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Assessing Environmental Performance in the Banking Industry: Moving Towards Green Banking

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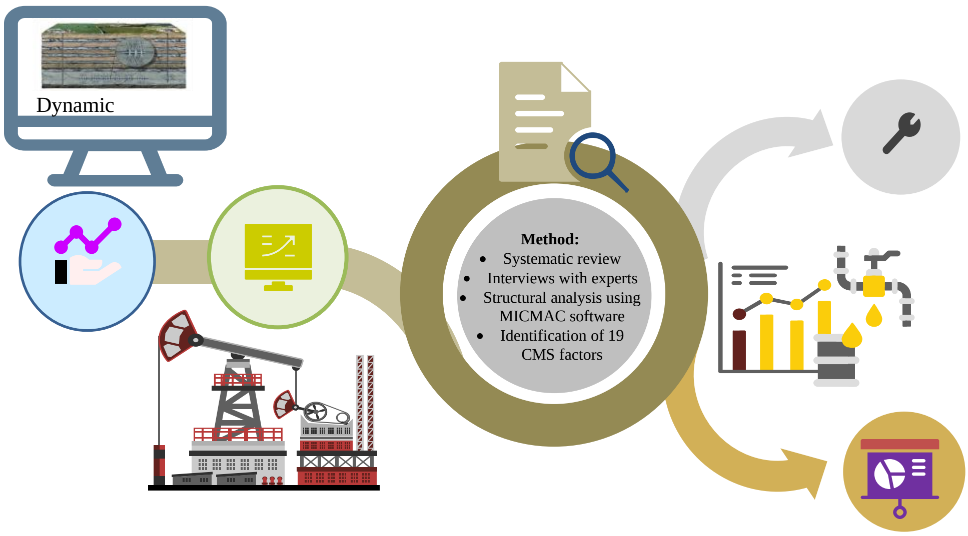
ABSTRACT

This paper aims at evaluating the barriers of implementing effective Configuration Management System (CMS) for Esfahan Oil Refinery Company (EORC)'s projects. CMS is one of the fundamental project management systems in business and production systems. The paper performs a document review as well as expert elicitation to extract required information to achieve the research objective. For expert elicitation, the most important technique is Delphi. Moreover, the major employed analytical model is structural analysis, by applying MICMAC software. The research findings show that for implementing CMS in the EORC, among 19 diagnosed items, the three first-ranked barriers are lack of senior management support for CMS, lack of resources, and absence of practical CMS tools. The authors hope the findings of this paper help the EORC's managers and policy makers, to facilitate the platforms to establish CMS in the refinery.



1. Introduction

Configuration Management System (CMS) includes activities that manage the definition of a product, system, or process from its earliest definition throughout its life cycle. In many cases, where access to data or documents may be required for regulatory purposes, CMS is also needed. Many engineering organizations widely use CMS processing to manage changes throughout the life cycle of complex systems, such as vehicles, and information systems. Achieving process excellence is not a short-term goal but takes time through incremental and progressive improvement methods. Organizations reach their goals only through extraordinary efforts, dedication, and planning. It is important to emphasize that configuration management is an integral part of the capability maturity model for software, the systems engineering capability model, and the integration capability maturity model. However, CMS initiatives have not been adequately implemented even with a structured methodology and required standards. CMS is based on sound business principles for creating product configurations, identifying and managing changes over time, accounting for all approved changes, and maintaining configuration integrity by validating and verifying required conformance.

In Project Management (PM) environment, many researchers consider CMS an integral element of PM, which may hinder effective practice. Indeed, CMS is an integral part of the project delivery strategy with clear rewards for reducing product development time, minimizing costs, and increasing overall product quality. According to Khraiwesh [1] CMS has been described as one of the essential supports in implementing organizations' projects. CMS helps project professionals ensure that products and systems meet their defined functional and physical requirements and that any changes to these requirements are tightly controlled, accurately identified, and accurately documented (Samaras, [2]). Additionally, CMS is a set of good work practices to deal with uncertainty and change (Hasani and Mokhtari, [3]) and attract project participants' commitment to design evolution. The Project Management Professional (PMP) needs CMS to support the project infrastructure actively (PMI, [4]).

