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Research Paper

Identifying laxity factors in moving towards emerging innovations (Case study: government organizations)

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ABSTRACT

Background & Purpose: The literature on novel and emerging innovations has typically focused on describing the hard and technological levels. The aim of the current research is to identify the effective factors in stagnation or uncontrollable delay in the movement of government research organizations in the direction of new and emerging innovations.

Methodology: In terms of philosophy, interpretation and positivism, and in terms of the type of goal, in the category of applied research and research strategy, in the qualitative part, it has used thematic analysis with an inductive approach, and in the quantitative part, the method of partial least squares has been used. The data was collected in the qualitative part using in-depth semi-structured interviews with experts and in the quantitative part of the statistical population of employees of government research organizations, 269 samples were selected as statistical samples using Yamane's formula. In this research, a researcher-made questionnaire was used to collect data, and the technique of hierarchical component models using the partial least squares (PLS) method and SmartPLS4 software was used.

Findings: Based on the analysis of the textual data of the interviews, after the integration of 148 primary identifiers, 35 basic themes, 7 organizing themes and 3 overarching themes were identified.

Conclusion: Lack of supportive culture as the most important cause of lakhti Hanban, including cooperation and working group, fostering a culture of teamwork, sharing ideas and views, not valuing organizational culture, not encouraging the owners of innovative ideas and views, have formed structural indicators of the lack of supportive culture.

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1. Introduction

The emergence of innovation can face several challenges. Emerging innovations are often created in a very uncertain and ambiguous environment. This fact can make it difficult to predict their potential impact, understand their implications and make informed decisions about their development and adoption (Fagerberg et al., 2013). On the other hand, the development and implementation of emerging innovations may face technological barriers such as technical limitations, scalability issues or the need for more research and development to overcome technical challenges (White & Bruton, 2010). Emerging innovations may face regulatory and policy barriers that can impede their progress. These obstacles can include outdated or restrictive regulations, lack of appropriate policies or uncertainty in legal frameworks (Noruzi et al., 2023). Adequate funding and resources are critical to the successful emergence of innovation. However, financing emerging innovations can be challenging, as they often involve high levels of risk and uncertainty (Mollanouri Shamsi & Noruzi, 2023). Resistance to change from different stakeholders, including individuals, organizations or industries, can be an important challenge for the emergence of innovation (Rotolo et al., 2015). Resistance can stem from anxiety about disruption, fear of the unknown, or self-interest in maintaining the status quo. The emergence of innovation often requires collaboration and coordination between multiple actors, including researchers, industry players, policy makers, and other stakeholders. However, achieving effective collaboration and coordination can be challenging due to differences in goals, priorities, and interests (Halaweh, 2013).

Therefore, addressing these challenges requires a comprehensive approach that includes creating an enabling environment, promoting collaboration, providing adequate resources and support, and developing flexible and adaptive regulatory frameworks. As a result, the main question of the current research is, what are the factors that cause laxity in the movement towards new and emerging innovations (laxity) in government research organizations?

2. Research background

2-1. Theoretical background

In this research, after explaining and clarifying the research problem, the literature review process was considered in order to identify the causes of laxity in the movement towards new and emerging innovations through previous studies in Table (1).

Table 1. Some of the previous studies

author (year)	Summary of the research	Regarding inhibiting factors in innovation
(Arranz et al., 2019)	Firms materialize the objectives of eco-innovation from a reactive attitude to external pressures, to a more proactive attitude that implies the voluntary incorporation of eco-innovation activities.	Voluntary integration of environmental innovation activities is one of the solutions from laxity in moving towards innovation.
(Clausen & Fichter, 2019)	About two thirds of environmental product and service innovations are consumed in small market niches. This constitutes a problem, because possible environmental benefits only occur to a limited extent.	small market niches and its relationship with laxity in attracting innovation
(Hiwatari et al., 2023)	This article examines the individual attitudes of humans in the face of innovation	Individual attitudes of people may be risk averse. So, attitude can be an obstacle to move towards innovation.
(Farmer et al., 2023)	Drawing on role identity, dynamic constructivism and the norm-based model of cultural tightness, they examine the innovation paradox of *whether* and *how* congruence of home and host culture in tandem with creative role identity not only enhances but also constrains different facets of innovative behavior for global workers.	The role of dynamic constructivism and norm-based model on the speed of technology adoption

2-2. Innovation

Innovation has a history as long as human history (Fagerberg et al., 2013). Innovation is the process of developing and implementing new and improved products, processes, materials and services. Innovation involves creating something new and valuable that causes change and solves problems. Innovation can be categorized into different types, such as product or process novelty, use novelty, or a combination of both. It is a fundamental aspect of technology management and involves creating an environment that encourages creativity, risk-taking, and proactive problem-solving (White & Bruton, 2010).

2-3. Emerging innovations

An emerging technology is a relatively fast-growing, completely new technology that exhibits certain characteristics. These characteristics include radical novelty, relatively rapid growth, coherence, prominent impact, and uncertainty and ambiguity (Chiaroni et al., 2011). Emerging technologies have the potential to exert a significant impact on the social and economic sphere and are observed in terms of the combination of actors, institutions and patterns of interaction between them. However, their most prominent impact is still unclear and ambiguous, as it lies in the future (Rotolo et al., 2015).

