



# Proposing a model for absorption capacity of technology

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## Abstract

Absorption capacity of knowledge is the concept which is been introduced in this situation. This phenomenon describes why some countries are in a better condition with a view to technology. Many countries believe that the power to stay in the battle and excel other competitors directly depends on their abilities in taking knowledge. Many countries have used their technological gap with developed countries as an accelerator for improving their absorption capacity. In this study, authors tried to produce a complete definition for absorption capacity through analyzing different research. Then with using expert opinions, a categorization for dimensions of absorption capacity will be prepared by using the structural equation modeling analysis, and finally a model for measuring absorption capacity is suggested. The results show effective dimensions in 5 different section. Studies depict that the most important one is keeping which could be a fundamental for long-term policies of 1404.

*Keywords:* Absorptive Capacity; Innovation; Structural Equation Model; Nanotechnology; Knowledge.

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## 1. Introduction

Today, competitive advantage is more affected by the available knowledge than it is dependent on physical resources because physical assets alone cannot provide competitive advantage like before despite two characteristics of ambiguity and complexity in new business environments. There are knowledge resources beyond the hypothetical boundaries and competitive capabilities can be developed by using and exploiting them [1]. Absorptive capacity refers to ability to put new ideas and combine them in internal processes and this ability has been widely considered as one of the main performance factors [2, 3]. Today, ability to detect value of new things, external information, absorb, adapt and apply them is important and vital for commercial purposes for the innovation activities and plays important role in development of innovation advantages and flexibility It is necessary to note that ability to evaluate and use the external knowledge is dependent on knowledge resources, primary knowledge level and ability of the enterprise or country to consider the external knowledge.

Absorptive capacity means learning of the environment which is a type of learning which pays attention to learning of knowledge resources in the environment instead of emphasis on value creation through experience [7-9]. Theoretically, concept of the absorptive capacity is common among some issues such as dynamic capabilities [10], organizational learning and knowledge management [11]. The researches were conducted on absorptive capacity dominated by the quantitative studies which investigated specifications, factors and dynamicity in terms of absorptive capacity [12], [13]. In recent studies, the approach was toward studies of innovation networks and knowledge transfer in coalitions. However, few studies have investigated the internal processes of absorptive capacity [14].

Concept of absorptive capacity has been widely applied for analysis of innovation processes and effect of learning on creation of competitive advantage but it has been prevented from creation of stable body of theoretical knowledge, recognition of the effective factors and main actors and components and results [15], [16].

## 2. Place of absorptive capacity in definitions

To know place of absorptive capacity, place of absorptive capacity can be specified in the known concepts of the technology management. In studies by Lin, four research flows have been mentioned with strong overlap with absorptive capacity [13], [17].

**Table 1:** Place of Absorptive Capacity

	Knowledge identification	Knowledge protection	Knowledge utilization
Internal	Creative capacity	Transformational capacity	Innovative capacities
External	Absorptive capacity	Binding capacity	Repulsive capacity

**Table 2:** Research Flow with Strong Overlap with Absorptive Capacity

Strategic unity	Organizational learning
Resources based attitude	Knowledge management

## 3. The studied levels of absorptive capacity in the researches

The studied levels in researches of absorptive capacity which have been collected in the following Table show orientation of the researches. The reason for orientation of the researches on absorptive capacity on the enterprises levels are the expressible need and payment of financial costs in this level of researches.

**Table 3:** The Studied Levels of Absorptive Capacity in Researches [13], [18-20]

The studied levels	Writer
Individual	Cohen & Levinthal, 1990
Cooperation among people	Malhotra, Gosain, and El Saw, 2005
Business units	Szulanski, 1996
Organizational	Cohen and Levinthal, 1990
Paired	Lane and Lubatkin, 1998 , Lane et al., 2001
Cluster-based	Giuliani, 2003; Giuliani and Bell, 2005
Industrial blocks	Aage, 2003
	Criscuolo and Narula, 2008
State and national	Dahlman and Nelson, 1995
	Mower and Oxley, 1995
	Kedia and Bhagat, 1998

