

# The Power of ROFO Principle Together with Companywide Training in Executing Lean Production Strategy

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## Abstract

This paper reports the findings of the case study conducted at Schaffner Thailand (ST) factory regarding the application of the ROFO principle coupled with companywide training on the execution of Lean Production (LP) strategy. The case study was motivated by 3 main objectives: 1) to examine the effectiveness of the ROFO principle and companywide training on the execution of LP strategy, 2) to study whether there were significant improvements in productivities between periods I and II, and 3) to assess whether ROFO principle had influenced significantly in changing the mindset of the staff. Companywide training was carried out on 3 modules: the ROFO principle, 5S and Lean Production (LP) concepts. The training of the 3 modules was implemented in period II (2008 to 2012) but not in period I (2003 to 2007). The methods used were survey, interview, and observations. The findings fully support the 3 objectives. The results were encouraging as productivities were not only improved in period II but also the willingness mindset of the staff. This is the power of the ROFO principle as each cycle of the ROFO principle resulted in a chain of corrective actions and learning.

**Keywords:** ROFO, ownership, lean production, co-operation, learning and trust

## 1. Introduction

This paper presents the case study on the application of the ROFO principle and the companywide training in the successful execution of Lean Production (LP) strategy in Schaffner Thailand (ST) factory. ROFO stands for: R-Responsibility, O-Ownership, F-Focus and O-On-time corrective action. The authors wish to clarify that this is not a full scale research study as the main motivation is to investigate whether there is any improvement after the implementation of the ROFO principle and companywide training. It is a practical study to share with the industry practitioners. The ROFO principle is defined as follows: “it is both a management concept and a tool for solving problems. It is also a guiding principle for the working behavior of the staff. It motivates staff to own the total process until the desired outcome is achieved. The continuous cycles of responsibility, ownership, focus, and on-time corrective action result in cooperation and learning. Outcome is attained with enthusiasm, passion and without blaming others”. The study was conducted in Schaffner Thailand (ST) factory. ST factory is located in Lamphun, a province near to the famous tourist city of Chiang Mai in Northern Thailand. A span of 10 years was selected for the study with periods I (January 2003 to December 2007) and II (January 2008 to December 2012).

In the past, the ROFO principle coupled with companywide training had been successfully implemented in a Singaporean company (codenamed Lai). Lai (Goh, 2001, 2015) was so successful that the whole Quality department was disbanded as the control of the quality was in the hands of the production workers. In 2006, Lai was awarded by the President of Singapore as one of the six finalists in the field of manufacturing excellence in a national event organized by the Singapore government. The sterling performance of the Lai Company was attributed to two fundamental factors; leadership commitment to training and learning, and the execution culture (mindset) that was nurtured through years of practicing the ROFO principle. Based on this success story, the authors have reason to believe that the ROFO principle coupled with companywide training, if implemented well, should have a positive impact on ST factory. This belief is further strengthened by the fact that no massive training on continuous improvement (CI) has ever been undertaken in period I. To be consistent, the key process indicators (KPIs) that were used in Period I should also be applied in Period II. Six categories of staff covering the entire factory were randomly invited for the study. As the primary aim of the study is to assess the changes in

mindset and productivity between periods I and II, two hypotheses are formulated:

H1: The implementation of the ROFO principle and companywide training in period II has resulted in better productivity improvements than in period I.

H2: The ROFO principle has resulted in a positive change in mindset in period II in comparison with period I.

### 1.1 The ROFO Principle (Goh, 2001, 2015)

The main objective of the ROFO principle is to create ownership and the willingness to go the extra mile to execute tasks successfully and on-time. In the minds of ST staff, there is a fine difference between “responsibility” and “ownership” and it can be explained by using the “microscope” example. This example illustrates that even though one has behaved responsibly in performing a task, it doesn’t mean the desired result has been achieved.

#### 1.1.1 The Microscope Example

Imagine there are two companies, namely X and Y. The former and latter are manufacturers of wire-bonding machines and microscopes respectively. Microscopes are needed to check the quality of the wire-bonding process. Company Y supplies microscopes to company X. On a certain day of a week, let’s say Monday at 8 am, company X receives a huge order of 10 units of wire bonding machines to be delivered at its customer’s factory at 8 am on Friday, failing which the order will be cancelled. To fulfill the customer order, company X requires the microscopes to arrive at 8 am on Wednesday so that they would have enough time to be ready for the air shipment at 12 pm. Company Y receives the order of 10 units of microscopes at 9 am on Monday from company X and has committed fully to the delivery date. To achieve company X’s order, the following events must be carried out by company Y:

- 1) The production manager must ensure that his employees work round the clock from 9 am Monday to 2 am Wednesday.
- 2) The van driver must start the delivery journey at 2 am as it takes a minimum of 5 hours by road to reach the company X’s factory.

Assuming event 1 has occurred but not event 2 as the engine of the van breaks down after half an hour on the road. The breakdown of engine is due to the failure of the driver to send the vehicle for regular servicing (maintenance schedule). The van driver informs the production manager about the engine breakdown promptly. The production manager has two options to take:

**Option 1:** Informs his superior at the most appropriate time (8 am or earlier) that he has kept his commitment of completing the microscope order at 2 am but the delivery has failed due the engine breakdown.

**Option 2:** He drives down immediately using his own car, picks up the microscopes and continues the journey until the final destination. Later, he informs the driver and his superior (Human Resource Manager) that the vehicle maintenance schedule has to be strictly followed.

