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Controlling Service Business at a German Printing Press Manufacturer

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Abstract

HEIDELBERGER DRUCKMASCHINEN AG is the world leader in manufacturing offset printing presses. During the last few years machine sales and profits have grown strongly and have made HEIDELBERG a successful brand. HEIDELBERG focuses on divisions to control its various product businesses. Derived from the HEIDELBERG strategy service activities like spare part sales and field services are considered as an own business opportunity.

At first the paper describes the complex interactions between machine and service business as own cost or profit centers and the problems which result on that. In the following service business interactions will be shown in causal loop structure. Here the focus lies on important delayed relations between cause and effect on operational service and machine business as well as the whole financial success of HEIDELBERG in interaction with customer satisfaction. To avoid false decisions in long-term business these interactions have to be understood by the managers to plan and control their business with focus on long-term success. Based on that system conditions a first complex system dynamics model will be developed for service business to simulate and understand the effect of operational and strategic decisions. Especially the optimisation of long-term financial success will be taken into consideration. The model analyses financial performance in short and long term context. Various simulation runs show that controlling service is very complex and each decision with long-term effect should have to be analysed in financial and operational effect to avoid the risk of a decrease in company's total performance. In addition the design and setting of suitable objectives for the management will be discussed.

Introduction

During the last few years the public interest in business was dominated by the so-called "new economy". Especially the start-up e-commerce enterprises have come under focus because of their presence at the stock market and the widely increase and decrease of their shares. In the recent system dynamics research some publications analysed the business development of the new economy because of their interesting growth.

HEIDELBERGER DRUCKMASCHINEN AG (HEIDELBERG) with headquarter located in Heidelberg in the center of Germany, is an 150-years-old company and has become the world leader in manufacturing offset printing presses and the leading supplier to the print media market with sales of 3.9 billion US$ in FY 2000. HEIDELBERG employs about 23.000 people in over 150 countries.

Today HEIDELBERG is a high quality provider of integrated profit-building solutions for every segment of the print production process within a printing office. The global company closely focuses on meeting the productivity and quality needs of each individual customer. That was achieved by some acquisitions during the last few years. So the HEIDELBERG workflow solution starts with “prepress” product division providing professional scanners, work stations, image and platesetters. The development and manufacturing of offset printing presses represent the traditional core business. Finally HEIDELBERG bindery products like folders, cutters and other finishing machines show the variety of products to provide integrated workflow solutions. Some new businesses like all digital printing activities as well as value-added services like training and consulting complete the HEIDELBERG product portfolio.

The divisions have become unable to be overviewed and controlled by the general management. The larger companies are the more problems the management will have when controlling the company’s performance. One possible, and in reality often chosen, solution to the problem of physical growth is decentralization of the company. Decentralization can be defined as the process to split one organization into several more or less independent units which have at least one remaining relationship - they are owned directly or indirectly by the same shareholders. To control the financial performance of each product line HEIDELBERG has a decentralized organization with own business units/divisions responsible for the success of their products.
The advantages of decentralization are an increase in motivation, flexibility and transparency. In addition decisions are made by people with the highest competence for the special situation. The most important disadvantages of decentralized companies are the increase of asymmetric information distribution and the tendency to optimisation of sub-objectives instead of global objectives. To keep a decentralized unit close to the general objectives and policy of the supervising management the top management has to introduce special controlling tools to optimise the company as a whole to secure and to maximize long-term success.

HEIDELBERG products, especially the printing presses are long-living products. Some printing presses have been used for 100 years at print shops worldwide. Therefore in customer’s view all services have been played an important role compared with other manufacturing businesses, which produce “short-living” goods.
Based on that peculiarity the service does play an important role for the HEIDELBERG business. For HEIDELBERG customers it is important that the after-sales service will provide a reliable high quality standard just like the machines.
Because of the high machine population in field and their long live-span HEIDELBERG considers services as an own business and profit opportunity to generate additional earnings. Therefore service activities do not consist of a service center with budgeted costs only. Instead all service activities for all HEIDELBERG products have been concentrated in an special business unit “customer support” with own profit and loss responsibility. In that way all services are not driven by customer satisfaction only but by financial goals, too. Another advantage is that the whole HEIDELBERG service know-how is concentrated in one unit and standards in service quality and service processes could have been established.

Objective

The HEIDELBERG machine population currently used in field determines the market for HEIDELBERG service business directly, because the number of spare parts and service hours HEIDELBERG can sell depends on the installed machine base.
So there is a relation from the machine sales today to the service market for tomorrow which is characterized by various delays.
During the annual planning process all financials will be planned at HEIDELBERG. So there is a sales, cost, investment and profit budget. One important element especially for the service business is the headcount planning. Service business is a people business and so sales, costs and profits directly depend on the number of service technicians HEIDELBERG employs.
Because of the long time it takes to educate a usual machine technician to become productive as a HEIDELBERG specialist it is important to hire new service personnel at the right time. That means, the headcount planning should take the forecasted machine sales and the whole machine population development into consideration to determine the service personnel necessary to hire today.
To get optimal and high-qualitative planning results and to ensure the long term success of the service business and the whole company it is significant to use planning support tools which allow to understand and optimise business interactions with delayed relations. Therefore as a first step causal-loop-diagramming is introduced to allow managers to understand the complexity of the system and the important delayed feedbacks which have to be taken into consideration during the planning process. Afterwards first system dynamics models show the power of dynamic simulation tools to support service controlling.

