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A framework for project portfolio selection with risk reduction approach

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The ever-increasing penetration of projects necessitates effective management of multiple projects. Project portfolio management (PPM) is one of the modern project management tools that is utilized for strategy implementation in project-based organizations. This technique includes the following processes: Identification, categorization, evaluation, selection, prioritization, portfolio balancing, and authorization. In this paper, strategy implementation is considered the main goal of the organization. In other words, the more the strategy implementation, the more organizational success. Also, we know that one of the key risk objectives of PPM is detecting inappropriate projects. This ensures that the mix of ongoing projects will be the best available project opportunities. In other words, the importance of selection is enormous. In this paper, first, the main efficiency factors are analyzed and presented new definitions and methods to assess each of them. Based on the literature, four main evaluation factors of a portfolio are: 1) strategy fit, 2) single project success, 3) portfolio balance, and 4) interdependence between projects. Then, a framework is presented based on project strategy and Diamond approach concepts. The framework helps the organization to project evaluation and selection accurately. It also can be used for project prioritization. Some instances such as project definition, project objectives and project success criteria are defined in project strategy. Diamond approach is also used to analyze a project in four dimensions: 1) Novelty, 2) Technology, 3) Complexity, and 4) Pace (NTCP).

Key words: Project portfolio management, project selection, strategy, project strategy, risk.

INTRODUCTION

“Strategy” is applied in different contexts. According to Quinn (1980), strategy means the pattern or plan that integrates an organization’s major goals, policies, and action sequences into a cohesive whole (Hill and Jones, 1992). Glueck (1980) has defined strategy as a unified, comprehensive, and integrated plan designed to ensure that the basic objectives of the enterprise are achieved (Hill and Jones, 1992). Another definition of strategy is a set of approaches to attain certain goals on the business level (Reyck et al., 2005). An organization tries to attain its long-term goals with limited resources, so it must define strategy. Therefore, rate of strategy implementation is considered as a criterion for organization

success. Company function is affected by its relationship with its customers. Briefly, there are two types of customer relationships, direct and indirect. Companies that have direct contact with their customers referred as project-based. The project-based Companies carry out projects to provide specific customer needs. In such organizations, projects serve as primary capabilities to respond to change and thereby maintain a competitive edge (Dietrich and Lehtonen, 2005).

Project portfolio management (PPM) is about having the right information that can make the right decisions to select the right projects (Levine, 2005) and utilized to implement the strategy of a project-based organization as one of the modern project management tools. According to Rad and Levin (2006), PPM is a strategic and mission-driven process that is concerned with the entire enterprise as a whole. This paper analyzes the main success factors of a project portfolio that helps the organization to implement its strategy better. Also,

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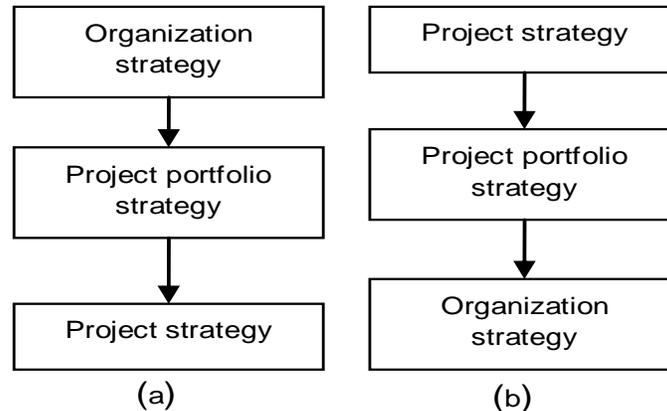


Figure 1. Hierarchy of strategy (a) formulation and (b) implementation.

considering the main goal that is implementation of organization strategy, relationship among project strategy, project portfolio strategy and organization strategy is reviewed (Figure 1) that shows their hierarchies in two states: a) formulation and b) implementation.

There are a few studies about project strategy. Arto et al. (2008) emphasized the importance of project strategy and proposed four types. According to Shenhar et al. (2005), project strategy is the missing link between marketing strategy and project execution and is necessary to complete the final link in the strategic chain. Poli (2006) in his PhD thesis has introduced project strategy as a path to achieving competitive advantages. But there are many sources about project portfolio management. In this paper, we present a new framework for project selection based on project strategy and Diamond approach. The framework can be used for prioritization of projects.

