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Insights from Implementing Performance Measurement System for Business Processes Model

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Abstract: This paper attempts to analyze and quantify strategic objectives of an Iranian construction Company by application of PMS-BP model. PMS-BP model provides an efficient and effective tool for monitoring performance measures in an analytical and graphical way. This paper suggested a performance system that can be efficiently measured by implementing PMS-BP model. The paper customizes the model for use in construction industry for a first time specifically for an Iranian firm. Performance measurement in this industry is mainly focused on profit, cost, time and etc that they are narrow, retrospective and statistic. But, this model has an integrated, future directed and dynamic view which considers performance at all company levels. This research indicates that applying PMS-BP model is difficult in construction industry because processes of this industry are dynamic and unpredictable. In this research, we benefited from experiences of project managers and specialists. Throughout the process, review sessions were held with the top manager's team and consultants in the case study company. Semi-structured interviews were also held with some of the specialists involved.

Key words: Strategic Objectives Measurement · Performance Measurement Systems for Business Processes (PMS-BP) · Iran Construction Industry

INTRODUCTION

In order for companies to ensure achievement of their goals and objectives, Performance measures are used to evaluate, control and improve production Processes [1]. The past 15 years have seen significant research and development in the field of performance measurement, resulting in the generation of various models, frameworks and methodologies by practitioners, consultants and academics. Some of these models, such as the balanced scorecard and the performance prism, have enjoyed general acceptance [2]. Performance measurement models designed to evaluate operational aspects should, therefore, focus on the terms such as quality, speed, delivery and flexibility, or areas, to ensure that none of these essential aspects, present in all industrial companies is ignored. Numerous authors have explored this area in depth and the performance measurement literature contains many examples of performance measurement models that have appeared in the past decade. These models have been classified and analyzed and Alfaro and his colleagues presented resultants of these researches in their articles [3]. Also, Bititic and his colleagues [4] considered requirements that all dynamic PMSs should meet if they were to be robust, efficient and effective [4]. Table 1 shows to what extent the different performance measurement systems reviewed met these requirements [3].

According to table 1, all of PMSs that mentioned in it have the limitations. In this article, we want to use PMS that overcomes the limitations of these models.

Performance measurement system for business processes (PMS-BP) is a performance measurement system based on IE-GIP. IE-GIP model (Enterprise Integration-Business Processes Integrated Management, acronyms in Spanish) is an integrated business process management model [5].

PMS-BP overcomes the limitations associated with the balanced scorecard approach in that it provides a structure which, from an integrated and dynamic perspective, allows the definition, monitoring and control of efficient parameters deployed throughout the company to enhance. The management process and allow the company to respond to the demands of the competitive environment in which it is operating. In designing PMS-BP, it was considered absolutely essential to create a

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Table 1: Performance measurement systems requirements analysis [3]

PMS requirements	BSC	PRISM	IDPMS	DPMSM	PMSIE-GIP
Reflects stakeholder requirement	**	***	*	*	***
Reflects external/competitive position	*	*	*	**	*
Reflects competitive criteria	***	***	**	***	***
Differentiates between control and improvement measures	*	*	**	***	**
Facilitates strategy development	*	**	**	*	***
Deploys strategic objectives	***	**	**	**	***
Objective deployed to business processes and activities	**	***	*	***	***
Focuses on critical areas of the business	*	***	***	**	***
Facilitates resource bargaining	*	***	***	**	***
Facilitates performance planning	***	***	***	***	***
Focuses on leading measures as well as lagging measures	***	***	***	***	**
Accommodates both quantitative and qualitative measures	***	***	***	***	***
Measures organizational capability and learning where appropriate	***	***	**	**	***
Uses measures at correct levels	*	**	*	***	***
Promotes understanding of the relationships between measures	*	*	*	**	***
Facilitates simple reporting-demonstrating trends	***	**	**	**	***

*** High fulfillment of the requirements; **medium;*low.

BSC, balanced scorecard ; PRISM, The performance prism; IDPMS, integrated dynamic performance measurement systems; DPMSM, dynamic performance measurement system model; PMS IE-GIP, performance measurement system IE-GIP.