2-4. The difference between innovation and novel and emerging innovations

The terms “innovation” and “emerging innovation” are related but have distinct meanings (Chen et al., 2018). Innovation refers to the process of introducing something new or making improvements to existing products, services, processes or business models. It involves the creation, development and implementation of new ideas, technologies or practices that bring about positive changes and values (Halaweh, 2013).

On the other hand, emerging innovation specifically refers to innovations that are in the early stages of development or have just begun to gain attention and recognition. These are technologies or ideas that are considered at the forefront of development and have the potential to significantly impact industries or society in the future (White & Bruton, 2010). Emerging innovations often show characteristics such as radical novelty, relatively rapid growth, and uncertainty and ambiguity.

In summary, while innovation is a broader term that encompasses all types of new and improved ideas or practices, emerging innovation refers to those innovations that are in the early stages of development and hold promise for future impact (Rotolo et al., 2015).

2-5. laxity in innovation

The move towards innovation in the research field of government organizations has become an important issue in the world. The United Nations has raised the issue of laxity in this regard in the Sustainable Development Goals (Delgado et al., 2023). Slowness often means reducing the quantity and quality of movement towards emerging innovations that are initially produced with the aim of national consumption.

The concept of "innovation lag" refers to the time delay between the emergence of a new technology or innovation and its widespread adoption or implementation. It represents the time required for the full adoption and integration of a new technology in different sectors or industries. Delays in innovation can occur due to various factors such as technological, economic, social or regulatory barriers that slow the adoption and diffusion of innovation. This delay can have consequences for the overall speed of technological progress and the potential benefits that innovation can bring (Rotolo et al., 2015).

2-6. Experimental background

Based on the review of the researches carried out regarding the scope of the current research, there is no related empirical background in the scope and topic considered in government organizations.

2-7. The innovation aspect of the present research

Compared to the previous research, the current research has two aspects of innovation.

1) The issue of laziness or delay in moving towards new and emerging innovations has not been discussed independently in domestic research.
2) In terms of the subject, the present research has not been conducted in the domestic and foreign background in the field of government research organizations; As a result, it is novel in this respect.

3. Methodology

In terms of philosophy, the current research is in the interpretation and positivism paradigm, and in terms of the type of goal, it is in the category of applied research, and the research strategy is in the qualitative part of thematic analysis (Boyatzis, 1998) and with an inductive approach and in the quantitative part of the minimal method. least square was done. The method of data collection in the qualitative part was firstly theoretical sampling and then continued using the snowball technique until the theoretical saturation of the data resulting from in-depth semi-structured interviews with the experts of the government research organizations of the Islamic Republic of Iran as described in Table (2).

Table 2. Introduction of the group of interviewees

group of interviewees (Number)	Reason for selection	Important records related to the research topic
Academic experts (5)	Complete familiarity with the subject	Publication of at least one book related to the field of research
Experimental experts (10)	Practical biology with the scope of research	At least 10 years of concentration in the field of research and government research organizations and carrying out a national research project
Managers and policy makers (6)	Complete familiarity with the issues and concerns of innovative fields	Membership history of the Supreme Council of the Cultural Revolution (2) Record of membership in the Supreme Council of Ataf (3) Management in the scientific policy research center of the country (1)

In the quantitative part, the statistical population was the employees of government research organizations, and 270 samples were selected as statistical samples using Yamane's formula. In this research, a researcher-made questionnaire was used to collect data, and the data was analyzed using the technique of hierarchical component models using the Partial Least Squares (PLS) method in the SmartPLS4 software environment.

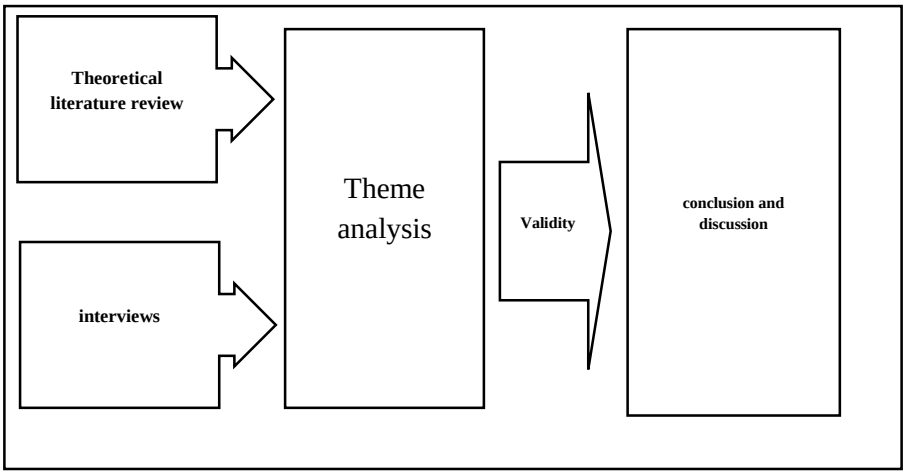

Figure 1. Research roadmap

4. Findings

After each interview with the experts of government research organizations as described in Table (1), the implementation interviews and initial concepts were assigned to semantic units; Among the 148 propositions or semantic units selected, 35 basic themes were extracted from the interviews, an example of which is presented in Table (2).

