

# Using systems thinking to better understand the implications of e-business strategies.

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## ABSTRACT:

*Many companies are making strategic decisions in relation to e-business without a full understanding of the implications. This paper, through the discussion of a case study, will show how systems thinking techniques can assist businesses to make better strategic decisions in relation to e-business.*

*Keywords: e-business strategy, B2C, systems thinking, system dynamics*

## INTRODUCTION:

The world of e-business is growing exponentially with estimates eclipsed almost weekly as new technologies to utilise this 'e-world' are becoming more prevalent. This current environment requires companies to react quickly to the opportunities presented or face loss of market share to competitors. The pace of change is so fast that it is easy to get carried away by the spirit of e-business and decide that the best strategy is an 'e-strategy' without a thorough understanding of the associated operational risks.

This paper will present a method of identifying and understanding both the risks and opportunities of investing in e-business. The demonstration of this will be done using systems thinking techniques in the form of causal loop diagrams. System dynamics will also be discussed.

It is outside of the scope of this paper to describe the process of systems thinking and building system dynamics models, however, the interested reader can refer to the following texts for reference: Forrester (1961), Richardson & Pugh (1981), Venix (1996), Sterman (2000).

This paper presents a case study based on recent assignments that the author has been involved in. The case study is based on a fictitious company in the consumer packaged goods industry called Compago. This industry has been greatly affected by the ability to use the internet to sell products direct to consumers (B2C – business to consumer). The case demonstrates the fact that mental models of the perceived benefits of e-business strategy can be overly optimistic. It also highlights the dynamic complexity of e-business strategy by identifying the multiple feedback loops that exist and shows how the tools of systems thinking and system dynamics can be used to better evaluate the merits of e-business strategy.

## Case Study

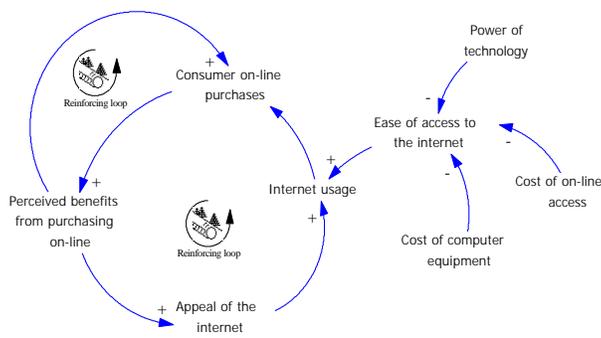
Compago wanted to maintain, if not better, its competitive advantage through an investment in e-business to enable the company to sell directly to consumers via the internet (B2C). At the time of the assignment

Compago sold its products via a network of distributors and did not sell direct to consumers. The management team felt that Compago products were well suited to being sold over the internet because they were all relatively high volume products which were non-perishable, easily transported and were currently expensive to consumers due to the mark-up from distributors.

Prior to the author being involved in this assignment the Compago management team had seen a report showing the increased use of the internet by consumers to purchase products and they believed that the number of consumers buying products on-line was growing exponentially. They believed that the growth was attributed to a number of factors: increased access by consumers to the internet, positive word of mouth from satisfied customers who then influence more to become involved, reduced cost of computer equipment, increased processing power of computers and modem technology as well as the reduced cost of accessing the internet.

From a systems thinking perspective the management team was initially attracted to the following underlying structure that causes an increase in consumer on-line purchases over time, presented in Figure 1 as a causal loop diagram:

**Figure 1: Feedback structure underlying the increased use of the internet to make purchases**



It is a fact that the use of the internet and using the internet to make on-line purchases is growing, fuelled by the reinforcing loops described in Figure 1. The Australian Bureau of Statistics data states that 6 million (44%) of Australian adults accessed the internet in the 12 months to Nov 1999 compared to 4.2 million (31%) in 1998 and 6% of Australian adults purchased goods over the net in the 12 month period to Nov 1999 compared

to 2.7% to Nov 1998 (ABS 1999). Also, a recent PwC survey shows that executives expect e-business to provide five times the revenue it does now (PwC 2000).