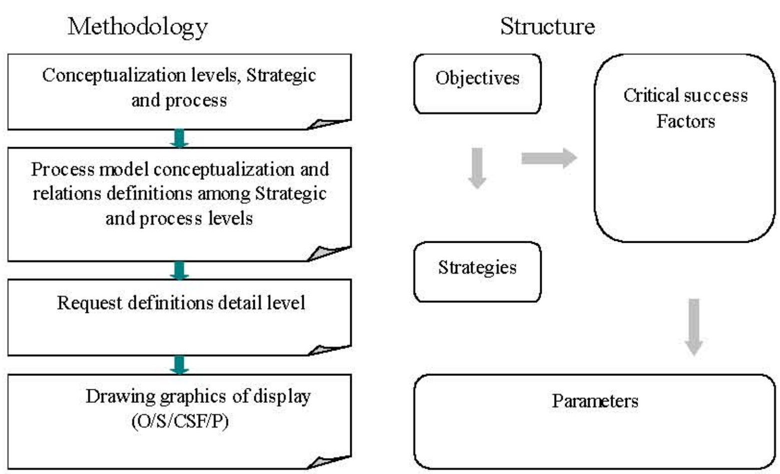

Fig. 1: Structure and methodology of PMS-BP [3].

structure that would be capable of aligning a company's operations with its objectives and strategies and to integrate these in such a way that would allow these operations to be managed from different vantage points. This system therefore allows attributes such as efficiency, effectiveness, profitability and quality to be evaluated at operational levels and rolled up to higher management levels, where they can be used to improve the quality of the decisions being taken [3].

First, we will de performance measurement in construction industry, Importance of performance measurement and characteristics of this industry. Then, we will explain the different stages (methodology) involved in choosing performance indicators capable of providing the information that a company needs in order to measure performance.

We will also define the performance measurement elements (measurement structure presented in figure1) associated with this methodology and the building blocks (architecture presented in figure2) which depict the different elements of a company from all possible informational angles. PMS-BP is a highly practical performance measurement tool, both for companies operating within a traditional context and for companies working in virtual or extended environments [3].

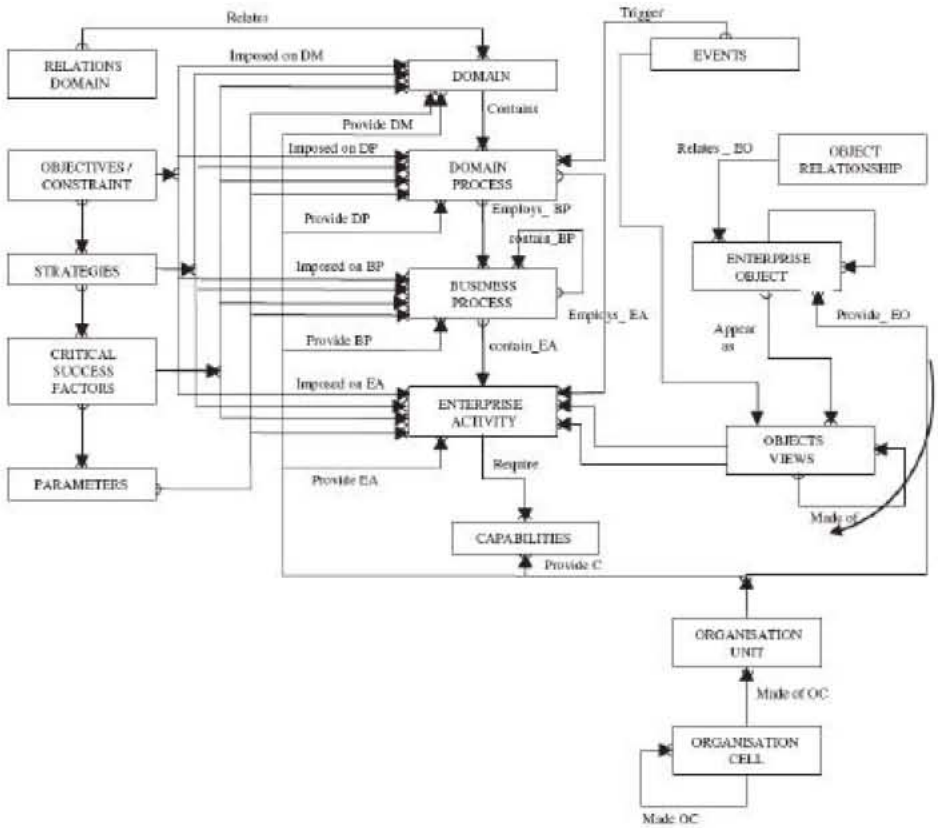

Fig. 2: Architecture of PMS-BP [3].

The aim of the study was to assess current practices in business performance measurement in construction engineering organizations. A survey was as part of large study measuring strategic objectives in a construction company. The specific objectives of the study were as follows: first, to examine attitudes and approaches to performance measurement; second, utilization PMS-BP model in the Iranian civil company third and identification of objectives unfulfilled reasons. Initial discussions with the company's managers provided the basis for identifying performance measurement elements.

