DATA-MINEURS, Co.

Modeling a Start-up Business

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Abstract

Scope of the work was to point out for a large governmental research organization, the underlying dynamics of going public with an in-house developed software package. The development of the software was governmental supported, but the commercialization costs had to be carried by the organization itself or an outside investor. Therefore the development group had to be privatized. This was the hour when DATA-MINEURS, Co. was born.

Shortly after the formation of DATA-MINEURS, Co. management a system dynamics study was commissioned. The system dynamics based simulation should prove management's assumptions, surface the customer generation dynamics, and should be used as a decision tool for pricing.

Setting up a system dynamics model, as well as defining several pricing-, respectively demand scenarios, and the subsequently simulation, could help the new management generate, prove, and visualize different assumptions. Just as important, the study would investigate the probability of success for a start-up company.

Introduction

Almost every action in our business life is somehow measured, recorded, and somewhere stored on files, whether on paper, magnetic tapes, or CD-ROMs. Most of the time this data is buried in organization's "family tombs". How to find and use data sets was the core idea of a large governmental research institution's software project. A data-mining software package was thought to be profitable. Data mining is one of the hottest topics in information technology. In general, data mining is a set of techniques (essentially if-then rules) used in an automated search to explore and surface relationships in large datasets. Up to now, the term is mainly used for examination of relational databases, but it can be applied for text-based or multimedia domains too. A data mining program, for example should be able to identify out of a million order customer base, whether a customer is creditworthy or not.

A team was commissioned and programmers started developing software two years ago. In parallel, a beta test customer base established to investigate the detailed need for future customers. The development of the whole software package was supposed to take three years.

Initial investigations of software demand was optimistic for the target, within the specialized industry. But it turned out early in the project's progress, that customers had to be split up into following groups:

1. Data Collectors: Companies interested in up-dating, browsing, and "polishing up" their existing datasets.
2. Passive Data Miners: With the help of a DATA-MINEURS, Co.
3. Active Data Miners: Purchasing the whole package, with the need of software support.

For each of this groups had different demands, the size of DATA-MINEURS, Co. had to be significantly expanded to accommodate what was initially planned. The slowly increasing customer generation process made it difficult for the management to cope with future revenues, costs, headcount, software support, and customer base. The growing scale of the project, as well as the necessity of generating the market introduction costs without subsidies, impelled management to commission a system dynamics team.

System Dynamics Study

The system dynamics team of three people was formed last year in November. One technical manager, one economical advisor, and the system's modeler. Both of the managers had been exposed to system thinking and system dynamics before. The group met for one week every day in the morning and in the afternoon to lay out the causality structure and to quantify the variables, e.g. headcount, salaries, costs, etc. After each session, the system's modeler programmed what had been accomplished, which then was revised in the following session. This iterative process accelerated learning and productivity. First, it forced system to be as realistic as possible, and secondly it helped the modeler to keep with the experts, ferreting out mistakes shortly after they were made.

As there was no similar business in operation then, the system's team had to completely rely on assumptions about the underlying structure of the market and the magnitude of e.g. demand, software support, etc.

During the first session the team concentrated on defining core variables. They were differentiated between controllable, influencing, and outside variables - prerequisites for formulating a system and its simulation. Based on the identified variables the team commenced to put together the causal relationships between them.

The plumbing of the causality structure (Fig. 1) was the subsequent team's task. As a starting point the expected behavior over time was drawn first. Part I, on the left side of Fig. 1, represents the notably growing sales right after market introduction of the software. Part II differentiated between two possible futures. The first is gaining market share again, through extended research and innovation, the latter – more pessimistic – case is loosing market share due to aggressive competitors.