If he takes option 1, the customer will not be happy and the driver will be blamed for not servicing the vehicle in accordance to the schedule. If he takes option 2, not only the customer will be happy but also the driver as well as his superior (Human Resource Manager). By taking option 2, the customer is oblivious of what is happening but the important point is that the microscopes are delivered on-time. The production manager takes full ownership of the entire process and ensures that the final objective is achieved. In accordance to the ROFO model, even though the production manager has fulfilled the customer order, his action is still incomplete as what he does is only reactive i.e. on-time correcting the problem and this is only the first part. The other part of the duty is to make sure that the same mistake will not be repeated. The production manager politely informs the van driver and his Human Resource manager that they must fulfill the vehicle maintenance plan. If the production manager takes option 1, he will not be penalized as it is not his duty to take care of the vehicle maintenance schedule. By examining further, it reveals that he is also behaving in a responsible manner as:

- He ensures that his employees work around the clock to complete the microscope order and this is by no means a small task.
- It is not his duty to keep track of the vehicle maintenance schedule.

The irony is that, even though he has behaved responsibly, the customer delivery remains unaccomplished. Being responsible is not good enough. Therefore he has to expand his responsibility so that he will own the entire process (Figure 1).

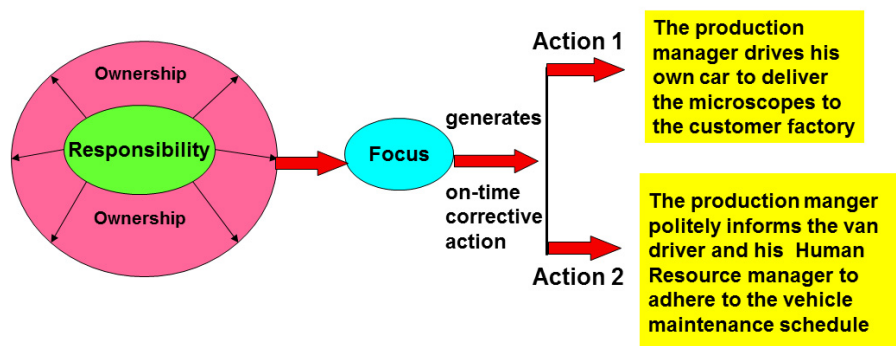


Figure 1. The ROFO Principle (Goh, 2015)

The microscope example stresses the importance of owing the total process until the desired outcome is delivered. A process is a system of interrelated activities to deliver the desired outcome. The strength of the ROFO model is that when individuals are practicing it, an environment is created for team learning as in the microscope example; the production manager learns to take ownership and the van driver and his superior learn not to repeat the mistake in a friendly and co-operative spirit. As a consequence, team learning occurs.

### 1.2 Background of Schaffner Thailand Factory

Table 1 shows the background of ST factory. The factory was built in 1989 and was an extended workbench of the Swiss company in Switzerland.

Table 1. Profile of Schaffner Thailand company

Schaffner Thailand Company: A Subsidiary of Schaffner EMV AG of Switzerland	
Group revenue	About 200 million USD sales
Location	Northern Region Industrial Estate, Lamphun 51000, Thailand
1989	Started operation with 50 staff only in Lamphun factory
No of Managers	More than 30
No of engineers	More than 60
No of production workers	1200
Awards	ISO 9000, ISO 14000, TS 16949, OHSAS 18001. In 2014, ST had 2 awards: "An Outstanding Establishment in Skill Development" and "The National Award for Outstanding Corporate in Occupational Safety, Health and Working Environment" by the Ministry of Labor
Division/Products	Two Divisions: 1) EMC ( Electronic Magnetic Capability) producing electronic filters for energy efficiency/ reliability, and 2) Automotive producing products for keyless entry (low frequency antenna) and filters for electric cars
Leadership style	Period I: Top down Period II: Coaching, empowerment and a balanced approach between top down and bottom up
Lean Production (LP) implementation	Period I (January 2003 to December 2007): No LP implementation. Period II (January 2008 to December 2012): Implemented LP successfully throughout the entire company.

Quality Management system	<p>Period I: Taylor (1911) principle of division of labor. Quality department is responsible to solve all quality problems. Relied heavily on inspection, re-inspection and rework.</p> <p>Period II: Taylor principle was displaced by the ROFO principle based on trust and cooperation. Relied on learning and prevention cost</p>
ROFO principle implementation	<p>Period I: No ROFO principle implementation</p> <p>Period II: ROFO principle implementation and practicing.</p>

*Note.* ISO-International Standards Organizations.

## 2. Literature Review

LP was invented by Ohno (1988) of Toyota Motor Company of Japan. Toyota named it as Toyota Production System (TPS). In 1977, Sugimori, Kusunoki, Cho, and Uchikawa (1977) presented a paper on TPS but it did not attract much attention in the West until the publication of the book, “The Machine that Changed the World” by Womack, Jones & Roos (1990). Toyota was so successful in TPS implementation so much so that in 2006 it displaced General Motors as the World’s largest producer of vehicles (Holweg, 2007). Western companies were trying to emulate Toyota’s success but were unsuccessful (Spear & Bowen, 1999; Spear, 2004; Turesky & Connel, 2010). Three decades later after the paper by (Sugimori et al., 1977), New (2007) published a paper indicating that the West was still struggling with the TPS implementation issues. Staats and Upton (2011) stated that TPS was the most important invention after Henry Ford’s T-model but attempts to implement it proved to be frustratingly difficult. Researchers listed a host of critical success factors (CSFs) that were necessary for the successful execution of CI programs, and one of which commonly cited was organizational culture (Abraham, Fisher, & Crawford, 1999). To change the organizational culture is extremely difficult (Foley, 2004). A practical approach is to change the mindset of the organization as illustrated by this case study.

There are many reasons for the failures of the implementation but this case study shows that LP could be successfully implemented by applying the ROFO principle and companywide training.

LP is continuous improvement initiative which requires training. The Total Quality Management (TQM) School is a strong proponent of training ever since its emergence after the Second World War. Deming and Juran were invited to Japan to teach basic quality control principle. Deming (1986) emphasizes 14 points for transformation of the organizations. Two out of the 14 points are related to employee training and education:

- Point 6—Institute training on the job.
- Point 13—Encourage education and self-improvement for everyone.