**Table 4:** Definitions of Absorptive Capacity [1], [12], [21-26]

Writer	Definition
Alen, 1984	He has defined absorptive capacity as result of research and development efforts to use external knowledge.
Cohen and Levinthal, 1989	They defined absorptive capacity as learning ability through processes of identification, absorption and utilization of external knowledge.
Cohen and Levinthal, 1990	They introduced absorptive capacity as ability of an organization to recognize values and external information , absorb and commercialize it which is dependent on the previous knowledge , diversity and extent of knowledge base, experience, learning, common language, mutual relations, subjective models, the presence of human force with ability to solve problem.
Lichtenthaler, 2009	Absorptive capacity is the ability of a company to use external knowledge through combined processes of exploration, change, learning and utilization.
Teece ‘Shuen ‘ 1997	Absorptive capacity is defined as a vital factor and intangible source which have increased performance of the company and brought competitive advantage for the organization.
Lane and Lubatkin 1998	They have defined ability to recognize value, absorb and use the acquired knowledge from another organization and they were the first scientists who introduced reinterpretation of Cohen and Levinthal’s structure. Absorptive capacity was introduced as knowledge absorption from other sections but Lin and Lubatkin introduced absorptive capacity as absorption from other organizations.
Van den Bosch et al. 1999	They have defined absorptive capacity as including evaluation, acquisition, integration and commercial use of new external knowledge. They show that environmental knowledge can affect absorptive capacity and stimulate the periodical tend by absorbing learning absorptive capacity and is regulated with nature and competitive field in which the organization is located. They point out that company regulates different organizational forms with emphasis on different mechanisms to collect knowledge considering nature of these settings (stable, chaotic etc.). by mentioning that the previous knowledge is effective on absorptive capacity, they proved that effect on capacity is

Writer	Definition
	determined through a set of the related mechanisms with organizational forms and studied effect of structures such as performance, part and matrix on absorptive capacity and what they suggest as combinatorial capability indicates the way in which the company acquires knowledge and applies it.
Minbaeva , 2003	Minbua studies absorptive capacity as ability of the organization to use and apply the previously acquired information and indicates that the specified activities of human resources management will have positive effect on development and improvement of absorptive capacity.
Lane et al, 2006	Absorptive capacity refers to one of the main learning processes which means ability to identify, absorb and utilize the environmental knowledge and structure of ability of a company to use the external knowledge by 1- recognizing and understanding external knowledge through exploratory learning, 2- absorbing new knowledge through transformational learning, 3- use of the absorbed knowledge for creation of new knowledge and commercial outputs through learning of the exploiter.
Arbussà and Coenders, 2007 Liao et al. 2003	These writers created changes in definitions of Cohen and Levinthal and also few changes in dimensions. They performed this work by limiting the structure into two dimensions: evaluation, acquisition and absorption of the external knowledge and internal publication and application of the knowledge.
Todorova and Durisin, 2007	They define absorptive capacity as ability to recognize value of information and new external knowledge, absorb, apply and commercialize information. They argue that when the external knowledge is based on the cognitive structures, absorption occurs and it leads to direct utilization using it. But when the external knowledge is not based on the suitable ideas with the structures of internal knowledge, knowledge and ideas are changed and converted.
Bergh & Lim 2008 Harrington & Guimaraes, 2005	Absorptive capacity is an important factor in determination of ability of an organization to obtain and use the external knowledge in its favor and use it in internal procedures and it will be available when it results in higher productivity and internal application of the acquired and absorbed cases leading to a thing beyond the present procedures.
Cadiz, Sawyer & Griffith, 2009	Absorptive capacity is an approach which has three steps: ability to convert new knowledge into the usable knowledge through the processes of evaluation (identifying and filtering valuable information), homogenization (converting new knowledge into usable knowledge ), application (use of knowledge )
Kallio and Bergenholtz, 2011	Social cohesion mechanism means need for communication between absorptive capacity potential and realization of absorptive capacity to reach the intended goals.
Uotila et al. 2013	These writers regarded concepts and dimensions presented by Todorova and Darinsen as development and absorptive capacity affected by learning and considered the same classification with a new approach and believes that effect of learning on absorptive capacities is an introduction for innovative actions. 1- Acquiring, absorbing and utilizing leading to incremental innovation and utilization and 2- acquiring, change and utilization relating to the exploratory innovation processes.

## 4. Presented model

To present the model, two methods were used in the research and by reviewing all literatures , dimensions were identified and a primary hypothetical model was presented by classifying it with qualitative method (grounded theory) and it was argued that four steps were corrected in this model that is dimensions and classification were first presented to the experts and the participant were asked questions about dimensions and classification and the corrected , added and deleted dimensions were considered in one step and the classifications were considered in the next step. in the next step, the dimensions which had semantic and conceptual overlap were corrected and one sage was also performed after performing the experimental factor analysis to correct the accruing errors for correcting dimensions and classifications. The selected dimensions and class for absorptive capacity were presented in two Sections: 1- Processes, 2- Capabilities.

