Original Research Article

Examining the credit supply chain network problems of Iran's banking industry Using Work-Centered Analysis (WCA) framework

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Abstract: In the situation where the main credit supply of the country's enterprises is done through the banking system, it is necessary to analyze and explore the defects of the financing and credit supply relationship between banks and enterprises. This study is considered a descriptive-applied research and the required data were collected through library studies, workplace observation, and interviews with process experts. In this research, 37 credit experts from 17 different bank branches were interviewed about the process of granting facilities. Work-Centered Analysis (WCA) framework and conducting audits through questionnaires and related checklists revealed that the structure of Iran's credit supply chain network suffers from such problems as deviation in the appropriate use of allocated credit resources, structural faults of the banking system and lack of administrative health, high bureaucracy, directed facilities, etc. In the end, some suggestions are provided for redesign and optimization of the credit supply network.

Keywords: Credit supply chain network, Supply Chain Finance (SCF), Work-Centered Analysis (WCA) methodology, Technology-Based Companies (TBC), Banking industry; Diagnosis

1. Introduction

What can be said about Iran's economy is that, unfortunately, no appropriate model for financing enterprises can be found in our country, and what is always mentioned in scientific and academic circles is the problem of bank-centered financing in the country. However, the fact is that the bank-centeredness in Iran has not had a successful and acceptable experience, and this has emerged from many weaknesses and challenges. In proving this failure, reference can be made to international and national indicators regarding financing and credit supply and restrictions on access to financial resources for enterprises, which is the most significant problem and challenge in enterprise surveys. One of the main international indicators in this regard is the report on economic competitiveness; according to the 2015 report, Iran ranks 138 in terms of ease of access to loans, 135 in access to financial services, and 121 in health of the banking network, among 144 countries and the scores obtained in these indicators (out of 10) were 1.6, 2.9 and 3.8, respectively. In Iran, SMEs receive 5 to 6 percent of banking facilities, while SMEs hold 81 percent of banking facilities in South Korea, nearly 65 percent in China, about 62 percent in Hungary, 54 percent in Greece and Poland, nearly 51 percent in Malaysia, 45 percent in Georgia, 4.36 percent in Brazil, 8.34 percent in Britain, 3.32 percent in Turkey, 5.29 percent in Australia, 20 percent in Chile and Indonesia, and 5.17 percent in the United States[1]. Comparing the share of SMEs in banking facilities in Iran and other countries raises the question that what the ratio of the Iranian banking system to production is. That is, if banking facilities are not provided to production, then where do these facilities end up?

The major contributions of this study can be summarized as follows:

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(1) The innovation of the present research is that domestic studies have not been conducted on deviation and diagnosis in granting banking facilities in the country and most of the studies have focused on the granted facilities and their effect on economic growth, not on diagnosis of granting credit facilities.

(2) This is the first time in the country that defects are identified through the process study.

(3) In this paper the process of the banking system is analyzed from five components by Work-Centered Analysis (WCA) framework: architecture, performance, infrastructure, content and risk.

(4) In international studies, conventional banking does not face facility deviation because facilities are not paid in the form of contracts. Therefore, there are no international studies on this issue; rather, some studies have addressed moral hazards.

(5) The deviation from the use of credit resources at the disposal of banks and financial institutions is one of the biggest challenges in supplying credit to technology companies. This studies endeavors to analyze business processes in the area of credit supply in one of the largest private banks of the country, identify the existing defects and examine them to provide an appropriate operational prescription for the country's banking system to optimally manage its financial and credit resources so that credit resources will be given to the real applicant through the right way.

The main steps of this study can be outlined as follows:

(1) In this research, considered in first determining the scope of the system and then in analyzing the process from five, then audit meetings were held in 17 different branches of the selected bank in order to check the compliance of the actual implementation of the process of "granting credit facilities" to technological and knowledge-based companies in state banking.

(2) In the second stage, they had a consensus meeting with a number of experts and people involved in the implementation of the process at the level of the bank and bank employees (a total of 37 experts from the credit and supervision department) in order to further analyze the state of the said process.

(3) Next, the results were analyzed based on the methodology (WCA) and the weaknesses and defects of the mentioned process were identified and finally appropriate solutions were presented.

(4)And finally, an innovative solution was presented to solve the mentioned problems through the selected research method.

2. Review of literature and research background

One of the most significant financial planning issues in the supply chain is financing the components of this chain. Supply chain financing for working capital financing is done according to the profitability of companies through supply chain financing tools. In this regard[2]. Predicted the credit risk of small and medium-sized enterprises in supply chain financing. They tried to develop a model to anticipate enterprises' credit risk by considering both enterprises-related and supply chain-related factors. They used a machine learning model to identify the most significant factors affecting credit risk in enterprises in China[3]. Evaluated the tangible benefits of examining different financing strategies. Based on the analytical formula, the benefits of three supply chain financing strategies, including reverse factoring, inventory financing, and dynamic discounting, are examined and a model is presented to examine the benefits that a buyer can obtain from the benefits of these three schemes through relation with suppliers[4]. Addressed the decisions made about supply chain financing in the form of commercial credit of supply chain components. They offer a simple pattern of financing through credit, consisting of a bank, a parent company and a retailer. Finally, the main parameters of the model are analyzed based on game theory in order to decide about the profitability and reliability of supply chain components[5]. presented supply chain financing for small and medium-sized enterprises and proposed the reverse factoring as the best method by examining the financing methods of small and medium-sized enterprises in the supply chain[6]. developed a mathematical optimization model in this regard by examining the existing financial model with the aim of reducing loan risk and increasing the expected profit of the bank when financing the supply chain, and

showed that inventory financing can extend the credit to lower-level companies and benefit all members of the supply chain[7]. Examined the effect of bank credit on Nepal's economic growth using the Johansen co-integration approach, and the error correction model and time series data for the period of 1975-2013. The results show that private-sector bank credit has a positive effect on Nepal's economic growth only in the long run. There is also a feedback effect of economic growth on private sector credit in the short run. In another research Markus ML and Mao JY and Gregor S and Jones D, promotes the importance of showing a design theory as the basis for the building of a design artifact.[8, 9]

A review of existing and previous literature of studies conducted abroad illustrates that most studies that have provided a mathematical model for supply chain financing, have mainly focused on the type of financing methods and choosing the best method, or conventional banking does not face facility deviations in such models because facilities are not paid in the form of contracts. In Iran, most of the research conducted in the field of financing small and medium-sized enterprises in the supply chain are in the form of review or comparative research, questionnaires, and interviews aimed at identifying the methods and their advantages and disadvantages in financing these enterprises in the supply chain. Therefore, no study has been found in the research literature that focuses on financing and its pathology and diagnosis with the approach of structural and process recognition of financing system and paying attention to physical and credit flows. Due to the significance of this issue, the effects of deviations related to the granted facilities in the banking system of the country will be examined in what follows.

2.1 Technology-based companies

Proper understanding of the type of business and the characteristics of start-up technology companies is fundamental in defining and analyzing policies to support them. Start-up technology companies derive most of their value creation through knowledge created by their human resources. They are mainly in the primary and intermediate value chains, and a limited number of them interact with the general end consumer[10]. In general, there are four main keywords used in the definitions of start-up technology companies:

The novelty of start-up technology companies both in terms of company age and technology[11], small and medium-size[12], its dependence on entrepreneurs and their financial and professional capabilities[13,14], and finally, the characteristics of the founders and their specialization[15].

2.2 Credit supply chain network and actors

Financing from domestic sources, i.e. non-distribution of cash dividends, seems to be desirable for the company on the one hand, and on the other hand it may change the plan of micro-shareholders for providing a part of the living expenses from this source[16]. In the 1960s and 1970s, organizations sought to increase their competitive power by standardizing and improving their internal processes to produce better quality and lower cost products. The prevailing view at the time was that strong engineering and design, plus well-organized integrated production operations, were a prerequisite for achieving market demands, and, thus, gaining a larger market share. Therefore, organizations focused their efforts on increasing efficiency. In the 1980s, as the patterns expected by customers became more various, organizations became increasingly interested in producing and developing new products to meet the needs of customers; an endeavor that requires credit and a credit supply chain. In the 1990s, along with the improvement in supply chain processes, many managers realized that improvement of internal processes and flexibility in the company's capabilities are not sufficient to maintain their presence in the market, and there must also exist a supply chain network. With such an attitude, approaches to the supply chain and its management came into play. On the other hand, with the rapid development of information technology in recent years and its widespread use in credit supply chain management, many basic chain management activities are being carried out with new methods[17]. According to the process classifications made in the field of banking facilities and obligations and the process value chain presented in the area of granting banking facilities, which are classified into two sets of main processes (Figure 1), the first set includes processes

that begin from accepting the customer's credit application and ends with the granting of facilities or obligations to the applicant if all the necessary conditions are satisfied. The second set includes processes generally related to changing the terms and conditions of the facility or obligation, repaying, and settling the facility or claim. According to these processes and factors and actors of the credit supply chain, the credit supply chain network of the bank can be drawn as Figure 2.

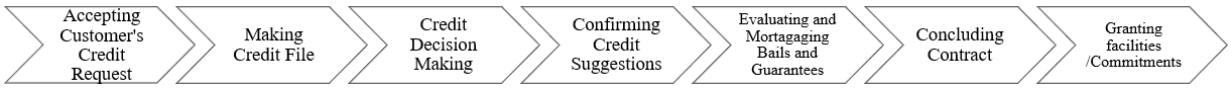

Figure 1 Sequence of the value chain of granting facilities (illustrated by writers).