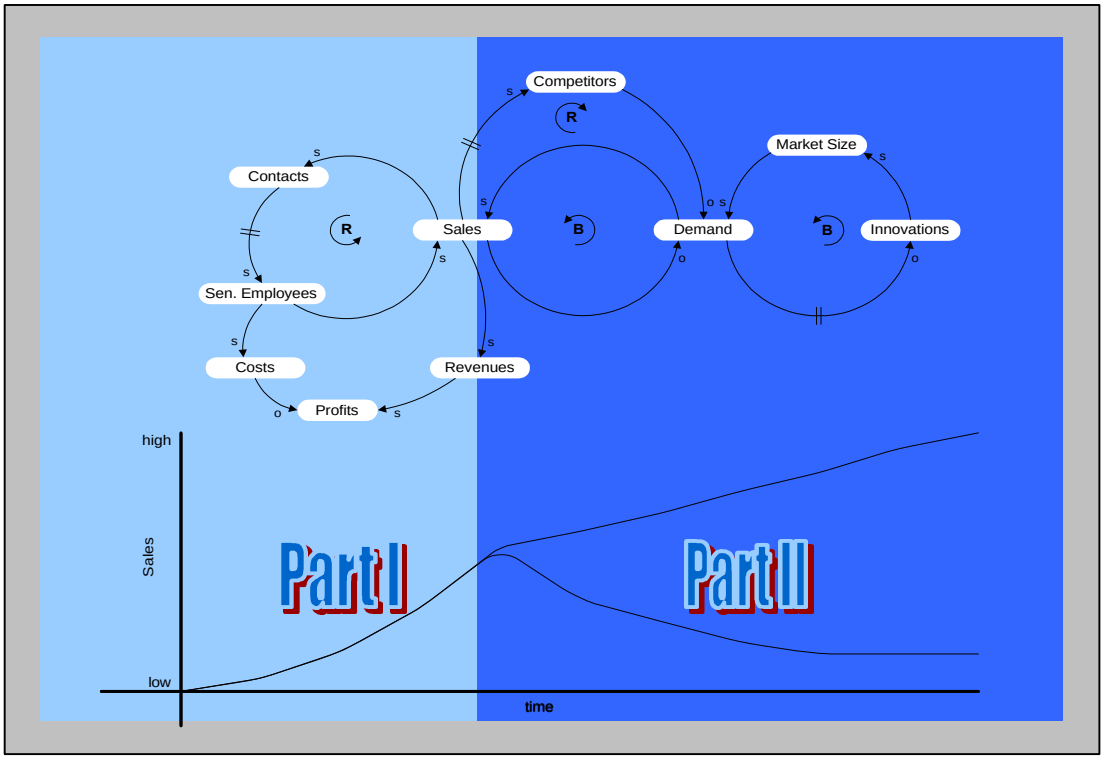

Fig. 1, Causal Loop Diagram and Sales over time

The macro causal loop diagram above of sales versus time curve comprises five feedback loops. The engine for the initial business success is the reinforcing loop to the very left of the diagram. The other loops, all balancing, were recognized to kick in later. Especially the

innovation loop and the customer support loop which were seen crucial for DATA-MINEURS, Co.'s future success.

Although the team was aware of the possibilities, as well as the long troubles ahead, the system dynamics study was intended to focus upon the start-up of the company, i.e. the first three years after commercialization. The real life assumption is: If you don't make it in three years, your changes of meeting it is almost non existent. After the team finished the daily meetings, it took the system's modeler another five days to combine all parts, debug, polishing up the stock & flow diagram, as well as preparing the user's manual. Fig. 2 gives an impression of the level of complexity of the model.

