Strategic Dynamics of the Project Based Organization

Stamboulis Yeoryios, Kalaouzis George

Laboratory of Infrastructure, Technological Policy and Development, Department of Planning and Regional Development , University of Thessaly, Pedion Areos, 33834, Volos, Greece; email: ystambou@uth.gr, gkala@uth.gr

Abstract
Project management is one of the most important and demanding fields of management. Cost and time overrides are more than common, while more organizations are becoming project-based. Through a systems perspective we develop a holistic view of the project-based organization as a structure of resources committed to activities and the strategic decisions that involved in the operation of the organization. A systems dynamics model is developed in the fashion of a balanced scorecard.

Keywords: strategic project management, system dynamics, systems thinking, simulation, resource-based view, project-based organization, balanced scorecard

1. Introduction

During the course of the evolution of the economic organization of production, the project-based organization has always played a predominant role especially in technological change. Since the 1990' there has been renewed interest in this type of organization as it is considered to predominate in technology intensive industries such as software, in service-based industries such as advertising, as well as in the so call complex product systems industries (Complex Product Systems –CoPSs – Hobday, 1998) which account for an increasing share of the economic product. This type of organisation is also critical within firms, especially in technology and R&D intensive industries. In other words it is considered to lie at the heart of the knowledge based economy.

One aspect that characterises CoPS and projects in general is that they tend to be produced in projects or small batches, allowing in a significant way the direct influence of the user on the final product as well as on the project process, in contrast to mass production, where the user influence is mostly indirect through commercial transactions. Thus, it is common that requirements and standards change during production with the result of high uncertainty, fuzzy goals and risks that are hard to foresee and quantify. Success or failure as well as performance are hard to define and measure. Time and cost overruns tend to be the rule rather than the exception.

Hobday (2000b) suggests that this type of project-based organisation characterises a wide spectrum of industries and activities and demands a rather distinctive approach that it focus on the intricacies of project processes. The mainstream approach to project management has tended to take a linear and departmentalised view of the organisation

of project-based production. Both experience and research has shown that a systemic approach can yield significant benefits (e.g. Lyneis et al. 2001, Sterman 1992 and 2000). However, little work has been carried out towards developing a comprehensive approach that links the systems perspectives to project management with the theory of the firm and strategic management. Here we suggest that an approach based on the resource based-view of strategic management provides a robust foundation for such a theory and at the same time is highly compatible with the systems dynamics method of analysis.

2. The systems dynamics approach to the resource-based view

The assumptions underpinning mainstream approaches intensify the static nature of orthodox theory:

1. Productivity is considered stable during the course of each project. .
2. It is assumed that there are no errors or that rework is part of downstream tasks.
3. No interaction and feedback is assumed between tasks and operations. Management tools focus on the direct influence that changes may effect on projects and neglect indirect influences.
4. Every project is considered unique. Inter-project, systematic learning is neglected.

In every business strategy course across the globe students are introduced into Porters value chain as an epitome of the strategic view of the firm. It is usually neglected that both at his early work as well as later, Porter (1996) insisted that the value chain should be viewed as a system of activities. It is the unique architecture of the system of activities of individual firms that determines their performance. However, Porter does not explain how these activities come into being and perform.

According to the modern theory of the firm as founded by Penrose (1995), the firm is based on a stock of resources, which are committed to activities. Thus, the value chain is structured into a system of activities and resources committed to them (Ghemawat and Pisano 2001). A distinct set of resources, the dynamic capabilities of firms, with learning the most important amongst them, determine how the current commitment of resources to activities will affect the future performance of the firm.

Figure 1 shows a simple representation of the suggested theoretical approach. It shows how an individual activity may be represented as carried out based on tangible and intangible resources, as well as the potential effect of dynamic capabilities such as learning. In a more complex view interaction between activities as well as influence from factors outside the firm or at its boundaries (such as reputation and trust, represented as resource stocks) should be taken into account. Here we stress the need for as much ontological realism as possible.

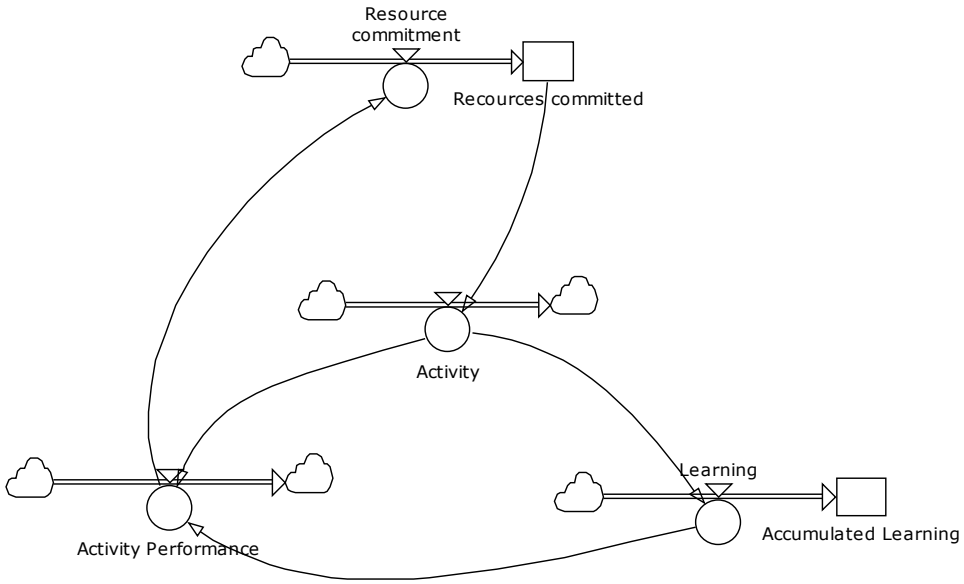

Figure 1: A schematic of the dynamic perspective of the resource based view

3. Model's General Description

The organization's problem of adapting to increasing demand, while maintaining profitability is faced in this model. In other words, it is investigated how can the firm increase its productivity in order to respond to increased demand without undermining key resources such as experience, quality and reputation.

