Influence of Projects' Size on a Professional Service Firm Performance

Mgr. Tomas Hubik*
Faculty of Mathematics and Physics, Charles University in Prague
Malostranske namesti 25, Prague 118 00, Czech Republic
00420 605 922 912
hubik.tomas@gmail.com
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Abstract

In the presented work we devote to creating a computer model of a professional service firm using the theory of business modeling. The whole model was programmed using the application Vensim. Another part of this work was to use this model to answer some key questions about the professional service firms. We were studying how projects' size influences company's performance. We have also identified optimal project size for our model settings. Such model could then be used for better understanding patterns of companies in the professional service industry and we can use it to manage the company more effectively in this environment.

I. Introduction

Professional service firms are often referred to as consulting companies. This is not very accurate as they are generally companies selling their services. Consulting companies are rather the subset. When we consider taxonomy of professional service firms generated by *Von Nordenflycht* (2010), we will focus on companies in the first and in the second group. To the first group belong classic professional service firms – characterized by a high knowledge intensity, a professionalized workforce, and low capital intensity. They are for instance law or accounting firms. The second group is called neo-professional service firms, where the high knowledge intensity and low capital intensity is also typical. Neo-professional service firms are for example management consulting companies.

In the area of professional service firms a special emphasis on a creation and maintenance of a group of developing and experienced professional staff at various levels of seniority is put. This emphasis is evident, as the greatest asset of each professional service firm are actually its employees.

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These companies also create a motivating and challenging environment to keep employees busy and support them in developing their skills. There is often a system "up or out" implemented in these firms. It means that each employee's performance is evaluated on a regular basis, and the best are promoted and the under-performing ones "go out". This system provides a steady flow of new employees who must fill gaps left by the under-performing ones. This ensures a high quality of work and thus building a reputation, which is a prerequisite for future growth. Not infrequently happens that the employees of these companies later found application in managerial positions in businesses of their former clients. This is another beneficial effect of this system and a way how to get interesting contracts.

As we already mentioned, professional service firms are characterized by high knowledge intensity. For newcomers basics are usually learned through initial trainings. Further knowledge is then gained through work on the projects – so called on the job learning. It is obvious, that projects and project types influence how fast people are gaining their knowledge and mastery in the field. Short projects are often not effective for learning of less experienced employees as there is simply no time for that and large projects are usually demotivating with low morale. The whole performance is also influenced by changes of team members during the project. The bigger the project is, the more probable is that the team that started will not finish with the same members.

The main goal of this paper to build a complex model of a generic professional firm that can then be used by managers and other interested people and help them understand the behavior of their company and thus help them to manage their company more effectively. Another goal is to elaborate on dependency between projects size and company performance measured as a profit. We would like to answer questions about optimal project size. There were many papers dealing with dependency of company performance on average project size, but none of them were studying the dependency from the context of the whole company. For example *Going To Great Lengths* (*Cooper*, 1994) and *How To Go To Great Lengths* (*Stephens*, 1995). They were usually modeling just the project management part.

The main principle of operation of a professional service company is shown in the diagram 1.

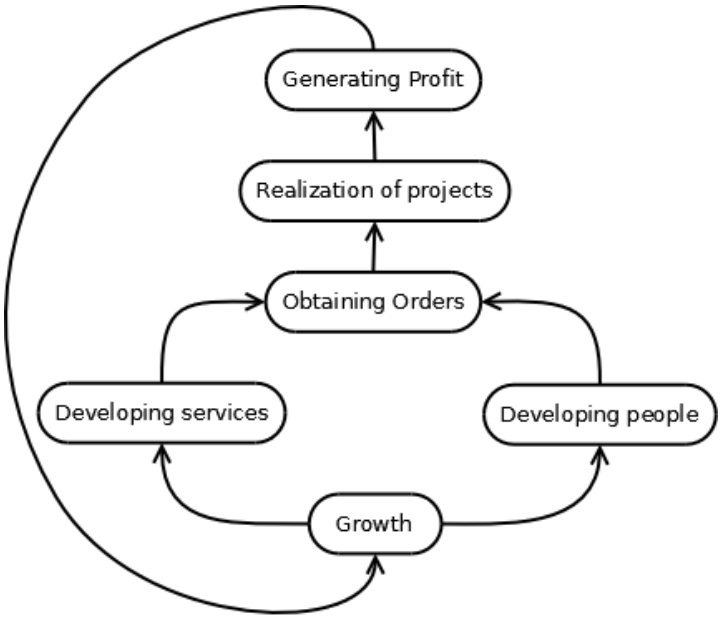

Figure 1: *Diagram of operation of a professional service firm*

II. MODEL

The whole model was built on basis of so called "best practices" in a professional service firms management and on the own experience with work and company culture in two companies of the Big 4[1]. Inspiration were also publications *Strategic Management Dynamics* (*Warren*, 1997), *Managing the Professional Service Firm* (*Maister*, 2008), *Essential Tools For Management Consulting* (*Burtonshaw-Gunn*, 2010) and management game *The Professional Services Microworld* with manual (*Warren and Spencer*, 1999).

