

Cases Studies on Total Productive Management and Competitive Advantages

Li chang-chung and Tsai Ping-chen

Department of Industrial Engineering and Engineering Management.

National Tsing Hua University

Hsinchu, Taiwan, R.O.C.

Abstract

The purpose of business strategy is to achieve competitive advantages which includes higher efficiency, better quality, more innovation and faster customer response. In other words, The business strategy is to build unique capability of lower cost and/or differentiation. In production aspect, unique capability means better production power with better performance at 3M(Man, Machine, Material) of input and PQCDMS (Product, Quality, Cost, Delivery, Safety, Moral) from output. The Total Productive management (TPM), a series of improvement activities focused on reduction of equipment loss, is a tool to establish business competitive advantages.

In this paper, several domestic companies who won the Japan TPM Award have been studied. It is found that there is a strong cause-effect relationship between TPM and competitive advantages because.

1. TPM can change employees mindset effectively.
2. TPM can upgrade employees capabilities.
3. TPM can lead to excellent productivity.

Key word: strategy, competitive advantages, TPM, vocation paradigm, mindset change.

1. Backgrounds

Businesses all over the world are seeking competitive advantages. The basic purpose of business strategy is to achieve competitiveness. And competitiveness is the ability to get customers to choose your product or service over competing alternatives on a sustainable basis. On the hand, we need to put our

abilities at hand into consideration to form strategies. Therefore it is clear that there is a close-looped relationship between business strategy and ability. See Figure 1.

Facing the global fast changing and severe competition business environment industries in Taiwan are trying to build up manufacturing competitive advantages from labor intensive to technology or capital

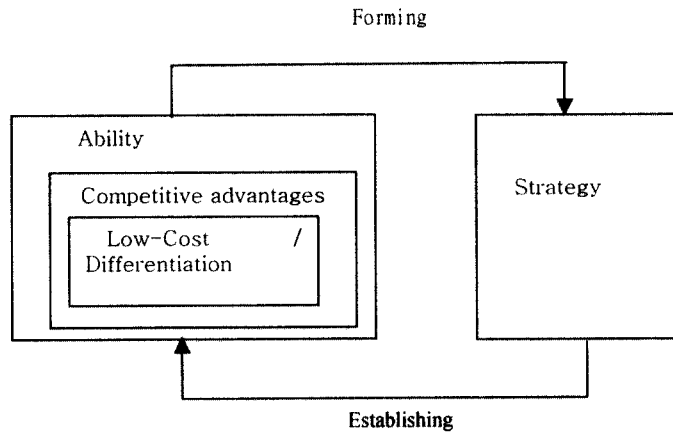


Figure 1 relationship between strategy and capability [2]

labor intensive to technology or capital intensive through mechanization or automation of production equipment. However, according to the 7th survey report on automation by Industry Development Bureau of Economics Ministry conducted in 1993, the efficiency and effectiveness of introducing automation base on low cost strategy were not significant. For example, CPT(Chung Hwa Picture Tubes) and TYM(Taiwan Yamaha Motor) company, both highly automated, the overall equipment efficiency(OEE) were only 57,6% and 65.6% respectively.

The main reason of low OEE for CPT and TYM is that they dont have a proper landing point to execute competitive production strategy, ie., there is a gap

between direction (strategy) and starting point(executing strategy).

2. Introduction of TPM

How to execute manufacturing competitive advantages to improve production efficiency and effectiveness? What is a good landing point to start? First, we have to realize that there are 16 losses with respect to productivity in production activities. The so-called productivity can be defined as

$$\text{Productivity} = \text{Output} / \text{Input} = (\text{Volume, Quality, Cost, Delivery, Safety, Morale}) / (\text{Material, Machine, Man})$$

Hence, these 16 losses can be grouped into 3 categories: impeditive to equipment, impeditive to man, and impeditive to material. And the purpose of TPM is to eliminate all 16 losses such that production efficiency and effectiveness can be improved.

As mentioned earlier, various equipment losses can be quantitatively calculated. With the results of those calculations put together, we can calculate the equipment operating state and judge if the equipment utilized to its fullest. To express the overall equipment efficiency, the following equation should be used

Overall Equipment Efficiency = Availability × Performance rate × Quality product rate

Availability = (loading time – downtime) / loading time

Performance rate = (standard cycle time × product units processed) / operating time

Quality product rate = (product units processed – defect units) / product units processed

Otherwise, downtime loss including equipment failure loss, set-up loss, cutting blade and jig change loss, start-up loss, performance loss including minor stoppage and idling loss, speed loss, defects quality loss including defect and rework.

