AMERICAN UNIVERSITY OF BEIRUT

BUSINESS PROCESS REENGINEERING: FRAMEWORK DESIGN. BUTEC CASE

by
ELISSAR KHALIL SAMAHA

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ELISSAR KHALIL SAMAHA

Approved by:

Dr. Victor Araman, Associate Professor — First Reader
Suliman S. Olayan School of Business

Mr. Ziad Younes, General Manager — Second Reader
BUTEC s.a.l

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AN ABSTRACT OF THE PROJECT OF

Elissar Samaha for Master of Business Administration
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Business Process Reengineering (BPR) is fundamental rethinking of business processes (mainly core processes) to achieve breakthrough improvements in measures of performance such as cost, quality, time and flexibility. Companies undertake a BPR project as the gap becomes large between what a process is supposed to produce/deliver and what it is currently producing/delivering. BUTEC s.a.l. is an Engineering, Procurement and Construction (EPC) contractor operating in the MENA and GCC regions. BUTEC has recently decided to undertake a BPR endeavor that will affect some of its critical (support) processes. The objective of this project is to design a framework that BUTEC can follow in reengineering its processes, and to apply the framework to procurement, a pilot process that BUTEC carefully chose to prioritize. In this project report, we introduce BPR, present a literature review on some of the available methods/frameworks in the literature and select the framework to be used. Finally, we present the results of reengineering the procurement process. It is worthy to note that in the reengineering process itself, we focused mainly on the time dimension, being the most important strategically. Our findings show that the main reasons of delay are related to four aspects: people, product, process and third party (suppliers, planning department and consultants). The solution would be to divide the items to be ordered by procurement, into two categories, mainly critical and non-critical items, in order to design a process, manage resources and adopt supply chain practices for each category independently.

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ABBREVIATIONS

BPR: Business Process Reengineering

HOD: Head of Department

KPI: Key Performance Indicator

PO: Purchase Order

PM: Project Manager

PR: Purchase Request

RFQ: Request for Quotation

TQM: Total Quality Management

CHAPTER I

INTRODUCTION

Business process reengineering (BPR) activity certainly counts as one of the most notorious modern management achievements. It is a tool and a technique that organizations have been adopting and benefiting greatly from. BPR is an effort that companies undertake as the gap becomes large between what a process is supposed to produce/deliver and what is currently producing/delivering. Such endeavor is difficult and requires great deal of resources, in particular management commitment. To reduce the risk associated with the change and increase the likelihood of success of the project, researchers and consultants have developed frameworks for companies to follow during this reengineering endeavor.

In order to expand in a competitive market characterized by political and economic instability, BUTEC-a major regional construction company- has recently decided to undertake a BPR project targeting some of its most critical processes. Moreover, the timing is optimal as BUTEC is currently considering major changes to its IT system that will help, in particular, in automating some of its activities.

In this project, we design a framework that BUTEC can follow in reengineering its processes. Furthermore, we apply the framework to BUTEC procurement process. It is a pilot process that was carefully selected to start with.

The work done is presented in the next three chapters. In chapter 2, we define business process reengineering and review various BPR methods available in the literature in order to design a customized framework which will be used thereafter. In

chapter 3, we share some background on BUTEC and summarize relevant characteristics of the industry it operates in; we define the procurement process, highlight its strategic importance, and then design the framework based on its characteristics. In chapter 4, we move to the reengineering process itself, where we start with a root cause analysis in order to identify the issues BUTEC is currently facing, complemented by an analysis of best practice to benchmark against the leaders in performance. Finally, we develop an effective solution to the procurement process that will address most of the issues we identified in the analysis.

CHAPTER II

FRAMEWORK DESIGN

The purpose of this chapter is to define Business Process Reengineering (BPR), review some of the BPR methods available in the literature, and select a BPR framework that we believe is adequate for BUTEC, its industry, its strategy and its processes.

A. BPR Definition

1. The function view vs the process view

Business process (BP) is a network of buffers and value adding activities that transforms a set of inputs into a well-defined output. The traditional way of viewing an organization is as a set of functional lines, such as sales, marketing and production, practically linked to departments. Another approach of viewing an organization is through a set of cross-functional processes (See figure 1 below) which is particularly relevant and helpful for the purpose of BPR. Now we move to explain how organizations are viewed and managed through processes.

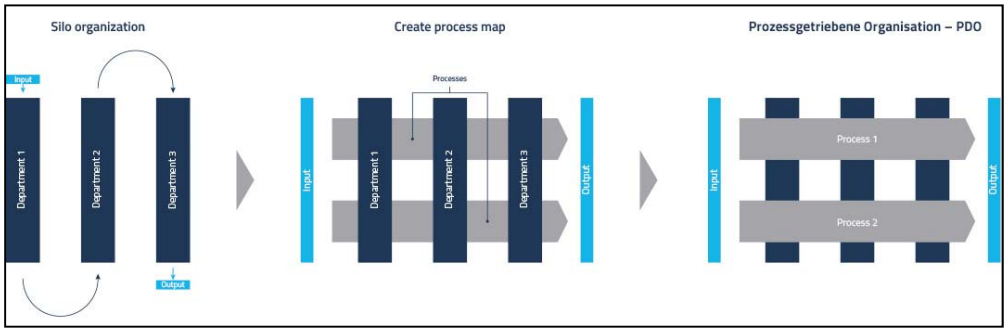

Figure 1. From functional organization to process driven organization (PDO) (Barkawi, n.d.)

The company's processes can be divided into two categories: core and non-core process. Core processes are those directly impacting the value proposition of the organization and thus are strategic in nature and through them companies generate competitive advantages.

This process view of the organization reduces the conflicts of interests between departments and enables a holistic, result-oriented, view of performance.

2. The process view performance measures

Organizations succeed financially when they can create the maximum value for their customers at the lowest possible cost. Therefore, the core processes that produce/deliver such output need to be extremely efficient. For that, they need to be constantly evaluated and continuously improved. In that view, performance of processes can be evaluated through four dimensions. These four dimensions are cost, quality, time and flexibility.

Cost is the total cost incurred by the process as it delivers its output (Product/Service). It includes, but not limited to, raw material costs, manufacturing costs, human resources cost (usually the highest cost for services).

Time is the total time it takes the input to be transformed into output. For example a consultancy project starts when the analysis is done and ends when the report is submitted to the client. The total time incurred from the beginning of the analysis to the report delivery is the dimension we want to measure. For example, a normal time for a project is X weeks. Another alternative is to do it in X/2 weeks, but this is definitely more expensive because it requires more resources and more coordination among involved parties. In this example we can see clearly the tradeoff between time and cost.

Quality is the ability of the process to deliver the output that meets customers' expectation. A good quality process is the one that delivers outputs with the lowest possible number of defects. Improving quality by reducing the number of defects requires a quality management approach which comes at a cost. However, product failure comes at a cost too, the sooner you detect the defect in the process the lowest the failure cost is. The most expensive is when you detect the defect after the product /service reach the customers. A good example of an external failure cost is Toyota car recalls. Improving process quality reduces the likelihood of failure and hence reduces cost. A balance point between failure cost and quality cost should be found in order to maximize the profit.

Flexibility is the amount of flexibility the process should have to be competitive. Flexibility could be in term of volume and variety, a flexible process is the one able to handle high volume and / or many varieties. Handling big volume and varieties is called mass customization (DELL is a good example), it is desirable and rewarding but hard to achieve. Having one process for every type of product or service comes at the expense of cost and time.

A company has to position itself around these four dimensions, and find the most beneficial tradeoff between these four dimensions in-line with its value proposition. It has to cascade the business unit strategy to an operational strategy. As an example, if a company strategy is to be a cost leader, then the operational strategy should focus towards reducing costs; e.g. removing waste, improving efficiency, reducing complexity.

As we have said, companies must continuously review the ability of the process to meet the strategic objectives and face market challenges, and as a result companies must continuously improve and adjust its processes accordingly. However, when the gap between the current and the desired performance is too high. Companies consider at this point to drastically change those processes. Hence the concepts of BPR.

3. BPR vs Continuous improvement

Continuous improvement: is the ongoing effort to incrementally improve process and to develop capabilities to produce better results.

BPR: "Fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service and speed". (Hammer & Champy, 1993). (See Figure 2 for an illustrative explanation)

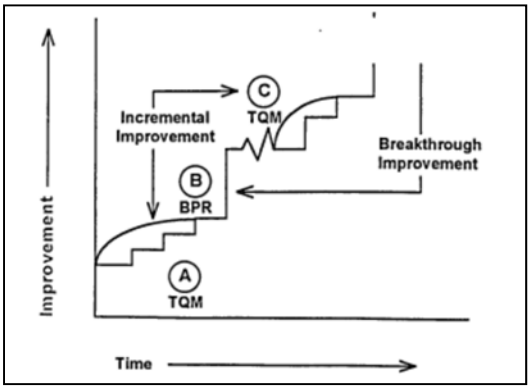

Figure 2. BPR vs Continuous improvement (Cross & Feather, 1994)

B. BPR drivers

Unlike continuous improvement, changing drastically the processes is not an easy decision; there are several factors that drive companies to undertake this decision (Johanson, Mchuch, Pendlebury, & Wheeler iii, 1993):

Customers: In today's word customer has become part of the decision making of the company. Listening to the "Voice of customer" is key, but customer's needs and expectations not only evolves, but also are affected by trends and fads. Companies' processes should be ready to face these challenges and if possible do a better job through exceeding customers' expectations.

Competition: The intense competition that is continuously increasing is a clear driver for BPR. Companies must review their processes in order to survive or create a competitive edge.

Cost: As important as facing competition and meeting customers need, cutting costs without affecting the value proposition is definitely a BPR driver.

Technology: Companies must cope with technological shifts. They should leverage it to improve their operations before it becomes too late to face competitors that are using technology.

Economy, Regulation and Politics: these factors are out of the organization control. For example, Environmental regulations, product standards, labor Laws.

All the factors listed above create the urge of an organizational transformation. And a BPR endeavor is needed for the company to evolve in order to improve its performance and face the market challenges. (Johanson, Mchuch, Pendlebury, & Wheeler iii, 1993)

Having set the objectives and decided to undertake a BPR endeavor, the question now is how to do it?

C. BPR Methods

Theoretically, BPR is about scraping the current process and starting from scratch, except that such extreme way is too expensive and often practically impossible. Moreover, a number of problems arise when one starts with the implementation of such radical change. The execution takes a lot of time, change resistance arises. As a result, companies can't afford this radical change and BPR effort deems to fail. A more realistic approach to BPR that has been more successful in practice is one where you follow a specific methodology with a list of steps including a careful design of the implementation phase. This latter approach has been criticized for limiting the creativity and the potential of breakthrough improvement.

However, throughout the years, BPR projects have become more pragmatic. Practitioners have developed methods that were tailored to project needs and specificities. This pragmatic approach has left enough room for creativity while keeping some structure. It enabled to capture the organization needs and the change level of the project, and at the same time they it is used as a roadmap which helps monitor progress,

execute the project in a systematic way and reduce the risk of failure (Klein, 1994). To have an idea about these methodologies we will review those of three consultants: A.T. Kearney (Harrison & Pratt, 1993), Gateway (Manganelli & Klein, 1994) and McKinsey (Kaplan & Murdock , 1991) .

1. A.T. Kearney Methodology

The methodology developed by A.T. Kearney (Harrison & Pratt, 1993) is a balance between improving existing processes and redesigning them. It is composed of seven steps and does not have an endpoint. The change process is ongoing. (See figure 3 below).

