

According to the Goal: How Eliyahu Goldratt Helps Organizations Examine Their Processes to
Achieve Maximum Results

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Bio:

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Abstract:

Eliyahu Goldratt's Theory of Constraints has helped companies around the world improve their profit margins by effectively managing business processes. Goldratt first introduced his theory in 1984 in the book, *The Goal: A Process of Ongoing Improvement*. This essay summarizes Goldratt's book and explains the business model he proposes. The model is expanded in his later book, *The Theory of Constraints*. Goldratt's business model is examined in a case study of i2 Technologies. i2 Technologies is one of the fastest-growing companies in the world and supplies software to businesses to help them function according to the Theory of Constraints. The success story of i2 Technologies explains why managers in the world's top companies embrace Goldratt's model to overhaul the traditional business processes to become more efficient and profitable.

Introduction

Eliyahu Goldratt is one of the most influential people in business process analysis. His world-renowned book *The Theory of Constraints* has overhauled company structures around the world. *The Goal: A Process of Ongoing Improvement* was published prior to *The Theory of Constraints*, but includes the core ideas that Goldratt expands on in the latter book.

The Goal is unique because it explains a business model in detail through the use of fiction. In fact, the story includes many personal drama elements. Alex, the main character of the story, has extensive marital problems because he spends too much time at the plant and ignores his spouse and children. Alex eventually balances family life with his career, but only after the deep consideration of business processes and time away from his family.

In order to promote his ideas further, Goldratt founded the Avraham Y. Goldratt Institute (named after his father) in 1996. Over the years, Theory of Constraints (TOC) experts have expanded his model and contracted with businesses to improve their bottom line potential. By now, the TOC model has been applied to diverse industry sectors, including aerospace, automotive, construction, defense, distribution, education, health care, manufacturing, services, semiconductor, technology, and telecommunications (AGI-Goldratt Institute, 1996).

The list of clients that the AGI-Goldratt Institute serves is impressive. Not only does it include over 50 companies, but among them are some of the world's most renowned companies such as 3M, Boeing, General Motors, Intel, and Lockheed Martin. Goldratt's TOC has proven to be the most effective way to structure a business, regardless of the business type. Any business will have constraints that directly affect its ability to increase its net profit (bottom line).

This essay summarizes Goldratt's *The Goal: A Process of Ongoing Improvement* and the business model he proposes. I will also conduct a case study on i2 Technologies, a Dallas-based

supply chain management company founded in 1988 and based on Goldratt's TOC model.

Today, i2 Technologies helps companies such as Nokia, Siemens, and IBM improve their net profit and eliminate inefficiencies.

Summary of Book

The Goal: A Process of Ongoing Improvement is a work of fiction describing a very real thing—the process of manufacturing a product. This includes the engineering and production process, marketing, sales, and interaction with corporate and regional headquarters. As an employee in a corporate contract manufacturing environment, I felt that this was not a work of fiction at all. In fact, this book describes “my plant” in many instances.

The main character in the story is Alex Rogo. He is the plant manager of a UniWare division plant in Bearington. Readers are never fully introduced to what kind of products they make, but soon learn that UniWare requires heavy machinery and elaborate engineering processes to manufacture their products.

Alex's plant has not been profitable for some time, and the division president informs Alex that the Bearington plant will be closed within 3 months unless there are visible improvements. Alex decides that he will not give up on the plant because it is in his hometown and he has an increased sense of responsibility for the plant's future.

In order to overhaul the plant, Alex contacts his former professor, Jonah. Curiously, Jonah is a physicist, yet Alex remembers a meeting with Jonah a few months ago during which Jonah questioned Alex's business decisions. Alex was scheduled to give a presentation at a UniWare division meeting, but Jonah raised particular questions about the way Alex defined productivity and efficiency in his presentation. Alex was upset about this because he has an M.B.A., yet he feels that Jonah is “just” a scientist.

It turns out that Jonah has been an independent consultant to businesses to help improve their productivity. He is very busy and travels frequently. During several phone conversations and face-to-face meetings, Jonah explains his business model to Alex. He does this by giving Alex definitions to examine plant structures. He also explains correlations that determine the success of the business.