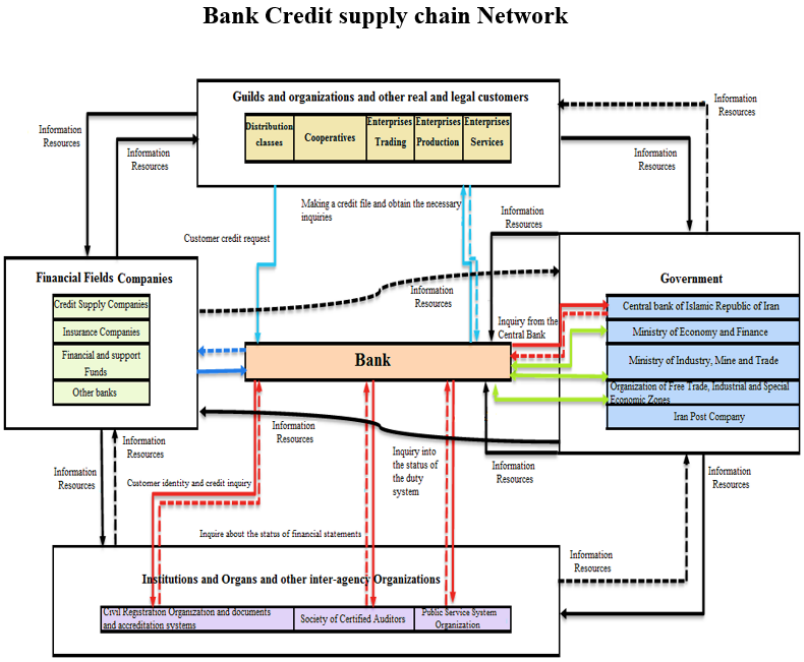

Figure 2 Stakeholders and actors of the bank supply chain finance (illustrated by writers).

(-- Information resources -- Inquiries -- Credit application process -- Directed credits process and government interactions)

2.3 Work-Centered Analysis (WCA) framework

In his study,[18] addressed the use of Work-Centered Analysis (WCA) framework in which significant parameters in the study and analysis of any existing or desirable system in an organization are described. A system in this framework is defined as "a work system that includes business processes implemented by human resources using information and communication technology tools". The WCA framework has six elements and five perspectives of evaluation[19, 20] A brief description of the elements and perspectives of the framework is given below (Figure 3).

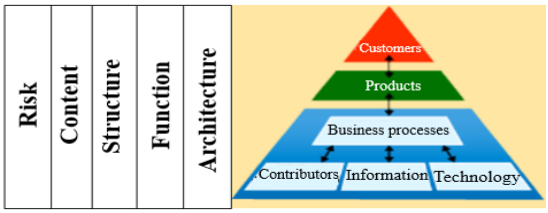

Figure 3 Different elements and perspectives of the WCA framework.[19, 20]

2.3.1 WCA framework elements

Framework levels indicate what elements should be considered in the analysis of a work system[21]. These

elements are:

- **Customer:** The person or persons who use the products and services of a work system. This customer can be inside the organization or outside the organization.
- **Product:** A combination of physical/non-physical information, services, and products that a work system produces for the customer.
- **Business process:** A sequence of steps and stages of work done in a work system. These steps may be well defined in some cases or not structured in some other cases.
- **Participants:** People who take business steps in business processes. A business process may be performed with different success rates due to the skills, training, or interest of its participants.
- **Information:** Information used by participants to perform process steps. Some of this information may be present in information systems and some other information may be used manually.
- **Technology:** Including hardware, software, and other tools and resources used by participants to perform process steps[22].

2.3.2 Perspectives of WCA framework

Perspectives of the framework illustrate from which angles a working system may be analyzed. These perspectives include:

- **Architecture:** It shows how an existing or desirable work system operates and how its components interact.
- Performance: It indicates the good performance of a system and each of its key components.
- **Infrastructure:** It includes human resources and external technology on which a system depends, as well as the infrastructure and resources it shares with other systems.
- **Context:** It includes the organizational and technical areas and competitive environment in which the system operates, such as shareholders and partners, organizational policies, organizational culture, laws and regulations, etc. that affect the system.
- **Risk:** Predictable events that may weaken of halt the operation of a system[22].

It should be noted that due to the nature of the audit that is performed in bank only for business processes, only the business processes level of WCA framework is performed and the analysis is not done for other levels. Based on the model mentioned in the WCA framework, the indicators and sub-indicators for auditing business processes in the field of credit supply are presented in Appendices (1) and (2).

According to the general framework of WCA methodology, the macro model of the audit framework of the process of granting credit facilities to technology companies in the case study bank is shown in Figure 4.

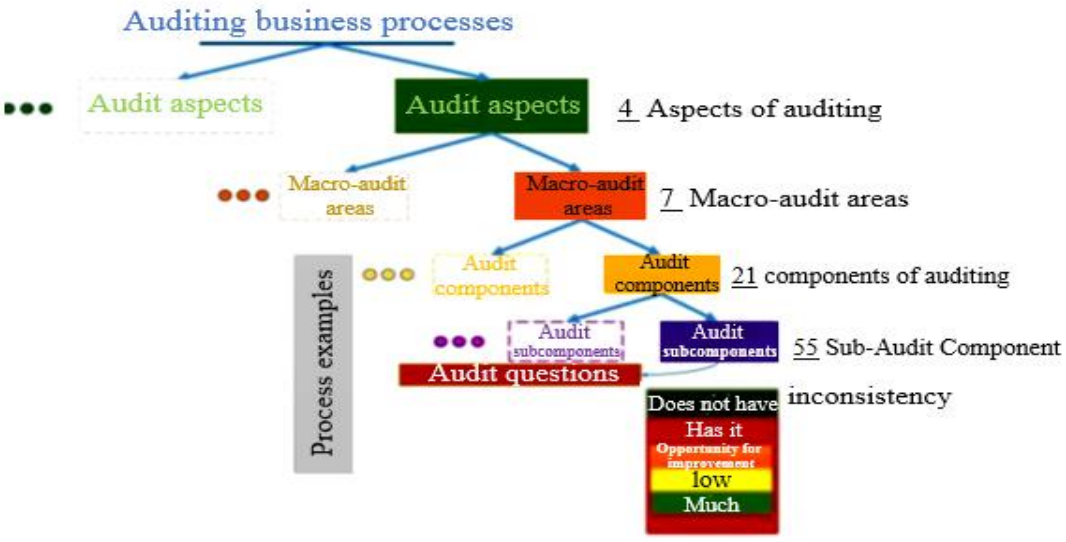

Figure 4 The macro audit model of the credit facility granting process in the case study bank (Drawn by authors).

3. Research method

Whereas choosing the appropriate method plays the most important role in designing, implementing and executing any pathology project, the existing methods were reviewed, the feasibility of their implementation in terms of compatibility with the structure and format of the credit supply system process was examined, and surveying experts in this field. It was found that Work-Centered Analysis (WCA) methodology was the most appropriate method for pathology and identification of defects and shortcomings of the current process of credit supply system, and depiction of the desired situation in the country's banking industry. Process analysis leads to a general knowledge and understanding of the current state of the organization's processes and shows the degree of compliance of the examined processes with the business environment. To this end, and with the aim of examining the process domain of banking facilities and obligations management, the titles of the processes in the mentioned domain are prioritized, and the process of "granting credit facilities" is chosen from among the effective processes with high priority in the mentioned field as the selected process and examined from different perspectives (architecture, performance, infrastructure, context, and risk). Due to the nature and current state of the process of "granting credit facilities", the following techniques have been used from among the several of process analysis techniques.

- Brainstorming
- Auditing (holding face-to-face meetings to assess the compliance of the process implementation with the instructions, notices, and circulars issued for its execution)
- Surveying experts

In the first part, audit process was performed by referring to 17 branches of the bank branches located in Tehran (with different ranks and in different urban areas), 2 branch headquarters out of the total 5 branch headquarters operating in Tehran province, and finally the Directorate General of Bank Credits. 37 bank staff with different organizational positions were interviewed as described in Table 1. The results obtained from the interviews conducted in the audit phase are provided in Table A3.

Table 1 Organizational positions of audit process interviewees.

Organizational positions of audit interviewees in branches	**Head of the branch or the head and banker of credit and receivables group**
Organizational positions of audit interviewees in branch headquarters	Head of the credit department
Organizational positions of audit interviewees in directorate general	Experts division supervisor and credit expert

Regarding the audit conducted through the checklist (Table A3), it is important to note that the review of the answers provided to the questions in the audit questionnaires indicates the similarity of the received answers surfaces from questionnaire No.37 onwards. Hence, it seems to sufficient to conduct the audit with 37 questionnaires. In the second part, in order to hold brainstorming sessions, a meeting was held with the relevant members to perform activities related to analysis, improvement and development of the process of credit facility granting as well as a number of experts working in organizational positions involved in various parts of the said process (Table 2).

Table 2 Composition of members participating in brainstorming sessions.

Bank line	**Bank staff**
Four heads of credit and receivables group of selected branches.	Two heads of experts division of credit directorate general.
Two experts of directorate general for credit planning and supervision. Two experts of credit systems and processes division.	One employee of credit department of headquarters of the selected districts
Total participating in the meeting.	11 persons

Due to the small size of the statistical population, all statistical population members were selected purposefully. The data collection tool in this study is a questionnaire and face-to-face interview. To this end, the content validity method is used to determine the validity and reliability of the questionnaire of this research. The initial questionnaire was prepared by studying different resources and reviewed by professors and experts of this section, and the CVR (content validity ratio (Equation (1)) and Table 3) of all items of the questionnaire was higher than 0.8. On the other hand, Cronbach's alpha is used to check the reliability using Spss23, to perform necessary calculations, and it was found that the prepared questionnaire has a reliability of 83.9%, which is an acceptable value.

$$CVR = \frac{\mathrm{ne} - \mathrm{N}/2}{\mathrm{N}/2} \quad \text{(Eq.1)}$$

N: Total number of experts; ne: Number of experts who selected the "necessary" choice.