We have used the *Vensim* (*Ventana Systems, Inc.*, 2012) modeling software for the implementation of the whole model.

The whole model is built from several components representing different fields of a firm management. A component *Human resources* simulates, as some could expect, human resources management. A process of hiring new employees is done automatically by the model using prediction of the firm needs. The needs are computed by a component *Projects*. This component also takes care of projects life cycle. It means from the first proposal till a successful finish or failure. This component is closely connected to a component *Clients* holding information of an actual number of company's customers. Another component is a component simulating company reputation with the same name. It influences firm attractiveness for both its clients and employees. The component *Reputation* depends on a component *Work quality* simulating quality of a work and employees utilization. This component is also connected to the components *Human resources*, *Projects* and to a component *Knowledge base*

[1]The Big Four are the four largest international professional services networks in accountancy and professional services, offering audit, assurance, tax, consulting, advisory, actuarial, corporate finance and legal services. See web pages *http://en.wikipedia.org/wiki/Big_Four_(audit_firms)* for more details.

simulating current abstract level of the company's "know-how". Bearers of the knowledge are the employees and their knowledge is gained through the work on the projects. Another component is a small component called *Services range*. This component simulates some kind of variety of projects, company could solve. The wider the range is the more offers the company obtains. It is related to the components *Work quality* and *Projects*. The last component is a component called *Money* simulating company's cash-flow. It does not influence any components. This component serves only as a point for company financial performance monitoring and evaluating. For clarification of the whole model structure refer to the picture 2. The arrows are showing from influencing components to affected ones.

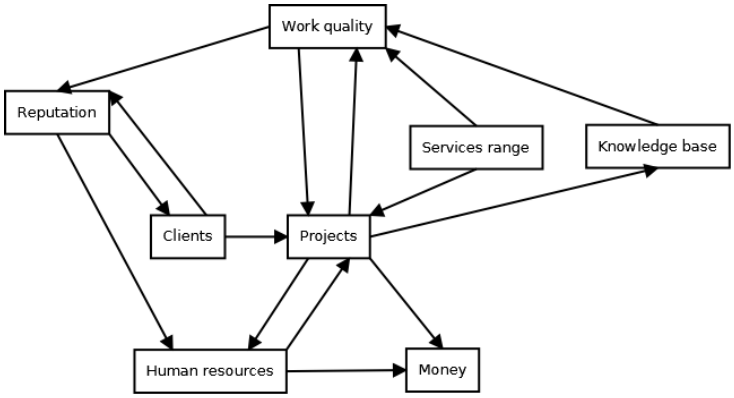

Figure 2: *Schema of model components connections*

Now we will briefly describe the most important components for this article, the component *Projects*, *Knowledge base* and *Work quality*.

II.1 Projects

Component *Projects* is one of the main components of the whole model. It simulates a basic aging chain. The whole process is depicted in the picture 3.