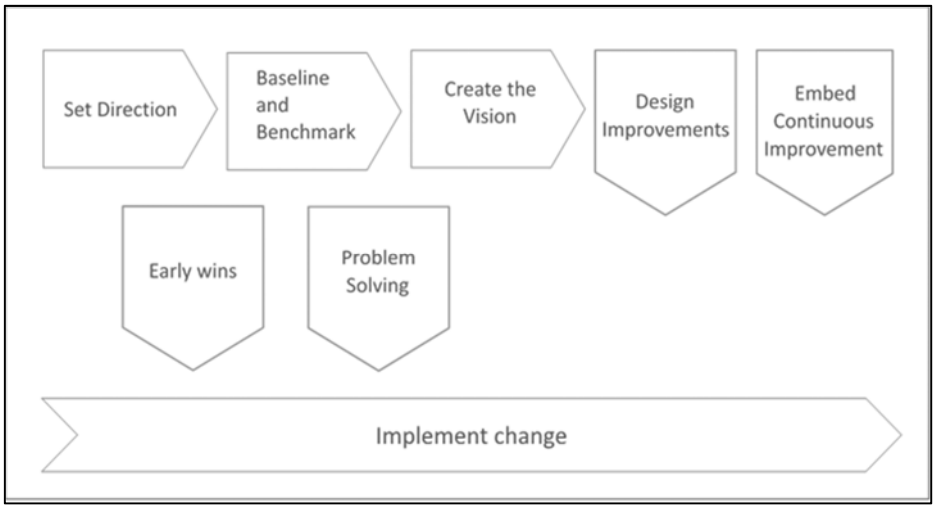

Figure 3. A.T. Kearney BPR methodology (Harrison & Pratt, 1993)

Briefly the sevens steps are:

Step 1-Set Direction: the purpose of this step is to select the process to redesign, assign the responsible team and communicate the need of change to the organization.

Step 2-Baseline and benchmark: the team conducts a detailed study of the current performance and benchmarks it to reputable organizations. In this stage "early wins" appears. These are opportunities to make direct improvement.

Step 3-Create the Vision: in this step the team begins to visualize the new process.

Step 4-Launch Problem solving Projects: this step is lunched the same time as step 2, in this step the team investigates the problems and solves them. The result of these projects is handed for implementation.

Step 5-Design Improvements: at this point the team draws the new process, identify the organizational structure and the technology needed for the new design. In addition the team sets an implementation plan.

Step 6-Implement Change: this step is ongoing, as previously said it starts in "early win" continues after problem solving projects and escalates as the whole organization become involved when the new design is ready.

Step 7-Embed Continuous Improvement: the purpose of this step is to emphasize on team work and ongoing improvement of performance.

2. Gateway Methodology

The methodology developed by Gateway consultant (Manganelli & Klein, 1994) is called: "The Rapid Re methodology". It is a simple five stage, fifty-four steps methodology that includes a set of integrated familiar management techniques needed to identify opportunities and achieve radical change. (See figure 4 below)

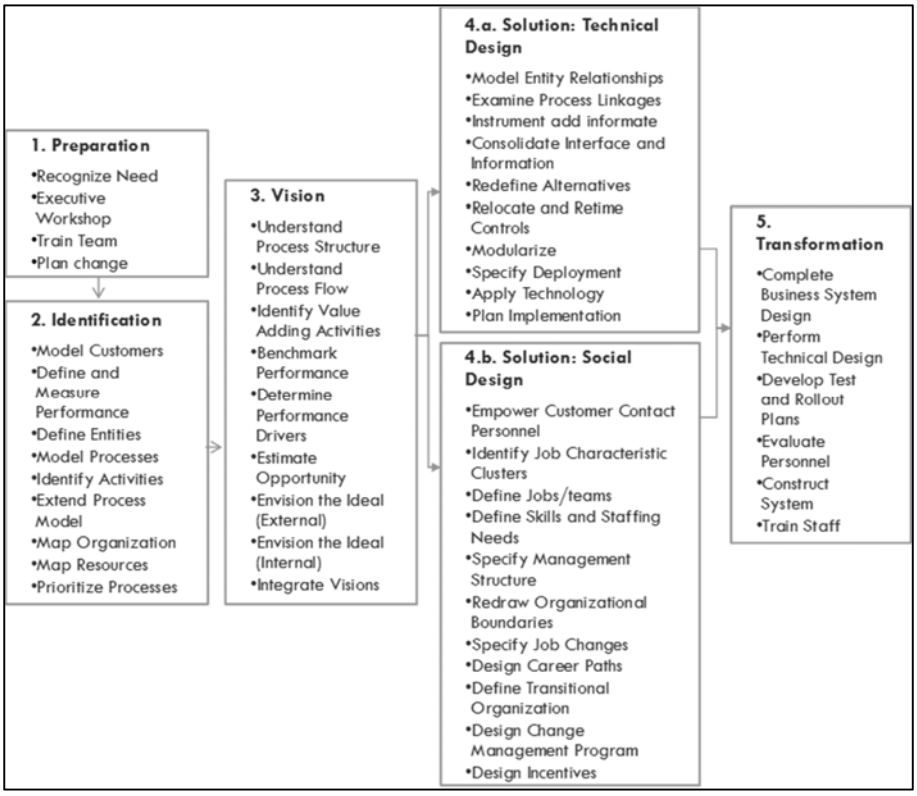

Figure 4. Gateway BPR methodology

The five stages are:

Stage 1-Preparation: the purpose of this stage is to define the goal of the project, prepare the organization for the change and train the reengineering team. Examples of management techniques used in this stage are: team building, motivation, change management and project management.

Stage 2-Identification: the purpose of this stage is to identify the strategic and value added process that has the highest impact on achieving the goals.

Examples of management techniques used in this stage are: performance measure, process modeling, and process value analysis.

Stage 3-Vision: the purpose of this stage is to identify opportunities of change and develop the vision of the new process.

Examples of management techniques used in this stage are: benchmarking and workflow analysis.

Stage 4-Solution: this stage is divided into two sub-stages:

- Technical design which specifies the standards and the technology needed to implement the new design.
- "Social" design which defines the human resources required for the new process.

Examples of management techniques used in this stage are: information engineering and team building.

Stage 5-Transformation: the purpose of this stage is to implement the new process.

Examples of management techniques used in this stage are: continuous improvement and performance measurement.

3. McKinzey Methodology

McKinzey (Kaplan & Murdock , 1991) developed a broadly based, structured, and phased approach. It is divided into five phases.

Phase 1-Identifying processes: companies define at high level its core processes.

Phase 2-Defining performance requirements: companies assign one or two strategic objectives for each process. These objectives may be customer-driven or financially driven. In this phase also an analysis of the current performance is done to find the gap between the current and required performance.

Phase 3-Pinpointing problems: companies conduct an analysis to know the causes of the performance gap and prioritize them. The use of "root-cause" or "cause and effect" tree is helpful in this phase.

Phase 4-Developing a vison: companies develop several options of redesign, evaluate each option and select the new initiative.

Phase 5-Making it happen: companies develop a detailed implementation plan that includes low risk testing.

Mckinzey also defined the factors that ensure the success of BPR, some of these factors are: Strong Leadership, Cross-Functional Involvement, Creativity and early wins.

As we can see, we can find many commonalities between these three methods. In addition to the methods presented above, there are plenty of other methods available in the market. Given all these methods, which one to select?

An interesting study was done on 25 consultant methodologies, and found enough common things to describe a common BPR effort. The researchers derived a BPR project Stage Activity Framework (S-A Framework) that combines all these methodologies into one composite framework. The researchers also presented the analysis that should be done to customize the framework to any BPR project (Kettinger, Teng, & Guha, 1997).

4. Stage Activity Framework

The stages of the S-A framework are: (Kettinger, Teng, & Guha, 1997)

Envision (S1): this stage involves informing top management and selecting process.

Initiate (S2): this stage includes the assignment of the reengineering team, setting performance goals and informing the employees.

Diagnose (S3): in this stage the team identify process requirement, analyze the reasons of bad performance and remove non-value adding activities.

Redesign (S4): in this stage the new process is developed after brainstorming and generating alternatives.

Reconstruct (S5): this stage ensures the smooth migration to the new process, it emphasize the use of change management techniques.

Evaluate (S6): this stage is about monitoring the new process to make sure it met its goals.

For each stage listed above there is set of activities that should be executed. The framework is shown in figure 5 below.

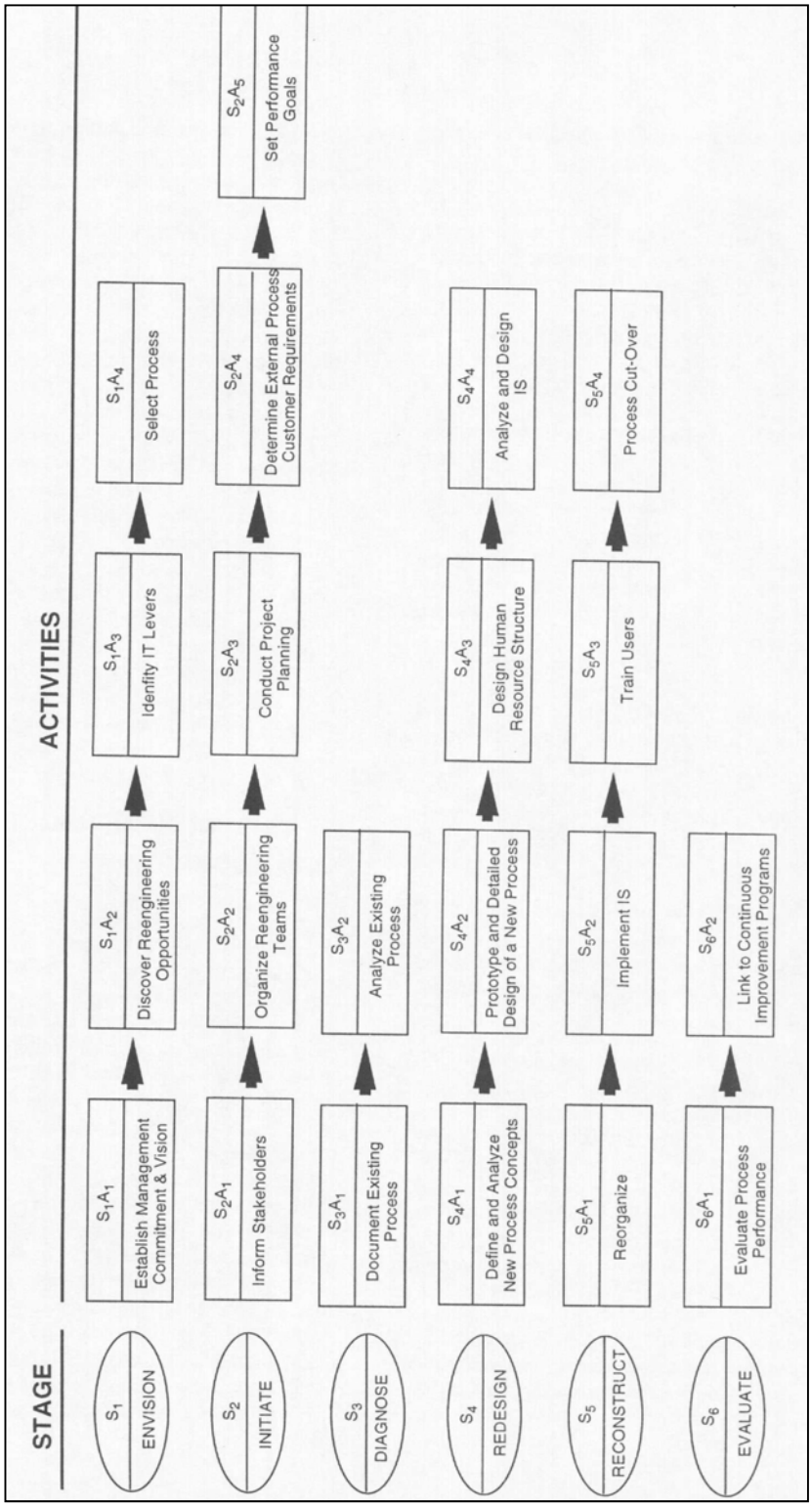

Figure 5. Stage Activity BPR framework (Kettinger, Teng, & Guha, 1997)

Because there are no two BPR projects that are alike, it is essential to select the appropriate activities to emphasize on, and the irrelevant activities to be disregarded. In order to do that projects characteristics will be identified and assessed based on the following four dimensions:

Project Radicalness: the project radicalness presents the degree of change in the project.