Figure 2 depicts the generic form of the model, which combines the structure of the model, the stages and the way in which they interact. Each stage represents a subsystem of the model. The design of this model is based on the balanced scorecard theory.

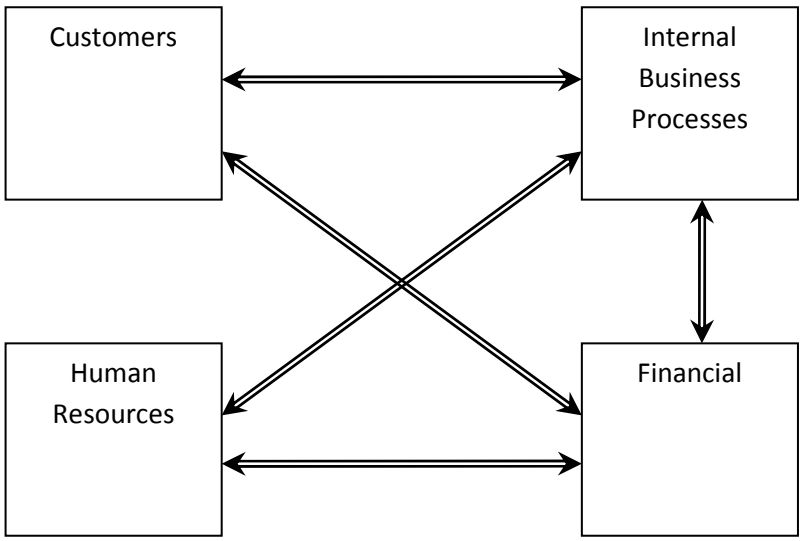

Figure 2: a generic form of the model

A more detailed description of these subsystems, in the form of causal loops and models is provided below.

3.1 Human Resources

As shown in the figure 3, the production capacity can be increased by recruitment and can be decreased by employee loss, which occurs when the workload pressure of the employees becomes important. Additional parameters that impact employee loss are the time needed for promotion and the salary satisfaction.

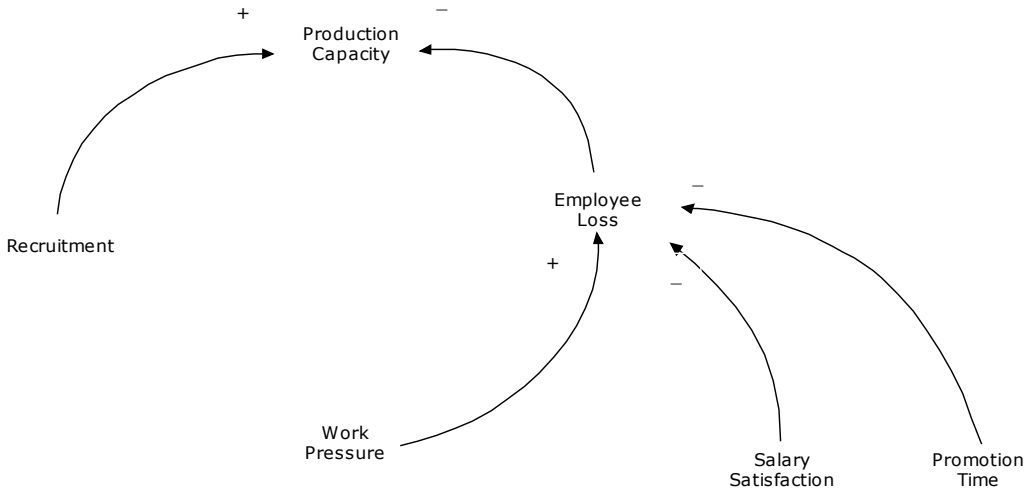

Figure 3: Causal loop diagram of the human resources subsystem

It is assumed that human resources are classified into four categories according to their abilities and their role.

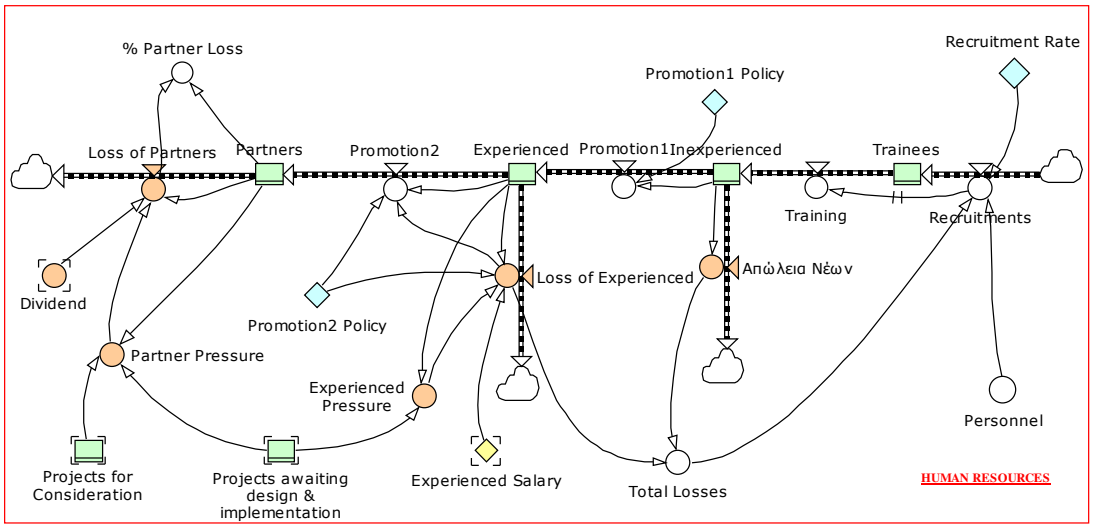

Figure 4: Model of the human resources subsystem

1. Trainees. It is the staff who has recently been recruited and is following a period of training. It does not contribute to the project, but rather consumes resources employing company's experienced personnel in education.
2. Inexperienced. It is the staff who has completed the training period and is employed in the affairs of the company, albeit with a smaller productivity compared to their senior colleagues. After a period of time they, either promote to experienced staff, or leave the company. The loss fraction is considered constant and independent of model's state.
3. Experienced. They are the primary productive resources. Additionally, they are charged with the training of younger executives. The pace of withdrawal from the company depends on the workload, pay and promotion policy to the next grade.
4. Partners. They have great experience and long history of collaboration with customers. They are not involved in the execution of projects , but they are responsible to communicate with customers and wishfully make an agreement. Apart from their salary, they are entitled to dividend from the profits. They withdraw when salaries are not good enough, and when the workload is excessive. With the withdrawal it is assumed that a part of the client base of the company is also lost.

