

# The Mediating Role of Hard Quality Management in the Relationship Between Soft Quality Management and Innovation Performance

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## Abstract

**Purpose-** Hard and soft quality management are known as two important dimensions of total quality management (TQM) that can improve the performance of manufacturing and service organizations. The paper aims to examine the effect of soft quality management (soft QM) on innovation performance (IP) with the mediating role of hard quality management (hard QM).

**Design/Methodology-** A questionnaire was designed for the model test and distributed among 130 small and medium-sized enterprises (SMEs) in Golpayegan industrial town located in Iran. PLS-SEM was used to analyze the data.

**Findings-** The results showed that soft QM affects hard QM and IP. Also, the impact of hard QM on IP was confirmed. The mediating role of hard QM in the relationship between soft QM and IP was also confirmed.

**Practical Implications-** The findings of this research encourage managers of SMEs to focus attention on hard and soft QM simultaneously to improve innovation performance in companies.

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## Introduction

In recent years, competition has increased worldwide and organizations must focus on innovation to have a long-term competitive advantage. However, researchers show that as technology becomes more specialized and complex, the risk of development and the rate of failure of innovative activities increases (Rehman et al., 2023). Innovation causes economic growth in countries (Hameed et al., 2021). Innovation performance is one of the key results of innovation. Given that economic growth is linked to innovation, innovation performance has long been a topic of interest in the contemporary business context. Innovation performance is defined as the application of innovative capabilities to outcomes that lead to market success (Robertson et al., 2023). Innovation performance is the result of different management strategies implemented in the business practices of companies. Studies have examined innovation performance in terms of product and process innovation. Product innovation performance is defined as the successful introduction of goods and services to the market, while process innovation performance is characterised by the implementation of new processes in a company's operational activities (Hurtado-Palomino et al., 2022). Meanwhile, the quality of products and services of small and medium-sized enterprises (SMEs), which are closely related to the supply chain of larger companies, plays an important role in creating innovation and economic progress in developing countries (Masoudi, 2021). Entrepreneurial companies such as SMEs are committed to accepting risks to be the first company to provide new products, services and operational technologies, which shows that these companies have a great tendency to implement innovative strategies (Masoudi and Shahin, 2021). One of the important sources in creating and improving innovation that plays an important role in sustainable economic development in countries is SMEs (Gumel, 2019).

Organizations use different methods to improve innovation performance in offering new products and services. For example, in the production sector, Andersson et al. (2020) showed in their research that psychological safety has an impact on innovation performance among Norwegian SMEs. In their research, Ardito et al. (2021) showed that digital and environmental orientation affects the innovation performance of North American SMEs. Rehman et al. (2023) showed in their research that intellectual capital and the Internet of Things affect the performance of innovation in the automotive industry of Pakistan. Also, in the service sector, Al-Sabi et al. (2019) pointed out in their research that quality management and innovation performance are the primary keys to improving productivity, profitability and ultimately customer satisfaction, as well as part of the set of management techniques in dealing with many challenges such as competitiveness, economic changes and advanced technologies in the service organizations. Al-Sabi et al. (2023) showed in research that employee empowerment affects innovation performance among five-star hotels in Jordan. In research in the banking sector, Ahinful et al. (2024) concluded that total quality management (TQM) impacts innovation performance. From the past until now, TQM has been considered because of its importance in improving the overall performance of organizations (Kalogiannidis, 2021). Implementing TQM in organizations has many benefits including improvement in financial results, operational performance, and customer and employee satisfaction (Talib et al., 2013). Quality management (QM) improves teamwork among employees of organizations and causes employees to provide innovative ideas to improve products, services, and processes. This has finally made organizational structures flexible, which is one of the vital factors in creating innovation (Zeng et al., 2017). Also, QM systems significantly affect the reputation of organizations and customer trust, and with this, competitors' efforts in introducing new products and services to meet customer expectations will increase (Masoudi and Shahin, 2022).

Researchers have identified two dimensions of TQM: soft and hard. Soft quality management (soft QM) focuses on the behavioural characteristics of QM from the point of view of social aspects and the organization's culture in dealing with people. In contrast, hard quality management (hard QM) focuses on technical aspects through scientific methods and statistical tools. The classification of QM into two soft and hard dimensions is supported

by the socio-technical systems (STS) theory researched by Manz and Stewart (1997). In this theory, soft QM are those that affect the social subset and hard QM are those that affect the technical subset. Also, this theory states that the simultaneous use of hard and soft QM is more productive than when they are used alone (Sciarelli et al., 2020). The use of the hard elements of TQM to increase performance has been recognized by researchers because it tends to complement the soft elements of TQM (Oji and Oke, 2021). Various quality-related tools or techniques are usually associated with hard elements, while soft elements are related to operational management procedures. Both types of elements play an important role in quality management systems, but soft QM has been shown to have a greater impact on performance than hard QM (Lepistö et al., 2023). Existing literature shows that soft and hard quality management can foster innovation because it fosters an environment and culture that supports innovation by recognizing customer needs, promoting knowledge sharing, training, commitment, and participation and work systems are continuously improved. Quality management practices correspond to aspects that are fundamental to innovation: customer orientation, promotion of flexible organizational structures, strengthening of independence and creativity in employees, teamwork, employee participation and supplier participation (Segarra-Ciprés et al., 2020). Also, according to the theory of socio-technical systems (STS), soft QM is part of broader changes in human resource practices, while hard QM is a limited set of technical tools. Soft QM are the philosophical aspects related to management concepts and principles while hard QM are the technical aspects that refer to management tools, techniques and practices. Soft QM deals with behavioural and people dimensions, while hard aspects relate to tools and systems. Soft QM corresponds to social and behavioural factors, while hard QM is related to design, implementation and technical improvement. Soft aspects use organizational development techniques to facilitate change while hard QM adopts methodological and technical strategies to deal with design, implementation and improvement. Soft aspects include behavioural characteristics, including people and organizational culture, while hard QM focuses on scientific methods and statistical tools, and for this reason, soft QM can influence hard QM (Babatunde, 2021).