Juran (1988) provides 10 steps for Quality improvement and step 4 relates to, “Provide training”. There is no doubt that both Deming (1986) and Juran (1988) know the significant role of training and education if companies want to move forward. Deming says what organization needs is people that are constantly improving with education. Other famous Quality management experts also stress the importance of training and education (Shewhart, 1931; Crosby, 1979; Feigenbaum, 1983; Imai, 1986). Ishikawa (1985) emphasizes that Quality begins and ends with education.

Feigenbaum’s philosophy is basically summed up in 3 steps:

- 1) Quality leadership—based on sound planning rather than reactive mode.
- 2) Modern Quality Technology—integration of the entire staff in organization to continuously evaluate and solve quality issues.
- 3) Organizational commitment—continuous training and motivation of the entire workforce.

In ST, it is compulsory for every staff to undergo the 3 modules of training which are: the ROFO principle, 5S, and Lean Production (LP). 5S (Sort, Store, Shine, Standardize, Sustain) is a Japanese system of keeping the place tidy to ensure the smooth flow of materials, human beings and information. LP (Ohno, 1988) basically covers on the removal of 7 wastes (unnecessary motion, over production, over processing, inefficient transportation, excess inventory, waiting, and quality defects) and the 5 principles of LP (Womack & Jones, 2003) which are:

- 1) Specify value by specific product seen from the customers’ points of view,
- 2) Identify the value stream for each product,

- 3) Make the value flow without interruptions by eliminating wasteful steps,
- 4) Pull system: Let the customer pull value from the producer,
- 5) Pursue perfection.

In ST, training is a non-stop process and every employee will be trained and retrained.

### 3. Method

In order to maintain consistency as well as to reduce biases, the interviews and observations were carried out solely by the first author (Goh).

The study was conducted in the following two periods:

- Period I–January 2003 to December 2007
- Period II–January 2008 to December 2012

These two periods were chosen as massive trainings and development on ROFO, 5S and LP concepts were carried out throughout the organization in period II but not in Period I. The workers were grouped into the following 6 categories as shown in Table 2.

Table 2. Categories of the employees

Category	Description
1 A-Top managers	Managing Director and those top managers reporting to him directly.
2 B-Middle managers	The middle managers that report directly to the top managers.
3 C-The professionals	They are the accountants, engineers, sourcing specialists, planners, tooling specialists, designers and HR executives etc. They report usually to either the top or middle managers.
4 D-The supervisors & Technicians	They supervise the production workers to ensure that they produce efficiently. Technicians are the repairers who undertake maintenance work of the machines.
5 E-The Front-line workers	They assemble the parts into a final product to be ready to deliver to customers.
6 F-Auxiliary workers	Others who do not belong to the above and they are mostly auxiliary workers like security guards, gardeners and cleaners

#### 3.1 Survey

The survey (Appendix A) was carried out on all 6 categories of workers (A to F) and 150 out of 1,200 employees were randomly selected. Each respondent had to answer 15 questions (also available in Thai version). Using Minitab software (Version 16), paired- t test was conducted on each of the 15 questions (5E, 6E, 10C to 10F, 11 TO 14 and 15\_1 to 15\_5) to determine the statistical difference between periods I and II. A scale of 1 to 10 was chosen for each question as consistency in score was assured by having a common denominator of 10 points, with “1” being the weakest and “10” being the strongest. It was an extensive exercise as it required 90 statistical analysis tests (15 questions X 6 categories) to be administered. A Thai administrator was appointed to carry out the study. 150 survey questions were sent out in early December 2012.

#### 3.2 Observation

Observations were carried out solely by Goh, at least two times a month (about one and a half hours each time) throughout the entire factory. Observations were carried out in the period January 2013 to June 2013 and were unannounced to the staff or production manager. Goh would look for the following key items as:

- Work in process and inventory level in each lean cell.
- Scorecard at each lean cell. A scorecard, which is updated hourly, is a visual management on a real-time basis on safety, quality problems (if any?), inventory level and output units at each lean cell.
- The overall 7 wastes of LP concepts.
- Skills and knowledge of the workers, etc.

### 3.3 Interview

Interviews were carried out on the first four categories of workers (Groups A, B, C, and D). It was conducted from January 2013 to June 2013. Interviewees were selected by randomly picking out from the pile of survey forms. It was a face to face interview. Each interview lasted between 45 and 75 minutes. Follow up phone calls were made to further clarify doubtful points. In order to be as fruitful and truthful as possible, before the start of the interview, the candidate was told that his or her name would never be quoted in any of the reports without his or her permission. The interview was characterized by probing whether there were significant changes between periods I and II. It was an in-depth interview and a simple coding system was employed to capture the essence of the conversation. The same questions (Appendix II) were used for all the interviewees.

## 4. Results

Ninety five participants responded out of 150 indicating a 63.3% response rate which was encouraging. Thirty two respondents were selected randomly for the interview as shown in Table 3.

Table 3. Number of interviewees

Categories	No. of Invited Candidates	No. of Respondents	No. of Interviewees
A	4	4	3
B	14	12	9
C	32	24	10
D	41	26	10
E	47	22	Not applicable
F	12	7	Not applicable
total	150	95	32

### 4.1 Observation Findings

In period II, 15 observations were made. Positive observations were: work-in-process reduced drastically, operators worked attentively in an ergonomic manner and no stoppage of work due to missing materials. A senior interviewee told Goh that the striking scene in period I was long conveyor lines filled with work-in-process materials and workers appeared busy by walking around in search of tools or missing materials. This unproductive scene disappeared in period II. In period II, Supervisors and workers were happier (compared to period I) as they could fully concentrate on their jobs without the disruptions of searching tools or requesting help for replenishing the missing materials.