Table 3 Minimum amount of acceptable CVR based on the number of experts.

Number of experts	The amount of CVR	Number of experts	The amount of CVR	Number of experts	The amount of CVR
5	99%	11	59%	25	37%
6	99%	12	56%	30	33%
7	99%	13	54%	35	31%
8	75%	14	51%	40	29%
9	78%	15	49%		
10	62%	20	42%		

The experts of this research should be individuals with sufficient knowledge, experience, and expertise in the field of credit supply in the banking system. Therefore, university professors, and senior and experienced experts and managers of the bank's credit and financing division were selected as experts participating in interviews and brainstorming sessions. Further, since receiving the opinions of experts requires proper interaction between the researcher and the said group, and summarizing their opinions requires effort and expertise, great care was taken in determining the indicators of choosing experts. The indicators for selecting experts are as follows.

Criteria for selecting experts：

(1)Holding a master's degree or PhD in financial management;

(2)Having experience and work record in the field of financial and credit resources;

(3)Having work record in areas related to financial resource management in financial and credit institutions as expert or senior manager;

(4)Being interested in participating in the survey.

This group of experts was selected using non-probability judgment sampling technique. Considering the above criteria, a list of 49 experts was provided first and they were contacted in person or in absentia, of whom 37 people were willing and able to participate in the study. The demographic characteristics of panel members are described in Table 4.

In the third part, in addition to holding brainstorming sessions and conducting audits, the opinions of credit experts were obtained in the form of interviews and symposiums on the process of "granting credit facilities". Their most significant views on problems and defects related to the said process are presented in Table 5.

Table 4 Descriptive statistics of panel members.

Property	Characteristic	Number	Percentage
Education rate	Ph.D.	9	24%
	Masters	21	57%
	Bachelor	7	19%
	Total	37	100%
Job	Manager and expert in finance and credit.	32	86%
	Lecturer and researcher in the field of finance and working in the credit department of the bank.	5	14%
	Total	37	100%

Table 5 Expert opinions on the defects and problems of the credit facility process.

Row	Title of the identified problem
1	Strict bureaucracy in the stages of granting facilities.
2	Security-based lending of facilities.
3	Lack of transparency in the process of granting facilities and customers' unawareness of the stages of legal actions of banks.
4	Lack of a clear and well-stated process for valuable customers (non-observance of credit assessment and capacity assessment of customers, i.e. over-lending of facilities and, thus, deviation).
5	Lack of a non-judgment model in the process of decision-making regarding the granting of credit facilities.
6	Lack of bank managers' commitment to fulfilling credit obligations in granting facilities to the economic and production sector.
7	Impossibility of pledging intangible assets and incompatibility of the type and amount of the collateral received from customers with the facilities paid to them.
8	Lack of systematic access to reports for property valuation and credit information through the Credit Information and Property Valuation System, and banks' failure to pay attention to customers' debt-to-income ratio.
9	Insufficient attention to credit health standards in granting facilities and giving facilities with superficial documentations.
10	Adding the future interest of the installment facility to the principal amount of the facility at the time of transforming the liability into current debt and increasing the amount of facilities, and, consequently, unaffordability to repay debt.
11	Lack of continuous monitoring of the production and sales status of domestic companies and examining their susceptibility to the governing economic, political, social, ... conditions and granting them facilities again.
12	Difficulty in selling pledged collaterals.
13	Insufficient accuracy in setting the provisions of contracts and promissory notes and occurrence of numerous errors.
14	Incompatibility of the type of customer's activity with the type of application as well as the type of the concluded contract.
15	Negligence to the continuous increase of fixed assets and deviation of working capital facilities towards it.
16	Failure to register indirect liabilities of borrowers, endorsers of promissory notes and guarantors in the systems of the Central Bank of the Islamic Republic of Iran, and customers' abuse of non-implementation of Core Banking system in all banks.
17	The expected interest rate of the facility is lower than the current inflation rate in Iran.
18	Intervention of different organizations in the payment of facilities, deferring them, and re-arranging their installments, and the orders issued for payment of most large facilities (directed credit).
19	The imposed economic sanctions and continued economic recession.

Pursuant to the audit, points of weaknesses and non-compliance between the current situation and the presented user documentation are addressed in the process mentioned in Table A3, and the results are presented in Table 6 in the form of problems and defects identified in the process of granting credit facilities through audit.

Table 6 Defects and problems in the process of granting credit facilities through conducting an audit process.

Row	Title of the problem/identified non-compliance
1	Scatteredness of notices confuses the network in carrying out the process, particularly in the section on the scope of authority, because there are many items in this section that the approving authority should take into account, such as the scope of authority in respecting the equity in terms of, for instance, the amount of facilities granted to customers with/without an operation permit.
2	Lack of accurate and updated economic information and statistics regarding macro components.
3	The number of inquiries required in the process and access to these inquiries is limited and must be performed at certain hours.
4	There are no written and integrated documents to explain the steps and their sequence for the approval process. The existing documentations are sorted by product and package type, in which the executive terms and conditions to approve credit facilities are included but the work process is not specified.
5	In some cases in the current situation, an action is taken that does not exist in the process. For instance, the collaterals may be valuated first and then the approval is obtained. Therefore, the valuation charges may have been received from the customer but granting of the facility may be disapproved. This will lead to customer dissatisfaction.
6	Lack of a reporting system to monitor processes.
7	Weak control of the State Inspection Organization, the Central Bank, and other regulatory and policy-setting institutions on the performance of credit institutions and the process of facility granting.
8	Lack of proper cooperation of the State Deeds and Property Registration Organization with banks in identification of property and assets.
9	It is sometimes observed that approvals are issued conditionally (for instance, subject to compliance with the equity or in lieu of submission of audited financial statements, etc.).
10	According to the results of the investigations, it was observed that in some cases, the bank line did not know how to update notices and instructions or get new versions of some systems, such as the various inquiry systems, used in the process, from the credit approval all the way to granting of credit facilities, and sometimes notification is not done in a timely manner.
11	Moreover, in cases where an expert report is required for approval, the documents are not controlled due to the lack of electronic archives of documents and the approval is permitted to be passed without the said report.
12	The degree of effectiveness of equipment in this process is high and the lack of appropriate hardware and software equipment disrupts the process. It is necessary to equip the divisions involved in the process (especially the bank line) with different hardware and software equipment, such as appropriate printers, scanners and computers, In order to perform different steps of the process.
13	The key indicator examined in this section is the time indicator. Some steps are general and scheduled, and no attention is paid to the type of the received collateral or the customer's classification (based on new or old customers or their value). (Measurement of the standard time to perform the process will have a great impact on improving customer satisfaction and improving the credit portfolio of customers.)
14	Experiences of experts are transferred orally and are not documented or recorded anywhere.
15	There are several unlinked credit systems. In the current scope of the process, three different systems (centralized facilities system, credit information system, and office automation system) are used to transfer information.
16	Auditors did not know much about the approved organizational structure of their workplace, especially in the line section of their bank. Thus, it is not possible to compare the existing organizational structure and the organizational structure intended to implement the process.
17	The bank is not obliged to provide customer information to the Rating System and the Central Bank.
18	The required credit trainings offered to the actors involved in the process are not in proportion or consistent with the process of performing the work, and less attention is paid to the practical aspect in trainings (trainings on the centralized system, customer capacity assessment, commitments, etc.).
19	Branch users have access to notices and circulars during a limited time (Only a limited number of users in branches have access to the intranet and the Internet for a limited time, which disrupts the process).
20	Imbalance of workload with the allocated human resources, especially in the bank line.
21	User errors in identifying and registering approved elements in the process of approving credit bids when preparing bids.

Furthermore, the weaknesses and problems identified in brainstorming sessions are described in Table 7.

Table 7 Defects and problems in the process of granting credit facilities, identified in brainstorming sessions.

Row	Title of the problem/identified non-compliance
1	Several credit inquiries are required in the process of data recording, where the information recorded in the results of the inquiries is sometimes redundant. Further, obtaining the mentioned inquiries is time-consuming.
2	The centralized banking system does not halt when inquiry time is expired (In some cases, the results of credit inquiries for the customer are invalid, but the centralized banking system does not give any warning to the bank user in this regard and does not restrict the process of reviewing customer's application).
3	Not all users and experts involved in the process, especially those in the bank line, have access to the Internet and intranet in order to be informed of the issued notices, circulars, and instructions, and receive some credit inquiries.
4	Failure to enter the complete information of the customer and the guarantor or guarantors in the system of the related division to receive credit information of the mentioned persons; moreover, it is not mandatory for the bank to provide customer information to the Rating System and the Central Bank.
5	Lack of proper policy-setting and adequate supervision by the Central Bank of the Islamic Republic of Iran
6	Lack of appropriate hardware and software equipment to perform different steps of the process (e.g. scanners, printers, and computers with higher process capacity, etc.).
7	Lack of adequate mechanism to record the performance of the actors involved in the process, and consequently, considering the performance of individuals in their career improvement.
8	Lack of adequate documents in determining the standard time of process execution.
9	Incompatibility between the size of the automated activities (systematic steps) and non-automated activities or activities done outside the bank systems in different stages of the process.
10	Lack of automatic control of the scope of authority for facility granting in the related systems.
11	Imbalance between workload and the number of human resources allocated to the Credit and Receivables Group of the branch.
12	There are several scattered notices, circulars, and instruction issued regarding the process.
13	Receiving facility interest or extending the contract on the basis of the initial contract, or renewing facilities with the lowest expected interest and settling the previous facility.
14	In some cases where directors of district/province branches or other higher-ranking decision-making authorities should decide about the manner of facility granting due to the large amount of the facility demanded by the customer, the opinion of the branch is not taken into account in the decision-making stages because the decision-makers do not consider the records available in the credit file of the customer, or because there is no direct contact between the decision-makers and the applicant branch.
15	In some cases, the process sequence for facility granting is not executed in accordance with the provided value chain. (For instance, the process of valuation, pledging the customer's collateral and guarantee is done first, and then the process of approving the credit bid is put in the agenda.)