In this point, let's observe two facts:

(A) A review of the current CMS procedures in the oil industry projects sector shows no plan to implement CMS. Therefore, there is a great executive and management gap in this field, so it is necessary to identify and

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highlight some of the main barriers to the success of CMS (Wang et al., [5]).

(B) Achieving a well-functioning CMS is not easy and requires further studies to examine the barriers to implementing high-grade CMSs (Burgess et al., [6]). In addition, ranking situations in PM are important (Hatefi and Razavi, [7]), thus ranking the mentioned barriers should be paid attention by researchers .

Considering the above facts, the current paper aims at focusing on oil-based projects in Esfahan Oil Refinery Company (EORC), to diagnose barriers of implementing CMS (Notably, in the literature of assessing the obstacles to creation/establishment of a system/application, the general word "risk factor" is replaced by the unwelcome word "barrier" and welcome word "enabler". In addition, the literature often prefers to use the word "barrier", not the word "obstacle"). The EORC is one of the 9 oil refinery companies in Iran, in which several projects are annually done. Such study will help CMS analysts better plan and avoid the effects of barriers in the early stages of project definitions in the EORC. In this research, the authors tend to examine the barriers for effectively implementing an effective CMS in the EORC's projects (let us from this point on, call them "CMS Implementation Barrier" or "CIB" for short). Follows, major literature on this subject is reviewed.

Fowler [8]considered CMS models and applications. With an overview of CMS, the researcher provides a treatment of the concept in its broadest context and an assessment of its potential and state of evolution. The subject's history was traced from its origins in the expansion of technology in the mid-1960s to modern developments related to information systems and document processing. Generalized concepts of CMS were reviewed, drawing on existing literature, with several CMS models compared and contrasted. It also assessed CMS's recent role in several industries, from software development to construction, manufacturing, nuclear power, and shipbuilding. Ali and Kidd [9] investigated CMS barriers in a research project. According to the researchers, CMS is not a set of new ideas; it shows an effective way for project managers to use a formal methodology to manage its status and changes during the life cycle. This research sleeked to identify and prioritize barriers in the effective implementation of CMS methods, categorize these barriers into more manageable groups of factors, and analyze the effects of multiple factors on identifying and ranking these barriers. Nineteen barriers were finalized and prioritized based on their criticality. As a result, three groups (management and organizational barriers, implementation barriers, and planning and process barriers) were extracted with the help of factor analysis. Safdar et al. [10] conducted an investigation titled CMS and its implementation barriers in Pakistan's public sector engineering organizations. This research aimed to divide the data collection process into two different phases. In the first step, some CMS experts were asked through a question to identify these barriers. Then, in the second stage, a questionnaire was provided to these experts to answer a series of questions related to the barriers to the implementation of CMS. Fifteen barriers were identified through the process. Then, the barriers were ranked and finally categorized with the help of Factor Analysis (FA). Wang et al. [5] investigated the level of knowledge of executive managers in several private companies regarding the implementation of CMS. In the end, they stated that one of the main barriers to the implementation of CMS in the studied companies is the low level of knowledge of executive managers in this field, and according to the obtained results, the topics that should be presented in the CMS training course to improve the knowledge level of executive managers from the general concept, benefits of implementing CMS, a brief overview of the CMS process, to change management and configuration control .

Recent research has elucidated the challenges encountered in employing CMS inside industrial systems and during the digital transformation process.

The amalgamation of Building Information Modelling (BIM) with Product Lifecycle Management (PLM) technology has revolutionized configuration management processes, enhancing traceability and coordination, as noted by Zhou and Li [11].

Similarly, Singh and Ahmed [12] identified managerial commitment, resource limitations, and inadequate training as the primary impediments in process industries. Rabih and Omar [13] proposed an integrated Delphi–MICMAC technique to classify and rank organizational barriers, providing a robust framework for decision-making.

Building upon these perspectives, Mohammadi Koushki, El-Shekeil, and Kant [14] formulated ConfExp, a root-cause analysis approach aimed at detecting service misconfigurations in business systems, emphasizing the power of automation in reducing human error.

Dande et al. [15] examined the prospective advantages of ITIL-based service configuration management in supporting organizations during their digital transformation .

The challenges associated with data integration and standards render CMS less advantageous than it could be.