General service business characteristics

All manufacturers of industrial investment goods have to provide a reliable professional service for their products. There have to be well-educated technicians who are specialized in installing, repairing and maintaining the machines. That physical processes may happen at the customers plant or at the factory. So at first service should have to be considered as a “people business”. The second element of traditional service consists of the spare part sales. Usually it is strongly combined with a physical shipment. Therefore a powerful logistic system is important to meet increasing customer needs.
The first year after sales service business itself can be considered as a of free-of-charge support to the customer because of the warranty time given by law. But after that all service activities mostly can and have to be charged to the customer. In this way it is an additional opportunity to make more profit than with machine sales only and should be considered as a chance to boost total company’s earnings. On the other hand service may be a financial risk because all service activities to provide high service quality are expensive.
To understand all complex structures of that enterprise it is important to understand and to emphasize the interaction between “new” service and “traditional” machine business here. When customer’s expectations concerning service quality will not be fulfilled he could decide to buy a competitor’s product next time he invests because the after sales service for that long living machine will be better or even cheaper there.

The causal-loop-diagram below shows simple basic interactions in the service business of a typical company in a customer’s perspective.

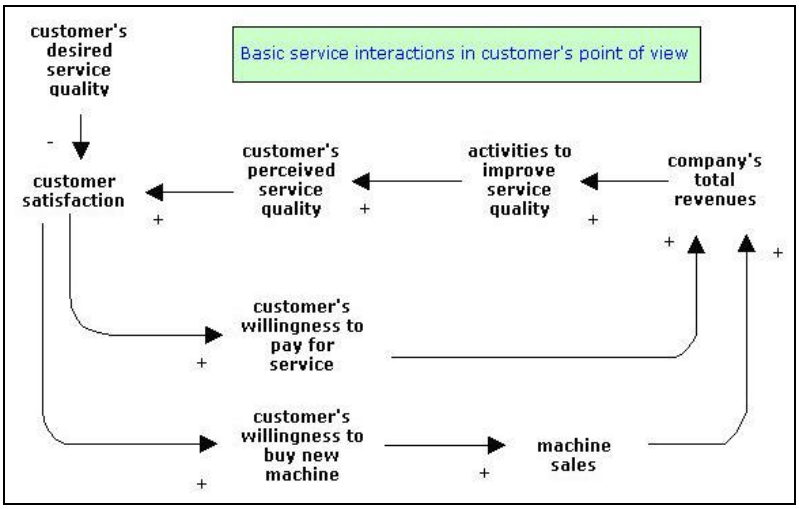

fig. 1 Basic service interactions in customers point of view

The interactions between the elements shown above describe a re-enforcing loop with focus on customer satisfaction. That causal relations are dominated by long-time cause and effort relations. At the first glance all elements are going to grow. But the quality of the service activities by a company are referring highly to the long-term financial performance of the company. So there are some restrictions which have to added to the diagram.
In fact, all service activities are expensive. When taking measures to improve service quality more costs will arise with long term effect. Therefore the operating profit will decrease in the financial year and because of their fixed characteristics they will lower the financial budgets to improve service during the next years.
The causal loop diagram below describes that short term relation in a company's perspective and shows a balancing loop.

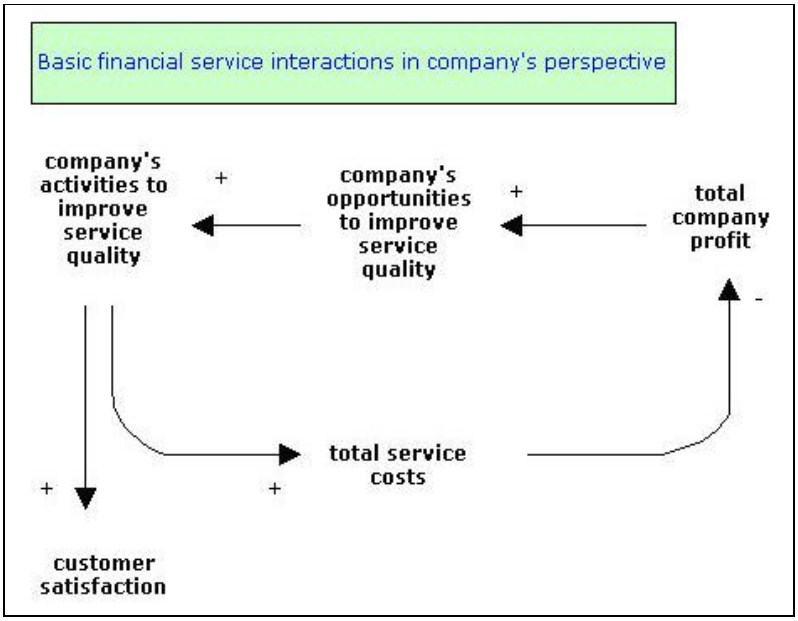

fig. 2 Basic financial service interactions in company's perspective

When taking a closer look at service business elements like hotline, field service and spare part sales the main characteristics of service costs their impact can be understand easier.