Other observations also revealed that there were constant interactions and dialogue among the workers to solve problems. Smiling faces were a common feature not only at the shop floor but also in the canteen and along the walkways. Goh attended 6 daily production and quality meetings and found them effective as i) no blaming of each other, ii) everyone came with a solution and not with a problem to discuss, iii) healthy dialogue among members despite there were differences in opinion, iv) no fear in expressing their own opinions, and v) meetings always ended within the specified duration of 30 minutes. Goh was told that the shortest production meeting they had ever recorded was 12 minutes. In one of Goh's observation trips, a production supervisor popped up and said surprisingly, "before the ROFO intervention, workers appeared to work hard but not so nowadays". Goh calls it the Parkinson effect as work extends to fill the amount of available time (Wikipedia, 2014). The authors wish to clarify that no similar observations were conducted in period I.

### 4.2 Interview Results

It is not possible to provide the full interview manuscript as only the most relevant will be presented.

Here are some extracts of the interview related to improvements in period II;

#### 4.2.1 Category A-Top Managers

- There was a significant positive mindset change in the years 2009 and 2010.
- The ROFO principle ignited a continuous cycles of action and learning.
- People had cooperation and trust with each other and as a consequence, there was a quantum leap in

productivity improvements.

4.2.2 Category B-Middle Managers

- Many jobs got done because people trusted each other. We liked the short production meeting of about 20 minutes.
- The coaching of the ROFO principle had helped a great deal. The ownership aspects improved significantly. We had good ROFO role models for others to emulate. Staff seemed to be happier compared to period I.
- Most significant improvements were: positive mindset change, huge productivity gains, increased cooperation and trust with each other, no smart talk, short production meetings and no firefighting.

4.2.3 Category C-Professionals

- Motivation of the staff had improved. They worked with satisfaction and took tasks assigned to them seriously.
- The big leap of improvements happened in year 2010 (positive mindset change) and sense of ownership had increased significantly.
- The habit of giving excuses, smart talk, and firefighting had decreased significantly and turned into a culture of execution, trust and co-operation.

4.2.4 Category D-Supervisors

- We strongly believed in ROFO, 5S and Lean concepts. Jobs got done faster with lesser supervision.
- The big changes were: positive mindset, short production meetings, no smart talk and firefighting, better OTD to customers and happier workers.
- We could see that workers were embracing the sense of ownership in accordance to the ROFO principle. We enjoyed the co - operative spirit and the trust with our peers and superiors.

Table 4 summarizes the main gist of the interviews in coded letters or words. In period I, it was dominated mainly by long production meetings (LPMs), working a lot of overtime and large work in process (WIP), poor on-time delivery (OTD) to customers, lacking of ROFO spirit, using smart talk to substitute action, and no companywide training. In period II, it was the reverse as productivity improved, no more firefighting (FF) or smart talk (SMAT) and they enjoyed the cooperation and trust (COAT) through the ROFO spirit. Workers in period II were happier than in period I as they had the positive mindset to learn and improve their problem solving skills. According to Miles et al. (2014), a meaningful relationship can be established through the qualitative studies as shown in Figure 2. From the interview findings, it is the intervention of ROFO principle coupled with companywide training that resulted in positive mindset change and productivity improvements. These transformational results therefore support hypotheses 1 and 2.