Recent studies in the energy and industrial sectors have highlighted the complex and systemic challenges related to digital implementation (Wang et al.; Chen et al., 2024; Alshibani et al.)[16,17].

The results revealed substantial impediments, including financial, organizational, and technological barriers, alongside technical complexity and inadequate institutional support. These insights together underscore the imperative for flexible, data-driven, and cooperative strategies to address CMS implementation issues in intricate industrial projects.

The paper is simply organized as follows. Introduction is offered in section 1. Then, in section 2, the research method is proposed. In section 3, the findings are portrayed, and then in section 4, the summary and conclusion are discussed

2. Method

2.1. Methodology

As mentioned earlier, this research is to assess the CMS Implementation Barriers or CIBs. The overall approach of the study is descriptive and qualitative and is carried out using the Delphi method for gathering data. Thus, the study is on the basis of Subject Matter Expert (SME)'s opinions. Twenty managers ($m = 20$) and SMEs of the EORC constitute this research's sample of participants ($i = 1, \ldots, 20$). Moreover, library study and review of texts and content of materials, as well as field methods such as questionnaires and interviews, are used. The type of research is based on a combination of two quantitative and qualitative approaches to assess the CIBs.

Let us observe some information about the SME panel. Regarding gender, 10% of SMEs participating in the research (2 people) are women, and 90% of the Delphi group respondents (18 people) are men. Therefore, most respondents participating in the Delphi research group are men. Regarding age criterion, 15% of respondents (3 people) are under 35 years old, 55% of respondents (11 people) are between 35 and 45 years old, and 30% of respondents (6 people) are between 46 and 55 years old. Also, considering education, 20% of the respondents (4 people) have a bachelor's degree, and 80% (16 people) have a master's degree or higher.

Firstly, practical CIBs in the implementation of the effective CMS in the field of the EORC's projects are diagnosed, employing literature review and theoretical background. The output of this stage is called "preliminary list". Thus, to form the preliminary list, a relatively comprehensive understanding of the available studies in this field is obtained, by library method and document review such as reading books, records of previous domestic and foreign studies, existing laws and programs, and documents. Then, through the Delphi method and in-depth face-to-face interviews, an attempt is made to work on the preliminary list of CIBs, in order to achieve the list of CIBs to be analyzed. Let's call it "refined list". A CIB in this list is denoted by $\mathrm{CIB_j}$ ($j = 1, \ldots, n$).

Secondly, a rating questionnaire is developed for scoring the refined list of CIBs. To develop this questionnaire, we followed the methodology mentioned in (Rabih et al., 2024). This is a researcher-made questionnaire to collect the required data to assign scores to the CIBs. The respondents, including 20 managers of the EORC, should determine the score of each of the CIBs using a Likert scale. This scale, in the current study, is a five-point measure that is used to allow SMEs to express how much they determine the importance of a given CIB. The five points are very important (score 5), important (score 4), moderately important (score 3), slightly important (score 2), and unimportant (score 1). The score of $\mathrm{CIB_j}$ suggested by ith SME is denoted by $s_{i,j}$. After that, a geometric mean of Likert scores (denoted by S_j) is calculated for each CIB separately, as Equation (1). Moreover, an overall geometric mean (denoted by S) is calculated for all the CIBs totally, as Equation (2). These calculations can be simply performed by Excel software.

$$S_j = \left(\prod_{i=1}^{m} s_{i,j}\right)^{1/m} = \sqrt[m]{s_{1,j}\, s_{2,j} \ldots\, s_{m,j}} \quad (1)$$

$$S = \left(\prod_{j=1}^{n} S_j\right)^{1/n} = \sqrt[n]{S_1\, S_2 \ldots\, S_n} \quad (2)$$

In this point, this rule is applied: "The CIBs whose individual mean (i.e., S_j) is lower than overall mean (i.e., S) is removed, and the CIBs whose individual mean is equal to overall mean or higher, is remained in the refined list". The obtained final list is named "screened list".