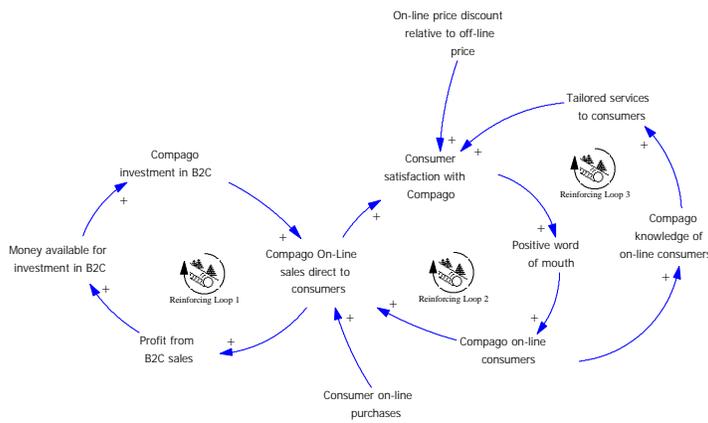
The Compago management team felt that sales of their products over the internet would grow in line with other on-line purchases and also sales direct to consumers would be at a higher margin which would increase the profit and value of the company. They also thought there would be some sort of a prestige factor as a result of the investment as they would be first company in their niche market to sell direct to consumers via the internet. It was felt that the combination of these factors would lead to a share price increase and since most of the management team had stock options so this seemed like a very attractive strategy indeed.

In addition to the benefits of the investment, Compago were concerned about the risks of not investing. They were concerned that if they did not act then there was a risk that either an existing competitor or a new entrant could use the technology of the internet to create competitive advantage at the expense of Compago.

The Compago management team therefore decided that an investment in B2C was required, however, PricewaterhouseCoopers were asked to assist the management team in further assessing the merits of this strategy and offer advice on how to implement the B2C investment.

The author was part of this PwC team and held a number of interviews with the management team. It was quickly evident that the team was in favour of the investment in B2C for the reasons noted above. The management team had intuitively identified a reinforcing loop structure that they felt would justify the investment. A simplified explanation of the reinforcing loops identified by the Compago management is shown in Figure 2 below:

**Figure 2: Initial reinforcing loops to justify the e-business strategy**



It was expected that the initial attraction for consumers would be the fact that they would be able to purchase the product more cheaply and have it delivered to them as opposed to them having to purchase the product from a retailer.

The main reinforcing loop in Figure 2 that attracted the Compago management was 'Loop 1'. The expectation was that an investment in B2C would bring

added profit to the company. The more sales over the web, the more profit would be created from the strategy which could then be reinvested to fund further investment in its B2C capability. This investment would improve the quality of the B2C service which would further increase sales to consumers. The expectation was that both sales and profit would grow exponentially.

A second reinforcing loop, 'Loop 2', existed because the management team felt that the benefits the consumer would receive as a result of being able to buy direct from Compago over the internet would increase consumer satisfaction which would create positive word of mouth attracting more consumers and greater sales.

The management team also identified a third reinforcing loop, 'Loop 3'. As the number of on-line consumers increased, they felt that Compago would gain knowledge of the consumers which would enable Compago to create tailored services for consumers which would further increase consumer satisfaction and then further increase on-line sales.

In summary, the management team expected that profit from the B2C investment would grow exponentially as the success of the B2C strategy would fuel more success. Without any further analysis this would appear to be a 'no-brainer' as so many e-business strategy decisions have 'appeared' to be. The types of comments you can hear from people in this situation are: *"The investment will be self funding in a few years"..... "this is a win win for us and our customers"*. It is very easy to get carried away with e-business and the appeal of the reinforcing loops identified above. Indeed, this environment of overly optimistic thinking also led to the

investment communities over valuation of dot.com stocks and companies that have announced that they had an e-business strategy. However in these types of systems there are usually limits to growth, since nothing can grow forever. These limits need to be taken into consideration as they inhibit the expected exponential growth in the number of on-line sales.