- If project radicalness is high, focus on activities related to change management and new process design.
  - Establish management commitment and vision (S_1A_1)
  - Inform stakeholders (S_2A_1)
  - Design human resource structure (S_4A_3)
- If radicalness is low, stress on activities related to continuous improvement
  - Document existing process (S_3A_1)
  - Analyze existing process (S_3A_2)

Process Structure: if the process is structured, i.e. the process is consisted of a simple set of steps and does not have many proliferation, more emphasize should be given to process modeling activities.

- For radical projects:
  - Define and analyze new process design (S_4A_1)
  - Prototype and detailed design of a new process (S_4A_2)
- For projects lower in radicalness:
  - Document existing process (S_3A_1)
  - Analyze existing process (S_3A_2)

Customer focus: if the process has high focus on external customers, emphasize on activities that determine external process customer requirements (S_2A_4).

The potential for IT enablement: if the process requires high IT enablement, emphasize on activities related to developing IT enablers.

- Analyze and design IS (S_4A_4)
- Implement IS (S_5A_2)

Project Radicalness is the most important and the hardest to assess. To help companies, the researchers of this study developed a planning worksheet with a set of questions to assess project radicalness (See figure 6 below). A score of 1 (improvement) to 5 (radical change) is given to each question, and then the average of these scores is calculated. The questions could be given equal weights or sometimes the ones that are more relevant to the project could be given higher weights. The final average may be adjusted for risk. This average represents the degree of radicalness on a scale from 1 to 5 (highest).

The questions helps asses the willingness, the ability and the importance of change. There is set of questions about how strategically important is the process, and whether it has an inter-organizational or an internal focus, and whether it is functioning well or not. Another set of questions focus on change culture of the organization, they cover the rigidity of the structure of the organization, and the management commitment and contribution to the ease of implementation of the change. And finally, a set of questions to assess the availability of IT resources in addition to the feasibility of the IT change. For the detailed set of questions refer to figure 6 below.

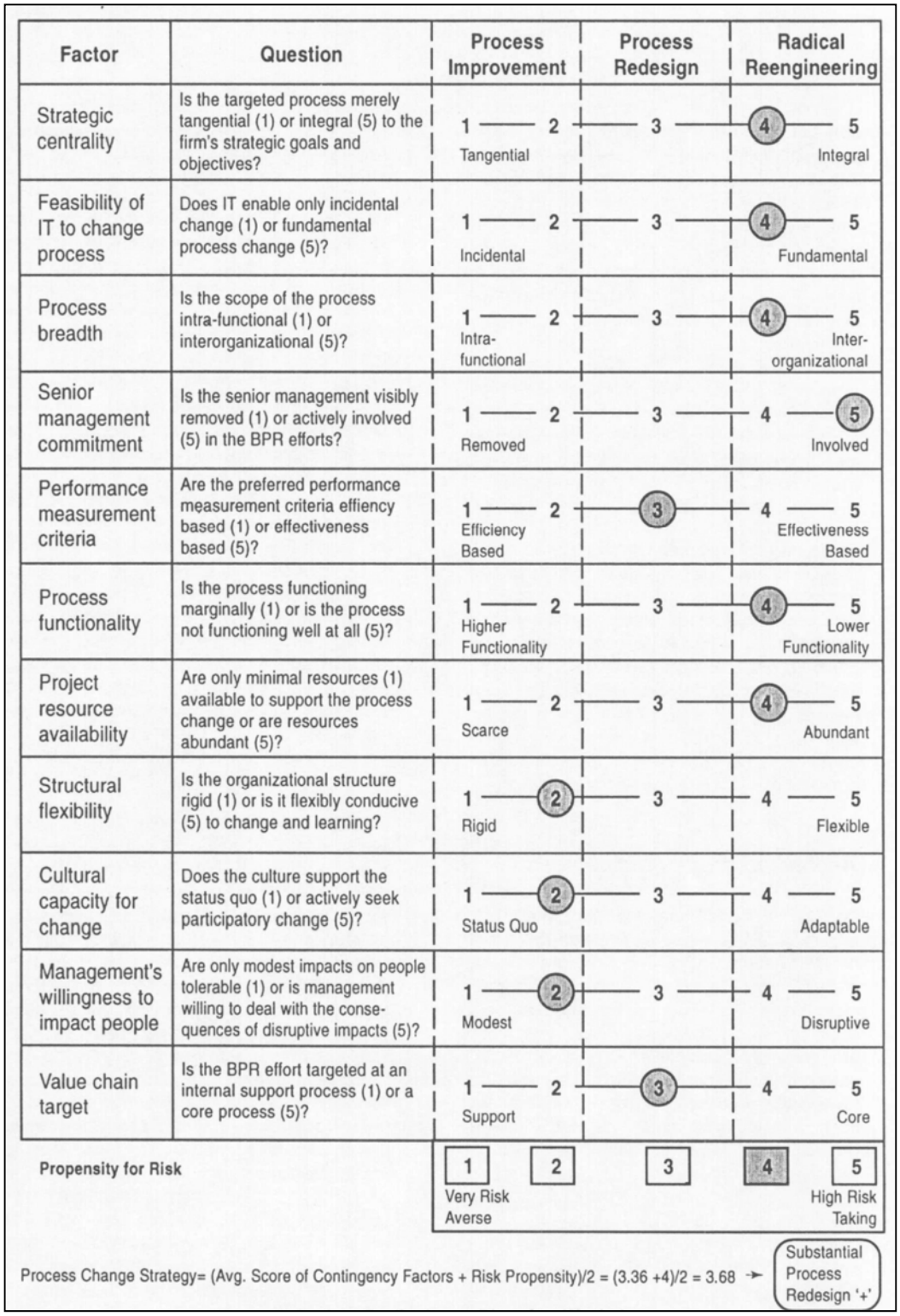

Figure 6. Project radicalness planning worksheet (Kettinger, Teng, & Guha, 1997).

D. Method Selection

Following a comparative analysis among the different methods / frameworks / approaches, it became clear to us that the S-A framework is quite comprehensive and adaptable. It is based on the study of 25 consultants' methodologies; it is a general approach applicable in most of the cases. Plus we can benefit from the tools provided in this research to customize the framework to BUTEC needs. As a result, we decided to follow the S-A framework for our reengineering project.

The first stage in this framework, which is "Envision", was done by BUTEC, the management decided to start with the procurement process due to its strategic importance. The scope of this project is restricted to the procurement process. However the same approach could be adopted by BUTEC for other processes. In the next chapters we will customize the framework to the procurement.

CHAPTER III

BUTEC AND THE FRAMEWORK CUSTOMIZATION

In this chapter, we introduce BUTEC and the industry it operates in, show the reason behind selecting the procurement process, then customize the S-A framework to BUTEC procurement process.

A. Company Overview

BUTEC is a leader in the MENA&GCC construction market. Since its establishment in 1964, BUTEC is offering services ranging from execution of pre-designed projects to a full solution EPC (Engineering, Procurement & Construction) projects. These projects fall in the following sectors: Environmental Projects, Infrastructure, Oil & Gas, Industrial Projects, and Buildings. BUTEC is based in Lebanon, with branches across the Middle East, North Africa, GCC and Europe, its projects are located in the Arabian Gulf and Algeria. Aligned with its vision of being able to offer high quality services worldwide, BUTEC aims to expand to other regions.

BUTEC expansion strategy is facing several challenges. The economic and political instability in the GCC and the increased competition in the construction industry. In addition to these external threats, BUTEC is facing internal issues due the fact the company grew at a fast pace, however its core processes were not updated accordingly creating great inefficiencies and causing the dissatisfaction of stakeholders. As a result BUTEC decided to take a BPR endeavor to achieve a competitive advantage moving forward.

B. Industry Overview

The construction industry is divided into two segments:

- General building Construction: it includes residential, commercial, institutional and industrial buildings projects.
- Engineering Construction: it includes all infrastructure projects.

Each project is unique in term of type, size, and complexity; and requires specific professional skills. This is what makes the construction industry different than other products industries.

The construction industry involves many entities. The most important players are the owner, the design professional or consultant, and the contractor. The construction supply chain starts with the owner when he identifies his need, conduct a feasibility study and decide to go for a project. It ends when the project is delivered to the owner. In between there is the design conducted by the consultants, and the execution of the project done by the contractors. The relationship between consultants and contractors is not the same in every project, it depends on the project delivery method decided by the owner during the pre-project phase. We will present the two most common methods. The first is the traditional method *Design-Bid-Build* and the second one is *Design-build* method (Bennett, 2003).

Design-Bid-Build is the most common method. The owner awards the design professional to develop the design, write the specifications, and develop construction drawings. Upon completion of this step, contractors are invited to bid on the project. And the owner awards the bid winner the execution of the design.

Design-build method has become more common recently. The owner awards one single organization that will be responsible for the design and the execution of the

project. The detailed design will be done in parallel with the construction. This approach improves productivity through integrating the design team with the execution team, it enables cost savings but it is more risky in terms of possible lower quality due to less control over the selection of the designers.

Figure 7 below highlight the difference between these two methods

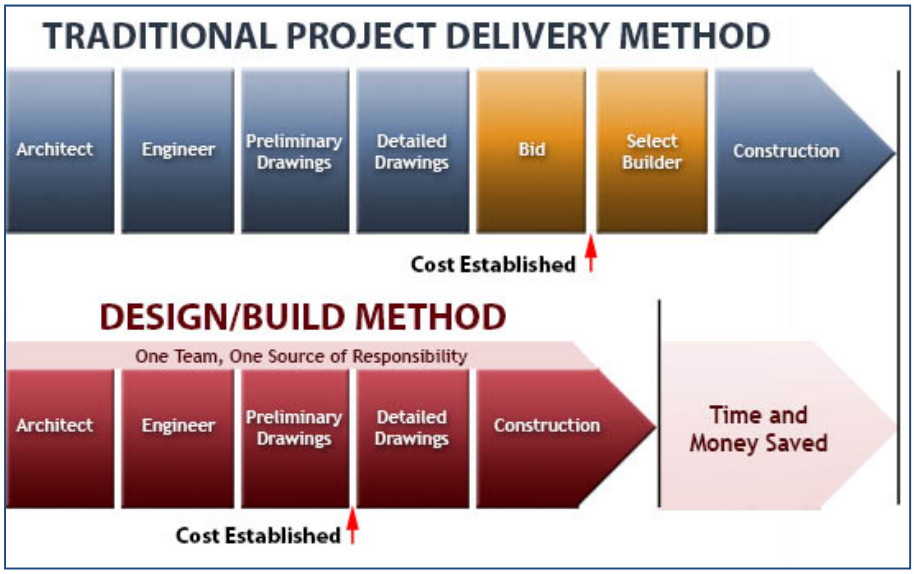

Figure 7. Design-Build method vs Design Bid Build method

The last phase of the project is the execution of the design. It is the last phase in the whole construction process. The processes in this phase are: Planning process → Procurement process → Supply process→ on-site building process.

Planning is the process of scheduling the work that should be completed during a specific period. This includes the manpower and the material needed for this period. The planning process is updated periodically and is the initiator of the procurement process. Procurement is the process of purchasing material from an external source. The supply process is the delivery of material on site. And finally the last process is the execution of the project.

C. Procurement at BUTEC

BUTEC decided to undertake BPR. Knowing that breakthrough improvement is achieved through reengineering core processes, procurement was selected to start with. Procurement is a core activity in the construction process. It directly affects BUTEC's strategic objectives:

- The cost of material has a direct impact on P&L of the project
- The availability of material on site is key to complete the project on time
- The good quality of material is the base of a good quality project

In case of BUTEC, the procurement process starts from the purchase request to the delivery of the goods on site or in office. The procurement process at BUTEC involves both the purchasing of office equipment and of construction material.

In this project, we will focus mainly on the procurement of construction material because of its strategic importance and impact on bottom lines. However, we will still briefly include the office procurement because they are part of the process and are using capacity.

Now we have selected the process and the BPR framework we want to follow, we need to customize it and select the relevant activities in each stage of the S-A framework.

D. Customize S-A Framework to Procurement

To customize the S-A framework, we have to assess the project radicalness along with the structure of the process, degree of customer focus, and the degree of IT enablement.

1. Project Radicalness Assessment

To assess the project radicalness we followed the worksheet we presented in chapter two. We Selected the relevant question to BUTEC case, we reached an average of 3.9/5 (See table 1 below) → the project radicalness is high.

