

COMPARATIVE ANALYSIS OF THE OPERATIONAL
PHILOSOPHY OF FFC AND TOYOTA PRODUCTION
SYSTEM (TPS)



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2015



**COMPARATIVE ANALYSIS OF THE
OPERATIONAL PHILOSOPHY OF FFC
AND TOYOTA PRODUCTION SYSTEM
(TPS)**

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CERTIFICATION

It is certified that this thesis, "**COMPARATIVE ANALYSIS OF THE OPERATIONAL PHILOSOPHY OF FFC AND TOYOTA PRODUCTION SYSTEM (TPS)**", prepared by Syed Muhammad Mehdi Abbas, has been approved for submission to NUST Business School.

Mr. Kamran Khalid

ACKNOWLEDGEMENT

I take this opportunity to offer my sincere thanks and gratitude to Mr. Kamran Khalid, who encouraged me for the choice of topic. I am also very grateful to him for his valuable advice, motivation and for the personal interest he took in guiding me to prepare this thesis in the present form.

I am thankful to Almighty Allah for giving me the strength and ability to carry on. It was His blessings that I was extended much needed cooperation and collaboration from everyone who mattered.

Last but not the least, I would like to thank my parents who persistently reminded and chased me for completing and submitting my thesis within the given time frame.

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Introduction

Fertilizer is of vital importance in improving crop output substantially. It has helped the world in meeting the ever increasing demand for food, the rapid increase in population and its ever increasing requirement for food can only be met with the aid of the chemical industry application in the right proportion.

The ever decreasing fertility in soil due to constant farming is a major threat, which directly endangers livelihood of the farmer and lowers output (supply) compared to the spiking demand. The decrease in fertility lowers the yield and results in lower water holding capacity, thereby increasing chances for drought. The main objective for the farmer in this scenario is to retain the productive capacity of soil, which can be done by the efficient use of fertilizers. Like all things an excessive use of fertilizer is harmful and can cause pollution levels to rise in the environment. As a result it is of extreme importance to carefully use the fertilizers according to the prescribed limits. Of all the numerous methods used to increase agricultural productivity levels fertilizers have proved to be the most awarding. Rapid development of pesticides, insecticides and weed killers coupled with fertilizer responsive plants has resulted in the current popularity towards fertilizer use. As stated earlier without commercial fertilizers we would have soon reached a point where demand would be substantially greater than output. Relatively low cost of fertilizers in lieu of other agro-based inputs such as land, labor (wages), and capital (machinery) have encouraged fertilizer consumption.

If properly used, fertilizers can increase productivity levels of low natural fertility, allowing for a larger variety of crops to be farmed. By increasing the number of crops farmed over different seasons we can ensure more efficient and rewarding returns as compared to the past. In short use of fertilizers increases the efficiency rate of land, labor and water utilization.

Fertilizer Industry of Pakistan

Pakistan is rated amongst the six most populous countries in the world. The topography of Pakistan, climate, soil conditions, presence of both surface and perennial water, sufficient fertilizer produce, plenty of sunshine, availability of hardworking trained manpower has helped the country to produce sufficient food grains to feed our ever growing population. In spite of the country's economic woes, prevailing lawlessness, unemployment particularly of youth, unabated corruption and worst energy crisis, it is our flourishing agrarian economy that is keeping the country afloat. The main crops being produced are wheat, rice, cotton and sugar cane. Besides main crops a variety of vegetables and fruits are produced throughout the year.

Varied topographical conditions of Pakistan featuring mean sea level to highest peak of the world provide enormous scope for the cultivation of all tropical and sub-tropical fruits and vegetables. The inflow of almost all types of varieties is maintained throughout the year. Fruits and vegetables are considered as the most important component of daily diet of human beings. Their consumption not only helps in maintenance of good health but also leads in improving the economic conditions of small and marginal farmers.

Apart from increasing productivity and production of fruits and vegetables it is very important to supply fruits and vegetables to consumers regularly at a reasonable price. If revolution in horticultural production has to be aimed and achieved to improve the nutritional status of the people and also earn the much needed foreign exchange through exports, it is necessary to reduce or diminish losses and wastages to ensure continuous availability of fruits and vegetables over a longer period at favorable prices to the consumers and also to arrest distress sale by producers.

To do so we need to step up the harvest yield of crops exponentially with the ever increasing demand. The current changing climatical conditions and the ever present threat for natural calamities have raised the requirement to reduce crop turnover times and to get maximum

yield from each harvest. For this purpose use of fertilizers is of vital essence to the well-being of a nation.

Pakistan has been ranked amongst the major exporter of fertilizer based products and also has one of the largest fertilizer plants present in the world. Based on the consumption of fertilizer we can easily gauge the growth of agricultural sector as our country is primarily an agrarian economy. Despite all the economic and political conditions prevailing in Pakistan the fertilizer industry of our country is one of the most renowned worldwide, averaging an industry capacity of well over approximately 7.5 million tons per annum.