SMEs must adopt mechanisms to overcome specific challenges limiting their business performance. The implementation of TQM widely in many SMEs in different sectors has resulted in maintaining stability, improving business performance and achieving competitive advantage, and it leads to the satisfaction of customers and employees. However, compared to large organizations, SMEs have performed poorly in adopting QM tools such as TQM. Especially in developing countries, most SMEs lack efficient structures to achieve long-term quality goals. Because the performance of innovation and attention to quality and customer are the main characteristics of leading organizations in today's era, as a result, these conditions have created a suitable field for researchers in this field. This issue is especially important in industrial towns whose goal is to create entrepreneurship and innovation with quality indicators. Accordingly, in the current research, the mediating role of hard QM in the relationship between soft QM and innovation performance among SMEs has been discussed.

Very few studies have studied the mediating role of hard QM in the relationship between soft QM and IP. Also, in this field, no research has been done in Iran and among SMEs located in industrial towns. Rahman and Bullak (2005) showed in their research that soft QM affects hard QM. Zeng et al. (2015) showed in their research that soft QM has an effect on hard QM and hard QM has an effect on IP. Kanapathy et al. (2017) concluded in their research that soft QM affects IP. In another study, Zeng et al. (2017) showed that soft QM affects hard QM. Gambi et al. (2020) showed in their research that soft QM affects hard QM. Sciarelli et al. (2020) showed in their research that soft QM affects hard QM. Nasaj and Marri (2020) in a study in the UAE service sector showed that soft QM has an effect on hard QM and IP, and hard QM has an effect on IP. Also, the research results showed that hard QM has a mediating role in the relationship between soft QM and IP. Tari et al. (2023) showed in their research that soft QM affects hard QM.

In the continuation of this paper, first, the theoretical foundations are introduced and defined, then the proposed research model and its assumptions are presented, and the research method is explained. The desired model is tested in a practical study and finally, according to the obtained results, a discussion and conclusion are made.

## Literature Review

### Innovation Performance

One of the important benefits of innovation is that companies can move ahead of their competitors (Eze et al., 2019). Innovation can be created through individuals or organizations. It is a process that starts with an idea, progresses through improvements, and ends with a new output such as a process, product, or service (Kutieshat and Farmanesh, 2022). Also, innovation is the source of entrepreneurial activities, especially for SMEs. The ability of organizations to create value through new ideas, processes, products and services has been defined as innovation performance (Chávez-Rivera et al., 2024). Innovation performance refers to the development of new programs, services, and products or changes in existing programs, services, and products (Benitez et al., 2022). Organizations meet market needs by innovating to overcome limitations by applying changes in products and services. For example, electric cars like Tesla were produced for environmentalists (Chang et al., 2024). Innovation performance refers to the development and application of new things for which employees have not yet learned the required strategies and knowledge, which helps to sustain the effectiveness of the organization by learning the required knowledge. Innovation performance refers to the degree to which an employee creates and implements creative and valuable ideas in the organization. Innovation performance is essential to help organizations design and develop sustainable competitive advantage, which shows why creativity and innovation are essential in any company to enhance performance. Therefore, innovation performance plays an important role in promoting organisational innovation (Singh et al., 2021). Innovation performance is very important for the survival and development of a company because it reflects the result of the innovative behaviour of the company. At the individual level, innovation performance refers to original and valuable products, ideas or projects, and at the organizational level, innovation performance refers to the successful implementation of original ideas (Zhang et al., 2023).

According to the research of Escrig-Tena et al. (2018), innovation performance consists of two dimensions product innovation and process innovation. Production innovation is the newness of a company's products; Using the latest technological innovations in the creation of new products; It refers to the speed of new product development and the number of new products that the company introduced to the market for the first time. Process innovation to the company's competitiveness from a technological point of view; the speed of using the latest technological innovations in processes; It refers to the up-to-dateness or newness of the technologies used in the processes and the rate of change in the processes, techniques and technologies used in the company (Escrig-Tena et al, 2018).

### Hard Quality Management

Researchers have identified two dimensions of TQM, namely soft QM and hard QM (Psomas et al., 2014). Hard QM, while more easily expressed in quantity, is also system-oriented. It generally hard QM deals with benchmarking, quality assurance, just-in-time, flexibility, quality systems, continuous improvement and innovation, zero defect, , information and performance measurement, process management, strategic planning, process control and product/service design (Lewis et al., 2006; Daud and Yusoff, 2011). Hard QM includes work process control and production techniques such as just-in-time philosophy, process design, ISO 9000 standard and seven main quality control tools that can ensure proper performance of processes such as flow charts, run charts, control charts, brainstorming, Pareto charts, tree diagrams, histograms, scatter diagrams, force-field analysis (Abdullah and Tari, 2012). Hard QM elements are important pillars that influence the

progress of quality management in organizations and provide tremendous benefits to the system. The success of any management decision and project depends on the correct selection of hard QM elements to complement the soft aspects (Oji and Oke, 2021).