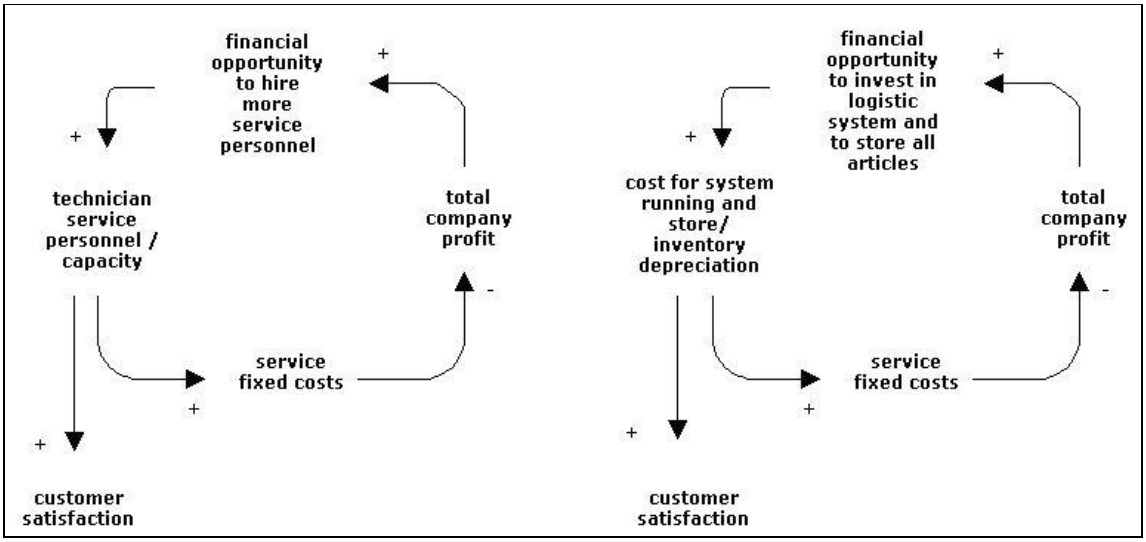

fig. 3 Special interactions between service operations and financial performance

A high standard of service quality can be defined by all measure done by the company to shorten the time a customer can not run his machine to produce and to earn money. All activities done by any service department to improve service quality for the customer will generate costs which determine the total costs of a company for a long term. The costs for service hotline and field support mainly consist of personnel, education and IT infrastructure costs. Any costs to improve the customer's needs in spare part sales require investments in logistic systems as well as IT support. Further important cost drivers are the increasing depreciation and capital costs for logistic system and the parts in stock there.
The main problem in financial controlling service business is the interaction between costs and service availability. If a company wants to offer a 24 h service for its customers high capacities will have to be installed and operated. The problem for spare parts logistics is the expensive storage of goods to guarantee availability and fast delivery without any delays.

Service business - a people business

In general all service activities depend on the personnel capacities a company has. Considering service business as a pure sales business of something the product is service hour. When a company wants to increase its service revenues and profits there are two alternatives to achieve that objective:

- increase service prices
- increase service capacities (condition: there is market volume left to be acquired)

The following diagram shows that simple relation between headcount, service hour and service revenue.

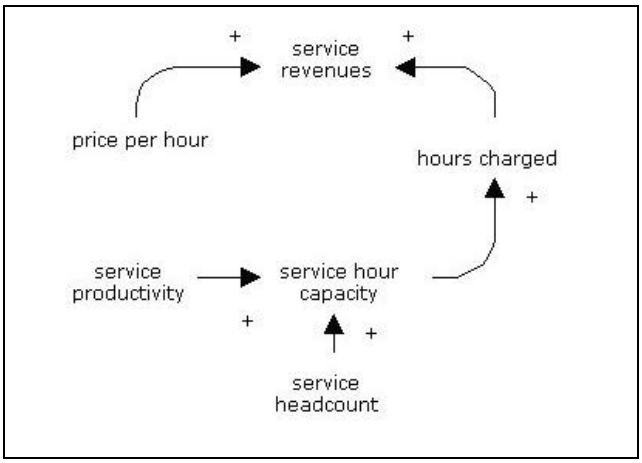

fig.4: determination of service revenues

A company may increase service quality to allow increasing prices if the customer is willing to accept. In real life there are no opportunities for any high-pricing strategies because of special market surroundings like customers willingness to pay, the threat of cheaper competitors etc. The only way to increase revenues and profits is to expand the service capacity. That means the company has to hire more and more service personnel in order to achieve that goal.
When doing so any added personnel has to be considered as additional costs which lower the profit first. To earn more money in total the company has to sell their personnel's capacity like any other product.
So there are important financial issues like product quantity (here: headcount), product quality (here: qualification), research & development costs (here: education costs) etc. in service business like a machine business. A company has to calculate all elements influencing the financial result. In each company service headcount is the base for nearly all further service calculations: the sales budget, the various cost budgets as well as the profit budget.

Controlling service business at HEIDELBERG

As described before HEIDELBERG is a decentralized company with an own business unit "customer support" responsible for all services for HEIDELBERG products. The unit could be considered as a corporate service center for machine units. But instead it has been established as a profit center to initiate activities to push service as a business with own additional earning chances.
Derived from the HEIDELBERG long-living product characteristics and the high level of high tech inside the machines the employees at hotline and the technicians in field service have to be well-educated. The education of a technician will take a few years to enable him to solve complex technical problems in field. In addition the high percentage of international customers with about 80 % requires a worldwide service network with specialists everywhere available at any time.

Under that circumstances some problems could arise when studying the described service interactions. When as it happened in the recent years the machine sales will increase by a worldwide market growth there is a strong need to expand and strengthen service capacity for installation and support. That may be a problem when hiring and educating of new service employees did not happen on right time. Even when the increase of the machine market has been known by the manufacturing

machine business unit at the right time the information flow had to be make sure within the company. In addition there is another risk because the management of the service business unit could avoid hiring and educating expensive personnel to maximize the service profit in short term. The reason is that during the education of service people costs will be generated for them without any added income for the unit.

The following causal-loop-diagram includes the CLDs discussed before and shows the complex interactions between the market, the customer, the machine business and the service business at HEIDELBERG in detail.