### 4.1. Processes

They have been included in three classifications. Unlike the previous models particularly Zahra and George's 4-part model [22], [35] which is the dominant flow in absorptive capacity, the above model has 4 parts which have been included in three classes. The next changes added to the model create two dimensions of keeping and reordering. Variables of the dimensions considered for this index are summarized in three classifications in unlike the previous models particularly Zahra and George's 4-part model [22], [35] which is the dominant flow in absorptive capacity; the above model has 4 parts which have been included in three classes'. Tables. Unlike the previous models particularly

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**Table 5:** Variables of Dimension of Processes and Index of Exploration

Researcher	Variables
1- Recognition	
Jansen et al. 2005	Paying attention to search for information
Experts' view	Surveying environment for new technologies
Experts' view	Observing and expressing technological trends
Experts' view	Exploring details of technologies in external sources
Experts' view	Informing external technology
2- Acquisition	
Caloghirou et al. 2004	Openness relative to environment
Lane et al. 2001	Competition knowledge
Arbussà and Coenders	Internal development of capacities and technological abilities
Veugelers 1999	Common research projects with the research institutes beyond industry
Wilkens et al. 2004	Exchange of information inside the same industry
3- Absorption	
Jansen et al. 2005	Technology absorption
Caloghirou et al. 2004	Human resources
Tu et al. 2006	Determining industrial criteria
Arbussà and Coenders	Participation in knowledge publication
Jansen et al. 2005	Attendance in educational courses
Szulanski 1996	Knowledge management
Lu et al. 2006	Role of a good model in knowledge distribution
Gee Woo and Young-	Knowledge sharing
Espinosa et al. 2007	Organizational self-awareness
Shu et al. 2005	Informal communication
Ko, Kirsch, and King	Mutual relations for exchange of knowledge , ideation and problem solving
Experts' view	Absorbing knowledge from formal and informal professional sources
Experts' view	Technological use of external sources
Experts' view	Organizing special sessions with foreign partners
Bontis et al. 2002	Regular interactions with foreign institutions for technological knowledge
Experts' view	Transfer of technological knowledge in response to technology acquisition opportunities

**Table 6:** Variables of Processes and Index of Change and Utilization

Researcher	Variables
1- Transfer and change capacity	
Jansen et al. 2005	Transfer of knowledge based on information technology
Jansen et al. 2005	Innovation capability
Jansen et al. 2005	Adaptation capacity
Soo et al. 2007	Exchange of scientific and technological information
Vinding 2006	Research and development integration
Pavlou and El Sawy	Creating communication between the existing knowledge and new insight
Tiwana and McLean	Intelligent use of local and foreign information
Collins and Smith	Formation of ideas with cross relations
Farrell 2000	Relationship between learning and competitive learning from the viewpoint of management
Hock-Hai et al. 2006	Means of promoting knowledge to increase competition
Hock-Hai et al. 2006	Involvement of personnel in education and learning
Hock-Hai et al. 2006	Use of knowledge base for increasing insight
Liao et al. 2007	Structuring ability
Ettlie and Pavlou	Use of new knowledge in activities
Bontis et al. 2002	Encouraging personnel to produce knowledge
Pavlou and El Sawy	Knowledge adaptation capacity
Experts' view	Ability to adapt new technologies to idea
Experts' view	Rapid recognition of technological utility of the new knowledge
Experts' view	Ability of manpower to share their specialty
Experts' view	Ability to renew knowledge
2- Application	
Jansen et al. 2005	Utilization of new knowledge
Soo et al. 2007	Use of experience

George et al. 2001	Development of patent
Jansen et al. 2005	Being pioneer in development
Jansen et al. 2005	Converting new ideas into patent
Nambisan, 1999	Supporting development of stereotypes
Jansen et al. 2005	Adopting new technologies
Jansen et al. 2005	Adaptation of the existing technology to the new knowledge
Experts' view	Regular application of technology in new products
Experts' view	Observing follow-up approach for better utilization of technology

**Table 7:** Variables of Dimensions of Processes and Index of Keeping and Reordering

Researcher	Variables
1- Keeping	
Sawy 2006 ,	Protecting the related and required knowledge
Vorhies and Harker 2000	Regarding technological knowledge of manpower as the future references
Ko et al. 2005	Communication with the related knowledge in the activity level
Experts' view	Internal knowledge management
2- Reordering	
Laursen and Salter 2006	Rapid recognition of business opportunities with the available knowledge
Sidhu et al. 2007 ,	Activation of the available knowledge and ability to utilize new technology
Hulland 2002	Rapid analysis of changes with the available technology
Liao 2006	Rapid understanding of new opportunities with the available technology

## 4.2. Capabilities

Capabilities are the main part modeled in absorptive capacity section. Considering the conducted studies in the previous models, none of them have the dimension which refers to abilities and competencies. For this reason, this section was considered and this part of model was presented based on view of the experts and the conducted researches. This section includes two general classifications including coordination of collective efforts and capacity of production and transfer of foreign knowledge. In this part of the model, it can be named as research flowing section considering that it is completely new. Since any dimension called capabilities with a concept close to this index was never used in any of the researches on the absorptive capacity and the researches with similar subjects and this index was used with the approach in which a series of capabilities and grounds which are mentioned as capabilities should be available in addition to the process concepts [22], [35].