Table-12 Province-wise Consumption of Fertilizers

(Thousand nutrient tonnes)

Year/Province	Nitrogen	Phosphate	Potash	Total
2010-11				
Total	3132.1	767.1	32.4	3931.6
Punjab	2231.3	548.3	24.0	2803.6
Sindh	593.7	162.3	5.4	761.4
Khyber Pakhtukhwa	206.0	40.4	1.8	248.2
Balochistan	101.1	16.1	1.2	118.4
2011-12				
Total	3206.5	633.1	21.3	3860.9
Punjab	2181.3	451.4	15.9	2648.6
Sindh	657.4	125.8	2.8	786.0
Khyber Pakhtukhwa	222.1	35.1	1.6	258.8
Balochistan	145.7	20.8	1.0	167.5
2012-13				
Total	2853.6	747.0	20.9	3621.5
Punjab	1987.8	537.4	15.2	2540.4
Sindh	522.8	122.8	3.4	649.0
Khyber Pakhtukhwa	212.9	51.0	1.6	265.5
Balochistan	130.1	35.8	0.7	166.6

Source: National Fertilizer Development Centre, Islamabad.

Focus of Study

I will be focusing my thesis research on the supply chain and business activities of the fertilizer industry with special reference to Fauji Fertilizer Company to narrow down the scope of my research within a manageable framework. The practices of Fauji Fertilizer Company FFC will be compared with the 14 principles of Toyota Way. Based on major business activities of the firm the study is a quality based research. FFC is involved in numerous diverse and complicated activities, but the core focus of this study is to analyze the main events of FFC from production till the end of marketing and consumption of ready to use products.

Analysis of the activities carried out by FFC will be carried out by identifying the concepts of Dr. Jeffrey Liker in context of the 14 core principles which he introduced in his book "The Toyota Way". The 14 principles identified by the Michigan University professor have far reaching effects on the production and supply chain activities and are believed to lead to a successfully integrated and completely production system with the least amount of wastage. The study will analyze these concepts in regard to FFC during each major business activity step in the firm's supply chain system. We will scrutinize how successful FFC has been in maintaining and applying these core principles and ensuring their overall effectiveness. We would also research whether the remaining concepts could be applied in this present environment in the fertilizer industry.

Fauji Fertilizer Company (FFC)

History

FFC was established in 1978 as a private joint venture between Fauji Foundation and Haldor Topsoe of Denmark. The initial capital worth of the firm was Rs. 813.9 Million, which is just a fraction of the current capital of the firm crossing the Rs. 8.48 billion mark. Other than its core activities of fertilizer production FFC has actively diversified its operations over the time period to include subsidiaries such as Fauji Fertilizer Bin Qasim (FFBL), Al-Hamd Foods (now known as Fauji Fresh & Freeze) and Askari Bank to name a few.



In the early 1970s fertilizer shortfall was being met by imports which were proving to be a hefty burden on the national exchequer. On the government's insistence FFC took the initiative to establish a urea manufacturing plant to meet the void between domestic demand and supply. The first plant of FFC was established at Goth Machhi and commercial production commenced from June 1982 with annual designed capacity of 570 thousand tones urea, which was increased to 695 thousand tons annually by increasing the base unit in 1992. In 2002 FFC

through mergers and acquisitions was able to acquire another plant at Mirpur Mathelo capable of producing 574 thousand tons annually.

Present Scenario

Presently FFC comprises of three plants with aggregate designed production capacity standing at approximately 2 million metric tons annually. The increasing production capability and the supply of locally manufactured fertilizer has saved the country over 7.5 billion dollars in foreign exchange since the company's inception.

Competitors

Numerous players are present in the fertilizer industry but the following make up the market leaders list in terms of production and sales.

- Engro Fertilizer
- Fauji Fertilizer
- Dawood Hercules

Over View of Key Players

Dawood Hercules:

Dawood Hercules Chemicals Limited was established on 17 April 1968, it was a joint venture between the Dawood Group and Hercules Inc. USA. It had the honor of being the first private venture in Pakistan to receive funding from the World Bank, besides that it was the largest urea plant in the country at that time. The plant went through major restructuring in 1989 and 1991 to increase production capacity and to allow for more efficient and environmental friendly production. Amongst its numerous firsts Dawood Hercules has the honor of being the first fertilizer manufacturing company to be ISO-9000:2000 certified. Dawood Hercules also has a long line of numerous safety and excellence rewards in its list of achievements.

Engro Fertilizer:

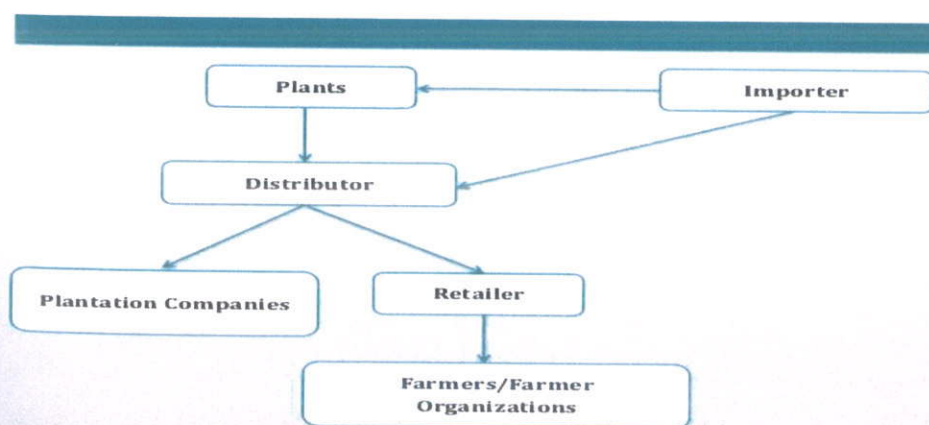
Engro Chemical Pakistan Limited is ranked as being the second largest Urea Fertilizer producer in Pakistan. The company came in to being in 1965, formerly known as Exxon Chemical Pakistan Limited until 1991, it was bought out by the employees of Engro when Exxon on a global basis decided to divest from the fertilizer business. Engro is a public limited company listed on the Stock Exchanges of Karachi, Lahore and Islamabad.