Next stage is carrying out a structural analysis in order to take strategic decisions and visioning the results. This stage is performed using MICMAC software, the new version designed by the French Institute of Computer Innovation under the supervision of the Center for Research Organization and Vision Strategy. MICMAC is abbreviation of Matrix Impact Cross-reference Multiplication Applied to a Classification. This software is a famous and well-established tool for Interpretive Structural Modeling (ISM). For providing data to input the software, a pairwise comparison form ($n \times n$) to be filled by SMEs is constructed. Each SME needs to compare each two CIBs, and to state his/her judgement on scale: 0: No effect, 1: Weak effect, 2: Moderate effect, or 3: Strong effect. As a matter of fact, each time, SME should compare a given CIB at a row of the pairwise comparison form to another given CIB at a column of the pairwise comparison form, and expresses his/her answer to this question: "How much the row CIB can impact on column CIB?". The overall number of pairwise comparisons by each SME is represented as $(n) \times (n-1)/2$, where n represents the number of elements (i.e., CIBs) to be compared (Choudhary et al., 2022). Once the pairwise comparisons were received from all SMEs, a matrix of direct effects is formed. Each cell in this matrix is the maximum number offered by all SMEs. Finally, in matrix of direct effects, row sums and column sums are calculated, the former shows "driving power" of CIBs and the latter depicts "Dependence power" of CIBs.

The final stage is to analyze the MICMAC results. MICMAC categorizes CIBs into 4 zones. It portrays the driving values of CIBs on the y-axis, and dependence values of CIBs on the x-axis and, then classifies the CIBs into 4 following zones:

- Autonomous CIBs (low driving and low dependence values): These CIBs stand for minimum influence on other CIBs. Because of the weak linking power, they share with other CIBs. These CIBs have relatively no considerably relations with the overall system.
- Independent CIBs (high driving and low dependence values): These CIBs are the key barriers that have a substantial impact on many other CIBs. They possess a high driving force and depict limited dependency index.
- Dependent CIBs (low driving and high dependence values): These CIBs are dependent on other CIBs having a low influence on the remaining parts of the model.
- Linkage CIBs (high driving and high dependence values): These CIBs act as a connection between independent and dependent CIBs, and therefore aid in the transmission of impacts between barriers. They have important driving force in addition to high dependency. We can conclude that any variation in them will impact others, or vice-versa.

3. Results and Discussion

Firstly, 23 practical CIBs ($n = 23$) were identified, by literature review, theoretical background, and SME's comments. Additionally, they are categorized in four clusters: (1) Management and organizational (CIB_1 to CIB_7), (2) Planning and process (CIB_8 to CIB_{13}), (3) Implementation (CIB_{14} to CIB_{19}), and (4) Cultural and scientific (CIB_{20} to CIB_{23}).

The 23 CIBs are used to establish rating questionnaire form (see Appendix, Table A-1) to be filled by SMEs. Once the scores were received, the calculation and screening actions were done. A geometric mean of Likert scores was calculated for all the CIBs totally, and the total average was 3.41; then, individual geometric means were calculated. For example, for CIB_1 (i.e., Lack of CMS training across organizations), the responses (i.e., scores $s_{1,1}$ to $s_{20,1}$) suggested by SMEs were in the order 3,2,4,5,3,5,5,4.3,5,4,2,3,5,2,3,5,4,3,4, and the geometric mean was calculated as $\sqrt[19]{3.2.4.5.3.5.5.4.3.5.4.2.3.5.2.3.5.4.3.2} = 3.41$. Baed on the the established rule, the CIBs whose score is lower than 3.41 should be removed. Therefore, among the 23 CIBs, 19 barriers were finally selected. This means that four CIBs are removed. Interestingly, all these four CIBs were from category of cultural and scientific: Lack of sufficient scientific resources ($S_{20} = 2.98$), Project implementation managers' lack of belief in CMS ($S_{21} = 2.47$), Lack of trust in CMS ($S_{22} = 2.98$), and Lack of connection with scientific and academic centers ($S_{23} = 2.74$). Table 1 shows the results, i.e. screened list of the CIBs. Note that the number of CIBs was updated as $n = 19$.