**Table 8:** Variables of Capabilities Dimension

1- Intrecational and external capacities	
Native education	
Human capitals experience	
Possessing human capitals	
Native publication of creativity and innovation	1.1.external knowledge production and transfer capacity
Penetrability of economic and social structure	
Easy native cooperation	
Naïve strategic orientation	
Support of general management	
Interconnected information and knowledge services	1.2.collective efforts coordination
Collective support and education services for R&D	
General environmental coordination	
Environmental credit	
2- Internal capacities	
Innovative system and culture	
Proportion of personnel with learning goals	
Obligation of manpower toward innovation	
Managerial support of learning	
Organizational design for learning	
R& D Investment	

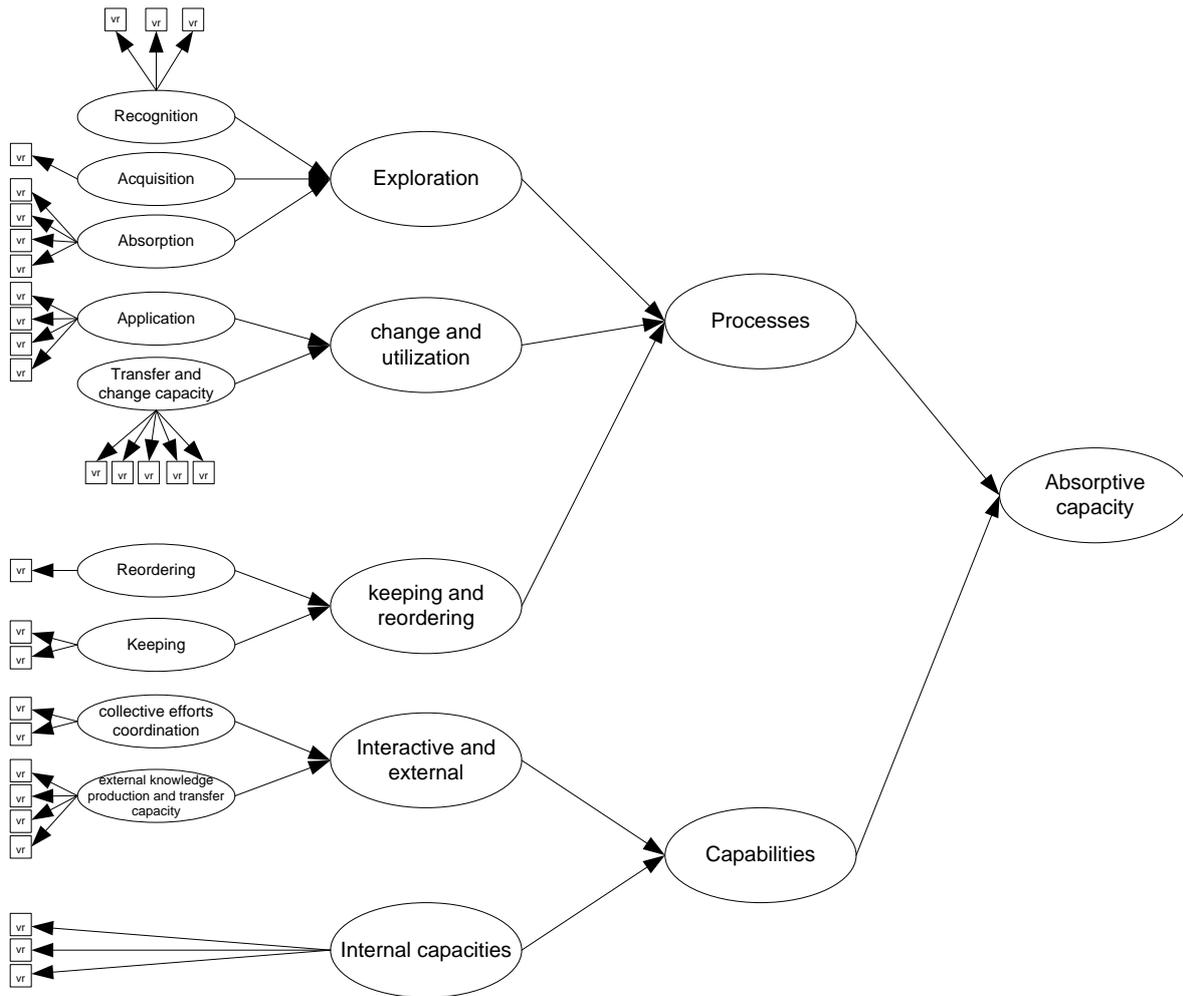


Fig. 1: Absorptive Capacity Model

## 5. Research method

Considering unlimited statistical population in this research, the desirable sample size was calculated with Cochran formula. This number included 267 persons. In this research, to study content validity, attempt was made to use the related questionnaires and then views of the professors and experts were used. The statistical population of the research included experts and players and also B.S and M.S students of technology management and Nano field and also companies involved in nanotechnology. The research was conducted in three steps:

First step: Design of the initial model with qualitative method grounded theory: the used instrument included study of the documents and the statistical population included all papers and information.

Second step: The model validation step with qualitative method focus group: the used instrument was interview and the sampling method was snowball sampling method.

Third step: surveying and revising the model with survey quantitative method. To design of the model, SEM has been used. The used instruments are SPSS software and LISREL.

## 6. Validity and Reliability

Validity: Attempt has been made to use the related questionnaires and then views of the professors and experts were also used. The exploratory factor analysis was also used to study construct validity. Regarding the proposed model, the model was improved with stepwise method.

Reliability: In the research, Cronbach's alpha was calculated in two steps. After collecting 30 initial questionnaires, results show that the research instrument has enough reliability and Cronbach's alpha was calculated 0.92 indicating high reliability and in the second step, the test was studied against after collection of the questionnaires.

Initial study of data: The number of outliers was 7 data with elimination method and the  $D^2$  probability function value has been used. 6 cases of the observations relating to the dependent variable and 4 cases of the independent variables were excluded 1 reverse item was also observed.