FFC'S SUPPLY CHAIN & BUSINESS ACTIVITIES

FFC has a fully integrated supply chain, which extends from its production line to the supply of the final product to end customers. FFC sources its raw materials from numerous local and international vendors; as a result it is constantly faced with the challenge of market uncertainty due to exchange rate fluctuations, trade policies and numerous other external factors. However to counter this FFC has numerous multiple suppliers for the same raw material to ensure steady and cost effective supply.

FFC has a vast supply chain involving number of business activities. The activities include sourcing the raw materials from the selected suppliers and delivering them to their production facilities where there production takes place, resulting in the end product. Numerous activities are also carried out to support the main supply chain such as marketing the product to retailers and entering in to trade agreements with them, R&D for the best composition of chemicals to use based on local topographical and climatical conditions, sending mobile quality assurance labs to rural areas and establishment of a well-connected distribution system. Furthermore, in each of the business activity, FFC ensures that the best and most effective equipment is utilized.



Supply Chain

METHODOLOGY

DATA COLLECTION METHODS

In order to collect updated information, I interned at FFC headquarters situated in Rawalpindi for 6 weeks. Although time consuming, but since it was an imperative requirement to be able to collect qualitative information that can provide us with concrete evidence. During the internship numerous department managers were interviewed along with use of company reports for which permission was taken before hand.

Much of the data utilized in conducting this research was collected through interviews from managers or other concerned employees. Most of the data is also present on the company's official website. Moreover, published journals and articles have also been made use off. 14 principles of Toyota have been taken from Dr. Jeffrey's book the "The Toyota Way".

DATA ANALYSIS METHODS

A comparison analysis was carried out to ascertain the similar principles applied by FFC. Aid of fellow classmates and the research supervisor was taken to verify the seeming accuracy of analysis, with changes and modifications being made wherever necessary. The major business activity of FFC with respect to fertilizer production has been observed and compliance with 14 principles checked to see whether or not their application is taking place.

LITERATURE REVIEW

Toyota Production System (TPS) comprises of set principles developed by the automobile company "Toyota", on which the company has modeled its entire management philosophy and its production system. The Toyota Production System defines the most effective way for organizing manufacturing and logistics for the company; it also sheds light on relations with customers and suppliers. TPS is a major forerunner of the more standard "lean manufacturing" (Brown, 1999).

TPS can be viewed as the theoretical manifestation of Toyota's people and client oriented approach. The principles are not a stiff company-imposed technique but a set of values that have been confirmed in day-to-day practice over many years (History of Toyota, 2012). Many of these ideas have been adopted and imitated all over the world.

TPS can be viewed upon as having three sought after outcomes (Toyota Motor Corp.):

1. Provide customers with highest quality vehicles, in a timely manner at lowest cost and minimum lead times.
2. Ensure members are provided job security, equal treatment and have work satisfaction.
3. Enable the company to be flexible to the respond to the market, attain higher profits arising through cost reduction activities and long-term prosperity.

TPS attempts to eliminate waste to as little as possible, reduce burden and disproportion in all areas enabling members to work efficiently and easily. The fundamentals of TPS are built on regularization to guarantee a safe manner of operation and a dependable approach to excellence. Toyota members seek to constantly develop their standard processes and techniques in order to warrant maximum quality, improve productivity and reduce waste. This is known as kaizen and is applied to every domain of the company's activities.

One of the most essential aims of the Toyota Production System is to improve the value delivery of the whole system (Ohno, 1988). For this purpose the TPS aims to work out Muri (overburden), Mura (inconsistency) and Muda (waste) (Brown, 1999) & (Liker, 2004). The most notable results on process value addition stem from a process that provides the required outcome in a smooth way, i.e. by working out Mura (inconsistency) (Brown, 1999). The reason is that Mura leads to Muri and Muda. Moreover, it is of dire importance to safeguard that the process has the desired flexibility to deliver without stress or "Muri" (overburden), which subsequently results in "Muda" (waste). Lastly, the calculated improvements of waste reduction or the elimination of Muda are very valuable.

TPS emphasizes on the following seven types of waste (Ohno, 1988) (Liker, 2004).

1. Waste of overproduction (largest waste).
2. Waste of time on hand (waiting).
3. Waste of transportation.
4. Waste of processing itself.
5. Waste of stock at hand.
6. Waste of movement.
7. Waste of making defective products.

14 PRINCIPLES OF TOYOTA WAY

Dr. Jeffrey Liker, a professor from University of Michigan industrial engineering department, published "The Toyota Way," in 2004. Toyota Way basically talks about, "a system aimed at providing the requisite tools for people to continually keep on improving their work." The system is based upon the 14 principles (Liker, 2004), which are also commonly known as 'The Toyota Way'. These principles provide guidelines in all areas of business activities, starting right from the work floor and going up to the top management.

