An Innovation Management Model for Petrochemical Companies Producing Polyethylene Products in Iran

Yadollah Sadeghi[a] and Abbas Khamseh*[b]

[a] M.A., Technology Management Department, Faculty of Management, Tehran Science and Research Branch, Islamic Azad University, Tehran, Iran, Email: Yadollah.sadeghi@srbiau.ac.ir
[b] Assistant Professor, Industrial Management Department, Management and Accounting College, Karaj Branch, Islamic Azad University, Karaj, Iran, Email: Abbas.khamseh@kiau.ac.ir

ARTICLE INFO

Keywords:
Innovation
Innovation management
Innovation
Management model
Petrochemical industries
Polyethylene products

Received: 17 Nov. 2017
Received in revised: 10 Jan. 2018
Accepted: 24 Jan 2018

ABSTRACT

Since a major part of Iran petrochemical base products has been considered for export, it is essential and inevitable to consider international markets so as to examine the economic conditions of petrochemical development projects. The aim of the current work is to offer appropriate solutions to the facing challenges and to the development of innovation management model in the petrochemical companies producing polyethylene products and approaching new polyethylene goods. Data collection was conducted using the library and field studies; after taking these steps, 58 main indicators were considered by experts' through screening among 130 extracted indices. Based on these indicators, a final questionnaire was designed by Likert scale and distributed. Finally, after receiving the comments of 105 managers and experts in 5 different petrochemical companies producing polyethylene on these indicators, the data were collected, and the research model was fitted using a structural equation and Smart PLS software. After fitting, 29 indices, 2 factors, and 6 dimensions were accepted for designing the model. The general dimension was composed of economic, organizational, regulatory, and supervision factors, while the specific dimension was formed of technological, technical, marketing, and systemic factors. According to the research conducted for successful innovation management, considering all the above-mentioned points is necessary in petrochemical companies producing polyethylene products.

1. Introduction

With the rapid advancement of technology, product lifecycle is constantly shrinking. A company, in order to compete with others in a highly competitive global market, should seek to use product innovation to differentiate itself from its competitors (Kimitaka and Munehiko, 2016). Innovation is, in fact, the most important competitive advantage of companies in competing with powerful domestic and global competitors to gain more added value and increase relative market share, sustainability, and sustained economic growth (Gupta, 2010).

Today, companies and organizations are made to innovate in the process with an approach to producing the new products in order to maintain a competitive advantage (Salajegheh, 2008). A fall in world oil prices and the subsequent drop in prices of petrochemical products in global markets have had the large aftershocks so far, in which the metamorphosis of petrochemical industry to companies producing more advanced products and the use of new technologies are some of its effects (Li et al., 2015). One of the most widely used products in petrochemical industry is polyethylene. Since the major part of basic petrochemical products in Iran is taken into account for export, considering international markets for investigating the economic conditions of petrochemical development projects is essential and inevitable (Nasermelli et al., 2015). As a result, the need for new technologies is an essential factor in achieving innovation and its objectives.

* Corresponding Author

Therefore, Iran's petrochemical industry must enter the field of highly value-added petrochemicals and chemicals to leave the challenges; also, it must act as an entrepreneur and must lead to creation of sustainable jobs by the systematic development of downstream petrochemical industries in the form of industrial, petrochemical and chemical parks and by creation of knowledge-based small and medium enterprises approaching innovation and manufacture of new products (Nasermelli et al., 2015). On the other hand, it should cause a reduction in the costs of production and should eventually achieve the maximum added value from petrochemical raw materials. According to the above-mentioned problems in Iran's petrochemical industry, the current work seeks appropriate solutions to deal with the encountered challenges and to develop an innovation management model for the petrochemical companies producing polyethylene products; the goal is to adopt an approach to the new polyethylene goods (Nasermelli et al, 2015).

The subject area of this research is linked to the management of innovation in the petrochemical industry. The realm of this research is the petrochemical companies that produce polyethylene products, including five petrochemical companies producing polyethylene chain products. This research uses the data gathered in the period of March 2016 to October 2016, but the data collected from experienced experts in previous years also reflect the value of data from previous years.

Given the lack of attention to the value chain of these polyethylene products, these companies need to focus on generating value-added products for end users in order to generate wealth and value for their stakeholders rather than selling polyethylene; this wat they can develop and innovate highly value-added products.

In selecting the experts of the statistical community, research was carried out to identify the experts in the research and development departments of petrochemical companies and downstream industries; we have focused particularly on those who are expert in the production of polyethylene and related products, including polyethylene pipes and fittings, and those who are aware of the future market of these products.

Therefore, this study was carried out based on the main question of "what is the innovation management model for petrochemical companies producing polyethylene products with an approach toward new polyethylene grades?"

