Developing an Organizational Performance Evaluation Model Using Grounded Theory Methodology and ARAS Method

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Abstract

In today's dynamic and competitive climate, organizations need to have a coherent framework for performance management. The models and frameworks in the literature may not be consistent with businesses' changing nature and peculiar goals. They mostly rely on results and are ambiguous about how to be translated into specific performance measures. In response to these issues, this study designs a four-layer organizational performance evaluation model. Each layer of this model is broken down hierarchically into the two levels of measure domains and measures. The effects of measure domains on their next layer are determined using a novel approach based on the hierarchy of the model. Subsequently, the measures are ranked using Additive Ratio Assessment (ARAS) method. Research validity is guaranteed via data triangulation and methods triangulation. Eventually, the insights obtained from analyzing the research results are offered to the target organization to improve its performance management. The principal scientific value added by this paper is to present a new organizational performance evaluation model that offers a complete classification of performance measures and captures a comprehensive picture of business components and their relationship with organizational results. Moreover, the proposed model can improve some drawbacks of current models and their implementation challenges.

Keywords: Performance Evaluation Framework, Organizational Performance, Performance Reference Model, Balanced Scorecard (BSC), Grounded Theory, Multi-Criteria Decision Making (MCDM), Additive Ratio Assessment (ARAS).

1. Introduction

It is generally acknowledged that the business environment is constantly changing. The pressures resulting from global competition, technological advances, economic entanglement, free trade, and the like have made organizational life ever more complex. Since the central issue in all

organizational analyses is performance, whose improvement requires measurement, an organization is inconceivable without a performance management system (PMS) [1]. To this end, it is imperative to have a framework on which the organization can build to go through performance management processes. Such a framework must both integrate a PMS and be resilient to change [2].

Any performance management framework and model suggests a specific arrangement according to which the organization's performance measures should be structured. Some of these models include processes that explain how to design indicators and establish a PMS [3]. A number of these frameworks explicitly list the criteria that need to be considered in such systems. Other frameworks emphasize that each organization should have a unique PMS [4].

Many researchers have moved towards combining or customizing performance evaluation models to solve the challenges and gaps in implementing these models [5]. On the other hand, the literature stresses the necessity of designing a performance reference model (PRM), a concept that is often adopted at the level of governments, industries, and big organizations [6-13]. The PRMs define the measurement areas and determine the measures required for managing and monitoring an organization as a system [8].

This study focuses on the same view and attempts to design a PRM for an information technology (IT) organization in the banking industry. Unlike many articles that have examined, compared, prioritized, and combined performance evaluation models, this study is not limited to existing models but seeks to design a comprehensive framework. This contribution is the primary scientific value added by the present paper. Indeed, the study develops a new performance evaluation model that captures an inclusive picture of business components and their relationship with organizational results and solves the implementation challenges of the current models.

2. Literature review

Many researchers have been keen on performance management and measurement in the past three decades. Issues related to developing a strategic performance management framework were first discussed in the early 1990s [14]. A large and growing body of literature has investigated performance measurement, focusing on the development of performance management frameworks. These studies suggest a paradigm shift from a financial perspective to an integrated view from 1991 to 2000. Besides, they maintain that from 2001 onward, the operational stance has been overshadowed by the strategic perspective and a concentration on sustainable using simulation systems and techniques. One of the critical contributors to these evolutions has been the expansion of the IT industry [4,15,16].

The balanced scorecard (BSC) is a dominant PMS used worldwide [4,17]. It was introduced by Kaplan and Norton in 1992 and was later expanded and improved. To evaluate any organization's performance, it suggests, organizations need to use a series of balanced indicators so that senior managers can have an overview of four crucial organizational factors: finance, customers, internal processes, and growth and learning [18,19]. Ignoring the impact of various stakeholders is one of the leading causes of failure of some industries that adopt this model [20,21].

Oliveira et al [22] addressed the existing gap in the literature by detailing how the BSC assists managers in organizational communications. Bescos et al. [23] examined the role of the BSC over a long-term perspective with a large deployment and numerous hierarchical levels and analyzed the interrelation between human and non-human actors.

Although first introduced in the BSC model, the concept of balance has been underlined in several other performance evaluation methods [24]. The notions of critical few [25], performance dashboard [24], and EFQM excellence model [26-29] have also been developed based on the concept of balance [24].

The EFQM model is not the only model for organizational excellence. Earlier, in 1987, Malcolm Baldrige's model (BEF) was introduced, which includes seven criteria for performance excellence [30,31]. The literature review provided by Ubaid et al. [32] has identified 46 organizational excellence methodologies (OEMs), which indicates the diversity of OEMs used by organizations from different business sectors. Some studies highlight the need to apply the organizational excellence model alongside the BSC model because the latter can address two significant weaknesses of the organizational excellence model, namely lack of strategic orientation and lack of centralization of improvement activities [33,34].

Another widely used model in performance management is the process model. Introduced by Brown [35], this model is a framework that prioritizes the horizontal flows of materials and information in the organization and accentuates causal relationships [36-39].

Criticisms against the BSC have begun since 2000. Some researchers have upgraded the BSC under the following terms: Kanji's BSC [40], holistic scorecard [41], total performance scorecard [42], system dynamics-based BSC [43], sustainability performance measurement system (SPMS), and fuzzy logic-based proactive BSC [44]. Other developments include the introduction of a performance prism model [45], dynamic multidimensional performance framework [46], performance planning value chain [47], and an extended framework for performance management systems [48]. In 2010, Sushil proposed a new PMS called the flexible strategy game card, which aimed at a model that stressed gaming cards more than the concept of BSC [49].