A further series of interviews and workshops were held with the management team to identify factors that could limit the success of this strategy. Below is a summary of the main factors which required further consideration before the true merits of the B2C investment could be assessed:

- *Logistical concerns:* Did Compago have the appropriate delivery network to be able to deliver to the doors of the consumers within a reasonable time? Could the quality of the distribution company damage the reputation and brand value of Compago?
- *Financial management issues:* Did Compago have the appropriate sales ordering systems to cope with the sales of product to small consumers as opposed to the large distributors that Compago was used to?
- *Impact on the existing business:* How would the current distributors react to the news that the company had just tried to cut them out of the business? Would they fight back? Will Compago staff be so excited by the fact that the company had now entered cyber space that the focus on the current sales channels would suffer?
- *Organisational design:* Could the existing organisational design cope with the new opportunities of e-business? Should the company set up a new business unit to handle the on-line sales or should it be integrated into the business as a whole?
- *Funding:* Where would the funding come from to start the investment? Would it be taking funds from elsewhere in the business that offered a greater long term return on the investment? If so, what was the opportunity cost of the forgone investment? What would be the total cost of this strategy? e.g. cost of training staff, developing the technology, added logistical costs etc.
- *Change management issues of the consumer:* How easy would it be to change the buying behaviour of the consumers? Could it be that the consumers enjoy the experience of buying the product from the distributor? Would there be any security or privacy concerns of the consumer in relation to sales over the internet?

Each of the factors above can be used to create balancing loops to describe potential limits to the success of the proposed B2C strategy. During the assignment a detailed model was created which captured all the thoughts of the management team. For the purposes of this paper a summary of the effects of some of these factors are shown in Figure 3:

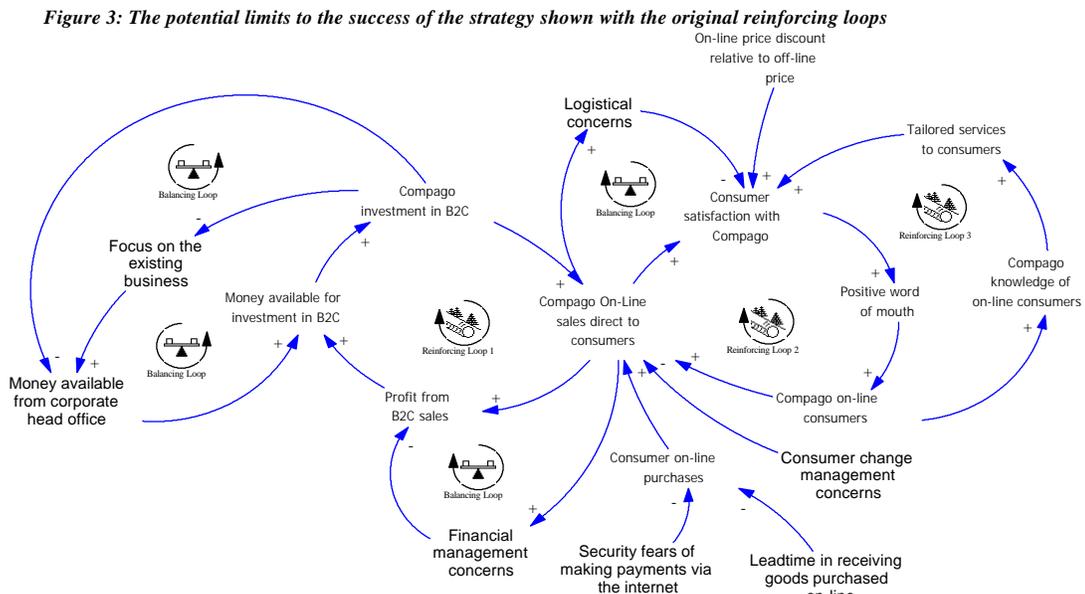


Figure 3 simply identifies the important factors and the causality between them in relation to the decision to invest in B2C sales. The diagram identified that there were some potential inhibitors to the success of the proposed strategy and also showed that the initial mental model of the management team, in Figure 2, was incomplete and overly optimistic. The Compago management team decided that these issues warranted further assessment before investing in its B2C capability.