Table 3. Examples of the discovery of semantic units and basic themes from in-depth interviews

code	concepts	Basic themes
PA2	People may resist new ideas or ways of doing things, which can hinder innovation.	Resistance to change
PW4	Limited financial, human or technological resources can prevent innovation.	Limited resources
PF1	Fear of failure or uncertainty can deter individuals or organizations from taking risks and pursuing innovative ideas.	risk aversion
PQ14	An organizational culture that does not value or encourage innovation can stifle creativity and prevent the implementation of new ideas.	Lack of supportive culture
PK1	Inadequate collaboration and communication between team members or departments can hinder the sharing of ideas and inhibit innovation.	Lack of cooperation and communication
PE6	Without strong leadership support and commitment to innovation, overcoming obstacles and driving innovation initiatives can be challenging.	Lack of leadership support
PM2	Inefficient or rigid processes and procedures can slow the innovation process and make it difficult to implement new ideas.	Inefficient processes

In total, after merging 148 extracted themes, 35 basic themes were confirmed and organized into 7 organizing themes and 4 inclusive themes. In the following, the clustering of research findings based on the done coding is presented.

Table 4. Themes extracted from in-depth interviews with experts from research organizations

Organizer themes	Basic themes (frequency in interviews)
Resistance to change (individual barriers)	Resistance to new methods (3)
	Resistance to new ideas (7)
	Providing opportunities (5)
	Providing tools to express creativity and generate new ideas (2)
	Understanding new needs and preferences (8)
lack of resources (organizational barriers)	Funds (2)
	human resources (12)
	Technology resources (5)
	Limited financial resources (9)
	Limited human resources (4)
risk aversion (individual barriers)	fear of failure (7)
	Unreliability (11)
	Encourage risk taking (8)
	Testing innovative ideas and approaches (6)
	The experience of previous failures (8)
lack of supportive culture (cultural barriers)	Cooperation and teamwork (9)
	Cultivating a culture of teamwork (11)
	Sharing ideas and opinions (6)
	Not valuing organizational culture (4)
	Failure to encourage the owners of innovative ideas and views (7)
lack of cooperation and communication (organizational barriers)	Inadequate communication between team members (8)
	Lack of sharing of ideas and innovation (9)
	Creating an environment with open and transparent communication (8)
	Free flow of ideas (8)
	Providing an environment for innovative ideas (9)
lack of leadership support (organizational barriers)	Strong leadership (4)
	Leadership commitment to innovation (6)
	Creating an innovative culture (5)
	Encouragement by organizational leadership (7)
	Leading innovative initiatives (7)
Inefficient processes (technical barriers)	Inefficient processes and procedures (4)
	Hard processes and procedures (6)
	Understanding and incorporating new needs and preferences (6)
	Continuous learning (11)
	Relying on past experiences (12)

In the second part, after conducting in-depth semi-structured interviews with experts working in government research organizations, the network of themes extracted from the interviews after the validation and validity of the first part, the findings resulting in the design of a questionnaire containing the causes of laxity (each factor consisting of 5 indicator)

This questionnaire was used to collect data, and its validity was confirmed by three subject experts. The reliability of this questionnaire was checked using Cronbach's alpha coefficient as a pre-test (30 questionnaires) according to table (5). The results show that the questionnaire has reliability in all the investigated dimensions. A 7-level Likert scale was used to measure the variables (number 1 was equivalent to low importance and number 7 was very important).

Table 5. Cronbach's alpha values to check the reliability of the measurement tool

Organizer themes	Number of pointers	Cronbach's alpha
Resistance to change	5	0.79
lack of resources	5	0.77
risk aversion	5	0.73
lack of supportive culture	5	0.81
lack of cooperation and communication	5	0.75
lack of leadership support	5	0.83
Inefficient processes	5	0.80

The statistical population of this research included all the innovators of the government research organizations of the Islamic Republic of Iran in innovative units, numbering 820 people. The studied sample was selected according to the available method. This non-probability sampling method is common in qualitative research (Pakgohar & khalili, 2021). However, in cases where it is not possible to use probability sampling methods correctly in qualitative studies, it is considered an efficient method. It should be noted that the sample size (269 people) was determined through the formula (YAMANE, 1973) as follows:

$$n = \frac{N}{1 + N(e)^2} \qquad \textbf{equation (1)}$$

$$n = \frac{820}{1 + 820(0.05)^2} = 269$$

In this formula, n represents the sample size, "N" represents the population size, and "e" represents the accuracy level, which is considered equal to 0.05 (95% confidence). It should be noted that after distributing 270 questionnaires among the studied population, 269 questionnaires were finally received. Among the received questionnaires, those with missing or unanswered data were removed and finally 267 valid questionnaires were included in the final analysis.