Factor	Question	Score	Comment
Strategic Centrally	Is the targeted process merely tangential (1) or integral to the firm's strategic goals and objectives	4.5	Procurement is a strategic core process at BUTEC
Feasibility of IT to change process	Does IT enable only incidental change or (1) or fundamental process change (5)?	4.5	BUTEC has an IT department. They develop the code in-house
Process breadth	Is the scope of the process intra-functional (1) or inter-organizational (5)?	4.5	The procurement process involves external parties which are the suppliers
Senior management commitment	Is the senior management visibly removed (1) or actively involved (5) in the BPR efforts?	4.5	They are involved in decision making. (Part of the BPR steering committee)
Process Functionality	Is the process functioning marginally (1) or is the process not functioning well at all (5)	3	The stakeholders are complaining and are not satisfied
Structural Flexibility	Is the organizational structure rigid (1) or it is flexibly conductive (5) to change and learning?	3	The organization is old and mature
Cultural capacity for change	Does the culture support the status quo (1) or actively seek participatory change (5)?	4	The culture of change exists among BUTEC employees.
	Average	3.91	

Table 1. Assessment of project radicalness

2. Other Characteristics Assessment

Along with the project radicalness, we need to assess other characteristics which are the degree of process structure, customer focus and IT enablement. (See table 2 below)

Characteristic	Assessment	Comment
Degree of structure of the process	High	The process is simple and structured, it does not have many proliferations.
Degree of customer focus	Low	The procurement process does not involve contact with external customers
Degree of IT enablement.	High	BUTEC is willing to automate all activities

Table 2. Assessment of project characteristics

3. Customized S-A framework

Based on the assessment we did in the previous section. We found that:

- The degree of project radicalness is 3.9/5 → Radical Project
- The Degree of IT enablement is high.

We can conclude that the degree of change needed for the procurement BPR is high. In addition, there is commitment form BUTEC management to succeed in this effort and a willingness to take some calculated risk in order to implement possibly some radical changes. As a result, while implementing BPR, a high emphasize should be given to the activities related to change management in order to avoid change resistance and increase the likelihood of success. Especially that BUTEC is a big company and implementing change gets harder with large scale companies.

Regarding the IT change, beside that the technology is a key enabler of the new process, it has a big impact on employees' acceptance of the new way of doing things. If

the new application is not user friendly or convenient, the risk of rejection is high. So while implementing BPR, a high focus should be given to the design and the implementation of the IT system to be able to design an application in line with the new activities and the end-user needs.

As a conclusion, we can remove the activities related to customer (S_2A_2) and emphasize on the activities related to change management (S_1A_1) and IT design (S_4A_4). Refer to figure 8 below, the activities surrounded by a blue rectangle are the most important that BUTEC should emphasize on.

For the scope of this project, we will focus on the activities related to the analysis of the existing process and the design of the new process concepts. In the following chapter we will present the results of these two activities.

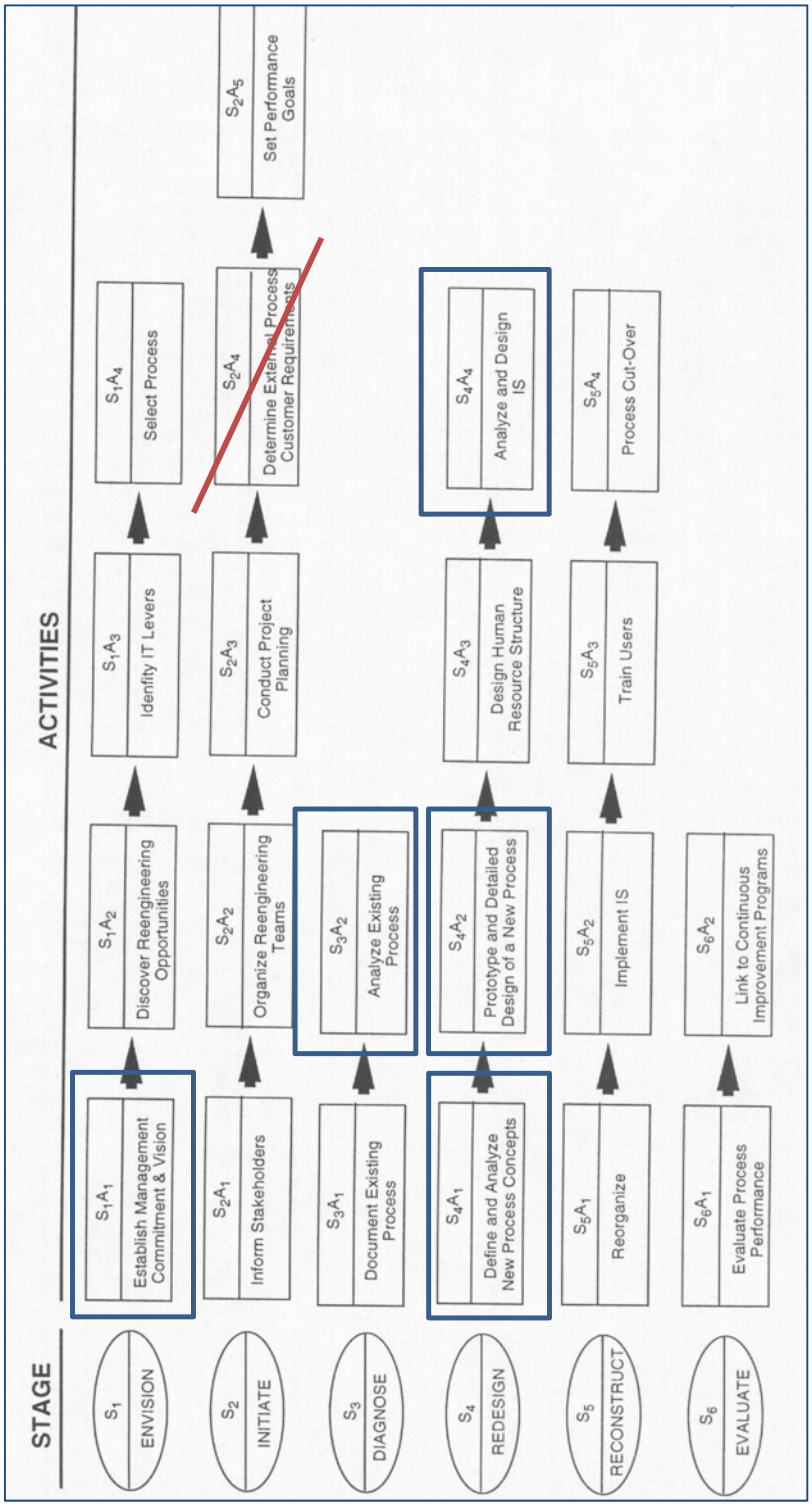

Figure 8. Customized S-A framework

CHAPTER IV

BUTEC AND THE FRAMEWORK APPLICATION

In this project the main focus was given to the following activities: Analyze Existing Process (S_3A_2) and Define and Analyze New Process Concepts (S_4A_1)

The purpose of this chapter is to present the approach we followed and some of the conclusions we will be recommending as a result of the above activities. On the analysis end (S3A2) we used root-cause analysis tool to understand the main source of the problems. However, first it is necessary to become very familiar with the current process, understand how it functions and recognizes its weaknesses. To do that, we spent a decent time at BUTEC, we read their procedures, we interviewed managers, and attended the BPR steering committee meetings.

After we identified the issues BUTEC is facing, we looked at Best practice and then developed a customized solution (design of concepts) to address all the issues.

A. Analyze Existing Process

The analysis of the performance of the existing process is based on the four dimensions of cost, quality, time and flexibility. Knowing that the procurement is a core process at BUTEC, and based on BUTEC value proposition to finish the project as scheduled, time is the most important dimension in our case. The importance of time was also highlighted by the CEO of BUTEC during a steering community meeting. He stated that the main objective of the procurement team is to place orders as early as possible to avoid delays.

After recognizing the importance of time for the process. We decided to take a look at the number of purchase orders that arrives on time. To do that, we measured the difference between the expected date of arrival of the order and the actual day of delivery. We were able to measure this because the process at BUTEC is partially automated via SIEL (BUTEC information system), the user issues a purchase request (PR) in the system and fills all the required details, including a date called the "Due Date" which is when he expects the goods to arrive. On the other side when the goods arrive on site, the storekeeper issues a delivery notice in the system that includes the delivery date. By comparing these two dates we were able to calculate the number of days the goods were delayed. The graph below (figure 9) represents the number of purchase orders (PO) in function of the number of the days delayed. We can see that only **20%** of orders arrived on time. The data used is probably not fully clean yet it is good enough to illustrate the issues and generate a red flag!

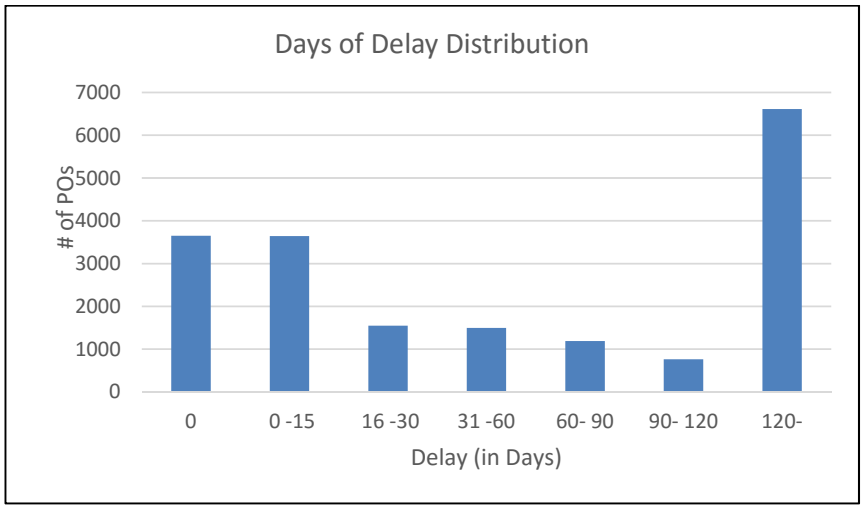

Figure 9. Days of Delay Distribution

Time is the most important factor, yet only 20% of orders arrive on time. This is definitely a serious issue that we need to deeply analyze to understand where this delay comes from.

1. Overview of Reasons of Delay

As a first general look, we can attribute the delays to three possible reasons:

- The procurement team is notified too early.
- The procurement process is taking longer than expected
- The delivery of goods is delayed.

These three reasons are not mutually exclusive. They can happen all together, or each one alone. To find out what is the main reason in BUTEC case, we gathered some data. To see if the procurement was notified early, we measured the number of days that was given to the procurement to do his job, so we compared the date the PR was issued, and the expected date of delivery of the goods. To measure the process duration, we took the difference between PR request date and the PO issuance date. To know the delivery duration, we calculated the difference between the PO issuance date and the date of delivery of goods on site. To analyze the data, assuming all data are homogenous, we plotted the distributions of each set into two graphs, one for the delayed items and the other for the on time items. Again the accuracy of data is not 100%, but we are using them as a representative guide line to possible reason of delays.

Below are the graphs of distribution of notice period (Figure 10 and 11).