4. Research findings and results

The scores are evaluated and the audit results are quantified according the evidence obtained from the degree of compliance of each of the audit components of business processes based on the questions asked in the audit interviews, and the identified non-compliance. Thus, all subcomponents are divided into the following two categories:

(1) **Compliant subcomponents:** In this subcomponent, there is no evidence of noncompliance or deviation of the subcomponent and the subcomponents are in their best condition in terms of auditing. Obviously, no problems have been observed with regard to these subcomponents, and, thus, no measures for improvement can be defined.

(2) **Non-compliant subcomponents:** In this category of subcomponents, at least one case has been observed where the subcomponent has a deviation and additional measures are needed to improve the status of the component in this regard. The degree of deviation of the subcomponents or in other words, the degree of their non-compliance is scored based on the three-point Likert scale (1, 3 and 5) as follows to evaluate the degree

of non-compliance of each subcomponent quantitatively:

① **Chance for improvement:** The sub-components for which the chance for improvement is identified fall into this category and are marked with a score of 1. These non-compliances are minor and are presented with a process improvement approach.

② **Trivial non-compliance:** Subcomponents for which trivial non-compliance is identified fall into this category and are marked with a score of 3. These non-compliances are rare and have low priority for remedial action to be removed.

③ **Significant non-compliances:** Subcomponents for which significant non-compliance are identified fall into this category and are marked with a score of 5. These non-compliances are major and have a high priority for improvement measures to be removed.

In evaluating the challenges and complications of the processes related to granting credit facilities and financing of technology companies in a quantitative manner, the degree of compliance and non-compliance will be determined first. The percentage of compliance/non-compliance in each subcomponent, component, general audit scope, and audit perspective will be calculated by dividing the number of compliances/ non- compliances by the total number of subcomponents. Furthermore, to evaluate the degree of non-compliance, the score of each component is calculated from the average score of the subcomponents, and the average of the obtained figures will be integrated up to the level of macro-audit scopes and audit perspectives. Finally, the non-compliance score of each business process will be calculated. It is evident that processes with lower non-compliance score have a better status than other processes; and, conversely, processes with higher non-compliance score require more attention because their situation is more critical than the others.

Now, with regard to the brainstorming sessions, audits and interviews with experts in the field of supplying the credit of the country's banking and credit system within the framework of research methodology (WCA methodology), the results and the extent of non-compliance are illustrated in Tables 5,6 &7, and A3. The degree of non-compliance of the process of granting credit facilities to technology companies is shown in Figure 5.

Figure 5 The degree of non-compliance of the process of credit facility granting.

As seen in Figure 5, the non-compliance degree of the "Credit Facility Granting" process is equal to 2.75. According to the classification mentioned in Table 8, this shows that the said process in general, and considering the audit indicators, is in a state of average-nearly high non-compliance, therefore, appropriate solutions should be offered to increase the degree of compliance of non-compliant audit components (especially those with significant non-compliance) in order to improve the mentioned situation.

Table 8 Non-compliance scores and their related status.

Full compliance status	Score zero (0)
Low non-compliance status	Score zero to 1
Moderate non-compliance status	Score 1 to 3
High non-compliance status	Score 3 to 5

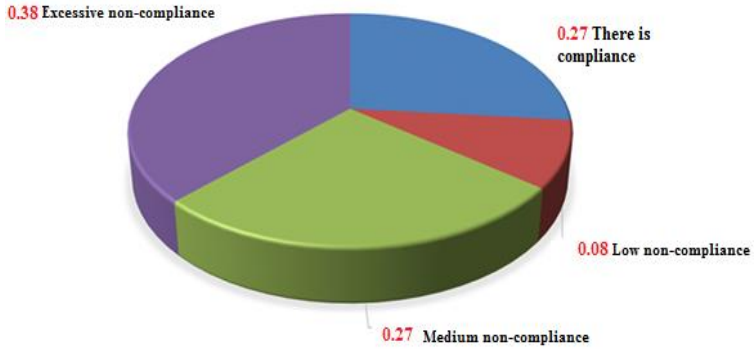

Figure 6 Chart of the general status of the results of evaluation of credit facility granting process.

According to Figure 6, in the process of granting credit facilities, 27% of the audit components have full compliance and there is no significant weakness in them. Regarding the non-compliances (the remaining 73%), in 38% of the cases, high non-compliances are observed, indicating that the existing non- compliances are often large and significant. Moreover, 27% average non-compliances and 8% trivial non-conformances are observed. According to Figure 7, the status of the process of credit facility granting in different audit perspectives is as follows:

Architecture = Non-compliance score of 2.04
Performance = Non-compliance score of 2.26
Infrastructure = Non-compliance score of 4.02
Risk = Non-compliance score of 2.77

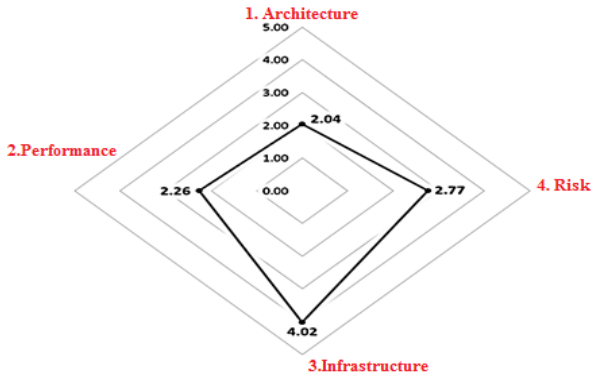

Figure 7 Radar chart comparing different perspectives of auditing the process of credit facility granting.

4.1 Corrective actions to improve identified problems and defects

Nowadays, examining the performance of successful organizations and companies in the world has proven that business process management (BPM) plays a key role in the success of any organization. Moreover, organizations have learnt experimentally that effective business process management is somehow an investment in quick response to environmental changes and a factor to create value and a competitive advantage. In this regard, business process analysis (BPA) and, subsequently, presentation of solutions for business improvement (BI) is one of the main components of the process management life cycle[1] in any organization that can lead to increased profit and maximum efficiency of the organization and, thus, its business boom. In the last decade, the banking system has also undergone major changes in the national arena. The presence of non-governmental banks and private financing institutions in the country's economic scene has created a new competitive market in the country, and on the other hand, electronic banking is expanding rapidly. In this market, banks with decades

[1] Process management life cycle consists of four main parts, namely design, execution, audit and analysis, and finally improvement and development.

of history and newly established banks are active alongside one another, while in both groups of banks, business processes are almost the same. Therefore, it is particularly important to pay attention to the improvement of processes as a factor in gaining a competitive advantage in each of the banks. In this regard, the researchers in this study held audit meetings in 17 different branches of the selected bank in order to assess the conformity of the actual implementation of the process of "granting credit facilities" to technology and knowledge-based companies in the state banking system in view of the instructions and user documents issued by higher-ranking and regulatory bodies, such as the Central Bank of Iran on how to implement the said process. They also had a brainstorming session with a number of experts and individuals involved in process implementation in the bank line and bank staff (a total of 37 experts in Credit and Supervision division) in order to further analyze the status of the mentioned process. The results were analyzed based on the methodology selected for the research (WCA) (which was mentioned in the research results and findings section), the weaknesses and defects of the said process were identified, and, ultimately, appropriate solutions were provided to solve these problems. The final results of the analysis based on the WCA methodology and based on the research findings and results, and the attached Tables 1, 2, 3&4 are as described in Table 9.

Table 9 The performed analysis and findings, and solutions for improvement based on WCA methodology.

Analysis Perspective	Non-Compliance Score	Macro Analysis Scope	Non-Compliance Degree	Analysis Components	Non-Compliance Degree	Problems identified in the process of credit facility granting	Solution for Improvement
Architecture	2.04	Process operations	1.95	Process inputs	1.54	Lack of a clear and well-stated process for valuable customers (non-observance of credit assessment and capacity assessment of customers, i.e. over-lending of facilities and, thus, deviation). Intervention of different organizations in the payment of facilities, deferring them, and re-arranging their installments, and the orders issued for payment of most large facilities (directed facilities).	Full identification of the facility applicant in terms of qualification and accreditation and other financial and credit indicators, including having no history of bounced checks, etc.
				Order and sequence of process steps	2.52	Non-observance of the sequence and priorities in process steps (as per the related instruction). Strict administrative bureaucracy. Security-based lending of facilities.	Implementing the correct standards of credit decision-making in accordance with the approvals and issued instructions, and close supervision during and after the payment of facilities.
				Process outputs	1.80	Insufficient attention to credit health standards in granting facilities and giving facilities with superficial documentations. Lack of a non-judgment model in the process of decision-making regarding the granting of credit facilities.	Ensuring and fully monitoring the use of the facility and preventing its use outside the purpose of the contract.
		Process characteristics	2.12	Degree of structuredness	2.00	Lack of transparency in the process of granting facilities and customers' unawareness of the stages of legal actions of banks.	Reviewing and integrating notices/circulars in the form of an integrated document and changing the credit attitude of managers and credit decision-makers of the state banking system, and adopting an appropriate credit mechanism for granting facilities.
				Openness of partnership	5.00	At present, due to the lack of any service-level agreements (SLA) and operational-level agreements (OLA) for implementation of the process in the bank or between the bank and other competent external authorities, significant non-compliance is identified in this section.	Establishment of necessary mechanisms for concluding SLAs and OLAs to provide financing services in the context of granting credit and financial facilities.