The two defining principles of TPS are respect for people and continuous improvement. The principles for continuous improvement comprise of establishing a long-term vision, working on challenges, continual innovation, and getting to the source of the issue or problem in order to ascertain main problem. Principles relating to respect for people include ways of building respect and teamwork (Liker, 2004).

Four broad categories can be used to divide these 14 principles. The categorical division done by the professor in his book and the one being practiced by Toyota in actuality is slightly different. Toyota summarized its core philosophy, values and manufacturing benchmarks in the year 2001, naming it as "The Toyota Way 2001," based on which it has the following focal points:

Continuous Improvement

Challenge (We form a long-term vision, meeting challenges with courage and creativity to realize our dreams.) (Cho, 2001)

Kaizen (We improve our business operations continuously, always driving for innovation and evolution.) (Cho, 2001)

Genchi Genbutsu (Go to the source to find the facts to make correct decisions.) (Cho, 2001)

Respect for People

Respect (We respect others, make every effort to understand each other, take responsibility and do our best to build mutual trust.) (Cho, 2001)

Teamwork (We stimulate personal and professional growth, share the opportunities of development and maximize individual and team performance.) (Cho, 2001)

Whereas, Dr. Jeffery K. Liker in his book TPS has shed light on the following 14 principles and broken them down into the four given categories:

Long-term philosophy

- I. Base your management decisions on a long-term philosophy, even at the expense of short-term financial goals.

The right process will reap the right results.

- II. Create continuous process flow to bring problems to the surface.
- III. Use the "pull" system to avoid overproduction.
- IV. Level out the workload (heijunka). (Work like the tortoise, not the hare.)
- V. Build a culture of stopping to fix problems, to get quality right from the start.
- VI. Standardized tasks are the foundation for continuous improvement and employee empowerment.
- VII. Use visual control so no problems are hidden.
- VIII. Use only reliable, thoroughly tested technology that serves your people and processes.

Development of people and partners results in value addition.

- IX. Grow leaders who thoroughly understand the work, live the philosophy, and teach it to others.
- X. Develop exceptional people and teams who follow your company's philosophy.
- XI. Respect your extended network of partners and suppliers by challenging them and helping them improve.

Continuously striving to solve base problems enhances/improves organizational learning.

- XII. Go and see for yourself to thoroughly understand the situation (Genchi Genbutsu)
- XIII. Make decisions slowly by consensus, thoroughly considering all options (Nemawashi) implement decisions rapidly;
- XIV. Become a learning organization through relentless reflection (Hansei) and continuous improvement (Kaizen).

The Toyota production system can be compared to extracting water out of a dried well, meaning it a set of systems which ensure waste elimination to the minutest level possible. Waste can be referred to anything which does not improve or facilitate the process. Most people only try to control the wastage that is easily identifiable and apparent. However, there are a lot of activities and processes which do not add value to the product or services but are left unidentified due to no specific focus on them. Toyota is of the belief that the following elements need to be scrutinized, this being the reason Toyota Motor Corp. has explained such wastages in detail on their company website. In a way TPS encourages us to be pro-active.

Kaizen - Continuous Improvement

Kaizen lies at the heart of the Toyota Production System (Toyota Motor Corp.). Similar to all other mass-production systems, the processes adopted by Toyota require that all tasks, both mechanical and human, be defined very precisely to ensure standardization, maximum quality output, waste elimination and improvement in efficiency.

Workers at Toyota are required to follow these guidelines and continuously try to improve wherever they find any anomaly. Speaking practically it is known that the inefficiencies present

within the system will be better known to the people who are performing the day to day operations related to the process.

These day-to-day improvements are known as 'Kaizen,' which workers at Toyota make to enhance their equipment's and work practices. Broadly speaking the term has a far reaching effect than just on the specific activity, meaning that the firm is constantly striving to improve its operations within every field of operations, starting from the sourcing of the raw material to the end product being delivered to the customer.

Just In Time

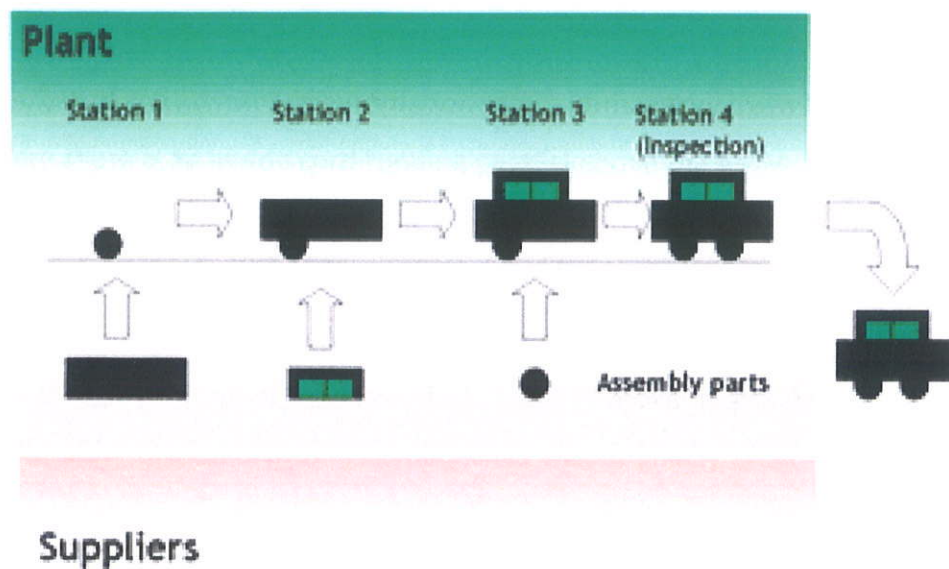
The foundations for this approach were laid down by Toyota and over time it has gained universal acceptability in all the manufacturing being presently carried out worldwide (History of Toyota, 2012). As a matter of fact the term was made by an engineer employed at Toyota. The approach no matter how simple shows Toyota's commitment to waste elimination and the need for improving quality one step at a time. In lay man terms JIT allows for manufacturing to be carried out on the principles of supply and demand with respect to the market as compared to relying on a push strategy primarily.