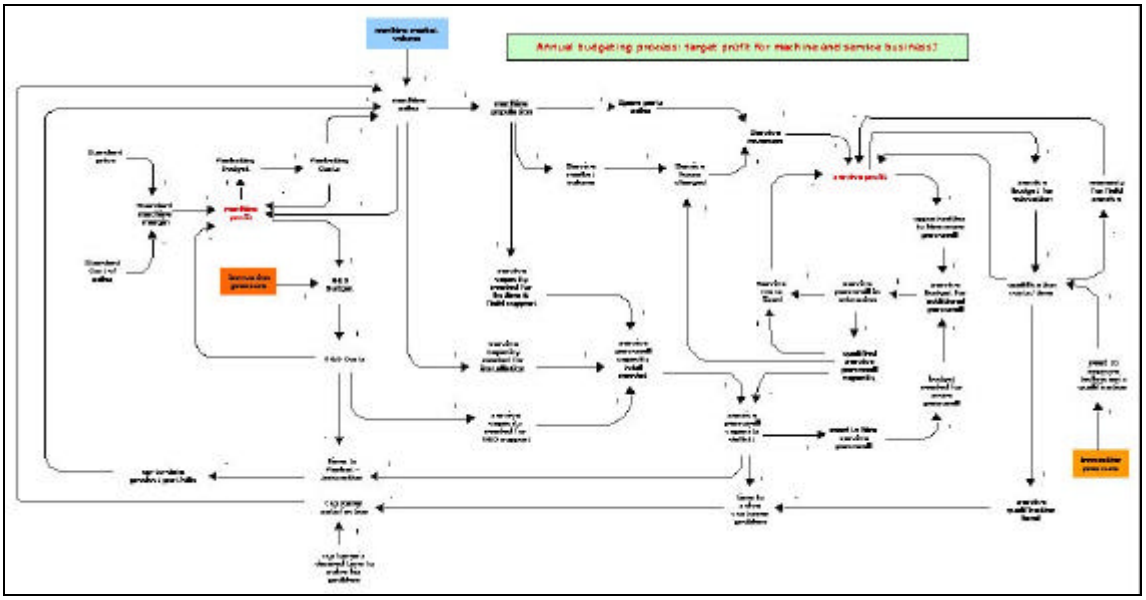

fig.5: Total business interaction at HEIDELBERG

When studying the complex loop structures the whole system may be in an equilibrium but there are some influences which determine the dynamics of the system. At first the development of the world machine market volume determines the machine sales as one of the most important initial elements to understand the system. Another important external influence is the competition pressure to develop innovative products to be more competitive. In addition to the machine profit the machine sales has got an effect on the machine population in field. Depending on the machine population the service market volume influences service revenues and profits. The service revenues are depending on the service capacities which are determined by the actual service headcount. In operational context the service performance measured e.g. by time to problem solving, depend on the service capacity and so the customer satisfaction does. The customer satisfaction will have a long term feedback on new machine sales.
In financial context service costs which are influenced by headcount will determine the service profit. When concentrating on the dynamics in the separate service system the former generated profit allows to educate and to hire more personnel if you consider service business as an own company. But as described before there are “external” influences which should be taken into consideration. So it may be necessary to spend or “invest” more money on hiring and educating in first period to increase the service business in future periods. Therefore in general it should have

been allowed by the company's internal policy to decrease a single unit's profit in order maximize the total in long-term. Certainly an increase of all standard costs should be taken in mind when thinking about profitability increase.

As one of its core function management and cost accounting at HEIDELBERG consists of an annual 5-year financial planning and budgeting process as well as the monthly financial reporting to the management. One result is the sales and profit budget for each business unit to measure its financial success as an element of the Balanced Scorecard at HEIDELBERG.
During the budgeting process the personnel planning element is one of the most important. In addition to the direct personnel costs e.g. salaries and insurances a lot of further costs are depending on the headcount a company has or wants to have. So office costs, IT costs, travel and education costs can be considered as costs variable to the headcount.
After studying and understanding the described complex and dynamic interactions it has become one of the most important challenge to set the annual financial short-term objective for each unit in order to maximize the total profit of the company in long-term focus. After using causal-loop-diagramming to understand the interactions system dynamics modelling gives the chance to make it operable and to simulate and optimise the planning parameters and target results in order to achieve the profit-maximizing in long term.

A system dynamics model to support the planning process and to maximize corporate success

Derived from the causal loop diagram in fig. 5 a system dynamics model has been developed to understand, analyse and measure the system behavior. The model is being used to demonstrate the opportunities a system dynamics simulation gives to support the planning process in order to achieve long-term success.
Simulating various scenarios including changing machine market volume, various decisions in operating service like hiring policy and machine business as well as various budgeting objectives and policies for each unit allow a quantified analysis of long term financial performance of HEIDELBERG.
The whole model can not be described here but an imagination can be given when focussing on the 3 main sectors. In the following the model elements will be shown and described in a short way.

Market model sector

In the market sector as core element the market for machines was modelled by using a TIME-GRAPH function. In addition the resulting development of the machine population was modelled like a pipeline. Depending on the age of the machines in use the market for service parts and service hour was modelled for different machine categories in that way:

*spare_parts_market [spare_parts/month] = (spare_sparts_needed/machine/month) * machines*

*service_hour_market [hours/month] = (service_hours_needed/machine/month) * machines*

All other variables used in the model concentrate on the internal structures of the company. The following picture shows the model element to simulate the development of the machine population by age.

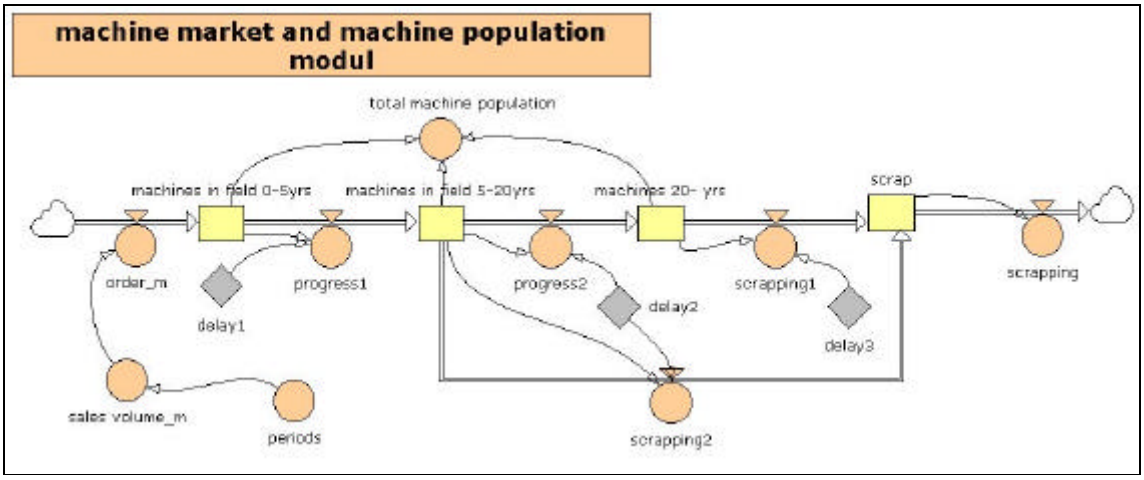

fig.6: part of the market model element

Depending on the initial population and the machine sales during the simulation time the number and age structure of the machine population is simulated. The following panel gives an overview of the machine population and its age structure at the end of the simulation run.