Given the rapid changes in the industrial and business environments in recent years, researchers have become increasingly interested in developing performance management models and frameworks [50]. In a 2010 study, an innovation PMS was designed based on four perspectives: strategy and portfolio, culture, structure, and learning and competence [51]. Ivanov and Silvia [50] developed a conceptual framework for evaluating the performance of the innovation process. Franco et al. [52] proposed a strategic measurement framework to monitor and assess the circularity performance at the micro-level by two multi-criteria decision-making methods. Costa et al. [53] presented a study to understand the potential of BSC adoption in health institutions. Elbanna et al. [54] explain the concept of causality among BSC perspectives.

Boerrigter [55] provided the sustainability BSC framework for managing the performance of small and medium-sized businesses in the Netherlands. Nicoletti Junior et al. [56] have proposed an organization performance framework considering competitiveness and sustainability to validate the practical application of Sustainability Evaluation Model (SEM). Sarker et al. [57] have presented a sustainability performance measurement model, which integrates the BSC perspectives and the fuzzy multiple-criteria decision-making (FMCDM) approach. Some researchers have applied the integrated FMCDM approach to the BSC-based new service development evaluation [58,59]. Lop et al. [60] reviewed some models in the literature and their compatibility with the manufacturing industry. In another research, performance measurement systems in banks were analyzed [61]. Similarly, a study was conducted to review, design, and establish performance evaluation systems regarding collaboration between universities and public organizations [62].

Some authors have used the BSC model to construct a framework for the IT industry [63,64]. Others have extensively dealt with developing BSCs to evaluate performance in the supply chain [65-67]. Frederico et al. [68] presented a theoretical approach based on the BSC concerning performance measurement in supply chains for the Industry 4.0 era. Another study integrated the notions of resource-based theory and organizational capability. It conducted a performance analysis of BSC's four perspectives by implementing the fuzzy set theory and data envelopment analysis [69]. A further study investigated the roles played by dynamic capabilities theory and performance evaluation approaches in enhancing business strategy alignment with technology strategy [70]. In another study, the performance of an organizational resource planning system was measured using a hierarchical BSC model based on multi-criteria decision-making [71].

Rodríguez et al. [72] have presented a dynamic supply chain BSC methodology to improve business efficiency. A recent study presents a business performance management (BPM) framework, where the key components influencing business performance are explained [73]. The proposed BPM framework rests on five key components: environment, organizational culture, systems and IT, processes, and people, as the core to everything. Yadav and Waal [74] compared Indian and Asian organizations using the High-Performance Organization (HPO) framework [75]. Do and Mai [76] have reviewed and synthesized notable literature on HPO.

Some studies [77,78] have proposed a BSC-DEA model to measure organizational efficiency in the banking industry. Akman and Turan [79] presented an expanded BSC structure for banks by adding risk and agile perspectives to the current BSC structure. Yazdi et al. [80] evaluated the performance of Colombian banks by ranking them based on BSC and MultiCriteria Decision Making (MCDM) methods. Oyewo et al. [81] concluded that banks do not adopt an integrative approach to performance measurement. A recent study [82] has been conducted with the aim of choosing the most suitable approach for developing a green organization benchmark by examining the evaluating methods of organizational performance.

Basar [83] proposed a new BSC-based methodology to evaluate the performance of IT projects in a fuzzy environment. Abbasi et al. [84] introduced a multi-objective BSC model for New Product Development (NPD) project portfolio selection. Antunes et al. [85] developed a dynamic performance evaluation framework designed exclusively to look at startups' reality. Haerizadeh and Sunder (2022) examined a real-time application of the EFQM model to Bridge organizational performance gaps [86]. Azhang et al. [87] presented a conceptual framework for performance evaluation in the field of management accounting. Agarwal [88] designed a combined BSC-QFD (namely, House Of Performance Management or HOPM) model to identify potential leveraging points for performance enhancement.

All these studies have attempted to design and present performance evaluation frameworks and models that are highly applicable and flexible in the target industries and organizations. Basically, performance management has shifted over time from a more pyramid approach, top-down organizational approach to flat collaborative environment [89]. In recent years, production orientation has been supplanted by service orientation, and the emergence of new paradigms such as IT and the digital economy has transformed businesses. As a result, characteristics such as integrity, comprehensiveness, dynamism, process orientation, agility, greenness and sustainability have been highlighted in performance management frameworks and models.

3. Methodology

3.1. Research method

According to the research onion model [90], this study can be described as basic research. It is interpretive in terms of philosophy, applied in terms of purpose, and inductive in terms of approach. The study has a mixed-methods design and draws on grounded theory as a research strategy. The data were collected longitudinally through structured interviews for qualitative data and a questionnaire for quantitative data. The coding process of the grounded theory was used for qualitative data analysis, and the ARAS multi-criteria decision-making method was employed for quantitative data analysis. The study intended to answer the following two fundamental questions:

1. Given the characteristics of current performance evaluation models and frameworks, what is a comprehensive, practical, and measurable framework for an IT organization that can be used as a reference to manage an organization's performance?
2. How are performance evaluation measures prioritized in this framework?

The primary process in this research follows the grounded theory methodology. However, quantitative methods were used in some steps as well. Indeed, PPRM is designed as a grounded theory based on the field environment observations and literature data.

The target environment in this study is the Tejarat Iranian Digital Development Company (TIDDEV), which is an IT organization in the banking industry. The company was founded in May 2015 as a private joint-stock company invested 100% by Tejarat Bank. The company's mission is to generate and continuously increase value for this Iranian bank by introducing and promoting modifications in the bank. The purpose is to be accomplished with a focus on implementing a comprehensive central banking system and all other systems related to the principal operations of the bank business, designing and developing innovative and value-creating digital products and services, and continuous support and improvement of the related systems. The company hires nearly 250 people working in various software design, development, and support specialties. The scope of this research covers all aspects of the organization that should be examined to evaluate a company's performance.

3.2. Research validation

In grounded theory, validation is not a separate research stage but is actively performed during the research process. This concurrence is because there is no baseline hypothesis that can be validated in a separate stage of this research method. Instead, the hypothesis is extracted from the analysis performed on the data. Therefore, critical in this research strategy is the validity of the data and the credibility of the analysis method [91]. Notably, reliability is not entirely appropriate for qualitative research based on grounded theory [92]. Often, the transparent staged process of grounded theory guarantees the reliability of the research per se. Also, the reliability of this research type is generally ensured through other strategies such as trustworthiness, rigor, and quality of data collection.