Hierarchical component models technique (Ringle et al., 2022) was used to analyze the data using the partial least squares (PLS) method in the SmartPLS4 software environment. Unlike structural equation modeling approaches that are covariance-oriented, partial least squares modeling helps theory development in exploratory studies (Samie & Barati, 2023). In this method, theory development is done by focusing on explaining the variance of the dependent variable (Hair et al., 2016).

In this study, the main causes of laxity were considered in the form of a hierarchical model. The desired model consists of two component levels. The high-level component represents a high-abstract totality, and the low-level component represents the sub-dimensions related to the high-level totality (Hair et al., 2016). In fact, the indicators corresponding to each structure are loaded on their own structures first in a reflexive way (in the direction of the effect from the structure to the indicator) or constructively (in the direction of the effect from the indicator to the structure) and then each structure is loaded on a higher level structure. It becomes (reflection or development). Finally, all the markers that were loaded on their corresponding structure in the previous step are loaded once again on the high-level structure. Based on the loaded structure of markers, different models can be obtained. In this study, considering the concept of structures and markers, the reflective model has been used (Mehrabi & hematinejhad, 2023). This means that the direction of the effect is from the structure to the indicator, and for the structures, it is from the upper level structure to the lower level structures. In this study, the high-level component includes the causes of weakness and the low-level components include all its evident causes in the various links of the supply chain of emerging innovations. It should be noted that the low-level components are also measured by indicators that form a part of the model at the lowest level. In order to check the desired model, the factor loadings related to the indicators as well as the low and high level components were taken into consideration.

Estimation and evaluation of the model was done in two steps. In the first step, the measurement model that measures the relationship between each structure and its corresponding indicators was considered. In the second step, the relationship between low-level structures and high-level structures was evaluated. Factor loadings were used to check the appropriateness of indicators in measuring the relevant structure. Indicators with a factor load higher than the threshold value of 0.71 were retained in the model. To check the accuracy of the indicators in measuring the relevant structures, the significance of the t statistic was considered. The corresponding t values of each factor load were compared with a criticality of 1.96. It should be noted that in order to check the construct validity of the low-level components of the composite reliability indices (CR), the average variance extracted (AVE) And Cronbach's alpha was used. If these indices are respectively higher

than 0.6, 0.5 and 0.75, the reliability of the structures can be confirmed. The GOF index was used to check the overall fit of the model. The values of 0.01, 0.25 and 0.36 for this index indicate weak, medium and strong fit of the overall model, respectively.

As mentioned, 267 producers of emerging innovations in government research organizations were surveyed. Table (4) shows some of their demographic characteristics. According to the contents of this table, more than 75.6% of them were men. They were mainly in the age group of 45-55 years with an average age of 45.5. Most of them (45.3%) had a bachelor's degree. Also, more than 70% of them had work experience of 10-20 years. Table (6) provides more details about the personal-professional characteristics of the studied sample.

Table 6. Results of personal and professional characteristics of the studied sample (Source: research findings)

Percent	number of people	Category	Variable
75.6	202	male	gender
24.4	65	female	
100	267	total	
17.6	47	35≥	Age
24	64	35-45	
36.3	97	45-55	
22.1	59	≥55	
100	267	total	
30.7	82	Diploma and less	Level of Education
45.3	121	Masters	
24	64	Masters and above	
100	267	total	
12.3	33	≤10	Work Experience
72.7	194	10-20	
4.8	13	20-30	
10.1	27	≥31	
100	267	total	

6-1. Hierarchical component model of the causes of laxity in moving towards innovation

The causes of laxity were considered in the form of hierarchical components model. In this model, first, the low-level components were determined in the form of structures explaining the causes of waste (seven structures) along with their specific indicators (five indicators for each structure), and then all these structures were determined by a high-level structure that monitors the causes of waste in the entire supply chain. were explained. In the following, each of the hierarchical levels is estimated and evaluated separately.

6-2. Evaluation of the low-level component model

Considering that each of the low-level components have unique indicators, in this section, the validity and reliability of these structures are considered first. The results of table (7) show that all the structures located in the lower level have a composite reliability index value higher than 0.6. In this way, it can be seen that the studied structures have an acceptable composite reliability. Also, the values of Cronbach's alpha in these structures are more than the threshold of 0.75. The values of the AVE index for all these constructs are calculated to be higher than 0.5, which shows convergent validity in the target constructs. For example, the construct "weakness of operations and measures" has acceptable reliability and validity with Cronbach's alpha value of 0.831, composite reliability of 0.835, and average variance extracted (AVE) of 0.6.