At the heart of Jonah's business model are three definitions: throughput, or "the rate at which the system generates money through sales," inventory, or "all the money that system has invested in purchasing things which it intends to sell," and operational expense, or "all the money the system spends in order to turn inventory into throughput" (Goldratt and Cox, 1992, pp. 60, 61). Using these definitions, Alex always has a basis to determine if his decisions are helping the plant move towards the goal. The goal of the plant is to make money, which is characterized by increasing throughput and decreasing inventory and operational *expense*.

The story progresses through Alex's struggles at home and in the plant. Just as in everyday life, there are several victories followed by setbacks. However, through hard work and with the use of a skilled team and Jonah's help, Alex is able to make the plant the most productive one within the UniWare division. Alex is promoted to lead the UniWare division as president and is entrusted with implementing Jonah's business model throughout the entire division. Alex's marital life also improves because he and his spouse resolve their conflicts.

This summary is brief and leaves out many of the fictional elements that make the story such an interesting and fast-paced read. I encourage anyone that is interested in learning about manufacturing a product to read Goldratt's book. It is the most efficient way to understand the challenges involved in the manufacturing processes. In this essay, I will focus on the business model Goldratt describes.

Eliyahu Goldratt's Business Model

Eliyahu Goldratt's *The Goal: The Process of Ongoing Improvement* was first printed in 1984. Ever since it was published the book has sold more than one million copies. In 2004, it was released in its third edition. When Goldratt introduced the book it created a minor earthquake in the manufacturing world. Goldratt attacked some of the most basic procedures in manufacturing plants all over the United States and other parts of the world. Suddenly, a guy from Israel comes along and tells manufacturing industries that cost accounting is profoundly flawed. He claimed that managers should refrain from using performance incentives, economic order quantities (EOQ) should be thrown out, and productivity and product cost are really not what they seem (Sytsma, 1997). It seems as if those 2 years in business school and that M.B.A. on the wall are worth nothing according to Goldratt's commonsense approach. The following will examine and contrast Goldratt's business model with the way we traditionally look at manufacturing businesses.

Goldratt's business model is based on two principles. The first principle defines three ways to measure whether or not businesses are achieving the goal of making money. These three measurements are interrelated and easy enough to apply to any process. The three measurements are *throughput*, or "the rate at which the system generates money through sales;" *inventory*, or "all the money that the system has invested in purchasing things that it intends to sell;" and *operation expense*, or "all the money the system spend in order to turn inventory into throughput" (Goldratt & Cox, 1992). The second principle of Goldratt's model relates *dependent events* and *statistical fluctuations* to the manufacturing process. *Dependent events* are processes that must first take place before other ones can begin (Goldratt & Cox, 1992). An example would be a car assembly line. Before the engine is put into the car, the frame must be finished and the

steering wheel cannot be attached until the steering column is put into place, and so on.

Statistical fluctuations occur when one is unable to precisely predict events or quantities (Goldratt & Cox, 1992). The book presents an excellent example illustrating this principle. Alex and Jonah sit in a restaurant and Jonah points out that they are able to precisely predict the capacity of the restaurant by counting the available seats. On the other hand, they are unable to predict how long the waiter will need to fulfill their order (Goldratt & Cox, 1992). This uncertainty is referred to as *statistical fluctuations*.

Using these two principles we are able to apply them to the traditional business model. This model relies on forecasting and efficiencies. In this system, it is constantly the goal to reduce cost of production and keep processes running at maximum efficiency. In many cases, this model is on a microlevel because it accounts for specific areas of the system instead of focusing on the entire system. For example, it is most efficient to have every worker and all machines running constantly at 100%. If this is the case, a company gets the most out of their investment in the labor force. Companies realize that 100% is a utopian figure and scale it to an acceptable range of 85% to 95%. This efficiency rating is then used to forecast how long it will take for processes to occur and a production schedule can be determined. Oftentimes this schedule is inaccurate and companies miss out on opportunities to make money. Instead of focusing on the actual capacity of the entire system, capacities are determined for individual stages, limiting the company's ability to make money.

