



Lean production, six sigma quality, TQM and company culture

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Abstract

Purpose – The authors analyze the principles and results of lean production and compare the lean production philosophy with the six sigma quality process and the principles of total quality management (TQM). At the end of the paper, it is discussed how to build the necessary company culture for having success with these principles/management philosophies.

Design/methodology/approach – Literature search and comparative analysis complemented with a Danish case on wastage in a core process.

Findings – It is shown that the lean production philosophy and the six sigma steps are essentially the same and both have developed from the same root – the Japanese TQM practices. The improvement process from six sigma, the DMAIC process, can be regarded as a short version of

the Quality Story, which was developed in Japan in the 1960s as a standard for QC-circle presentations. We conclude that the roadmaps of lean production and six sigma quality are examples of new alternative TQM roadmaps. We also conclude that especially with lean production and six sigma quality there seems to be too much focus on training people in tools and techniques and at the same time too little focus on understanding the human factor, i.e. how to build the right company culture.

Originality/value – The detailed and historical analysis of six sigma quality, lean production and TQM combined with a focus on the human factor and the needed corporate culture.

Keywords Lean production, Six sigma, Quality, Total quality management, Organizational culture

1. Introduction

There is a widespread confusion and misunderstanding of what is “lean production”. Is it just an old “fad” which can be ignored like most other fads or should companies, begin to understand what it is? The same confusion may also be related to the “new” old fad – “six sigma quality” and its relation to total quality management (TQM) (Mikel, 1998; Tadikamalla, 1994;

Voehl, 2000)? Is “six sigma quality” just old wine in new bottles, or has it one or more important learning points, which should be remembered and practiced? What are the differences and similarities between lean production, the six sigma quality process and TQM? There seems to be a need to analyze these popular and often misunderstood concepts together and to relate them to the relatively well-established management philosophy TQM.

Another widespread confusion and misunderstanding is concerned with the key success criteria of six sigma quality. It seems as if most training programs on six sigma quality, which typically are planned as a number of 3-5 days modules, focus only (or mainly) on training in various tools and techniques and almost ignore the human factor, i.e. how to build up a company culture characterized by commitment for continuous improvements and everybody's involvement.

This paper has two purposes. The first purpose is to present the main concepts behind lean production and to relate the discussion to "six sigma quality" and "TQM". This will be done in Sections 2-4. The second purpose is to focus on some of the latest findings on how to explain human commitment. In Sections 5-7 of the paper, we will reflect on these findings and shortly discuss the implications of these findings in relation to building a company culture, which supports the implementation of TQM, and hence the implementation of lean production and six sigma quality.

2. Lean production, six sigma quality, and TQM

2.1 The origin of lean production is Japan

Lean production or lean thinking (Womack et al., 1990; Womack and Jones, 1996) has its origin in the philosophy of achieving improvements in most economical ways with special focus on reducing muda (waste). The concept of muda became one of the most important concepts in quality improvement activities primarily originated by Taiichi Ohno's famous production philosophy from Toyota in the early 1950s (Dahlggaard-Park, 2000, p. 128). This philosophy was widely called as Toyota production system in Japan (Udagawa et al., 1995; Womack et al., 1990), and it became later on (1986) labeled as lean production and lean thinking by Womack et al. (1990).

Toyota adopted statistical quality control methods in the last part of 1949 by attending the statistical quality control course provided by JUSE to overcome the crisis. At the same time Eiji Toyoda went to USA to study how automobiles were manufactured in the world's largest and most efficient manufacturing plant – Ford's Rough plant in Detroit. At that time, Ford's Rough plant produced 7,000 cars per day, which seemed like a dream compared to Toyota's accumulated results of 13 years of effort by 1950 – 2,685 cars. It is understandable, that Eiji Toyoda decided to study intensively (3 months) how cars were produced in this plant.

During his stay at Ford Eiji wrote back to the headquarter, that he "thought there were some possibilities to improve the production system" and back in Japan, Eiji and his production genius, Taiichi Ohno (who also visited Detroit several times), however soon concluded, that mass production as running at Ford could never work in Japan (Womack et al., 1990, p. 49).

What they realized in USA was, that there was too much waste everywhere. There were wasted man power, efforts, materials, space and time, i.e. muda of man power, muda of production, muda of inventories and excess processing, muda of defects, muda of waiting, muda of transport, muda

of facilities. For instance, they could observe that none of the specialists beyond the assembly worker were actually carrying out value adding activities to the production. They were just responsible for designing the production process and giving orders and instructions to the workers. The only activity of a foreman was to ensure, that line workers followed orders, and the assembly-line workers would just, repetitively, perform one or two simple tasks (Womack et al., 1990, p. 55). From these observations they realized, that they (Japan and Toyota) were too poor to have these kinds of waste (both of human resources and material resources), and they could not afford to just copy and implement, what they have seen in USA (Dahlggaard and Dahlggaard-Park, 1999b).