Table 7. Validity and reliability results of the measurement model (source: research findings)

Organizer themes	Abbreviation	AVE	CR	Cronbach's alpha
Resistance to change	LOT	0.600	0.835	0.831
lack of resources	LPT	0.653	0.870	0.861
risk aversion	LMT	0.580	0.827	0.819
lack of supportive culture	LFT	0.703	0.826	0.893
lack of cooperation and communication	LKT	0.553	0.810	0.796
lack of leadership support	LTT	0.725	0.908	0.904
Inefficient processes	LDT	0.585	0.826	0.817

Table (8) shows the indicators corresponding to each of the low-level components after modifying the model. All these components (structures) equally have five markers. The indicators related to the first structure all have approximate factor loading values higher than 0.7. The t statistic related to these indicators is above the critical limit of 1.96, which shows the accuracy of the indicators in measuring their corresponding structure. Five specific indicators corresponding to the second structure (infrastructure weakness) have also been identified with factor loadings greater than 0.6. Although one of the indicators of this construct has a factor loading of less than 0.7, according to the recommendation of (Hair et al., 2016), the target of this indicator did not lead to the improvement of AVE values and therefore it was retained in the final model. This is also the case for other indicators with a factor load of less than 0.7.

The lack of supportive culture is also considered as another component, all of its indicators have a factor load of more than 0.7 and are also significant at the 5% error level (t-statistic above 1.96). For most of the indicators located in other components, the factor loading values are more than the approximate value of 0.7 and these indicators are significant at the 5% error level. This means that their factor loadings differ from zero with 95% confidence. In this way, it can be seen that the indicators have sufficient accuracy in measuring their corresponding structure. Table (8) shows the factor loadings of each indicator.

Table 8. Low-level components, indicators and factor loading values along with t values (source: research findings)

Organizer themes	Basic themes	Ab	FL	t
Resistance to change	Resistance to new methods	LO1	0.810	28.77
	Resistance to new ideas	LO2	0.773	24.83
	Providing opportunities	LO3	0.825	32.13
	Providing tools to express creativity and generate new ideas	LO4	0.768	19.27
	Understanding new needs and preferences	LO5	0.684	17.17
lack of resources	Funds	LP1	0.861	46.56
	human resources	LP2	0.604	14.14
	Technology resources	LP3	0.886	56.63
	Limited financial resources	LP4	0.796	24.21
	Limited human resources	LP5	0.860	45.21
risk aversion	fear of failure	LM1	0.723	20.60
	Unreliability	LM2	0.737	21.20
	Encourage risk taking	LM3	0.819	36.53
	Testing innovative ideas and approaches	LM4	0.738	20.56
	The experience of previous failures	LM5	0.785	30.50
lack of supportive culture	Cooperation and teamwork	LF1	0.820	38.08
	Cultivating a culture of teamwork	LF2	0.772	22.23
	Sharing ideas and opinions	LF3	0.824	40.56
	Not valuing organizational culture	LF4	0.903	66.00
	Failure to encourage the owners of innovative ideas and views	LF5	0.867	42.60
lack of cooperation and communication	Inadequate communication between team members	LK1	0.883	43.54
	Lack of sharing of ideas and innovation	LK2	0.743	25.56
	Creating an environment with open and transparent communication	LK3	0.706	20.28
	Free flow of ideas	LK4	0.760	23.19
	Providing an environment for innovative ideas	LK5	0.662	11.77
lack of leadership support	Strong leadership	LT1	0.905	72.06
	Leadership commitment to innovation	LT2	0.855	37.68
	Creating an innovative culture	LT3	0.758	28.18
	Encouragement by organizational leadership	LT4	0.886	60.00
	Leading innovative initiatives	LT5	0.845	35.65
Inefficient processes	Inefficient processes and procedures	LD1	0.741	27.09
	Hard processes and procedures	LD2	0.643	13.57
	Understanding and incorporating new needs and preferences	LD3	0.675	17.13
	Continuous learning	LD4	0.879	53.57
	Relying on past experiences	LD5	0.875	40.85

6-3. High-level component evaluation

To evaluate the high-level component model, it is necessary to examine the path coefficients and R2 values associated with two levels of the components of the hierarchical model. Table (9) shows the results related to these levels. As the standardized coefficients show, the lack of supportive culture is identified as the most important cause of laxity with a coefficient of 0.903. In fact, as the results show, more than 81% of the variance of this cause is explained by the causes of laxity.

Also, the factors of lack of resources, inefficient processes, and resistance to change have coefficients of 0.861, 0.853, and 0.852, respectively, with a slight difference. This shows that more than 70% of the changes of each of these factors are explained by the high-level factor. It should be noted that all the mentioned reasons have t values of more than 1.96 and thus it can be seen that the coefficients corresponding to them

have a significant difference from zero. It should be noted that the factors of risk aversion and lack of cooperation and communication with coefficients of 0.822 and 0.83 are of relatively lower importance in the set of causes related to the occurrence of delays in the innovation supply chain.