Table 9 (Continued).

Analysis Perspective	Non-Compliance Score	Macro Analysis Scope	Non-Compliance Degree	Analysis Components	Non-Compliance Degree	Problems identified in the process of credit facility granting	Solution for Improvement
				Integration levels	1.05	One of the related processes is the process of obtaining inquires which is very time consuming because there are several different systems. Further, the update process of notices and circulars is done by delay. Lastly, The notices and circulars system is available at certain limited hours.	Creating a new platform to perform the process of granting facilities; changing and revising the process of facility granting; and integrating credit information, scoring, and classification of current and new customers based on their credit data through a software module: in addition to specialized human resources, there must be an accurate and reliable information system for an effective ranking system.
				Complexity	0.00	-	-
				Dependence on equipment	4.70	Lack of appropriate hardware and software equipment to perform different steps of the process (e.g. scanners, printers, and computers with higher process capacity, etc.).	Equipping branches with related hardware and software equipment as soon as possible.
				Relation between planning, execution, and control	5.00	Difficulty in selling pledged collaterals of some opportunist customers. The expected interest rate of the facility is lower than the current inflation rate in Iran, which results in increase in outstanding claims for inexpensive bank facilities.	In the current system, it is of great significance to pay attention to the compliance of the performance with the instructions issued by the higher-ranking authorities, and also its compliance with the religious standards of financing the country and avoiding superficial banking transactions.
Performance	2.26	Performance indicators	2.02	Process output rate	0.00	Lack of adequate mechanism to record the performance of the actors involved in the process Insufficient attention to credit health standards in granting facilities.	Establishment of a supervisory mechanism as well as training the staff and briefing them to avoid superficial operations, and also enhancing ethical indicators, such as trustworthiness and honesty
				Key indicators of process performance	2.75	Lack of macro indicators to examine performance.	Careful review of justification reports on the presented idea and plan; ensuring the accuracy and authenticity of the provided documents and assumptions; and conforming the assessments made in the inspection reports with the market situation and avoidance of flaws, such as superficial documents or false invoicing.
				Process cycle time	3.32	There is not sufficient documentation on the work process time based on bank strategies.	Determining the standard time of the work process according to the bank's strategies using the mining process method.
		Flexibility and innovation in process	2.50	Process flexibility	5.00	Impossibility of pledging intangible assets.	Following up the approval of the bylaw for valuating intangible assets.
		-	-	Innovation in process	5.00	There is no innovation and processes are done as per the traditional procedure.	There should be structural changes in the financing and credit system of the bank.
Infrastructure	4.02	IT infrastructure	4.71	Infrastructure related to receiving input	4.84	Multiplicity of systems for obtaining inquiries required during process prolongs and interrupts the process. These systems should be integrated The Core Banking system does not halt the process if inquiry is expired.	There should be structural changes in the financing and credit system of the bank.

Table 9 (Continued).

Analysis Perspective	Non-Compliance Score	Macro Analysis Scope	Non-Compliance Degree	Analysis Components	Non-Compliance Degree	Problems identified in the process of credit facility granting	Solution for Improvement
				Infrastructure related to transformation of output into input	4.28	Incompatibility between the size of the systematic process with the executive process Lack of systematic control of authorities of bank stakeholders. The Core Banking system does not halt the process if inquiry is expired.	There should be structural changes in the financing and credit system of the bank.
				Infrastructure related to output transfer	5.00	Lack of systematic access to reports for property valuation and credit information through the Credit Information and Property Valuation System, and banks' failure to pay attention to customers' debt-to-income ratio.	There should be structural changes in the financing and credit system of the bank.
		Organizational infrastructure	3.34	Organizational chart and duties	1.78	Imbalance between workload and allocated human resources. Large size of the plans referred to banks and insistence on quick decision-making, and thus, impossibility of accurate assessment of plans by banks.	Employing qualified and experienced people in credit affairs, such as individuals who have a work record in the field of credit and have the necessary and sufficient information about facilities and obligations, as well as different types of Islamic contracts and their details.
		-	-	Human resource skill	4.90	Appropriate credit trainings in conformity with the work process are not given to actors involved in the process.	Offering required trainings on Credit.
Risk	2.77	Risk	2.77	Attention to errors and exceptions	4.00	Weak control of the State Inspection Organization, the Central Bank, and other institutions on the performance of credit institutions. The imposed economic sanctions and continued economic recession. Incompatibility of the paid facility and obligations with the type of application and the concluded contract.	Carrying out strict monitoring of customer performance and ensuring the consumption of paid sums for the intended purpose and approved economic activities; serious prevention of consuming facilities more than the anticipated amount and outside the designated purpose of the project.
				Disorganized procedures in the process	1.53	Failure to register indirect liabilities of borrowers, endorsers of promissory notes and guarantors in the systems of the Central Bank of the Islamic Republic of Iran, and customers' abuse of non-implementation of Core Banking system in all banks. Sudden change of risk-weighted coefficients by the Central Bank.	Accurate periodic revision of policies and instructions issued by senior bank managers; their flexibility with environmental conditions and the needs of the community; and transparency of performance for all members of the community. In this regard, in order to obtain knowledge about the market situation under the activity of the chain and also the financial performance of the member companies in the chain, banks and other financial institutions in contract with the credit supply chain should always not only control the market situation and obtain related information, but also monitor the performance of every single company in the chain. This way, they can revise the terms of their cooperation with supply chains as well as long-term and short-term investments in the market if there are income and profitability risks in their investments.

5. Conclusion

As mentioned earlier, one of the examples of bias in the relationship between banks and technology companies is the deviation of bank facilities from the purpose of the contract (facility grant contract). For instance, someone has submitted certain documents and deeds to introduce himself as a manufacturer to the bank, and

after receiving the facilities, he transfers the resources to another area, such as speculation (buying and selling coins, hard currency, etc.) or uses the resources for a purpose other than the approved purpose. One way to reduce such deviation is to monitor and control the consumption of facilities, which, of course, is rarely practiced due to its high costs for the bank. The problem of facility deviation occurs in both macro facilities and micro facilities. Quick return of facilities during the office of the ninth government[2] can be pointed out as a relatively unsuccessful experience with micro facilities. According to the Central Bank report of a study on how quick-impact employment facilities are used shows that a large part of the resources was spent for a purpose other than the approved plan. Therefore, regarding the challenges of financing and credit supply process of technology and knowledge-based companies, it is necessary to use new methods of financing for the purpose of resilient economy, such as financing the production value chain, collective financing of projects related to small and knowledge-based businesses through partnership with Financial technologies (fintechs) and indirect financing through networking between large, small, medium-sized, and knowledge-based firms. Ultimately, it is essential to use new financing tools and mechanisms, called supply chain financing (SCF), to reduce the need to bank resources.

One of the main benefits of supply chain financing is the reduction of financial costs along the chain as well as proper management of insufficient or surplus funds and liquidity, effective supply of working capital along the chain, and enhancement of the seller-buyer relationship. Ensuring how and where allocated resources (paid facilities) are spent, and, thus, creating a suitable platform for stronger supervision, volume control, and money creation by the banking system, as well as reducing bank's risk if financing in a suitable and secure technological environment are other benefits of supply chain financing.

The country's banking system can take a big step in solving the financial and credit problems of technology-based and knowledge-based companies by implementing this new method, and reduce the banking system's concern about the withdrawal of resources regarding how they are spent; and, finally, reduce the financing risks for the bank. Moreover, the receivables of the financed firm reduce the financing risk because the goods and products of the economic firms return within the cycle. In this way, a targeted capital supply can be guaranteed for technology and knowledge-based companies. Figure (8) shows how the main actors in supply chain financing interact in this way.

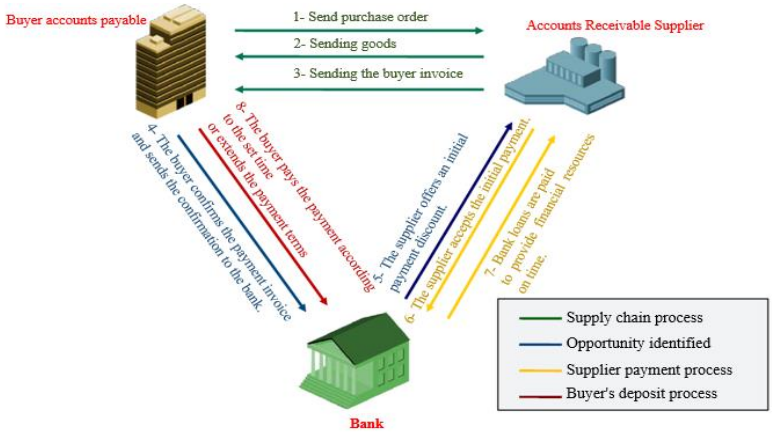

Figure 8 Interactions of key actors in supply chain financing.[23].