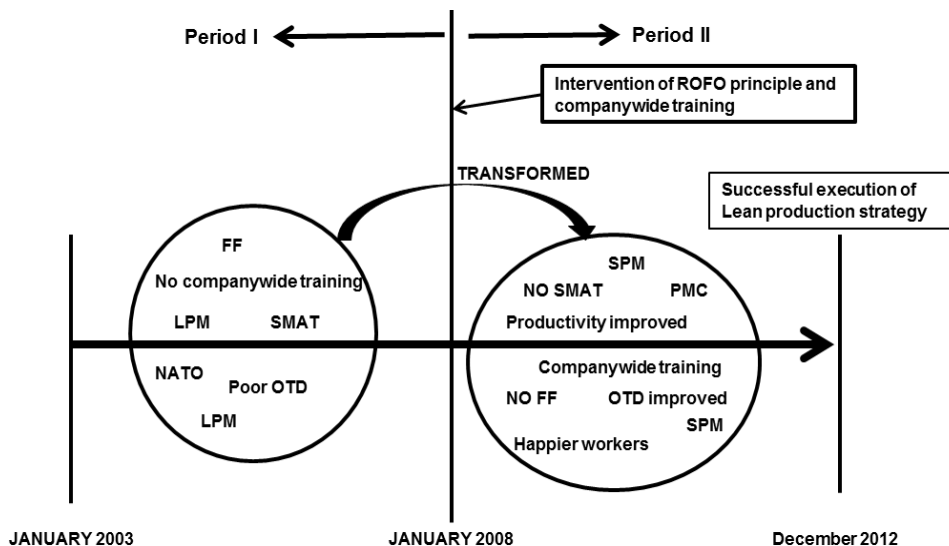


Figure 2. Intervention of ROFO principle and companywide training

Table 4. Results of the interview using coded words

Category/No. of Interviewees	Period I	Period II
A/3 (Top Managers)	LPM = 1x, poor OTD = 2x, FF = 2x, no companywide training = 1x, no ROFO spirit = 2x	OTD improved = 3x, no FF = 2x, SPM = 1x, PMC = 3x, have ROFO spirit & learning = 3x, COAT improved = 1x, happier with the job = 1x, effective companywide training = 3x, productivity improved = 3x, IPQ = 1x, problem solving skills improved = 3x, less resources needed to produce the right quality = 2x
B/9 (Middle Managers)	LPM = 3x, poor OTD = 3x, NATO = 8x, closup = 4x, A lot of OT & WIP, no ROFO spirit = 7x, FF = 4x, SMAT = 3x, I like the company = 2x, No companywide training = 6x	OTD improved = 8x, PMC = 9x, no NATO = 7x, no FF = 4x, SPM = 9x, no closup = 3x, have ROFO spirit & learning = 8x, COAT improved = 6x, happier with the job = 7x, SMAT disappeared = 4x, effective companywide training = 8x, PMC = 9x, IPQ = 6x, lesser inspection = 7x, problem solving skills improved = 6x, Productivity improved = 7x
C/10 (The Professionals)	NATO = 5x, FF = 7x, not so happy with the job = 5x, no ROFO spirit = 9x, FF = 3x, SMAT = 3x, LPM = 9x, no companywide training = 5x, closup = 5x, A lot of OT & WIP = 4x, I like the company = 6x	PMC = 7x, no NATO = 6x, SPM = 10, OTD improved = 4x, no closup = 4x, no FF = 4x, COAT improved = 6x, happier with the job = 10x, have ROFO spirit & learning = 8x, SMAT disappeared = 6x, effective, productivity improved = 7x, effective companywide training = 6x, NIPQ = 3x, problem solving skills improved = 7x
D/10 (The Supervisors & Technicians)	Not so happy with the job = 8x, NATO = 8x, FF = 6x, LPM=10x, SMAT = 8x, no companywide training = 5x, no ROFO spirit = 3x, closup = 9x, A lot of OT & WIP = 6x, I like the company = 4x	PMC = 10x, no NATO=10x, SPM=10x, no closup = 6x, no FF = 3x, COAT improved = 8x, happier with the job = 4x, have ROFO spirit & learning = 14x, SMAT disappeared = 10x, effective companywide training = 8x, NIPQ = 2x, problem solving skills improved = 8x, OTD improved = 2x, productivity improved = 10x
Legend (in alphabetical order from left to right)		
Closup-close supervision required to execute jobs	OT-overtime work	
COAT-co-operation and trust	OTD-on-time delivery	
FF-firefighting	PMC-positive mindset changed	
IPQ-improved product quality	ROFO-responsibility, ownership, focus & on-time corrective action	
LPM-long production meeting (more than 45 minutes)	SMAT-smart talk	
NATO-no action talk only	SPM-short production meeting (average 20 minutes)	
NIPQ-no improvement in product quality	WIP-work in process	

Note. x means "time" such as "2x" means the item is repeated 2 times.

#### 4.3 Survey Results

Figure 3 shows the graphs of mean pool rating for both periods and it can be divided into 3 zones. Zones A, B and C represent productivity improvements, mindset change, and overall improvements (productivity and mindset) respectively. Since period II graph is consistently above that of period I, it indicates that there are



productivity improvements (zone A) and positive mindset change (zone B) in period II in comparison with period I. To analyze further, for each zone, hypothesis testing is carried out to determine whether period II is better than period I.

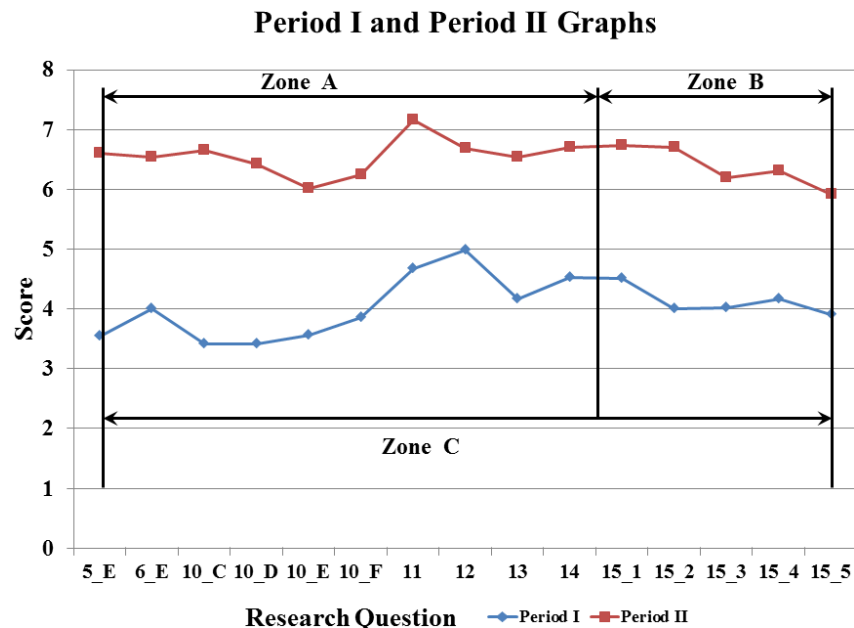


Figure 3. Graphs of mean pool rating comparison

#### 4.3.1 Hypothesis Testing for Zone A (Similar Set Ups for Zones B and C are not presented)

Below is the set-up of hypothesis testing for zone A:

HA0 (Null hypothesis): There is no difference in productivity improvements between periods II and I (no significant difference).

HA1 (Alternative hypothesis): Period II is better than Period I in productivity improvements (significant difference).

Table 5 shows that there are significant differences for all 3 zones, confirming the findings in the interview results as depicted in Table 4 and Figure 2. Therefore hypotheses 1 and 2 are fully supported by both the interview and survey results.

Table 5. Results of hypothesis testings between Periods II and I

Zone	Mean	Standard Deviation	T-Value	P-Value	Significant Difference
A (Productivity Related)					
Period II	6.73	1.93	9.64	0.000	Yes
Period I	3.93	2.07			
B (Mindset Related)					
Period II	6.34	1.87	7.12	0.000	Yes
Period I	4.17	2.31			
C (Productivity/ Mindset Related)					
Period II	6.60	1.83	8.98	0.000	Yes
Period I	4.07	2.05			

Note. One tailed test at  $\alpha = 0.05$ .