**Table 9:** Study of Data

Low skewness limit : 0.038				High skewness limit : -0.59			
Low kurtosis limit : -0.91				High kurtosis limit : 0.346			
Kurtosis error	Kurtosis	Skewness standard error	Skewness	Standard deviation	Mean	Median	Statistic
0.314	-0.282	0.157	-0.276	1.5	3.33	3.23	Value

## 7. Results of factor analysis

The first step is recognition of performing factor analysis on the data. Bartlett test, KMO test: In the first rank exploratory factor analysis, KMO is equal to 0.718 for 29 items relating to the absorptive capacity variable which indicates that the research data are reduced to some infrastructural and fundamental factors. The second step is recognition of share of factor set in explaining variance of any item. Here, variance of any item is specified based on table of similarities which includes initial value which is always equal to 1 and the extracted value which any item could explain is higher than acceptable limit of 0.4 for all items and the third step is recognition of share of each factor in explanation of sum of variance of all items based on literature. 10 factors have been defined as dimensions of absorptive capacity variable. At the same time, 9 factors have eigenvalue of above 1 and the next step has eigenvalue of close to 1. Sum square roots of the rotated factor loads also show the explained variance. These 10 factors explain about 80% of the absorptive capacity variable changes. At the end, in the fourth step i.e. recognition of correlation matrix between items and factors and classification of any item in each factor, results of the rotated table should be used to classify the items among factors based on their factor load. This Table shows correlation between items and factors after rotation in which correlation value fluctuates in  $\pm 1$ . At the end, the following Table indicates the obtained dimensions and their naming.

**Table 10:** Initial Classification of Dimensions and Their Naming

Factor	Questions	Naming	Factor	Questions	Naming
1	14 to 17	Absorption	6	21 to 25	Change
2	1 & 2	Collective efforts coordination	7	3 to 6	Production capacity
3	26 to 29	Utilization	8	7 to 9	Internal capacity
4	18 to 19	Keeping	9	20 & 21	Reordering
5	10 & 11	Recognition	10	12 & 13	Acquisition

## 8. Final classification of dimensions

In the next step, we repeat the previous steps for summary to specify if a new classification can be obtained for the dimensions. Therefore, it is necessary to perform the performed steps and tests for the extracted classification and dimensions in the previous step. According to Table of step 3, it was specified that 10 extracted Factors from the first rank of the absorptive capacity can be classified into 5 general factors. Based on Table of the rotated factors, it can be specified which factors form dimension or component with each other.