Table 1. Screened list of the CIBs

Code	CIBs	Geometric mean
CIB1	Lack of CMS training across organizations	3.51
CIB2	Lack of authority to enforce CMS principles and policies	3.45
CIB3	The implementation costs outweigh the benefits of CMS	3.47
CIB4	Not recognizing and underestimating the importance of CMS	3.66
CIB5	Lack of career advancement for CMS specialists	3.93
CIB6	Lack of senior management support for CMS	3.50
CIB7	Lack of a centralized entity to administer CMS	4.05
CIB8	Failure to maintain consistency in CMS practices across projects	3.47
CIB9	Lack of a CMS process during lifecycle	3.82
CIB10	CMS requirements and process are not defined	3.93
CIB11	Deprecated CMS application process	3.51
CIB12	Lack of flexibility in CMS process	3.93
CIB13	Lack of current CMS plans	3.51
CIB14	Lack of awareness of CMS in the customer world	3.86
CIB15	Lack of practical CMS tools	3.55
CIB16	Short supply	3.60
CIB17	Lack of support from stakeholders	3.57
CIB18	The existence of very intense project pressures	3.62
CIB19	Lack of effective communication	3.54

The 19 key CIBs were inserted in a pairwise comparison form to be filled by SMEs (see Appendix, Table A-2). Hence, using the Delphi method and pairwise comparison, the cross-effects matrix dimensions were 19×19. Table A-3 (see Appendix) shows the matrix of direct effects. As shown in Table 2, the filling rate of the matrix is 81.44%, and it shows that the selected CIBs did not have a large and scattered effect on each other, and the system had an almost unstable condition. In this matrix, 67 relationships are zero (without influence), which means that the CIBs did not influence or were not influenced by each other, accounting for 18.06% of the total volume of the matrix. Out of the total of 249 evaluable relationships in this matrix, the number of ones equals 112, which is equal to 45% of the total volume of the filled matrix. Also, in this matrix, the number of twos equals 143, which equals 57.43% of the total volume of the filled matrix. The obtained matrix has 39 threes, which is 15.66% of the total volume of the filled matrix. On the other hand, the matrix has 96% desirability and optimization based on statistical indicators with 2 data rotations, indicating the questionnaire's high validity and answers.

Table 2. Preliminary analysis of matrix data and cross-sectional effects

Indicator			Value
Size of the matrix:			19
Number of repetitions:			2
Empty matrix:	67	Number of zeros:	67
	112	Number of ones:	112
Filled matrix:	143	Number of twos:	143
	39	Number of threes:	39
Potential effect:		0	0
Total			249
Matrices			81.44

In Figure 1, the position and distribution of the CIBs are shown, in which the y-axis shows the driving values of CIBs, and the x-axis displays the dependence values of CIBs. The distribution of the CIBs is stretched diagonally from the northwest to the southeast. The state of the distribution screen shows that the CIBs are unstable. Most of the CIBs are scattered around the diagonal axis of the plane. Influential CIBs are displayed in the northwest part of the diagram. In this research, based on the results obtained among the company managers, the following CIBs are considered as influential CIBs: 1- Lack of senior management support for CMS, 2- Lack of resources, 3- Lack of practical CMS tools, 4- Lack of a centralized entity to administer CMS, 5- Requirements and the process of CMS is not defined 6- Lack of recognition and underestimation of the importance of CMS at the organization 7- Lack of awareness of CMS in the customer world 8- Lack of current CMS plans 9- Lack of effective communication 10- Lack of Maintaining stability in CMS methods throughout the projects. These ten-system input CIBs are considered.

Autonomous area: 1- The existence of very intense project pressures, and 2- Lack of CMS process during life cycle, are located in this area.

Linking area: Such results and reactions have a boomerang effect, which ultimately causes attenuation or intensification of the initial effect and symptom. That is, if there is a change in the amount of input CIBs, it will cause changes in the linkage area. It is found out that (1) lack of training in CMS are located throughout the organizations in this area, and (2) lack of authority to enforce CMS principles and policies as the target CIB.

Dependent area: 1-Lack of career advancement for CMS specialists 2-Implementation costs are more than the benefits of CMS 3-Lack of flexibility in CMS process 4-Outdated CMS process as influential and dependent components, CIBs are considered.