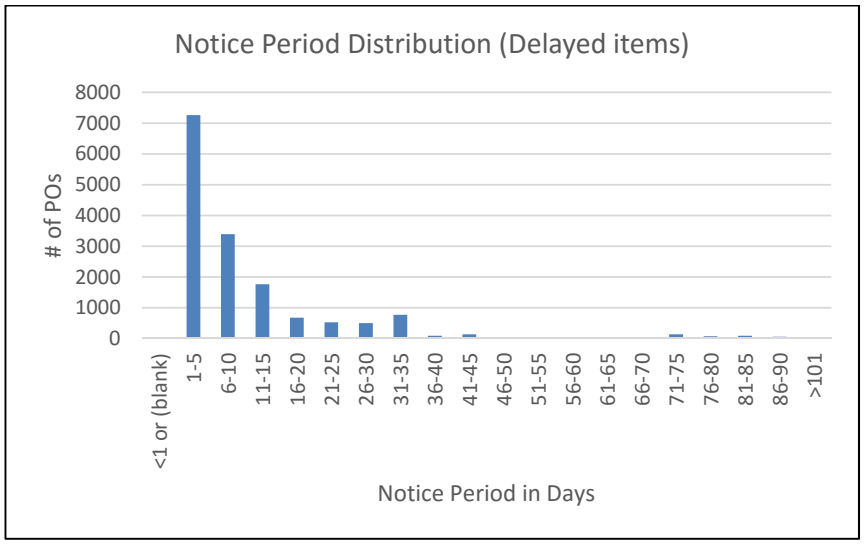

Figure 10. Notice Period Distribution for delayed items

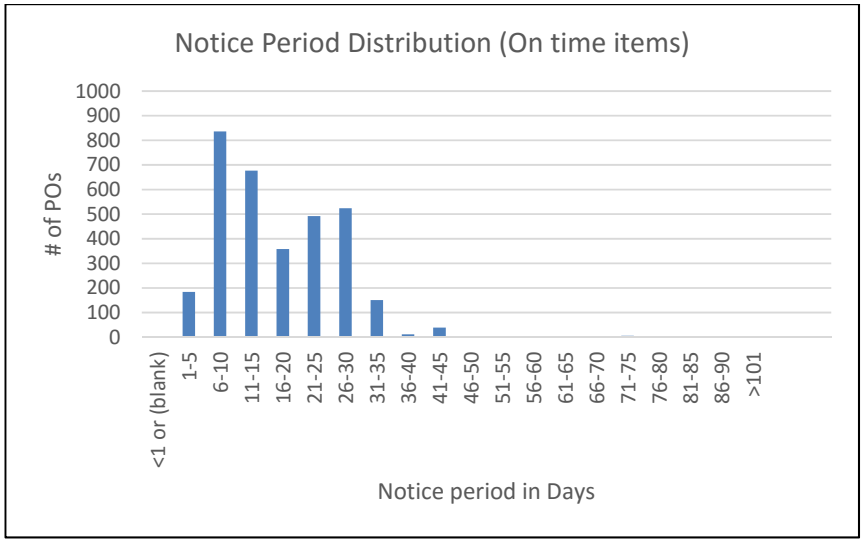

Figure 11. Notice Period Distribution for on-time items

Observing the notice period distribution in figure 10, we can easily spot that 46% of the delayed items had a notice of 1 to 5 days, which is relatively low. On the other hand only 6% of the on time items- presented in figure 11- had this short notice. We can confirm that the early notice is a reason for delay.

Now let's take a look at the process duration distribution (Figure 12 and 13).

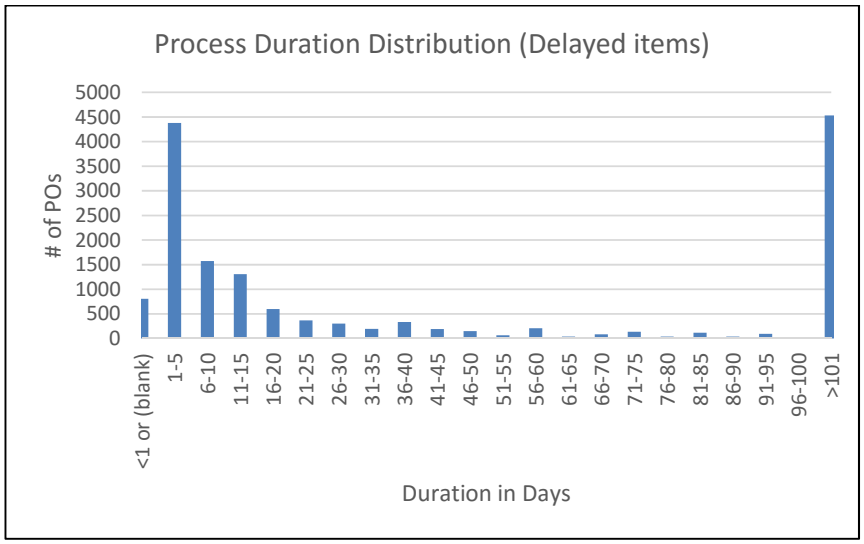

Figure 12. Process Duration Distribution for delayed items

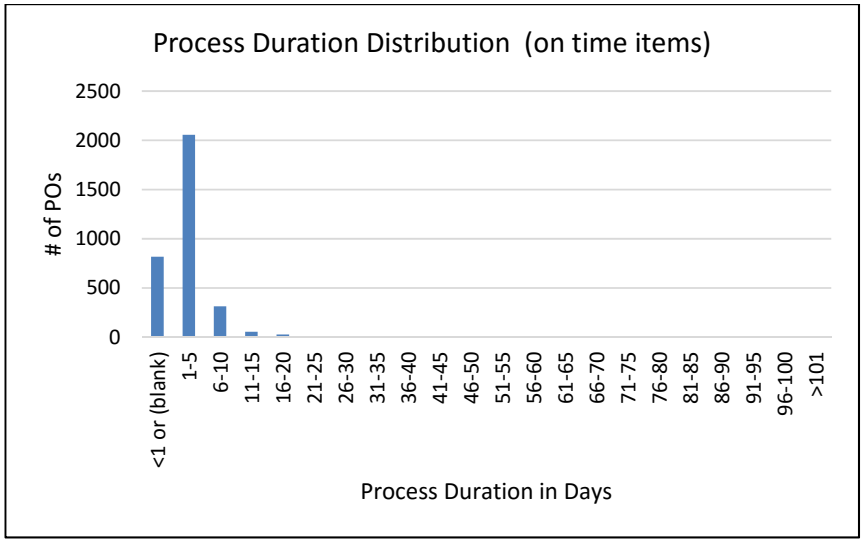

Figure 13. Process Duration Distribution for on-time items

Looking at the distribution of the process duration, we notice that only 33% of the delayed items took less than 5 days to process, compared to 87% of the on time items → the duration of the process is a reason of delay. In addition reducing the processing time is important in case we have an early notice, so it is essential to know which activities are causing delay in the process and where we have an opportunity to save time.

Finally let's take a look at the delivery duration distribution (Figure 14 and 15).

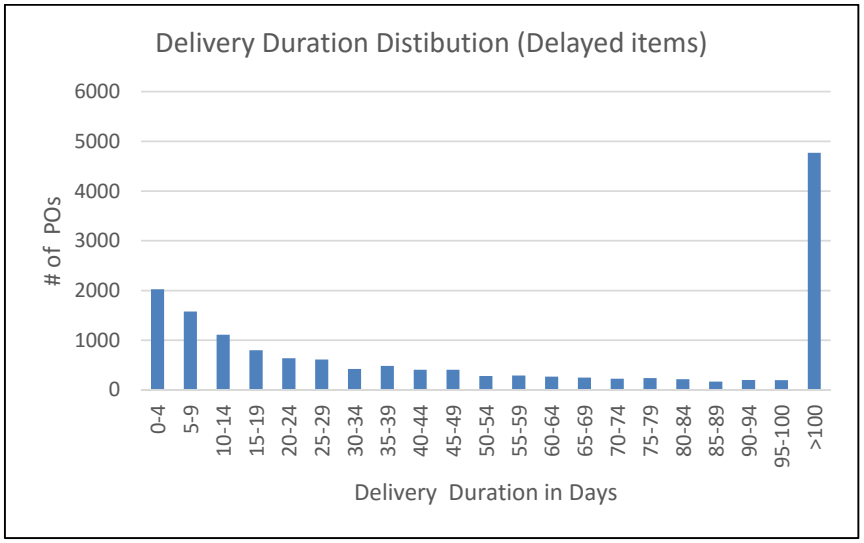

Figure 14. Delivery Duration Distribution for delayed items

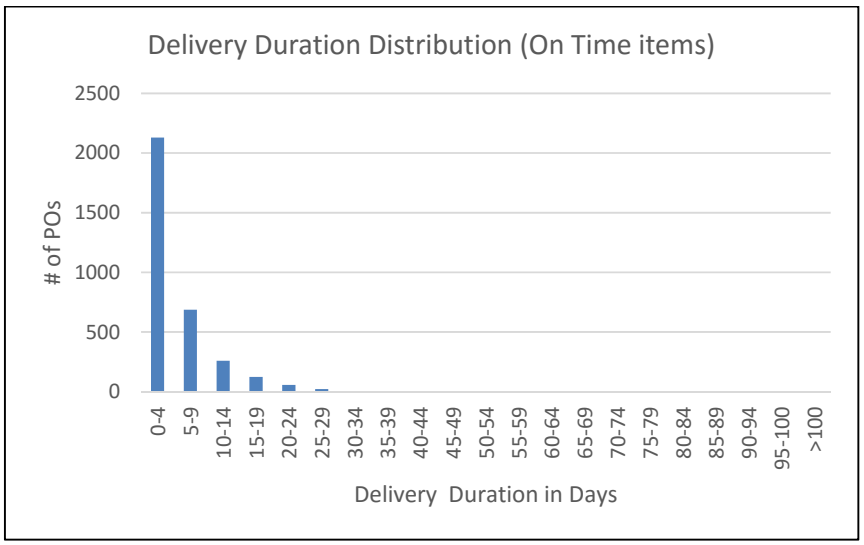

Figure 15. Delivery Duration Distribution for on-time items

Observing the delivery duration distribution, we notice that more than 86% have delivery time lower than 10 days compared to only 23% of the delayed items. Longer delivery time could be normal for high lead items or an unexpected delay for low lead items. Hence the possibility of delay due to delivery is a valid assumption.

After analyzing the data, we conclude that all the cases mentioned above are to some extent a source of delay. Now we need to conduct a root cause analysis and go in details in each case to find the initial source of delay.

2. Root Cause Analysis

a. Short Notice or Unexpected need

The main reasons behind unexpected need are external. See figure 16 for summary of these reasons.

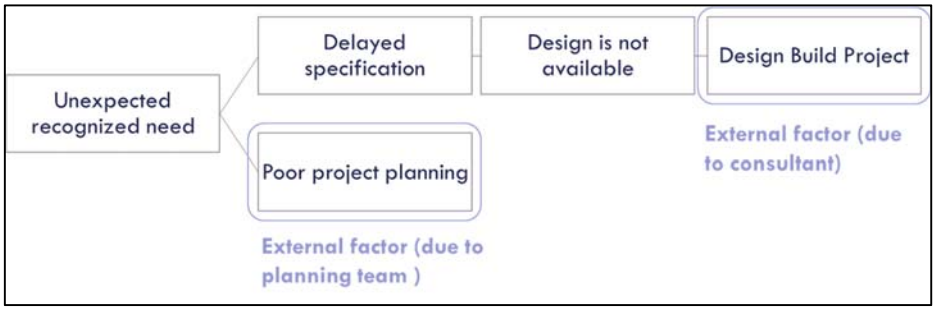

Figure 16. Unexpected Need Root Cause Analysis

For the procurement process to start, we need to have complete information about the item we want to order. The most important are the detailed specification, the exact quantity needed, and the expected date of use. Specifications are the output of the design process while the other information is the result of the planning process.

The availability of the data depends on the project delivery methods discussed in the industry overview, these two are the *design bid build* and *design build*.

In the first delivery method, the design process ends before the construction process starts, this implies that the specifications are always available before the initiation of the procurement. In this case missing information is only caused if there is poor project planning or absence of synchronization between the procurement process

and planning process. In the second delivery method, the design and the construction process run in parallel and this will reduce the probability of availability of specification before initiating the procurement process.

The unavailability of data is causing variability in the timing of demand of the procurement process and is a source of uncertainty that cause delay in the process.

In summary, the first reason of delay is outside the procurement process, it is because of the consultants and the planning department that are creating uncertainty of demand.

b. Long Processing Time

To analyze the delay that could happen because of the process activities, we went through each step in the process flowchart and highlighted in red the potential sources of delay - refer to the process flowchart in Appendix A. Below you find the explication of why each activity could cause delay in the process.