Literature Review

Importance of Performance Measurement: PM has been given a prominent place in most organizations as it helps achieve continuous improvements. PM enables managers to make decisions based on facts rather than on assumptions and faith. Therefore PM has become an integral part of planning and controlling organizations. PM identified as the first stage of any improvement process that benefits the end users with lower prices and the organizations with higher profit margins, whilst enhancing the quality of the product [6].

PM is defined as “the process of determining how successful organizations or individuals have been in attaining their objectives and strategies”. Since PM systems encompass supporting infrastructure, a wider definition is "as the quantification of efficiency and effectiveness of past actions by means of data acquiring, collection, sorting, analyzing, interpreting and disseminating"[6].

The importance of PM summarized as: ensuring that customer requirements are properly met (and if not, why); enabling the establishment of achievable business objectives and monitoring compliance; providing standards for business comparisons; providing transparency and a scoreboard for individuals to monitor their own performance; identifying quality problems and those requiring priority attention; giving an indication of the costs of poor quality; justifying the use of resources; and providing feedback for driving the improvement effort.

By considering the above subjects, it can be said that PM is an important aspect for organizations to evaluate their actual objectives against predefined goals and to make sure that the organization is doing well in the competitive environment. Nevertheless, PM is not without any disadvantages. The use of complicated and excess performance measures creates negative effects due to their considerable consumption of time, investments and commitment of people, whilst also sometimes limiting the freedom of managers due to their rigidity. In addition, the inappropriate selections of performance measures-setting unrealistic and incorrect targets/norms-can generate misleading information. Therefore, it can be argued that the use of PM not only has positive impacts on organizations but also has negative impacts. However, the solution is not to avoid the use of PM, but to design a system which is user friendly and which negates the negative impacts by providing more positive impacts. The section below discusses how performance measures have developed over the past years [6].

Features of Construction Industry: The current trend in the construction industry is now moving towards higher quality. Contractors are forced to upgrade the quality of their service. This orientation towards quality has been brought about by the following reasons. First, clients are becoming increasingly more knowledgeable. Some of the larger clients also have international assets and interests. With increased affluence and knowledge, clients are demanding better quality because in many construction projects, clients often find themselves paying high prices for defective works that do not satisfy their needs. Such situations often result in disputes that result in higher costs to the client at the end of the day. According to Juran and Gryna, “quality is customer satisfaction”. Therefore, contractors, who continue to neglect the sophisticated requirements of their clients, do so at their own perils. This is because in the quality perspective, profit is a result of continuous conformance to clients’ requirements. Quality is also the cornerstone of competitive strategies for contractors seeking to widen as well as secure their clients. The global competitive arena has compelled contractors to constantly think of new ways to gain a competitive edge [7]. However, in practice, most of such efforts involved only physical product innovations that can be replicated easily by competitors, resulting in short-lived competitive advantages. Hence, quality may be the main or only differentiating element in the eyes of the clients as it cannot be easily copied and duplicated. In view of this, developing an excellent service-culture that is unique to the operations of a contractor is critical to its survival. Such exceptional quality service may well be the last strategic differentiation factor and hope for contractors to achieve a sustainable competitive edge. Peters and Waterman in their book, In Search of Excellence, found that the most consistent factor among companies that they rated as most successful is an obsession with some form of quality [8].

Performance Measurement in Construction Industry: In order to obtain good project performance, the performance of construction work processes should be improved. Traditionally, good project performance means a project is on budget and on time with expected quality. Thus, most project managers have used project performance indicators concerning time, cost, quality, safety, profitability, etc.

However, these performance indicators are result-oriented and they cannot measure the performance of construction work processes, which called as process-oriented performance.

Based on a survey with more than two hundred executives have concluded that measurement-managed companies exhibit better performance compared to their non measurement-managed counterparts. This is because performance measurement provides the necessary information for process control and makes it possible to establish challenging and feasible goals. Also the use of performance measures is strongly related to the necessity of improving process transparency in production management. By using indicators, some of the invisible attributes of the process are made visible [9]. Performance improvement has been the subject of recent studies and initiatives in the construction industry as a result of complex internal and external factors. Clients, investors and other stakeholders are demanding continuous improvement.

The increased reliance on industry-specific key performance indicators (KPIs) particularly in large organizations are a reflection of the growing importance of performance measurement. It is also recognition that industry performance should be judged not only on financial information, as this is no longer sufficient for understanding the dynamic business environment. The dominance of financial measures is due to traditional accounting practices with emphasis on short-term indicators such as profit, turnover, quarterly earnings, cash flow and share prices. There is growing evidence that non-financial measures are becoming important to organizations, their clients, investors and stakeholders. Demand for changes in corporate reporting are also likely to force organizations to adopt a more balanced approach to performance measurement.

