Identifying
Critical Success Factors in

Project-Based Organizations Using QFD

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Abstract: This paper presents an innovative research methodology that enables a company to define its Project Success (PS) outcome objectives and PS factors to improve its project management system. We use a House of Project Success (HoPS) method for project-based organizations (PBOs). The method determines the main PS factors and the obstacles the firm may face in applying them. Based on this innovative methodology, using the mean square error (MSE) criterion, outcomes and factors that maximize the PS policy's objectives are chosen. This paper presents the application of the methodology in an infrastructure communications company. The main findings show that teamwork and communication between employees is perceived as the most important project success factor and constitutes a moderate difficulty in teamwork.

1. Introduction

Nowadays, many firms invest a lot effort and money in project management as a way to improve their performance and earnings. The focus is on successfully accomplishing assigned projects. The term project success (PS) factors refers to a set of components, as determined by an organization's management team, which are essential for this organization to reach its project objectives. Though some organizations may list others, the main project objectives are a satisfactory quality product/service, with minimal financial violations and no time violations (on-time delivery). The literature reveals numerous definitions for critical success factors (CSF). According to Liedecker and Bruno (1984), success factors are not easily discerned. They characterized CSFs as conditions and variables that—when properly sustained, maintained or managed—can have a significant impact on the success of a firm competing in a particular industry; for example, a firm can define a CSF as price advantage or capital structure. They divided the analysis of CSFs into three categories: firm specific, industry and economic socio-economic and political environment. Using these three categories, Liedecker and Bruno (1984) built a strategy formulation process, comprising seven stages:

- Strategy identification
- Environment analysis

- Resource analysis
- Gap analysis
- Strategic alternatives
- Strategic evaluation
- Strategic choice

Essentially, Liedecker and Bruno (1984) claimed that identification of CSFs is a strategic plan and depends on the firm's industry, circumstances and market constraints. Byers and Blume (1994) presented a four-phase model to distinguish the right CSFs:

Information gathering phase
Information summarize phase
Information systems tactical planning phase
Information systems implementation phase.

This four-phase process necessitates a high degree of user involvement at high levels of the organization in the identification and prioritization of projects. Such involvement is essential. Users must commit resources—both financial and personnel—to projects during this four-phase planning process. User involvement and commitment must not only be present in the initial planning stages but also ongoing throughout the development of the systems. Such commitment helps lead to ownership of the projects by the user group. Information systems must understand the business functions in order to assist managers to make better decisions. Business managers must see information systems as a key resource and critical success factor, for attaining a competitive advantage. This technique views the project staff as important partners in attaining project success and gaining a competitive edge.
Belassi and Tukel (1996) offered a structure covering four CSF groups:

- Factors related to the project
- Factors related to the project manager and the team members
- Factors related to the organization
- Factors related to the external environment.

They found that performance is affected by two parameters:

- The uniqueness of the project: when there is no standardization, it should have a negative effect.
- • Resource allocation, especially labor.

Other aspects are the commitment of the project manager (management skills), teamwork and good communication between employees, and top management support.
Our longitudinal study asserts that basic guidelines can reveal the vital PS outcome objectives and factors essential for the positive conclusion of an individual project. Our research question focuses on how to reveal the PS causal structure in a project-oriented organization.
Over the years, project management (PM) researchers have raised and tested several PS perspectives and, consequently, have defined many PS factors and outcomes. The study of project success and CSFs is essential when seeking to improve the effectiveness of project delivery (Chan, 2004). When managing large projects, it is especially crucial to recognize CSFs across project phases (Takim et al., 2004). In this paper, we investigate the CSFs of a project-oriented organization, while exploring several relevant papers selected from PM literature.
Project management in project-oriented organizations
Today, applying project management knowledge to project-oriented organizations for optimal use of resources and increasing productivity is inevitable. This phenomenon ensures that organizations, especially those involved in large projects, find ways and techniques to improve the way of handling and managing projects. Many project managers look for the most dominant factors that have the most overriding effect on a project's success.
Parchami and Koosha (2014) found that project-based organizations have a significant advantage over non-project-based organizations. They found that the former demonstrates:

- A 31% decrease in failed projects
- A 19% increase in delivering projects ahead of schedule
- A 30% savings in costs
- A 21% improvement in productivity
- A 13% increase in resource capacity.