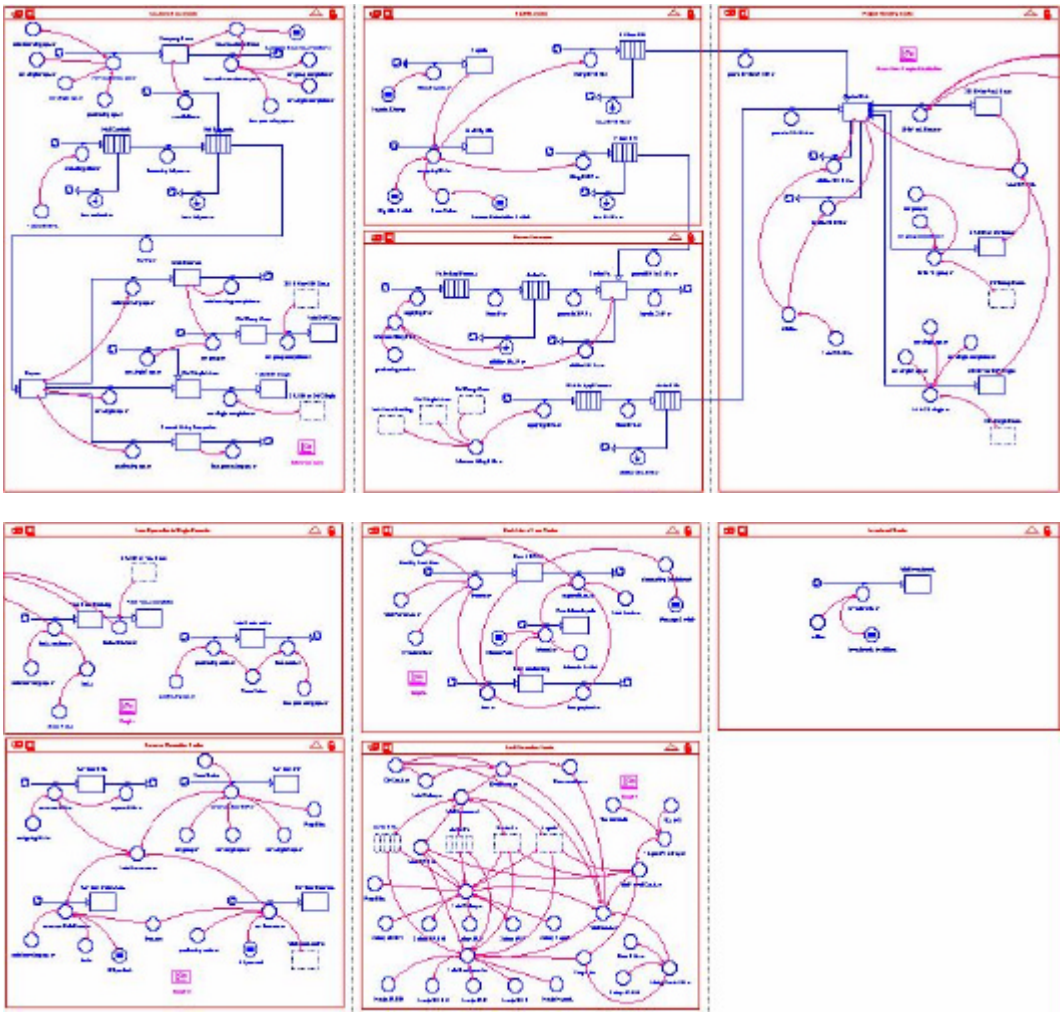

Fig. 2, The Stock & Flow Diagram

The entire model consists of 35 stocks, 46 flows, and 45 converters in 9 sectors. The formulation of the sub-models for the customer generation and the human resources sector was mainly influenced by the involved feedback structures The cost and revenue generation sectors that were modeled were straight forward, i.e. similar to spread sheet applications.

The initial runs were calculated, for easier comparison, deterministically. Also, a random generator was incorporated into the model. The front-end (Fig. 3.) displays the random switch in the upper right corner.