RESEARCH APPROACH

Our research consists of two stages. First, we reviewed the literature on the project portfolio management to find what has been written about PPM. The scope of research was limited to journals, books, and publications by specialized organizations such as the PMI in the USA. This research did not consider popular media or white papers. A new definition presented for success of organization and main success factors were analyzed. In the second stage, a new framework was developed for project portfolio selection based on depicted conceptual framework (Figure 2) with risk reduction approach. The portfolio selection and decision criteria rely on two data groups.

First, project risk management and planning data that will be used to evaluate and prioritize each project opportunity. So, project risk analysis should always be a key input for portfolio selection decisions.

Second, unrelated data to project management such as assessment of markets and potential competition (Kendrick, 2009), hence, the presented framework is divided into two parts: 1) single project evaluation and 2) portfolio evaluation. We also used project strategy concept and Diamond technique.

Strategy implementation

Implementing strategy throughout the organization is more difficult than formulating it (Hrebiniak, 2006). According to Crittendens (2008), strategy implementation is a critical cornerstone and is essential for building of a capable organization. Based on Johnson's study (2004), 66% of corporate strategy is never implemented. There are many obstacles to strategy implementation. According to Hrebiniak (2006), top five obstacles to strategy implementation are:

- 1) Inability to change management,
- 2) Poor or ambiguity strategy, not having a model to guide strategy implementation,
- 3) Poor or inadequate information sharing,
- 4) Unclear responsibility and accountability, and
- 5) Working against the power structure.

At first, there must exist a suitable and well-formulated strategy. If the strategic direction of the organization is sufficiently articulated, the portfolio management system will make those decisions on behalf of the enterprise (Rad and Levin, 2006). Successful implementation of the strategy will enable a company to become better and better over time, therefore will facilitate achieving its longer-term vision of a good mission, good planning, and overall corporate success (Crittendens, 2008). Larry Bossidy, former CEO of AlliedSignal and Honeywell, and Ram Charan, one of the world's leading management consultants, have stated that strategies most often fail because they are not well executed (Bossidy and Charan, 2002). This is where the importance of PPM is specified. PPM is able to remove or reduce most of the aforementioned barriers.

Project portfolio management

Project portfolio is a group of projects that compete for scarce resources and are conducted under the sponsorship or management of a particular organization (Archer and Ghasemzadeh, 1999; Shenhar et al., 2001; Elonen and Arto, 2003; Martinsuo and Lehtonen, 2007). According to Platje et al. (1994), a portfolio is a set of projects which are managed in a coordinated way to deliver increased benefits (Elonen and Arto, 2003) and project portfolio management (PPM) is the management of the project portfolio so as to maximize the contribution of projects to the overall welfare and success of the enterprise (Levine, 2005). Based on Kremmel

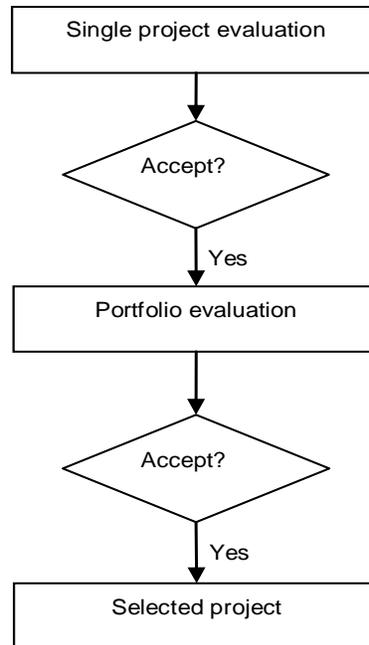


Figure 2. Conceptual framework of research approach.

et al. (2011), PPM is a set of processes used to support a business in conducting the mix of projects, which best fit the organization's various needs (Kremmel et al., 2011). These set of processes must support the main business goals and includes the selection of projects for an organization, maintaining the selected projects in portfolios, and reviewing the mix of projects periodically (Archer and Ghasemzadeh, 1999; PMI, 2008). Selection process deals with proposed projects and includes: preparation of project proposal, evaluation of project value and benefits, appraisal of the risks, aligning with organization strategy, determining the most favorable use of resources, rank projects, and select projects for the portfolio (Levine, 2005).