2. Literature review

Since a major part of Iran's petrochemical base products has been taken into account for export, it is essential and inevitable to consider international markets to examine the economic conditions of petrochemical development projects. The aim of this research in Iran's petrochemical industry is developing appropriate solutions to the facing challenges and for the development of innovation management model in petrochemical companies producing polyethylene products with an approach to the new polyethylene goods. The general dimension is composed of economic, organizational, regulatory, and supervision factors, while the specific dimension is formed of technological, technical, marketing, and systemic factors. According to the research conducted for successful innovation management, considering all the above mentioned points is necessary in petrochemical companies which are producers of polyethylene products (Khamseh and Sadeghi, 2018).

Innovation is a process in which a person allows their imagination at first to ascend to the heavens and then brings it back to Earth; next, he/she engineers the idea to become an idea (Liao and Shih, 2008). Then, ideas are converted to scientific, useful, and convenient thoughts through management. Innovation is described by Schumpeter (1943) as an irreversible and historical change in the way of doing things and a creative destruction. Here, innovations are defined as new creativities in terms of economic importance. In fact, innovation is a process through which existing problems are identified and defined by organization. Then, new knowledge is utilized to actively solve it (Fathian, 2005).

Some innovation studies have focused on types of innovation such as product/process, administrative/technical, and fundamental/gradual. Other types of innovation are administrative innovation and technical innovation (Li et al., 2015). Technical innovation is related to new products, processes, or services, while institutional innovation refers to changes in the organization social structure such as attraction policies, resource allocation, task structure, authority, and rewards (Foose, 2010).

If an organization seeks survival in a dynamic and changing environment, it is necessary to invest in different types of innovation as they affect organization in different ways and lead to diverse results (Chiesa and Davide, 2011). Some studies related to innovations have focused on its different types such as product/process, administrative/ technical, and fundamental/gradual innovations. Some other types of innovation include administrative and technical innovations (Gruber and Ogut, 2014). Technical innovation is defined in relation with new products, processes or services, while administrative innovation is referred to changes in the social structure of the organization such as attracting policies, allocation of resources, structure of duties, powers, and rewards (Rowley, 2011). There are also two categories of innovation in the field of economy and business including gradual innovation and radical innovation (Rasa, 2016). Gradual innovation is the result of a process of continuous improvement. This means that innovation can develop and refine the existing knowledge and processes. On the other hand, fundamental innovation (radical) is an entirely new and discrete phenomenon which is often obtained from the research and development activities in industrial laboratories, academia, or studies. (Chiesa, 2001, North and Smallbone 2000). The present society is associated with movement and dynamism. The axis of the dynamics is removing traditions and past rules. Today, most of the techniques, concepts, approaches, and practices, which have been useful for the effective management of organizations and helped them to grow and succeed over the years, are not practical at present (Popiolek, 2016). In fact, it should be noted that today world is the realm of innovation (Fadaee, Mosayyebi, 2011). Innovation management is the process of combining different knowledge sets together and creation of a successful innovation in situations with high uncertainty and resource mobilization (Tidd, J. Bessant, 2002). Key changes such as the acceleration and global distribution of knowledge production, globalization, and virtual markets; the emergence of active users; the development of technological and social infrastructure which work in the turbulent context of innovation cause the creation of a variety of models, innovation concepts, and processes in the management (Rahimi and Abdolvand, 2016). This has had a significant impact on transforming innovation to a key component of economic policy. Innovation management has increasingly become as one of the main causes of long-term success in companies in competitive markets because companies with a high innovation capacity will be able to respond to environmental challenges more quickly and better. (Liao S. et al., 2008). In a study conducted by Ismail Pur et al. (2016), it was pointed out that access to financial resources has a significant role in managing innovation. Innovation strategy and studying the variables including appropriate strategies and state control in innovation management were also investigated by Jonathan (2011).

In this regard, leadership style as an influential factor in innovation management has been expressed by Nasermeli et al. (2015). The role of knowledge management and knowledge processes in innovation management was studied by researchers such as Jing Wen et al. (2008) and Bang et al. (2016). Moreover, they confirmed the effect of these characteristics on innovation.