Triangulation is one of the most effective methods in validating qualitative research, specifically in grounded theory, where data triangulation is used. Furthermore, to ensure the validity of the results, the research process was planned based on the framework provided by the so-called "W method" [90]. In this method, the researcher alternates between the literature and the study field to validate the findings [90,93,94]. The case study method is another measure to guarantee the model's validity

3.3. Research process

The primary research process drew on the steps of grounded theory methodology, focusing on Corbin and Strauss's [91] approach and the W method. To this end, seven main steps were defined. The first, third, fifth, and seventh steps were related to the field environment, and the second, fourth, and sixth steps were related to the literature environment. Figure 1 displays the steps taken in the research methodology.

Figure 2 presents the input, method, and output of performing each step. Each of the research steps is described below.

3.3.1. Phase one: Understanding the problem and defining research questions

3.3.1.1. Step one: Problem definition in the field environment

In this step, basic knowledge concerning the nature of the organization and its activities was acquired through visits to the target organization and meetings held with the managers of different departments. Moreover, the strategic documents and performance reports were all reviewed. This step aimed to identify various issues and challenges in performance management.

3.3.1.2. Step two: Review and comparison of models presented in the literature

A total of 56 articles, 11 books, and 14 managerial reports or white papers were reviewed. These works introduced and discussed performance evaluation models and frameworks. As such, 23 models and frameworks for performance evaluation were identified. The outcome of this step was identifying the core issue in performance models: that an overlook to adapt models to the nature and type of organizations restricts their applicability. Moreover, it was noticed that most models focus on monitoring the results and tend to introduce measures that fall into the domain of the results. Besides, the majority lack a measuring and scoring system for measures. The field research findings similarly indicated that organizations often face difficulty applying the models because measuring the results is complicated. These issues and gaps highlight the need to design a PRM.

The first and second steps led the researchers to a more accurate understanding of the problem. After the literature and practical field issues related to performance management were studied, the research team determined the central topic of the research and formulated the research questions in detail.

3.3.2. Phase two: Designing the performance evaluation model framework

3.3.2.1. Step three: Open coding of field information

The first subprocess in grounded theory is open coding. In open coding, concepts are identified, and their properties and dimensions are explored in the data [95]. Concerning this step in the current study, an interview protocol was developed based on the outputs of the previous steps and the research questions to collect field environment information in more detail. Six structured interviews with various managers from the target organization were conducted.

After the data were collected, the anchor identification and coding process began. An anchor derives from specific data in interview transcripts and indicates a topic being assessed or monitored at each level of the organization. In addition, cases whose performance management seemed important but had no formal measurement and monitoring were also coded as anchors. As such, 169 anchors were identified, following which the conceptualization phase was initiated. Concepts are basic or micro-analytical units. The emerging anchors were classified into 48 concepts. In the last step, categories were identified and defined. Categories are more abstract

than concepts and are at a higher level [91]. Thus, categories are formed when concepts are grouped (Table 1).

3.3.2.2. Step four: Modifying and finalizing categories

Since the field environment is limited to one organization and some categories may not be mentioned during the interviews and review of the company's informational documents, this step tried to draw once more on the literature to prepare a comprehensive list of categories related to performance evaluation. The purpose was to increase the validity of the final model and create the ability to generalize the model to all software companies. For this purpose, new categories were identified and termed, based on Ariawan et al. [96], under the three categories of knowledge, communication capital, and physical capital to consolidate and integrate them (Table 2). The transcripts of the field interviews were re-examined, and concepts related to these new categories from the field were identified.

3.3.2.3. Step five: Axial coding and framework creation

Axial coding is the process of linking categories to subcategories and linking categories to each other at the level of properties and dimensions [91]. According to the features proposed by Strauss [97] and Lee [95] concerning the notion of core category, the "activities" category was selected as the core category, and axial coding was visualized (Figure 3).

One voluntary step that can be taken in grounded theory is to break some categories into subcategories. After the axial model was presented to the participants and the categories were examined, it was concluded that the "activities" and "results" categories are too broad and need to be broken down. Field environment information was applied to break the *activity* category, and various types of activities were identified. Thus, this category was broken down into four subcategories: unit, project, process, and product activities. The *results* category was broken into the two subcategories of internal and external results by applying the field feedback received from the BSC.

According to the results of conceptual coding, it was concluded that developing a framework that separates performance measures into different parts and is not entirely focused on the results can be a more appropriate framework for a reference model and answering the first research question. Thus, the idea was formed to map coded categories based on Brown's process framework. This framework emphasizes causal relationships and is very practical [36-38]. Hence, Brown's process model (Figure 4) was drawn upon to define a four-layer framework and to identify and classify the measure domains of the PPRM.

Thus, the ultimate PPRM framework was defined with the four layers of inputs, activities, outputs, and results to sort categories and subcategories (Figure 5).

Each layer is divided into sections in this framework, called measure domains (measurement areas). Moreover, the measure domains of the results layer were classified similarly to the internal and external results in the BSC model. In fact, the measure domains are the same categories and subcategories defined in the research method.

3.3.3. Phase three: Defining performance evaluation measures

The performance evaluation framework obtained at the end of the fifth step is by itself a valid and feasible research output. Organizations can use it as a performance evaluation framework by defining their respective measures in each part of the framework. Nevertheless, the present study goes a step further and extracts and defines the measures for the proposed framework. This

further step was taken for two reasons. First, this can be considered a method for validating the framework in terms of comprehensiveness, inclusiveness, and applicability, which could demonstrate the inclusiveness of the framework. The second reason was for the framework to be readily available for organizations to use with minimal localization required. This was necessary because the purpose of this study was to provide a comprehensive reference framework for performance management. The structure of the PPRM was completed by defining the measures. Figure 6 illustrates the hierarchy of the PPRM.