The process starts by **"Fill purchase request" (1):** in this step the PR issuer has to select the product from the available database, this database has 23,000 available items from which 7,000 are obsolete. The selection takes longer because of this large quantity to select from. In addition there is the risk of entering a wrong reference and in consequence repeat the process to order the right item again. The reason behind this large number of items in the data base is the complex referencing system adopted at BUTEC. Each item is referenced to the last detail. For example, there are currently three references for the gloves:

- A.03.0208: for Workers' Gloves (Size: 9)
- A.03.0209: for Workers' Gloves (Size: 10)
- A.03.0210: for Workers' Gloves (Size: 11)

If the requestor needs a glove of different size, a new reference has to be added to the database. This detailed referencing system is causing the continuous addition of new products. To reduce the errors of duplication, these references are added by one person and as a result the activity **"add a product reference" (2)** is becoming a bottleneck for the process.

After the PR is issued, the PR has to be **"sent" (3)** manually or via email to the project manager to **"Approve request" (4).** The lack of automation and responsiveness are the reasons of delay in these two steps.

Refer to figure 17 below for summary of root cause of delay at PR level.

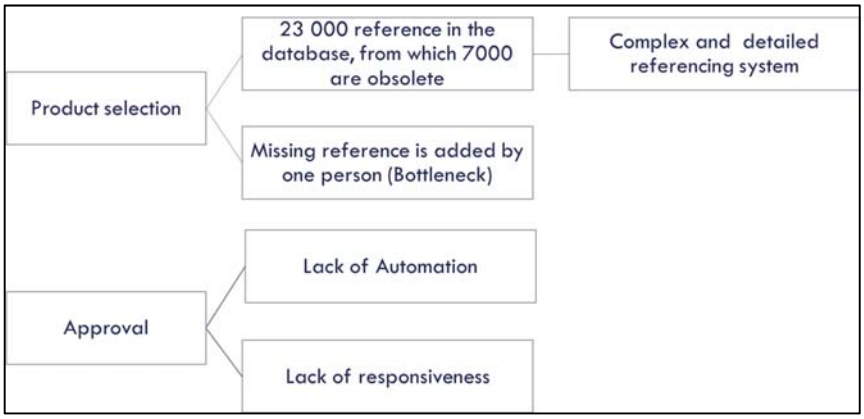

Figure 17. Long Processing Time Root Cause Analysis - PR level

Once the request is approved, procurement officer has to **"select suppliers" (5)** to ask them to prepare a quotation. This step causes delay because BUTEC has a large number of suppliers (3,500 in total). This high number is the consequence of the absence of an effective supplier management system. Suppliers are evaluated once per year using the same criteria for every type of product.

After the supplier receives the request, he **"prepares the quotation and sends it back" (6).** The supplier responsiveness is key in this process. His speed of reply is a factor of the supplier itself, its relationship with BUTEC and the item ordered. He

could simply be a bad or unresponsive supplier. He may not give BUTEC priority if he has a high bargaining power, or he has financial problems with BUTEC, or he takes time to reply because of the complexity of items ordered.

Once the quotation is received, the procurement officer **"compare quotations" (7)** and select the best offer. The caparison of offers might be delayed if there is critical difference in offers and this happens when the items ordered are complex.

Refer to figure 18 below for root cause analysis summary at RFQ level.

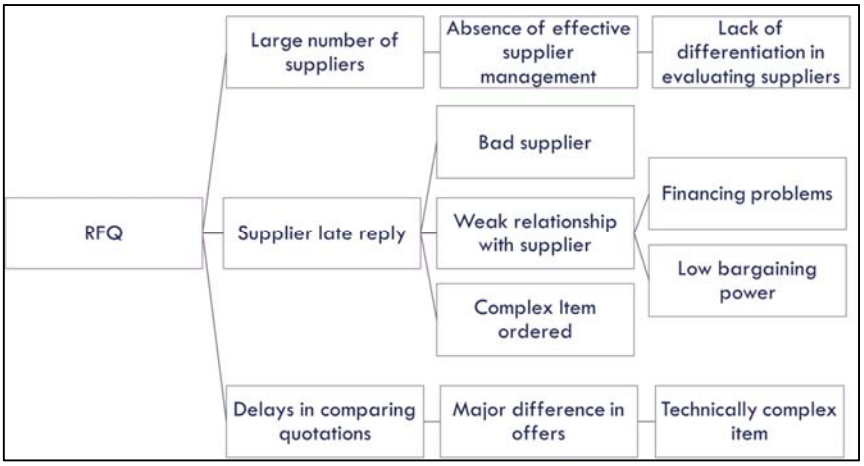

Figure 18. Long Processing Time Root Cause Analysis- RFQ level

When the offer is selected, it is sent to the project manager to approve it. He could **"reject the supplier" (8)** and select another one or even just reject the request and all the efforts spent by the procurement process is wasted. This happens because of the lack of coordination between procurement and managers, and the absence of logging of the rejection activity so it won't be repeated again. This problem is significant because this approval is redundant and comes in an advanced stage of the process.

The project manager can approve the supplier, but can ask the procurement officer to **"negotiate" (9)** the offer. The weak relationship with the supplier and lack of negotiation skills among employees affects the duration and the outcome of this step.

After the supplier is approved, the officer issue the purchase order and send it for Approval. Here we come again to the problems of automation and lack of responsiveness we mentioned earlier.

c. Delayed or bad Quality Delivery

The last possible source of delay is related to the delivery of material on site. The material could arrive later than expected without any specific reason, or because of BUTEC's weak relationship with supplier also. In addition to the on-time arrival, the good quality material is key to avoid returning it back to the supplier and waiting for him to deliver better quality product.

d. Other issues

In addition to the problems we identified above, there are other issues we need to take into account also.

First, the whole approval system is complex, it requires an approval at every step in the process and is a major reason of delay.

Also there are some other human errors that could happen due to the lack of awareness about the importance of the tasks they are doing and the data they are entering. These errors might have serious negative outcomes, as example selecting the wrong reference could lead to the delivery of a wrong item and hence repeating the whole process again.

And finally, we noticed that there is absence of inventory data. There is high risk of wasting time ordering existing items.

3. Delay Analysis Summary

The root cause analysis helped us gather the main reasons behind delay.

We can summarize the issues we found at the process level by the following:

- Referencing phase:
    - Continuous introduction of new references→ Wasted time
    - Referencing is being added by one person→ Bottleneck
- Approval phase:
    - Lack of automated workflow→ Longer time and higher risk of errors
    - Approval required at every step (PR,RFQ,PO)→ Longer time
- RFQ phase:
    - Large number of available suppliers → Affects time but also has impact on cost and quality of the product which are also of great importance
- Ordering phase:
    - Absence of inventory data → higher risk of ordering existing items → wasted opportunity of time saving.

In addition to the issues in the process activities, we found that delay is happening because of people's errors and unresponsiveness, items 'complexity, and uncertainty coming from the consultants and planning department. As a result, we can group the issues into four categories: people, product, process and third party (Refer to figure 19 below) and we should find the solution that addresses as many issues as possible.

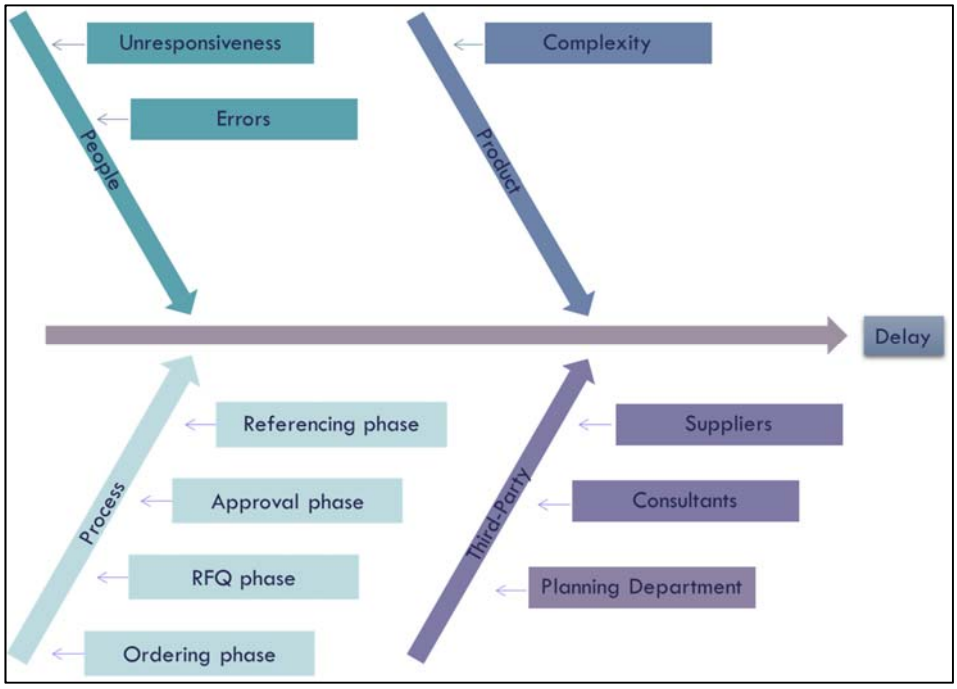

Figure 19. Root Cause Analysis Summary

B. Define and Analyze New Process Concepts

After analyzing the current performance of the process, we need to think about a solution that will address most of the issues. For the issues related to product and process (referencing, approval and ordering) and third party (consultants and planning department) will solve them by redesigning the activities of the process. For the problems generated from suppliers, process (RFQ, which is directly related to suppliers) people and technology we will take a look at Best practices in these areas and implement what fits BUTEC most. So our solution is divided into three main parts: redesign activities, adopt supply chain practices, and manage resources.

1. Redesign Activities

Knowing that the time is the most important dimension strategically, the objective of the new solution should mainly focus on reducing time. As a result, we decided to change the process from one flexible process for all items to two or more standardized processes in order to gain on time. The objective now is to categorize the items and design a process for each category. We thought about several possible way of categorization and we came up with six possible categories:

Capital intensity: This category is based on the price of the item ordered. The process of ordering a bolt should be different than this of ordering a chiller or a generator. Especially regarding the approval phase.

Complexity: The complexity of items is a possible way of categorization**.** The check of the compliance to the specifications of the quotations received for a CCTV equipment does not require the same skills and knowledge as the analysis of a quotation for a drain or grill.

Perishability: The items that require special attention, the cement for example, should be taken into consideration and ordered based on different assessment. For example sometimes it is better to select the nearest supplier instead of the cheaper.

Use (Office/Project): The items that are to be used in the project are more critical to the strategic objectives.

Price volatility: The items that their prices fluctuate continuously require deeper analysis before ordering to get the best value and reduce the risks of losses.

External supply/Internal request: this categorization is a two ways matrix for the external supply (long/short lead items) and the internal request (short/long notice period). It leads to four categories. The most critical one is the long lead and short

notice items. The benefit of this categorization is to be prepared to react for the items that have short notice.

After we have identified possible way of categorizing the items, and highlighted the benefit of each one of them. We need to select the most beneficial way of categorization. To do that, we developed a set of key success factors to evaluate the impact of each one. We want to select the categorization that address most of the issues we identified in our analysis, which were the approval, the referencing, the complexity and the uncertainty generated form consultant and planning department. It's essential also to take into account the impact of this categorization on cost and quality and how feasible the categorization is. We will give each categorization option a score from 1 to 4 for each factor described above and select the one with the highest score. The scores are presented in the table 3 below, the column represents the categories, and the rows represent the success factors.

	Capital Intensity	**Complexity**	**Perishability**	**Use**	**Price Volatility**	**Supply/ Request**
Complexity	1	4				1
Uncertainty	-	3				4
Approval	4	2		2		-
Referencing	3	3		2		
Improve Quality	-	4				1
Reduce Cost	2	2	4		4	-
Easy to execute	4	3	4	4	4	1
Total	**14**	**21**	**8**	**6**	**8**	**7**

Table 3. Categorization evaluation based on Key Success factors

The rationale behind the score found in the table:

Reducing the effect of complexity: categorizing based on complexity of items is the best way to design a specialized process for the complex category to reduce the effect of complexity. All the others have either zero or a negligible impact on it.

Reducing the impact of uncertainty: the categorization based on the internal request /external supply is the most beneficial one. On the other hand the uncertainty is positively correlated to the complexity. The more the item is complex the highest the probability of having a delayed specification or inaccurate planning. So the categorization based on the item complexity could help reducing the impact of uncertainty.