What Ohno did, when he returned to Japan, was firstly to establish groups (teams) with workers, and to encourage them to work together to perform the best way of operations. This first step was followed by the next step, where Ohno extended tasks for the teams to include tool repair, quality-checking, and other housekeeping jobs such as the five-S activities (Dahlggaard-Park, 2000, p. 128). When the teams were running well, Ohno extended further their tasks. Now he set time aside periodically for the team to suggest ways collectively to improve the process (Womack et al., 1990, p. 56). This teamwork was the early version of "quality circles".

Another famous system to reduce muda (waste) was also invented by Ohno – the so-called just-in-time (JiT) or Kanban system. Ohno saw at Ford Detroit, how much muda was produced under the mass production system. For instance, there was high inventory cost to keep a large number of parts that were later found to be defective, when installed at the assembly plant (Womack et al., 1990, p. 60). From this observation, Ohno developed a new way to co-ordinate the flow of parts within the supply system on a day-to-day basis, thus the parts would only be produced at each previous step to supply the immediate demand of the next step. This JiT system later on became much more efficient, when they used a kind of card (Kanban) as a tool for information exchange between different production lines. From that time, the JiT system was called as the Kanban system (Udagawa et al., 1995, p. 96). In fact, Taiichi Ohno got this JiT idea, when he saw the modern supermarket system in USA (Womack and Jones, 1996, p. 37; Udagawa et al., 1995, p. 96; Ohno, 1978, pp. 137, 141).

By implementing JiT or Kanban system much muda could be reduced. First of all, a large space was not necessary to keep a large number of parts. Second, only the needed quantity of parts was produced. Third, if defects were produced, it was immediately discovered, thus the system prevented a large number of defects to be produced. However, this new system was not easy to implement, especially if the system often produced defects. That means if just one small part of the whole production system failed with defects, the entire production system should be stopped. In fact, this point was precisely, what Ohno had thought about. He wanted that every member of

the entire production system paid attention to the prevention of potential problems and in this way reduced muda.

In spite of several advantages of Ohno's new production system, his idea did not get popularity in the company. The majority of people were more interested in establishing the mass production facilities, and thereby to secure the production in quantity. Thus, Ohno's idea was in the beginning limited to be applied only in his own plant (he was the Manager for one of the production plants at the head quarter).

Focusing on quantity in production, Toyota increased radically productivity, and in 1959, Toyota produced for the first time 100,000 cars a year (Udagawa et al., 1995, p. 91). However, Toyota was confronted with a serious crisis in the last part of the 1950s, when the US market rejected Toyota's new brand Crown for several reasons such as lack of security, lack of power, too heavy, etc. At the same time, the Japanese government was forced to liberalise trade by confronting pressures from overseas.

To improve quality was the critical factor in order to overcome the crisis. In this critical situation, the management team of Toyota agreed to implement TQC (total quality control) in the whole company together with the Kanban system (Udagawa et al., 1995, p. 93). As a consequence of these activities and the improved quality, Toyota was awarded with the Deming Prize (Udagawa et al., 1995, p. 101).

We know today that the Toyota Production System became so competitive that Toyota and other Japanese car manufacturers gradually increased their market shares all over the world. But it is important to remember that the so-called Toyota Production System was not a traditional quality assurance system as, e.g. an ISO9000-based quality system. It was first of all a human-based system where people were involved with continuous improvements, and the foundation for the system was leadership and empowerment through education and training.

2.2 The "birth" of the term "lean production"

The IMVP Researcher John Krafcik originally coined the term "lean production". IMPV is an abbreviation of the International Motor Vehicle Program established at Massachusetts Institute of Technology in 1985. During the following 5 years, the IMVP staff carried out the world's most comprehensive benchmarking study ever seen.

The study collected data from automobile assembly plants all over the world in order to understand the differences in quality and productivity. The results of this benchmarking study were published in the well-known book *The Machine that Changed the World* (Womack et al., 1990), in which there is an exciting historical analysis of the machine called "the automobile". In the book, the origins and elements of lean production are presented together with the results of the benchmarking study.