Parchami and Koosha (2014) found 18 organizational factors that have the most positive impact on Project Management Organization (PMO), of which nine are the most dominant:

- Supportiveness of organizational senior managers
- Organization's PM structure
- Presence of PM professionals in the organization
- The extent of PM processes required by the organization
- Relation between organization's strategies and PM development
- Organization's project size in terms of duration
- Organization's project size in terms of size of staff
- Number of simultaneous projects in the organization
- Geographical distribution of organization's projects.

Gemünden et al. (2017) dealt with project-based organizations (they called them project-oriented firms or project-oriented organizations, but the meaning is the same). They characterized project-based organizations as organizations whose strategy is directed by projects. This type of organization concentrates on dealing with many projects of many kinds, and the main leadership is well skilled in PM. Project-based organizations (PBOs) are flexible in responding to customer demands and achieve a benefit for the customer by using systematic PM. Their main idea was the importance of planning a PM strategy for the organization and finding the main factors that could achieve it. They found a positive correlation between the firm's success at being innovative and its business success. Nevertheless, the share of time invested in being innovative did not correlate significantly with the business success. This motivated the authors to develop a project success model, which creates a benefit for the firm by organizing it as a PBO. The most effective factors proposed by their model are:

- Leadership – the ability to take control of all the project's arrays.
- Creativity – generating new ideas and innovative thinking
- A strategic plan in line with the organization's PM environment; Gemünden et al. (2017), however, do not think that the firm's success is necessarily a result of organizing it as PBO.

PBOs based on distinct products, focusing on a number of similar projects with small diversity, offer good value to their customers. Organizational PBOs often develop systematic procedures for managing workflows, allocating people who have certain skills and monitoring progress. They also sometimes establish formal systems for codifying and storing project team "knowledge" and training staff in the firm's collective expertise. Many complex and creative organizations, which manage creative, projects and have a creative labor force, must deal with conflicts between PM issues and creativity (Bérubé and Gauthier, 2017).

Mishra et al. (2011) found that in PBOs, the project manager is the most dominant person and has the most impact on project success: he or she needs strong leadership and resource management skills. The project manager must be able to motivate and properly direct the staff working under him or her. The project staff needs to be committed and cooperate (Belassi and Tukel, 1996; Hyvari, 2006; Mishra et al., 2011).
Hagen and Park (2013) examined how both open communication and ambiguity acceptance by project leaders can affect project outcomes such as customer satisfaction and successful project completion. The PM stages such as project definition, planning and organizing, implementation and control, and closeout require communication; it is the most important factor for project success (Finch, 2003; Hyvari, 2006; Pinto and Prescott, 1988). In addition, communication is not only a critical factor related to project team members but is also a project manager's most critical leadership skill in order to be effective (Belassi and Tukel, 1996; El-Sabaa, 2001; Zimmerer and Yasin, 1998). Communication has diverse functions in PM. As part of project strategy, strategic communication is a key PM success factor (Toney and Power, 1997). Effective communication within teams externally contributes to establishing relationships among people, helping to contribute to improved PM practice (Loo, 2002). Open communication in project teams has an important role in accessing, sharing, and interpreting information; exchanging feedback; incorporating ideas; interacting with external groups; maintaining relationships; and reaching consensus during a conflict (Gillard and Johansen, 2004). Moreover, communication for brainstorming, obtaining information, and progress reviewing attains and increases cross-functional cooperation among project teams (Pinto and Pinto, 1990). In terms of project success, communication is strongly linked to project outcomes.
The research found that design changes, lack of quality systems, ineffective use of technology, contractor selection, and inter-organizational interactions have a negative effect on construction projects (Alwaer and Clements-Croome, 2010), but top management support and experienced and dedicated project management may help counter-balance this negative impact.
From the literature review, we concluded that the following 23 project success factors are relevant for our investigation:

- Teamwork
- Communication between employees
- Employee involvement
- Leadership
- Supportive management

- Professionality of PM in the organization
- Clear description of the tasks
- Nurturing an open communication
- Project size in terms of duration
- Clear targets
- Resource capacity
- Plans approved by interested parties
- Number of simultaneous projects
- Innovation attitude
- Creativity
- Adopting continuous improvement
- Conflict solving
- Recourse flexibility
- Structuring PM in the organization
- Communication with end user
- Strategic planning
- Integrating PM with other management techniques
- Information system/technology.