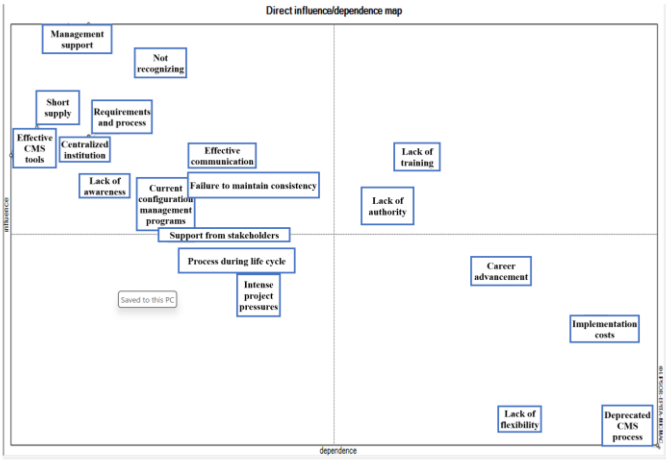

Figure 1. Position and distribution of CIBs in the plan

Table 3 shows the driving power and dependency power of CIBs. In this table, CIBs are prioritized on the basis of driving powers. The leader of CMS in the refinery should oversee CMS, ensure that CMS approaches are aligned with the refinery's strategic goals, and support them. Senior management has critical responsibilities in implementing CMS. One of the most essential measures that the EORC must take to ensure the success of CMS is for the senior manager to believe in CMS. That is, choosing the right manager and defining its roles and tasks significantly contribute to the successful implementation of CMS. The information of senior managers is the only tool that helps them make decisions. By receiving information and processing it, managers gain knowledge based on which they recognize the possible options in solving problems and choose the most appropriate ones, so the support of the senior manager of CMS can be successful and implemented.

The CIB of not recognizing and underestimating the importance of CMS at the organization, with a total driving power of 42, ranks second in importance. Managers' understanding of the importance of CMS can lead to coordination and program development to reduce confusion in the organization. They specify, organize, and control the programming group's software modifications to maximize production capability while minimizing errors, which is considered CMS's most crucial goal.

The lack of resources, with a total driving power of 36, is the third most important. It can be said that various resources and items are needed for the successful implementation of CMS. A Configuration Item (CI) includes an asset, service component, or any other item that is (will be) under the control of CMS. CMS Items and Resources (CIRs) can be defined in a wide range of complexity, size, and type. A CMS resource may be an input service or an installed system (from hardware, software, documentation, and support personnel to a simple software module or small hardware device). The CIRs may form a group or control each other (for example, different components released in the same version). The CIRs should be selected, grouped, and identified based on specific indicators to manage and track them throughout their life cycle. The CIB of CMS requirements and process are not defined; with a total driving power of 35, it ranks fourth in importance. In fact, for the successful implementation of this program in the refinery, various requirements and processes are needed, which are necessary for the life cycle of CMS configuration management resources. Service management plans, service life cycle plans, service design packages, and the organization's business strategy and legal requirements are all necessary to successfully implement CMS. The remaining CIBs are ranked in terms of importance as follows:

- Lack of a centralized entity to administer CMS ranks fifth, with a total driving power of 35.
- Lack of practical CMS tools with a total effectiveness score of 33 ranks sixth.
- Lack of effective communication, with a total score of 32, is ranked seventh.
- Lack of training in CMS in all organizations is ranked eighth, with a total driving power of 32.
- The lack of stability in the methods of CMS throughout the projects, with a total driving power of 31, is ranked ninth.
- The lack of current CMS plans with a total driving power of 30 is ranked 10th.
- Lack of awareness of CMS in the customer world is ranked 11th in importance, with a total driving power of 29.
- Lack of authority to enforce CMS principles and policies is ranked 12th in importance, with a total driving power of 27.
- Lack of support from stakeholders is ranked 13th, with a total driving power of 26
- Lack of CMS process during life cycle with a total driving power of 21 ranks 14th
- Lack of job progress for CMS professionals, with a total driving power of 20, is ranked 15th.
- The project had intense pressures, with a total driving power of 19, ranked 16th.
- CMS's implementation costs are higher than its benefits; with a total driving power of 14, it ranks 17th
- The inflexibility CIB, with a total driving power of 4, is ranked 18th
- The deprecated process CIB is ranked 19th in importance with a total driving power of 2.

Table 3. Final ranking the CIBs.