Shenhar et al. (2001) emphasized that projects and especially project portfolios are powerful strategic weapons that initiates to create economic value and competitive advantage. Projects may be considered as building blocks in the design and execution of future strategies of the organization (Dietrich and Lehtonen, 2005). A project-based organization may have several ongoing projects simultaneously. Thus, it has at least one project portfolio but level of PPM adoption may be low or high that depends on implementation of project portfolio processes. According to Reyck et al. (2005), organizations at the lowest level of PPM adoption confront problems such as commitment of business leaders, poor alignment of projects to strategy, little coordination between projects and conflicting project objectives. If the projects are selected regardless to the strategy, it is possible that the organization is moving towards an unintended direction, overall goals are not attained and scarce resources are wasted (Kremmel et al., 2011).

The three well-known objectives of portfolio management are maximizing the value of the portfolio, linking the portfolio to the strategy and balancing the portfolio (Cooper et al., 2002). So, the success of a project portfolio depends on the success rate of each of these objectives. According to Meskendahl (2010), project portfolio efficiency is based on four factors: 1) strategy fit, 2) single project success, 3) interdependence between projects, and 4) portfolio balance. This paper follows these factors and each of them is analyzed as follows:

Strategy fit: The result of fit between several factors or analysis of a factor in two states (as is and to be) is used to performance measurement. Strategy fit is the result of comparison between two strategies. In this field, project strategy is compared with the project portfolio strategy and the organization strategy. But strategies are dynamic in nature and change over time. Also, the concept of strategy is ambiguous and rather abstract in nature. So, the exact measurement of the organization's ability to comply with the intended strategy is not an easy activity (Dietrich and Lehtonen, 2005). There are several strategies and plans at all levels of an organization that their hierarchies are as follows: the highest level strategy is at the corporate level; the corporate strategy generates the corporate strategic plan that describes building for the future. The corporate strategic plan is then handed to the business units. They develop a business strategy based on the corporate strategic plan. Then the business strategy is converted to a business plan that describes impact on the business. Then the business plan is handed to marketing and is generated marketing strategy and then marketing plan that describes impact on the customer.

Finally, the project takes the marketing plan and develops a project strategy. Project plan is generated based on project strategy. So, project strategy and plan are typically presented as part of a hierarchy of strategies, objectives, and plans for a company (Arto et al., 2008) and does not replace or change the other strategies. Following the right patterns as part of a project strategy will help projects achieve better competitive advantage (Poli, 2006). Formulation of project strategy helps organizations to manage their projects strategically. According to Shenhar et al. (2005), strategically managed projects are focused on achieving business results. Arto et al. (2008) presents a generic project strategy definition. Project strategy is a direction in a project that contributes to success of the project in its environment.

According to them, word "direction" can be interpreted as either one or several of the following: goals, plans, guidelines, means, methods, tools, or governance systems and mechanisms including reward or penalty schemes, measurement, and other controlling devices. They concluded that two main parameters can influence

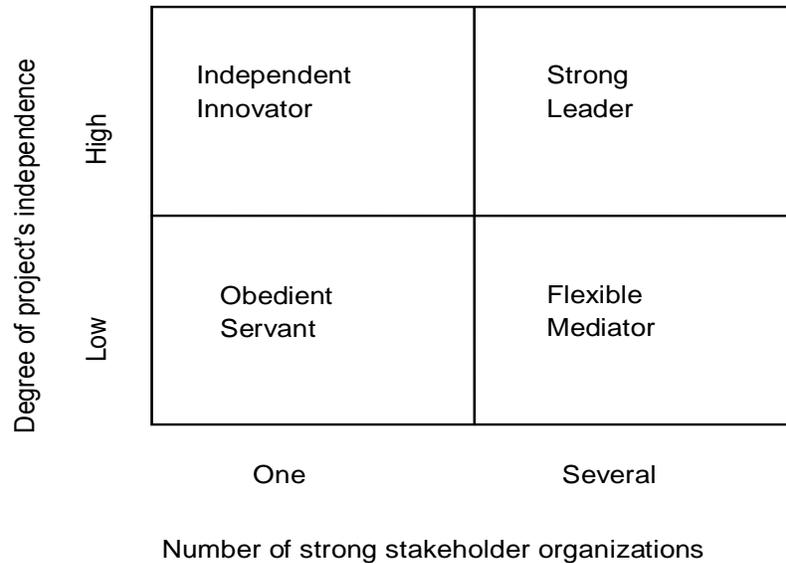


Figure 3. Four types of project strategy based on project's independence and strong stakeholders (Arto et al., 2006).

formulating project strategy: 1) degree of project's independence and 2) number of project's strong stakeholders. So, they suggested four types of project strategies (Figure 3).