Table 9. Path coefficients of low-high level components, R2 values

Organizer themes high level	Organizer themes Low level	Ab.	Path coefficient	(T-VALUE)	R^2
Lack of leadership support	Strong leadership	LOT	0.852	39.26	0.726
	Leadership commitment to innovation	LPT	0.861	56.43	0.740
	Creating an innovative culture	LMT	0.822	40.97	0.676
	Encouragement by organizational leadership	LFT	0.902	80.78	0.813
	Leading innovative initiatives	LKT	0.830	35.18	0.690

The hierarchical component model related to the causes of laxity can be seen in Figure (2). This model depicts both low and high levels at the same time. The values located in the center of the structures represent the R2 value and the other values show the factor loadings (standard coefficients). Considering that the amount of R2 for three values of 0.25, 0.5 and 0.75 indicates weak, medium and strong variance explanation respectively (Hair et al., 2016), it can be seen that most of the structures have The explanatory coefficient is high.

It should be noted that figure (3) also depicts the values of t statistic for each of the low-level structures and their corresponding indicators. All these values are above the critical limit of 1.96 and therefore are considered significant at the 5% error level.

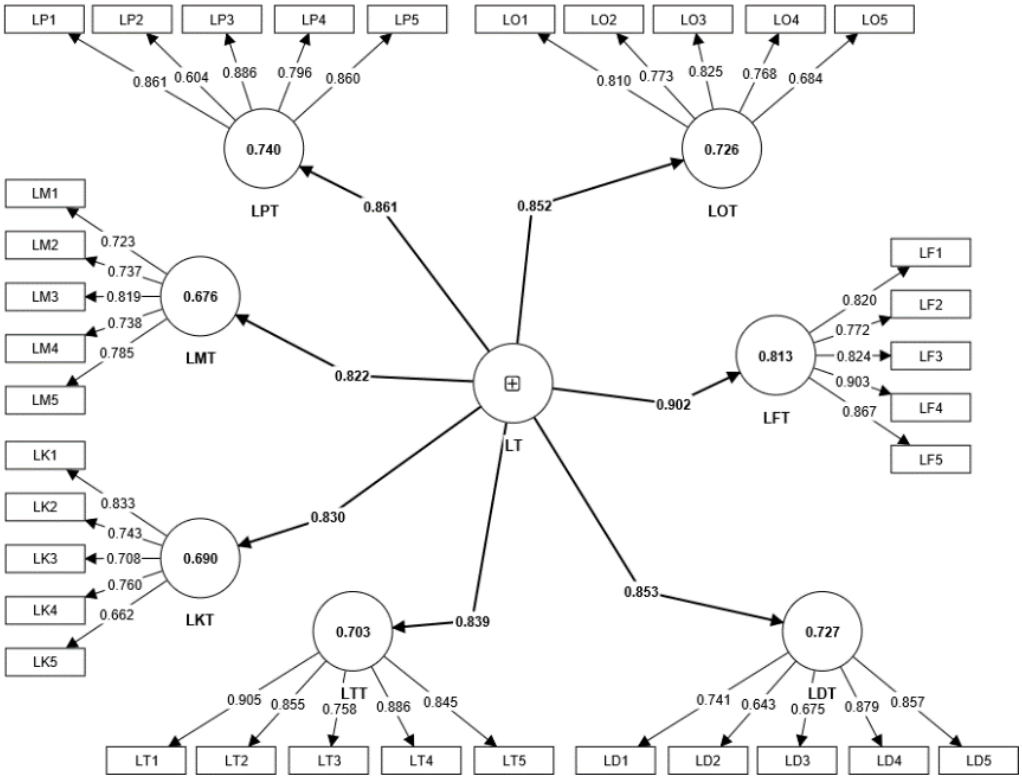

Figure 2. Standard coefficients of the hierarchical component model related to the causes of laxity in moving towards innovation