Helps addressing the approval issue: the best one is the capital intensity mainly because the approval objective is to reduce fraud. By categorizing based on the capital we can tailor the approval accordingly. We gave a lower score to the categorization based complexity due to a low positive correlation between complexity and prices. Same logic applies for the categorization based on use. Less complex items and office items tend to be cheaper.

Help with the referencing issue: Categorization will help in this case no matter what the category is, if this categorization divides the items more or less in equal way. The case of categorizing based on use will be less beneficial and does not have a valuable impact since the number of items that will fall under the office category is few. This case is worse for perishability and price volatility.

Improve quality: the categorization based on complexity reduces the number of defects by reducing the risks of ordering wrong item. In addition we can deal with complex items in a better way and hence order the one that comply most with the specifications.

Reduce Cost: the categorization based on perishability will reduce cost by reducing waste. Price volatility categorization will enable cost reduction if hedging strategies are used.

Easy to execute: the hardest one to execute is the external supply/ internal request categorization. It is not straight forward to determine under which category each item will fall. In addition, the characteristic of the items might vary from project to project.

As you can see, the categorization based on complexity has the highest score. Also the categorization based on capital intensity is beneficial in some points that complement the former. As a result, the optimal way to proceed is with two different processes one for the critical items (complex and/or expensive) and one for the others. To allocate items to each category, BUTEC should conduct an analysis on previous POs, assess the characteristic of each item and then assign it to a category. And later BUTEC should treat the items ordered for the first time as critical, and evaluate their characteristic after the first order, and then decide whether to assign it to the other category or not.

After finding the optimal way of categorization, we need to redesign activities accordingly.

First we need to change inventory management system:

- For the non- critical items, procure to stock and always check if the item is available in inventory before ordering.
- For the critical items, stocking expensive inventory is costly, and stocking complex items has higher risk of obsolescence. Hence procure to order

using JIT techniques. This requires a better forecasting and anticipating demand by identifying these items at the budgeting level.

And we need to review the approval process:

- Remove the exception manager approval for both categories.
- Remove the supplier approval for the non-critical items, but include a recommendation or objection about any supplier from the PM when approving a PR.
- Replace Supplier Approval by a Subject Matter Expert Approval at RFQ level, and add the PM opinion about suppliers at the PR level
- Define a threshold where the PO is reviewed by the critical team. This is to be aware if the item is inexpensive but ordered in large quantity.

Having redesigned the activities and addressed the issues related to process and product, we need to solve the issues related to suppliers.

2. Adopt Supply Chain Practices

To address the problems related to suppliers we will look at what best Practice is this area is and then select what is applicable and most convenient to our case.

a. Supply Chain Best Practice

Based on the report of A.T. Kearney's Assessment of Excellence in Procurement (AEP) study of 2011 (A.T. Kearney, 2011) and study done by Ernest & young Australia (Ernst & Young, 2014). We found that there are activities that leaders in procurement engage in to achieve procurement Excellency. The activities related to supply chain are strategic sourcing and supplier relationship management.

Strategic sourcing is a systematic approach for reducing the cost of purchasing without affecting the quality. Its objective is to get the best product at the best value. To achieve that companies have to:

Look at the entire value chain and calculate the total cost of ownership instead of focusing only on the price paid to the suppliers

Make decisions based on market analysis, understand supply and demand powers and tailor a strategic purchasing approach to each category. Figure 20 is the purchasing chess board developed by A.T. Kearney. It is an example of strategic approach based on supply and demand power. (A.T. Kearney, 2006)

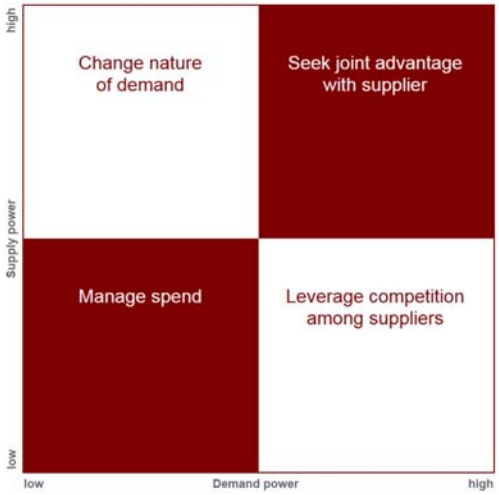

Figure 20. The purchasing chess board developed by AT. Kearney, based on market Supply/Demand

Supplier Relationship Management: is about building a collaborative relationship with suppliers in order to create more value and reduce risks, in other words create a win-win situation for both parties. Plus it is important to manage contract and continuously monitor compliance.

b. Supply Chain practices at BUTEC

As we have seen from best practice, Supplier Relationship Management is key for the success and value creation from the procurement process. And this is missing in BUTEC and should be taken into consideration from now on.

For Non-Critical Category:

- Use blanket orders (make order for a specific period with multiple delivery date) for recurrent items. By doing this the number of POs issued decrease.
- Increase the number of suppliers per item moderately to increase competiveness and benefit from competition among suppliers.
- Evaluate suppliers on a yearly basis, using a simple evaluation form to ensure everything is on the right track

For Critical Category:

- Build strong relationships with suppliers and develop long term frame agreement including continuous improvement and penalties
- Pay suppliers on time, procurement team need to notify finance department as soon as possible to avoid delays in payment to maintain the strong relationship with the suppliers
- Evaluate suppliers every six months
    - Continuously monitor PM feedback and take it into consideration in the periodical evaluation of supplier
    - Use specific criteria or give different weights for criteria depending on the product. For example give higher weight for the location when dealing with suppliers of perishable items.
- Link suppliers' evaluation to selection.

3. Manage Resources

The final part of the solution is to design the required resources for the new process and the new supply chain approaches we adopted.

a. Best Practice in resources

At the resources level, the leaders invest in talents and leverage technology.

Invest in Talents: to achieve their objective leaders recruit and retain top talent**.**

Leverage technology: in addition to the automation, leaders invest in technology that enables them to have access to real time data and give them more visibility to spending. This enable them to conduct accurate analysis and improve the decision making process.

b. Resources needed in BUTEC case

BUTEC is willing to automate all activities and change its IT system. In addition for Non-Critical category we need to track the items flow at each step by automatically setting expected dates and generating alarms when there is delay .For Critical category we want a clear and detailed reporting of spend and duration of process.

Regarding employees, training is a must especially for critical category employees. For the new vacancies, we need to make sure to recruit accountable experts- preferably with engineering background- with strong analytical and ethical skills.

C. Conclusion

The first objective of the project was to design a framework that BUTEC can follow in reengineering its processes. This is what we did by reviewing the literature and analyzing the available BPR methodologies. The result was to select the S-A framework because it is comprehensive and adaptable.

The second objective was to apply the framework to the procurement process. We analyzed the process using the performance measures of cost, quality, time and flexibility. We mainly focused on time because it is the most important strategically. We found that the reasons of delay in the procurement process are because of people, process, product and third party outside the process itself which are suppliers, consultants and planning department. After identifying these issues, we proposed a solution that addresses these issues. Our approach was to change the procurement from one process to multiple standards processes in order to gain on time. We identified that the best way is to divide the procurement into two categories, one for critical items and the other for non-critical items. Finally, we selected the appropriate activities for each category. We tailored the approval process, the inventory management, the relationship with suppliers and the resources management to each category.

The design concepts of the new process are ready. Now BUTEC have to implement the remaining steps guided by the stages and activities of the S-A framework. The implementation phase will face several challenges, beside the change resistance that may arise, dividing the procurement team into two separate teams requires careful human resources management to ensure this smooth transition. Also the management of relationship with suppliers and creating a win-win situation for both

ends is easier said than done and requires a lot of commitment and continuous follow up and check for compliance.

After successfully implementing BPR, BUTEC should continuously improve its process in line with its strategic objective. To achieve that it has to develop a set of relevant KPIs to monitor the process performance. KPIs should mainly focus on time and suppliers. As example, it should monitor the process cycle time, percentage spend per strategic suppliers from total spend, percentage of compliance with contract.

As a conclusion, if BUTEC succeed in reengineering its process and continuously monitor and improve its process strategically. BUTEC will be able to face the external threats and create a sustainable competitive advantage.

APPENDIX A

THE PROCUREMENT PROCESS FLOWCHART AT BUTEC

In this appendix you can find the flowchart of the procurement process. The activities highlighted in red are those that might cause delay in the process. The detailed analysis of the reason is presented in the section A.2: Root cause analysis in chapter III.