A balanced approach is essential in identifying areas for improvement and facilitating continuous improvement. However, continuous improvement cannot be adequately monitored unless it is measured as "what gets measured gets attention, particularly when rewards are tied to the measures". Measurement is therefore, an integral part of business improvement, as it is often seen as the information system at the heart of the performance management process.

Following the presented report on Rethinking Construction in the UK [10], a significant interest has been generated in measuring the performance of construction organizations using so-called Egan key performance indicators (KPIs). KPIs mainly incorporate project and related measures to identify areas for improvement and to facilitate benchmarking against best practices. However, awareness of the use of other measurement systems such as the balanced scorecard and the excellence model has increased in construction engineering organizations. The balanced scorecard, for example, allows managers to assess performance from four important perspectives; a customer perspective, financial perspective, internal business perspective and innovation and learning perspective. The excellence model encourages organizations to adopt a forward-looking perspective by focusing on a broad range of measures including processes, people, leadership, partnership and resources, products, society, learning and innovation. Both the balanced scorecard and the excellence model have been around for over ten years but the take-up within construction organizations is slow. Construction organizations have often been criticized for resistance to change and for failing to adopt innovative approaches to improve future business performance [10].

MATERIAL AND METHOD

Stage 1- Conceptualization at the Enterprise and Business Entity Level: The first stage of the process involves establishing general parameters that can be used to measure the performance of the company chosen from strategic and process perspectives. Essential elements (mission, vision, stakeholder objectives, strategies, critical success factors and parameters) described requirements, which would allow parameters to be defined in a coherent manner and form a solid structure on which to build the rest of the methodology. These objectives, strategies, critical success factors and parameters from the four perspectives that have presented in balanced scorecard model to ensure a balanced view of the business and reveal the different cause-effect relationships.This system provides an immediate visual confirmation (Figure 3) of whether all of the measurement elements (objectives, strategies, critical success factors and parameters) have been defined for all perspectives and levels [3].

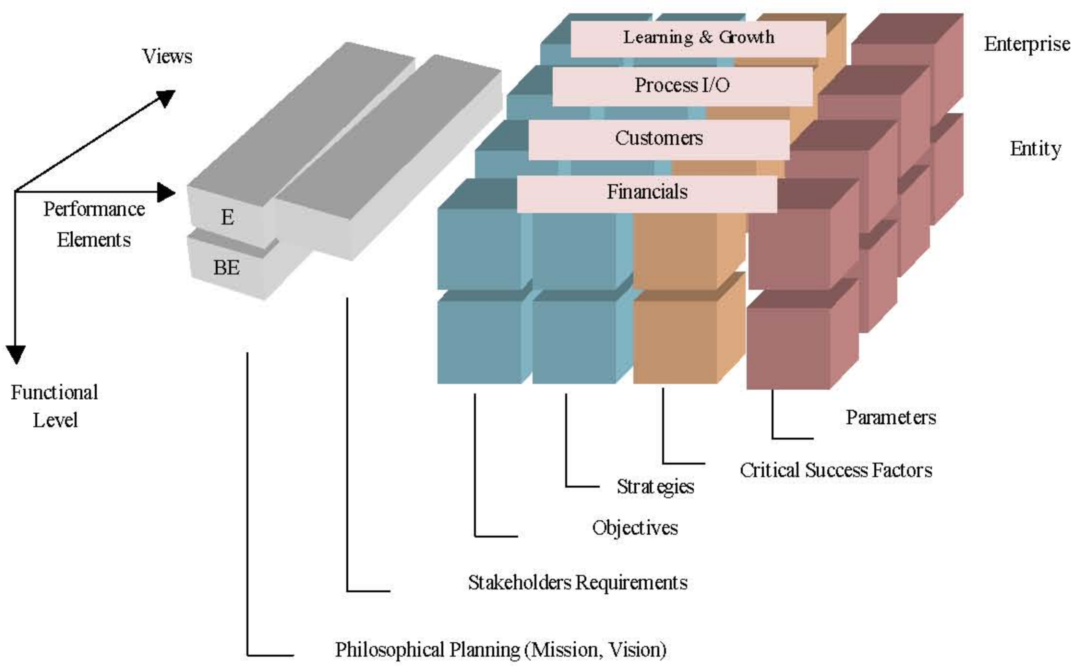

Fig. 3: Enterprise and business entity elements-structure diagram [3].