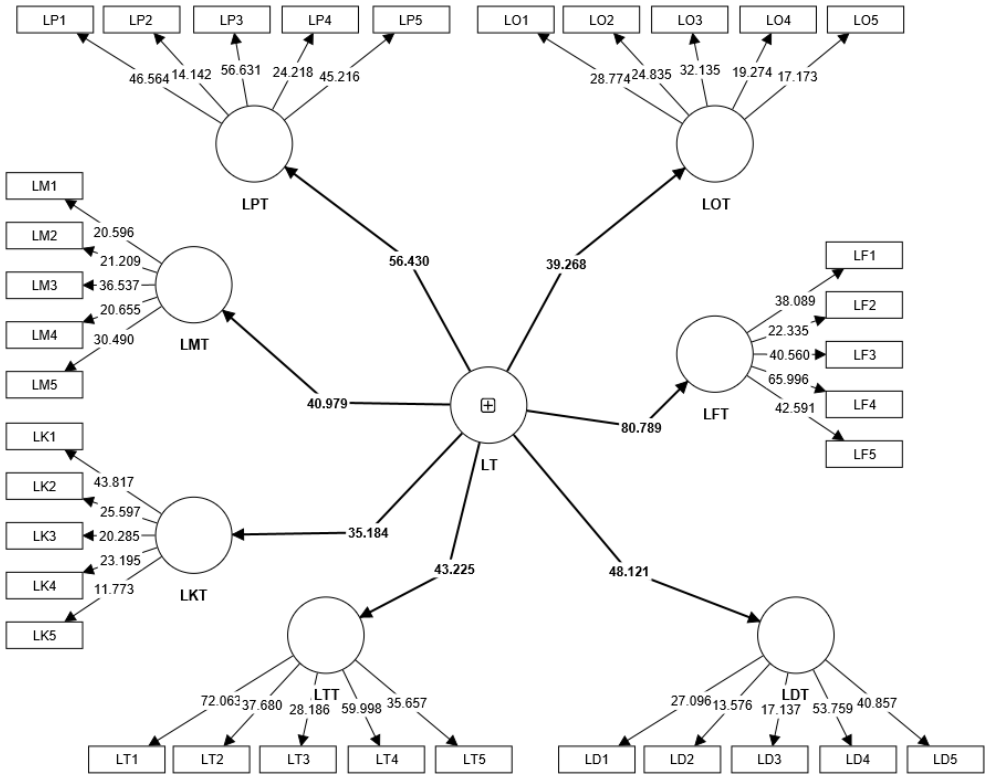

Figure 3. t values of the hierarchical component model related to the causes of laxity in moving towards innovation

6-4. Model validation

GOF is used to check the fit of the overall model in the partial least squares method. This criterion is calculated based on the average sharing rate and the average explanation coefficient. The average degree of sharing represents the average of the squared standard factor loadings and the average explanatory coefficient is obtained by calculating the average explanatory coefficient of the seven research constructs (Figure 1 or Table 8). Equation (2) shows the details of fit calculation. According to three values of 0.01, 0.25 and 0.36 which are considered as weak, medium and strong values for GOF, it can be seen that the value calculated for the research model (0.673) indicates a very good fit. It is suitable for the general model.

$$GOF = \sqrt{\overline{communalities} \times \overline{R^2}}$$ Equation (2)

In this equation, GOF represents the model fit index, communalities represents the average square power of the factor loadings, and R^2 represents the average explanatory coefficients of the model structures.

7. Discussion

The present study was conducted with the aim of identifying the causes of laxity and providing a strategic plan to reduce it. Based on the findings of the research, seven constructs including resistance to change, lack of resources, risk aversion, lack of support culture, lack of cooperation and communication, lack of leadership support and inefficient processes, which were responsible for the causes of weakness, were taken into consideration along with their corresponding specific indicators. The results showed that the lack of supportive culture is the most important cause of laxity. In this structure, low-level structures including cooperation and working group, fostering a culture of teamwork, sharing ideas and views, not valuing organizational culture, not encouraging the owners of innovative ideas and views, have formed the indicators of the lack of support culture. As the standardized coefficients show, the lack of supportive culture is identified as the most important cause of laxity with a coefficient of 0.903. In fact, as the results show, more

than 81% of the variance of this cause is explained by the causes of laxity, which is similar to the research (Hair et al., 2016).

Based on the results of the research, risk aversion was suggested as the least important cause of laziness. In this structure, the low-level structures included fear of failure, insecurity, encouragement to take risks, testing innovative ideas and approaches, and experiencing previous failures, and as the results show, 67.6% of the variance of this cause is explained by the causes of weakness, which is reports the lowest value to others.

Also, the results showed lack of resources, inefficient processes and resistance to change with coefficients of 0.861, 0.853 and 852 respectively. With a slight difference to each other and after the lack of supportive culture structure, they have the greatest effect on the formation of laxity in research organizations. This result is similar to parts of the researches of (Noruzi et al., 2023) and (Rotolo et al., 2015).

In this research, the high-level component includes the causes of weakness and the low-level components include all its obvious causes in the various links of the supply chain of emerging innovations. It should be noted that the low-level components were also measured by indicators that form part of the model at the lowest level. To check the desired model, the factor loadings related to the indicators as well as the low and high level components were taken into consideration.

8. Practical suggestions and suggestions for future research

1) It is suggested to investigate the origin of emerging technologies in the Islamic Republic of Iran. Due to the limited knowledge in this regard, future researches can be done around determining the factors and conditions for the emergence of new and innovative technologies.

2) Given the increasing access to full-text publications, data, and big data, it offers significant opportunities for future research in the field of scientometrics. As a result, it is suggested to develop indicators and methods to evaluate the characteristics of emerging and innovative technologies using these data sources.

3) Since the detection of emerging technologies relies on data, it is suggested that future researches focus on developing frameworks and methodologies to structure the discovery of new data sources for the detection of emerging technologies.

4) Future research can examine the impact of emerging and innovative technologies on various aspects, such as society, economy, environment and policy. Understanding the implications and implications of emerging technologies can help decision-making and policy development.

5) The emergence of innovation is not only influenced by technological factors, but also by social and cultural dynamics. It is suggested to investigate the role of social and cultural factors in the emergence of innovation, including the influence of values, norms and social expectations in future researches.

Authors Contributions

Khalil Noruzi: Conceptualization, Methodology, Software, Data curation, Writing- Original draft preparation, Visualization, Investigation. **Mohammad Hossein Shadmanfar**: Supervision. Software, Validation, Writing-Reviewing and Editing

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Conflicts of Interest

The authors declare no conflict of interest related to this publication.