Rank	Code	CIB	Driving	Dependency
1	CIB6	Lack of senior management support for CMS	47	21
2	CIB4	Not recognizing and underestimating the importance of CMS	42	23
3	CIB16	Short supply	36	19
4	CIB10	CMS requirements and process are not defined	35	21
5	CIB7	Lack of a centralized entity to administer CMS	35	21
6	CIB15	Lack of practical CMS tools	33	18
7	CIB19	Lack of effective communication	32	25
8	CIB1	Lack of CMS training across organizations	32	33
9	CIB8	Failure to maintain consistency in CMS practices across projects	31	26
10	CIB13	Lack of current CMS plans	30	23
11	CIB14	Lack of awareness of CMS in the customer world	29	21
12	CIB2	Lack of authority to enforce CMS principles and policies	27	32
13	CIB17	Lack of support from stakeholders	26	24
14	CIB9	Lack of CMS process during life cycle	21	25
15	CIB5	Lack of career advancement for CMS specialists	20	36
16	CIB18	The existence of very intense project pressures	19	27
17	CIB3	The implementation costs outweigh the benefits of CMS	14	40
18	CIB12	Lack of flexibility in CMS process	4	37
19	CIB11	Deprecated CMS application process	2	43

In Figure 2, the most important direct effects of the CIBs are briefly shown. As it can be seen, the lack of senior management support for CMS is the most critical CIB that affects other CIBs. In this model, this CIB affects the lack of consistency in CMS methods throughout the projects, the lack of current CMS plans, the lack of resources, the lack of CMS process during life cycle, and the lack of flexibility in CMS process.

Also, in this summary model, the lack of support from senior management, the lack of recognition and underestimation of the importance of CMS at the organization, and the lack of training of CMS throughout the organization make the process of CMS seem obsolete. On the other hand, lack of current CMS plans in the refinery makes the implementation costs outweigh the benefits of CMS. Also, the failure to define the requirements and process of CMS, as well as the failure to maintain consistency in CMS practices across projects, ultimately causes a lack of career advancement for CMS specialists. Also, all the relationships in the model are shown in Figure 3.

In Figure 3, the plan of all the relationships between the CIBs is shown. As can be seen, fragile effects are shown with dotted lines, weak effects with thin black lines, medium effects with thin blue lines, relatively strong effects with thick blue lines, and most substantial effects between CIBs with thick red lines. Also, in the plan of indirect relations, the results show that the most important result of the effect and influence of the CIBs was the lack of support of the senior management from CMS, which is based on the lack of authority to enforce CMS principles and policies, the costs, the implementation of more than the advantages of CMS, the lack of career advancement for CMS specialists, the lack of flexibility CMS process, the lack of training of CMS in all organizations had had a strong impact, and also the CIB of not recognizing and underestimating the importance of CMS at the organization affects the CIB of implementation costs more than the benefits of CMS, the lack of flexibility in CMS process, the outdated CMS process. Figure 3 shows some of the most essential indirect relationships in the model.