Key decisions are the pace of recruitment and the promotions policy, which is the period an employee must remain in a tier before promoted to the next.

3.2 Financial

This relatively simple stage describes the organization's ability to have reinforcing revenues through feedback loops.

As it can be seen in the causal loop diagram on figure 5, recruitment of new employees increase the production capacity of the company, and thus target more effectively increasing demand. The revenues can then be used for new recruitments, creating a reinforced feedback loop.

Key performance indicator is the profits obtained.

The company's revenues come from the conclusion and delivery of the project given to it. The cost is to pay personnel. A dividend may be given of the profits to partners every six months. The remainder (income minus expenses minus dividends) remains in the company as capital.

Key decisions are the personnel's monthly salary and the given dividend.

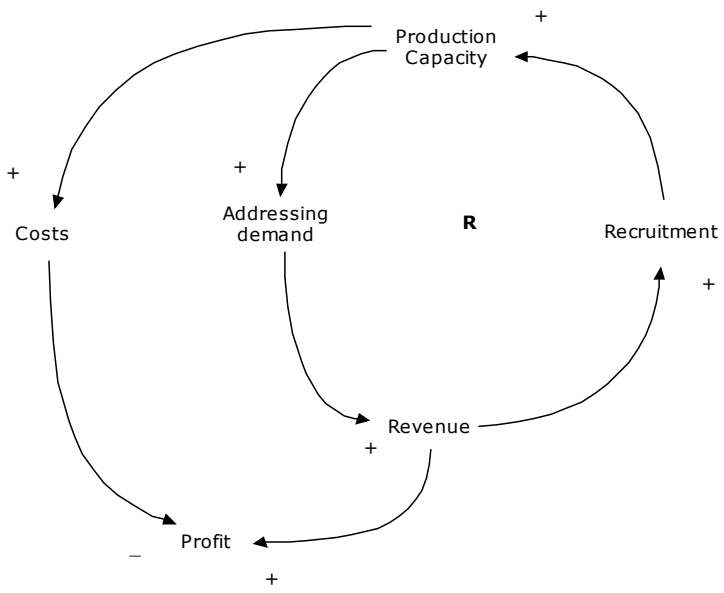

Figure 5: Causal loop diagram of the financial subsystem

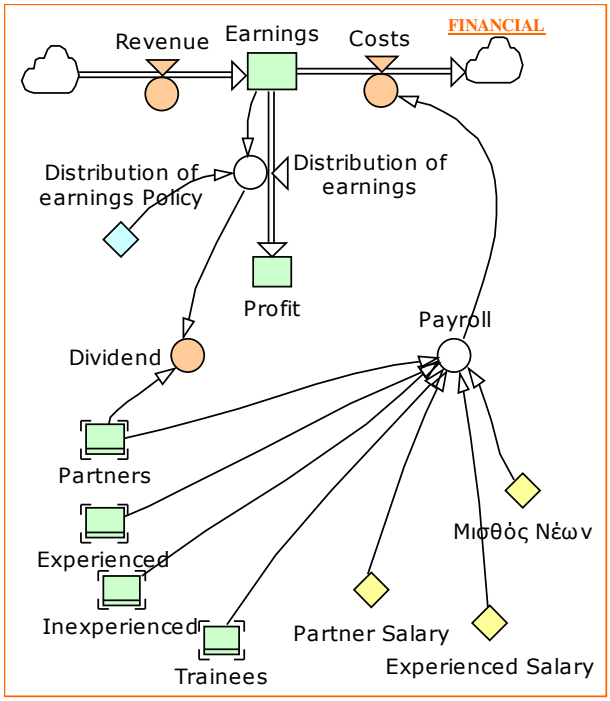

Figure 6: Model of the financial subsystem

3.3 Customers

This stage describes the main factors affecting customer satisfaction.

Most important indicators for customer satisfaction, as seen in figure 6 and 7, are the time needed to complete projects and the supporting activities that can take place. Higher customer satisfaction positively affects the reputation which affects demand for new projects.

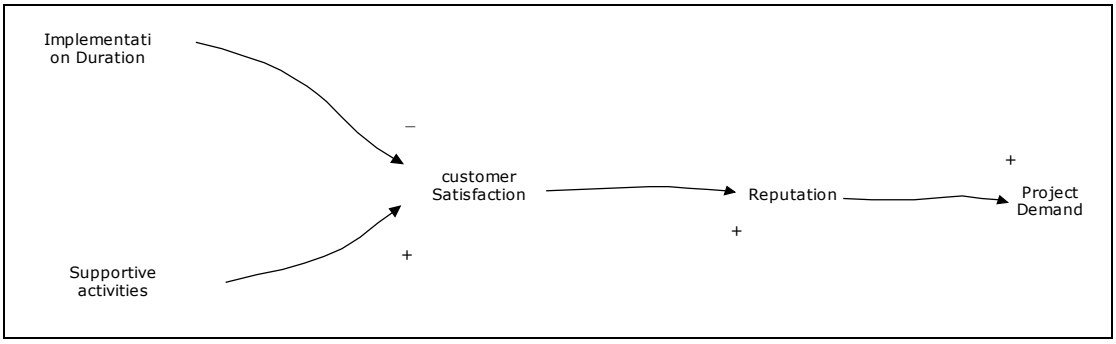

Figure 6: Causal Loop Diagram of the Customer subsystem

To attract customers, they must be contacted by partners in order to advertize the company and its operations. An important factor in creating this contact is assumed to be the company's reputation that is emerging from the quantity of completed projects and customer's satisfaction.