We can conclude that the term "lean production" is a result of the benchmarking results from the IMVP. The word "lean" was suggested because the best assembly plants (the Japanese plants) in the study (Womack et al., 1990, p. 13):

Uses less of everything compared with mass production – half the human efforts in the factory, half the manufacturing space, half the investments into tools, half the engineering hours to develop a new product in half the time. Also it requires keeping far less than half the needed inventory on site, results in many fewer defects, and produces a greater and ever growing variety of products.

These impressive results have been achieved by the leading Japanese companies because of a continuous quest for quality improvements since 1950. We can say that the results are due to the quality evolution in Japan from 1950 to 1980 in which period most Western companies did not bother very much on quality issues (Dahlgaard-Park, 2000). The new management philosophy "TQM" was borne in the last part of the 1980s partly because the West woke up and began to study "what happened in Japan".

2.3 Lean production, quality management and waste

In our further analysis of the relationship between TQM and lean production we will use the following definition of TQM (Dahlgaard et al., 1998a)[1]: TQM is a company culture characterized by increased customer satisfaction through continuous improvements, in which all employees actively participate.

By comparing this definition of TQM with the ultimate objectives of the lean producers as described above it is obvious that there do not seem to be any contradictions between the two objectives. This is not a coincidence because the roots of TQM can be traced back to the Japanese quality evolution, where Toyota was one of the pioneering companies. Toyota practiced the philosophy and principles of TQC so early as in the last part of the 1950s. The Japanese version of TQC became later on in the last part of the 1980s the main reference when the term TQM was born.

It is also not a coincidence that TQM was not mentioned at all in the first book about lean production *The Machine that Changed the World*. This book was published in 1990 and written in the last part of the 1980s, and TQM was not a well-known management philosophy at that time. The authors probably did not want to adopt the well-established Japanese term TQC – the forerunner of TQM. In the next book on lean production – *Lean Thinking* – several references to TQM have been included, but the authors did not discuss the similarities and differences (if any) to the key principles of TQM.

In the book *Lean Thinking*, the very first word is interestingly the Japanese word for waste (muda), and it is concluded that muda is everywhere. This is a very important observation not only in relation to lean production but also to TQM.

By defining waste as the excess resources used compared with perfection we can say that the aim or objective of lean production is to eliminate waste. What then constitutes waste? In order to be able to work with a generic definition we suggest the following definition of waste: Waste is everything that increases cost without adding value for the customer.

It was documented in the book *The Machine that Changed the World* that wastes can add up to very significant resources. The problem with waste is that you will not have an overview of its size because it is never registered or measured as a whole in the company's management accounting system. Some bits and pieces are measured and registered but most of it is invisible for the managers unless you compare your company's processes and cost structure with other companies. This comparison is called benchmarking.

Comparing these two definitions we should understand that in 1951 quality control was regarded as a narrow engineering discipline and the main activities were focused on defects in production. In 1988, quality control had developed into a holistic management philosophy called TQM, which was not only dealing with production but also all other processes in the company and all types of industries including services of any kind. By using the metaphor "the gold in the mine" Juran signalled that the size of quality costs could be of a significant size.

An example [2] from a leading Danish service company indicates that the COPQ or waste is still "a problem everywhere". The example is from 1999 where one of the company's key processes was analysed in order to identify waste or opportunities for improvements. The yearly salaries for running the process were calculated to approximately DKK 25 millions. 74 percent of the total salaries were used on waste of different kinds! The waste related to production and correction of failures was 45 percent of the yearly salary! With an overlap of 16 percent with waste for failures the table shows that the waste for non-value adding activities was 46 percent! There was definitely a huge need for understanding and mastering the key principles for identifying and reducing waste in this company – and it is our experience that the need is everywhere – in any company – big, medium and small companies – public as well as private!

2.4 The principles of lean production and Motorola's "six steps to six sigma"

The following five principles for reducing waste and building lean enterprises were given by Womack and Jones (1996, p. 10) after about 6 years of thinking following the publication of the book *The Machine that Changed the World* in 1990:

specify value by specific product;(2) identify the value stream for each product;(3) make the value flow without interruptions;(4) let the customer pull value from the producer; and (5) pursue perfection.

Some comments on the above principles will be given in the following.

The first comment to the above five principles is that these principles were exactly the same as the ones, which were the guiding principles of craft production before mass production became the leading production philosophy in the industrialised nations.

We can say that lean production is a production philosophy, which tries to combine the principles of crafts-

manship with mass production. In craft production, the customer and his needs are in the focus, and no production will be initiated unless you have an order from a specific customer. When the order comes in all employees in the workshop works with commitment to satisfy the customer's needs. Everybody understands what the consequences with waste are for the customer, for the owner and for themselves. The employees understood the purpose of their work and they had pride in producing the products with the quality standard, which characterized the craftsmen of the workshop. These good attributes of craft production became lost in mass production with huge invisible waste as a consequence including the waste of not utilising the brainpower of millions of workers all over the world.