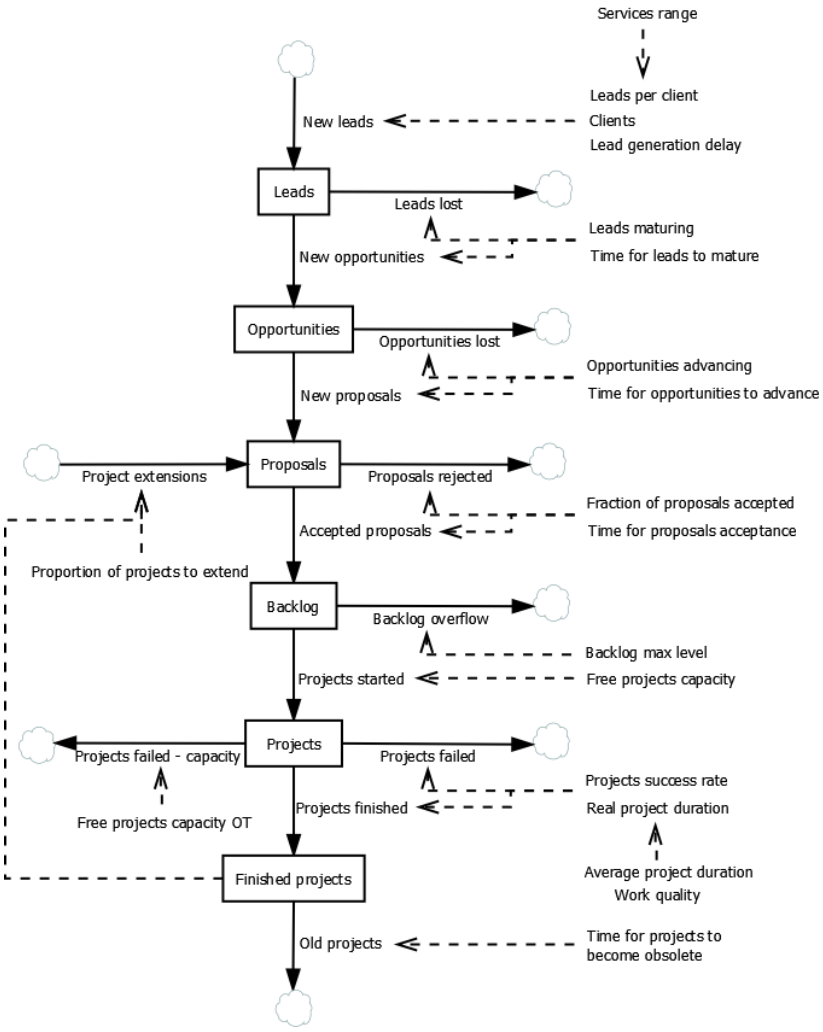

Figure 3: *Projects component schema*

At the beginning of the chain there are project leads. Number of the leads depends on services range offer and number of clients. There is also a reinforcing feedback loop from finished projects to new proposals. This feedback loop simulates extension to finished projects. We can see that at any stage of the aging chain there are some losses. Lost leads, rejected proposals and so on. Actual projects have three different possibilities of development – success, failure from lack of capacity and failure from other reasons. Failure from lack of capacity is simulated by other parts of the model and basically expresses that a one or more team members that were working on the project left and we have no employees left to replace them leading in the failure. Failure from other reasons is simply simulating success rate of the whole company – the actual reasons are not simulated in the model.

The work backlog means projects that are contracted but not started yet. A typical practice is that a company holds some backlog to smooth fluctuations in a demand. The desired backlog can be set manually as a model parameter, the actual backlog is computed in weeks and so depends on an actual number of employees and an actual number and length of con-

tracted projects. It expresses how long time we can supply our employees to keep them fully utilized with no new contracts. This part of the model was based on two publications discussing an optimal project size and an idea of the backlog, *Going To Great Lengths* (*Cooper*, 1994) and *How To Go To Great Lengths* (*Stephens*, 1995). New employees are hired at the time the actual backlog is by 5% higher than the desired one and hires the number of consultants to compensate the whole difference. We will describe details of this calculation later. The new employees are not ready to work immediately but there is some delay that can be set as a model parameter. This delay in the real world corresponds to a selection process duration and consequent trainings.

II.2 Knowledge base

As we already mentioned – the main asset of a professional service firm is knowledge "stored" in its employees. The component *Knowledge base* is simulating this knowledge and the figure 4 is showing component's internal structure.

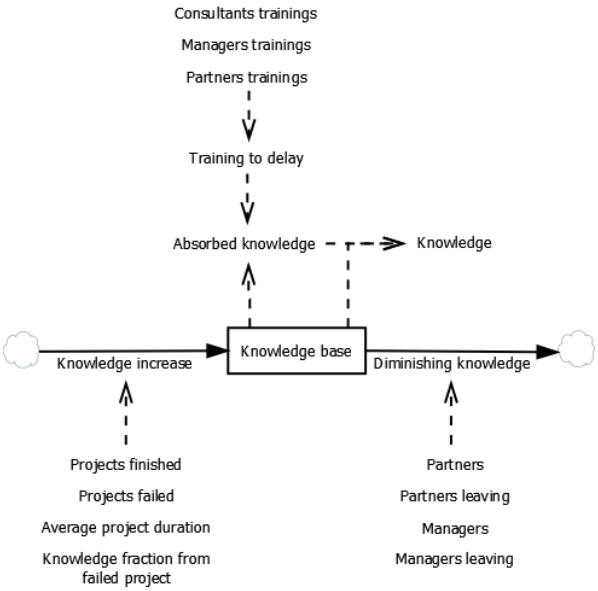

Figure 4: *Knowledge base component schema*

The component simulates a knowledge level. The level is increased through work on projects and decreases with leaving employees. Both successful and unsuccessful projects are some kind of experience so both are increasing knowledge level. We used a simplification where we assume that the main bearers of knowledge are managers and partners. There is another assumption that it takes some time to propagate the knowledge to other employees. This delay can be reduced by trainings. There always has to be some balance as with extensive trainings employees have less time for actual work and the knowledge base is not increasing so fast and with no trainings the knowledge base is increasing relatively quickly but the knowledge is not being absorbed by other employees.

II.3 Work quality

Component *Work quality* is the simplest one from these three. The structure of the component with all links is illustrated in the figure 5.