In 1971, Japan Institute of Plant Maintenance (JIPM) gave a description of TPM as

- pursuing the highest efficiency of equipment;
- building a PM system for equipment life

cycle;

- including planning dept, user dept, and maintenance dept of equipment;
- involving all personnel from top management to first line employee; and
- proceeding with voluntary small group (flexible, mobile).

But in 1989, the content of TPM were extended to

- Establishing a corporate culture that will maximize production system effectiveness;
- Organizing a practical shop-floor system to prevent losses before they occur th-

roughout the entire production system life cycle, with a view to achieving zero accidents, zero defects and zero breakdowns;

- Involving all the functions of an organization including production, development, sales and management;
- Involving every employee, from top management down to front-line operators, and
- Achieving zero losses through the activities of "overlapping small group."

Loading time		
Operating time		Downtime loss
Net operating time		Performance loss
Valued operating time	Defects	quality loss

Table 1 compares the differences between these two definitions. From Table 1, it is clear that TPM is gradately becoming a company-wide and cross-functional activity on a continuous base.

process including target setting and actual performances. Then we compare implement process with 12 steps. Finally, we list actual success factors for future references.

Table 1 Comparison contents of TPM in 1971 and 1989

Item	Contents in 1971	Contents in 1989
Efficiency to	Equipment	Production system
Life Cycle to	Equipment	Production system
Involved Department	Planning, User, Maintenance	All department
Involved Levels	From manager to operator	All department
Activity Organization	Small group	Overlapping small group

As for execution of TPM, there are 4 stages including 12 steps in TPM development programs. Table 2 gives stages, steps and essential activities in each step.

3. Cases studies

In this section, well use three cases study to illustrate the deployment process of TPM.

These 3 companies belong to different industry while they all won TPM award. First, we briefly introduce each company his history and products followed by important

3.1 Companies Briefing

ChungHwa Picture Tube Corp.(CPT), SanYo Electronic (TaiCHung) Corp. (SE T) and Breaker & Switchgear System Factory of ShiLin Electric & Engineering Corp. (SEECO) were selected as a sample to re-present information , semiconductor and electrical engineering industries, respesively. First, CPT is a CRT manufacturing company, established in 1961 and now established in 1960,ChungHwa Picture Tube Corp. is the largest CRT manufacturer in world with over 15,000 employees. CPT has

Table 2 12 steps in TPM development programs

Stage	Steps	Essential Activities
Preparation	1. Declaration by management to implement TPM	Declared in TPM in-house meeting use company bulletin
	2. Introductory education and campaign for TPM	Manager: Trained seminar camp at each working level General employees: Seminar meeting using slides
	3. Establishing TPM promotion organization and pilot organization model	Committee Special subcommittee TPM promotion office Model machine for Jishu-Hozon training by group leaders and up
	4. Setting basis principles and target for TPM	Bench-mark and target Predication of effect
	5. Creating of master plan for establishing TPM	From preparations for implementation to application for PM award
Kick-off	6. TPM Kick off	Invite supplier, cooperation and affiliated companies
Implementation	7. Establishing systems for improving production efficiency	Pursuing maximum efficiency of production
	7.1 "Kobetsu-Kaizen"	Project team activities and small group activities in the workshop
	7.2 "Jishu-Hozon"	Step system, audit, qualification certification
	7.3 Planned maintenance	Corrective maintenance Time-base maintenance Predictive maintenance
	7.4 Education and training for operation and maintenance skill upgrade	Leader's operation and maintenance skills upgrading training and provide skill in transmission of education to circle numbers
	8. Initial control system for new product and equipment	Easy-to-manufacture product development and east-to-operate equipment
	9. Establishing the Hinshisu-Hozon system	Setting conditions to eliminate defective products and maintenance control
	10. Establish the system to realize operation efficiency in the administrative department(s)	Support for production, increasing efficiency in office and OA equipment
	11. Establishing safety, hygiene, and working environment protection system	Zero-accident, zero-pollution
Steady application	12. Total application of TPM and raising its level	Application for PM award challenge target

six production sites and branch offices in Malasia, Mainland and England. Main products of CPT are CTV (Color TV CRT), CDT (Color Display CRT), Electron Gun Mount, LCD Modlues, DY (Deflection Yoke), MDT (Mono Display CRT)^o

SET is a professional company on packaging, testing and sales of semiconductor products. It was established in 1976 and isa100% Japanese-owned company with 755 workers. It is main products includes IC, small single transistors and large single transistors.