3.3.3.1. Step six: Defining the properties of categories (measures)

The need to define measures led to another step in the grounded theory method: defining the properties of categories. This step is optional but was performed because of the need mentioned in the above paragraph. In order to complete the structure of the PPRM, the models and performance evaluation frameworks proposed in the literature were re-examined as regards the measures. All potential measures and criteria were extracted, rewritten as per the nature of the target organization, and listed separately for each section of the framework.

3.3.3.2. Step seven: Dimensionalizing category properties (the weights of measures)

After the properties were defined, they were dimensionalized as the next step. A dimensionalized property means that the researcher considers the property on a continuum and assigns to each property a point between the two extremes of a continuum using a valid method [98]. In this research, categories are the measure domains of the performance reference model, and the properties of each category are their measures. The dimension of each property will also determine the weight of the measure in the ultimate model. This step aimed to rank the performance measures according to their significance in achieving the organization's desired results and finalize the PPRM. This ranking aims to identify a set of measures that can provide a good evaluation of the organization's performance (answer to the second research question), thus saving time and energy from measuring, monitoring, and managing a larger number of them.

To prioritize the measures, the research team considered the results layer as what ultimately reflected the organization's performance and illustrated its desirability status. The measures were prioritized based on the results obtained from analyzing the effects of PPRM's different layers on each other and the organization's ultimate results. Thus, using the group decision-making method, the research team first made a pairwise comparison between the measure domains (perspectives) of the results layer to determine their respective weight and importance in the target organization. Accordingly, nine senior managers and experts from relevant departments of the target organization were selected and assigned a weight and degree of expertise.

Afterward, decision-makers assigned their desired values to the pairwise comparison matrix such that the inconsistency rate of each decision matrix was lower than the maximum allowable inconsistency coefficient ($i.e., < 0.1$). The values of each matrix can be denoted by a_{ij}^{k}, meaning the opinion of the *k*th decision-maker about row i and column j.

The above matrix was solved in two ways. In the first method, the pairwise comparison matrices of each decision-maker were calculated separately using the arithmetic mean proposed by Saaty [99,100]. Later, the weighted mean of each weight was calculated using the values of expertise weight (w^{k}) and considered as the final importance of the perspectives of the results

layer. In the second method, for each *i* and *j*, the weighted geometric mean (i.e., $\sqrt[9]{\prod_{k=1}^{9}(a_{ij}^{k})^{d^{k}}}$) was obtained based on the opinions of all decision-makers. Subsequently, the resulting pairwise comparison matrix with an allowable inconsistency rate of 0.015 was solved using the arithmetic mean method and the final weights of the results-layer perspectives. The results of the two methods were not considerably different from each other. Yet, the second method results were used as the basis for subsequent calculations thanks to its higher accuracy.

Finally, the measures of each domain were ranked using a novel and hop-by-hop method based on the hierarchy of the PPRM framework (from the highest level to the lowest level). This helped calculate the weight of each measure domain of the output layer and rank the measures accordingly. Additionally, each lower layer was evaluated in terms of its effects on its upper layer in a hierarchical fashion.

The decision-makers performed these evaluations using Likert scale values in the form of a set of decision (influence) matrices. Because of the unipolarity of the effect criterion, negative values are not taken into account. The measures were ranked by calculating the geometric mean score of each decision-maker's opinion using the ARAS method. ARAS is one of the most recent multi-criteria decision-making methods introduced in 2010 [101]. It can be easily implemented because all of its criteria are positive and unipolar. The output of this method is the ranking of specific options (here measures). The steps of implementing this method are as follows:

1- Form a decision matrix so that the options (A_i) and the criteria are placed in the row and the column, respectively. It is assumed that the weights of the criteria are present, that there are m options and n criteria, and that a_{ij} represents the values of the decision matrix.
2- Add the hypothetical ideal option (A_0) to the set of options; in this study, the ideal value would be equal to the maximum value in the columns as the criteria are positive.
3- Normalize the matrix. For positive criteria, each value is divided by the sum of its column values ($\frac{a_{ij}}{\sum_{i=0}^{m} a_{ij}}, \forall j$);
4- Form the weighted matrix such that the values of the normalized matrix are multiplied by their corresponding criterion weights;
5- Calculate the total utility of each decision option (S_i); to do this, one simply has to add the normalized weighted values in a row ($S_i = \sum_{j=1}^{n} \hat{a}_{ij} \; ; \; i = 0,1,...,m$);
6- Calculate the relative utility of each option (K_i) ($K_i = \frac{S_i}{S_0} \; ; \; i = 0,1,...,m$);
7- Rank the options based on K_i in descending order. The option with the highest K_i is the best.

4. Results

4.1. Final framework of the performance reference model

The first outcome achieved in the fourth step of the research was a PPRM (Figure 5). As can be seen, the PPRM consists of fourteen measure domains that are categorized into four conceptual layers. The measure domains of this model are defined according to the conditions of the case study environment. Below, each layer is defined, and its related measure domains are described.