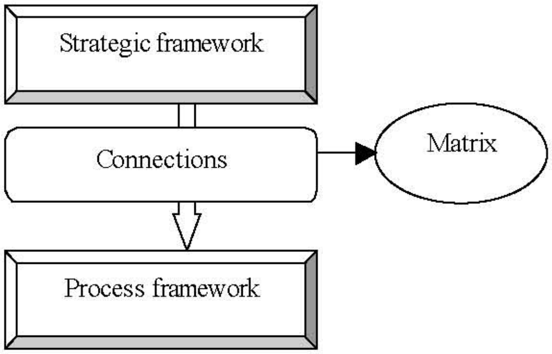

Fig. 4: Stage 2 diagram [3].

Stage 2- Specify Relationships Between Strategic and Process Levels: The aim of the second stage is to identify the linkages that exist between the strategic framework and the business process framework, which is monitored from this stage on (Figure 4). As the performance measurement elements (objectives, strategies, critical success factors and parameters) are no longer defined or viewed according to the perspectives described previously, it is important to maintain coherence during this stage by preserving the linkages between these elements. To ensure that all the elements at the business entity and process levels were consistent with each other, we applied several matrices that analyzed the connection-relationship coherence between the levels. The matrices were applied to each of the four elements that made up the performance measurement structure. A three-point scale (A, high; B, medium; C, low) can also be used to evaluate the strength of these relationships.

This three-level categorization must be performed by the enterprise persons who have a wide business view. This system provides a clear overview of the connection-relationship-coherence between the levels and also makes it difficult to overlook any important aspects at this stage [3]. The usual inconsistencies are nowadays due to enterprise dynamics, which force them to change the objectives and strategies and therefore the former defined parameters; that is, they must periodically perform a revision under a top-down approximation about the coherence between the performance measurement elements by means of the matrices previously described. On the other hand, the parameters are elements which identify the accomplishment degree of the critical success factors. So, in case they may be incorrectly defined or chosen and therefore they do not properly evaluate such an accomplishment degree, they must be substituted or adapted [3].

Stage 3- Detailed Definition of Performance Requirements: The third stage of the methodology involves defining the performance requirements in greater detail. Due to the operational nature and applicability of the PMS-BP system, architectural elements was used for designing the IE-GIP system, which had been modeled on the building blocks developed for CIMOSA (Computer Integrated Manufacturing Open_Systems architecture for CIM—AMICE[1]). This architecture is powerful and well structured since it allows the generation of enterprise processes models through its cycle life and provides standard modeling languages. Besides, its structure facilitates the integration of the created models, since it analyses in an integrated manner the functions, the information, the resources and the organization. PMS-BP has added in complementary building blocks for the elements in the performance measurement structure in order to ensure that all the information that might be required for the structured and effective implementation of the system would be available [3].

Stage 4- Design of Deployment Graphs: Once the building blocks had been defined (and with them the necessary performance measurement elements), a series of graphs have generated to show how the essential performance measurement elements (objectives, strategies, critical success factors and parameters) were deployed across the different functional levels of the enterprise. There are two types of graphs:

- Full-view graphs showing the deployment of the performance measurement elements. These graphs show how the different performance measurement elements are deployed across the different functional levels of the company (enterprise, business entity, processes, sub-processes and activities). There are four graphs in total: one for objectives, one for strategies, one for critical success factors and one for parameters.
- Partial-view graphs showing deployment of performance measurement element by levels.

These graphs complement the full-view graphs by showing which elements are required to measure performance at specific levels. They provide a graphical illustration of how the performance measurement elements are deployed, of which elements are required to generate which parameters, of which parameters are more relevant, etc [3].

[1]AMICE Consortium was a European organization of major companies, including users, vendors, consulting companies and academia, from 1985 to 1995

Table 2: Process 8-Construction project management

Objectives
O20: Productivity improvement in management and execution of construction projects
O21: Increase of project profitability
Strategies
S37; Decrease of cost price
S38; Increase of claims
Critical Success Factors
CSF17: Decrease of cost price, Increase of claims
Parameters
P30: Percent of Profit margin = (revenue/ profit)×100

Table 3: Objectives building block Template

Type:
Identifier; O7
Name; Strategic Objectives7
Description; Promotion of company technologic capability
Perspective: Learning & Growth and Technology
Objectives (Low level):
O20: Improvement of decision making quickness and accuracy
O32; improvement of available technologies

Performance Measurement in an Iranian Construction Company (Applying PMS-BP): This section discusses the real-life application of the PMS-BP performance measurement system to strategic objectives of a construction company. This company established in 1958 and, exploiting a skilled and experienced staff, using suitable and advanced machinery and equipment, applying a dynamic planning and management, succeeded in taking an important step towards implementing various development projects such as: Construction of dams, tunnels, highways, airports, power plants, refineries, railways, gas and oil transmission lines, industrial factories and other similar projects.