Dror and Eliezer (2018) developed a technique that links project success factors and outcomes but requires those who wish to implement it to identify the main success factors, prior to applying it, which is sometimes difficult. This paper extends the methodology presented by Dror and Eliezer for project-oriented organizations. We develop new steps for the methodology that considers the difficulties in applying PS factor improvement. The paper describes the implementation of the enhanced methodology in a project-oriented organization, whose main business focus is designing and planning communication infrastructure projects.

2. Methodology

Quality function deployment (QFD)

Quality function deployment (QFD) was developed in Japan and implemented effectively by leadings firms around the world. It was originally developed as a product quality design methodology whose rationale was to assure that customers' needs, or desires are translated into demands in technical product features, engineering parameters, and finally, in production systems (Akao and Mazur, 2003).

The original QFD methodology comprised four successive stages or matrices: (1) The product planning matrix (also known as the House of Quality (HOQ)), (2) the product design matrix, (3) the process design matrix, and (4) the production design matrix. The HOQ maps the voice of the customer (what the customer wants) into final technical product features as understood by the research and development engineers.

Chan and Wu (2002) presented a literature review of quality function deployment (QFD) based on a reference bank of about 650 QFD publications found by searching various sources. They also conducted a categorical analysis of QFD's functional fields, applied industries and methodological development. Chao and Ishii (2004) provided an advanced product definition methodology based on QFD principles to identify and minimize the risks of project failures due to failure to align with the voice of the business. The methodology was developed by reviewing current design product definitions and QFD tools and then applied to a number of industry-based design projects being studied by researchers as well as an in-depth case study at one industry organization. LePrevost and Mazur (2005) applied QFD to help National City in identifying and prioritizing the needs of their customers and then using these to evaluate each project for the benefit it brings and degree of complexity, which will help assign appropriate resources to the project. Dror and Barad (2006) built on the HOQ by developing a House of Strategy (HOS) for translating the improvement needed in a company's business objectives into relative importance of its competitive priorities. Dror and Barad (2006) suggested a Mean Square Error (MSE) criterion, supporting the selection of the vital competitive priorities needing improvement. It divides a group of items (a set of competitive priorities) into two groups: vital few and trivial many. The partition minimizes the overall MSE and, by so doing, delineates two homogeneous groups. The method was implemented in companies from three industry types. It revealed their different HOS structures and thus provided useful information on the vital competitive priorities to be improved as dictated by their respective business objectives and internal capabilities.

The House of Project Success (HoPS)

Dror and Eliezer (2018) developed a procedure for quantitative evaluation of the relations between various project success factors and outcomes based on the QFD method. A House of Project Success (HoPS) matrix is created using statistically combined input from various managers and experts. The HoPS matrix summarizes the desired improvements in the successful outcomes and connects them to the relevant success factors. Based on the HoPS matrix, factors and outcomes that maximize the desired results of the project policy are chosen, using the mean square error (MSE) criterion.

Dror and Eliezer (2018) presented the the application of the above methodology in two organizations, involved in different project types, namely weapons development and information systems implementation. In the weapons development case, the vital project success factors, 'Clear description of the tasks', 'Clear targets', 'Plans approved by interested parties', 'Employees' involvement' and 'Communication with the end user', were the drivers of 'Sustainability' and 'Effectiveness', the PS outcomes to be improved. In the information systems project, 'Communication between employees', 'Employee involvement', 'Employee skill', 'Clear targets', 'Clear description of the tasks', and 'Teamwork' were found to be the best PS factors for improving the 'Effectiveness', 'Efficiency', and 'Sustainability' PS outcomes. We find that the QFD- based approach successfully quantified PS initiatives related to PS priorities.