References

- Arranz, N., Arroyabe, M. F., Molina-García, A., & Fernandez de Arroyabe, J. C. (2019). Incentives and inhibiting factors of eco-innovation in the Spanish firms. *Journal of Cleaner Production*, *220*, 167-176. https://doi.org/https://doi.org/10.1016/j.jclepro.2019.02.126
- Boyatzis, R. E. (1998). *Transforming qualitative information : thematic analysis and code development*. Sage Publications Thousand Oaks, CA.
- Chen, J., Yin, X., & Mei, L. (2018). Holistic Innovation: An Emerging Innovation Paradigm. *International Journal of Innovation Studies*, *2*(1), 1-13. https://doi.org/https://doi.org/10.1016/j.ijis.2018.02.001
- Chiaroni, D., Chiesa, V., & Frattini, F. (2011). The Open Innovation Journey: How firms dynamically implement the emerging innovation management paradigm. *Technovation*, *31*(1), 34-43. https://doi.org/10.1016/j.technovation.2009.08.007
- Clausen, J., & Fichter, K. (2019). The diffusion of environmental product and service innovations: Driving and inhibiting factors. *Environmental Innovation and Societal Transitions*, *31*, 64-95. https://doi.org/https://doi.org/10.1016/j.eist.2019.01.003
- Delgado, R., Stefancic, J., & Harris, A. (2023). *Critical Race Theory, Fourth Edition: An Introduction*. NYU Press. https://books.google.com/books?id=tqCUEAAAQBAJ
- Fagerberg, J., Martin, B. R., & Andersen, E. S. (2013). *Innovation Studies: Evolution and Future Challenges*. OUP Oxford. https://books.google.com/books?id=I29pAgAAQBAJ
- Farmer, S. M., Lorenz, M. P., & Ramsey, J. R. (2023). The innovation paradox of global work: Does cultural tightness shape or constrain innovative behaviour? *Journal of Occupational and Organizational Psychology*, *n/a*(n/a). https://doi.org/https://doi.org/10.1111/joop.12463
- Hair, J. J. F., Sarstedt, M., Matthews, L. M., & Ringle, C. M. (2016). Identifying and treating unobserved heterogeneity with FIMIX-PLS: part I – method. *European Business Review*, *28*(1), 63-76. https://doi.org/10.1108/EBR-09-2015-0094
- Halaweh, M. (2013). Emerging Technology: What is it? *Journal of technology management & innovation*, *8*(3), 19-20. https://doi.org/10.4067/s0718-27242013000400010
- Hiwatari, T., Harada, F., & Shimakawa, H. (2023). Human Interaction and Emerging Technologies (IHIET 2023), Vol. 111, 2023, 102-109. *Human Interaction & Emerging Technologies (IHIET 2023): Artificial Intelligence & Future Applications*, 102. https://doi.org/https://doi.org/10.54941/ahfe1004014
- Mehrabi, G., & hematinejhad, m. (2023). Theoretical and Experimental Considerations of Designing a Formative and Reflective Measurement Model. *Sport Management Studies*, *14*(76), 43-74. https://doi.org/10.22089/smrj.2020.8626.2946
- Mollanouri Shamsi, E., & Noruzi, K. (2023). Extracting the knowledge of networks in solving the innovative military bottlenecks of the Islamic Republic of Iran during the era of holy defense. *Scientific Journal of Strategic Management of Organizational Knowledge*, *6*(1), 193-220. https://jkm.ihu.ac.ir/article_207920.html
- Noruzi, K., Hajihasani, s., Khatami, H., khatami, M. E. K., & Yaghoubalipour koundelaji, A. (2023). Examining Sardar Soleimani's military management innovations in the resistance front. *Basij Strategic Studies*, *25*(97.2), 33-69. https://www.bsrq.ir/article_167402.html
- Pakgohar, A., & khalili, m. (2021). Investigation of sample size in qualitative sampling methods. *Popularization of Science*, *12*(1), 270-297. https://doi.org/10.22034/popsci.2021.286809.1090
- Ringle, C. M., Wende, S., & Becker, J.-M. (2022). SmartPLS 4. Oststeinbek: SmartPLS GmbH. *J. Appl. Struct. Equ. Model.*
- Rotolo, D., Hicks, D., & Martin, B. R. (2015). What is an emerging technology? *Research Policy*, *44*(10), 1827-1843. https://doi.org/https://doi.org/10.1016/j.respol.2015.06.006
- Samie, M. E., & Barati, F. (2023). The effect of knowledge management on the performance of technology commercialization with the mediating effect of organizational innovation. *Knowledge Retrieval and Semantic Systems*. https://doi.org/10.22054/jks.2023.70236.1538
- White, M. A., & Bruton, G. D. (2010). *The Management of Technology and Innovation: A Strategic Approach*. Cengage Learning. https://books.google.com/books?id=-bY8AAAAQBAJ
- YAMANE, T. (1973). *Statistics. An introductory analysis. Third edition*. Harper & Row. https://books.google.com/books?id=sl75MgEACAAJ