There is another definition of project strategy that is similar to the aforementioned definition, but with more clarity or transparency. Project strategy is the definition of position, the means, and the guidelines of what to do and how to do it, to achieve the highest competitive advantage and the best value from the project and involves six elements: 1) Objective, 2) Product Definition, 3) Competitive Advantage/Value, 4) Success Criteria, 5) Project Definition, and 6) Strategic Focus (Shenhar et al., 2000; Poli and Shenhar, 2003; Poli, 2006). Table 1 shows related elements and questions. According to the different dimensions of organization strategy, it may have several project portfolios. Based on strategy hierarchy, organization strategy is at the highest level, then project portfolio strategy and finally project strategy. So, strategy fit is defined as a level of project strategy matching with organization strategy according to the dimension that project portfolio is defined. Likewise, the strategy fit of the project portfolio will be the sum of strategy fit of all projects in the portfolio. In other words, for evaluation of strategy fit, project strategy must be formulated and analyzed carefully according to the portfolio and organization strategy. This paper follows the definition of project strategy by Poli and Shenhar (2003). So, in project selection process, project strategy is formulated and after adapting with high level strategies, the project can be selected.

Single project success: Success is a broad concept that in a simple sense means meeting or exceeding expectations and goals. Project success is a multi-dimensional concept. A project may provide an useful solution to a customer, whereas be considered as a failure in terms of business success by the performing organization (Lim and Mohamed, 1999). Most organizations traditionally utilize financial measures to evaluate and measure their success, whereas such measures alone are insufficient to evaluation of organizational success in the long run. There is another common approach to project success. This approach considers a project successful when it has met its time and budget goals but there are many examples where this approach is not

enough. The construction of the Sydney Opera House took three times longer than anticipated and cost almost five times higher than planned. But it quickly became Australia's most famous landmark (Shenhar et al., 2001). So, other elements should be considered to analyze project success such as customer satisfaction or the level of satisfaction of four different stakeholders (the customer, the developer, the project team, and the end user) (Dvir et al., 1993). Martinsuo and Lehtonen (2007) documented in their study that project management with a broader set of success criteria has a strong and significant effect on project portfolio efficiency.

Therefore, the success of project within the portfolio forms one of the most important dimensions of project portfolio success. According to the definition of organization success, the main goal is strategy implementation and the tool is PPM that the projects are the elements of the portfolio. So, the success of a project is defined as its contribution in the project portfolio success. All factors between a project and a portfolio are divided into two categories: 1) Single project-level and 2) Portfolio-level. Similarly, factors between a portfolio and an organization are divided into two categories: 1) Portfolio-level and 2) Organization-level. Earlier research has concluded that some single-project level factors may contribute to portfolio management efficiency such as clear project goals (scope management), information availability, systematic decision making, and top management support (Cooper et al., 1997, 1999, 2002, 2004, 2004; Fricke and Shenhar, 2000; Engwall and Jerbrant, 2003; Arto and Dietrich, 2004; Dietrich and Lehtonen, 2005; Martinsuo and Lehtonen, 2007). Martinsuo and Lehtonen (2007) directed a questionnaire survey and based on responses of 279 different industry and service companies, concluded that information availability for decision makers appeared as the most significant project-level factor contributing to portfolio management efficiency.

Two other main project-level factors are goal setting (scope management) and systematic decision making. According to them, project management efficiency mediated single-project factors and portfolio management efficiency. Also, reaching of project goals was detected as a serious mediating factor between single-project factors and project management efficiency. In the process of project selection, first, the success rate of the proposed project must be

Table 1. Project strategy elements and questions (Poli, 2006).