The business model illustrated in *The Goal: A Process of Ongoing Improvement* can remedy this situation. In 1992, Goldratt titled his model the Theory of Constraints after a book he wrote with the same title. It suggests that companies should scale their entire production to the process within the system with the lowest capacity; the bottlenecks. This will make the system

appear less efficient, because areas in the factory may stay idle if they have a much higher capacity than bottleneck areas. However, implementing this approach will directly add to the bottom line. The Theory of Constraints uses dependent events and statistical fluctuations as its base.

Using the three measurements, we can see why limiting production to traditionally inefficient rates actually increases the bottom line. The starting point to understand this concept is throughput. Every time throughput increases, the company's sales increase, which directly adds to the bottom line. Throughput can only increase if the area of lowest capacity increases its rate of throughput. Running areas of the factory that have higher capacities at 100% will not increase the overall throughput of the system, and sales do not increase. The measure that increases is inventory, because the factory produces parts that cannot be assembled into finished goods until the area of lowest capacity produces enough parts. Inventory is an investment of money and thus subtracts from the bottom line. Keeping large amounts of inventory will further subtract from the bottom line, because warehouse space is costly. Lastly, running every worker and machine at 100% seems efficient but does not help the bottom line by reducing operational expense. The worker has been paid regardless if he or she works at all times. Machines have also been obtained and operational expense does not decrease when the highest efficiency rating is reached. In fact, running every machine at 100% can increase operational expense for machines, because they lose lifetime hours and consume energy. Every machine/worker must adjust its throughput to the throughput of the area with lowest capacity. This assures that operational expense and inventory stay at a desirably low figure. In fact, Goldratt suggests that this is the most efficient way to run any manufacturing business, regardless of what the percent-efficiency rating is of any area.

In *The Theory of Constraints*, Goldratt introduces mathematical formulas to help organizations further judge their processes. These formulas are:

- $Net\ Profit = Throughput - Operational\ Expense$
- $Return\ on\ Investment = \frac{Throughput - Operational\ Expense}{Inventory}$
- $Productivity = \frac{Throughput}{Operational\ Expense}$
- $Turnover = \frac{Throughput}{Inventory}$

The formulas can aid us further in understanding the benefits of Goldratt's model. For instance, we can identify that throughput is very important because it influences each of the four additional measurements. The formulas also describe why plants running at 100% efficiency do not function well. According to the Theory of Constraints, these plants are highly unproductive. As described earlier, throughput does not increase in this scenario while operational expense does. Goldratt's formula for productivity will yield a lower value in this case. Using the same analogy, net profit decreases and excess inventory is created, which will decrease return on investment. While inventory increases, throughput remains constant, which then will decrease turnover. According to Goldratt, it is wrong to run plants at their highest efficiency rating, a concept that clearly shocked U.S. manufacturers.

Another advantage of Goldratt's model is that it can be applied on the local plant level. Every worker can apply the three basic measures of throughput, inventory, and operational expense. If they are trained to identify that inventory and operational expense cannot be increased unless throughput increases, it will enable them to make good decisions directly on the local level, without using complicated cost accounting terms (Sytsma, 1997).

Professor Sid Sytsma of Ferris State University goes as far as hypothesizing that Goldratt's Theory of Constraint could be applied to any business and any organization. This is due to the

fact that constraints do not have to be physical. This point is valid and many organizations function under this model without even realizing it. Universities only offer as many courses as are necessary and courses offered are limited to the building and labor force capacities. It makes me wonder why many manufacturing plants needed Eliyahu Goldratt's book to learn about the Theory of Constraints.

Case Study: i2 Technologies

i2 Technologies was founded in 1988 by Sanjiv Sidhu. Prior to founding i2, Sidhu worked for Texas Instruments and optimized production by creating software applications based on constraints of the production cycle. Texas Instruments was not interested in commercializing Sidhu's software, which prompted him to establish i2 Technologies.

i2 Technologies offers supply chain optimization to its customers. J. Salmi defines the supply chain as "a chain of units that transfer demand data from customers to suppliers and converts the materials received from the supplier into products and services which are delivered to customers" (Salmi, 1998, p. 3). i2 Technologies creates systems that optimize how companies react to changes in supply and demand, and integrates these systems within the entire workflow of the company.