According to the research of Ali et al. (2022), hard QM from three dimensions of process management, quality information & analysis advanced manufacturing technology is formed. Process management to standardized operational processes in the organization; reducing the possibility of human error; and having the latest technologies and equipment; It refers to the inspection and tracking of key critical processes of the organization and the continuous improvement of processes to ensure the quality of products. Analysis and quality information to analyze data and organisational costs; review of customer and market-related data; keeping hardware and software systems up to date and information technology; Refers to benchmarking the performance of other industries and using the Internet to provide high-quality data and information to employees, customers, and suppliers. Advanced manufacturing technology uses computer-aided design; and computer-aided manufacturing; The flexible production system uses robotics in the production system and design validation (Ali et al., 2022).

### **Soft Quality Management**

Soft QM to behavioural aspects of people such as loyalty, training and education, leadership, human resource utilization teamwork, empowerment, customer focus and satisfaction, contacts with suppliers and professional associates, integration of the voice of customer and supplier, communication, performance awards, quality culture and social responsibility (Lewis et al., 2006; Daud and Yusoff, 2011). Soft QM refers to behavioural and human aspects of management such as people management and leadership (Abdullah and Tari, 2012). The failure of TQM programs has been attributed to the lack of attention paid to the soft side of QM by organizations, and teamwork, employee involvement, and top management commitment have been emphasized as essential to the success of a TQM strategy. The literature showed that the most advanced criteria for ensuring TQM success are "soft" in nature and rank high in importance and emphasis in the TQM implementation process. Soft factors are usually difficult to measure and evaluate, while hard factors are more systemic (Ahmed and Idris, 2020).

According to the research of Zeng et al. (2017), soft QM consists of three dimensions: small group problem solving, employee suggestion and task-related training for employees. Small group problem-solving uses members' ideas and opinions before making decisions; It refers to having problem-solving teams to solve problems and encouraging employees to try to solve their problems. Employee suggestion refers to reviewing suggestions for product and process improvement and encouraging employees to make suggestions and finally, task-related training for employees refers to regular training and improving the skill level of employees (Zeng et al., 2017).

### **The Relationship between Soft QM and IP**

The tendency to have innovation in organizations has a direct impact on the performance of organizations due to the creation of competitive advantage (Kumar et al., 2024). Implementing QM in organizations can identify innovation potentials, improve innovation programs, and create new innovative products, services, and processes. Effective process management in organizations can help create a learning base and support innovative activities (Perdomo-Ortiz et al., 2006; Peng et al., 2008). Soft QM that is related to employee empowerment, participation and teamwork helps innovation. Soft QM enables communication between employees and supports the suggestion of creative ideas that are essential for innovation. Soft QM emphasizes that it can help achieve rapid product innovation by creating teamwork and encouraging employees to give creative ideas. For this reason, soft QM can help create and improve innovation performance (Zeng et al., 2015). Therefore, the following hypothesis is proposed:

*H1: Soft quality management impacts innovation performance.*

## **The Relationship between Soft QM and Hard QM**

QM practices such as process management, quality information and advanced manufacturing technology, which are mainly technical and tool-oriented, fall into the hard QM category. However, just having great technology and hard quality tools may not be enough to increase competitive advantage. According to Kochan et al. (1995), to have good quality products, apart from having related techniques and tools, motivated and capable employees and good leadership by managers are needed to achieve maximum employee efficiency. These can be achieved with soft QM (Zeng et al., 2015). Soft QM influences hard QM because soft QM allows organizations to improve relationships between customers and suppliers by promoting employee training and participation. Better customer-supplier relationships allow customers' needs to be identified more quickly, which ultimately leads to improvements in products and processes (Tarí et al., 2023). Therefore, the following hypothesis is proposed:

*H2: Soft quality management impacts hard quality management.*

## **The relationship between hard QM and IP**

TQM acts as a catalyst for innovation performance and therefore provides the necessary platform for creating innovation in organizations (Miranda Silva et al., 2014). About the impact of hard QM on innovation performance, quality information and process management, it helps employees by identifying non-value-added processes during process improvement. This process is effective in speeding up production and bringing the new product to the market. In this regard, quality information & analysis is the most important QM method that can help in innovation-related activities (Zeng et al., 2015). Also, process control management can lead to improvements in identifying critical activities leading to process innovation through problem solving and testing. Process management requires the use of new technologies. In addition, having excellent process management leads to the development and creation of new products and a faster response to changing markets. Consequently, hard QM can contribute to product and process innovation. (Escrig-Tena et al., 2018). Therefore, the following hypothesis is proposed:

*H3: Hard quality management impacts innovation performance.*

## **The Mediating Role of Hard QM in the Relationship between Soft QM and IP**

Quality has a great impact on the credibility of companies and the trust of customers and for this reason, it has become the most important decision-making factor (Masoudi and Shahin, 2022). Therefore, companies aim to achieve high quality and high innovation performance simultaneously to increase productivity or profit (Manders et al., 2016). One of the main factors determining the success and survival of companies is TQM, which consists of two dimensions, soft and hard. The goal of TQM is to maintain continuous improvement and meet customer needs. Implementation of hard and soft QM in manufacturing organizations increases efficiency and effectiveness and reduces production costs (Kanapathy et al., 2017). The achievements obtained from the application of QM lead to the improvement of innovations in increasing performance. For example, organizations that use soft QM and coordinate their activities with their suppliers can offer their products and services in the best way to their customers. Also, the use of soft QM by empowering employees and improving teamwork makes employees present ideas for improving products and services to the management of the organization. Also, the use of hard QM in organizations leads to better management of organizational processes and data and makes organizations use their resources in the best way, which ultimately facilitates the development of quality products and innovations. (Tarí et al., 2023). According to the theory of technical-social systems, a successful system is the result of the simultaneous cooperation of the technical, organizational and

social aspects of the system, which expresses the relationship between soft and hard QM. However, merely upgrading technology and technical dimensions (hard QM) that are easy to imitate and adopted by competitors may not necessarily increase competitive advantage over time. For this reason, the use of expert human resources (soft QM) is needed to identify and eliminate quality-related defects (Zeng et al., 2017). Hard and soft quality management is related to eliminating waste and increasing efficiency with product and process innovation (Nasaj and Marri, 2020). Hard and soft quality management can provide opportunities for R&D technicians to apply QM principles and techniques to innovative activities. This has led to the identification of opportunities and needs of customers, which causes the sharing of produced knowledge and the improvement of work systems (Kim et al., 2012). Therefore, the following hypothesis is proposed:

*H4: Hard QM mediates the relationship between soft QM and IP.*

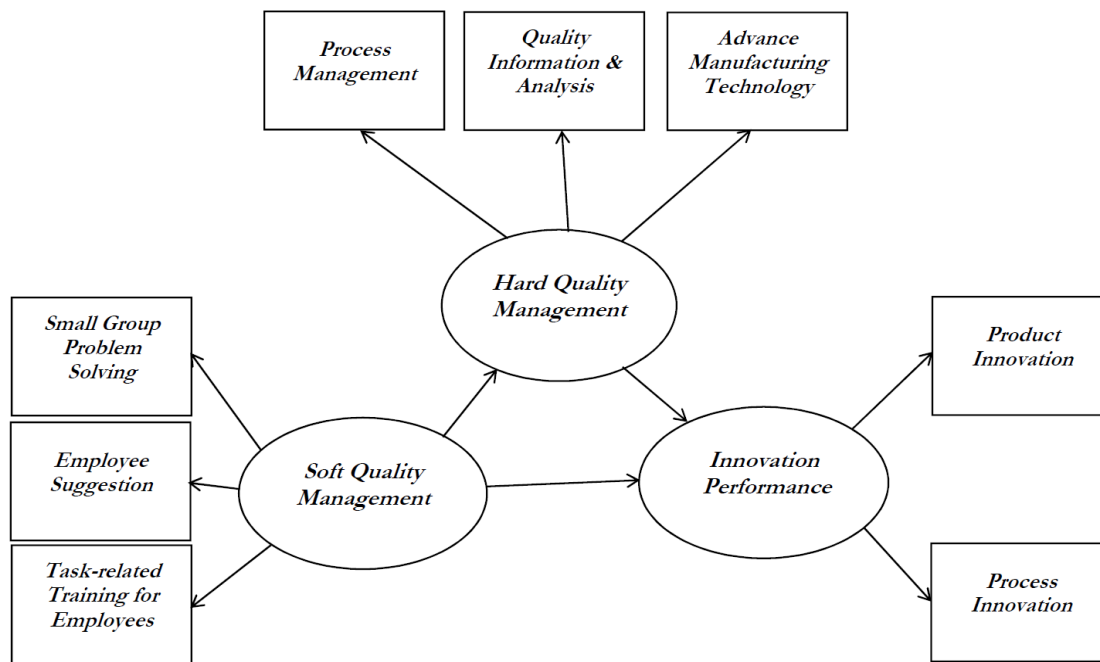


Figure 1. Research model

Figure 1 illustrates the proposed conceptual model. As it is known, the independent variable in this research is soft QM, the dependent variable is IP, and the mediating variable is hard QM.

## Research Methodology

### Measurement Instrument

The questionnaire was used to measure research variables. The questionnaire consisted of two parts, the first part included the demographic information of the respondents and included 4 items (Table 1). The second part was the items related to the research variables, which were measured based on a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). For the soft QM variable, we used the Zeng et al. (2017) questionnaire. This questionnaire measures soft QM with 16 items and includes 3 dimensions: Small group problem solving (6 items), employee suggestion (5 items) and task-related training for employees (5 items). For the hard QM variable, we used the Ali et al. (2022) questionnaire. This questionnaire measures hard QM with 18 items and includes 3 dimensions: process management (5 items), quality information & analysis (8 items) and advanced manufacturing technology (5 items). For the innovation performance variable from the questionnaire of Escrig-

Tena et al. (2018), we used. This questionnaire measures IP with 9 items and includes 2 dimensions of product innovation (5 items) and process innovation (4 items). Three expert academics and two senior industry experts reviewed the survey items to check the content validity of the survey.

## Population, Sample Size and Respondents

The quality managers of SMEs in the Golpayegan industrial town of Isfahan province constitute the statistical population of this research. A simple random sampling method was used to collect data in the winter of 2024. To determine the required sample size in PLS-SEM, G\*Power software was used to perform power analysis related to model settings (Hair et al., 2014). In this research, 130 observations were needed to reach 80% statistical power and detect R2 values of at least 0.1 with a 5% error probability by G\*Power software.

Table 1. Demographic analysis of research

	Sample (%)		Sample (%)
<b>Industry sector</b>		<b>Duration of the company</b>	
<b>Metals</b>	13.07	<10 years	20.77
<b>Chemical</b>	8.46	10-20 years	54.61
<b>Food</b>	11.54	>20 years	24.62
<b>Machine manufacturing</b>	15.39		
<b>Building Materials</b>	25.39		
<b>Plastics</b>	20.00		
<b>Others</b>	6.15		
		<b>No. of employees</b>	
		<50	47.70
<b>Respondent's work experience</b>		50-100	24.62
<b>&lt;10 years</b>	48.46	101-150	13.07
<b>10-20 years</b>	36.15	151-200	9.23
<b>&gt;20 years</b>	15.39	>200	5.38

## Results

Because the sample size of the study was small ( $n=130$ ) and by performing the Kolmogorov Smirnov (K-S) test, it was determined that the distribution of the structures was not normal at the level of  $\alpha=0.05$ , for this reason, PLS-SEM was used to analyze the data (Hair et al., 2012). For this reason, SMART-PLS version 3 was used to measure and model relationships between variables.