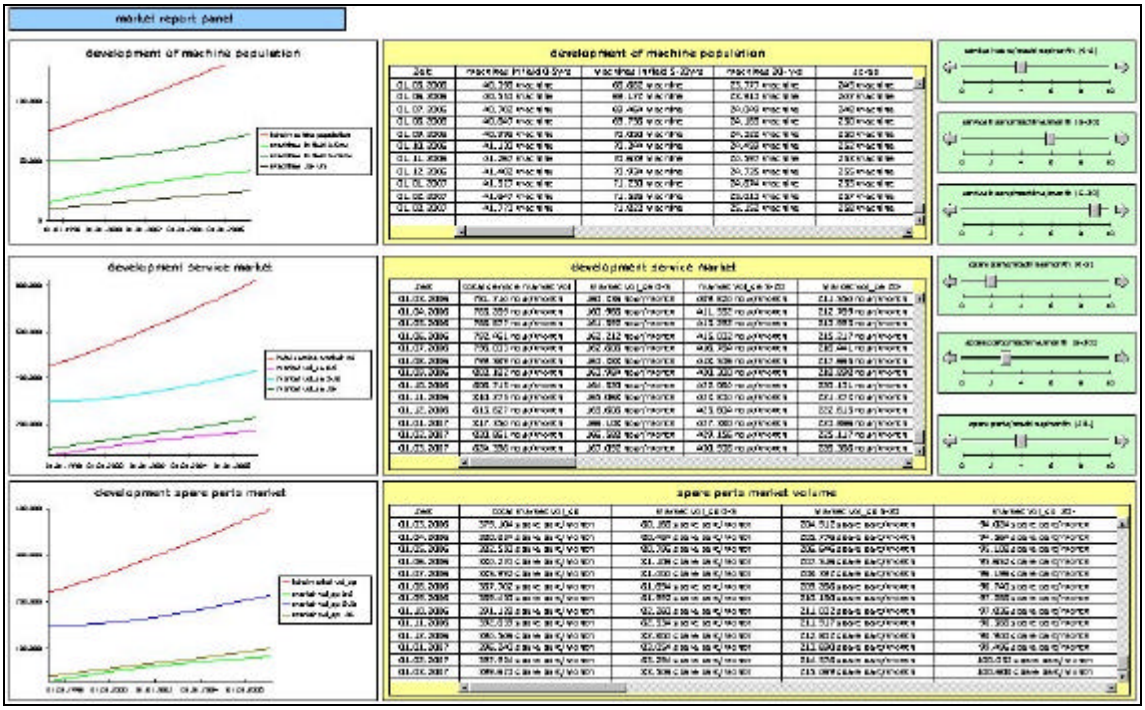

fig.7: simulation result for market sector

As a further result the simulation provides information about the service market volume in future periods. When having an idea how the machine population is characterized by age you can analyse the demand for service and spare parts at this time and, of course as the real added value it gives you a chance to invest in service capacity and logistics systems for spare parts sales at the right time. Any problems

caused by late reactions, e.g. bottlenecks in spare parts delivery because of a non-availability and long delays in problem solving because of service capacity deficits can be avoided.

Machine business model

In the machine business model the production and sales of machines were modelled. All financial key figures were included: revenues, direct material costs, direct labour costs, total cost of sales, administration headcount, personnel costs, IT costs etc.
In the following figure the simulation results are shown. They consist of a profit and lost statement for the machine sales business itself as well as of figures which show the development of machine standard price, standard cost of sales and the machine sales. For completion the development of functional costs is displayed separately.