The general building sequence of the HoPS comprises the following six major steps:

- PS outcomes (WHATs) – Listen to the voice of the manager and classify his desires (the walls).
- Importance and capability gap of the PS outcomes – Extracting data from the interviews regarding the importance interviewees attribute to each PS outcome (measured on a Likert scale) and the respective capability gap they attribute to each PS outcome.
- PS factors (HOWs) – Select a structured set of relevant PS factors (the ceiling), i.e., create a list of the important PS factors.
- Interrelationship matrix – Evaluate the relationship strengths between each HOW(j) and each WHAT(i). An appropriate scale is applied, illustrated by symbols.
- PS factor priorities – Calculate the required improvement level of each PS factor.
- Utilize the mean square error (MSE) criterion to select the vital few PS factors.

The authors utilized the MSE criterion, defined by a one-way ANOVA, as a quantitative tool for selecting the vital PS outcomes/PS factors to be improved (Dror and Barad, 2006).

The algorithm for utilizing the MSE in this work runs as follows:

- Arrange the normalized required improvement levels of the PS outcomes/PS factors in descending order, where the first component represents the highest required improvement level and the last component represents the lowest required improvement level.
- the first component represents the highest required improvement level and the last component represents the lowest required improvement level.
- While keeping this order, divide the k components into two groups – (a) vital few and (b) trivial many. Assuming that each group includes at least one component, there are k-1 possibilities for splitting the items into two groups.

3. Calculate $MSE(m)$, where $m = 1,2, \ldots . k-1$

4. Find $MSE(m^*) = \min_{1 \le m \le k-1} [MSE(m)]$

The essence of the HoPS is to extract the desired improvement in the PS outcomes (as viewed by managers and experts) and translate them into required PS factor improvements. Note that we have freely adapted the fundamental QFD matrix structure to fit the basic principles of our PS framework.

The updated methodology

The updated methodology for project-oriented organizations contains 10 steps—the HoPS six steps (listed above) and four new steps:

The updated methodology

The updated methodology for project-oriented organizations contains 10 steps—the HoPS six steps (listed above) and four new steps:

- Update the set of project outcomes for the project-oriented organization.
- Find the ability to apply each factor: scale the PS factors' priorities according to the interviewees' evaluations of the company's ability to apply each one.
- Define an indicator, which is a multiple of two metrics. The first metric expresses the importance of the PS factors, as calculated by the HoPS. The second metric expresses interviewees' evaluations of the ability to apply them. The principle conveyed by the calculated numerical values of the indicators here is that the higher the importance and the higher the customer's ability to apply, the higher is its improvement need.
- Again, utilize the MSE criterion for selecting the vital few PS factors.

3. Project Management Company Case Study

This section describes the implementation of the above methodology in a project involving a large group of engineers from a company specializing in project management of the infrastructure of communication and energy projects. These engineers are responsible for the design, development, and application of all stages of the infrastructure projects.

In this paper, we discuss a project of establishing a communication infrastructure in a skyscraper in Tel Aviv, Israel.

This project was a large one, which required maximal coordination between crews and leadership and used the latest state-of-art technology. In parallel, it demanded that the project's management plan the project as an entity with an ability to grow: new users must be able to join the system, users should be able to change identities, new technology should be developed, and the management should listen to users and understand their needs. Management should use flexible manufacturing methods and creative engineers and technicians. In short, sustainability is not relevant, but innovativeness is crucial.

The company installed a state-of-art network infrastructure in a skyscraper in the center of Israel. This building has 68 floors. At 235 meters high, it is considered the highest building in the Middle East. The top twelve floors are for residential use; the rests are offices and services of all kinds. Given its height, it needed special planning and design. This project contained the following milestones:

- Design of communications rooms and a horizontal communications infrastructure
- Setting up of major communications rooms and communications rooms on each floor
- Spanning and connecting cables
- Operating and enabling communications for all users (residents and businesses)
- Keeping the whole system open and flexible to technological changes and user demands.