To further clarify this we can say Toyota reversed the supply chain strategy and relied on market pull forces rather than focusing on pushing products in the market regardless of demand. Demand by customers' results in production only, as a result causing production to take place and subsequently required parts being ordered to facilitate production processes. As a consequence to this approach the right quantity of parts are utilized with minimal or no wastages or stock pileups. With 'JIT' the final power resides with the customer, due to the fact that only the customer is the initiator of the business activity within the system.

Takt time is used to measure the demand arising for the product in lieu of the manufacturing capability of the plant. To better explain this we can assume a scenario where the operating

time for a plant is 1000 minutes per day, whilst daily demand for the product in question is 500 units per day, as a result 'Takt time' will be 2 minutes. By reducing the takt time we are basically increasing the amount of resources employed for the same process compared to earlier scenario. Toyota follows a policy of having a multi skilled and well trained staff which is capable of working in numerous departments or processes, rather than having workload transferred to specific individuals based on their specific expertise, irrespective of the amount of workload.

Pull System visualization



Kanban is the tool for regulating production in the plant. Simply speaking Kanban is a message. An example can be taken from the process activities in an assembly department where a card is placed to every component taken and removed when it is placed back in its storage space. The placing back of the kanban to its originating source illustrates the re-ordering of the component. Kanban allows for minimization in paperwork, increase in effectiveness and most importantly allows the workers to be in control.



Jidoka

Jidoka in Japanese basically means automation. However at Toyota it has a slightly additional meaning which is 'automation with a human touch.' (Toyota Motor Corp.). Sakichi Toyoda in 1902 developed the first automatic loom in the world, which automatically stopped if there was any problem in the production process such as snapping of threads. TPS has made it one of its primary focuses to immediately stop and rectify a problem as soon as it arises rather than delaying it, which in essence is the main foundation of the 'Jidoka principle.'

A true example of the concept of automation with a human touch can be taken from the Toyota plants where there is an andon cord running parallel above the assembly line which any worker can pull if he senses something wrong in the production process, much like a stop chain found in all cabins of a passenger train.

Toyota has always been open to ideas which could improve its production process and based on this philosophy the concept of assembly lines was originally taken from the Ford assembly line, where processes were broken down into easy steps with work divided amongst employees. However the concept has been molded by Toyota in accordance to its own needs and company culture. The workers at Toyota have a free hand to manage their jobs based on their own comfort levels. Teams manage their own workstations, opportunities for further enhancement are recognized and initiative taken by the employees and management to bring about the change in a positive manner.

Suppliers & TPS

Synchronization of operations throughout the production channel is best done when Just-in-time and other components of the Toyota Production System work in coherence with each other. This can be viewed as egalitarian setup where each preceding business activity is the customer for the previous business activity.

Suppliers are encouraged to be autonomous with equal input in the production process with each party complimenting the other by achieving its prescribed objectives in a timely and efficient manner. As stated earlier the customer lies at the epitome of the whole business activity conducted at Toyota and only he/she is not answerable to anyone in the whole business cycle.

Suppliers are given the same facilities as the employees are given within the production system. Just-in-time results in constant demand for parts as parts are instantly used up whenever demand arises, therefore manufacturing can reduce inventories at parts providers just as quickly and effectively as it does at Toyota. Quality improvement in products takes place constantly, reason being that the Toyota Production System accounts for highlighting and eliminating anomalies as soon as they arise. Suppliers who become a part of the TPS are also required to bring about improvements in the work force and leadership relations. The primary reason being that the system strives to incorporate a broadened role for workers to handle their own work, thereby bringing the employees and management to strive for similar goals, ultimately leading to greater competency and efficiency in the production cycle overall.

Toyota Production System

Just-In-Time

- Operate with the minimum resource required to consistently deliver
- Just what is needed.
- In just the required amount.
- Just where it is needed.
- Just when it is needed.

High Quality

Man
Mach
Mat'l

Muda, Muri Mura

Min.
Input

Process



Max.
Output

Method

Minimum Lead Time

Jidohka

- One-by-one confirmation to detect abnormalities.
- Stop and respond to every abnormality.
- Separate machine work from human work.
- Enable machines to detect abnormalities and stop autonomously.