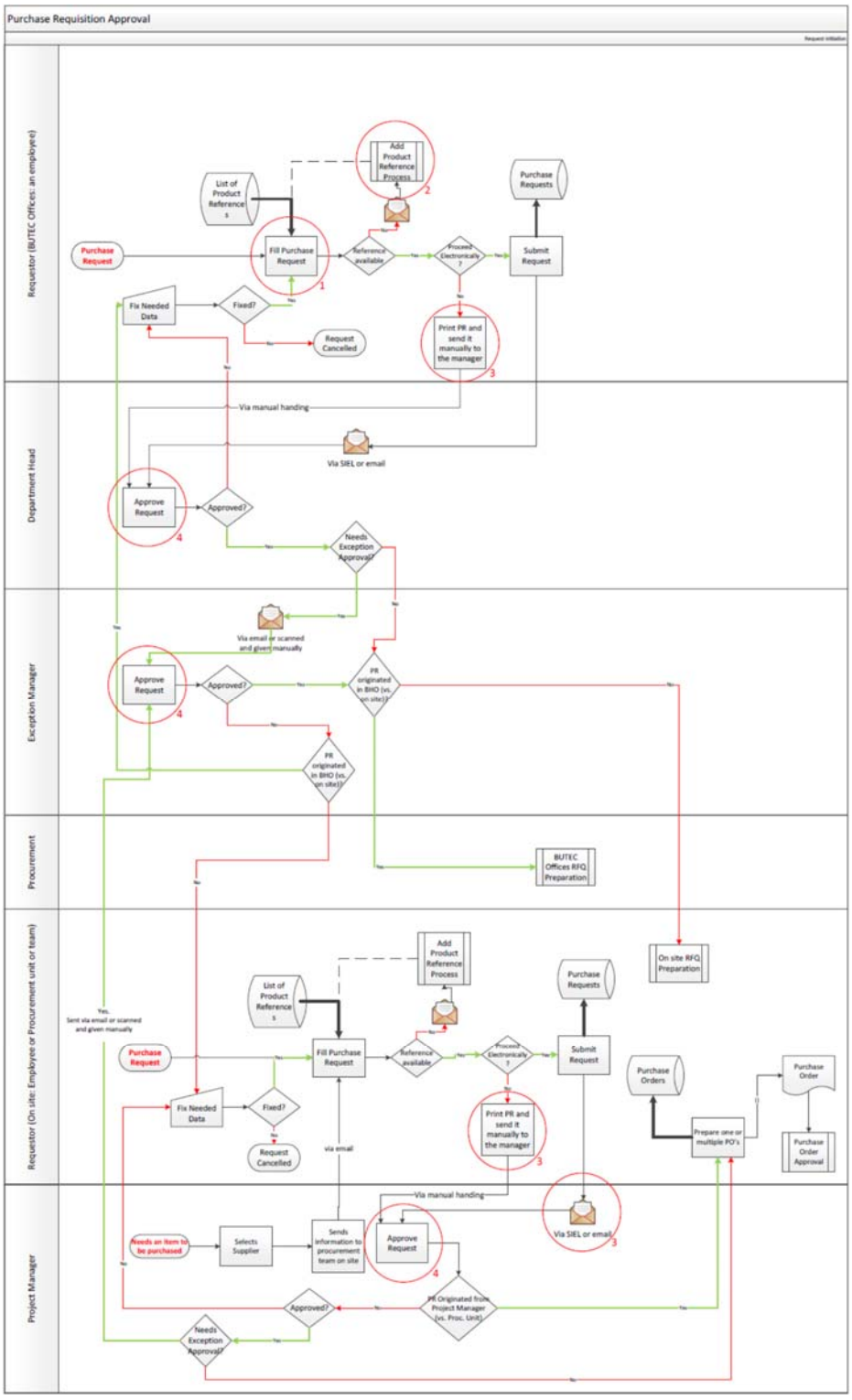

Figure 21. Procurement Process Flowchart- PR approval

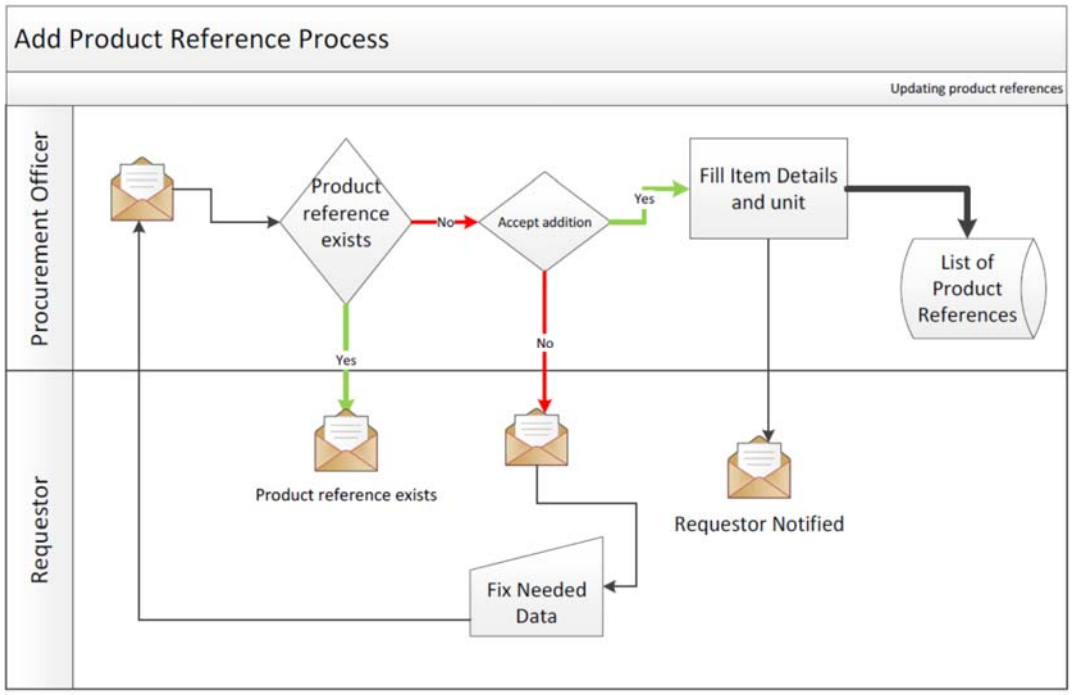

Figure 22. Procurement Process Flowchart- Add Product Reference

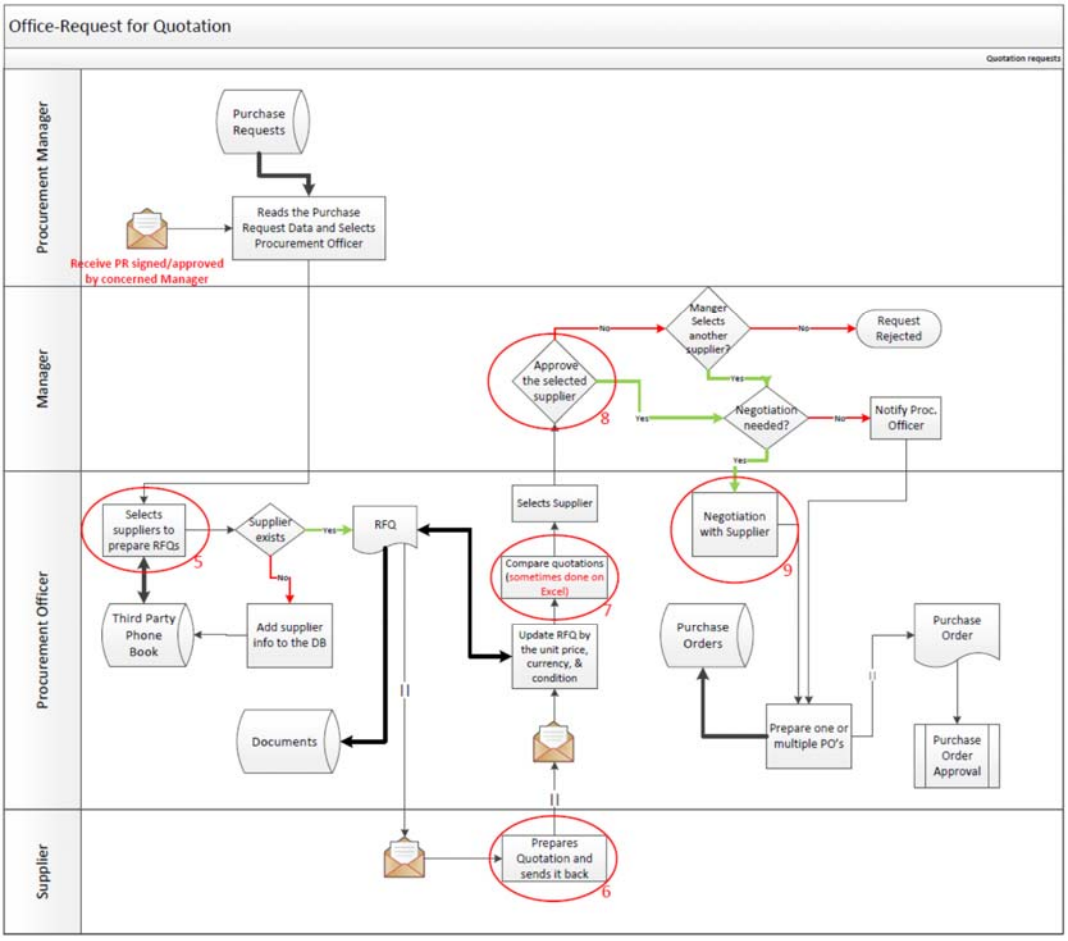

Figure 23. Procurement Process Flowchart-Office RFQ

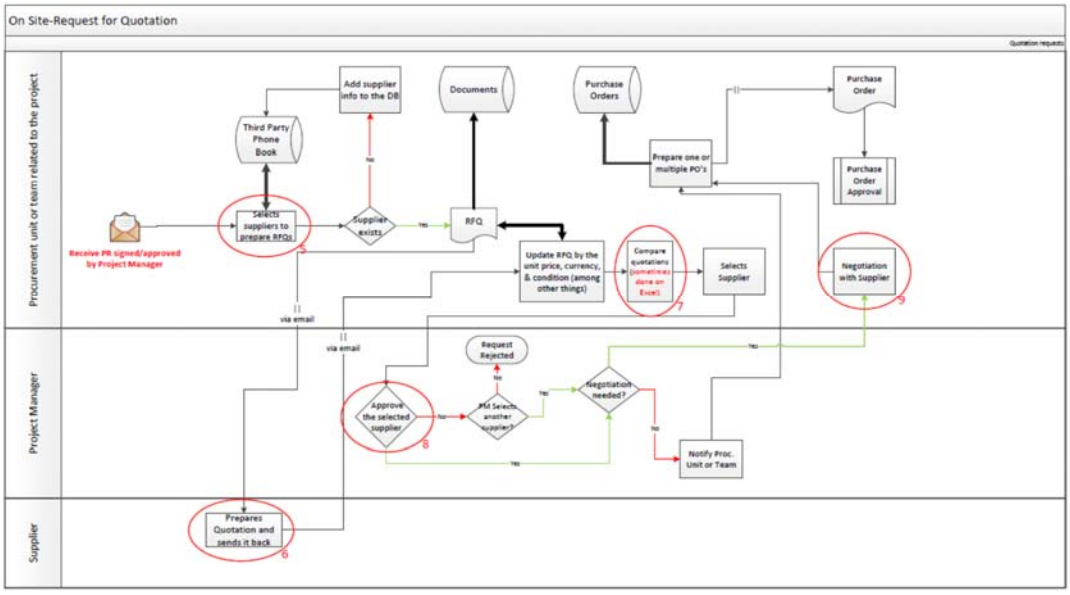

Figure 24. Procurement Process Flowchart-On site RFQ

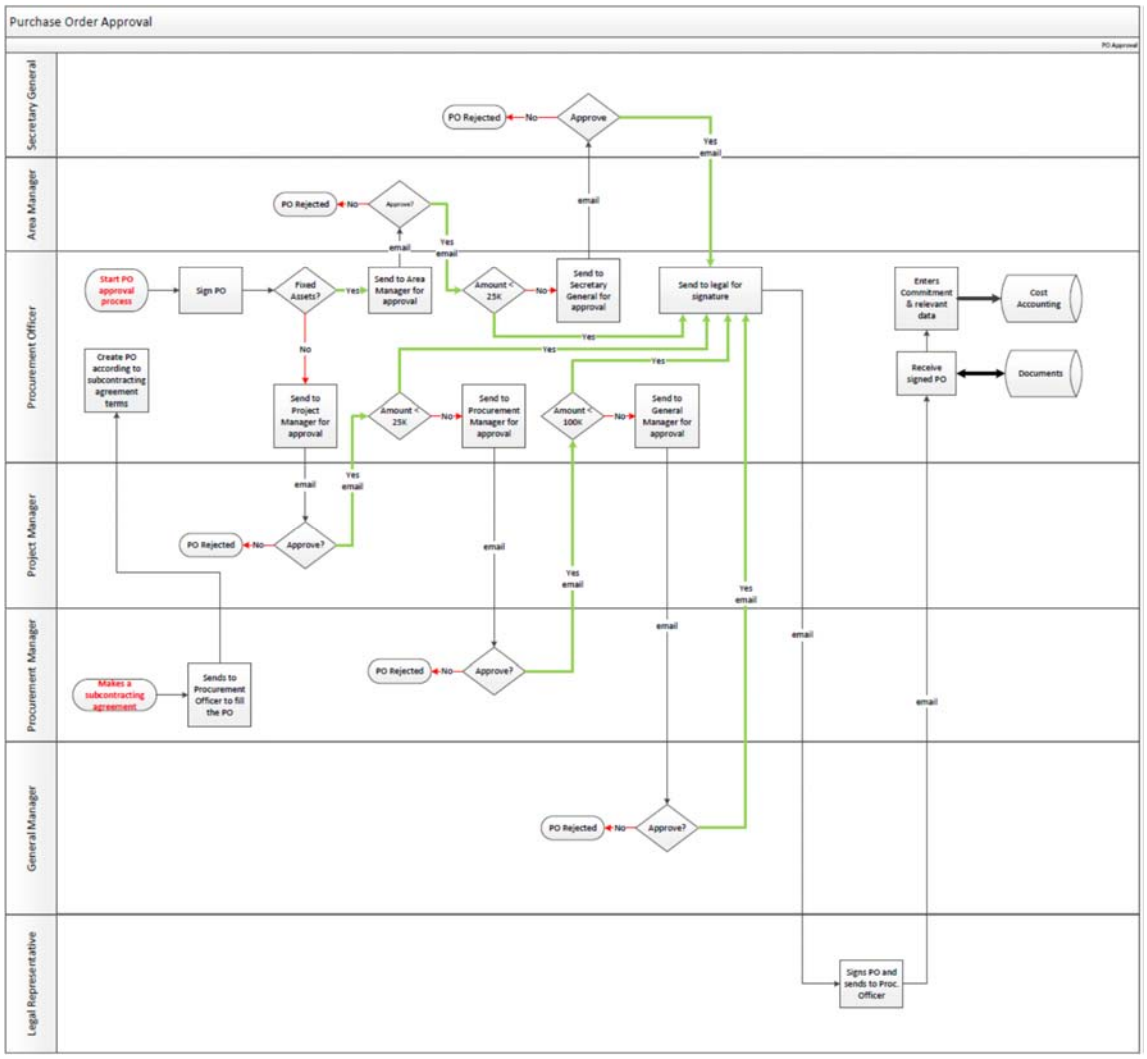

Figure 25. Procurement Process Flowchart- PO approval

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