It is indicated in the research conducted by Joe Tidd (2009) that clear goals and strategies, teamwork reflection, strategic cooperation, collaboration and interaction with centers of knowledge, research and development budget, the organizational structure of strengthening innovation, technological capability of suppliers, and the competitive environment of products are considered as factors affecting innovation management. The flexibility of structure and operational processes, the presence of clear procedures and mechanisms, an increased use of product by current customers, and the screening systems of ideas are taken into account as important factors in a research conducted by scholars such as Tidd, J. and Hull (2003) in the management of innovation. Samadi (2012) stated that organizational culture is considered as the effective characteristics of innovation management. Cost efficiency, international standards, and commercialization mechanism of novel ideas were cited as important and effective markers in the management of innovation by Kimitaka, N. Munehiko (2016). The index of innovation costs was investigated in innovation management studied by researchers such as Zhiqiang et al. (2016), and it was concluded that innovation costs were effective on management innovation. In this regard, the strategic cooperation is known as one of the important factors in the management of innovation by Popiolek and Thys (2016) as well as Hejazi and Divsalar (2012). In the same direction, the impact of organizational maturity and wages were pointed out on the innovation management by Hedayati and Khamse (2016). Intellectual property laws and antitrust rules were considered as important and effective characteristics on innovation management by Kexin et al. (2016) as well as Rahimi and Abdolvand (2016). In a subject discussed by Foose et al. (2010), government incentives and motivational systems were taken into account as effective features on the management of innovation. Environmental concerns were noted as an influential factor on innovation management by Mostajabi (2012).

The concepts of scientific changes and the adaptation of technology were examined by Rasa (2016); they studied the impacts of technology compatibility and the development of technology on management innovation and confirmed the effectiveness of compatibility as well as technology development. Market research, identification of customers, and a higher profit margin are taken into account as factors affecting innovation management by Gruber and Ogut (2014) as well as Ismailpur et al. (2016). In this regard, the variable of training and the development of human resources are considered important in the management of innovation by Soltani and Hussain (2010). On the other hand, the market needs were considered as an effective variable on innovation by Ebrow et al. (2014) and Chen et al. (2016). The development of new markets is also taken into account as an important issue by Jahangard (2003) in this respect. Sales support and network marketing on product innovation were considered significant by Motevasseli and Meygoon (2013). Another variable emphasized by Zhiqiang et al. (2016) is the position of participating in the value chain and considering the upstream and downstream chain of products. Variables of controlling records and measures as well as access to information and scientific systems were addressed by Khamse and Sheikhi (2016) as important issues in assessing the need for management innovation.

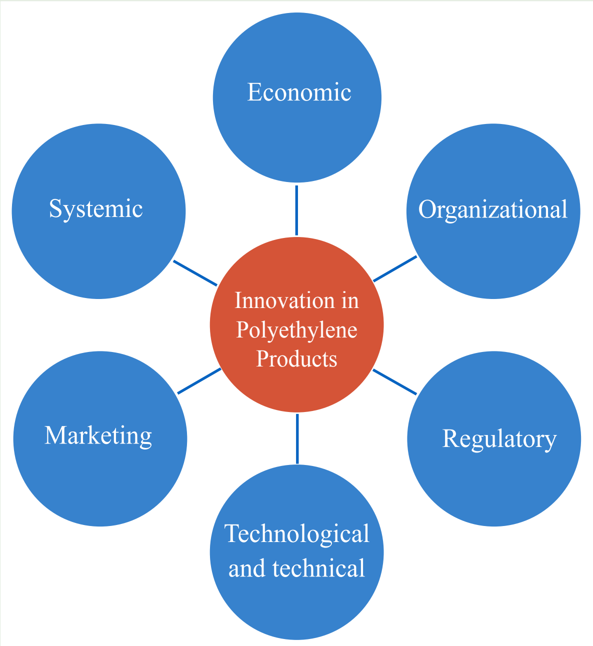

Figure 1: Conceptual model of research

The conceptual model of the research extracted from 48 studies is shown in Figure 1, in which innovation in polyethylene products is a type of dependent variable, and the other factors are independent variables.

3. Research method

In this research an approach combining quantitative and qualitative approaches is developed to achieve research data. In the qualitative section, data theory has been the basis for collecting data (130 indicators). In the quantitative section, the descriptive-survey method has been employed, but the implementation axis is the modeling of structural