Standardized Work

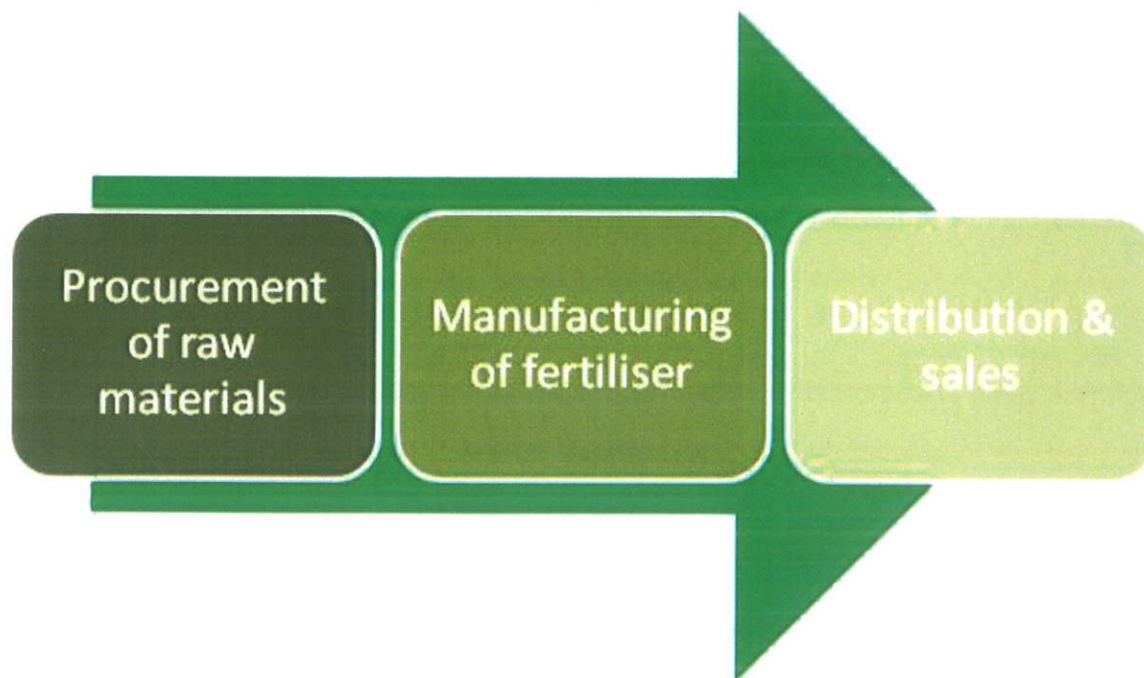
CRITICAL COMPARATIVE SUPPLY CHAIN ANALYSIS OF FFC THROUGH TOYOTA PRODUCTION SYSTEM FRAMEWORK

FFC has years of fertilizer experience and expertise and a striving commitment to increasing agricultural output; FFC oversees all stages of fertilizer production to deliver one of the best fertilizers locally manufactured in Pakistan. Having fully integrated supply chains and operations is one of the main competencies of FFC, something that the company prides it-self in. Along with being very cost effective and flexible these capabilities allow the company to command control over most of its operations. FFC benefits immensely from a fully integrated and in hand supply chain, in an industry which has substantial capital costs with numerous socio-economic embargoes.

Right from sourcing the raw materials from the vendors to the sale of final products at company owned outlets or franchises FFC ensures premium quality of their products.

Although significant differences being present in the nature of business of Toyota Motor Corporation and FFC, many of the Toyota's 14 principles are either directly or indirectly applicable to the firms operations. Although having its way of conducting business, a detailed study of FFC's core principals and dealings highlights that the company also uses the TPS as a guiding star in its operational activities. Following is a detailed analysis of the FFC's supply chain and operations, and how the 14 highlighted principles of Toyota Production System can be applied to it.

Amongst all the industries the fertilizer industry is operating in a constantly changing environment, FFC as a precaution has a well devised strategy layout which it ensures is carried out to the minutest detail to assure quality output in a cost effective and timely manner. Like all manufacturing processes there are three core steps in fertilizer production comprising of:



Sourcing Raw Materials

Major raw materials for the fertilizer manufacturing process comprise of minerals such as sulphur, rock phosphate etc. FFC imports most of its raw materials from outside vendors with which it has long term relationships. The sourcing of these raw materials entails the completion of numerous procedures ranging from contracts with suppliers, getting government clearance and employing clearing agents which will ensure smooth clearing of raw materials from the port to the company's storage facilities.

This stage is of empirical importance as the entire operational activities rely on these raw materials. Therefore, FFC takes immense caution at this stage and does not compromise on process quality under any circumstances. The concept of JIT is also very stringently applied during this stage. All the suppliers are certified through independent bodies specializing in the specific areas of business the raw material suppliers are operating in. The raw materials are transported via cargo ships in an environmentally controlled environment to ensure their chemical composition remains intact allowing for maximum results from their usage.

Numerous checks are carried out at different stages and time intervals to insure that the required sourced raw materials have their chemical composition intact. For this purpose temperature controlled warehouses are used by FFC in various locations of Pakistan and trained professionals are employed to keep check on the sourced materials.

The warehouses are mainly located on the port and within the company plant premises in the three locations where FFC has operational facilities setup.

Bio security is maintained at all stages as the raw materials have a defined storage life before their effectiveness starts to deteriorate below the desired level, therefore the company employs a strict all-in-all-out approach.

Strict bio-security measures are taken at all plants to reduce the risk of deterioration through degeneration due to contact with other reactive materials. We can see that the core principles of the 'Toyota Production System' are clearly applicable on this stage of the business cycle. Firstly, FFC makes use of established and tested suppliers and makes use of trained professionals working in controlled environments.

