How take advantage of the Systemic Leverage Analysis to obtain a more insightful Learning Laboratory

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ABSTRACT
Many tools, within the system dynamics world, have the advantages of identifying, capturing and transferring the essence of the understanding of a person in a model. This is the case of the learning laboratories, that provides a user-friendly interface with which the experts and non-experts learn from the model based on practice. The Systemic Leverage Analysis (SLA) , a tool created by The Strategic Decision Simulation Group (SDSG), is very good obtaining interesting insights from the causal diagram that can be applied on the construction of the lab. This paper explains how to combine these products in order to obtain a more insightful product to a client in a consulting process.

LEARNING LABORATORIES

As people work and live in their immediate environment, they grow their experience, knowledge and intuition about life in that environment. Their understanding of the environment is implicit in the mental model which they carry with them. When they leave the environment, all of their understanding leaves with them. How can we capture and transfer this implicit knowledge?

Learning laboratories are easy to use interactive interfaces (dashboard) that allow management to "fly" a company into the future, making different strategic decisions under different scenarios. In the consulting process, it is recommended that the consultants use a participatory approach to create them. This gains credibility of the model with the client. Managers may test or validate existing strategic initiatives as well as formulate new ones and evaluate the performance of the specific company looking forward under changing conditions. The purpose of each lab is determined by the client.

SYSTEMIC LEVERAGE ANALYSIS

As a consulting group, SDSG has developed a diversity of analytical tools to help their clients to gain deeper understanding about the system they are working and living in. One of our main products is the SLA. A brief description of this analysis will be explain in the following lines.

To obtain leverage within systems requires understanding: (1) the system's overarching purpose; (2) how the system-wide structure wants to behave; (3) how the "local" structures wants to behave, and (4) how system-wide and local rationales affect each

other (Ritchie-Dunham, 1997). There are a variety of tools integrating this analysis which provide insight into these issues.

Archetype analysis.- Describes at a very high level of aggregation how the system will tend to behave. It identifies strong and poor leverage points within the system. When combined with trend and matrix analyses, it tells how movement in each variable may be frustrating or alleviating system-wide problems (Senge, 1990).

Quadrant analysis.- Identifies each variable's leverage within the system. Influence determines how much the variable affects the system, thus the importance of understanding how its movement impacts system behavior. Exposure determines how sensitive a variable is to the movement of other variables, thus the management coordination necessary to affect a change in the variable.

Systemic view of organization map.- Determines the role different organizational groups play in pushing or pulling on these common variables, giving insight into why the variables behave as they do and the organizational difficulties with moving them.

Performance indicator analysis.- Describes the current metrics used at the traditional, functional level and proposes new performance indicators. "Lagging" or historical performance indicators show how the system performed historically (e.g., the odometer reading indicates how many kilometers the car has traveled.) "Leading" or predictive performance indicators show how the system is performing and probably will perform in the near future (e.g., oil temperature is a predictive measure of motor failure).

THE COMBINATION

Before identifying the value of each product of the SLA in the learning laboratory elaboration process, an example will be define in order to have a clear illustration of the concepts.

Example - A Small Family Business in a Competitive Market

Despite the fact that the company desires to be a strong competitor in an increasingly demanding competitive market, it has been facing problems, among them difficulty in meeting market demand, low customer satisfaction due to high order backlogs and decreasing market share. More people are buying from the competition even though the product has excellent quality. In spite of hiring more salesman to increase sells, profits and sales keep on dropping.

Archetype analysis is a big part in this process. It determines the learning we want to transmit at the end of the experience. After playing with the laboratory the user would be able to see the elements (variables, delays, relations or even a whole loop) which they have been missing in the structure. And once they identify the archetype, they will be able to create a entirely new, and more effective strategy.

The diagram on figure 1 describes the structural pattern template for the Growth and Underinvestment archetype. The archetype describe that growth approach a limit which can be eliminated or pushed into the future if the firm, or individual invest in additional "capacity". But the investment must be aggressive and sufficiently rapid to forestall reduced growth, or else it will never get made (Senge, 1990).