**Table 11:** Secondary Classification of Dimensions and Naming Then In the Second Step

Dimensions	Indices	Name
1	Keeping and reordering	Keep
2	Change and utilization	Change
3	Absorbing, acquiring and cognition	Explore
4	Collective efforts coordination, production capacity	Interactional competencies
5	Internal capacities	Internal capacities

## 9. Pearson correlation

Before executing structural equation model, it is better to study relation of variables based on correlation. Considering that data are in interval level and also data distribution follows normal form. Therefore, Pearson correlation coefficient has been used to measure intensity and significance of the relations. Before determining and interpreting correlation coefficient, it is better to study scatter diagram of the binary relations of the variables graphically. This diagram shows linearity or non-linearity, intensity and type of relation direct or reverse. Whenever scattering of the points increases, correlation coefficient will be reduced. Scattering diagram of these two variables is given in the following Figure. The line which has been drawn between the points is correlation or regression line.

**Table 12:** Table of Mean of Variables

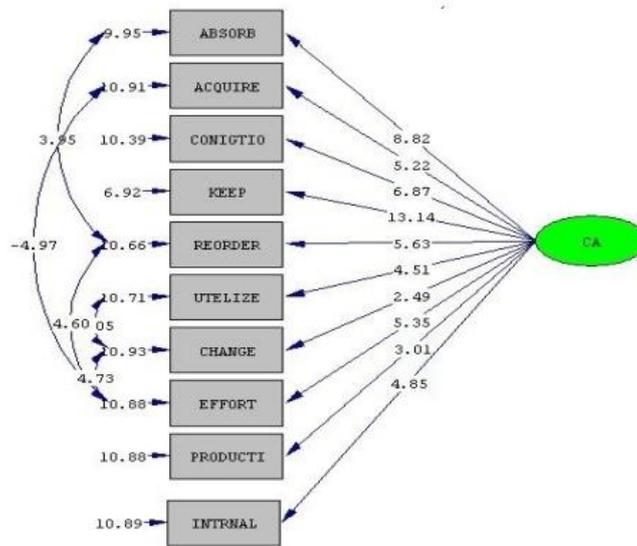
Variable	Mean	Standard deviation
Absorptive capacity	3.3	0.32

### 10. Studying the structural model

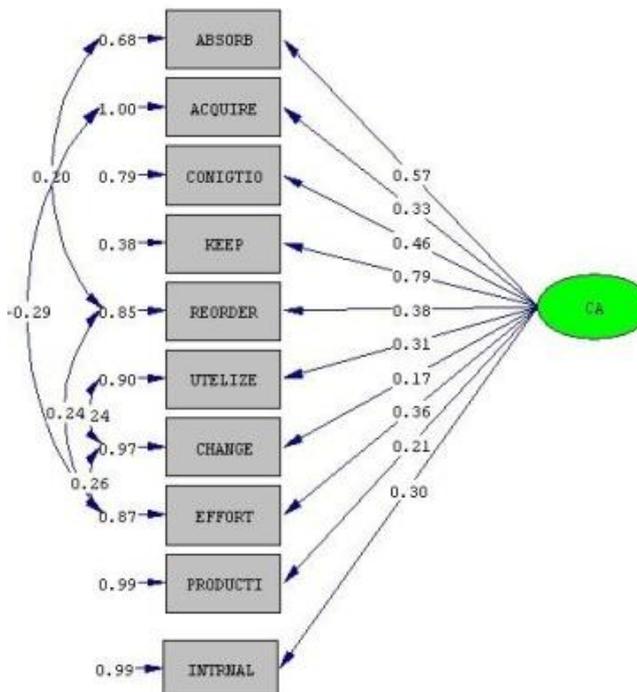
In the model structural section, relations among the internal and external hidden variables are considered. Here, theoretical relations among the variables in formulation of the framework will be studied to see if it has suitable fitness. On the other hand, significance of the relations is tested in this fitted model. Since general execution of the model is not possible in Lisrel software, we study the model in two levels separately.

**Table 13:** Analysis First Level Indices

Indices	DF	CFI	GFI	AGFI	SRMR
First model	159	0/89	0/81	780/	0540/



**Fig. 2:** Significance of the First Structural Model



**Fig. 3:** Standard Factor Loads of the First Structural Model

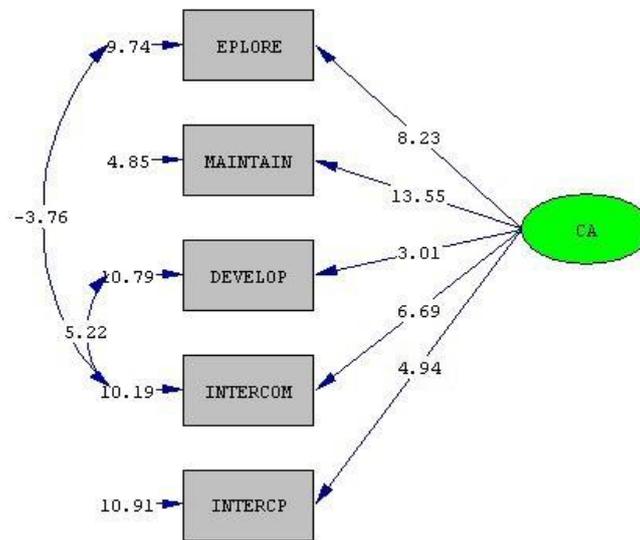
**Table 14:** Coefficients and Priorities of the First Structural Model