#### 4.4 Converging the Findings of Observation, Interview and Survey

The 3 case study methods (observation, interview and survey) have provided convincing results that fully support hypotheses 1 and 2. This is a strong testament that productivity improvements and mindset change are better in period II than in period I.

#### 5. Discussion

The above has adequately proven that the 2 hypotheses are fully supported. Next is to discover more findings by performing within and cross- category analyses as depicted in Table 6. Category B has not a single “ND” for all the 15 survey questions between periods I and II indicating improvements in all areas. Questions 15\_1 to 15\_5 have a straight ‘D’ marking across all categories, lending another strong support to hypothesis 2. There is unanimous agreement on improvements on questions 5E (effectiveness of production meeting), 10C (effectiveness of financial KPI), 10D (effectiveness of internal process indicator), 11 (on - time delivery) and 13 (solving quality and productivity issues). This quantitative finding further supports hypothesis 1.

Table 6. Overall results of 90 statistical tests

Question/Category	A	B	C	D	E	F	Remark
5E	D	D	D	D	D	D	Improved
6E	D	D	ND	D	D	D	XX
10C	D	D	D	D	D	D	Improved
10D	D	D	D	D	D	D	Improved
10E	ND	D	D	D	ND	D	XX
10F	ND	D	ND	D	ND	D	XX
11	D	D	D	D	D	D	Improved
12	D	D	ND	ND	ND	ND	XX
13	D	D	D	D	D	D	Improved
14	ND	D	D	ND	D	D	XX
15-1	D	D	D	D	D	D	Improved
15-2	D	D	D	D	D	D	Improved
15-3	D	D	D	D	D	D	Improved
15-4	D	D	D	D	D	D	Improved
15-5	D	D	D	D	D	D	Improved

Note. D-Significant difference, ND-No difference  $\alpha$  (alpha) = 0.05, XX-see section on: Brief analysis of “ND” questions.

#### 5.1 Brief Analysis on ND Questions

There are 6 categories and any question with more than 2 NDs is worthy of further examination as shown below:

Question 10F-(In your opinion, how effective is for each KPI by comparing the two periods: Innovation, training, and learning indicators between periods I and II?)

Top managers, professionals and production workers did not agree that there was an improvement on innovation, training, and learning indicators. From the interviews conducted, all agreed that training and learning had vastly improved. However, there remained room for improvement especially in the area of innovation among the professionals. Top managers agreed innovative solutions already happened in period II but they wanted more. Production workers also agreed they had learned a lot in period II especially in LP concepts. They were hungry to learn more particularly in the training and development of QC (Quality Control) tools. The conclusion is that all wanted too much good things to happen too soon.

This is indeed a positive finding.

Question 12-(In your opinion, what is the quality of the output of products between periods I & II?)

Question 12 refers to the output of the quality products. It appears that the first 2 categories (top and middle managers) have different views from the last 4 (professionals to auxiliary workers). The interview findings also agree with the survey results particularly (Table 4) for categories C (professionals) and D (supervisors/technicians). Investigation revealed that the outgoing quality of the products had improved in the sense that it used lesser resources in period II than in period I (Table 4, results of the interview on the categories A and B). The improvement came from the quantum reduction in quality costs as illustrated in Figure 4. In period II, prevention cost increased significantly but appraisal and failure costs had been reduced drastically. The professionals, supervisors, production workers and auxiliary workers probably failed to realize that the acceptable quality level in period I was achieved by enormous inspection and rework. Based on the aforesaid reasons, it is concluded that there is indeed meaningful improvement.

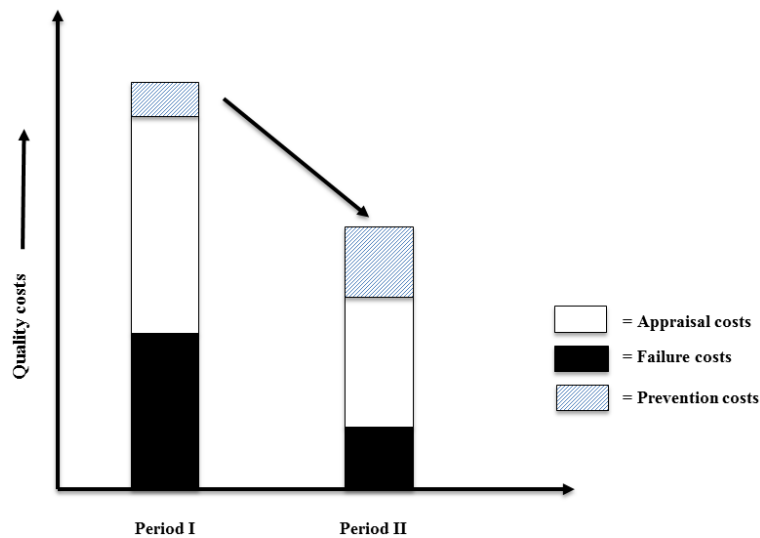


Figure 4. The quality costs between periods I & II

### 5.2 ROFO and Companywide Training Including Tangible Benefits

The companywide training on ROFO, 5S and LP concepts have benefited the company. In early 2008, only 2 lean cells were implemented and by the end of 2012, ST had 45 lean cells. An example of a completed lean cell with benefits is shown in Table 7. The units per hour have increased from 4 to 6 with the corresponding reduction in manpower from 10 to 8. This is indeed not a small improvement.