5.1 Limitations

Given that the publication of complication results may have effects and consequences on if the business of the bank is under study, the researchers have described the results as separation from the bank under study, in general and for the entire banking system.

[2] Executive bylaw for development of quick-impact entrepreneurial enterprises 2005

5.2 Suggestions for future research

The present study has pathologically examined the banking credit supply system from a process perspective, the following suggestions are presented for further research:

Since the idea of supply chain financing platforms emerged after the 2008 economic crisis and in response to the production-economic challenges of the time, and these platforms meet the needs of enterprises through the value production chain - from the supply of raw materials to financing and selling of end products, therefore, whereas the present study addressed supply chain financing (SCF) one of the mechanisms to improve the present situation of the country's banking system and credit supply, it is suggested that a study be conducted on how to implement and execute this mechanism in the country's banking system.

Using mathematical modeling and dynamic and viable system models, the credit system may be evaluated and examined from the perspective of credit laws and regulations, the manner of concluding financial and credit contracts, and regulatory policies.

The present study examines the defects in the financing network of the banking system only from a process perspective and through the Work-Centered Analysis (WCA) methodology, while these defects may be caused by other actors in the financing chain. Therefore, future research should simultaneously consider interrelationship between financing decisions and other credit flows.

Given that in the real world, issues such as the time value of money and inflation rate affect the amount of expenses of supply chain members, it is suggested that the mathematical model be used in future research to calculate the ratio of the time value of money, inflation rate and late penalty rate to costs.

Data Availability Statement

Due to the sensitive nature of the questions asked in this study, and that its disclosure could seriously damage the credit of the study bank, survey respondents were assured raw data would remain confidential and would not be shared. Data are not available/the data that have been used are confidential.

Conflict of interest

The authors declare no conflict of interest.

References

1. https://www.cbi.ir/(2020).
2. Zhu, Y., Zhou, L., Xie, C., Wang, G.-J., & Nguyen, T. V. (2019). Forecasting SMEs' credit risk in supply chain finance with an enhanced hybrid ensemble machine learning approach. International Journal of Production Economics, 211, 22–33. https://doi.org/10.1016/j.ijpe.2019.01.032
3. Gelsomino, L. M., de Boer, R., Steeman, M., & Perego, A. (2019).An optimization strategy for concurrent supply chain finance schemes. Journal of Purchasing and Supply Management, 25(2), 185–196. https://doi.org/10.1016/j.pursup.2018.07.004
4. Su, Y., & Zhong, B. (2017). Supply chain finance decision analysis with a partial credit guarantee contract. Journal of Applied Mathematics and Physics, 5(06), 1355–1369. https://doi.org/10.4236/jamp.2017.56112
5. Lekkakos, S. D., & Serrano, A. (2016). Supply chain finance for small and medium sized enterprises: The case of reverse factoring. International Journal of Physical Distribution and Logistics Management, 46. https://doi.org/10.1108/IJPDLM-07-2014-0165
6. Chen, S., & Murata, T. (2016). Decision-making of supply chain finance, based on inventory financing procedure under default risk and market risk. Proceedings of the International Multi- Conference of Engineers and Computer Scientists, 16–18.
7. Timsina, N. (2014). Bank credit and economic growth in Nepal: An empirical analysis. NRB Economic Review, 26(2), 1-24.

8. Markus, M. L., & Mao, J. Y. (2004). Participation in development and implementation-updating an old, tired concept for today's IS contexts. Journal of the Association for Information systems, 5(11), 14.
9. Jones, D., & Gregor, S. (2007). The anatomy of a design theory. Journal of the Association for Information Systems (JAIS), 8(5), Article 19.
10. Naghizadeh, R., & Namdarian, L. (2019). The Supportive policies for new technology-based firms (NTBF's). Journal of Science & Policy, 11(2), 285–296.
11. Cunha, D., Silva, S., & Teixeira, A. (2013). Are academic spin-offs necessarily new technology-based firms. Research Work in Progress, 482, 1–42.
12. Laranja, M. D. (1995). Small firm entrepreneurial innovation in Portugal: The case of electronic and information technologies. University of Sussex.
13. Little, A. D. (1977). New Technology-Based Firms in the United Kingdom and the Federal Republic of Germany: A Report prepared for the Anglo-German Foundation for the Study of Industrial Society.
14. Shearman, C., & Burrell, G. (1988). New technology based firms and the emergence of new industries: Some employment implications. New Technology, Work and Employment, 3(2), 87–99. https://doi.org/10.1111/j.1468-005X.1988.tb00092.x
15. Oakey, R. P. (2003). Funding innovation and growth in UK new technology-based firms: Some observations on contributions from the public and private sectors. Venture Capital: An International Journal of Entrepreneurial Finance, 5(2), 161–179.https://doi.org/10.1080/1369106032000097049
16. Garcia-Tsao, G., Abraldes, J. G., Berzigotti, A., & Bosch, J. (2017).Portal hypertensive bleeding in cirrhosis: Risk stratification, diagnosis, and management: 2016 practice guidance by the American association for the study of liver diseases. Herpetology, 65(1), 310–335. https://doi.org/10.1002/hep.28906
17. Govindan, K., Fattahi, M., & Keyvanshokooh, E. (2017). Supply chain network design under uncertainty: A comprehensive review and future research directions. European Journal of Operational Research, 263(1), 108–141. https://doi.org/10.1016/j.ejor.2017.04.009
18. Alter, Steven. (1999). A general, yet useful theory of information systems. Communications of the Association for Information Systems, 1(1), 13.
19. Alter, Steven. (2007). Service responsibility tables: A new tool for analyzing and designing systems. AMCIS 2007 Proceedings, 477.
20. Alter, Steven. (2008). Service system fundamentals: Work system, value chain, and life cycle. IBM systems journal, 47(1), 71-85.
21. Alter, S. (2013). Work system theory: overview of core concepts, extensions, and challenges for the future. Journal of the Association for Information Systems, 72.
22. Alter, Steven. (2006). Pitfalls in analyzing systems in organizations. J. Inf. Syst. Educ., 17(3), 295-302.
23. Popa, V. (2013). The financial supply chain management: A new solution for supply chain resilience. Amfiteatru Economic Journal,15(33), 140–153.

Appendices

Appendix 1 General Scopes of audit processes of bank Mellat credit section.

Audit aspect	Macro audit area	Audit components
Architecture	Process operations	Process inputs
		Sequence and sequence of process steps
		Process outputs
	Process features	Degree of being structured
		Participation rate
		Levels of integration
		Complexity
		Dependence on equipment
		The relationship between planning, implementation and control
Performance	Performance indicators	Process output rate
		Key indicators of process performance
		Process cycle time
	Flexibility and innovation	Process flexibility
		Process innovation
Infrastructure	IT infrastructure	Infrastructure related to receiving inputs
		Infrastructure related to converting inputs to outputs
		Infrastructure related to output transfer
	Organizational infrastructure	Organizational chart and tasks
		Manpower skills
Environment	Environment	Government laws and regulations
		Macro-organizational policies
Risk	Risk	Process risk components
		Cluttered and irregular procedures in the process

Appendix 2 Subcomponents and questions of credit process audit.

Audit components	Audit subcomponents
Process inputs	Documenting entries
	Identify the source that produces the inputs
	Adequacy of inputs
Sequence and sequence of process steps	Document the steps and sequence of process activities
	Compliance of execution with process steps
	Appropriate sequence of process activities
Process outputs	Documenting outputs
	Specify the source of the output
	Adequacy of outputs
Degree of being structured	Existence and availability of process support documentation
	Clear procedure for updating process backup documents
	Update process backup documentation
Participation rate	Identify the internal and external stakeholders of the process
	Document Service Level Agreements (SLA)

Appendix 2. (*Continued*).

	Adequacy of Service Level Agreements (SLA)
	Control of Service Level Agreements (SLA)
	Document Operation Level Agreements (OLA)
	Adequacy of Operational Level Agreements (OLA)
	Control of Operation Level Agreements (OLA)
Levels of integration	Identify process-related processes
	Appropriate integration of the process with other processes
Complexity	Clarity of points and decision parameters in the process
	Adequacy of decision making in the process
Dependence on equipment	The effectiveness of the equipment in the process
	Adequacy of equipment used in the process
The relationship between planning, implementation and control	Clear procedure planning, execution and process control
Process output rate	Documenting the criteria for measuring the volume of activities
	Control of activity measurement criteria
Key indicators of process performance	Documentation of key performance indicators
	Adequacy of key performance indicators
	Control key performance indicators
	The rate of improvement resulting from the control of key performance indicators
Process cycle time	Documenting the standard time of activities
	Standard time control of activities
Process flexibility	The degree of flexibility in performing activities
Process innovation	Record rate and share experiences
	Suggest innovative ideas
	Know the procedure for reviewing and applying innovative ideas
Infrastructure related to receiving inputs	Existence of information systems providing inputs
	Adequacy of information systems providing inputs
Infrastructure related to converting inputs to outputs	Existence of information systems supporting process activities
	Awareness of changes in information systems supporting process activities
	The extent to which information systems are covered by the process
Infrastructure related to output transfer	Mechanized transfer of outputs
Organizational chart and tasks	Adaptation of the current organizational structure with the approved
	Documentation of job descriptions
	Matching activities with job descriptions
	Clarify the relationship between organizational positions and process roles
Manpower skills	Provide process implementation training
	Adequacy of process implementation training
	Appropriateness of user-friendly IT tools related to the process
Process risk components	Identify errors and exceptions
	Documenting errors and exceptions to events in the process
Cluttered and irregular procedures in the process	The degree of interference with process activities
	The degree of interference with the activities of other processes

Appendix 3 Results and evidence of the audit for the process of credit facility granting.