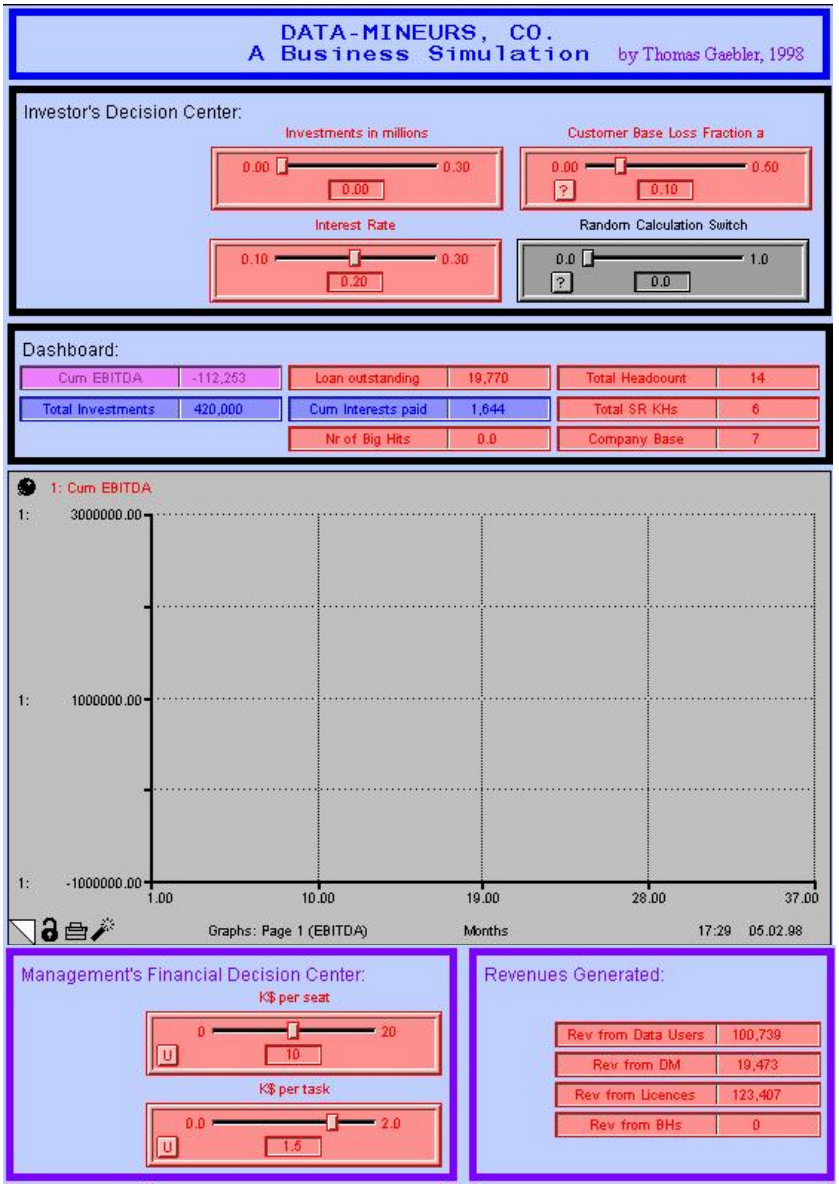

Fig. 3, The front-end

When the stock & flow model was finished, the system's team spent another day to set up and define four scenarios, for outside funding and internal funding. The scenarios summarize the possible market demand, which in return effects the pricing of the software package or the consulting services, i.e. data mining as consulting business. Outside funding implied the participation of an investor in exchange for share certificates. Internal funding, implies securing a loan. However, the loan would keep DATA-MINEUR, Co. independent, but would burden the juvenile company with substantial interests. Tab. 1 depicts the four scenarios and shows the results for all eight runs.

		Pricing		*Outside Funding*			*Internal Funding*		
Scenarios	*Run*	*Package*	*Task*	*Cum. Investments*	*EBIT*	*Run*	*Cum. Interests*	*Loan outst.*	*EBIT*
Booming	I	20,000	1,500	430,000	2,160,000	V	186,700	0	1,560,000
Consulting Demand	II	10,000	2,000	720,000	670,000	VI	355,700	195,000	97,800
Low Demand	III	10,000	1,000	830,000	340,000	VII	434,300	886,000	-37,000
Worst Case	IV	5,000	1,000	1,360,000	-19,800	IIX	596,800	1,665,000	-316,700

Tab. 1, Cumulative Earnings before Interests and Tax (EBIT) after three years, in US$

Scenario I, the most promising one, could indicate the overall success right from the start of the company. In both cases, internally vs. externally funded, the profitability of the enterprise could be proved. The cumulative earnings exceed five times the cumulative investments, and in an externally funded start-up, there is no outstanding loan at the end of the simulation period, and the cumulative interests paid sum up to less than US$200,000.

Scenario II, where the consulting demand is one third higher than initially expected, the cumulative earnings almost equal the investments over time. The total amount of interests paid sums up to more than US$350,000 and there is still a loan of almost US$200,000 outstanding.

Scenario III, with little demand in data mining at all, the cumulative investments substantially exceed the investments, and there will be the need of finding a long term interested investor. Internal funding will be no option any more, since the cumulative interests paid within the first three years exceed US$400,000 and the outstanding loan is still US$886,000.

Scenario IV, the worst case scenario with a price war, will certainly lead to bankruptcy of DATA.MINEURS, Co., when it is impossible to make money at all within the near future. The acquisition of an investor will not be realistic any more. An outstanding loan of US$1,665,000 plus almost US$600,000 of interests paid seems to testify the crash of the company.

Conclusions

The undertaken system study could prove several assumption and perceptions of the newly constituted management of a start-up company. Although the system dynamics study did not come up with smashing news (and it wasn't expected to), it could offer following help:

- Understanding the causal structure of the start-up company.
- Unveiling the dynamics of the initially acting reinforcing "sales-employees-contacts-sales" loop.
- Defining the most probable scenarios the new company might face.
- Calculating the different pricing strategies.

A future task will certainly be the extension of the existing start-up model to a full scale business simulation, where aggressive competitors join the limited market. Therefore the simulation period will have to be extended from three to six years.

The authors experience dealing with start-up companies, clearly show a naivety by "first timers" because of the lack of understanding of the dynamics particular to a start-up venture. As a consequence most start-ups fail. Realistically, many system dynamics model will not change all outcomes, but there is a possibility that the application of such models as presented in the paper could help improve the odds for success.