SEECO was established in 1973 and now is the largest Molded Case Circuit Breaker & Capacitor manufacturer in Taiwan. It has 617 workers, main products includes BH,NF Molded Case Circuit Breaker & Capacitor and Power Leakage Breaker.

3.2 Comparison of TPM Activities and 12 Steps

TPM is a continuous long-term activity to improve companys constitution. In order to promote effectively and examine performances, all these 3 companies uses different TPM award of JIPM as activity goal at different period of implementation.

To implement TPM, besides 12 steps, it needs a clear picture of company vision, deepening into the problems faced, goal setting and setting ambitions goal and short-,middle-,and long-term facilitating plans plus PDCA cycle as management means. Furthermore, it takes at kinds of diagnostic, competing and keep-up energy and performance needs for several years. Table 3,4,5 clearing showed the challenging goals and actual performances of 3 companies for promoting TPM at each period.

Table 3 Indices and Actuality of TPM Activity (CPT)

Category	Index	Unit	TPM- PART I 1991(base) ~ 1993			TPM- PART II 1994~1996	
			Bench Mark	Target	Actuality	Target	Actuality
P	Profit	Index	1	4	3.51	7.0	6.6
	Product	Kpc/月	568	--	652	877	835
	Productivity	pc/man.month	170	--	217	250	283
	O.E.E.	%	56.98	80	80.84	90	86.3
	Equipment Failure	pc	220	55	55	35	33
Q	Quality Loss	Index	1	--	0.64	0.6	0.61
	Glass Scrape Rate	%	1.3	0.71	0.75	0.32	0.27
C	Cost Down	Index	1	--	0.7	0.7	0.71

Table 4 Indices and Actuality of TPM Activity (SET)

Category	Index	Unit	TPM-PART I 1995(base)~1998		TPM-PART II 1999~2001
			Bench Mark	Actuality	Target
P	\$10k/man/day	\$K	16.8	19.0	32.2
	O.E.E.	%	55	86	92以上
	Equipment Failure	pc/month	779	3	0
	# of short B/D	pc/month	1411	255	0
Q	Customer Complain	pc/6 months	25	9	0
	Assembly Defective	%	3.1	1.36	0.31
C	Cost Down	%	—	2.1	30
	Accumulated Improvement	\$100kk	—	6.12	12
D	WIP	days	9.6	6.3	3.0
S	Labor Hazard	pc	3	0	0
	Suggestion	pc/month	1	5.2	10
	Quality Improvement	point/6 months	6	15	50
	Technical Certificates acquired	people	0	82	180

Table 5 Indices and Actuality of TPM Activity (SEECO)

Category	Index	Unit	1995 Bench Mark	1999 Target	1999 Actuality
P	O.E.E.	%	70.2	85	89
	O.P.E.	%	71.2	90	93
	Productivity	pc/hr.people	13	24	27
	Labor Output	\$10K/people.year	271	285	285
	Equipment Failure	pc/month	86	6	1
	# of short B/D	pc/month	45344	4500	5160
Q	Defective	%	1.3	0.1	0.1
C	Cost Down	%	0	20	20.1
	Maintenance Fee	%	0.04	0.01	0.021
S	Labor Hazard	pc	1	0	0
M	Suggestion	pc/month	0.15	4	4
	Handouts	pc	10	90	85
	One Point Lesson	pc	0	6000	6363
	# of Zero Failure Machine	pc	0	260	242
	# of Zero Defective Machine	pc	0	2000	145

Table 6 Comparing 12 steps in TPM development programs and CPT, SET, SEECO

Stage	Steps	CPT		SET		SEE
		PART I	PART II	PART I	PART II	PART I
Preparation	1. Declaration by management to implement TPM		○		○	○
	2. Introductory education and campaign for TPM		○		○	○
	3. Establishing TPM promotion organization and pilot organization model		○		○	○
	4. Setting basis principles and target for TPM		○		○	○
	5. Creating of master plan for establishing TPM		○		○	○
Kick-off	6. TPM Kick off		○		○	○
Implementation	7. Establishing systems for improving production efficiency					
	7.1 "Kobetsu-Kaizen"					
	7.2 "Jishu-Hozen"		○		○	○
	7.3 Planned maintenance					
	7.4 Education and training for operation and maintenance skill upgrade					
	8. Initial control system for new product and equipment	---	○		○	○
	9. Establishing the Hinshisu-Hozon system	---	○		○	○
	10. Establish the system to realize operation efficiency in the administrative department(s)	---	○		○	○
	11. Establishing safety, hygiene, and working environment protection system		○		○	○
	(NEW) Die maintenance	---	---	---	---	○
Steady application	12. Total application of TPM and raising its level		○		○	○

Although they all followed 12 steps, there were some differences, e.g., CPT started with manufacturing department to deploy. SEECO added die maintenance activity to enhance core technology.