Project strategy	
Elements	Questions
Objective	Why do we do it?
Product definition	What is the product?
Competitive advantage/value	How good is it?
	Why is it better?
	Why would the customer buy?
Success criteria	What is the value for us?
	What do we expect?
	How to assess success?
Project definition	How do we do it?
	What is the project?
Strategic focus	How to behave?
	What to do to achieve the best CAV?
	How to create a relentless pursuit of competitive advantage/value?

investigated. In this paper, we use project strategy and Diamond approach. Project definition, objectives, success criteria, and scope management are defined in project strategy. Four main dimensions of a project (Novelty, Technology, Complexity, and Pace) as well as are analyzed by Diamond approach. Interdependence between projects: The interdependence of all projects is an important parameter of the portfolio and special program. If any one project fails to deliver on time, the whole program is put at risk and cause to occur considerable cost (Young, 2007). The interrelationships among projects mean that the best individual projects do not necessarily make the best portfolio (Carazo et al., 2010). Many works emphasize the importance of taking into account the interdependence between projects (Fox et al., 1984; Santhanam and Kyparisis, 1996; Lee and Kim, 2000, 2001). Also, Verma and Sinha (2002) showed that interdependence between projects is a key determinant of project performance. Kaplan and Norton (2006) confirm the importance of synergies from a corporate strategy perspective (Meskendahl, 2010).

According to Platje et al. (1994) the coordinated management of all projects within a portfolio delivers benefits more than the results of independently managed projects. Gaining these benefits depend on identification of interdependencies between projects whereas, interdependencies within the portfolio are numerous and complex. So all benefits are often not put into practice and it is worth the efforts to reduce double work and enhance synergies (Loch and Kavadias, 2002; Verma and Sinha, 2002; Meskendahl, 2010).

Some interdependencies within a portfolio are caused by synergy while some others are defined merely because of constraints and logical relationships. We classify project interdependencies into four categories:

- (i) Resource interdependencies,
- (ii) Technology interdependencies,
- (iii) Marketing interdependencies, and
- (iv) Precedence relationships.

The first three items can enhance efficiency of portfolio and

organization and are called synergy. Resource interdependencies result from sharing scarce resources between different projects. Outcome of a project affects the resource allocation of other concurrent projects and subsequent projects. Resource interdependencies are referred to as inverse interdependencies. That is, the resource allocation for each project is inversely related to resources for other concurrent projects. The increase of resource level for one project would lead to decrease in the resource level of another project. This factor represents the compatibility of the organizational resources (capital, manufacturing facilities, manpower, and etc.) with the requirements of the project. Technology interdependencies result from leveraging common technology across multiple projects (Verma and Sinha, 2002) and represent a measure of the fit between the needs of the project and the firm's resources and skills with respect to R&D or product development, engineering, and production (Pattikawa et al., 2006). If multiple projects are executed concurrently, projects that are based on related project technologies tend to mutually benefit from one another. The project teams can clearly identify the stages of project implementation, work systematically through these steps, and solve problems. So they can achieve project objectives quickly with low risk (Verma and Sinha, 2002).

Marketing interdependencies represent the fit between the needs of the project and the firm's resources and skills with respect to the sales force, distribution, advertising, promotion, market research, and customer service (Pattikawa et al., 2006) and stem from (i) a new product into an already existing product market or (ii) utilizing a current product's market knowledge for development of a new product for an entirely different market. Meta-analyses by Pattikawa et al. (2006) proved that the firms with a strong market orientation, well-developed technology, synergy of resources and strong inter-functional coordination are most likely to achieve high performance. The projects may also have relationships with themselves. For example, a project may be predecessor of another project or a program is aggregate of some smaller projects. Precedence relationships among projects affect on resource, technology, and marketing interdependencies. For example, if a project is

predecessor of another project, same resources can be used in both projects. In two other cases, technology and marketing are similar too.

Balance: The idea of a balanced portfolio is based on modern portfolio theory by Markowitz (1952, 1991). This theory has been adapted by strategic management literature in the 1970s. In the field of project management, a balanced portfolio is the desired combination of projects. These projects enable a firm to achieve its objectives without unreasonable risk (Mikkola, 2001). An interview study by Cooper et al. (1997) with 35 companies identified that the objective of project portfolio management was to maximize the value of the portfolio in terms of company objectives, to achieve a balance of projects, in terms of strategically important parameters, and to ensure strategic direction of projects. According to PPM literature, to provide the best value to the organization, the portfolio must contain a balanced set of projects in terms of a number of key parameters (Archer and Ghasemzadeh, 1999; Cooper et al., 2002; Killen et al., 2008). So achieving some form of balance among the projects is an important aspect of portfolio. Different experts recommend several parameters such as: reward, risk, technical newness, market newness, strategic fit, implementation cost, competitive position, project type, project size, and short term vs long term projects.