Process title: Granting credit facilities						
Row	**Audit components**	**Non-compliance**				**Audit evidence**
		No	**Yes**			
			Low (1)	**Average (3)**	**High (5)**	
1- Architecture		0.29	0.2	0.35	0.16	-
1-1- Process operation		0.11	0.36	0.53	0	-
1-1-1-Process Inputs		0	0.74	0.25	0.01	-
1	Documented input	0	24	12	1	Since notices are considered process input, scatteredness of notices, particularly those on the scope of authority of approving authorities, results in incomplete observance to them and thus ignorance to them in work process.
2	Specific sources of producing input	0	24	13	0	Scatteredness of notices confuses the network in carrying out the process, particularly in the section on the scope of authority, because there are many items in this section that the approving authority should take into account, such as the scope of authority in respecting the equity in the amount of facilities granted to customers with/without an operation permit.
3	Adequacy of inputs	0	29	8	0	The number of inquiries required in the process and access to these inquiries is limited and must be performed at certain hours.
1-1-2-Orer and sequence of process steps		0	0.24	0.76	0	-
4	Documented steps and sequence of process activities	0	14	23	0	There are no written and integrated documents to explain the steps and their sequence for the approval process. The existing documentations are sorted by product and package type, in which the executive terms and conditions to approve credit facilities are included but the work process is not specified.
5	Conformity of implementation with process steps	0	11	26	0	In some cases in the current situation, an action is taken that does not exist in the process. For instance, the securities may be valuated first and then the approval is obtained. Moreover, the system controls the security after the approval and defects in the security are detected systematically; and there is a lack of a reporting system to monitor processes.
6	Appropriateness of order and sequence of process activities	0	11	26	0	In some cases, the securities may be valuated first and then the approval is obtained. Therefore, the valuation charges may have been received from the customer but granting of the facility may be disapproved. This will lead to customer dissatisfaction. Moreover, the security is controlled systematically after the approval and defects are announced to the customer, which may lead to his dissatisfaction.
1-1-3- Process outputs		0.33	0.1	0.57	0	-
7	Documented outputs	0	8	29	0	It is sometimes observed that approvals are issued conditionally (for instance, subject to compliance with the equity or in lieu of submission of audited financial statements, etc.).
8	Specific sources of receiving outputs	37	0	0	0	-
9	Adequacy of outputs	0	8	29	0	Since the approval in the current process is considered the process output, issuance of conditional approvals results in disruption in following steps.

Appendix 3. (*Continued*).

1-2-Process characteristics		0.47	0.04	0.18	0.31	-
1-2-1-Degree of structuredness		0.33	0	0.67	0	-
10	Availability of process backup documents	37	0	0	0	-
11	Specific procedure of updating process backup documents	0	0	37	0	According to the results of the investigations, it was observed that in some cases, the bank line did not know how to update notices and instructions or get new versions of some systems, such as the various inquiry systems, used in the process, from the credit approval all the way to granting of credit facilities.
12	Up-to-date process backup documents	0	0	37	0	Sometimes, the process had changed but the notification is not issued concurrently.
1-2-2-Degree of Partnership		0	0	0	1	-
13	Specific domestic and external process beneficiaries	0	0	0	37	At present, due to the lack of any service-level agreements (SLA) and operational-level agreements (OLA) for implementation of the process in the bank or between the bank and other competent external authorities, significant non-compliance is identified in this section.
14	Documented SLA	0	0	0	37	
15	Adequacy of SLA	0	0	0	37	
16	Controlling SLA	0	0	0	37	
17	Documented OLA	0	0	0	37	
18	Adequacy of OLA	0	0	0	37	
19	Controlling OLA	0	0	0	37	
1-2-3-Integration levels		0.5	0.23	0.27	0	-
20	Specific processes related to the process	37	0	0	0	One of the related processes is the process of obtaining inquires which is very time consuming because there are several different systems. Further, the update process of notices and circulars is done by delay. Lastly, the notices and circulars system is available at certain limited hours, which may occasionally interrupt the procedure.
21	Appropriateness of process integration with other processes	0	19	18	0	
1-2-4-Complexity		1	0	0	0	-
22	Specific decision-making points and parameters in the process	37	0	0	0	-
23	Adequacy of decision-making in the process	37	0	0	0	-
1-2-5-Dependence on equipment		0	0	0.15	0.85	-
24	Degree of effectiveness of equipment on the process	0	0	5	32	Degree of effectiveness of equipment in this process is high and the lack of appropriate hardware and software equipment disrupts the process.
25	Adequacy of the equipment used in the process	0	0	5	32	It is necessary to equip the divisions involved in the process (especially the bank line) with different hardware and software equipment, such as appropriate printers, scanners and computers, In order to perform different steps of the process.
1-2-6-Relation between planning, execution, and control		1	0	0	0	-
26	Specific procedure of process planning, execution, and control	37	0	0	0	-
2-Performance		0.46	0.04	0.14	0.36	-
2-1-Indicators of process performance		0.42	0.08	0.28	0.22	-
2-1-1-Process output rate		1	0	0	0	-

Appendix 3. (*Continued*).

27	Documented criteria for assessing activity loads	37	0	0	0	-
28	Controlling the criteria for assessing activity loads	37	0	0	0	-
2-1-2-Key indicators of process performance		0.25	0.25	0	0.5	-
29	Documented key performance indicators	37	0	0	0	-
30	Adequacy of key performance indicators	0	37	0	0	-
31	Controlling the key performance indicators	0	0	0	37	The key indicator examined in this section is the time indicator, which is general, and no attention is paid to the type of the received security or the customer's classification based on new or old customers or their value.
32	Degree of improvement due to controlling the key performance indicators	0	0	0	37	Measurement of the standard time to perform the process will have a great impact on improving customer satisfaction and improving the credit portfolio of customers.
2-1-3-Process cycle time		0	0	0.84	0.16	-
33	Documented standard time of performing activities	0	0	37	0	There is not sufficient documentation on the standard work process time based on the type of the security and the customer.
34	Controlling the standard time of performing activities	0	0	22	15	As mentioned above, there is no control in this regard due to lack of sufficient documentation.
2-2-Flexibility and innovation in process		0.5	0	0	0.5	-
2-2-1-Process flexibility		1	0	0	0	-
35	Degree of flexibility in performing activities	37	0	0	0	-
2-2-1-Process innovation		0	0	0	1	-
36	Degree of recording and sharing experiences	0	0	0	37	Experiences of experts are transferred orally and are not documented or recorded anywhere. For instance, in cases related to capacity assessment of customer, which is one of main factors in decision-making and approving proposals, the experiences of committee members should always be transferred due to differences between customers in the business domain. Due to the large workload, most branches do not have the time to record their experiences in the form of a proposal in the proposals system site.
37	Proposal of innovative ideas	0	0	0	37	No valuable proposal was made in the conducted audit.
38	Specific procedure of reviewing and implementing innovative ideas	0	0	0	37	All proposals (if registered0, regardless of the process/non-process classification, are merely distributed among experts for response through the proposals system site. The domain of the proposals is not explicitly stated to clarify to which division they relate. Therefore, valuable proposals are occasionally likely not to be followed up due to wrong classification.
3-Infrastructure		0.06	0.12	0.09	0.72	-
3-1-IT infrastructure		0	0	0.15	0.85	-

Appendix 3. (*Continued*).

3-1-1-Infrastrucuture related to receiving inputs		0	0	0.08	0.92	-
39	Existence of input-generating information systems	0	0	9	28	Multiplicity of systems for obtaining inquiries required during process prolongs and interrupts the process.
40	Adequacy of input-generating information systems	0	0	0	37	Considering the above-mentioned point, multiplicity of systems for generating the input items causes confusion and sometimes interrupts the process. The said processes need to be integrated.
3-1-2-Infrasture for conversion of inputs into outputs		0	0	0.36	0.64	
41	Existence of information systems supporting the process work	0	0	4	33	Multiplicity of systems for obtaining required inquiries and other systems with advisory roles in the facility granting process, such as the Iranian Ranking System, prolong and interrupts the process work.
42	Degree of declaring changes of information systems supporting the process work	0	0	37	0	Declarations are occasionally untimely (for instance, there are some changes in the Core Banking system which are not notified on time; or they are notified but the changes are not applied to the system yet).
43	Degree of overlap between information systems and process	0	0	0	37	Only the performance of two users of the credit committee is recorded throughout the entire process, from the approval stage to the systematic facility granting stage, while the approval process in most cases is done by a three-member committee.
3-1-3-Infrastrue related to output transfer		1	0	0	0	-
44	Automated output transfer	0	0	0	37	In the current scope of the process, three different systems (centralized facilities system, credit information system, and office automation system) are used to transfer information. Therefore, the output of each system does not automatically enter the other system (for instance, the data of the approval issued in the centralized facilities system does not directly enter the credit information system or the office automation system to inform different divisions and start the next process). Therefore, significant non-compliance is observed in this section.
3-2-Organizational Charts		0.13	0.24	0.04	0.6	-
3-2-1-Organizatioal charts and duties		0.25	0.47	0.04	0.24	-
45	Conformity of the current organizational structure with the approved one	0	0	2	35	Audits did not know much about the approved organizational structure of their workplace, especially in the line section of their bank. Thus, it is not possible to compare the existing organizational structure and the organizational structure intended to implement the process.
46	Documented job description	0	33	4	0	It is not possible to accurately compare the documents with the real implementation of the process because in the instructions issued for the process of granting credit facility, attention is given to the decision-making and financial aspects, including the issues covered in accounting, and organizational positions of individuals carrying out the different steps of the process are not clarified (in most cases, for instance, all activities to be done within a branch are assigned to the Credit and Claim Collection Group, without specifying which activity should be done by the director, banker, etc.).