All five milestones demanded accurate, careful work and adherence to the work schedule. To obtain the required input for building the HoPS matrix, we interviewed three senior engineers (company manager, project team head and project manager) from this company. They provided the qualitative and quantitative data detailed in **Table 1.**

The qualitative data are the PS indicators and the quantitative data are their respective importance and capability gaps. The possible values of the 'importance' and 'capability' gaps were based on a Likert scale ranging from 1 to 5. The values in Table 1 symbolize the median score among those assigned by the three interviewees. Usually, for measuring the mid-point of a sample, an average value is calculated. Here, the mid-point was measured by means of a median value. The median is less sensitive to extremely large or small values than is the average and, for our case study, this makes it a better measure than the average point, particularly since our sample was small. The column 'Required Improvement Level' is a result of multiplying the 'Importance' column by 'Capability Gap' column. Clearly, 'Successful/failed project' is the most important PS outcome (5), and it has the highest Capability gap (4). In second place stands, in terms of PS importance, is the 'Added value to customer/project quality', followed by 'Cost reduction' (4). The final column, representing the normalized required improvement level, is the input to the HoPS matrix. It emphasizes the firm's need to improve its Successful/failed projects (0.54).

Project Success Outcomes	Importance	Capability gap	Required improvement level	HOS input (normalized)
Added value to customer/project quality	4	1	4	0.108108
Successful/failed project	5	4	20	0.540541
Deliver project on time	3	2	6	0.162162
Improved productivity	2	1	2	0.054054
Increased resource utilization	1	1	1	0.027027
Cost reduction	4	1	4	0.108108
All objectives			37	1

Table 1: Required improvement level of the PS outcomes (HoPS input)

The HoPS matrix (**Table 2**) determines the required improvement level of each PS factor. It translates the required improvement level of the PS outcomes (the WHATs) into the required improvement level of the PS factors (the HOWs). The core of the HoPS matrix explores the relationships among all PS outcomes and all success factors, enabling us to translate the normalized required improvement level of the PS outcomes into the normalized required improvement levels of the success factors. In this step, the interviewees systematically answer the question: "What is the relationship between this specific PS factor and this specific PS outcome?" The interviewees rated the relationship levels on a four-point scale (none, high, medium, low, none), which were, respectively, replaced by typical numerical values (0, 1, 3, 9). This nonlinear scale stresses high relationships. Again, the values appearing in the HoPS matrix are the median of the interviewees' answers.

The required improvement level of each PS factor is calculated thus:

Let $h = (h_1, \dots h_p)$ be a vector of the required improvement levels of the PS factors, $w = (w_1, \dots w_q)$ be a vector of the required improvement levels of the PS outcomes, and $\boldsymbol{R}_{\mathrm{qxp}}$ be a matrix expressing the relationship strengths between the PS outcomes and the PS factors. Namely, $h = w \cdot \boldsymbol{R}$.

Clearly, the PS outcome that needs the most significant improvement is 'Successful/failed project', and the most relevant factors for it are: 'Teamwork', 'Communication between employees', 'Employee involvement', 'Leadership', 'Supportive management', 'Professionality of PM in the organization', 'Clear description of the tasks', 'Nurturing open communication', 'Project size in terms of duration', 'Clear targets', 'Resource capacity' and 'Plans approved by interested parties'.

The PS factors, which got the highest ranking, are: 'Teamwork' and 'Communication between employees', 'Professionality of PM in the organization', 'Clear description of the tasks', 'Employee involvement', 'Leadership', and 'Supportive management'. Surprisingly, 'Continuous improvement' and 'Structuring PM in the organization' have a very low effect