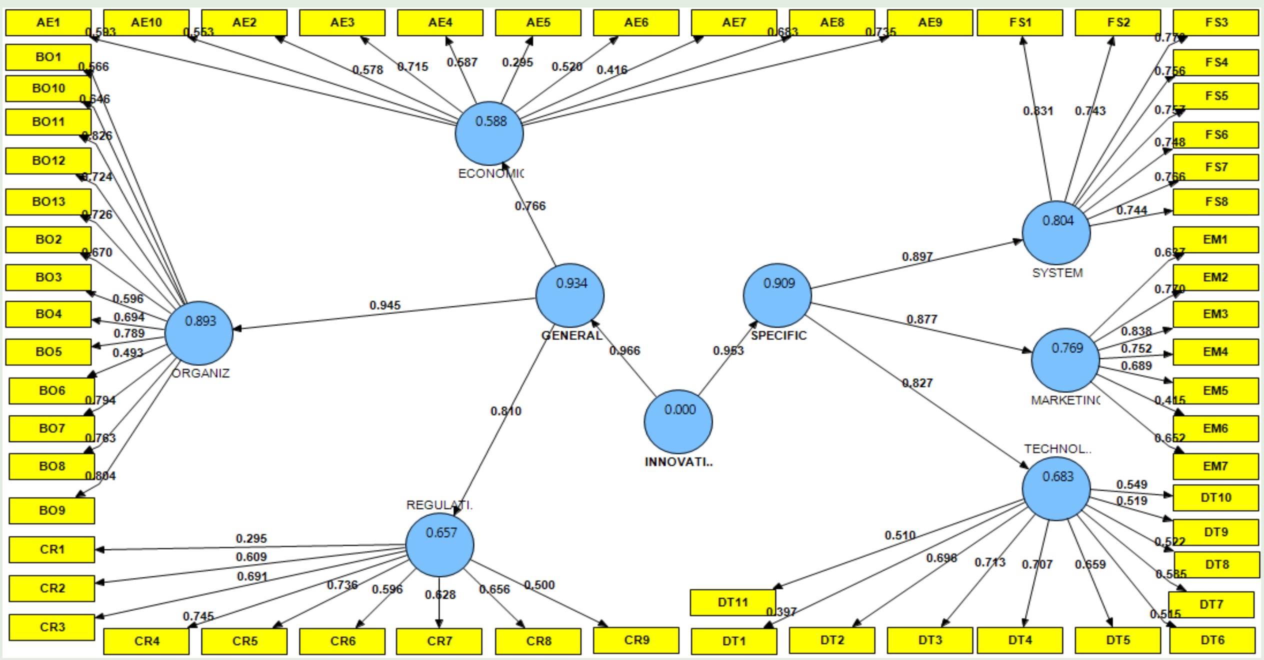

Figure 2: Initial structural equation modeling of research along with coefficients of loading factors

equations. It needs to be explained that structural equations have been used to confirm and fit the research pattern.

This study is considered as a descriptive research since the current situation is described by its results. Due to the direct connection of researchers with the studied phenomena, it is also considered as a field study. Moreover, it is an applied research since factors which are effective on innovation management in petrochemical companies producing polyethylene products and used in industry are identified in the current study. Data collection method was conducted using questionnaires and interviews with experts. The reliability of the questionnaire was evaluated by implementing Cronbach's alpha; its validity was also approved by the judgment of experts.

Based on studying the literature and summarizing conducted research and experts' perspectives, 130 effective indices on the management of innovation in the petrochemical industry producing polyethylene products were extracted by designing a questionnaire with Likert scale. Then, experts were surveyed for the effectiveness of these measures, and decisions were made using these indicators. After the screening, 58 indices were accepted and categorized in the form of 2 factors and 6 dimensions. The main identified dimensions include the general dimension, which consists of (economic, organizational, regulatory, and supervisory) factors and the specific dimension, which contains (technical and technological, marketing, and systemic) factors. The final questionnaire was designed and distributed among managers and experts in 5 petrochemical companies producing polyethylene products, and the questionnaires were then collected. A total of 25 managers and experts in each of the companies were selected as the statistical population. Finally, among 125 distributed questionnaires, 105 ones were completed and returned. The research model was then fitted using the structural equation and Smart PLS software.

Based on the purpose, title, and the conceptual model of study, the research questions are as follows:

1- What are indicators and factors effective on the innovation management in polyethylene products with an approach to the new products?

2- What is the form of innovation management model in petrochemical companies producing polyethylene products?

3- How is the ranking of factors affecting the innovation management in petrochemical companies producing polyethylene products?

4. The findings of the first research question

58 main filtered indicators were obtained to answer this research question. Finally, the research model was analyzed with SMART PLS software for validation; the research model is shown as Figure 3 which is an indicator