According to Chin (2010), the analysis of studies by PLS consists of two stages evaluation of the external model (measurement) and estimation of the internal model (structural), and the tests of the measurement model are used to check the validity and reliability of the structures. As can be seen in Table 2, all factor loadings of the constructs are above 0.7, which indicates the validity of the proposed model (Chin, 1998; Hair et al., 2010).

To check the reliability of the external model, Cronbach's alpha ( $C-\alpha$ ), composite reliability (CR), Dijkstra-Hensler index ( $Rho\_A$ ) and average variance extracted (AVE) were used, which as can be seen in Table 2,  $C-\alpha$  and CR are more than 0.7 and the reliability of the variables has been confirmed. AVE was also higher than 0.5 for all constructs, which was confirmed (Hair et al. 2014). Also, the value of CR was higher than AVE, which indicates the confirmation of composite reliability (Bagozzi and Yi, 1988).

As seen in Table 2, all VIFs are less than 3.3, which shows that the model is free from common method bias (Kock, 2015). Tables 3 and 4 show the discriminant validity results. It is shown in Table 4 that all the variables are consistent with the criteria proposed by Fornell and Larcker (1981) because all the AVE squares of the variables were higher than the correlation of that variable with other variables. Table 5 also shows that the HTMT indices were less than 0.9 and discriminant validity is established (Henseler et al., 2015).



Table 2. Measurement Model

Variable	Dimensions & Label	Factor Loading (Min-Max)	VIF (Min-Max)	C- $\alpha$	Rho_A	CR	AVE
<b>Soft Quality Management (soft QM)</b>	Small Group Problem Solving (SGPS)	(0.777-0.859)	(2.055-3.031)	0.896	0.897	0.921	<b>0.659</b>
	Employee Suggestion (ES)	(0.716-0.850)	(1.666-2.433)	0.851	0.860	0.894	<b>0.628</b>
	Task-related Training for Employees (TRTE)	(0.702-0.865)	(1.571-2.222)	0.820	0.839	0.874	<b>0.583</b>
<b>Hard Quality Management (hard QM)</b>	Process Management (PM)	(0.751-0.864)	(1.688-2.770)	0.876	0.878	0.910	<b>0.670</b>
	Quality Information & Analysis (QIA)	(0.731-0.806)	(1.908-2.622)	0.900	0.902	0.919	<b>0.588</b>
<b>Innovation Performance (IP)</b>	Advance Manufacturing Technology (AMT)	(0.770-0.877)	(1.772-2.954)	0.873	0.887	0.907	<b>0.662</b>
	Product Innovation (PtI)	(0.757-0.834)	(1.769-2.327)	0.860	0.861	0.899	<b>0.642</b>
	Process Innovation (PsI)	(0.741-0.898)	(1.617-2.942)	0.867	0.884	0.910	<b>0.717</b>

Table 3. Fornell and Larcker coefficients

	AMT	ES	PsI	PM	PtI	QIA	SGPS	MP
<b>AMT</b>	<b>0.814</b>							
<b>ES</b>	0.208	<b>0.792</b>						
<b>PsI</b>	0.243	0.349	<b>0.847</b>					
<b>PM</b>	0.400	0.305	0.306	<b>0.819</b>				
<b>PtI</b>	0.150	0.375	0.192	0.375	<b>0.801</b>			
<b>QIA</b>	0.073	0.297	0.196	0.357	0.447	<b>0.767</b>		
<b>SGPS</b>	0.169	0.359	0.177	0.363	0.456	0.631	<b>0.812</b>	
<b>MP</b>	0.091	0.587	0.299	0.211	0.322	0.390	0.356	<b>0.764</b>

In the analysis of the structural model of the research, a three-step approach including R<sup>2</sup> value, Q<sup>2</sup> model quality, and the significance of the path coefficient of the structural model were used (Aldás, 2016), and its results can be seen in Tables 5 and 6 and Figures 2 and 3.

According to the three values of 0.25, 0.50 and 0.75 (low, medium and high), the R<sup>2</sup> value for hard QM and IP was between low and medium (Hair et al, 2011; Henseler et al., 2009). According to the three values of 0.02, 0.15 and 0.35 (low, medium and high), the redundancy index structural model of hard QM and IP was medium

to high (Hair et al, 2014). Also, the commonality index for hard QM and IP was medium to high. Finally, considering the three values of 0.1, 0.25, and 0.36 (low, medium, and high) suggested by Tenenhaus et al. (2005), goodness of fit test (GOF) was used to evaluate the overall research model, and the overall value of the research model was high.

Table 4. HTMT criterion

	AMT	ES	PsI	PM	PtI	QIA	SGPS	MP
AMT								
ES	0.235							
PsI	0.257	0.408						
PM	0.433	0.350	0.352					
PtI	0.173	0.441	0.215	0.432				
QIA	0.134	0.332	0.217	0.396	0.507			
SGPS	0.182	0.406	0.199	0.411	0.519	0.702		
MP	0.136	0.688	0.346	0.242	0.364	0.444	0.400	