After the contact, the partners analyze the customer's needs and promptly submit an offer to the customer. If, due to increased workload, the submission of the offer is delayed, the customer is lost.

Upon delivery of the finished project, the customer, if satisfied with the quality of work and the duration of the project, is assumed to remain in the pool of potential customers, and may ask for additional projects to be done.

It should be pointed out the strong relationship between partners and customers. In the event of partner's withdrawal, it is considered that a significant number of potential customers are also lost.

Obviously, there is no direct influence on the operating conditions of this sector, which mainly depends on

a. the adequacy of the number of partners in order to make a contact and close down the agreement,

b. the adequacy of the number of experienced and young workers in order for the project to conclude within the expected time frames and

c. The reputation of the company.

3.4 Internal Business Processes

This stage describes the organization's main activity, the project implementation procedure, and how the decisions taken affect project's completion.

Important decision variable is the distribution of resources in the production process, namely the number of employees (production capacity) and their stratification in the different employee types (new - experienced - partners) or otherwise productivity. As resources and productivity increase, the project's time to completion is decreased.

Key performance indicator is the project's duration achieved.

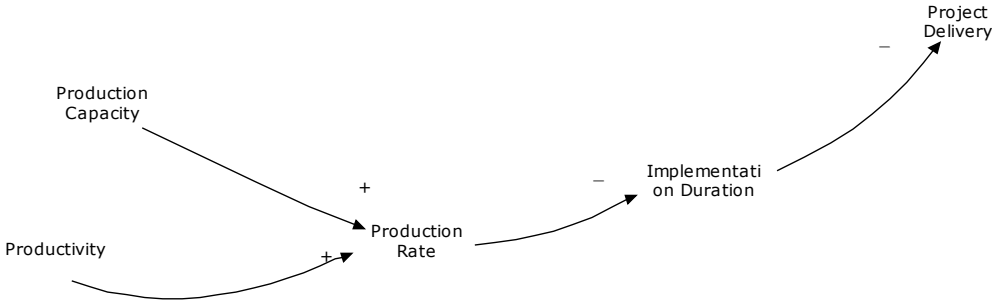

Figure 8: Causal Loop Diagram of the Internal Business Processes subsystem

The term internal processes refers to the sequence of actions need to be followed in order to complete a project.

The stages, in turn performed, are:

a. In the first stage a candidate project is introduced in order to be reviewed and an offer be submitted to the customer. If the offer is submitted on time (availability of partner's time is required) the project is transferred to the next stage that includes projects to study and implement. Otherwise the project is lost.
b. During the stage of study and implementation, experienced and new employees are working together to effectively perform all the tasks required by the project. Availability of experienced and/or new employees is required
c. The next stage contains finished, and hence, delivered to the customer projects

It is obvious that in this stage there is no direct control over the established conditions. Sufficient number of employees must be provisionally achieved for the company to succeed.