Table 2: HoPS matrix of infrastructure of communication project

Project success factors	Success Indicators						Importance
	Added value to customer/project quality	Successful /failed project	Deliver project on time	Improving productivity	Increasing resource utilization	Cost reduction	
Teamwork	9	9	9	9	9	9	9
Communication between employees	9	9	9	9	9	9	9
Employee involvement	9	9	9	9	9	3	8.351351
Leadership	9	9	9	9	9	1	8.135135
Supportive management	9	9	9	9	9	0	8.027027
Professionality of PM in the organization	9	9	9	3	9	9	8.675676
Clear description of the tasks	9	9	9	0	9	9	8.513514
Nurturing open communication	3	9	9	9	3	0	7.216216
Project size in terms of duration	9	9	9	1	1	0	7.378378
Clear targets	9	9	9	1	1	0	7.378378
Resource capacity	0	9	9	1	1	3	6.72973
Plans approved by interested parties	9	9	3	0	0	0	6.324324
Number of simultaneous projects	3	3	9	9	9	3	4.459459
Innovative attitude	9	1	9	9	1	0	3.486486
Creativity	9	1	9	9	1	0	3.486486
Adopting continuous improvement	3	3	3	9	3	0	3
Conflict resolution	1	3	9	1	3	0	3.324324
Recourse flexibility	1	3	3	3	9	3	2.945946
Structuring PM in the organization	1	3	1	3	1	1	2.189189
Communication with end user	3	3	1	1	1	0	2.189189
Strategic planning	9	1	0	3	3	1	1.864865
Integrating PM with other management techniques	1	3	0	1	3	0	1.864865
Information system/technology	0	0	1	3	1	3	0.675676
Required improvement level of the success indicators	4.00	20.00	6.00	2.00	1.00	4.00	
Normalized	0.108108	0.540541	0.162162	0.054054	0.027027	0.108108	

The MSE criterion is utilized to identify the vital few PS factors (**Table 3**). There were 23 success factors from which we had to deduce the vital few, $p_j, j = 1,2, \ldots \ldots 23$.

Accordingly, the importance levels of the PS factors were arranged in descending order, as follows:

After applying the MSE(m), we find that MSE(12)=19.42 was the lowest MSE(m). Therefore, the vital few PS factors to be improved are the first 12 on the list: *'Teamwork', 'Communication between employees', 'Employee involvement', 'leadership', 'Supportive management, 'Professionality of PM in organization', 'Project size in terms of duration', 'Clear targets', 'Clear description of the tasks', 'Resource capacity', and 'Plans approved by interested parties'*.

'*Teamwork' and 'Communication between employees*' were perceived as being the most important PS factors.

Infrastructure communications projects need good coordination and almost perfect understanding of the whole project by management and team leaders; each line worker must know his or her duties very well and be aware of their importance to the project. These projects also use state-of-art technology. Consequently, each employee needs occasional guidance and business mentoring. The latter emphasizes the importance of teamwork for these kinds of projects.

We can see that the company has good leadership and good communication between employees, but there is a moderate difficulty in achieving good teamwork. Embedding and nurturing good teamwork and communication demand a significant effort on the part of all teams and stakeholders. The kind of projects we are discussing demand continuous maintenance, to respond to malfunctions and problems, which will inevitably happen. Engineering teams have to come up with innovative ideas and/or effective solutions to new technological challenges. If not, they might find that by the time their systems have matured, the technology has changed, rendering their systems irrelevant, and they will lose the battle for market share. Therefore, development projects must be fast-tracked. One way of doing this is by using existing building blocks—components of systems that already exist, currently serving other communications platforms, and adapting them to the new platform. This includes new communications systems, based on older technology, but adjusted and upgraded for the newer and state-of-art systems.

The company manager we interviewed is experienced in managing large communications projects and is very skilled in project management.

In our next stage of research, we investigated the company's ability to apply the 12 PS factors mentioned before. The interviewees were asked to grade the difficulty of applying each factor from 1 to 5 (based on a Likert scale), where 1 is considered the most difficult and 5 the easiest. **Table 3** shows the results. It contains the median value of the three interviewees.

We see that '*Clear targets*' and '*Nurturing open communication*' are the easiest PS factors to apply, while '*Teamwork*', '*Professionality of PM*' and '*Plans approved by interested parties*' are the most difficult. These results motivated us to make a deeper analysis. We combined the importance and difficulty by multiplying both. This analysis enabled us to reveal significance linkage between the factors above and the major target, which is Successful/failed projects. New priorities for the PS factors were calculated as the multiple of '*Ability to apply*' (A) and '*Importance*' (I). The A∗I column represents the new priority levels. The MSE criterion was utilized again to identify the new vital few PS factors to be improved. From the original 12 success factors, we had to deduce the vital few, $p_j, j = 1,2, \ldots \ldots 12$ Accordingly, the A∗I level of the PS factors were arranged in descending order. After applying the MSE(m) criterion, we see that the lowest MSE(m) was obtained for MSE(7)=84.48. Therefore, the vital few PS factors to be improved are the first seven on the list.