The second comment is that the five principles resemble very much the well-known quality improvement process developed by Motorola in the period 1983 to 1989. Motorola called the process for "the six steps to six sigma" – a process which helped Motorola to save billions of dollars (George, 1992). In fact, the six sigma methodology was first introduced in the USA in 1985 at Florida Power and Light (FPL) when the company decided to apply for the Deming Prize. FPL learned the six sigma methodology from the JUSE counsellors who helped FPL to prepare for the prize application (Voehl, 2000).

Motorola's six sigma process was developed and implemented first in manufacturing, and from 1990 the process was adapted to the non-manufacturing areas of the company. According to George (1992), the savings from 1986 to 1990 by using "the six steps" were as large as \$1.5 billion in manufacturing. Motorola estimated in 1990, that it could save an additional \$1 billion a year in non-manufacturing (George, 1992, p. 116). At the European Quality Forum in Berlin 1995 it was reported that Motorola managed to save \$5.4 billion in non-manufacturing processes from 1990 to 1995! We agree with George in his conclusion on the opportunities for improvement of non-manufacturing processes:

Improving non-manufacturing processes (or non-primary service processes for service companies) is one of the weakest areas in the quality system of nearly every company. By comparing Motorola's quality improvement process with the five principles of lean production it may, on the surface, look like, that there are not big differences. If there are differences they seem especially to be related to the lean production principles (3) and (4): (3) make the value flow without interruptions; and (4) let the customer pull value from the producer.

These two principles are exactly, along with principle (2), what most differentiate mass production from lean production. Let us look more in detail on principles (3) and (4). Principle (3) tells us that the value must flow without interruptions. The meaning is to escape from the traditional way of producing in batches, which often wait in queues or inventories before the next or a later production step is started up. Our mental models (our heads) seem to tell us that this is the right and most efficient way of pro-

ducing goods, because we are not aware of the invisible waste consequences this production philosophy is due to. Proponents of the six sigma quality process may argue that the lean production principles (3) and (4) are embedded in Step 5 of Motorola's "six steps to six sigma".

The lean production principles (3) and (4) are also embedded or included in the TQM theories, principles and tools. Several examples from leading TQM companies, which have won the respected international quality awards such as the Malcolm Baldrige National Quality Award and the European Quality Award, show impressive benefits of focusing on and improving these areas (George, 1992; Zink, 1997, 1998). Deming (1986, 1993) addressed the same problems in his famous 14 points, where especially point number 9 focused on breaking down barriers between departments. The well-known quality tool QFD (quality function deployment) is one of the tools developed in Japan back in 1972 (Kobe Shipyard) to assure that the "voice of the customers" is heard and also built into the processes and the product by a close and systematic co-operation between departments (Dahlgaard et al., 1994). CFM (cross functional management) is another tool developed in Japan (Toyota) starting back in 1961, which also aimed at breaking down barriers between departments and improving cross functional co-operation:

CFM means that employees, across departments and functions, share common goals and the responsibility for reaching them (Dahlgaard et al., 1994, p. 114).

3. The DMAIC improvement process

In the previous section, we introduced and discussed Motorola's "six steps to six sigma quality" – i.e. Motorola's roadmap to achieve six sigma quality ($\frac{1}{4}$ 3.4 defects per million). These six steps were later replaced by GE when Jack Welch, Chairman and CEO of GE, at the Annual Meeting April 24, 1996, declared the six sigma process to be GE's corporate strategy for improving quality and competitiveness. The change of roadmap follows directly from the following extract from his speech (Park, 2003):

Motorola has defined a rigorous and proven process for improving each of the tens of millions of processes that produce the goods and services a company provides. The methodology is called the six sigma process and involves four simple but rigorous steps; first, measuring every process and transaction; then analysing each of them; then painstakingly improving them; and finally rigorously controlling them for consistency once they have been improved.

By comparing these four simple but rigorous steps with Motorola's six steps to six sigma quality it seems on the surface as if GE (or Jack Welsch) in beginning of their six sigma journey focused only on Step 6 in Motorola's roadmap. Later on we know that the sigma improvement process usually followed the so-called DMAIC process, which is defined as follows (Park, 2003):

- Define. Identification of the process or product that needs improvement.
- Measure. Identify those characteristics of the product

or process that are critical to the customer's requirements for quality performance and which contribute to customer satisfaction.

- Analyze. Evaluate the current operation of the process to determine the potential sources of variation for critical performance parameters.