However, there is no overall agreement on the parameters. According to Chao and Kavadias (2008) and Chao et al. (2009) success for project portfolios on new product developments requires the balancing between short-term benefits from incremental improvements of existing products and long-term benefits achieved through radically new products and services. Killen et al. (2008) constitute project type, risk level, and resource adequacy as criteria for balancing the portfolio. Archer and Ghasemzadeh (1999) point out the relevance of the dimensions project size and short term versus long term projects. So, this will require interactive displays to identify parameters for portfolio balance. For example, if project selection is too conservative on the risk dimension, the expected return from the portfolio may be too low. On the other hand, the proportion of high risk projects should not be too high because failure of several of these projects could be dangerous to the future of the company. Balance on project size is also important. If a large project fails, high proportion of resources allocated to the project will waste. Long term projects may cause financing or cash flow problems. Many of these criteria are not independent of each other. For example, project length and size are not independent and long term projects are normally bigger projects in size. Repetitive projects usually have less risk while an innovative project implicates a higher risk. Reward and risk are two most common balance parameters. According to Cooper et al. (1997), 44.4% of businesses use these factors. Applying Diamond approach that was developed by Shenhar and Dvir is very useful for portfolio balance.

Diamond approach consists of four dimensions: 1) Novelty, 2) Technology, 3) Complexity, and 4) Pace (NTCP). On the Novelty dimension, Shenhar classifies the project as derivative, platform, and breakthrough. Projects are classified as low-tech, medium-tech, high-tech, or super-high-tech on the technology dimension. Complexity is classified as assembly, system or array and finally four levels for pace: 1) regular, 2) fast, 3) time-critical, and 4) blitz. This approach can map project proposals on a matrix to show low-to-high benefit opportunity and low-to-high risk difficulty to approve or drop a project. The Diamond framework can help management distinguish between the platform products that customers will ask for, and the breakthrough products the company can pursue to disrupt the marketplace and capture great rewards. This framework also can help to decide which parts of a project to outsource. With any given increment, the closer each of the four bases is to the center, the more likely it is that you can outsource that element. The further out on an axis an element goes, the higher the risk and the

greater the talent required to making it work. Handle these risky aspects in-house or manage them internally if you hire outside expertise.

Project selection framework

Four effective factors in project portfolio efficiency are Strategy fit, Single project success, Portfolio balance, and Interdependence between projects. In the first two factors, the desired project is analyzed alone while in two others the project is compared with other projects. In the presented frameworks that are used to accept or reject a proposed project, all four factors are investigated independently in four steps (Figure 4):

- 1) Strategy fit analysis: Project strategy is formulated and compared with organization strategy and portfolio strategies. If approved, the suitable portfolio is selected.
- 2) Single project success analysis: At this step, a complete analysis of proposed project should be done and project strategy and Diamond approach are used.
- 3) Balance analysis: The balance parameters of organization (such as risk, reward, newness) and Diamond approaches are used and a table like Table 2 is prepared for each project. At this step the project may be rejected or accepted too.
- 4) Interdependence between projects analysis: The following items should be considered: resource, marketing, and technology situation. The project relationship with other projects must be analyzed.

DISCUSSION

The main goal of this paper is the success analysis of a project-based organization with applying project portfolio management (PPM) technique. This technique enables the organization to overcome obstacles of strategy implementation and attains long term plans if managed well. The processes of PPM implementation are completely clear. A proposed project should be evaluated by benefits, risks, alignment, and other business and project factors, then prioritized candidate projects and select the higher-ranking ones according to the organization's limited economic and human resources (Levine, 2005). The organization must analyze the proposed project accurately, compare with the other concurrent projects, and finally select or reject the project. In this paper, we propose a framework that facilitates the evaluation and selection processes. The proposed project may be rejected after analyzing of each factor. These factors are defined and described separately in the paper. Prior to applying the framework, two documents must be prepared: 1) project strategy and 2) the result of project analysis by Diamond approach. Six elements (product and project definition, project objectives, project success criteria, competitive advantage and strategic focus) are defined in project strategy. Diamond approach also analyzes the project based on four elements: 1) Novelty, 2) Technology, 3) Complexity, and 4) Pace.