Table 5. R<sup>2</sup>, Cross validity redundancy and communalities

Variables	R <sup>2</sup>	ARS	Redundancy index	Communality index
Hard Quality Management	0.350	0.345	0.101	0.257
Innovation Performance	0.382	0.372	0.140	0.273

$$GOF = \sqrt{AVE \cdot R^2} = 0.486$$

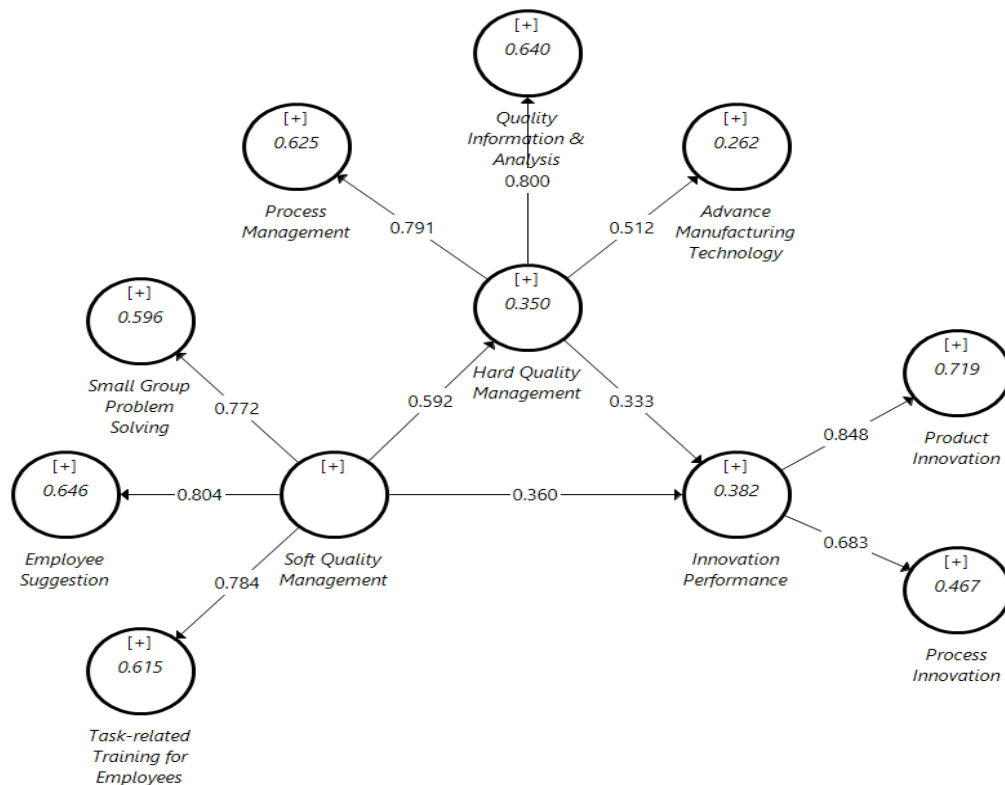


Figure 2. Research model with standardized factor coefficients

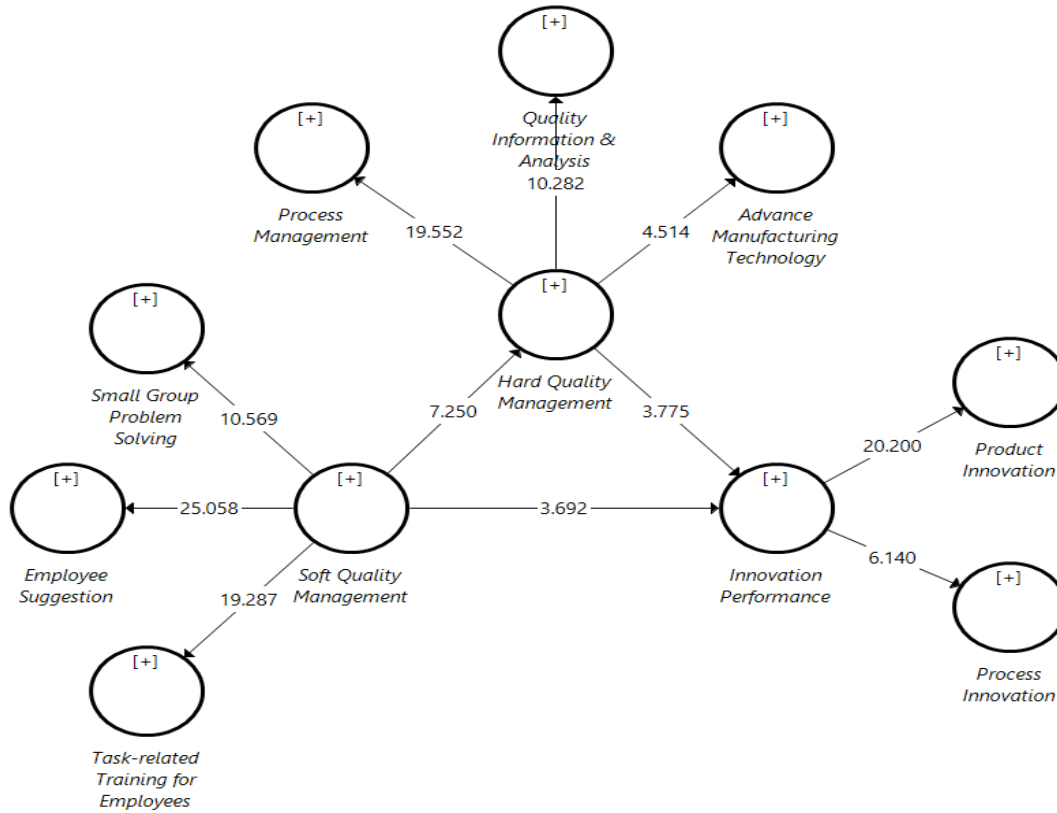


Figure 3. Z significant coefficients

Table 6. Hypotheses testing results

Hypothesis	Path coefficient	SE	t-value	p-value	Decision
Soft QM → IP	0.360	0.097	3.692	0.000	Supported
Soft QM → Hard QM	0.592	0.082	7.250	0.000	Supported
Hard QM → IP	0.333	0.088	3.775	0.000	Supported

Finally, for the structural model, the path coefficients test and the bootstrap technique were Used to determine the strength of the relationship between research hypotheses, and as can be seen in Figure 3 and Table 6, soft QM has an impact on IP and hard QM. Also, the results show that hard QM affects IP.