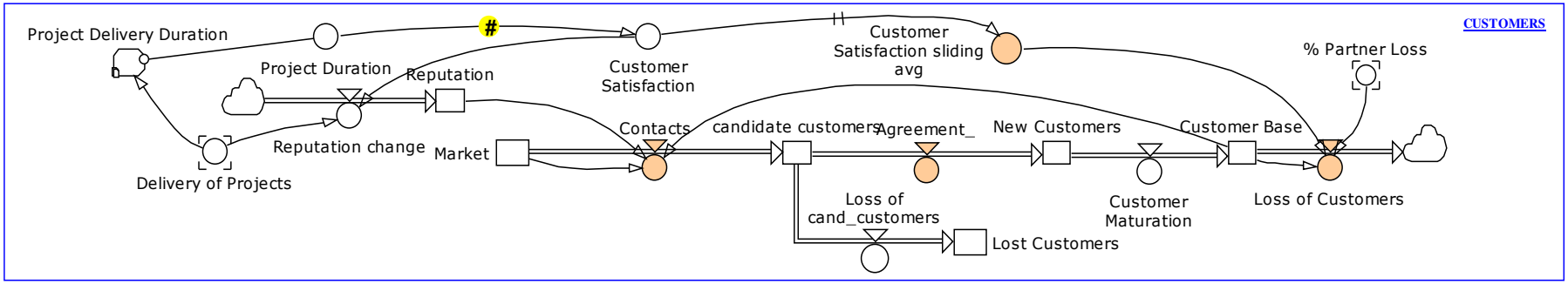

Figure 7: Model of the Customer subsystem

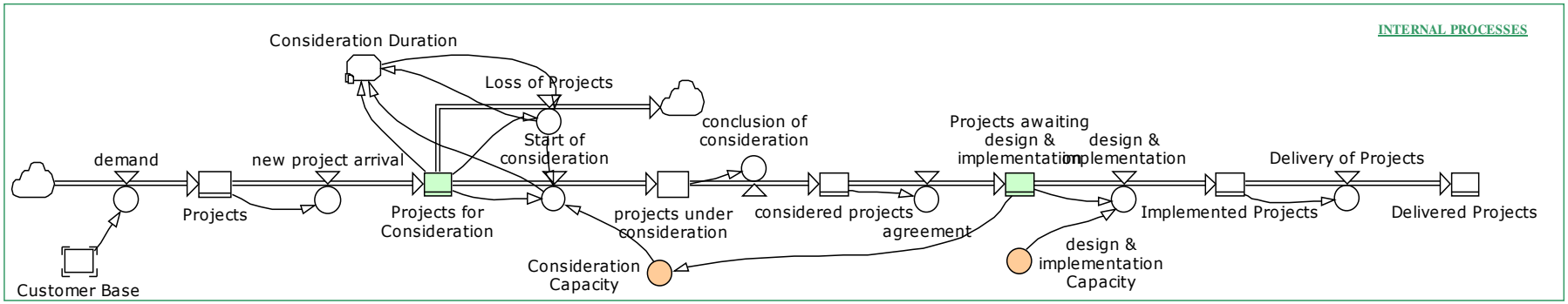

Figure 9: Model of the Internal Business Processes subsystem

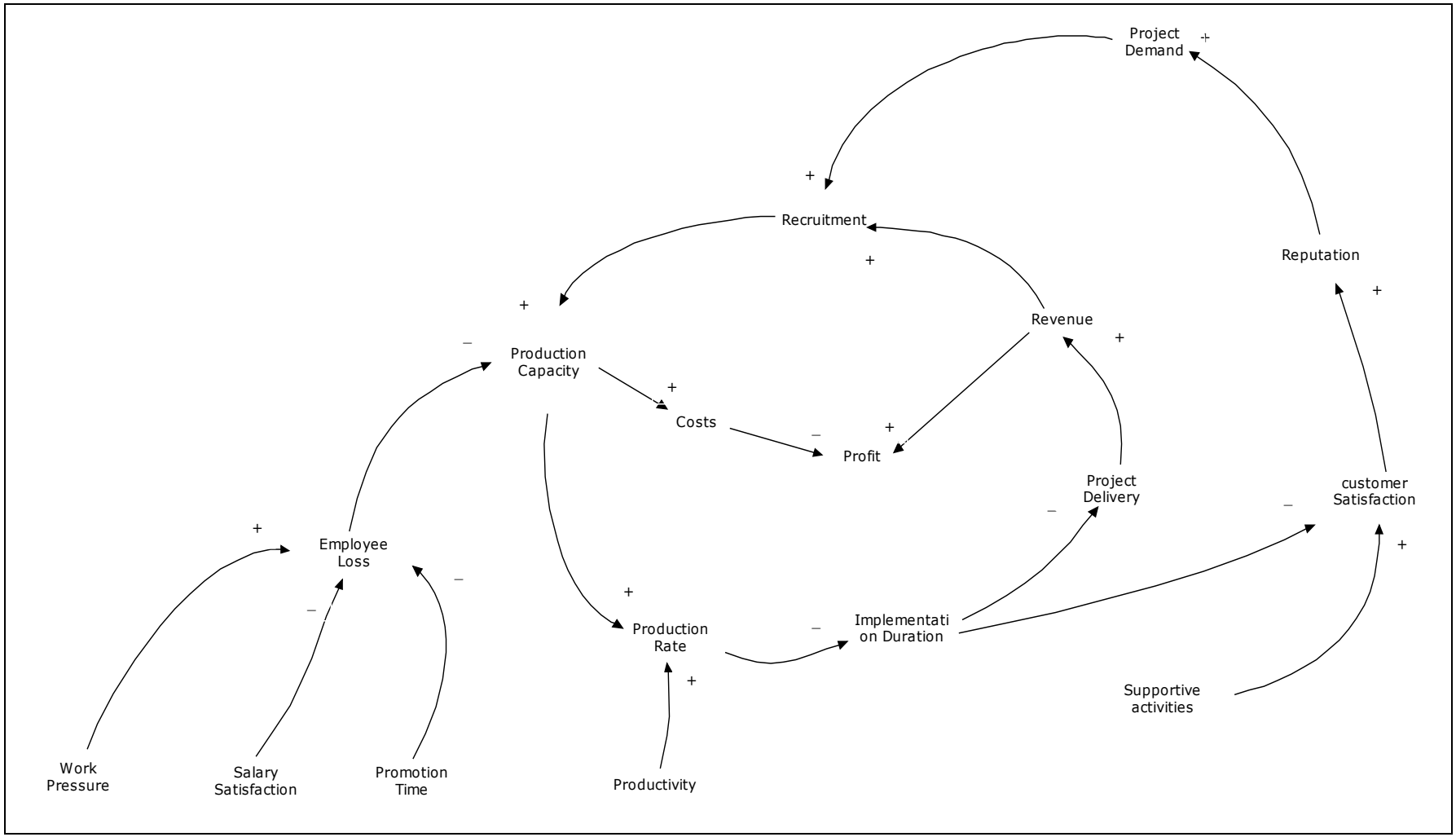

Figure 10: Causal Loop Diagram of the holistic view of the system

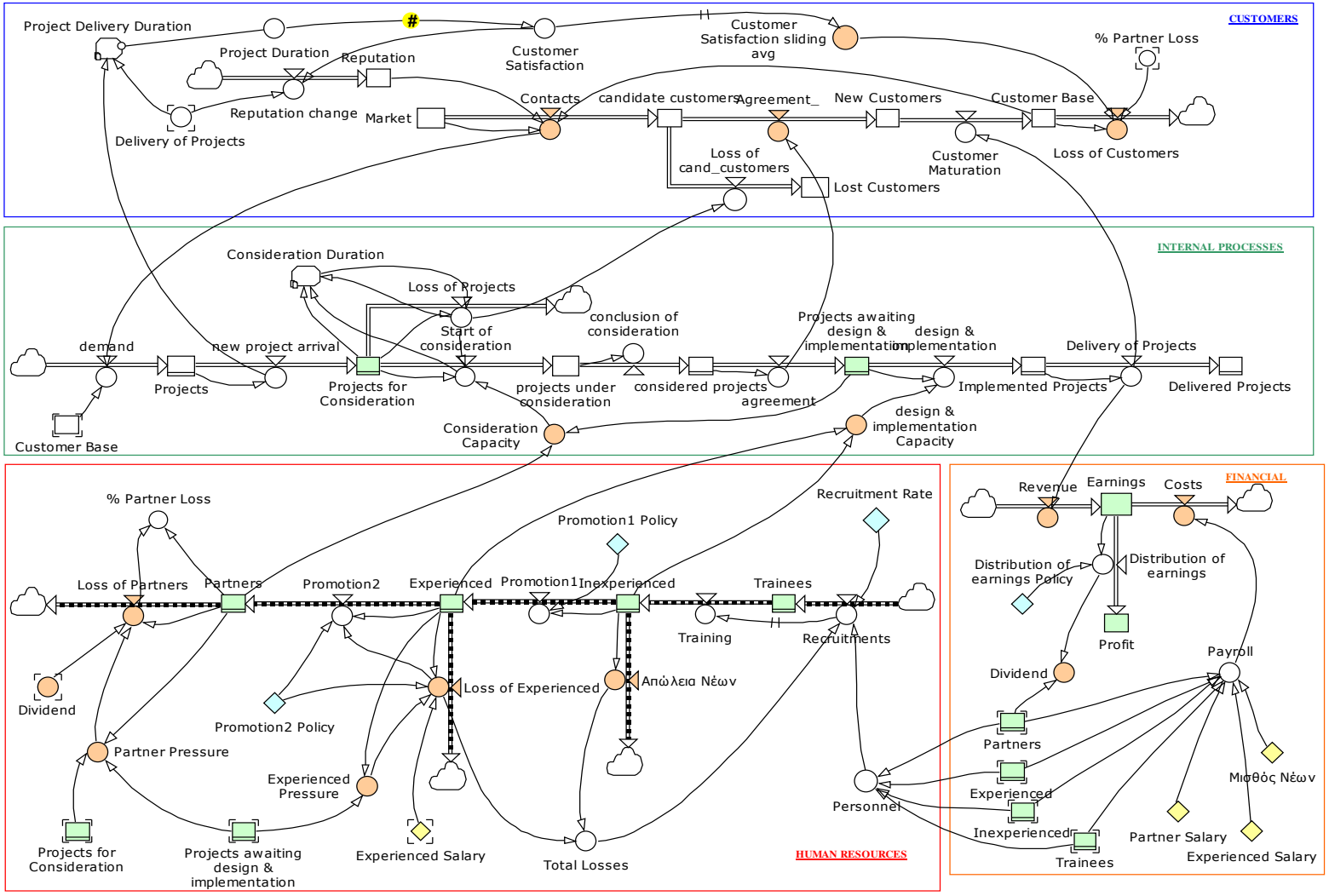

Figure 11: Model of the organisation's business system

3.5 Holistic View

The above four sectors-submodels are combined to compose the whole model which is shown in the form of causal loop diagram in figure 10 and in the form of a model in figure 11. The systems dynamics model is operating as a dynamic balanced scorecard facilitating the investigation of strategy alternatives along a variety of scenarios.

4 Results

We examined the effect of three different recruitment and promotion scenarios on the viability and profitability of the organization.

Each scenario's variables are shown in the table below

Variable	Scenario		
	Hesitative	**Balanced**	**Aggressive**
Recruitment ratio	1%	1.5%	1.5%
First Promotion	3 weeks	2 weeks	1 week
Second Promotion	0.4 yrs	0.2 yrs	0.1 yr

Table 1: Values of each scenario's decisions

The simulation is allowed to run for three simulated years and three performance indicators were observed.

Performance Indicators	Scenario		
	Hesitative	**Balanced**	**Aggressive**
Lost customers	1062	1025	1013
Capital	280K €	1101K €	1056K €
Production Capacity	2.6 projects/wk	5.56 projects/wk	4.29 projects/wk