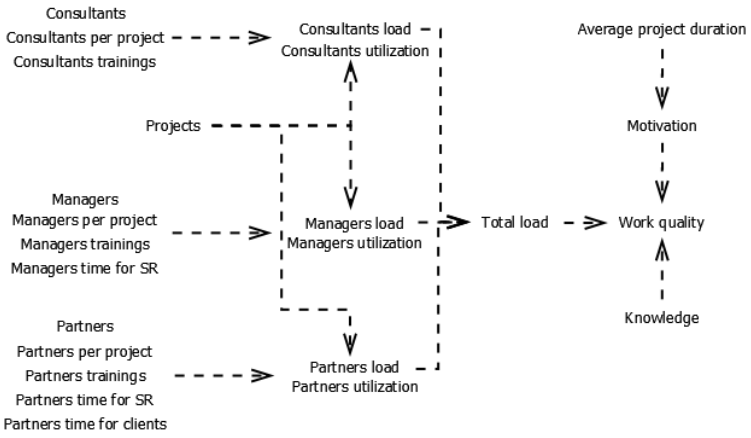

Figure 5: *Work quality component schema*

We can see, that the component does not contain any levels. The work quality is an abstract value determining not only the quality of any work done, but also a quality of the whole workforce. With higher work quality the company is able to finish projects earlier. The work quality depends on the previous components – *Knowledge base* and *Projects*. There is a simple idea that with higher employees' load there are many overtimes decreasing the work quality and motivation. Level of the knowledge influences the work quality directly. There is also a link expressing relation between the average project duration and the motivation. With excessively long projects the motivation decreases as the work become more monotonous.

We will not describe the other components of the model in detail as they are not relevant to this article. For the detailed description of the whole model refer to my Master's thesis (*Hubik*, 2012).

III. Results

In this section we will describe results of simulations with different setups representing various scenarios and situations, the company can face – especially different project sizes to determine the influence of the average project size on the company's performance.

After starting a simulation we have to wait for some time before the model stabilizes. The model contains many various delay functions that will start their internal counters at one time and so the results are not realistic at the beginning of the simulation. For example normally we promote consultants after a specific time spent on this position and as we hire consultants continuously in time, we also promote continuously in time. But at the start of the simulation, all employees are in the firm for the same time, so they are all promoted approximately at one time. This causes high deflections in the first years of the simulation.

III.1 Default settings of the model

The parameters of the model are set to nearly optimal values in the default settings simulating a mid-sized company. It means that the operations of the company and its growth are sustainable in the long term. The company has an optimal distribution of employees on seniority levels and an optimal number of them corresponding to the number of projects and clients. So the model does not need a long time to stabilize. We will use this setting as a starting point for our experiments. We will wait until the model stabilizes and then change some parameter to observe, what will happen on the resulting graphs. The table 1 contains default values of parameters related to the components of interest.

Parameter name	Value	Units
Average profit per project	2.5e+006	CZK
Average project duration	16	weeks
Backlog init	8	projects
Clients init	35	clients
Consultants hourly wage	170	CZK/person/hour
Consultants per project	4	persons/project
Consultants trainings	0.1	
Costs per project	1000	CZK/project/week
Delay to receive payment	8	weeks
Desired backlog weeks	9	weeks
Finished projects init	17	projects
Fraction of proposals accepted	0.5	1/weeks
Knowledge base init	50	knowledge units
Lead generation delay	12	weeks
Leads init	90	leads
Leads maturing	0.25	1/week
Leads per client adjustment	1	
Managers hourly wage	420	CZK/person/hour
Managers per project	1	person/project
Managers trainings	0.05	
Opportunities advancing	0.35	1/week
Opportunities init	30	opportunities
Partners hourly wage	900	CZK/person/hour
Partners per project	0.2	person/project
Partners time for clients	0.35	
Partners trainings	0.02	
Project preparation costs	10000	CZK/project
Projects init	12	projects
Projects success rate	0.8	1/week
Proportion of clients lost	0.2	1/week
Proportion of projects to extend	0.01	1/week
Proposals init	13	proposals
Time for leads to mature	4	weeks
Time for opportunities to advance	8	weeks
Time for projects to become obsolete	20	weeks
Time for proposals acceptance	8	weeks

Table 1: *Model parameters values – stable state*

Now we will look at graphs related to the projects representing simulation results for these stable settings. We will use the same graphs to compare various scenarios with each other. The graph 6 shows the number of currently running projects, the working capacity and current backlog. We can see that the company is working on 15 projects at one time in average.

We also see that the required backlog of 9 weeks means just about 8 to 9 projects. Line representing working capacity should never cross the line representing number of currently running projects. Any crossing means lack of capacity and thus failed project. In this graph we can also see the time needed for the model stabilization. In this case it is about 600 weeks. Such a long time is needed because of the fact that the human resources component contains quite long delays, so the model needs long time to desynchronize them. The time for stabilization of the model is directly proportional to the delays the model contains.

In the graph 7 we can see numbers of clients together with numbers of projects in different stages of their life-cycle. We can see that this part of the model stabilizes in just 55 weeks because delays in this part of the model are not so long when compared to other parts. We can also see that we have to have about 45 clients to have sufficient number of leads and thus projects to fully utilize our employees.