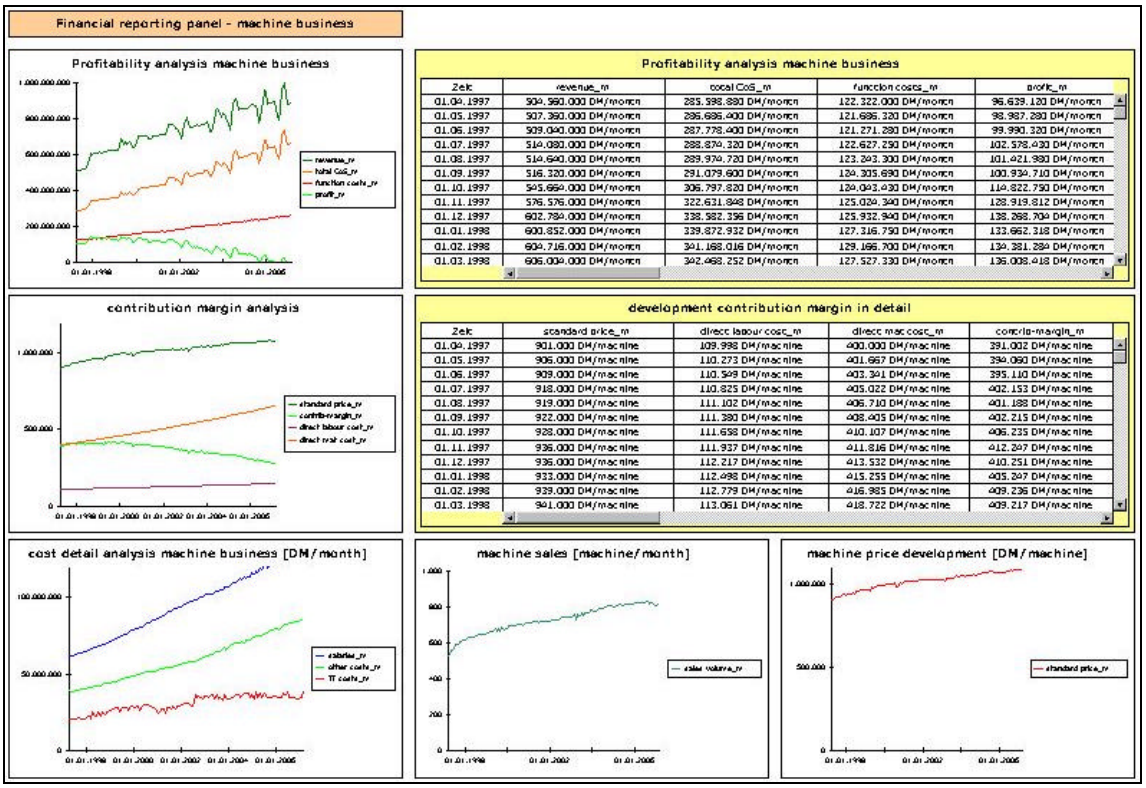

fig.8: simulation result for machine sales business

As a special sector in the model a special production chain was modelled to illustrate the various opportunities which are provided by system dynamics modelling and simulation.
In the figure 9 a production report is shown. It can be used as a strategic performance measurement tool for production departments. The model allows to simulate various developments of direct material costs per machine, direct labour costs per machine as well as some impacts on machine production rate derived from bottlenecks in production capacities. A typical delay between order, machine manufacturing and delivery can be analysed when modelling the production chain as a pipeline. That pipeline is characterized by workstations with restricted capacities:

*Production_capacity [machine/month] = ws_capacitiy [machine/month/ws] * ws-number [ws]*

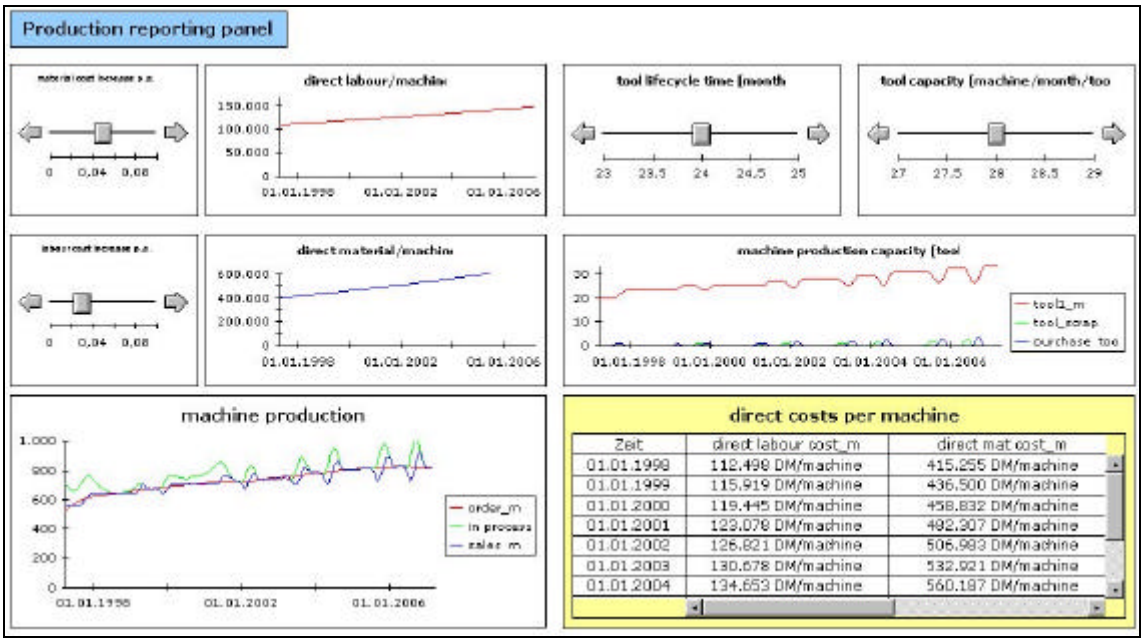

fig.9: production report as simulation result

Service model sector

The most important factor influencing the service operations and the business itself is the development of the service market volume determined by machine population.
Based on the initial service technician headcount consisting of beginners, young technicians and professionals the development of the headcount was modelled in a pipeline. The flows represent the educational process and the fluctuation of the technicians. Based on the actual headcount the total service capacity is calculated. The figure 10 shows the model element and a comparison between service capacity actual and the service capacity needed the cover the current market volume for service hours. That difference is the input for any service personnel hiring policy. In that way a full coverage of the potential service market should be achieved.