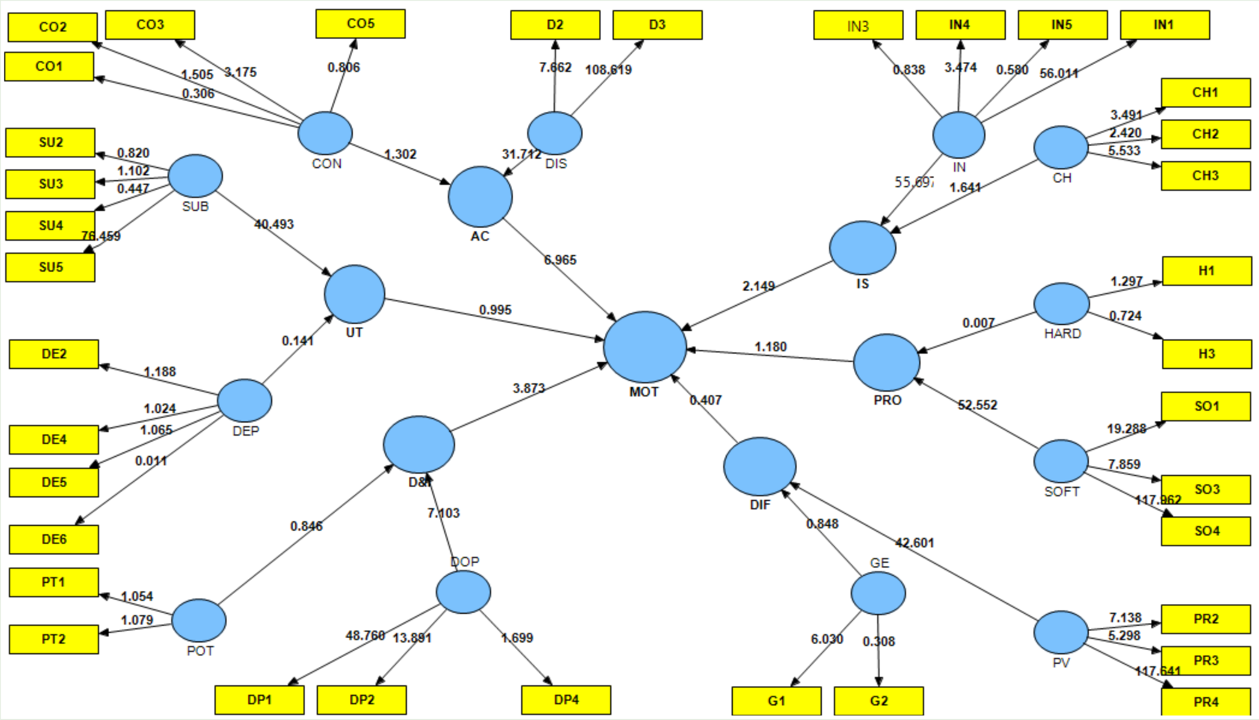

Figure 3: Measurement model of research after fitting with significant coefficients of Z

Table 1- Results of the fit tests of the research model

Model	Test Type			Acceptance Criteria	Test Result
Analysis of reflective measurement model	Homogeneity test			Load factors of all indicators are greater than 0.7	Removing 28 indicators with a load factor under 0.7
	Reliability Test	Cronbach's alpha		Greater than 0.7	Approval for all the factors
		Composite reliability		Greater than 0.7	Approval for all the factors
		Shared reliability		Greater than 0.5	Approval for all the factors
	Validity test	Convergent validity	Significance	T-value is greater than the absolute value of 1.96	Reliability Test
			Homogeneity	All the loading factors after fitting are greater than 0.7	Approval for all the indices
			AVE	Greater than 0.5	Approval for all the factors
			CR>AVE	Greater than 0.5	Approval for all the factors
			Transverse load test	Load factor of all observable variables on the corresponding latent variable is at least 0.1 higher	Approval for all the indices
			Fornell-Larcker test	Square root of the AVE for each factor is more than a correlation of the factor with other reflective factors in the model	Approval for all the factors
			Quality test of measurement model	Coefficient of variation of shared indicators with three values including: 0.35 (strong), 0.15 (average), and 0.02 (weak)	Quality measurement of model for all the factors and variables is strong.
Analysis of structural model	Factor of significance			T-value for all the relationships between the independent and dependent variables is greater than the absolute value of 1.96.	It is confirmed for all of the research relations.
	The coefficient of determination (R2)			Value of determination coefficient: 0.67 (strong), 0.33 (average), 0.19 (weak)	Coefficient of determination is moderate to high for economic, regulatory, supervisory, and technological factors, and it is strong for other factors.
	Relationship of predictor Q2			The amount of Q2 with the predictive power: 0.35 (strong), 0.15 (average), 0.02 (weak)	Moderate to high predictive power is confirmed for general, proprietary, regulatory, supervisory, and economic factors, and strong predictive power are confirmed for all the other variables.
Analysis of the overall model	GOF			The index with three values: 0.35 (strong), 0.15 (average), 0.02 (weak)	GOF=0.68 very good fit. The general model is confirmed.