Graphs 8 and 9 show weekly and annual cash-flow. From the graphs we can see that the company earns consistently around 49 million CZK per year with income around 134 million CZK per year and expenses around 85 million CZK per year. The overall earned money then shows the graph 10.

The last graph, 11 is showing knowledge base state, employees' motivation and total employees' load, in other words all components of the work quality, which is also displayed in this graph. The last thing in this graph is reputation which is dependent on the work quality. We can see that the company is slowly growing which is caused mainly by increasing knowledge base. Because of the growing knowledge base it is possible to process more projects with the constant number of employees, which in turn means more clients and more projects that are supporting growth of the knowledge base. We can observe a reinforcing feedback loop there.

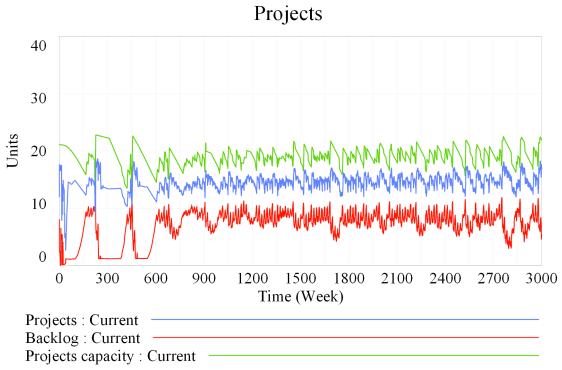

Figure 6: *Graph of number of projects, capacity and backlog – stable settings*

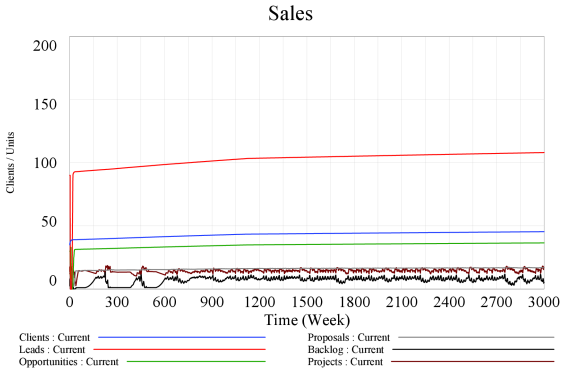

Figure 7: *Graph of numbers of clients and projects in different phases – stable settings*