Archetype Generic Behavior

When organizations see market share slipping, this archetype shows us that they typically respond by focusing on the Business Cycle with efforts to increase sales through sales promotions and acquiring new sales people, as long as their "more product and more salespeople" formula works.

This assumes that, with growth, they are not concurrently working on increasing operational and sales efficiency, which in the long-term limits Sales growth.

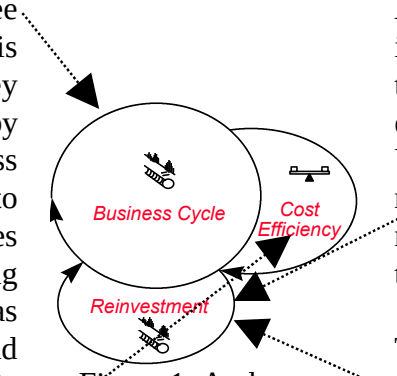

Figure 1. Archetype

Implications

As they increase price to meet increasing costs, demand for their product decreases, eroding the number of Finished Units Sold and management's reinvestment in Capacity, thus reinforcing the eroding ability to meet the demand.

The problem is worsened by the inability of management to respond quickly to increases in sales with corresponding capacity increases, which eventually increases sales backlogs, driving down future sales, which only exacerbates the problem, bringing in fewer revenues and decreasing reinvestment.

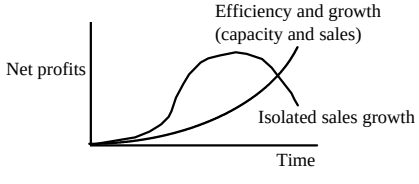

Figure 2. Behavior over Time

Figure 2 shows how net profits behaves over time. Pushing solely on sales for growth will accelerate both in short-term growth and the long-term demise of the system. Focus on operational efficiency and consistent growth in capacity and sales.

It is necessary to design the laboratory in order to show the situation in which the company is involved. In the lab, it is recommended to provide information regarding the current situation. Most of the time, the user will try to grow the company with sales promotions and hiring salesmen and cutting costs by limiting purchases of new production capacity. As the simulation progresses, pop-up information can be used to add pressure from the shareholders to improve results. After the simulation, the creation of a didactic, learning module could be included to help explain why certain behavior occurred. Herein lies the richness of the learning lab-after failing, the user can go right back and try again with the new knowledge obtained in the prior sessions of simulation.

Quadrant analysis provides to the lab the elements to create the dashboard.

- Q1- variables within the system with high leverage, shows the levers with more impact in moving the system.
- Q2- variables with high leverage and high exposure, identifies some policy levers and some performance indicators, depending on the nature of the variable.
- Q3- variables with high exposure, provides the indicators which are going to change the most with any change in the system. Generally they are outputs of the system.

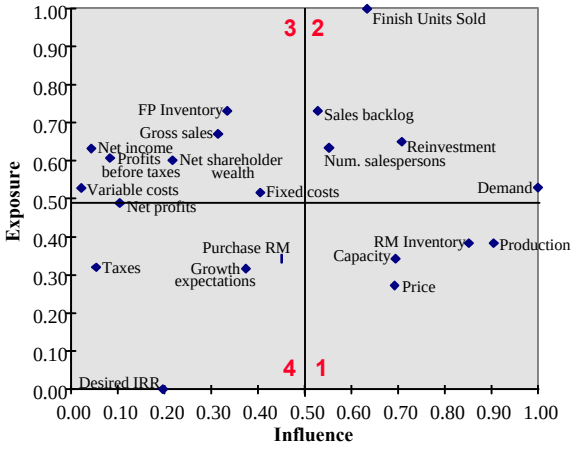

Figure 3. Quadrant Analysis

In the case study, some important variables have been identified by the quadrant analysis in figure 3:
Q1- *Levers***:** Price, raw material inventory, capacity.
Q2- *Levers***:** Reinvestment, number of salespersons. *Indicators***:** Sales backlog, demand.
Q3- *Indicators***:** Cost, net shareholder wealth, net profit, gross sales.

In this case, two variables of quadrant four are important to be included in the dashboard.
Q4- *Levers:* Raw material purchase. *Indicators:* Desired IRR.
These exogenous, corporate variables have relatively low interrelationship within the system. However, strongly affect investment decisions.