Table 2- Indicators and factors affecting innovation management in petrochemical companies producing polyethylene products

Row	Factors	R2	Dimensions	R2	Indicators	ID Code	Loading factor	R2	Ranking
1	General factors	0.934257	Economic		Access to financial resources	AE3	0.755	0.57	Third
2					Development of downstream / upstream industries and products	AE8	0.789	0.62	Second
3					Economic development	AE9	0.838	0.68	First
4			Organizational	0.893683	Method of leadership	BO4	0.707	0.49	Eighth
5					Innovation strategy	BO5	0.789	0.60	Third
6					Organizational culture	BO7	0.780	0.60	Fourth
7					Specified objectives and strategies	BO8	0.767	0.57	Fifth
8					Thinking about team work	BO9	0.841	0.70	Second
9					Organizational structure reinforcing innovation	BO11	0.851	0.72	First
10					Organizational maturity	BO12	0.741	0.54	Seventh
11					Motivational systems	BO13	0.758	0.56	Sixth
12			Regulatory		Antitrust laws	CR3	0.805	0.64	Third
13					Specified national industrial policies	CR4	0.855	0.72	First
14					Privatization policy	CR5	0.826	0.67	Second
15			Technological and Technical	0.600180	The technological capabilities of providers	DT2	0.854	0.72	Second
16					Technology Compatibility	DT3	0.859	0.72	First
17					Development of technology	DT4	0.834	0.68	Third
18			Marketing	0.686799	Increased use of product by current customers	EM2	0.788	0.60	Third
19					Sales support	EM3	0.839	0.68	First
20					Competitive environment of product	EM4	0.808	0.64	Second
21					Market needs	EM5	0.724	0.51	Fourth
22			System		Specialized systems for screening ideas	FS1	0.831	0.68	First
23					Access to information and knowledge systems in petrochemical field	FS2	0.743	0.54	Eighth
24					Commercialization mechanism of innovative ideas in the market	FS3	0.770	0.59	Second
25					Existing clear procedures and mechanisms	FS4	0.755	0.56	Fifth
26					Controlling records of previous measures	FS5	0.756	0.56	Fourth
27					Company status in the value chain	FS6	0.747	0.54	Sixth
28					Knowledge management and knowledge processes	FS7	0.765	0.57	Third
29					The flexibility of structure and operational processes	FS8	0.744	0.54	Seventh

of initial measurement model in case of estimating standard coefficients and as Figure 4 which is a representative of corrective measurement model (approved model) in case of estimating non-standard coefficients (significance of Z). All the questions with loading factors less than 0.7 are removed from the research model. Indicators, in which their loading factors are close to 0.7 and the indices of the variable are compensated by another loading factor, can be retained in

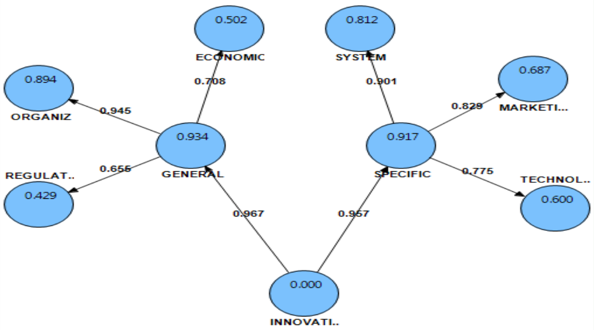

Figure 4: Structural model in the case of path coefficients (standard)

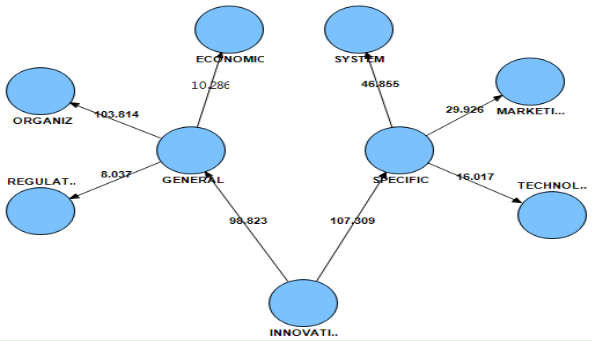

Figure 5: The structural model In the case of significance (non-standard)

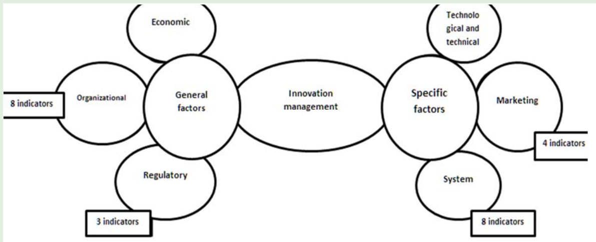

Figure 6: The model of innovation management in petrochemical companies producing polyethylene products

the model (Hair, 2006). According to Figure 3, 29 indicators were excluded from the model for the homogeneity of the model.

Any researcher who has documented his research in the form of a structural equation model must know that the developed model, based on the theoretical framework and the empirical background, is consistent with reality and is derived from acceptable scientific tests and criteria for confirming the theoretical model. Employing PLS software for this test should use acceptable scientific tests.

The results of all the tests of reflective measurement models, structural models, and general models are shown in Table 1. Finally, structural model in case of estimating path coefficients is shown in Figure 4, while the structural model in case of the significance of path coefficients is represented in Figure 5.