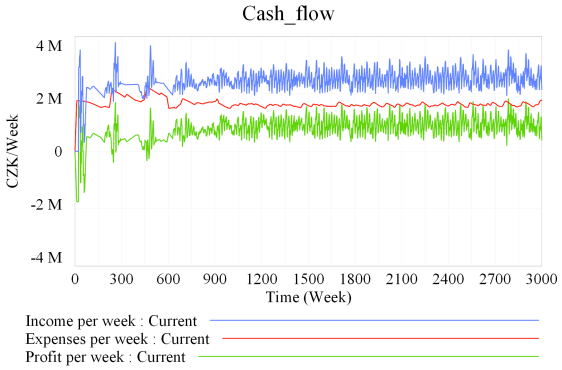

Figure 8: *Graph of weekly cash-flow – stable settings*

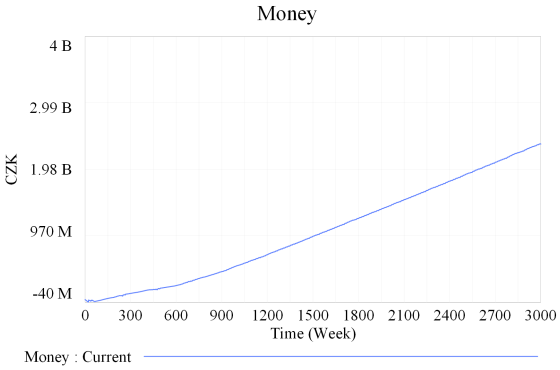

Figure 10: *Graph of money earned – stable settings*

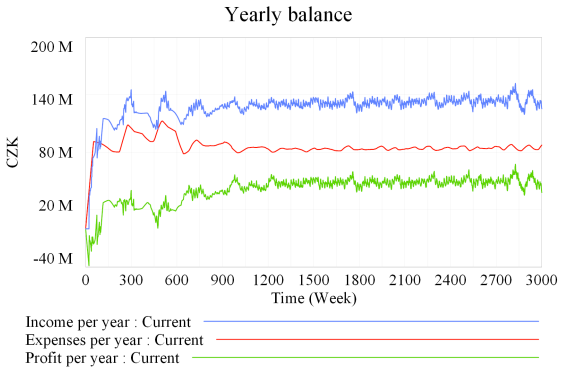

Figure 9: *Graph of yearly cash-flow – stable settings*

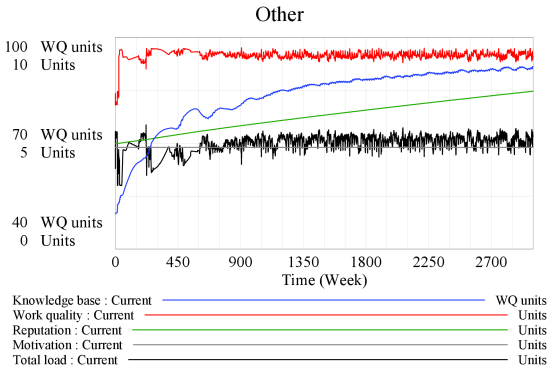

Figure 11: *Graph of knowledge base, motivation, employees' load, work quality and company reputation – stable settings*

III.2 Simulations

As we already mentioned, maintaining a highly motivated and knowledgeable teams of employees is one of the key aspects of any professional service firm. Project size is believed to be one factor influencing performance of a company. That is why we have built the model to test various hypotheses concerning corporate governance. Now we will test various parameters setups and their influence on company performance. As a performance indicator we have used profit.

III.2.1 Project size

In this section we will devote to analysis of dependency of profit on project size. We will elaborate on how big projects a company should accept and how many of these project will

the company need to prosper. We assume that the company has enough leads that it can filter them and accept only those that will satisfy given criteria.

When testing profitability we let the model stabilize for some time and then we changed project size that is accepted by the company. We started with duration of 2 weeks and make series of runs up to 74 weeks. For each duration we have made only one run and stored moving average profit for last 100 weeks of the simulation. We also assumed that the project size is directly proportional to the project price. Next assumption was that there is a direct link between the project size and number of leads generated by clients. In other words there will be many leads for small projects but only few leads for large ones. We had to modify a couple of equations to the following forms:

```
(005)    Average profit per project  =
            2.5e+006
                 / 16
                 * Average project duration
                 * Time units adjustment
                 * Profit per project units adjustment
   Units: CZK/Unit

(006)    Average project duration  =
            IF THEN ELSE ( Time
                      < 1000,
                 16,
                 20)

(100)    Leads per client adjustment  =
            16
                 / Average project duration
                 / Time units adjustment

         Profit per project units adjustment  = 1
   Units: CZK/Unit
```

The new variable *Profit per project units adjustment* is there only to preserve units compatibility. It does not influence the calculation.

The resulting graph 12 shows dependency of the total profit on the average project size.

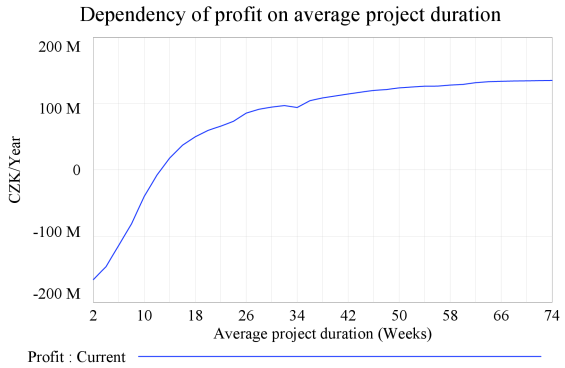

Figure 12: *Graph of dependency of total profit on average project size*

Graph is approximately logarithmic and it seems, that the bigger the project is the bigger

profit the company gets. But when looking at the graph more in detail, we can find out that accepting only really big projects is not sustainable in the long term with our model setting.

Firstly, we look at the smallest projects. Company must have relatively large number of these small projects to generate some profit. For this reason, it needs a large number of employees. Because of a fluctuation of the employees, it has to ensure steady flow of new employees. To attract these new employees it has to invest into marketing. Increased marketing, costs with recruitment process and other overhead results into loss. Retention of the employees and motivation are the biggest issues. High fluctuation and low motivation of employees results into declining work quality and reputation damage. With the declining reputation the company loses clients resulting into smaller number of projects and thus weaker knowledge base. This again reduces the quality of work creating a loop leading up to the collapse of the company. The graph 13 shows us the declining quality of work and its influence on the reputation. The graph 14 then displays the effects on the number of clients and projects. Both graphs were generated for the average length of projects two weeks.