The entire process involved some of expertise personals, top managers and consultants. We interviewed them and determined measurement elements at strategic and operations levels. For the reasons, this company could not fulfill its objectives. Thus, in this article, we want measure fulfillment percent of these objectives. Results of this project are important for the company. This section is presented stages that we applied for strategic objectives measurement.

Stage 1- Determining Measurement Elements of Strategic and Operations Levels: In this stage, measurement elements are determined with participation of expert personals. These elements are containing objectives, strategies, critical success factors and parameters. Table 2 shows measurement elements related to process 8.

Stage 2- Determining Relationships Between Measurement Elements of Strategic and Operations Levels: In this stage, relationships between strategic and operations levels are identified with matrices of connection-relation-coherence. Therefore, there are four matrices in total, one for objectives, one for strategies, one for critical success factors and one for parameters. The opinions of managers and experts are used to determine these relationships. They are based on tree-point scales (A, high; B, medium; C, low) can also be used to evaluate the strength of these relationships. Table 3 shows objectives relevant to strategic Objective 7.

Stage 3- Preparation of Deployment Graphs: Figure 5 (full-view graph) illustrates the general deployment graph associated with the objectives defined at all levels and figure 6 shows the corresponding partial-view deployment graph featuring objectives, strategies, critical success factors and parameters for the enterprise level. The lines show the linkages between the different elements. Both figures clearly show how easy it is to trace the linkages between the different performance measurement elements at the different levels [4]. For example, in figure 5, strategic objective 2 has high coherences with operations objectives of 19, 24 and 25 or strategic objective 1 has medium coherences with process objectives of 15, 16 and 18.

Stage 4- Measurement of Parameters and Fulfillment Percent Calculation of Strategic Objectives: This section measure parameters that determined in previous sections with gathering of necessary information and have interview with experts, then has considered fulfillment of strategic objectives by use of linkages between the different performance measurement elements at strategic and operations levels. For example, parameters measurement results of strategic Objective 1 show that this objective could not be effective and successful in company performance, therefore, processes objectives successful considered by their parameters for identifying unfulfilled reasons of strategic objective 1. This stage presents only unfulfilled reasons of each strategic objective. But, it is necessary that strategic objectives considered together. In the two next stages we utilize this.