Manufacturing Process

Fertilizer manufacturing is related to the process based industry as discussed earlier, requiring complex and thorough plans to ensure production takes place effectively and in an unhampered manner. Resultantly this requires high degree of automation and technical expertise, along with a well-laid out and inter-connected process flow.

Due to the constant increase in demand for urea and controlled supply we can safely assume the firm in question and all those in the industry are following a market pull based. All plants

are working on the principle of all-in-all-out, the driving force behind it being to prevent mixing of different batches of raw material with newer stock, although while this strategy is carried out, a buffer stock is always maintained to meet unforeseen demands. However it is also periodically replenished with new raw materials to ensure optimum product output capability. This principal is very similar to Heijunka, which requires leveling out the workflow. The all-in-all-out principle aids FFC in standardizing the work at all plants, which is one of the major components of TPS. Only when the work is standardized can the process of continuous improvement be initiated.

Moreover, the Principal of Jidoka can also be witnessed in FFC's storage and production facilities as all of them are equipped with automated environment control systems, which monitor and control factors such as temperature, humidity and material quantity; while being closely monitored by on sight professional thereby adding the human touch to the otherwise automated processes.

Distribution of the finished product

Once fertilizer production has taken place the product is packed off and sent to retail outlets and franchises operating within the rural areas of the country, this is a difficult task due to the absence of a strong road network within the country. However, by following the 'Genchi Genbutsu' approach the company and in particular the marketing department has effectively found a solution to this problem. The company partners with local suppliers and helps them develop their resources and aids in their technical and monetary development. This as a result instills trust of the distributor with the firm and builds lasting relationships, whilst ensuring the product is properly handled and timely distributed. FFC through its rural outreach programs and numerous CSR activities has tackled the problem of limited product coverage by aiding local people to setup state of the art warehouses and franchises in far reaching regions at a fraction of a cost to the firm would have incurred originally had it tried to setup personally run operations in out-back areas.

The distribution process of the firm in question is very much similar to the principles of Toyota Way. Analyzing the distribution chain highlighted that majority of the principles are being actively employed to increase overall efficiency of the supply chain.

Long Term Approach

The fertilizer value chain of FFC makes use of the TPS in all major operations. Furthermore, FFC is plagued by many external factors which if not properly handled can hamper its production capabilities. The country is faced with an ever increasing gas shortage and the government policies regarding procurement of raw materials are also following under political influences. Furthermore, as discussed earlier the shabby road and rail infrastructure also does not encourage effective and timely transportation of raw materials and finished goods to desired parties. FFC following a long term approach has setup its own energy production facilities on production sites and is in the process of empowering and upgrading local supplier base for raw material and end product supplies by engaging in numerous CSR activities and identifying individuals inclined towards excellence who it can partner with to safeguard long term goals.