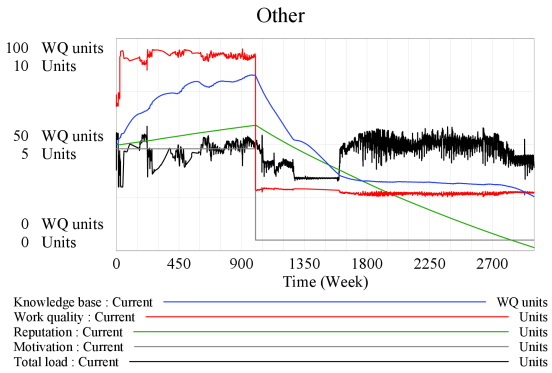

Figure 13: *Graph of knowledge base, motivation, employees' load, work quality and company reputation – average project duration 2 weeks*

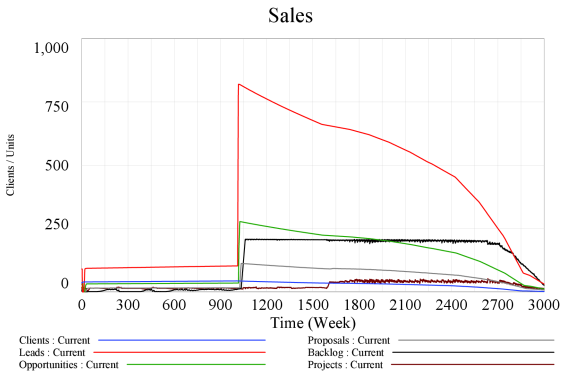

Figure 14: *Graph of numbers of clients and projects in different phases – average project duration 2 weeks*

Another important project duration in our simulation was 20 weeks. For this duration we have noticed the highest motivation and work quality. This implies growth of reputation and thus clients base. Yearly profit was not the highest in our time-frame (earnings were about 66 million CZK/year) but there was the highest potential for a growth in the long term. In the graph 15 we can observe the reputation growth.

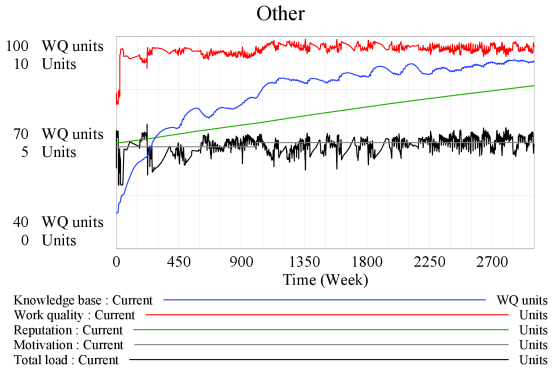

Figure 15: *Graph of knowledge base, motivation, employees' load, work quality and company reputation – average project duration 20 weeks*

Duration of 43 weeks is so called sustainability threshold. It is the highest project duration where we do not get into debilitating loop. The reputation is stable in this scenario. The reputation can be seen in the graph 16. Because of this fact company will have a stable number of clients after stabilization and will not further grow without any change or investment. We also know that it can sustain current profitability level, which is around 119 million CZK/year. The graph 17 then shows number of projects and clients after stabilization.

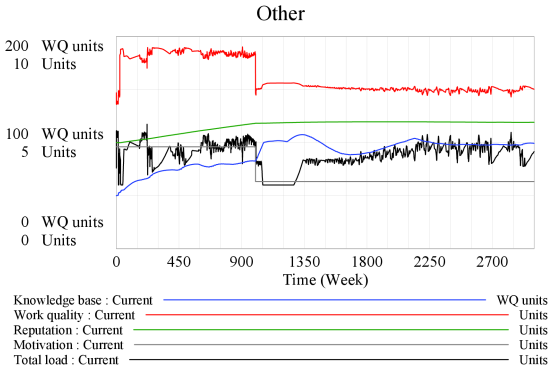

Figure 16: *Graph of knowledge base, motivation, employees' load, work quality and company reputation – average project duration 43 weeks*

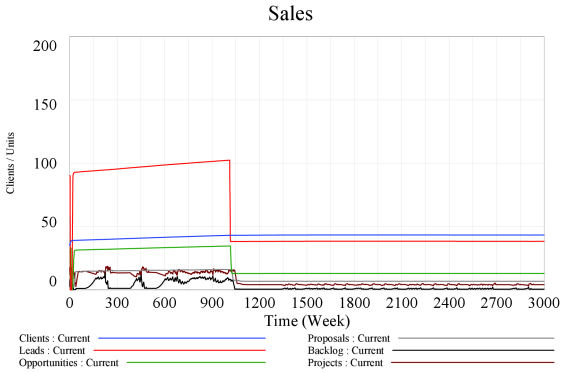

Figure 17: *Graph of numbers of clients and projects in different phases – average project duration 43 weeks*

The biggest project size where a company is receiving sufficient number of leads to have sufficient number of projects to keep its employees utilized is 60 weeks. With this duration company has one project at time to work on. Also profit is the highest with this duration – around 132 million CZK/year. This state, however, is not sustainable as we can observe declining reputation and motivation there. The graph 18 shows us development of the work quality and reputation over time and in the graph 19 we can observe slowly shrinking clients base.