- **First layer: Inputs:** The lowest layer in the model comprises measures that evaluate all the inputs that are considered resources in the organization for performing activities. The measure domains of this layer include physical, communicative, structural, and human capital. Physical capital includes everything related to the physical assets of the organization. Communicative capital includes any infrastructure, mechanism, and asset that can enable effective communication inside and outside the organization. External partnerships and inter-organizational relationships exemplify this type of capital. Structural capital includes non-human and intangible assets and the organization's strengths that provide a mechanism for improved effectiveness of human resources. Lastly, human capital entails all the potentials and capabilities of employees.
- **Second layer: Activities:** The second layer addresses the activities or measures taking place in the TIDDEV Company to convert inputs into outputs and includes four measure domains. First are unit activities, which include all activities related to organizational units. Second are project activities, which entail activities with specific initiation and termination dates (duration). Third are product activities, which cover activities related to the maintenance, support, development, and marketing of a product. Lastly, process activities include all structured activities that explicitly or implicitly define actions to be taken in the organization.
- **Third layer: Outputs:** The third layer consists of the outputs of the organization's activities, which are typically placed in the three domains of products, services, and knowledge. A product could be a specific software program, a web service, or a system with several software components, among others. Service includes items such as counseling and support services, while knowledge is the output of activities produced implicitly or objectively. Examples of knowledge outputs are designs, which are related to new ideas and activities of the organization.
- **Fourth layer: Results:** The current study identified the general dimensions or perspectives whereby the organization's macro results can be examined in this layer. These perspectives are modeled on the BSC and are categorized into two groups. Internal outcomes comprise learning, growth, and business processes, and external outcomes entail finance, customer, brand, and credibility. These outcomes will lead to measurable effects in line with strategic objectives. Eventually, strategic outcomes are higher-level results that will be achieved automatically when the results layer is realized correctly per the organization's strategic objectives.

4.2. Degree of the effects of measure domains

The two outcomes derived from analyzing the sixth step include determining the degree of effects of the measure domains on their subsequent layer and ranking the measures of the performance model. Table 3 summarizes the significance values of the perspectives from the results layer. These values are the results of solving the pairwise comparison matrix based on the weighted geometric mean of the decision-makers' opinions. Furthermore, as the weight of decision criteria, they are the basis for calculating the effects matrices of the outputs on the results.

The results of this section demonstrated that managers and experts in the target company are more focused on the customer than any other factor, as agreed by all decision-makers. The reason can be found in the commission of this company, whose main shareholder is a large bank (Tejarat Bank) and is indeed the company's principal customer.

After the weights of the results were determined, the weights of other measure domains (their relative utility) in the previous layers were calculated in reverse order, i.e., from the end to the beginning. Figure 7 exhibits the degree of effects calculated for each measure domain on the vector. In this figure, the thickness of the vector indicates a greater effect. As shown, the highest impact in the inputs layer is related to human capital. This measure domain also has the most substantial impact in all model layers.

In the activities layer, the performance model is affected more by the product, project, unit, and process activities, respectively. The low weight of process activities lies with the type of business with which the company is associated. The greater importance of product activities than project activities can be attributed to the fact that support, development, and innovation in existing products are more frequent than creating a new product.

In the outputs layer, the most considerable effect is associated with products, services, and knowledge. According to the decision-makers, it is primarily the company's products that could ensure the long-term survival and growth of the company and help achieve better results.

4.3. Ranking measures

Measures are placed at the lowest level of the PPRM framework. After the PPRM framework was completed and the effects weight of the measure domains was determined, each measure was assigned a rank, which indicates its respective importance in determining the status of a measure domain in the performance evaluation process.

4.3.1. Key insights and policy recommendations

- **Transformation of IT working environment:** From the decision-makers' perspective, it can be concluded that the work environment has lost its traditional meaning. The work environment, building, and land were ranked last regarding physical capital measures. However, the decision-makers identified "interactive physical workplace" as the most critical measure in this measure domain. This ranking highlights changes, for instance, telecommuting, cloud-based and Internet-based infrastructure, the shift in workplace layout to stress more interaction, and the physical downsizing of companies, all of which reflect a global trend gaining significance in recent years. These findings suggest that physical downsizing policies can be proposed as an effective policy.
- **Transformation of organizational structures:** Related to physical changes, but more important, are the changes taking place in the culture of managing various affairs in the organization. Decision-makers preferred measures representing flat team-like structures to broad, long, bureaucratic, and hierarchical ones. Thus, regarding communicative capital, the second priority was given to "internal social networks and interactive environments".
- **Seeking customer-centric culture:** Agility in the software industry has increasingly attracted the attention of researchers. This concept comprises a variety of behaviors, yet it can be regarded as a type of activity that ensures an organization is flexible and responsive to changes demanded by the customer. Indeed, customer orientation and agility are interdependent. The importance of these two complementary concepts can be deduced based on different observations. Thus, as described in the previous section, the customer

perspective acquired a high weight in the results layer. In process activities, "process agility" was ranked second with a high degree of relative utility (0.922). The first rank belonged to "familiar influential people in the employer organization" in the communicative capital category. Lastly, "customer satisfaction" attained the highest rank in both measure domains of products and services. All of this evidence suggests that the target organization should, first, regularly monitor the realization of agility and customer orientation in its performance management through relevant and highly-effectual measures and, second, plan for its continual improvement.

- **Proving an innovative and learning organization:** "Training and promoting human capital", the first rank among the measures of unit activities, substantiates that the organization can meet its requirements, provided that enough attention is paid to training and maintaining its current human capital. In the same measure domain, "maintenance of human resources" (utility = 0.728) is significantly more important than "recruitment" (utility = 0.616). Regarding project activities, "project knowledge management" ranked first, indicating the need to use the knowledge created in projects to employ people working on one project for other projects and activities. "Innovation management" had the highest score among the measures of product activities. In the measure domain of knowledge, as an organizational output, the most critical item was the "capacity to become a competitive advantage", which focuses on knowledge generation. These two measures support the perception that innovation is one of the most central and formative criteria in the organization's performance. Therefore, becoming a learning and innovative organization can be postulated as a crucial policy in this industry.

4.3.2. Suggestions for applying PPRM

The following steps are suggested to business managers who intend to conduct the company's performance management process using the PPRM model:

1) Focusing on measures that weigh more than 0.7;
2) Identifying the data required for evaluating the selected measures;
3) Assessing the current status of the organization based on selected measures;
4) Selecting patterns from similar companies, studying patterns, and targeting measures;
5) Continuous monitoring of the fulfillment of objectives;
6) Adding new measures and repeating cycles (weighing less than 0.7).

In this regard, deploying management dashboards as a business intelligence system can be an effective stimulus to follow and carry on the performance management process and trigger its improvement in each cycle.