### Mediation test

Preacher and Hayes (2008) approach and bootstrap method were used to test the mediation effect of the research. This approach is completely suitable for the PLS-SEM method and has been implemented in SmartPLS software. First, the research model should be implemented without the presence of the mediating variable, i.e. hard QM. If the effect of the independent variable (soft QM) on the dependent variable (IP) is significant, the effect of the mediator variable should be analyzed (Hair et al., 2014).

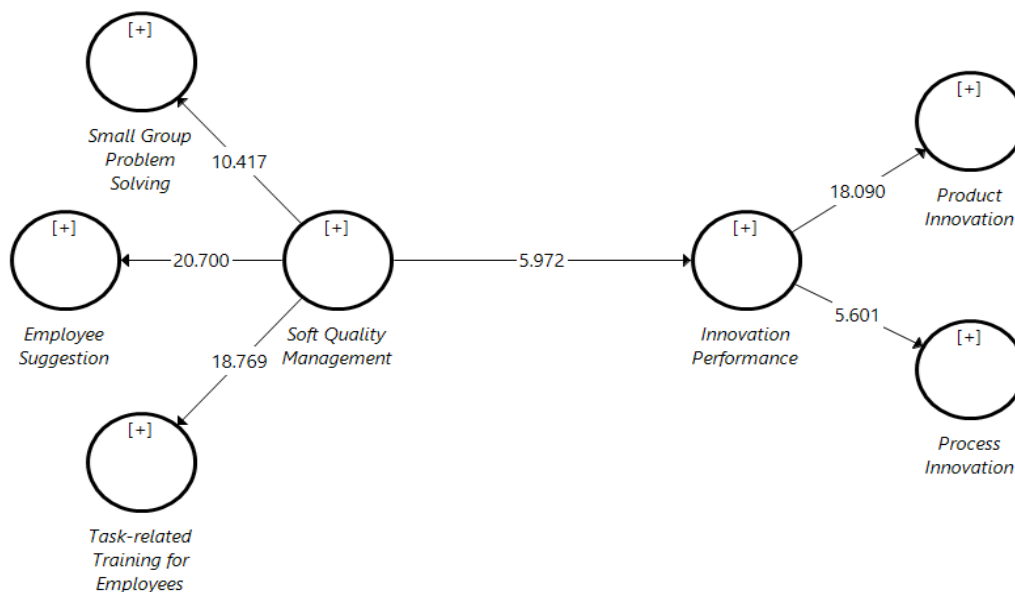


Figure 4. The result of the hypothesis test without the mediator variable

Table 7. The results of the mediator variable test

Hypothesis	Indirect effect	Total effect	VAF	SE	p-value	Decision
Soft QM → Hard QM → IP	0.197	0.557	0.354	0.072	0.000	Partial Mediation

As can be seen in Figure 4, the research hypothesis test was significant without the presence of the mediating variable. Now we have to go to the analysis of the model with the presence of the mediator variable. To measure the effect of the mediating variable in this study, the variance accounted for (VAF) was used. According to Hair et al. (2014), because the value of VAF was between 0.2 and 0.8, hard QM plays a partial mediating role in the model. This means that hard QM has a partial mediating role and %35.4 of the effect on soft QM can be explained through the mediation of IP. The results of the mediator variable analysis can be seen in Table 7.

## Discussion

In recent years, the concept of innovation has been linked with economic ideology, so that countries welcome innovation as a source of competition and a solution to face economic challenges. Innovation can occur in products, services and processes and increases productivity. Innovation performance is one of the key results of innovation, and the TQM approach, which consists of two important hard and soft dimensions, is effective in improving innovation performance. Applying QM and innovation in SMEs helps these companies maintain their focus on the target market, use their material and human resources in the best way and improve their competitive position in the market. However, compared to large organizations, SMEs have performed poorly in the use of soft and hard QM. In this regard, the present research was conducted under the title of the effect of soft QM on innovation performance with the mediating role of hard QM in SMEs.

The findings of the first research hypothesis showed that soft quality management has a positive and significant impact on innovation performance. The results of this hypothesis are consistent with the research results of Kanapathy et al. (2017) and Nasaj and Marri (2020). The results of the mentioned research also showed that soft QM has a positive and significant effect on innovation performance. Confirmation of this hypothesis indicates that soft QM has become a useful system for improving quality and creating innovation in SMEs and

overall customer satisfaction. Employee involvement is very important to find creative and new ideas to solve current problems or even create new and innovative products and services to meet customer expectations. Soft QM provides a background and atmosphere of trust for employees to act actively and participate in the quality improvement process by presenting new innovative ideas that ultimately affect the innovation performance of the company. Soft QM as a subset of TQM as a customer-oriented concept establishes a strong relationship with the organization's innovation performance. This shows that product quality is highly related to soft QM dimensions such as small problem-solving groups, task-oriented employee training, and employee suggestions. As was shown in the present research employee suggestions and task-related training for employees from soft QM have the greatest impact on innovation performance. Based on this, it is suggested to company managers: 1. To focus more attention to the variable of soft QM in the dimension of small group problem solving, because paying attention to this criterion leads to improvement in innovations and creation of innovation improvement of competitive strategies to increase quality; 2. In addition to applying the soft QM philosophy, giving freedom of action and independence to employees can provide a platform for employees to innovate in work processes and methods to improve the work process and 3. To remove fear and create space for sharing opinions, the company management should emphasize teamwork training and the formation of circuit improvement teams at the company level, and the management should not hesitate to give its all-around support to improve things.