'*Clear targets*' was found to be the most dominant. Clear targets designate the main project's targets and outcomes. '*Nurturing open communication*' was ranked in second place and '*Communication between employees*' after it. Communication involves transferring ideas and information, as well as communicating verbally in face-to-face meetings, and non-verbally through letters, emails, etc. '*Clear description of the tasks*' (fourth place) has an important effect on project success since it focuses on aligning and explaining the exact work that has to be done (mostly using WBS and milestones in PM). 'Employee involvement' (fifth) has a strong connection to open communication and an indirect effect on project success. '*Leadership*' and '*Supportive management*' are initially important, as expected.

In this PM company, we found teamwork issues, perhaps because workers prefer to work along rather than in groups, which require greater cooperation. Accordingly, clearly, although there is a healthy communication between workers and good leadership, the matrix revealed that there is moderately significant difficulty in nurturing good teamwork in the company.

From	Project success factors	Importance (I)	Ability to apply (A)	I*A	MSE
1	Clear targets	7.378378	5	36.89189	267.3949
2	Nurturing open communication	7.216216	5	36.08108	230.1721
3	Communication between employees	9	4	36	185.5843
4	Clear description of the tasks	8.513514	4	34.05405	160.13
5	Employee involvement	8.351351	4	33.40541	134.8904
6	Leadership	8.135135	4	32.54054	112.5006
7	Supportive management	8.027027	4	32.10811	84.4811
8	Project size in terms of duration	7.378378	4	29.51351	87.41125
9	Teamwork	9	3	27	121.9359
10	Resource capacity	6.72973	4	26.91892	142.9267
11	Professionality of PM in the organization	8.675676	3	26.02703	155.5668
12	Plans approved by interested parties	6.324324	3	18.97297	

Table 3: Project success factor priority

4. Discussion

The grounded theory on required improvement levels of PS outcomes emerged from the literature review, which was analyzed here using the House of Project Success (HoPS) matrix. The parameters presented in the first column of Table 1 are considered PS outcomes. The following discussion of the current work focuses on the effect of key success factors on PS outcomes in Project-Based Organizations (PBOs). *Successful/failed project*

Many papers have proposed reasons for project failures (Avots, 1969; Belassi and Tukel, 1996; Rockart, 1979; Rubin and Seelig, 1967). The company we studied stressed the importance of project success but has great difficulty obtaining it. It has experienced many failed projects. In its pursuit of project success, the company made mistakes: budget violations, time violations, with fewer quality gaps and bad feedback from customers.

Deliver project on time

Delivering a project on time considered as one of the three factors in the golden triangle of PM (time, cost and quality). The company we studied assigned moderate importance to it (3 out of 5 on a Likert scale) and demonstrated a moderate gap in performance. Interviewees explained that delays hardly ever happen, and in most cases, these are the result of unexpected changes requested by customers or unpredictable crises such as lack of labor and resources.

I*mproving productivity*

Achieving productivity improvement considered as a major advantage of PBOs over non-PBOs (Parchami and Koosha, 2014). Surprisingly, the company studied attributed low importance to this PS factor as well as to the gap between the real and desired situations. Interviewees reported that the company works efficiently and hardly any improvement is needed.

Increasing resource utilization

This parameter is considered and mentioned in many papers (LePrevost and Mazur, 2005; Mishra et al., 2011; Parchami and Koosha, 2014). The company studied here, however, does not deem it important. Interviewees noted that they think that the company utilizes its resources quite well and that there is no need for improvement.