One of the foremost principles of i2 Technologies is to reduce inventories. Goldratt's TOC states clearly that excess inventory indicates two things: (1) the overall system has not scaled production to the system with lowest capacity, and (2) the system wastes money by stocking excess inventory that is not immediately converted to throughput, yet raises operational expense.

One solution i2 Technologies developed was called RHYTHM®. RHYTHM® was a software application that helped companies connect with suppliers and customers over the

Internet. It helped customers respond to market changes and gather intelligence. This software was completely based on TOC and minimized the inventories that companies held at any given time. It also decreased operational expenses by eliminating costly department overhead needed to communicate effectively with suppliers and customers using traditional communication channels, such as telephone and postal mail. Although RHYTHM® has been obsolete for 3 years, other such programs are still being developed and deployed by i2 Technologies.

The software applications that i2 Technologies develop add directly to the bottom line of a company. Because of this, i2 is often listed as a TOC consultant. The most notable principle used by i2 Technologies is called Closed-Loop Supply Chain Management©. Closed-Loop Supply Chain Management© provides companies with tools to effectively identify the constraints of their supply chain. Constraints within supply chains directly impact the ability of a company to increase throughput.

Closed-Loop Supply Chain Management© is a closed-loop system because it provides immediate feedback, which in turn adjusts critical aspects of the supply chain, including synchronization of goals, measurements, and communications across groups (i2 Technologies, 2005). Having an effective supply chain that reacts to a changing market and customer demands will increase the ability of companies to reduce operational expense, inventory, and ultimately increase sales, which directly affects the company's profit potential.

i2 Technologies has shown that the Theory of Constraints can effectively help any company work more efficiently and increase the bottom line. i2 Technologies has embraced TOC and used it to write software that enables a business to operate according to TOC. Using this customer-oriented approach, i2 Technologies was ranked 8 among the top 100 fastest growing companies in 2000 according to *Fortune* Magazine (Reach-out Business Network,

2000). i2 Technologies is valued at \$7 billion and maintained a 3-year revenue growth of 71% (Reach-out Business Network, 2000).

Conclusion

I enjoyed reading Eliyahu Goldratt's book *The Goal: A Process of Ongoing Improvement*. The book sets itself apart by teaching basic yet powerful business aspects using a fast-paced fictional story. I must admit that I learned more from Goldratt's book than I did in any of my business courses. I recommend this book to anyone interested in learning about the manufacturing of a product.

Personally, I feel that this book is a must-read for any engineer. Engineers are sometimes portrayed as being out of touch with the real world, demanding things to happen that are difficult, if not impossible, to achieve. On one hand, that is part of the engineering culture—nothing is impossible. Although Goldratt's book does not try to teach engineering, it strives to give insights into the difficulties of making the products engineers design. Armed with such knowledge, engineers will be more valuable to their companies. I feel that it is essential to know the limitations and goals of the entire company in order to effectively design. This is shown primarily in parts of the book where Jonah questions whether certain treatments on parts are necessary. Production managers in Goldratt's fictional company explain that the engineering department required special treatment. However, further investigation showed that only 75% of the parts truly required the special treatment. Wasting 25% of company resources on unnecessary processes is unacceptable.

As an engineering intern for an electronics contract manufacturer, I see the Theory of Constraints functioning on a daily basis. The company I work for applies it in many areas.

However, after reading Goldratt's book, I feel that the company could apply his model to additional processes.

The case study on i2 Technologies truly showed the capabilities of the Theory of Constraints on a real-world model. i2 was founded entirely on Goldratt's theories and i2's success truly serves as an inspiration to other companies. The Theory of Constraints can be the difference for the success of any company, and Goldratt's *The Goal: A Process of Ongoing Improvement* is the definitive introduction.

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