrangements for hiring creative and innovative manpower,
- Organizational support of creative and innovative human resources,
- Designing an innovative behavior model according to the position, goals and organizational culture and following it as a roadmap

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