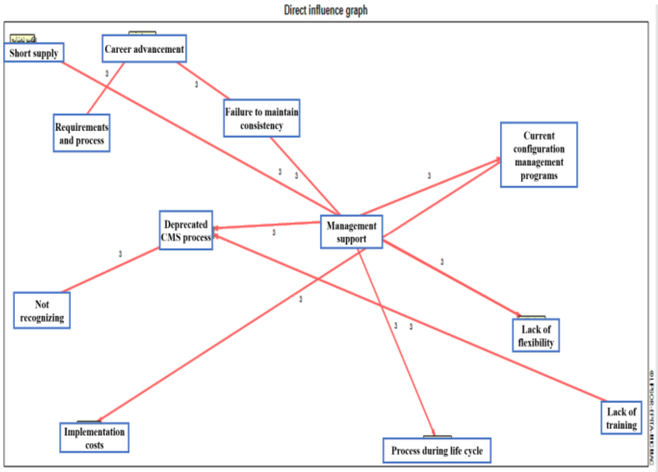

Figure 2. Plot of the most critical direct effects of the CIBs

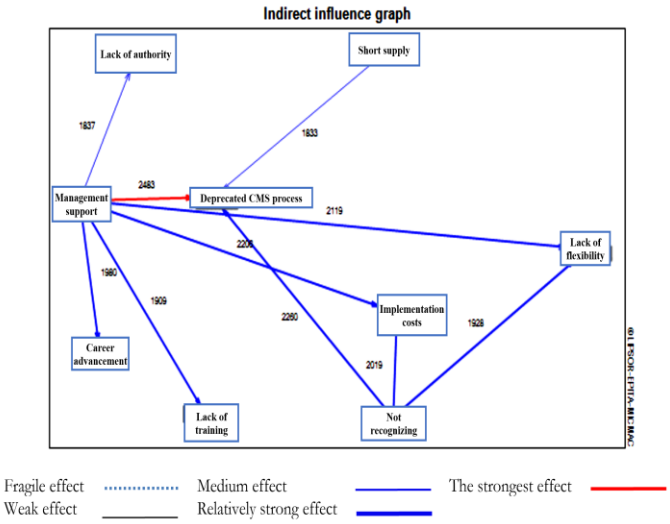

Figure 3. Plot of the most essential indirect relationships of the CIBs

4. Conclusions

This research was done in Esfahan Oil Refinery Company (EORC), to assess barriers of implementing Configuration Management System (CMS). The paper called barriers CMS Implementation Barrier (CIB). Some scientific tools were used, such as simple calculations (like geometric mean) in Excel software, and structural modelling in MICMAC software.

Data collected from 20 managers and experts through questionnaires revealed several critical barriers. The primary issue identified was the lack of senior management support, considered the most important system input. Additional barriers included insufficient resources, the absence of practical CMS tools, and the lack of a centralized institution to oversee CMS. Furthermore, undefined CMS requirements and processes, undervaluation of its importance across organizational levels, and limited customer awareness of CMS were significant challenges. Current CMS programs also suffered from instability and ineffective communication, hampering successful implementation. Future challenges highlighted included the absence of authority to enforce CMS policies and the lack of organizational training programs. Other contributing factors were limited career advancement for CMS specialists, high implementation costs that outweigh benefits, inflexibility in CMS processes, and reliance on outdated practices. The study underscores the necessity of addressing these barriers by ensuring managerial commitment, adequate resource allocation, modernization of tools and processes, and fostering organizational awareness about CMS's benefits. In abstract, regarding the results achieved in the structural analysis, the following ranked CIBs are considered as influential:

1- Lack of senior management support for CMS.
2- Lack of resources
3- Absence of practical CMS tools
4- Lack of a centralized entity to administer CMS
5- The requirements and process of CMS are not defined
6- Lack of recognition and underestimation of the importance of CMS at the organization
7- Lack of awareness of CMS in the customer world
8- Lack of current CMS plans
9- Lack of effective communication
10- Failure to maintain consistency in CMS practices across projects

As mentioned before, the leader of CMS in the refinery should have mastery of CMS, ensure that CMS's approaches are aligned with the strategic macro goals of the refinery, and support them. Senior management has critical responsibilities in implementing CMS. Choosing the right one and defining its roles and tasks significantly contribute to the successful implementation of CMS. The information of senior managers is the only tool that helps them make decisions. By receiving information and processing it, managers gain knowledge based on which they recognize possible options in solving problems and choose the most suitable ones, so the support of the senior manager of CMS can be critical in the success and implementation of CMS.

Also, lack of resources is the second input CIB of the system. It can be said that various resources and items are needed for the successful implementation of CMS. The CIRs may form a group or control each other (for example, different components released in the same version). The CIRs must be selected, grouped, categorized, and identified based on specific indicators to manage and track them throughout their lifecycle. The CIB of not recognizing and underestimating the importance of CMS is another system input that affects other system CIBs.

Also, the results showed that the following CIBs may affect the investigation of the CIBs in the future: (1) lack of authority to enforce CMS principles and policies, and (2) lack of training of CMS throughout the organizations. The results showed that the following CIBs are influential: (1) Lack of career advancement for CMS specialists, (2) Implementation costs are more than the benefits of CMS, (3), Lack of flexibility in CMS process, and (4) Outdated CMS process.

For the future scientific researches, the analysts may concentrate on the other methods like Decision Making Trial and Evaluation Laboratory (DEMATEL) (Tabrizi et al. [18]), and Multiple Attribute Decision Making (MADM) (Karbasian et al. [19]) for evaluation of CIBs. Additionally, a post analysis for the findings of the current paper is advised, i.e., how the EORC managers can deal with the key CIBs, and how high-rank CIBs may affect the other management systems in the EORC, e.g., performance management system, knowledge management system, etc.

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