Absorptive capacity					
Index	Coefficient	priority	Index	Coefficient	priority
Keep	0.79		Acquire	0.33	
Absorb	0.57		Utilize	0.31	
Cognition	0.46		internal capacity	0.3	
Collective efforts coordination	0.36		Production capacity	0.21	
Reorder	0.36		Change	0.17	

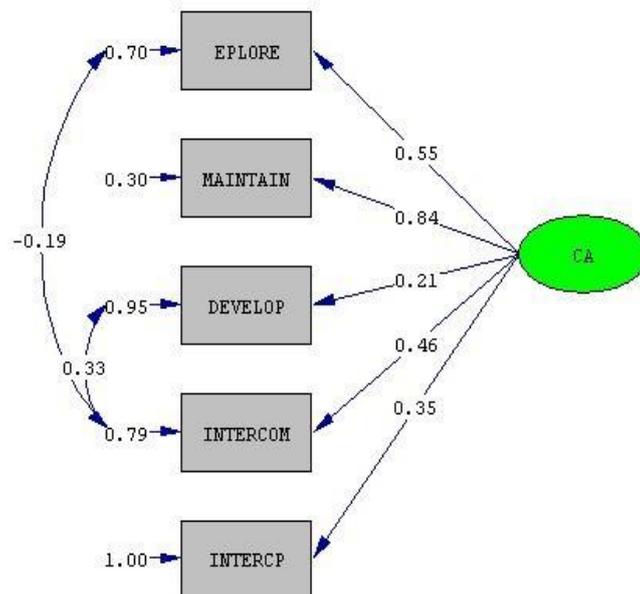
In the second level, with factor analysis, we will study what dimensions are used for classification of dimensions and the results can be observed. In this model, we study dimensions of the main variable. We first study fitting indices. These indices have been obtained after corrections of the covariance errors. The fitting indices can be observed in the Table. Considering fitting indices, relative chi-square value is below 3 and CFI, GFI, AGFI and SRMR are also standard. Therefore, fitness of the model can be confirmed.

**Table 15:** Analysis First Level Indices

Indices	DF	CFI	GFI	AGFI	SRMR
First model	23	0.88	0.91	0.83	0.020



**Fig. 4:** Significance Numbers of the First Structural Model



**Fig. 5:** Standard Factor Loads of the Second Structural Model

**Table 16:** Prioritizing Coefficients in the Second Order Exploration

Factor	priority
Keep	0.84
Explore	0.55
Interactional competencies	0.46
Internal capacities	0.35
Change	0.21

Considering the Table, it is evident that the largest coefficient belongs to keeping dimension and has the highest priority in prioritization; therefore, keeping index has the highest significance in this model considering the conducted studies and factor analysis. Thus, it can lead to policymaking and process making in the studied fields.

## 11. Conclusion

Learning is the first step and main factor in innovation and increase of competitiveness. Learning occurs when there is correct understanding of the environmental data and necessary capacity for receiving these data can be created. Absorptive capacity is an effective concept which leads to understanding of managerial activities and utilization of technologies and ability to make effective innovation. Absorptive capacity creates opportunities for innovation or reduces limitations of the internal combination of knowledge sources in an innovation model. Statement of this issue is a primary step for finding the root of the problem which the third world countries and developing countries have faced and that is dream of development. This puzzle is the root of many studies conducted in the past and many models for justification and statement of successful of the countries which could pass the way of development in short term. The researchers have documented and modeled the ways which this group of agencies has passed more comprehensively so that they can present a comprehensive and usable version. The present research can help find the lost circle of the high-tech industries particularly nanotechnology which led to low productivity of the said industries and slower growth and development speed than that of the pioneers considering special time conditions and situation of the country. As mentioned above, the main goal of this research is to identify factors of absorptive capacity.