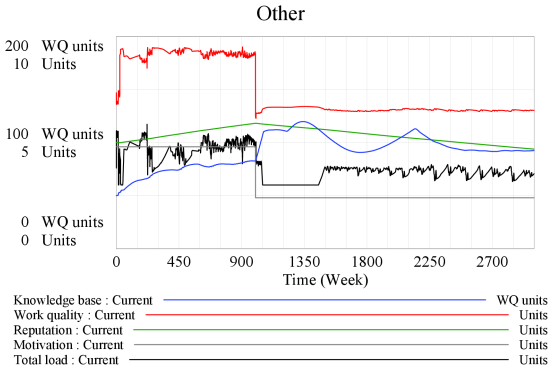

Figure 18: *Graph of knowledge base, motivation, employees' load, work quality and company reputation – average project duration 60 weeks*

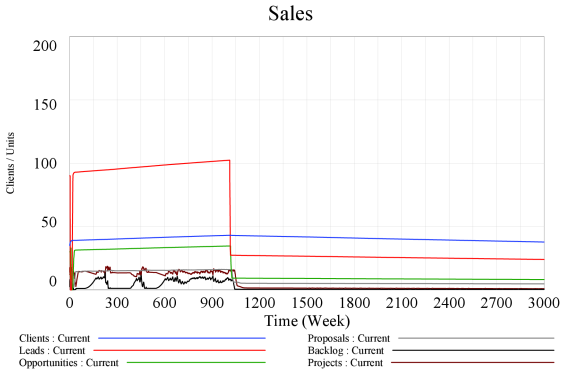

Figure 19: *Graph of numbers of clients and projects in different phases – average project duration 60 weeks*

From the above tests and scenarios we can see that answering the question of optimal project size is not easy. It depends on the time horizon where we want to maximize profit. When we do not consider stabilization period, first 1000 weeks, we are assessing time-frame 2000 weeks. It means around 38 years, which is a really long period. Some effects, however, have even longer incubation time. During the time-frame the optimal solution is to have the biggest possible projects as any negative effects are weak and will not fully develop during this time-frame. When we make this time-frame wider, we will see the collapse in time 4800 weeks from the beginning of the simulation, 3800 weeks from the change. This corresponds to 73 years. So far in the future the company will not have sufficient number of clients to generate sufficient number of leads for large projects and the company will bankrupt. Generally it is not reasonable to consider such a long simulation time as the conditions that were at the beginning will probably change.

The next options to consider are 20 and 43 weeks. We have generated graph 20 to compare these scenarios. The graph shows us the cumulative profit for each case. We can see that more profitable is the scenario with projects duration 43 weeks. The main reason is that the reputation of the company cannot grow indefinitely as there are some balancing feedback loops. The company growth will stop at one time. The company with projects with duration 20 weeks has higher profit during the first 1420 weeks – the derivative is higher – and since then the company with bigger projects become to be a leader with potential to accumulate more profit during the following years.

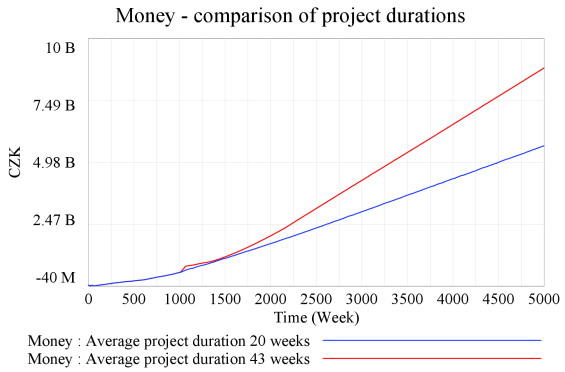

Figure 20: *Graph of cummulative profit – comparison of scenarios with average projects duration 20 and 43 weeks*

We can conclude that with our settings and assumption that there will be sufficient number of projects[2], the optimal project duration is 43 weeks – approximately 10 months.

IV. Conclusion

Issues of the professional service companies management are very extensive. It contains many different areas that need to be monitored, evaluated and controlled. We have to take care of the clients base to secure a sufficient inflow of new projects. As we have already mentioned, the employees and their knowledge is essential for every professional service firm. This implicates another key area – project management. Furthermore, we have to deal with a development of services, human resources, company reputation monitoring, marketing and so on but these tests were not covered in this paper. We can realize that we have to deal with a very complex system, where it is not so easy to estimate the effect of a change in one part of the system to the rest. This is not only about the effect but also to what extent and when the effect occurs. These questions make predictions even more complicated and, in some cases, with absence of a sophisticated model, almost impossible.

We managed to create a model of a professional service firm with which we are able to simulate various scenarios and situations which a company may encounter. We have also answered some key questions in the field of corporate governance. Furthermore, the system was able to identify the key feedback loops and their key parameters that we can use to effectively manage the entire company.

For the real-life model of a specific company the parameters and internal dependencies need to be further developed to meet the size and internal policies of the company.

[2]If the direct correlation between number of projects per client and project size will be preserved, the simulation confirms us that this assumption is reasonable and the company will have sufficient number of projects to utilize all its employees.

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