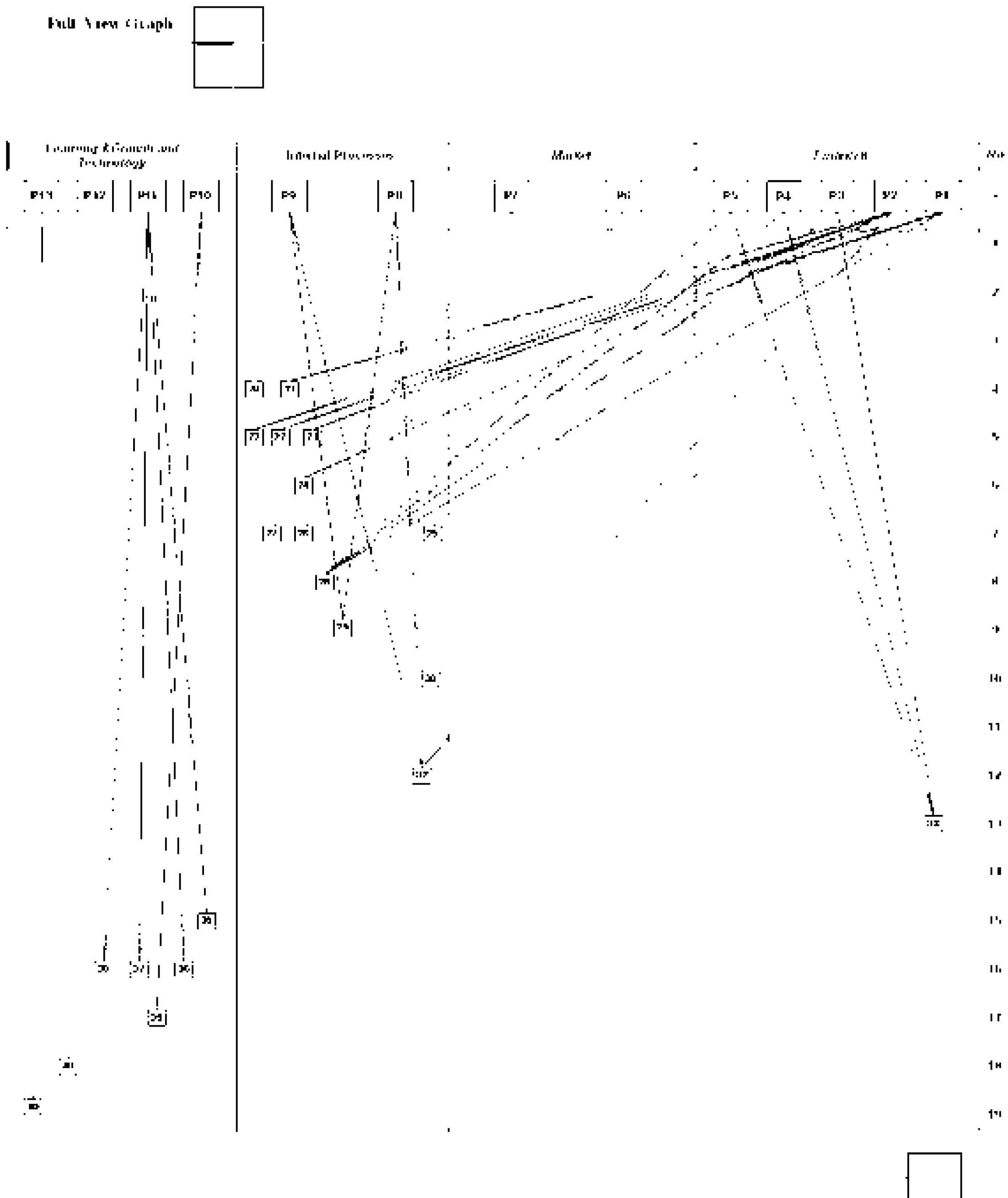

Fig. 5: Full-view objective deployment graph.

Table 4: weight of strategic objectives

Objectives	1	2	3	4	5	6	7	weights
1	0.122	0.117	0.134	0.122	0.122	0.119	0.121	0.12
2	0.212	0.202	0.198	0.212	0.212	0.207	0.209	0.21
3	0.047	0.052	0.051	0.047	0.047	0.07	0.054	0.052
4	0.122	0.153	0.134	0.122	0.122	0.119	0.121	0.13
5	0.122	0.117	0.134	0.122	0.122	0119	0.121	0.12
6	0.212	0.202	0.198	0.212	0212	0.207	0.209	0.21
7	0.160	0.154	0.15	0.16	0.16	0.157	0.16	0.16

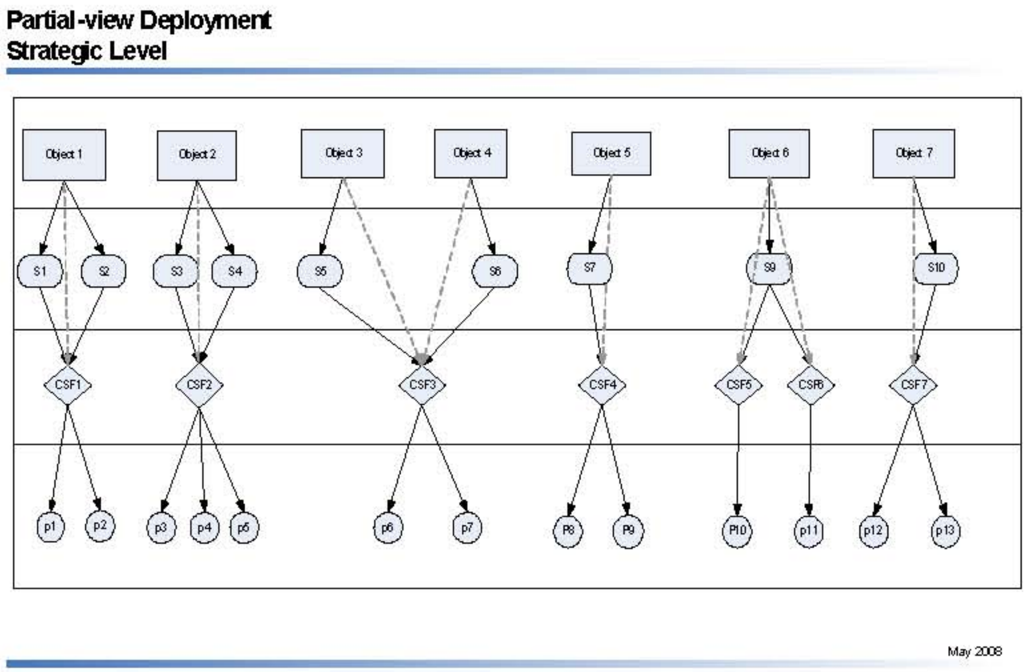

Fig. 6: Partial-view deployment graph.