At the beginning of the research, considering the absence of literatures in the country and newness of the research subject, the only way for defining the subject and identifying main factors is to refer to the internationally conducted studies. Then, attempt was made to identify and introduce main effective factors while providing comprehensive definition as far as possible. In the internationally provided definitions, absorptive capacity is defined as ability to recognize value of new things, external information, absorb, adapt and apply them is important and vital for commercial purposes for the innovation activities and focus was on this definition though many definitions were changed. For this purpose, attempt was made to present hidden layers, new factors and new definitions by studying research flows which had high overlap with the absorptive capacity in terms of dimensions and concepts. For this purpose, there was focus on key words of the absorptive capacity. In addition to the mentioned issues, concept of the absorptive capacity was studied in two fields. The first field included concepts of measurement and the second field included effective dimensions and finally, attempt was made to present a comprehensive model with literature and experts' view. In this research, new concepts were presented in the field of absorptive capacity. In the previous researches, we could include what was mentioned for absorptive capacity in classification of the processes meaning that all mentioned factors focused on the index which was regarded as process in terms of concept and nature and the main focus was on the set and structure. It was mentioned that it might be importance of the set or country but if there is need for any change, the internal changes should be made by correcting the processes. This process might be related to the inside and outside of the set. But a new concept was presented in this research which was named capabilities and this new concept changed the previous classifications in the field of absorptive capacity. A concept called processes was not referred before and this classification was presented to show substantial difference of the effective factors.

By studying the provided model which was extracted from conclusion of the materials and the conducted factor analysis, dimensions were included in 5 general classes including: 1-keeping, 2-exploration, 3-interactional competencies, 4-internal capacities, and 5-change. As the analyses showed, the factors were had the largest coefficient were keeping and reordering which consisted of two parts: 1- keeping and maintaining and 2-activating and reordering. Dimensions and indices can be resented for the said variable. It is worth noting that the mentioned indices have been prepared from the documents such as vision 1404 and the mentioned cases are among the main indices relating to the mentioned dimensions in the field of nanotechnology of Iran according to the experts and during interview with specialists and experts.

### a) Keeping:

- Protecting the related and required knowledge
- Regarding the technological knowledge approach of manpower as the future references
- Communication with the related knowledge in the activity level
- Internal knowledge management

### b) Reordering

- Rapid recognition of business opportunities with the available knowledge

- Activation of the available knowledge and ability to utilize new technology
- Rapid analysis of changes with the available technology
- Rapid understanding of new opportunities with the available technology

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## Appendix

**Table 17:** The First Step Bartlett's Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.718
	Approx. Chi-Square	2179
Bartlett's Test of Sphericity	Df	406
	Sig.	0

**Table 18:** Recognizing Share of Each Factor in Explanation of Sum of Variance of Items in the First Step

Total Variance Explained						
Component	Initial Eigenvalues			Rotation Sums		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative%
1	5.805	20.018	20.018	3.333	11.493	11.493
2	3.277	11.301	31.32	2.613	9.009	20.501
3	2.653	9.147	40.467	2.608	8.994	29.496
4	2.505	8.637	49.104	2.6	8.965	38.461
5	2.105	7.258	56.362	2.392	8.247	46.708
6	1.952	6.732	63.094	2.171	7.485	54.193
7	1.632	5.627	68.721	2.121	7.313	61.506
8	1.275	4.396	73.117	1.966	6.778	68.284
9	1.198	4.13	77.247	1.957	6.75	75.034
10	0.956	3.296	80.543	1.598	5.51	80.543
11	0.724	2.497	83.04			
12	0.712	2.455	85.495			
13-29	-	-	-			

Extraction Method: Principal Component Analysis.

**Table 19:** Second Rank Rotated Matrix

KMO and Bartlett's Test	
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0.67
Bartlett's Test of Sphericity	Approx. Chi-Square
	df
	Sig.

**Table 20:** Recognizing Each Factor In Explaining Sum Of Variance Of The Second Step Items

Total Variance Explained						
Component	Initial Eigenvalues			Rotation Sums		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.544	25.436	25.436	2.005	20.05	20.05
2	1.506	15.057	40.492	1.665	16.648	36.697
3	1.417	14.17	54.662	1.343	13.434	50.131
4	1.326	1.326	63.92	1.149	11.492	61.623
5	1.192	1.192	71.837	1.021	10.215	71.837
6	0.759	7.592	79.429			
7-10	-	-	-			

Extraction Method: Principal Component Analysis.

**Table 21:** Second Rank Rotated Matrix

Rotated Component Matrix					
Title	Component				
	1	2	3	4	5
Absorb			.736		
Acquire			.442	.436	
Cognition			.828		
Keep	.697		.408		
Reorder	.836				
Utilize		.803			
Change		.720			
Effort		.533		.619	
Production				.964	
Internal					.936

Extraction Method: Principal Component Analysis.