3.3 Critical Success factors of TPM

After TPM, the working environment of these 3 companies became nice and clean, the administration became more transparent through TPM activity boards showing each improvement indices and moving chart. In other words, they became autonomously managed. To sum up, we can induce the following common critical success factors of these 3 companies for others reference:

- Determination, patience and self-participation of the top management;
- Exact organization of promotion and vocational paradigm;
- Clear TPM activity policy, goal and plan;
- Advises from consultants;
- Vivid slogans with continuous presentation and competition activities;
- Set ambitions benchmark TPM award;
- Through TPM education and training and practice to build reform consciousness and foster improvement ability.

4. Discussion

The benefits of TPM activity can be divided into tangible and intangible parts. In tangible part, we use O.E.E. to illustrate. For CPT, SET and SEECO, O.E.E. of before / after TPM are 57.6% / 81.6%, 55% / 86% and 70.2% / 86.7%, respectively. The average improvement was 135%. It means that under the some equipment investment there will be 35% more efficiency, or 35% more production volume or sales. If the market need is un-changed, it also implies the business break even point is reduced such that profit is enlarged from ab to ac as Fig.2 showed.

For example, if we fix BEP of SEECO at 1997 when SEECO started to implement TPM as 100, then after 2 years, its OEE increased 1.24 times and BEP down to 81. Therefore, it is clear that there is a must-be relationship between increase from TPM and BEP.

Put it in another way, TPM can increase O.E.E. lower BEP. It leads to market competitive advantages by lower cost or high value-added.

Intangible effect

- Bring-out autonomous management, that is, Jishu-Hozon of equipment.
- Self-confidence can be built up through Zero-failure and Zero-defect operation.
- Crease, chips and dust will be removed

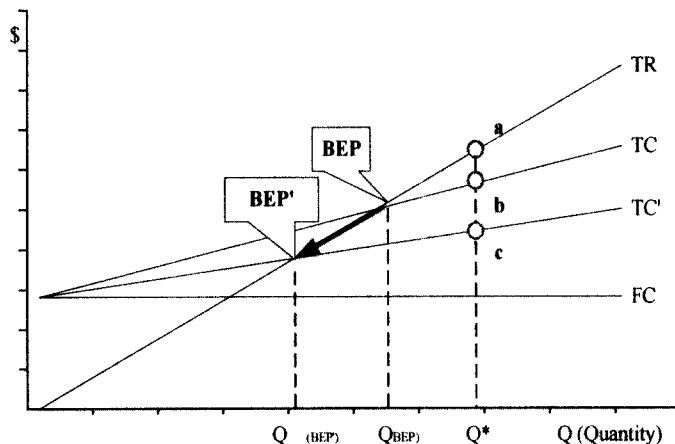


Fig 2 The relationships of OEE and Breakeven Point

and a delightful working environment can be created.

- Good maintenance impression to visitors leads to successful order receiving.

5. Conclusions

The purpose of competitive strategy is to create competitive advantage to enhances competitiveness. Based on above mentioned

three cases, It is not difficult to realize that TPM is a good out-in point for strategy development. That is, relative to its competitors, businesses can have better profitability because of higher efficiency, better quality, more innovation and faster customer response. Associated with each competitive advantage items, there are different TPM activities. For example, higher efficiency corresponds to labor productivity, OEE, and failure in TPM activities.

Table 7 TPM Activity Index and Competitive Advantages

Competitive Advantages	TPM Activity Indices	Best Company	Actual / Base
Higher Efficiency	Labor Productivity(pc/hr.man)	SEECO	24 / 13
	O.E.E.(%)	CPT	86 / 57
	Equipment Failure(pc)	CPT	33 / 220
Better Quality	Defectives(%)	SEECO	0.1 / 1.3
More Innovation	Suggestion(pc)	SET	5.2 / 1
	Cost Down(index)	CPT	0.71 / 1
Faster Customer Response	Customer Complaints(pc)	SET	9 /25

In Table 7, we gave the best performance index among three companies to demonstrate the power of TPM. Hence, TPM can improve competitiveness.

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