The findings of the second hypothesis of the research showed that soft quality management has a positive and significant impact on hard quality management. The results of this hypothesis are consistent with the research results of Rahman and Bullak (2005), Zeng et al. (2015 and 2017), Scirali et al. (2020), Nasaj and Marri (2020), Gambi et al. (2020) and Tari et al. (2023). The results of the aforementioned studies also showed that soft QM has a positive and significant impact on hard QM. Confirmation of this hypothesis indicates that for the proper implementation of any initiative in quality improvement, managers must first set the foundations of quality by focusing on soft QM dimensions. Managers should communicate it to all levels of the organization by determining objectives and goals that are consistent with this philosophy and by determining a well-defined policy and strategy, which in turn improves educational activities and ultimately improves quality. Based on this, it is suggested to the managers of the companies: 1. To focus more attention on the small group problem solving than the variable of soft QM, because attention to training will ultimately create higher quality products and services, and 2. Manufacturing companies, by implementing soft QM, take steps towards organizational learning, which can help to create organizational knowledge, continuous improvement and organizational survival by creating and forming quality circles in the organization, because the formation of quality circles has many benefits, including increasing teamwork, increasing solidarity and empathy among employees. Increasing the sense of people's participation, increasing the technical and specialized knowledge of group members through knowledge exchange and increasing morale, motivation and sense of belonging to the organization, will lead to quality improvement.

The findings of the third hypothesis of the research showed that hard quality management has a positive and significant impact on innovation performance. The results of this hypothesis are consistent with the research results of Zeng et al. (2015) and Nasaj and Marri (2020). The confirmation of this hypothesis shows that hard QM, which emphasizes the use of quality techniques and tools, helps organizations to establish order in the organization and have more control over organizational processes. Hard QM as a subset of TQM as a technical concept establishes a strong relationship with the organization's innovation performance. This shows that product quality is closely related to hard QM dimensions such as process management, quality information and analysis and advanced manufacturing technology. Based on this, it is suggested to the managers of the companies: 1. To focus more attention on advanced manufacturing technology and quality information and analysis from the variable of hard QM, because paying attention to these components will increase the quality of work and ultimately increase the quality and innovation in products and services. and 2. by providing the appropriate facilities of a new tool, it is possible to help realize the performance of organizational innovation.

Manufacturing companies, especially companies that experience environmental uncertainty in their field of activity, should always prioritize the updating of technical tools in their field of work to gain a competitive advantage through innovation in their products and processes from other competitors. Don't stay behind. The results of the findings of the first and third hypotheses of the theory of socio-technical systems (STS) confirm that organizations should effectively implement soft and hard QM practices to benefit from QM in the best way in their organization.

The findings of the fourth hypothesis of the research showed that hard quality management plays a mediating role in the relationship between soft quality management and innovation performance. The results of this hypothesis are consistent with the research results of Nasaj and Marri (2020). Confirmation of this hypothesis indicates that managers should use the synergistic properties of soft and hard QM to achieve superior innovation performance. Many thoughts of TQM are used as the main and powerful factor in moving towards improvement and creating innovation. Meanwhile, hard QM, which emphasizes the use of quality techniques and tools, helps organizations to establish order in the organization, and when a system is stable and under control, it causes an increase in organizational knowledge, which in turn improves the quality and performance of innovation in organizations. Organizations should implement hard and soft QM in their structure and should not limit their functions only to technical aspects. Innovation performance is a sign of continuous efforts that companies have made to innovate in the past. If the two categories of soft and hard QM are taken into consideration together, with the increase in quality and innovation in the organization, permanent and continuously improving competitiveness will be achieved, and this will lead to the improvement and effectiveness of businesses. had Based on this, it is suggested to the managers of the companies: 1. Through holding continuous training sessions, the managers first improve the understanding and knowledge of their employees about raising their work abilities, and then by presenting the quality improvement results, they can encourage the employees to solve problems. The company encouraged by creating more innovation; 2. Employees should be allowed to present their suggestions about improving the quality of organizational information and increasing performance to their superior managers; 3. Allowing employees to form small problem-solving groups to solve less important company problems, And finally 4. According to the results of the research hard QM has a greater impact on innovation performance than soft QM, managers should focus attention on the team spirit of people in hiring people, apart from having expertise.

## Conclusion

According to the field findings, the study of the mediating role of hard QM in the relationship between soft QM and IP was studied for the first time in SMEs located in industrial towns in Iran.

Limitations are essential to all research because they allow future researchers to develop and validate the results. The primary disadvantage of this research is the limited sample size, which makes it difficult to generalize the results of this research to a larger statistical population. Another limitation of the research was that all the SMEs studied were working in the manufacturing sector, and no company was active in the service field among the companies. Maybe that is why the effect of hard QM on innovation performance was greater than the effect of soft QM on innovation performance.

In general, it can be concluded that soft and hard QM in organizations are necessary for superior innovation performance. Just like a system, soft QM is an important input and hard QM is a key process, so innovation performance is a critical output. Also, the following suggestions can be made for future research:

1. In future research, researchers can examine the effect of several factors such as knowledge management, intellectual capital, entrepreneurship, and organizational learning on innovation performance in manufacturing and service organizations.

2. The present research was conducted among SMEs. Researchers are suggested to implement the current model among large manufacturing companies as well as service organizations.
3. In future research, other dimensions of hard QM (patterning, zero defect mentality and process improvement) and soft QM (management commitment, customer relationship and relationship with suppliers) should be addressed.
4. Conducting similar research in different countries, especially industrial areas, and comparing it with the findings of this research are other research suggestions for the future.

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