There is a significant improvement on the effectiveness of production meetings. In period I, there was a lot of talk and mostly problems were presented during meetings. In period II, great changes took place and employees were looking for solutions before they attended the daily production meeting. Just imagine how unproductive they were in period I to have taken between 45 and 75 minutes and yet not having all the problems solved whereas in period II, it took merely 20 minutes to settle all the production issues. Why is it so? It is because of the ROFO spirit that the staff are gradually internalizing and embracing. Interviewees told Goh that in period I, employees were protective and not willing to go the extra mile. They were only concerned with their own duties. Although they had long meetings, most of the issues remained unsolved. As a consequence, more and more problems were presented. Deliveries were postponed and special actions had to be directed from the top management to meet customers' deadlines. Some who were not doing their jobs well were able to get away free by smart talking (Pfeffer & Sutton, 1999).

Very often members agreed to solve the late delivery in the first meeting by checking with the suppliers as well as to seek alternatives. However, no progress was made at the next meeting. Their actions and words lacked consistency, and did not always act upon their words. The situation can be similarly compared to the GM (General Motors) nod regarding the faulty ignition switch which resulted in recalling 2.6 million cars (Valukas Report, 2014). It was reported in the USA Today paper (Healey & Meier, 2014) that, "when everyone nods in agreement to a plan of action but does nothing after leaving the meeting room".

Table 7. Example of the benefits of a LP cell

Item	Traditional Line	Lean Cell
Efficiency (%)	81.7%	110%
Working Area (m2)	39.52	26.65
Travelling Path (m)	213	12
Manpower (Persons)	10	8
UPH Per Person	4	6
Throughput (Days)	6	1.5

Note. UPH-units per hour, Efficiency = standard time divided by actual time, m = metre.

ST had gained from both tangible and intangible benefits. KPIs for the following had improved enormously:

- On-time deliveries based on first confirmation with customers had improved from an average of 80% in period I to an average of 96% in period II.
- In the EMC division, efficiency had increased from 65% in the first quarter of 2002 to 95 % in the last quarter of 2012. The formula for calculating efficiency is standard time divided by actual time.
- In the Automotive division, the efficiency had risen from 75% in the first quarter of 2002 to 130% in the last quarter of 2012.
- Inventory reduction had been substantial from 210 million Baht in 2007 to about 90 million Baht in 2012 (Figure 5).

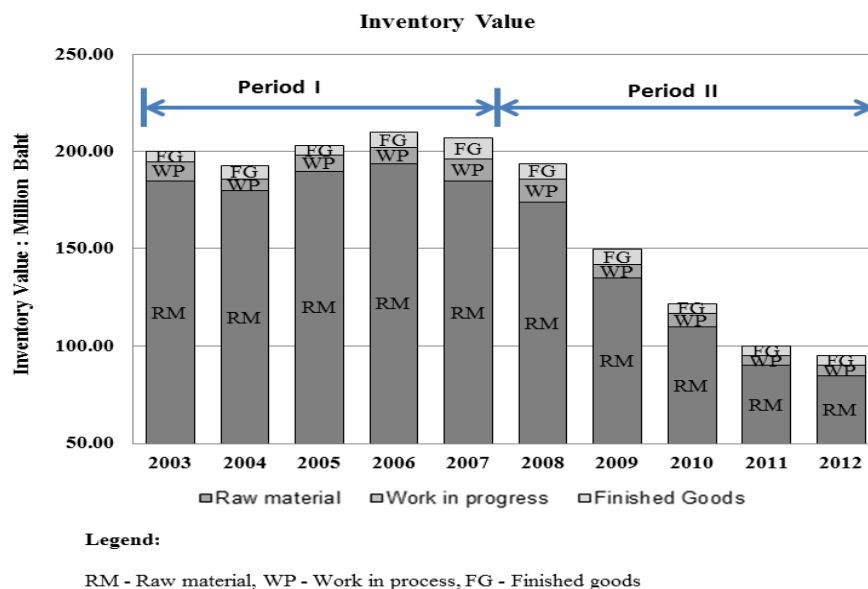


Figure 5. Inventory reductions

### 5.3 The Contributions of ROFO to Ownership, Commitment, Cooperation and Learning

The ROFO principle has two aspects: one is the management concept and the other is a tool for solving problems. The former deals with the ownership (mindset) of the entire problem and solve it successfully without blaming others (Figure 6). The latter is to treat it as a tool by first picturing every work is a process and a process is a system of inter-related activities to deliver the desired result (Figure 7).

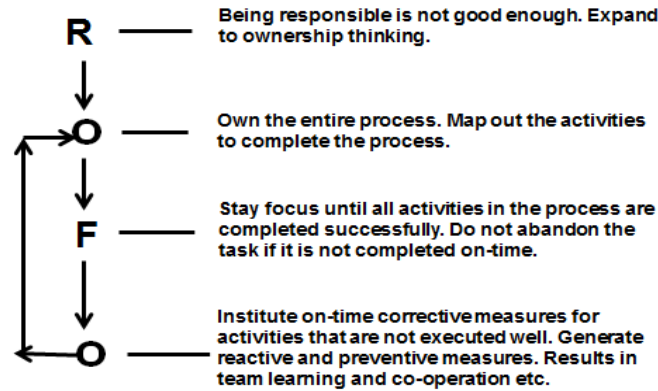


Figure 6. Key steps of ROFO principle(Goh, 2015)