Table 2: Values of key performance indicators for each scenario

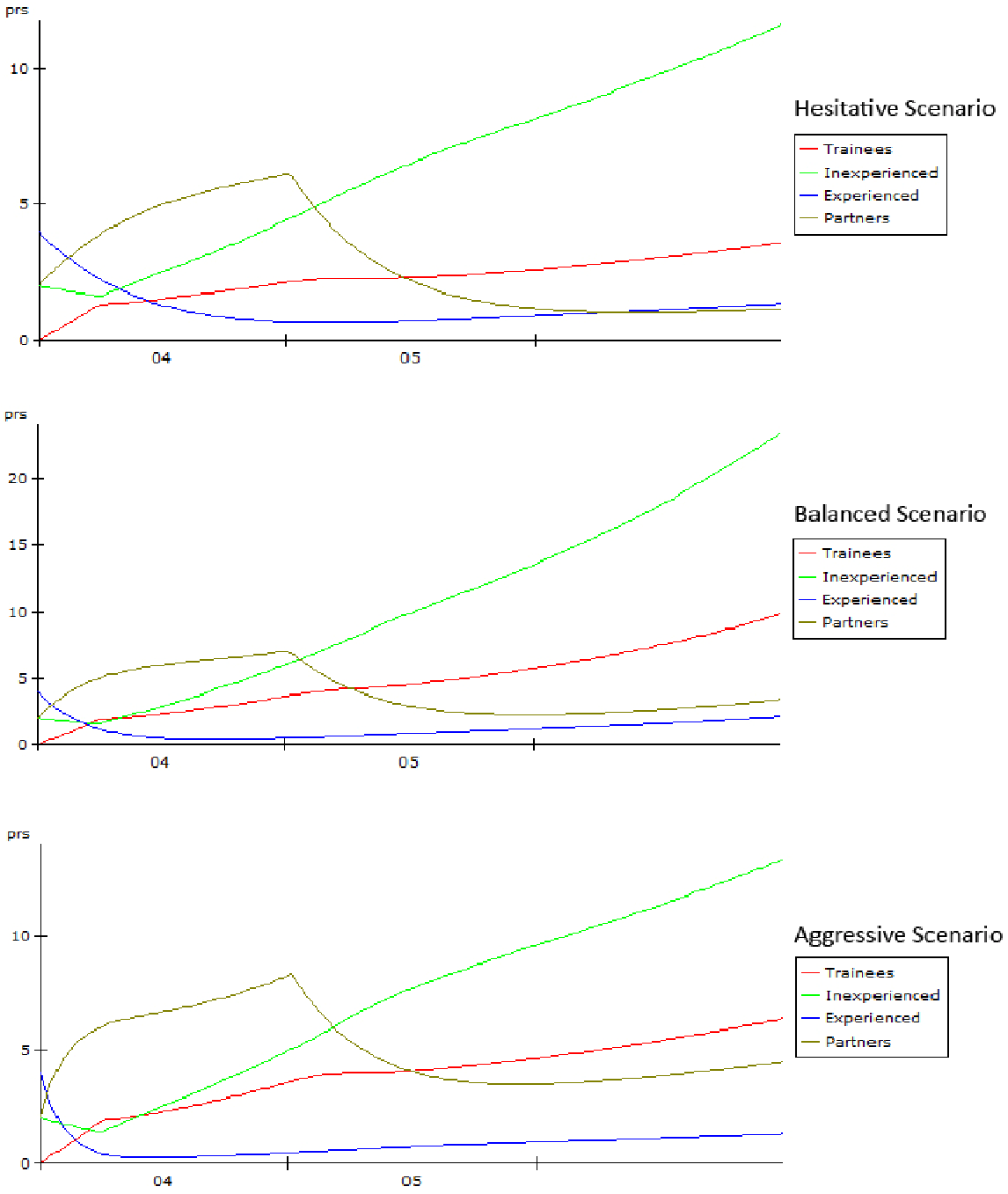

Figure 12: Time graph of employees' distribution for each scenario

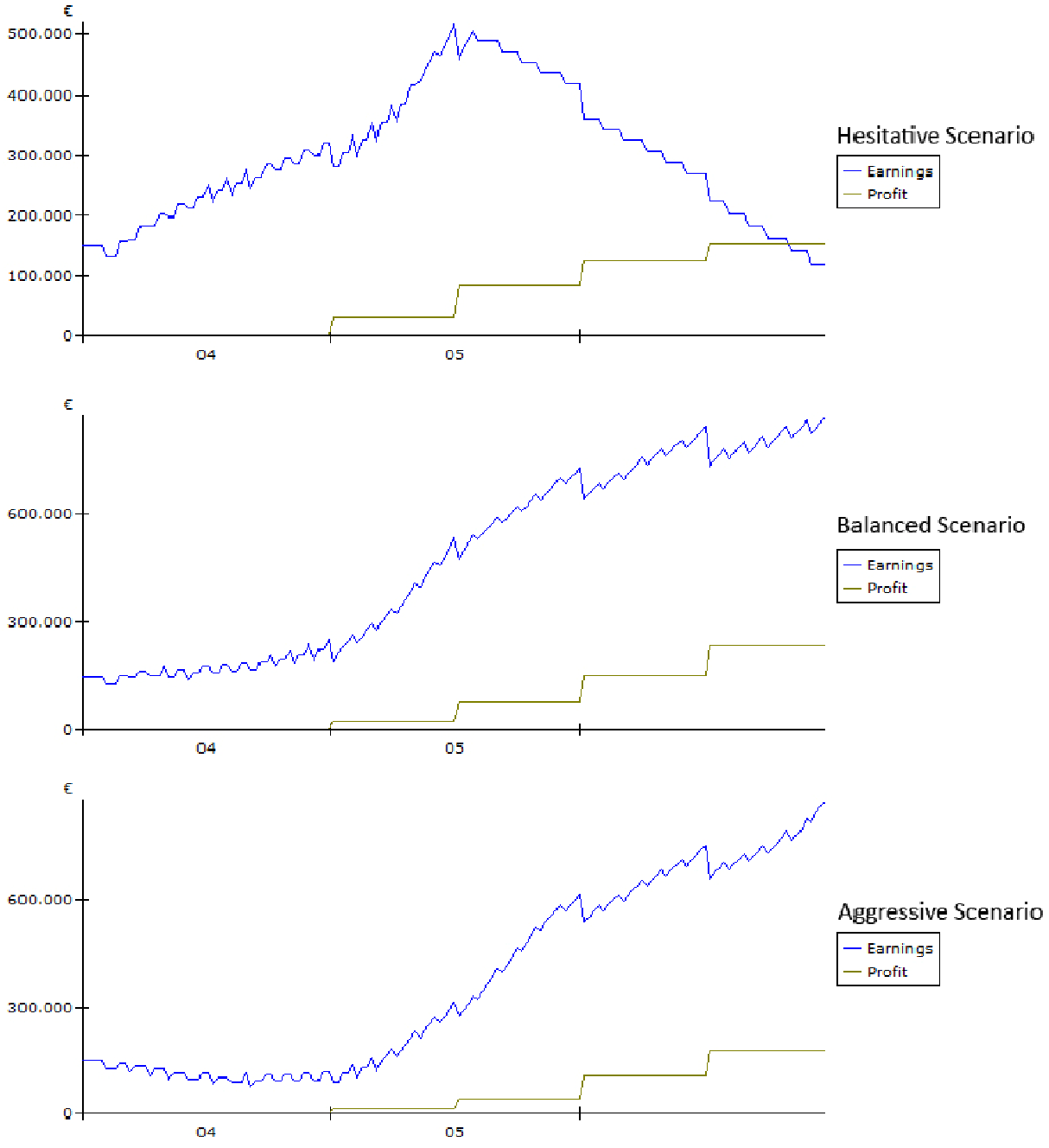

Figure 13: Time graph of earnings and profits for each scenario

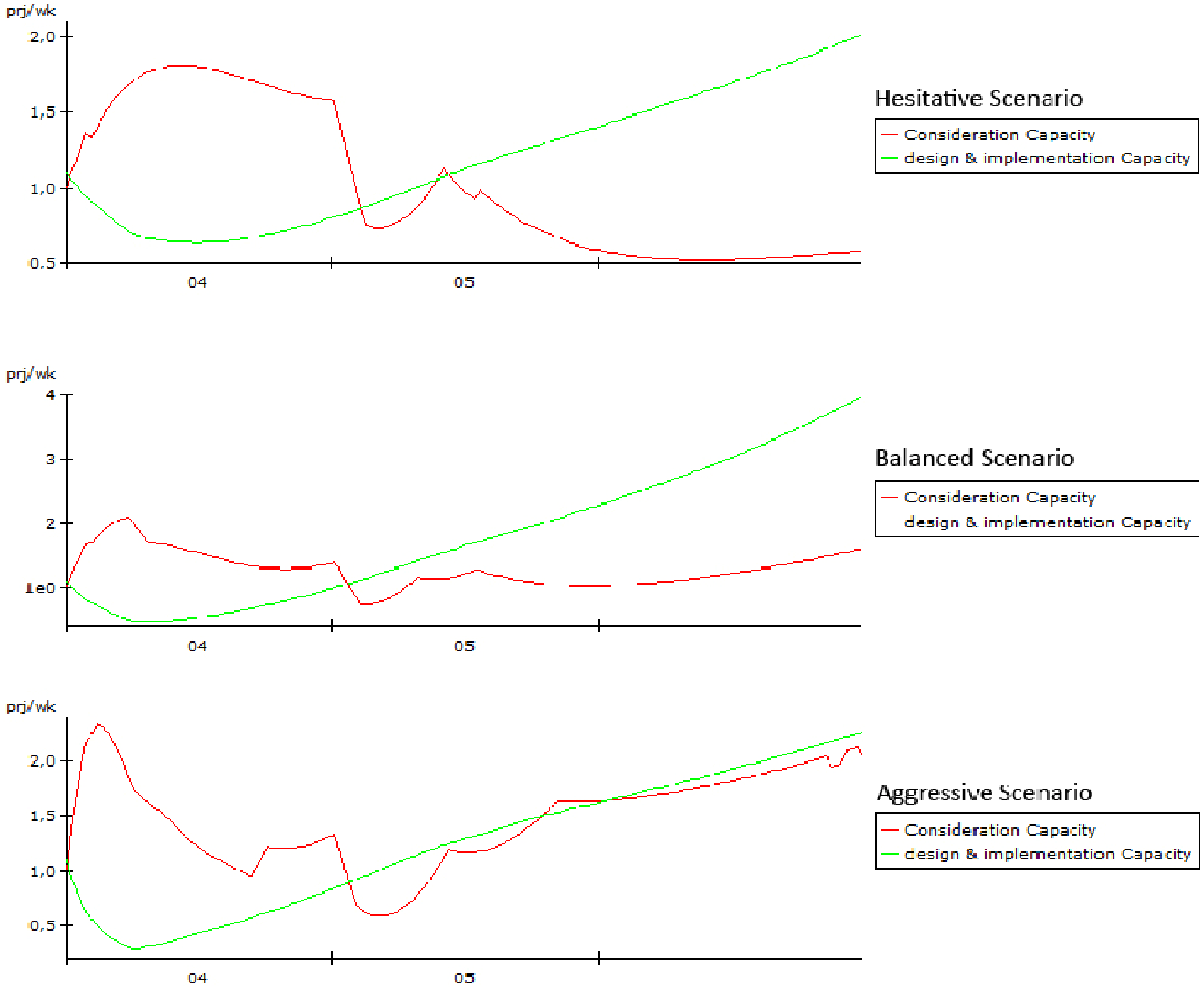

Figure 14: Time graph of consideration capacity and design and implementation capacity for each scenario

5 Conclusions

The aim in this paper has been to present a comprehensive framework for the theoretical analysis of the project-based organization and the development of a model of a corresponding dynamic balanced scorecard. Through a resource-based view of the PBO we have explored the system dynamics of the project based organization. We have also developed a system dynamics model of a balanced scorecard with the aim to provide a practical tool for the investigation of strategy alternatives under various scenarios. Emergent behaviour and counter intuitive performance results may be identified and explained, highlighting the value of the framework presented here.

References

Baccarini David (1996). *The concept of project complexity- a review*. International Journal of Project Management Vol. 14, No 4, pp201-204

Barlow James (2000). *Innovation and learning in complex offshore construction projects*. Research Policy 29, pages 973-989

Chapman Robert (1998). *The role of system dynamics in understanding the impact of changes to key project personnel on design production within construction projects.* International Journal of Project Management Vol. 16, No 4, pp235-247

Davies Andrew and Brady Tim (2000). *Organisational capabilities in complex product systems: towards repeatable solutions*. Research Policy 29, pages 931-953

Gann David M. and Salter Ammon J. (2000). *Innovation in project-based, service-enhanced firms: the construction of complex products and systems*. Research Policy 29, pages 955-972