According to the above table, indicators and factors affecting innovation management in petrochemical companies producing polyethylene products are obtained as tabulated in Table 2.

5. The results of the second research question

By using the indices extracted from a literature review, obtained by the conducted research, and gathered from experts in petrochemical industry and by confirming the model fitting based on Figure 2 and Table 1, an innovation management model in petrochemical companies producing polyethylene products was obtained as shown in

In this study, the above-mentioned criteria as effective variables on the necessity of innovation in petrochemical companies producing polyethylene products were extracted by taking the advantage of previous studies related to the subject as well as using experts' opinions.

The criteria are divided in two dimensions, including general and specific factors. Economic, organizational, regulatory, and supervisory indicators were considered in the general dimension, while technological, technical,

Table 3- Ranking of effective factors and dimensions on innovation management in petrochemical companies producing polyethylene products

Factor	Path coefficient	R2	Rank	Dimensions	Path coefficient	R2	Rank
General	0.967	0.935	First	Economic	0.708	0.501	Fifth
				Organizational	0.945	0.893	First
				Regulatory	0.655	0.429	Sixth
Specific	0.957	0.915	Second	Technological and technical	0.775	0.600	Forth
				Marketing	0.829	0.687	Third
				Systemic	0.901	0.811	Second

marketing, and system indicators were taken into account in the specific dimension.

6. The results of the third research question

According to the output of Smart PLS software, ranking of effective factors was conducted according to the coefficient of determination. Therefore, the rating of each factor and the dimensions affecting innovation management in the petrochemical industry is presented in Table 3.

7. Discussion and conclusion

As the major part of basic petrochemical products in Iran are currently planned for export, considering international markets for investigating economy conditions and petrochemical development projects is essential and inevitable. This research was conducted in order to achieve appropriate solutions to the challenges and for the development of innovation management model in petrochemical companies producing polyethylene products. In this study, 2 factors, 6 dimensions, and 58 indices were obtained; the results of the research indicated that economic, organizational, regulatory, supervisory, technological, and technical marketing as well as systemic dimensions, i.e. the general and specific dimensions, has a significant effect on innovation management in petrochemical companies producing polyethylene products. As a result, between the two factors involved, the general factor has the maximum influence on innovation management. On the basis of the outcomes obtained by SMART PLS software output, the indicators with the maximum R2 value have a greater share in explaining variance and in strengthening and predicting the behavior of the related factors; thus, more attention should be paid to them.

Innovations of this research are as the following:

- Innovation management model in petrochemical companies producing polyethylene products is proposed for the first time in this research;
- The study specifically concentrates on innovation management in petrochemical companies producing polyethylene products;
- The extracted model for managing innovation is obtained locally based on the collaboration of companies producing polyethylene products with an approach to the new polyethylene grades, and it enjoys integrity and high reputation in the mentioned companies.

According to the results presented in Tables 2 and 3 and Figure 2, the following results and recommendations are drawn:

- Economic development (AE9) in the economic factor of the indicator has the highest R2 among other indicators of this dimension. This means that the economic factor has the greatest share in explaining the variance of the economic factor. In this regard, it is suggested that the government should increase investment in petrochemical companies producing polyethylene products and should pay special attention to such companies.
- The organizational structure of innovation reinforcement (BO11) in the organizational indicator has the highest R2. In this context, it is recommended that the structure of the petrochemical companies producing polyethylene products be revised, and a flexible structure with minimal bureaucracy is employed.
- Specified national industrial policies (CR4) in regulatory and supervisory factor have the greatest share in explaining this factor. It is recommended that the government should take action on the codification of the industrial policies which reinforce innovative products for petrochemical companies in the field of polyethylene to strengthen this factor.
- The compatibility of technology (DT3) in technological and technical factor has the highest R2; improvement to greater efficiency is suggested so that innovative technologies are used locally and the specific circumstances of the companies are considered. Moreover, necessary adaptability is performed in the field of technology transfer.
- The index of sales support (em3) in marketing factor has the highest R2. Therefore, it is recommended that the process of selling support be revised and the responsible department be strengthened by education and training in order to strengthen this indicator.
- The highest value of R2 in the system factor is related to specialized screening system of ideas (fs1). It is recommended that a system should collect and select ideas and should eventually implement selected ideas so that it can lead to value takeover created and can maintain and strengthen the proposed indicator.
- In this research, applied proposals can be explained based on the determination coefficients of the same R2; in fact, the highest determination coefficients that determine the contribution of each indicator in the relevant factor should be strengthened.
- Finally, it is recommended that other researchers in the

same field apply the method used herein to other industries and fields of the petrochemical industry, including those with the difficulty of competition and lack of productivity.