Appendix 3. (*Continued*).

47	Conformity of activities with job description	0	36	1	0	As mentioned in the two clauses above, it is not possible to accurately compare the present situation with the desired status (the status stated in notices and instructions) due to lack of transparency in declaring the organizational structure intended for implementation of different steps of the approval process of credit proposals, and the examinations are done implicitly.
48	Specific relation between organizational positions and process actors	37	0	0	0	-
3-2-2-Human resources skills		0	0	0.05	0.95	-
49	Offering trainings on process implementation	0	0	4	33	The required credit trainings offered to the actors involved in the process are not in proportion or consistent with the process of performing the work, and less attention is paid to the practical aspect in trainings (trainings on the centralized system, customer capacity assessment, commitments, etc.).
50	Adequacy of trainings on process implementation	0	0	4	33	The required credit trainings offered to the actors involved in the process are not in proportion or consistent with the process of performing the work (for instance, the comprehensive system of Credits personnel training course, the practical process of using the centralized facility system, customer capacity assessment, commitments, etc. must be taught).
51	Appropriateness of trainings on using process-related IT tools	0	0	4	33	The required credit trainings offered to the actors involved in the process are not in proportion or consistent with the process of performing the work (for instance, required training on the centralized facility system, etc.).
4-Risk		0.25	0.01	0.47	0.27	-
4-1-Risk		0.25	0.01	0.47	0.27	-
4-1-1-Attention to errors and exceptions		0	0	0.5	0.5	-
52	Specific errors and exceptions	0	0	25	12	User errors in identification and recording of decision-making parameters usually occur in the process of granting credit facilities when writing or referring approval proposals, etc.
53	Documented errors and exceptions occurred in the process	0	0	18	19	Since the approval process of facility granting proposal is a two-user process, it is sometimes observed that although a three-member committee is formed (as per the credit policy), the approval is done by two users without notifying the third person; moreover, in some cases, the authorities who should approve the proposal in the system, give the approval code to other individuals. This entails risks in the approval process.
4-1-2- Disorganized procedures in the process		0.5	0.02	0.45	0.03	-
54	Degree of interfere with process work	37	0	0	0	-
55	Degree of interfere with work of other processes	0	2	32	3	Customer-related inquiries and documents should be completed at the time of approval, but in some cases the inquiries are expired. In other words, the approval-related process, which is customer file, is not updated.

Appendix 4 Table of scores obtained from auditing the process of "approval of credit proposals".

Process title: Granting credit facilities							
Row	**Audit components**	**Weight**	**Non-compliance**				**17 branches**
		-	**No**	**Yes**			
		-		**Low (1)**	**Average (3)**	**High (5)**	**Non-compliance score**
Process points		1	0.27	0.09	0.27	0.38	2.75
1- Architecture		0.4	0.29	0.2	0.35	0.16	2.04
1-1- Process operation		-	0.11	0.36	0.53	0	1.95
1-1-1-Process inputs		-	0	0.74	0.25	0.01	1.54
1	Documented input	-	0	24	12	1	1.76
2	Specific sources of producing input	-	0	24	13	0	1.7
3	Adequacy of inputs	-	0	29	8	0	1.43
1-1-2-Orer and sequence of process steps		-	0	0.24	0.76	0	2.52
4	Documented steps and sequence of process activities	-	0	14	23	0	2.24
5	Conformity of implementation with process steps	-	0	11	26	0	2.41
6	Appropriateness of order and sequence of process activities	-	0	11	26	0	2.41
1-1-3- Process outputs		-	0.33	0.1	0.57	0	1.8
7	Documented outputs	-	0	8	29	0	2.57
8	Specific sources of receiving outputs	-	37	0	0	0	0
9	Adequacy of outputs	-	0	8	29	0	2.57
1-2-Process characteristics		-	0.47	0.04	0.18	0.31	2.12
1-2-1-Degree of structuredness		-	0.33	0	0.67	0	2
10	Availability of process backup documents	-	37	0	0	0	0
11	Specific procedure of updating process backup documents	-	0	0	37	0	3
12	Up-to-date process backup documents	-	0	0	37	0	3
1-2-2-Degree of partnership		-	0	0	0	1	5
13	Specific domestic and external process beneficiaries	-	0	0	0	37	5
14	Documented SLA	-	0	0	0	37	5
15	Adequacy of SLA	-	0	0	0	37	5
16	Controlling SLA	-	0	0	0	37	5
17	Documented OLA	-	0	0	0	37	5
18	Adequacy of OLA	-	0	0	0	37	5
19	Controlling OLA	-	0	0	0	37	5
1-2-3-Integration levels		-	0.5	0.23	0.27	0	1.05
20	Specific processes related to the process	-	37	0	0	0	0
21	Appropriateness of process integration with other processes	-	0	19	18	0	1.97
1-2-4-Complexity		-	1	0	0	0	0
22	Specific decision-making points and parameters in the process	-	37	0	0	0	0
23	Adequacy of decision-making in the process	-	37	0	0	0	0
1-2-5-Dependence on equipment		-	0	0	0.15	0.85	4.7
24	Degree of effectiveness of equipment on the process	-	0	0	5	32	4.73

Appendix 4. (*Continued*).

25	Adequacy of the equipment used in the process	-	0	0	5	32	4.73
1-2-6-Relation between planning, execution, and control		-	1	0	0	0	0
26	Specific procedure of process planning, execution, and control	-	37	0	0	0	0
2-Performance		0.2	0.46	0.04	0.14	0.36	2.26
2-1-Indicators of process performance		-	0.42	0.08	0.28	0.22	2.02
2-1-1-Process output rate		-	1	0	0	0	0
27	Documented criteria for assessing activity loads	-	37	0	0	0	0
28	Controlling the criteria for assessing activity loads	-	37	0	0	0	0
2-1-2-Key indicators of process performance		-	0.25	0.25	0	0.5	2.75
29	Documented key performance indicators	-	37	0	0	0	0
30	Adequacy of key performance indicators	-	0	37	0	0	1
31	Controlling the key performance indicators	-	0	0	0	37	5
32	Degree of improvement due to controlling the key performance indicators	-	0	0	0	37	5
2-1-3-Process cycle time		-	0	0	0.84	0.16	3.32
33	Documented standard time of performing activities	-	0	0	37	0	3
34	Controlling the standard time of performing activities	-	0	0	22	15	3.81
2-2-Flexibility and innovation in process		-	0.5	0	0	0.5	2.5
2-2-1-Process flexibility		-	1	0	0	0	0
35	Degree of flexibility in performing activities	-	37	0	0	0	0
2-2-1-Process innovation		-	0	0	0	1	5
36	Degree of recording and sharing experiences	-	0	0	0	37	5
37	Proposal of innovative ideas	-	0	0	0	37	5
38	Specific procedure of reviewing and implementing innovative ideas	-	0	0	0	37	5
3-Infrastructure		0.3	0.06	0.12	0.09	0.72	4.02
3-1-IT infrastructure		-	0	0	0.15	0.85	4.71
3-1-1-Infrastrucuture related to receiving inputs		-	0	0	0.08	0.92	4.84
39	Existence of input-generating information systems	-	0	0	9	28	4.51
40	Adequacy of input-generating information systems	-	0	0	0	37	5
3-1-2-Infrasture for conversion of inputs into outputs		-	0	0	0.36	0.64	4.28
41	Existence of information systems supporting the process work	-	0	0	4	33	4.78
42	Degree of declaring changes of information systems supporting the process work	-	0	0	37	0	3
43	Degree of overlap between information systems and process	-	0	0	0	37	5
3-1-3-Infrastrue related to output transfer		-	0	0	0	1	5
44	Automated output transfer	-	0	0	0	37	5
3-2-Organizational Charts		-	0.13	0.24	0.04	0.6	3.34
3-2-1-Organizatioal charts and duties		-	0.25	0.47	0.04	0.24	1.78
45	Conformity of the current organizational structure with the approved one	-	0	0	2	35	4.89
46	Documented job description	-	0	33	4	0	1.22

Appendix 4. (*Continued*).

47	Conformity of activities with job description	-	0	36	1	0	1.05
48	Specific relation between organizational positions and process actors	-	37	0	0	0	0
3-2-2-Human resources skills		-	0	0	0.05	0.95	4.9
49	Offering trainings on process implementation	-	0	0	4	33	4.78
50	Adequacy of trainings on process implementation	-	0	0	4	33	4.78
51	Appropriateness of trainings on using process-related IT tools	-	0	0	4	33	4.78
4-Risk		0.1	0.25	0.01	0.47	0.27	2.77
4-1-Risk		-	0.25	0.01	0.47	0.27	2.77
4-1-1-Attention to errors and exceptions		-	0	0	0.5	0.5	4
52	Specific errors and exceptions	-	0	0	25	12	3.65
53	Documented errors and exceptions occurred in the process	-	0	0	18	19	4.03
4-1-2- Disorganized procedures in the process		-	0.5	0.02	0.45	0.03	1.53
54	Degree of interfere with process work	-	37	0	0	0	0
55	Degree of interfere with work of other processes	-	0	2	32	3	3.05