According to PPM literature, project portfolio efficiency is measured based on four main factors: 1) strategy fit, 2)

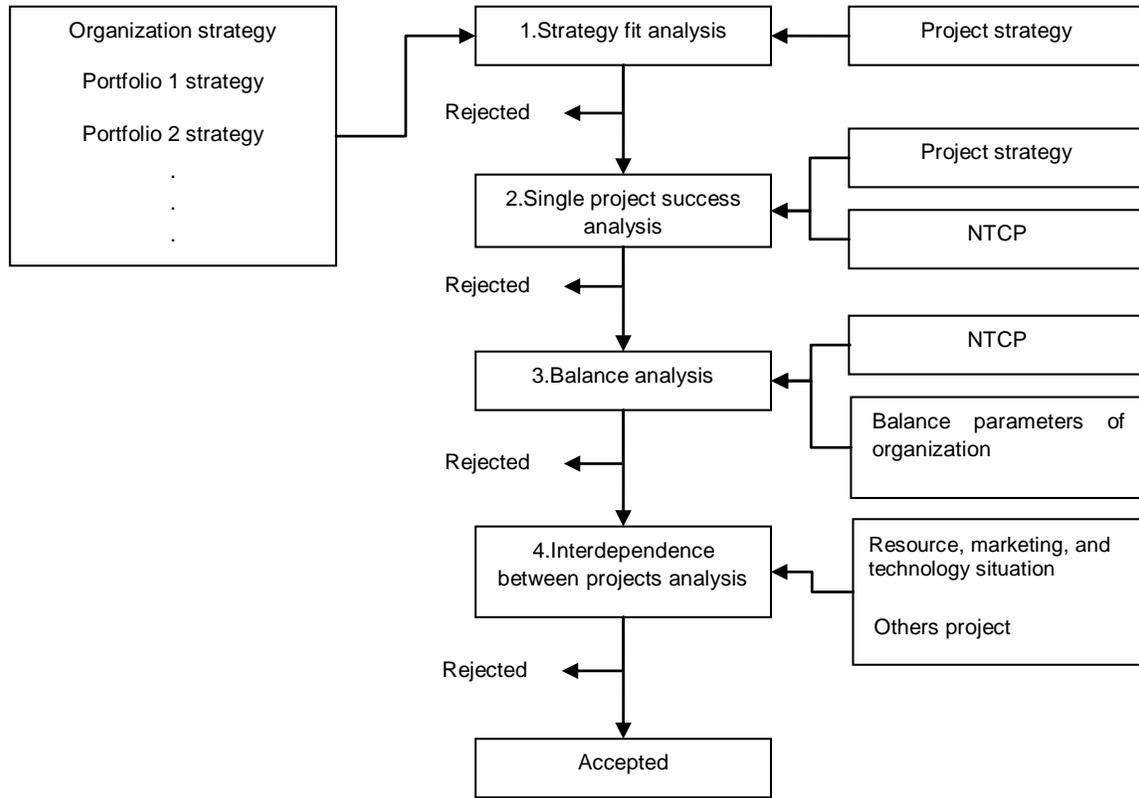


Figure 4. Project selection framework based on project strategy and Diamond approach.

Table 2. Balance analysis.

Diamond approach		N	T	C	P
	Risk				
Organization parameters	Reward				
	...				

single project success, 3) portfolio balance, and 4) interdependence between projects. In this paper, we presented a new framework for portfolio selection that all four factors are investigated independently. Strategy fit is the first parameter that was analyzed because the other portfolio projects should not be considered. Single project success is the second parameter. Project success should be measured based on risk and reward. According to Shenhar and Dvir (2007), there are four elements for project risk analysis: Novelty, Technology, Complexity, and pace. Based on Kendrick’s studies (2009), project risks can be grouped into three categories regardless of project type: scope risks, resource (cost) risks, and schedule (time) risks. These three parameters have been investigated previously in project definition element of project strategy document. In other words, all seven elements have been previously analyzed. Also, resource

(cost) and schedule (time) data are sufficient for reward analysis. So, a complete analysis of risk and reward is done in step 2. Portfolio balance is analyzed in step 3. First, parameters of balance must be specified that are divided into two categories: 1) independent such as technology, novelty and 2) dependent such as risk or reward (Table 2). In other words, Table 2 is completed for each project and all tables are analyzed simultaneously. In the final step, interdependence between projects is reviewed that three elements are considered: 1) resource, 2) technology, and 3) marketing. Resource requirements have been identified previously in project strategy document and should be compared with the available resources. Project technology also has been investigated previously in NTCP document and approved in step 2; and finally, project market must be analyzed. The elements of objective, competitive advantage and

strategic focus in project strategy document are related to project market that should be compared with the other projects in the portfolio.

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