Project success factors

The results obtained from Table 1 motivated us to delve deeper to identify the most important project success factors using the QFD methodology (Table 2), where the rows are the PS outcomes and their corresponding required improvement levels (vis-à-vis Table 1) and the columns are the PS factors. The aim of the analysis was to find the most important PS factors in the investigated company, out of 23 PS factors collected from the literature. As expected, Teamwork, Communication between employees (Belassi and Tukel, 1996; El-Sabaa, 2001; Finch, 2003; Hyvari, 2006; Pinto and Prescott, 1988; Zimmerer and Yasin, 1998 and many more), Employee Involvement, Leadership, Supportive management, Professionality of PM, Clear description of tasks, Open communication, Project duration and Clear targets were found to be the vital success factors. The company, however, does not value Creativity and Innovative attitude. The same is true about structuring PM in the company, Communication with end users and the remainder of the 23 PS factors we listed. Although the company uses state-of-art communications technologies, the interviewees were unaware of the importance of innovation and its potential positive impact on the firm's success. They also did not recognize the importance of PM principles on the firm's success (ranked only 1.865 on the importance scale). The explanation for this situation is that this company is already considered a PM firm, so PM principles are assumed to be embedded in company policy.

The first twelve success factors of **Table. 2** recognized as important, by MSE analysis.

Nurturing open communication and Clear targets definitions are the easiest to implement, however Teamwork, Professionality of PM in the organization and Plans approved by interested parties have a moderate difficulty; as a conclusion, this company manages projects quite successfully, but it has to improve its teamwork and PM professionality.

Following **Table. 3**, Clear targets are the most dominant factor, nurturing open communication is in second place and Communication between employees, a Clear description of the tasks, and Employee involvement follow it. Surprisingly, Leadership is only in sixth place followed by Supportive management.

These findings demonstrate that the company nurtures good communication but has difficulty in teamwork and that it does not see that this is a serious problem. In addition, this company is not aware of the positive effect of leadership as a very powerful tool. The findings indicate a need to improve the teamwork and the awareness of PM as a powerful tool in middle management and line workers by training and embedding PN principles in all company levels.

5. Conclusions

In the literature, project success is shown as having two components: PS factors, which are similar independent variables that contribute to the likelihood of success and PS outcomes. Beyond theoretical attempts at creating a classification of settings, however, it is important to elicit the reasons projects succeed or fail within their specific settings. In specific settings, the literature has little to say about why some projects succeed and others fail. Moreover, we know little about the difficulties and gaps between known and desired situations. In the current work, the QFD method was utilized as a mechanism for revealing the specific PS framework of a project-oriented organization, and more deeply, for discovering the obstacles and difficulties when the organization attempts to apply these PS factors. A House of Project Success (HoPS) matrix was created using combined input from various managers and experts. This matrix summarizes the desired improvements in the PS outcomes and connects them to the relevant PS factors. Based on the HoPS matrix, outcomes and factors that maximize the desired results of the PS policy in an individual project were chosen using the mean square error (MSE) criterion.

This paper presents the application of the above methodology in a communications infrastructure company. The main findings of the deep analysis show that teamwork and communication between employees are perceived as being the most important PS factors. From Table 4, we see that the company has good leadership and good communication between employees, but there is a moderate difficulty in teamwork. Embedding and nurturing good teamwork and communication demands a significant effort from all employees and stakeholders. Additional findings are that clear targets and nurturing open communication are the easiest to apply whereas teamwork, professionality of PM and plans approved by interested parties are the toughest.

The methodology has four important practical implications: (1) The QFD-based approach offers a good way to define the most important PS factors related to PS outcomes. (2) The applied approach is a scientific/engineering methodology for identifying a subset of vital PS factors necessary to achieve the best PS outcomes for all types of projects at any stage of development. (3) Following the main objective of the study, we confirmed the high level of interest by management personnel in the effective direction of project development in terms of PS. (4) The QFD technique enables us to locate the organization's most difficult PM stumbling blocks, and thereby, find the reasons that PM techniques fail in an organization. Project managers should use the purposed methodology as a measurement framework of the PS initiatives for project development evaluation.

Limitation of the current study: A disadvantage of our PS QFD-based methodology is the assumption that PS outcomes can be captured, documented and remain stable over the long term. The required improvement level of the PS outcomes, however, may change unexpectedly. Therefore, the QFD tool could complicate the issue since adapting to dynamic needs can be complex, confusing and costly.

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