5. Conclusion

A significant factor for the survival of an enterprise under a highly competitive environment is continuous management of performance. This requires, first of all, a comprehensive and reference framework based on which the organizational performance can be defined and measured. The literature review revealed that adapting these models to all enterprises is not enough, as these models ignore some characteristic problems of businesses and predominantly focus on results. Specifically, businesses face a fundamental problem in applying performance management models, namely translating the model into quantifiable measures. Since these

models are mainly based on obtained results, with the results being difficult to measure, the problem has become more complex, and its solution is fundamental.

The present research proposed a PPRM based on the idea that results are the outcome of a process that converts inputs into outputs. It covers the weaknesses mentioned above and defines different measures proportionate to the organization's nature. Moreover, it allows the performance evaluation process and definition of performance measures to be highly flexible. This allows the provision of the presented framework in many organizations upon customizing performance measures. Also, due to the process-based nature of the PPRM framework, it will be possible to observe the causal relationships between performance measures.

Regarding the necessity the prioritization of performance measures in this framework, a company active in banking IT was studied to illustrate the measure domains of each PPRM layer. The concept of "process" was utilized to break down the results into lower layers and specify quantifiable measures. Using this model enables monitoring and managing tangible measures related to inputs, activities, and outputs and thus helps understand the status of the organization's results.

The limitations of this study concern time and cost restrictions. This limited the researchers' access to organizations and further data. To address this limitation, researchers took two steps. First, a more in-depth field study was conducted; the number of interviewees and questions increased to identify all aspects of the target organization in more detail. Second, for the development of the model, the study did not suffice only to field information, and the information obtained from a comprehensive literature review was analyzed and used through the W method in all stages.

6. Recommendations for future research

The PPRM structure is designed to provide a standardized measurement hierarchy and framework uniquely tailored by decision-makers for a specific environment. Applying the PPRM to other company environments can clarify its implementation issues. In addition to applied research, the extension of this model to other businesses and industries along their peculiar measure domains could pave the way for further development studies. This is because each industry and organization's nature and environment necessitate unique performance reference frameworks that could be deployed to tackle its performance management appropriately. To develop and facilitate using this model, irrespective of the industry involved, researchers are recommended to focus on how to incorporate the model into the organization's strategic planning process to achieve an integrated model for strategic management and organizational performance.

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Figure captions:

Figure 1. Steps of the research method

Figure 2. Research procedure (The input, method, and output of each step are mentioned from left to right)

Figure 3. Visualized axial coding

Figure 4. Brown's process model

Figure 5. The final framework of the PPRM

Figure 6. The hierarchical structure of PPRM

Figure 7. Relative utility (effects) of each measure domain (Ki)

Table captions:

Table 1. The initial list of categories and concepts identified from the field environment

Table 2. Other categories (identified from the literature)

Table 3. Significance of the perspectives of the results layer

Figures:

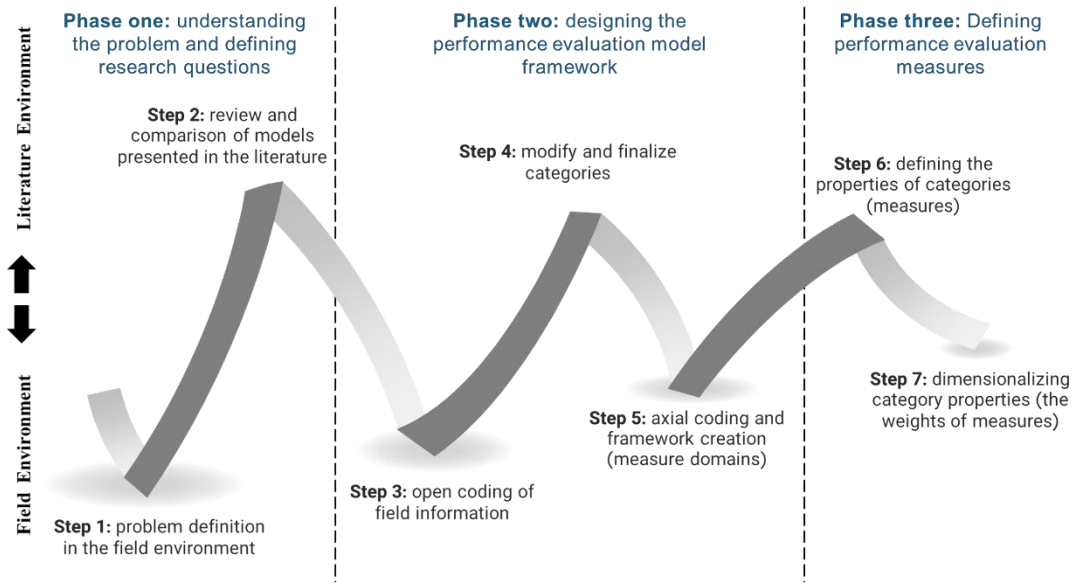

Figure 1

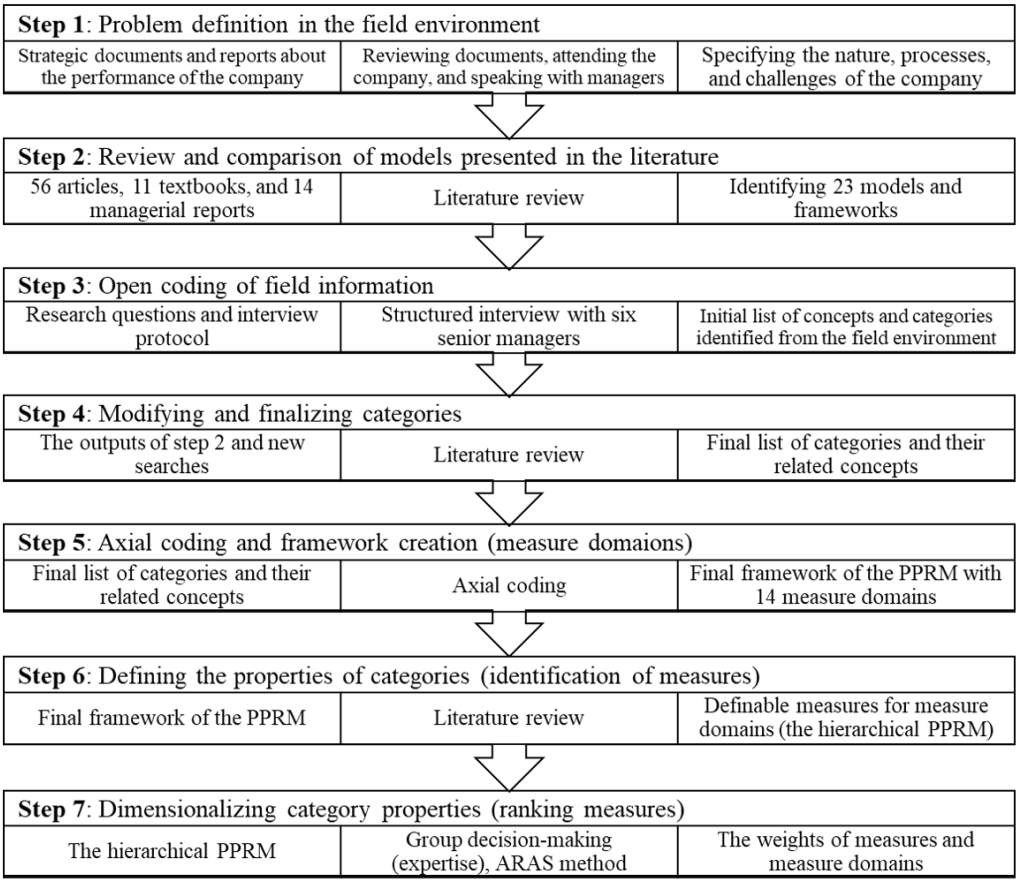

Figure 2

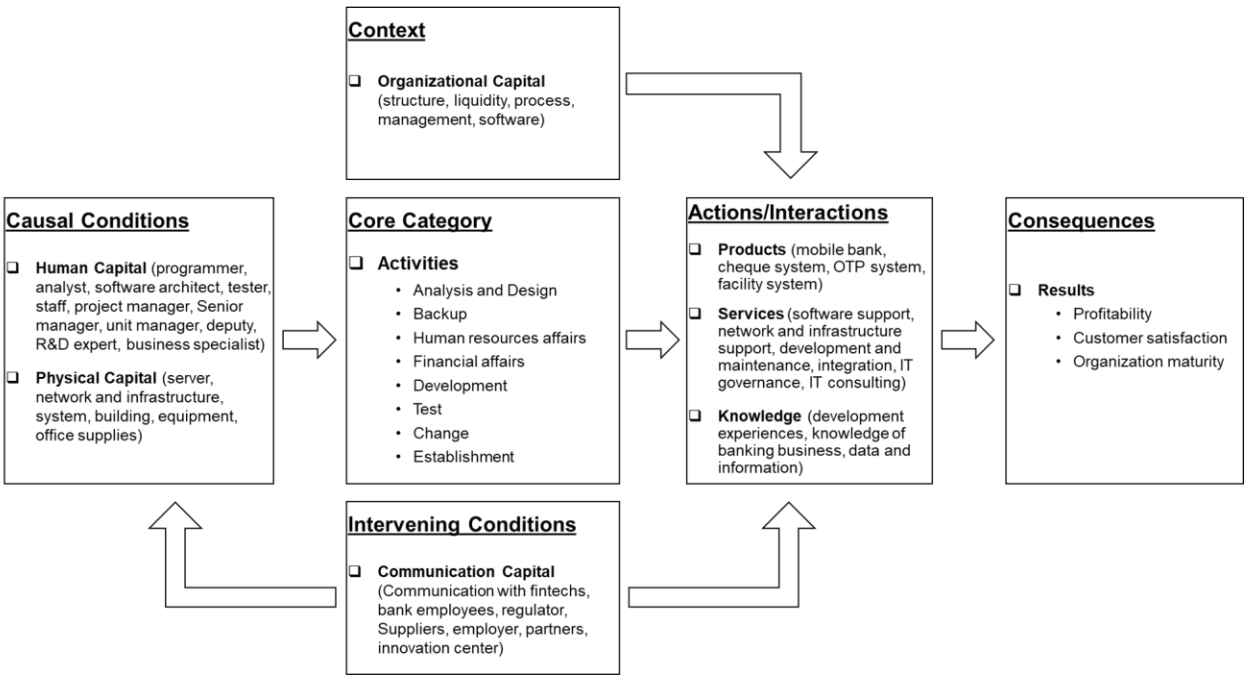

Figure 3

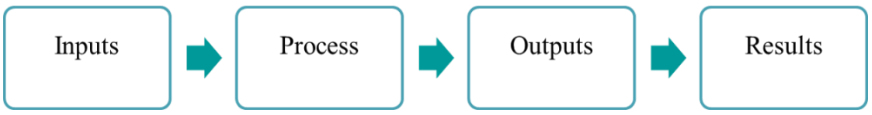

Figure 4

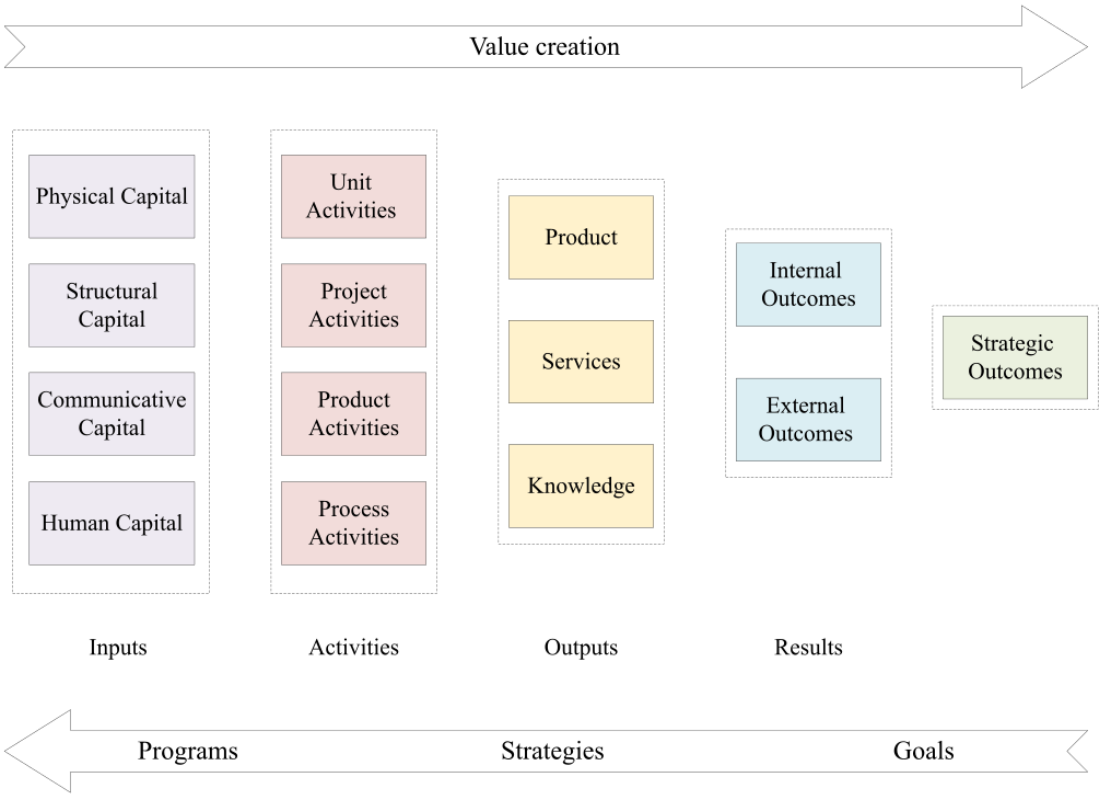

Figure 5

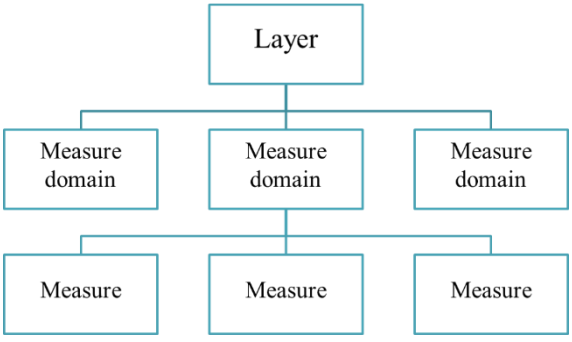

Figure 6

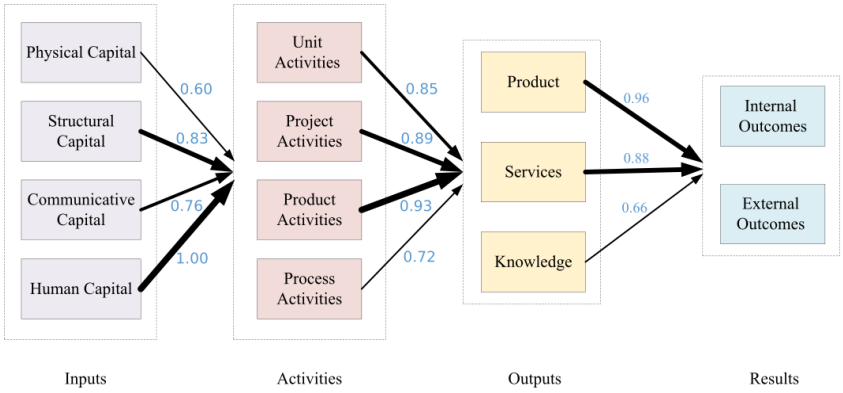

Figure 7

Tables:

Table 1

Category	Related concepts	Category	Related concepts
Services	- Software support - Network and infrastructure support - Software development and maintenance - Integration - IT Governance - IT consulting	Activities	- Analysis and design - Backup - Human resources affairs - Financial affairs - Development - Test - Change - Establishment
Human capital	- Programmer - Analyst - Software architect - Tester - Staff personnel - Project manager - Senior manager - Unit manager - Deputy - R&D expert - Business specialist	Products	- Mobile bank - Cheque system - OTP system - Facility system
Physical capital	- Server - Network and infrastructure - System - Building - Equipment - Office supplies	Results	- Profitability - Customer satisfaction - Organization maturity

Table 2

Category	Related concepts

Knowledge	- Development experiences - Banking business knowledge - Data and information
Communication capital	- Communication with fintech - Suppliers - Communication with bank employees on social platforms - Communication with the bank as a client - Innovation center - Communication with partners - Communication with the regulator
Organizational capital	- Structure - Liquidity - Process - Management - Software

Table 3

Perspectives of the results layer	Weight (significance)
Customer	0.509
Financial	0.252
Brand and credibility	0.064
Business processes	0.078
Learning and growth	0.097

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Mohammad Saidi-Mehrabad is a Professor of Industrial Engineering at Iran University of Science and Technology. He received his BSc degree in Mechanical Engineering from Oklahoma State University in 1983 and his MSc and PhD degrees in Industrial Engineering from University of Arkansas and West Virginia University in 1985 and 1992, respectively. He initiated his work as a faculty member at IUST since 1992. His major research interests are in cellular manufacturing, supply chain, and production planning as well as every system optimization problem. He has published some books and a large number of papers in high-impact international journals and many papers in research indexed journals and international conferences.

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