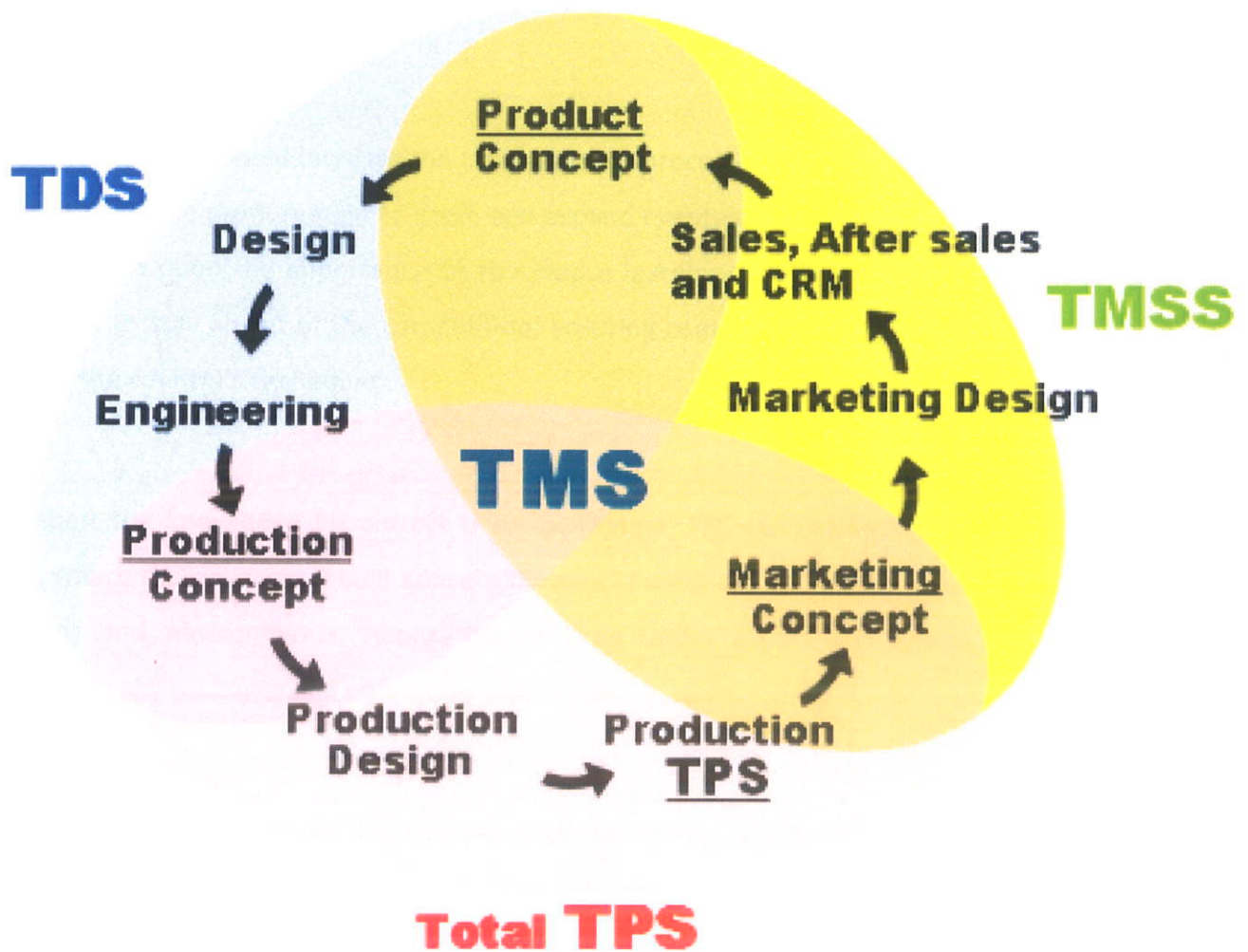
CONCLUSION

Toyota Motor Corporation and FFC are obviously in different industries, and the best practices do not have to be the same for both of them, but an in depth analysis reveals that several of the core principles that govern the operations of the two companies are similar and applicable in both of the industries. A thorough analysis of the firms operations showcases the presence of similar principles. The most prominent of which is Heijunka, i.e. leveling out the workload, Challenge, Kaizen, Teamwork, Respect. FFC implements its strategy in a slightly different manner, i.e. All-In-All-Out. The primary purpose of this rule is to avoid mixing of different batches, but it also serves an equally important function of leveling out the workload. Another highlight of the entire supply chain of FFC is the appropriate use of high quality and reliable technology, which adds value to the system.

Also, it can be observed that at FFC the grounds are set for continuous learning and improvement in the production cycle due to standardized operating procedures. Moreover, the supply chain works on the basis of "pull system", because every stage of the process is required to be calculated in advance.

Moreover, getting on the work floor yourself i.e. Genchi Genbutsu is also encouraged and expected in FFC, as is evident from the marketing strategies to increase outreach. Also one of the basic principles of the Toyota Production System is that the long-term philosophy should be the basis of managerial decisions and not the short-term financial goals, which is quite evident from the progress of FFC so far. Since, inception FFC has been on a single minded mission on no compromise on quality, proving that the company is willing to give up short-term financial gains for the attainment of the long-term philosophy and vision.

Apart from all these similarities, there are some principles which are either not much applicable or observable from the outside. Such as the decision making process of the company. Toyota Production System suggests the Nemawashi approach, which means getting to a consensus through thorough discussion of all the alternatives but then implementing in a rapid manner; however, it is not observable from the outside. Moreover, the applicability of visual controls for FFC is slightly different, since it is not like a manufacturing concern like Toyota, but in our research we did not find prominent use of such visual controls in production system. There are some areas where visual controls are employed such as when replenishment is needed; a warning signs appears on the screen of minimum stock in hand.



RECOMMENDATIONS

The 14 principles were applied in the Toyota Company that is a manufacturing firm in a developed economy. When applying the same principles in an entirely different industry which is located in a developing country would face some problems while implementing those principles. For instance, use of fully capital intensive techniques rather than labor would be not appropriate in a developing country like Pakistan where there is a huge problem of electricity shortage. Similarly, installing visual controls everywhere would not be possible due to same electricity problems as well as it requires sufficient investment in such type of latest equipment and devices.

I believe that FFC should increase the capacity of its processing units. It will help the company keep more of the profit margin to itself, and expand eventually. The company should continue to emphasize upon the importance of continuous learning and improvement, since it is very important to stay ahead of the competition, ensuring continued growth and a steady helping hand to the country's exchequer.

To impart the knowledge for correct Urea application, FFC can organize seminars at district levels where their experts should educate farmers in using correct products for different types of lands and environments. Application of Urea under expert supervision shall help in eliminating any wastages and enhancing production.

Not many institutions in our country are available where quality education with regards to fertilizer industry is imparted. Being a flagship company, FFC may take lead in arranging formal education in the sector.

Military personnel in lower ranks retire at comparatively very young ages. These people mostly come from areas having farming background. FFC may play its part in facilitating their rehabilitation. Following approaches can be proposed:

- I. Uncultivated tracts of lands having potential water resources may be leased by FFC.
- II. Retired military personnel may be given employment on these acquired lands.
- III. These large tracts of lands may be developed for cultivation.
- IV. Urea application may be done under the supervision and guidance of experts.
- V. These farming areas developed maybe used to 'showcase' capability of FFC's various products.

Research and Development may be given due consideration and provided reasonable funds by a company of the stature of FFC. Developing new products and varieties and bringing about any improvements in the existing products could bring about exponential increase in agro-products.

Central Asian countries are mostly rich in availability of natural gases. FFC may consider establishing their fertilizer plant' in one of these countries. Urea produced from this plant could be utilized for making up any shortfalls in the country and for export purposes.

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