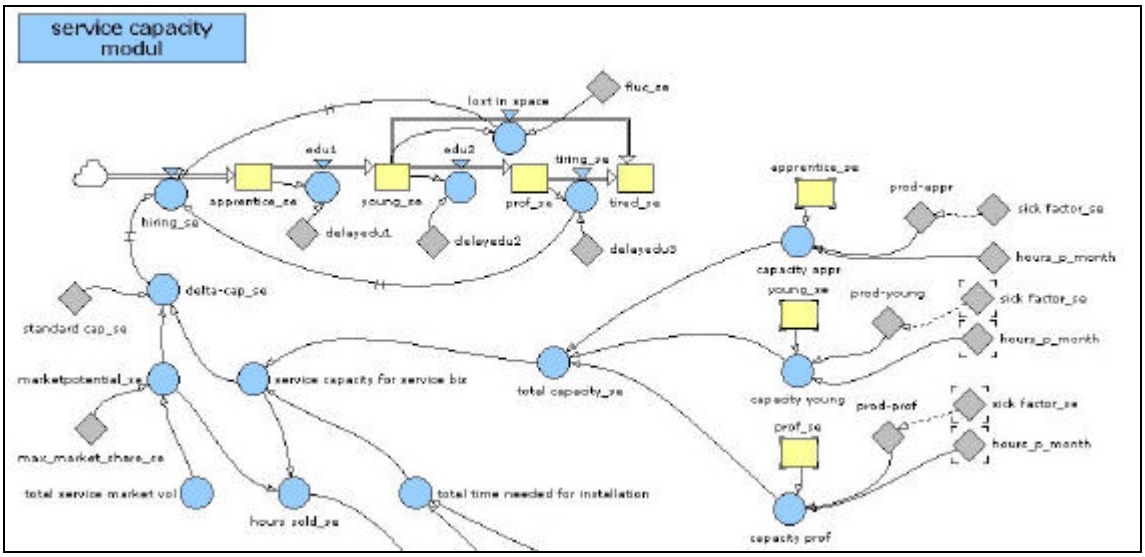

fig.10: part of the service operations model element

Service Operations Report

In the service operations model element the total service capacity was calculated from the service technician headcount and their standard productivity depending on their educational status and their sickness factor.
The model simulates the various activities done by service technicians: the machine installation time influenced by new sales and the capacity left to sell.
As an assumption in the model the total service market volume derived from the service market model element can not be covered by 100%. Instead there is a maximum of 80% market share which can be achieved when employing enough service technicians. That objective should be reached permanently. During the simulation process there is a periodic comparison between uncovered market volume and the service capacity left. Based on the result the hiring policy for new service technicians is determined.
In the figure below the development of the service technician headcount and the activity structure are shown as well as the main interesting parameters for service operations controlling. At the beginning of the simulation run there is a huge market volume not covered by the company. So there is a hiring process initiated which drives the market share in field service to the maximum of 80 % over the time.

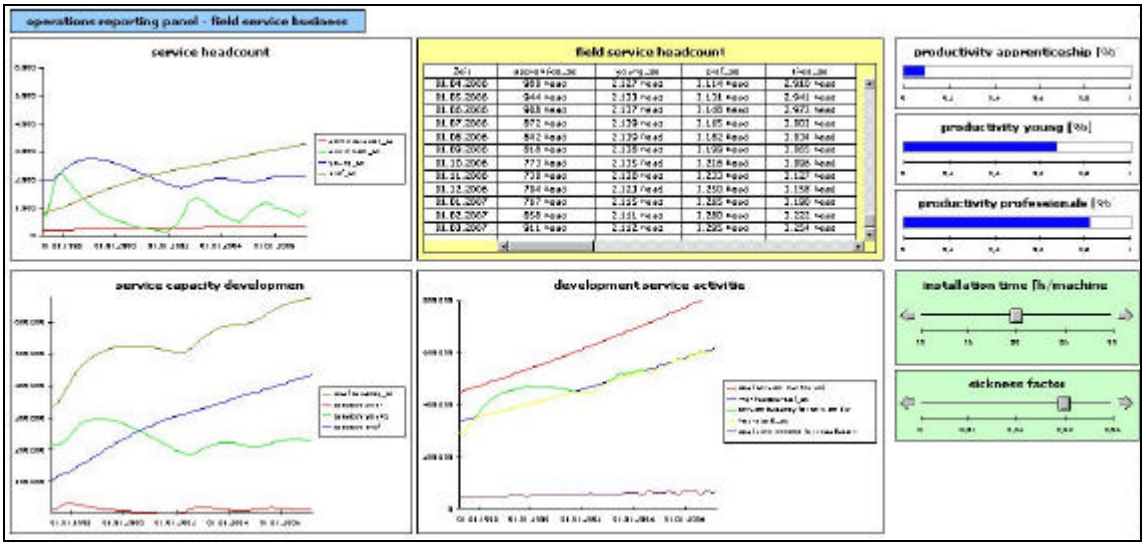

fig.11 service report as simulation result

Service Business Model

Depending on the service technician headcount and the service hours charged in each period revenues, costs and operating profit for the total field service can be calculated when modelling a price per charged hour variable and the average costs per service technician employed.

In the system dynamics model described and simulated here there some additional elements included which can not be explained here. In particular it is the service administration department and the costs there as well as the spare parts sector which represent the spare parts business in the same way like the machine business with standard prices, standard cost of sales etc.

The financial report in figure 12 illustrates the total financial performance of the service business unit.