At this stage of the assignment the Compago management team commented that the tools of systems thinking which they had been introduced to, specifically causal loop diagrams, were a powerful communication and knowledge capture tool. The management team said they knew there were obviously some downside to their strategy to invest in B2C but they had never before used an analytical tool where ideas from throughout the organisation could be captured concisely in one model that everyone could understand. The causal loop diagram improved the ability of the management team to discuss these complex issues in a way that they had never been able to before.

The one concern, however, was that there were some disagreements about the importance of individual loops to the success or otherwise of the strategy. It was accepted that to gain further understanding of the impact of the feedback loops a quantified model would need to be developed. Therefore, the next issue was to decide which modelling tool was most suited to not only quantify the relationships described above but also to allow for scenario testing and alternate policy analysis. Due to the dynamic nature of the issue and the existence of feedback the author recommended that system dynamics be used.

System dynamics is a methodology for understanding complex problems which are dynamic and which involve feedback (Forrester 1961). Once developed, the model improves the ability of management to assess the future impacts of the proposed strategy by developing a management flight simulator (Sterman 1992). The management flight simulator allows management to see the impact of their strategic decisions in a short time period so that there is a greater opportunity to gain a deeper understanding of the strategy prior to implementation.

Once the system dynamics model was built, Compago management could simulate the effect of the strategy on the company over a five year forecast period in the space of a few minutes. Alternate scenarios and strategies could be explored to assess the impact on the company. The system dynamics model brought to life the causal loop diagram. Each of the feedback loops were incorporated into the quantified computer simulation. After each simulation run, the results of a model should be used to search for leverage points (Richardson & Pugh 1982). For the Compago management team this became the search for a set of strategic decisions that would maximise the potential for success of their e-business strategy and minimise the risks.

An example of the factors that the Compago management team were able to assess once the system dynamics model was developed is shown below:

- Different estimates of the response of the current distributors to the news that Compago would be selling direct to consumers. Quantification allowed estimates to be made of how successful the B2C investment would have to be to compensate for the lost revenue from the existing customers
- Different estimates of the take up rates for consumers were assessed based on consumer satisfaction and word of mouth effects to calculate the likely distribution requirements.
- Different investment options to fund the B2C investment were investigated. For example, should Compago invest heavily at the launch stage of its B2C investment or should there be a small initial investment and then reinvest the profit.

All these options and more could be assessed using the quantified model and the financial outputs generated allowed Compago to better understand the impact of the B2C strategy prior to implementation. The key risks were identified and appropriate steps to compensate for Compago's lack of capability in certain areas were discussed.

Although it is impossible to predict the future, through the development and use of a well built system dynamics model you can gain a thorough understanding of the structure of the system which drives the behaviour (Forrester 1961) and confidence to make more informed business decisions (Lyneis 2000) and the ability to monitor performance more effectively.

The management team was left with a model they had confidence in and one which was used as a powerful learning tool.

## **Conclusion**

Systems thinking and system dynamics are valuable tools to assist in evaluating e-business strategy as there is a great deal of complexity and feedback between the various opportunities and risks.

The interrelationships can first be mapped using the technique of systems thinking before the significant relations are identified and further explored by developing a system dynamics model. This model can then be used for scenario analysis and testing of alternate strategies which facilitates team learning and preparation prior to implementing the strategy.

## **References:**

- Forrester, J.W. 1961. Industrial Dynamics. MIT Press: Cambridge, MA.
- ABS, 1999. 8147.0 Use of the internet by householders, Australia Nov 1999
- Lyneis J.M. System Dynamics for market forecasting and structural analysis. System Dynamics Review Vol. 16, No.1, Spring 2000. J Wiley, Chichester, UK
- PricewaterhouseCoopers (PwC), 2000. Electronic Business Outlook for the new Millennium
- Richardson G. and Pugh A. 1981. Introduction to System Dynamics Modelling. Productivity Press: Portland, Oregon
- Stermann J.D. 1992. Teaching Takes Off: Flight simulators for management education. OR/MS Today (October), 40-44
- Stermann J.D. Business Dynamics: Systems Thinking and Modelling for a Complex World. Irwin McGraw-Hill, Boston.
- Venix, J, 1996. Group Model Building: Facilitating Team Learning Using System Dynamics. J Wiley: Chichester, UK.