Ghemawat, P. and Pisano, G. (2001) Building and Sustaining Success, in Ghemawat (ed) Trategy and the Business Landscape: Core Concepts, Prentice Hall, New Jersey, pp. 111-134

Hobday Mike (1998). *Product Complexity, Innovation and Industrial Organisation*. CoPS Publication No52, page 10

Hobday Mike (2000a). *Innovation in complex products and system*. Research Policy 29, pages 797-801

Hobday Mike (2000b). *The project-based organisation: an ideal form for managing complex products and systems*. Research Policy 29, pages 871-893

Love P.E.D., Holt G.D., Shen L.Y., Irani Z. *Using system dynamics to better understand change and rework in construction project management systems.* International Journal of Project Management 20 (2002) 425-436

Lyneis James M., Cooper Kenneth G., Els Sharon A. (2001) *Strategic management of complex projects: a case study using system dynamics.* System Dynamics Review Volume 17 Number 3 Fall.

Nightingale P. (2000). *The product-process-organisation relationship in complex development projects*. Research Policy 29, pages 913-930

Penrose E. (1995) The Theory of the Growth of the Firm (3rd edition), Oxford University Press, Oxford

Porter, M. (1999) What is Strategy? Harvard Business Review, November-December

Reichelt Kimberly and Lyneis James (1999). *The Dynamics of Project Performance: Benchmarking the Drivers of Cost and Schedule Overrun.* European Management Journal Vol. 17, No. 2, pp135-150,.

Sterman John D. (2000). *Business Dynamics: Systems Thinking and Modeling for a Complex World.*

Sterman John D. (1992). *System Dynamics Modeling for Project Management.* Massachusetts Institute of Technology.

Wang Q. and Von Tunzelmann N. (2000). *Complexity and the functions of the firm: breadth and depth*. Research Policy 29, pages 805-818