References

Asmaeel poor, Reza et al. (2011). Examination the Role of Knowledge Management on Innovation. International Conference-New Management Paradigm.

, N., Xiaoyu, Y., Junsong, C. (2016). Brand Innovation and Social Media: Knowledge acquisition from Social Media, Market Orientation, and the Moderating Role of Social Media Strategic Capability. Journal of Industrial Marketing Management, Vol 51, PP 11-25.

Bi, Kexin & Huang, Ping & Wang, Xiangxiang, (2016). Innovation Performance and Influencing Factors of Low-carbon Technological Innovation under the Global Value Chain: A Case of Chinese Manufacturing Industry," Technological Forecasting and Social Change Elsevier. Vol. 111(C), pages 275-284.

Chiesa, V., Davide, C. (2011). The Open Innovation Journey: How Firms Dynamically Implement the Emerging Innovation Management Paradigm. Journal of technovbation, Vol 31, PP 34-43.

Fadaee, David, Mosayebi, Mohsen (2011). A Comprehensive Innovation Management. Publication of Latent Pen.

Fathian, Mohamad et al. (2005). The Role of Knowledge Management in Innovation. Strategy Journal, No. 164.

Foose, N. (2010). Customer Relationship Management and Innovation Capability. Journal of Industrial management, Vol 110, pp. 111-133.

Gruber, A. Ogut, H. (2014). Environment Factors Affecting Innovation Strategies of Companies. Journal of Procedia-Social and Behavioral Silences. Vol 150, pp. 718-725.

Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E., Tatham, R. (2006). Multivariate Analysis (6th Ed.). New Jersey: Pearson Education Ins.

Hejazi, R. et al. (2012). Provision of a Conceptual Framework for Enhancing Competitiveness of Knowledge Based Companies Using Open Innovation Model. The First International Conference and Innovation Management.

Khamseh, A. and Sadeghi, Y (2018). Identification and Ranking of Innovation Management Factors in Petrochemical Companies Producing Polyethylene Products

Kimitaka, N. Munehiko, I. (2016). Product Innovation in Response to Environmental Standards and Competitive Advantage. Journal of Cleaner Production. Vol 113, pp. 873-883.

Li, J.; Fan, J.; Zhao, D.; Wang, S. (2015). Allowance Price and Distributional Effects under a Personal Carbon Trading Scheme. J. Clean. Prod. 103, 319e329.

Liao, S. Chen, F. Chih, t. (2008). Relationship between Knowledge Inertian, Organizational Learning and Organization Innovation. Journal of Technovation, Vol 28, pp. 183-195.

Millson, M.R. & Wilemon, D. (2007). Driving New Product Success in the Electrical Equipment Manufacturing Industry. Technovation 26, 1268.

Naser-Melli, Mohammad-Hassan et al. Performance Assessment of Innovation Management Indices and Dimensions in Industry of Power Plant Equipment and Energy Supply; Journal of Technology Development, No.25.

North, D. & Smallbone, D. (2000). The Innovativeness and Growth of Rural SMEs during 1990s. Regional Studies, Vol. 34 No. 2, pp. 145-57.

Popiolek, N. Francoise, T. (2016). Multi-Criteria Analysis of Innovation Policies in Favor of Solar Mobility in France by 2030. Journal of Energy Policy, Vol 97, pp. 202-219.

Rahimi, Z. Abdolvand, N, (2016). Identifying and Ranking the Factors Affecting the Successful Implementation of Social Commerce in Iran Using Fuzzy AHP. Journal of Information Technology Management, No. 2, 295-314.

Rasa, V. (2016). How Corporate Decisions Force Innovation: Factors and Choices to Act. Journal of Procedia Economics and Finance, Vol 39, pp. 357-364.

Salajegheh, Sanjar & Nazari, Mojgan. (2008). The Role of Implicit Knowledge Management in Creativity and Innovation. The First National Conference on Creativity, Engineering and Innovation Management.

Samadi (2012). The Importance of Creativity and Innovation Management and Technology Monitoring for Organizations in the Turbulent and Unsustainable Working Conditions

Soltani, Shohreh; Hosseini, Farajollah (2010). Analyzing the Effective Factors on Technologic Innovation in Small and Medium Food Industries. Research of Agricultural Extension and Education, No.4.

Tidd, J. and Hull F.M. Eds (2003). Service Innovation: Organizational Responses to Technological and Market Imperatives. Imperial College Press, London.

Tidd, Joe. Bessant, John (2002). Managing Innovation: Integrating Technological change, market and organization; Translated by Arasti et al. Tehran, Resa

Zhiqiang, W. min, Z. Hongyi, S. (2016). Effects of Standardization and Innovation on Mass Customization. Journal of Technovation, Vol 48, pp. 79-86.