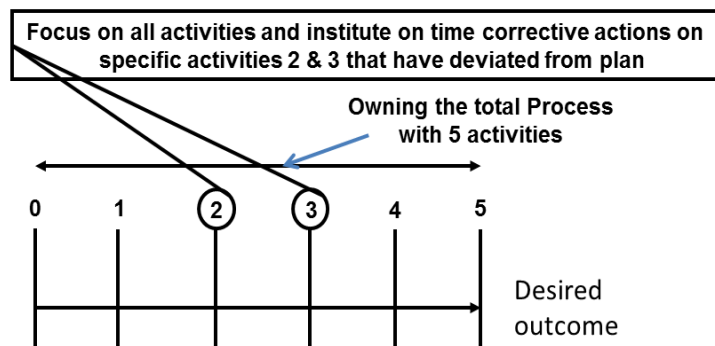


Figure 7. Ownership of a total process to deliver the result

As illustrated in Figure 7, the process owner will institute corrective measures immediately on activities 2 and 3. To solve activities 2 and 3, total quality management (TQM), 5 Why analysis, LP and Six sigma tools may be used such as; cause and effect diagrams, statistical process control (SPC) charts, ANOVA (analysis of variance) and so on. The process owner will frame activities 2 and 3 as challenges (not as problems) and this has positive impact on process improvement activities (MacDuffie, 1997). The process owner will not leave the bandwagon until all challenges are tackled successfully. In ST, this type of behavior is exhibited throughout the organization. Learning kicks in when there is a strong desire to fulfill the challenges similar to Senge's (1990) concept of "creative tension" which stipulates that learning occurs when individuals want to move from their present position to where they want to be. Argyris (1995) would put it simply, "learning occurs whenever errors are detected and corrected, or when a match between intentions and consequences is produced for the first time". A number of scholars believe that the implementation of TQM will result in learning (Senge, 1992; Barrow, 1993; Sohal & Morrison, 1995; Terziovski, Howell, Sohal, & Morrison, 2000). Going by the above logic, learning is therefore extensive in ST as the successful execution of LP program requires techniques that are beyond TQM tools. In addition, under the umbrella of no-blaming culture, the process owner is able to engage dialogue and sharing of ideas with his members in solving process related issues healthily (Kovach & Fredendall, 2013). Constructive dialogue and learning happen in ST as members shared the common ROFO mental model (Schein, 1993). It is the power of the ROFO principle which nurtures the ROFO (ownership mindset) spirit that ultimately gives rise to commitment, cooperation, learning and trust in the organization. Commitment comes from the ROFO spirit and the more the ST employees embrace the ROFO spirit, the better is the learning, cooperation, and trust. On the other hand, without the ownership mindset, organizations will fall into silo thinking and under which defensive routines and excuses (Ashforth & Lee, 1990; Mazen, 1997; Argyris, 1999) will seriously block the solving of problems. ST had successfully overcome them in period II.

Larson and Sinha (1995) say there is a strong practical implication that co-operation between people and departments triggers a chain reaction. Non-stop training and development on a companywide basis has created a

continuous cycles of action and learning. Each ROFO cycle resulted in a chain of corrective actions and team learning and as more cycles are generated, more learning takes place. Learning is a journey that needs time, dedication, and patience. Toyota has not changed its stance on training and developing on TPS since its first inception 50 years ago. Singapore Airlines (SIA), one of the best airlines in the world in terms of profitability and excellent service (Heracleous, Wirtz, & Pangarkar, 2006) is strongly committed to extensive investment in training and retraining. Welch, CEO of General Electric (GE), is a firm believer in human resources development. To Welch and Welch, the Human Resources Director is the second most important person in the organization (2005, page 99). He took 20 years to transform GE into one of the most admired company on Earth and on his eve of retirement (7 September 2001), Fortune Magazine named him, "Manager of the Century" (Bartlett & Wozny, 2005). Schonberger (1986) says training is the foundation for implementation and the West still has a lot to catch up with Japan and Germany. ST employees are proud that the ROFO practice has resulted in a non-political environment that favors not only learning but also an execution culture.

## 6. Conclusion

The three objectives which formed the basis of this study have been adequately fulfilled. The two hypotheses are also supported by the qualitative and quantitative findings. The power of the ROFO principle had made a paradigm shift in mindset that resulted in two fundamental changes; ownership and cycles of action and learning. Co-operation and trust emerged in period II which reinforced further learning. ST has found an effective way of maximizing learning by mindset change coupled with intensification of training and development of staff. The ROFO principle lives in the minds, hearts and hands of the people. The LP strategy was executed successfully.

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## Appendix A

### The Survey Questions (Abridged Version)

Note: A scale of 1 to 10 is selected for all questions with “1” as the weakest and “10” as the strongest.

- 5e. What do you think of the effectiveness of the production meeting by comparing the two periods?
- 6e. What do you think of the effectiveness of the Quality meeting by comparing the two periods?
- 10c. In your opinion, how effective is for each KPI by comparing the two periods on Financial indicators?
- 10d. On Internal business/ process indicators?
- 10e. On Customers indicators?
- 10f. On Innovation, training and learning indicators?
11. In your opinion, what is the on- time delivery to customers between Periods I & II?
12. In your opinion, what is the quality of the output products between periods I& II?
13. In your opinion how effective is your organization in solving quality and productivity issues between periods I & II?
14. Do you think your organization has the right level of knowledge to solve quality and productivity issues between Periods I& II?
15. In your opinion, mark the level of ownership on the 5 categories of staff (top managers, middle managers, professionals, supervisors and technicians, and front- line workers) in your organization between periods I& II. Take note that “ownership” is different from “responsibility” as explained in the ROFO principle.

## Appendix B

### The Interview Questions

Do you think there are changes between periods I and II? Please tell us whether they are positive or negative?

- 1) Do you think the changes have contributed to productivity improvements? Yes or No? Please explain.
- 2) What are the significant changes that have impacted the Schaffner operations most?
- 3) In what manner ROFO principle has made staff more aware of taking ownership to solve problems?
- 4) What is the knowledge and skills levels between periods I and II? What are about the problem solving skills?
- 5) Do you think the production and quality meetings held in Period II are more effective than in period I? And why?
- 6) What about the politics and cooperation spirit in period I? In period II?
- 7) Are you happier now in your job? Please explain your answer?
- 8) Do you think there are improvements in the major key process indicators (KPIs) between periods I and II?
- 9) Explain what do you think about the effectiveness of companywide training on ROFO, 5S and Lean concepts?

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