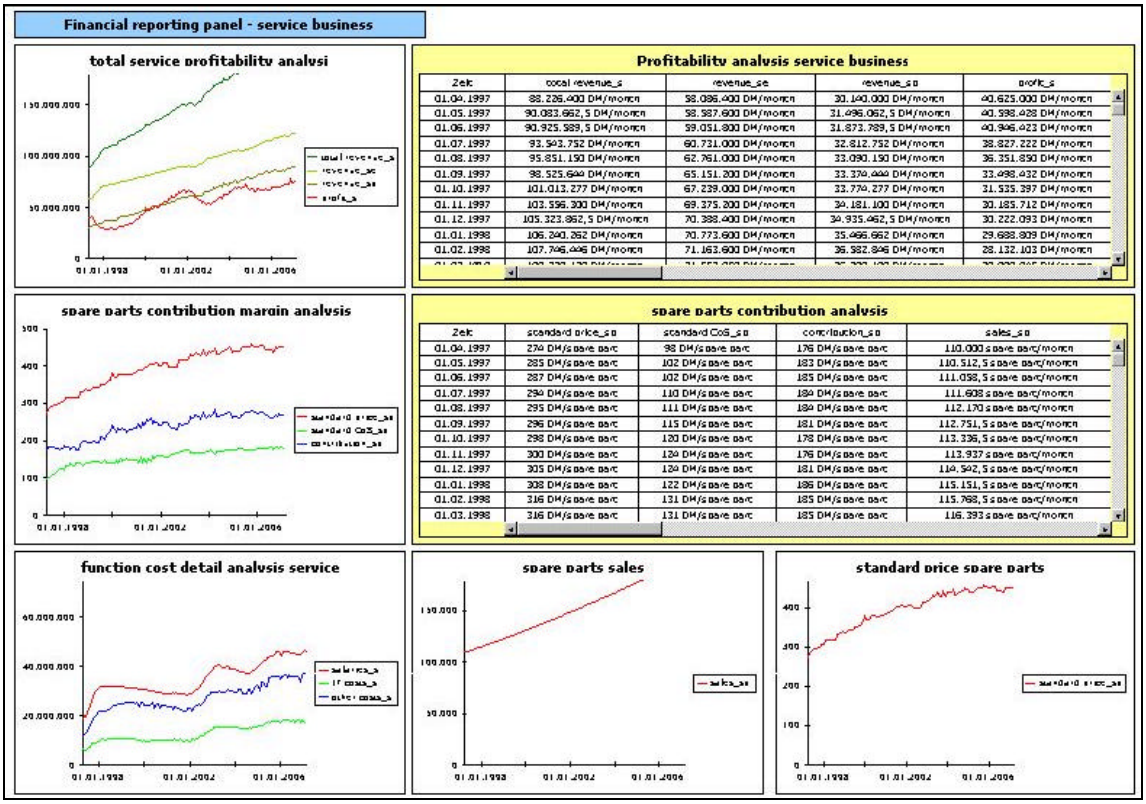

fig.12 simulation result for service and spare parts business

The intensive hiring of new service technicians lowers the profit first but after a certain time when the new personnel becomes productive a sustainable growth in revenues and profits was achieved because of the full coverage of the potential service market.

Company's main objective

The total model explained in this paper represents one company decentralized in a machine business unit and a service business unit with own revenues, costs and operating profits.

But the main objective of the whole company is to maximize total operating profit in long term. That means the machine and the service profit in sum should be maximized. The system dynamics model and its simulation described in this paper provides the opportunity to analyse different external scenarios e.g. variances in machine market volume, cost driver developments etc. as well different internal strategies, policies etc., e.g. hiring, pricing etc. by changing variable definitions. All changes in any parameter of the model or functional relationship can be examined immediately by simulating in order to analyse the impact on total company's financial performance in long term and to find the optimal strategies and decisions. So it may be possible that one unit's profit decreases while the other increases. Especially when modelling, simulating and analysing the company business units with their

activities it is very important to pay attention to the complex and often delayed relations between them.
The following figure 13 shows the total company's performance by adding the financial key figures of both business units.

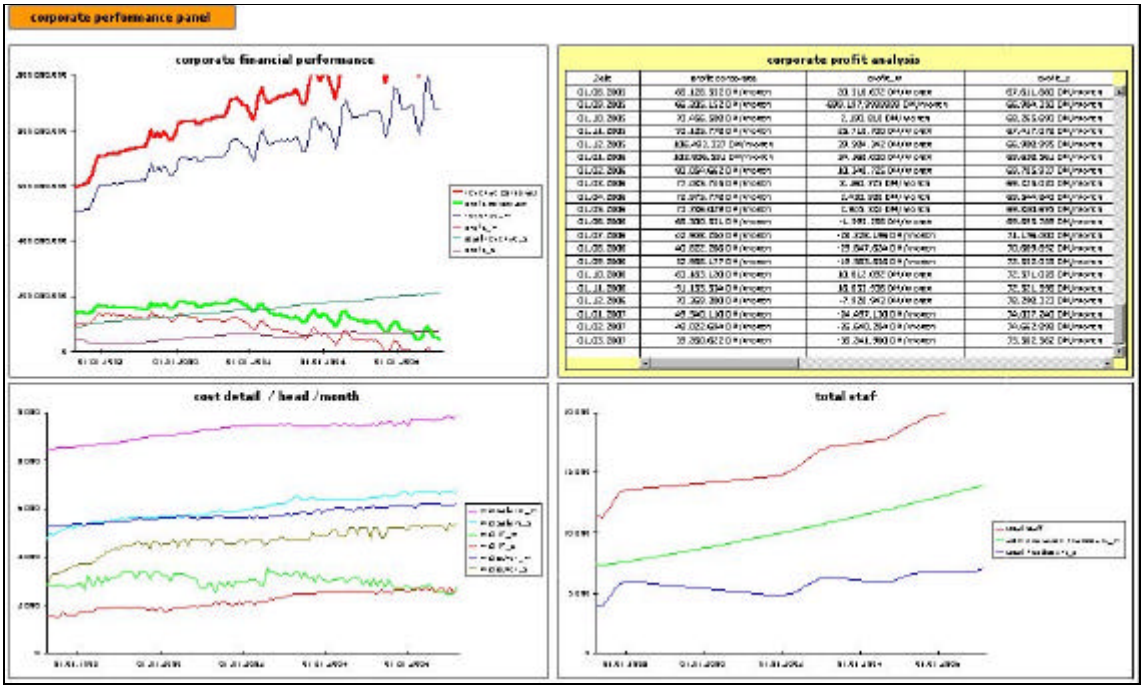

fig.13 simulation result for total company business

Conclusions

To control service business in an industrial enterprise with focus on whole company's long-term success it is very important to understand the general relationships between the machine business consisting of machine manufacturing and sales and the service business consisting of field service and spare parts sales. The real relations here may be characterized by significant delays which at first have to be discovered and understood. For explanation of that interactions causal-loop-diagramming has shown to be very useful as first step.
At HEIDELBERG system thinking is being introduced and afterwards further and more detailed system dynamics models than the model explained in the paper will be developed to support strategic planning and controlling of all service business activities to ensure a reliable and profitable service meeting all customer needs in long term.

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