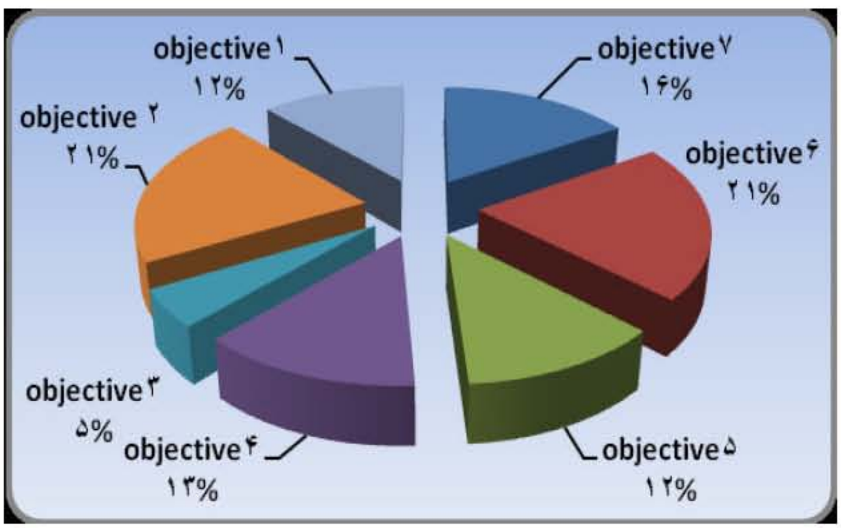

Fig. 7: Weight of strategic objectives

Stage 5- Importance Calculation of Objectives with Weighting Method of Group AHP: In order to determine strategic objectives importance, company top managers perform couple comparisons between strategic objectives then these objectives have ranked by use of weighting method of group AHP. Table 4 shows normalized matrix of strategic objectives couple comparisons.

We ranked strategic objectives base on their weight. Results present in the following.

O2, O6> O7>O4> O1, O5>O3. Pie diagram of strategic objectives weights illustrated in figure 7.

Stage 6-analysis of Objectives and Conclusion: With considering importance of strategic objectives, we would be able to analysis incomplete fulfillment reasons of strategic objectives. For example, parameters of objective 4 show low effectiveness in company performance. Considering operations objectives fulfillment, reveal essential reasons of this problem. Some of the processes were not efficient and effective. Reasons related to unfulfilled objectives that have high important should be in first rank and the company should pay more attention to these items than others.

Results of strategic objectives measurement in this company show that it could not to meet essential requirements for reach to its strategic objectives. However, some of the objectives have fulfilled roughly, but their unfulfilled reasons should be considered and present propositions for performance improvement in the future. This model can help to organizations to identify these cases because of its dynamic and integrated view.

CONCLUSION AND IMPLICATIONS FOR PRACTITIONERS

Literature and surveys suggest the PMS-BP model utilizing most of the others similar models features and capabilities to measure business performance in an organization (see table 1). Alfaro and his colleagues believed that PMS-BP model is designed to measure performance in all types of industrial companies from an integrated perspective. This study tried to use PMS-BP model for performance measurement of a construction Company and the following resultants is received:

After implementing this model for an Iranian construction company, we concluded that this model has advantages for construction industry. The following is a summary of these advantages:

- Determined of coherencies between strategic and processes levels measurement elements, facilitate traceability of objectives.
- Earlier identification of deviations fundamental reasons in strategic objectives even in during of projects before projects have completed.

In addition to the upper advantages, this study had limitations that discussed in the following:

The implementation of the PMS-BP model is operationally difficult in construction industry because construction industry has dynamic and unpredictable processes, therefore determination of measurement elements for strategic objectives and processes are not exact and accurate. Different characteristics of Construction Industry distinguish our research from research's Alfaro. Thus, it is manifestly clear, these characteristics cause to changes in implemented way of PMS-BP model as described in section 4. In this case, we benefited from experiences of project managers and specialists. Throughout the process, review sessions were held with the top manager's team and consultants in the case study company. Semi-structured interviews were also held with some of the specialists involved. This information was presented and discussed in the review sessions.

Design of performance measurement systems for Iranian construction companies is a little researched area and resultants of previous researches acknowledge this problem. Thus Iran construction industry need to more researches in the field of performance measurement. Future research can be focus on "designing a model for performance measurement of Iran construction industry".

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