The systemic view of organization map helps to identify the most important areas within the system. It also helps identify which dashboards to create. Besides, it indicate which levers and indicators should be common to all dashboards within the learning laboratory.

The diagram on figure 4 describes the role different organizational groups play in pushing or pulling on common corporate resources, as well as the formal and informal incentives for each group's behavior within the company.

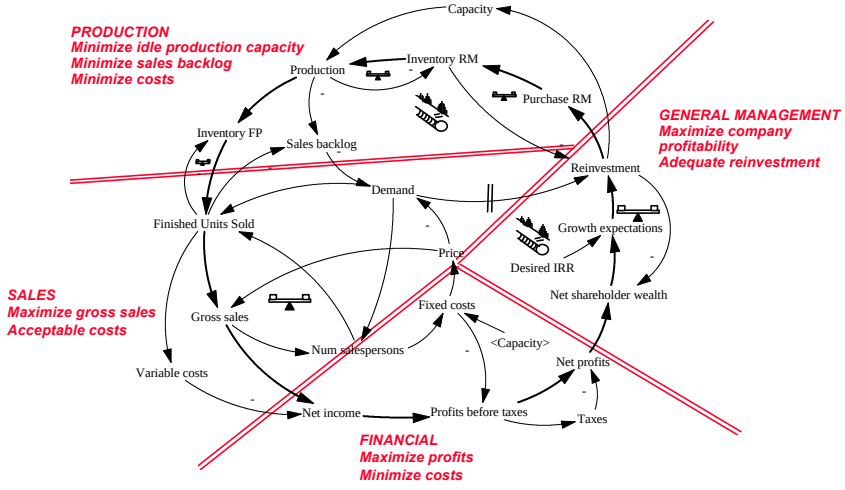

Figure 4. Systemic View of Organization Map

In this case, there will be four dashboards (or four separations in just one dashboard), in order to reflect the situation within the company: sales, production, financial and general management. If the idea is to reflect the communication problems within the company, four dashboards with four people interacting all at once would be effective. If the intent is to stick to the archetype situation, maybe the best policy would be to use only one dashboard and one user in the manager role.

The performance indicators identify the variables which need more attention in the system, either by area or as a whole company.

In table 1 is a summary of the traditional performance indicators that were used in each functional area within the company, proposed performance indicators based on the current analysis as well as the core competencies to be developed as a result of using proposed indicators.

Functional Area	**Performance Indicators**			**Proposed**
	Traditional	**Proposed Lagging Indicators**	**Proposed Leading Indicators**	**Core Competencies**
Sales	Total sales Sales per salesman	Deliveries per salesman Losing clients	Sales backlog / total sales Sales change (%)	On time deliveries Customer service
Production	Production costs Installed based used	Production time by order Sales backlog Inventory cost	Production capacity Inventory	Operational efficiency
Financial	Net profits	Gross sales / profits before taxes	Cost efficiency Net profits change (%)	Long-term decision approach
General Management	IRR Shareholder wealth Company growth	Annual growth IRR of capacity investment	Capacity reinvestment percentage Raw material reinvestment percentage IRR change (%)	Investment decisions efficiency Strategy strength

Table 1. Performance Indicators

It is important to identify whether these variable are leading or lagging indicators. "Leading," or predictive, performance indicators will be represented by indicators such as numeric displays or warning devices. "Lagging," or historical performance indicators will be represented by graphs or tables.

CONCLUSIONS

Using the Systemic Leverage Analysis enriches the insights gained through learning laboratory by adding rigorous analytical tools that can be used for teaching key insights. By adding the archetype analysis, the user gains understanding from the highest systemic level. In the quadrant analysis, the relative importance of key variables is explored. The systemic view of the organization map highlights how different incentives drive behavior in each functional area, often times at odds with the overarching goal of the system. With the performance indicator analysis, the user moves from system dynamics tools to hands-on, business management tools to improve their understanding of their system's behavior. In sum, learning laboratories are effective mechanisms for creating and transmitting knowledge and are made even more effective by creating them together with the Systemic Leverage Analysis.

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