- Improve. Select those product or process characteristics which must be improved to achieve the goal. Implement improvements.

- Control. Ensure that the new process conditions are documented and monitored via statistical process control methods (SPC). Depending on the outcome it may become necessary to revisit one or more of the preceding phases.

This DMAIC process may be regarded as a short version of the following Quality Story which was developed in Japan in the 1960s as a standard for QC-circle presentations, but later on became an important quality improvement standard (Dahlgaard et al., 1998a):

Plan: (1) Decide on a theme (establish goals); (2) Clarify the reasons this particular theme is chosen; (3) Assess the presentsituation; (4) Analysis (identify the causes); (5) Establish corrective measures;

Do: (6) Implementation;

Check: (7) Evaluate the results;

Action: (8) Standardization; (9) After-thought and reflection, consideration of remaining problems; (10) Planning for the future.

4. The roadmaps of TQM, lean production and six sigma quality

From the previous analysis, we conclude that both lean production and six sigma quality comprise management and manufacturing philosophies and concepts, which have the same origin as the management philosophy called TQM – namely Japan's quality evolution. We also conclude that the principles, concepts and tools of lean production and six sigma quality should not be seen as alternatives to TQM but rather as a collection of concepts and tools, which support the overall principles and aims of TQM.

But we also conclude that this collection of concepts and tools is something more. Both lean production and six sigma quality recommend simple and clear roadmaps to follow for companies which have decided to embark on a quality journey to TQM and world-class quality. But, as our analysis has shown, we may hesitate to call these roadmaps for totally new roadmaps because we can find previous roadmaps in the quality literature which cover the same or almost the same steps.

The following good question may now be asked: which is the best road map to follow if a company wants to achieve world-class quality? Our answer to this question is very simple. These alternative roadmaps are very dangerous to adopt without the right company culture. Companies should understand that such simple roadmaps would never work without a company culture characterized by the core principles of TQM. The history of the Western adoption of the Japanese quality-control circles back in the

1970s is a good example of what will happen if the context is not ready for adoption. Failure will be the result. Many companies have experienced the same (failure) when they tried to implement TQM in the same way as buying and implementing a machine. So to repeat our answer to the question above, these roadmaps may be good roadmaps to follow if the right company culture has been established from the top management level to middle management and to the shop floor level. This is not a “quick fix”. May be there is a need to agree on a set of new company values because the old values may be characterized by Tayloristic values only. This is not a “quick fix”.

May be there is a need of education and training in TQM principles and tools from top to the shop floor level. This is not a “quick fix”. The alternative roadmaps discussed can and should be integrated in such company-wide education programs in order to assure that all people understand the what, how and why both at the overall level, the group level and the individual level. If such pre-conditions have been achieved then such simple roadmaps may work. For the automobile industry and other mass production industries, the lean production road map may be a good road map to follow. But we also argue that other simple roadmaps developed, for example, within TQM, such as Motorola’s six steps to six sigma, have shown the same impressive results (Voehl, 2000).

The lean production principles were developed in Toyota and, of course, developed to fit to the conditions of the auto assembly industry. As both the lean productions methodology and Motorola’s six sigma process have the same origin (Japan) it is not strange that the basic principles of the two competing quality improvement methodologies are the same. To chose between the “on the surface” two competing methodologies does not seem to be a big issue.

On the surface it seems as if Motorolas’s six sigma process and DMAIC is easier to understand and hence to implement compared to the five lean production principles. Motorola’s six sigma process and DMAIC does not explicitly require, that the pull and ow principles from lean production are applied. This may be regarded as an advantage in industries where these principles may seem too difficult to apply. But we believe that the best strategy is to study both competing roadmaps in order to be able to evaluate where in the total production flow from suppliers to customers (the total supply chain) it may be possible explicitly to apply the ow and pull principles from lean production.

Another advantage in our view of Motorola’s six sigma process compared to the process of implementing

the five principles of lean production is that Motorola’s six sigma methodology has a specific process to follow for improvement of manufacturing processes and another specific process to follow when you are outside manufacturing. Especially Motorola’s six sigma process for non-manufacturing seems very easy to understand and hence to apply for people in the many non-manufacturing processes which are everywhere in any company (manufacturing, service and public companies).

We conclude that the five principles and the aim of lean production as well as the principles and tools behind the six sigma process are embedded in the principles, concepts and tools of the holistic management philosophy called TQM (Dahlgaard et al., 1998a), so that the case stories related both to lean production

and six sigma quality are just to be regarded as specific TQM case stories. But we also have to be thankful to the contributors of lean production and six sigma quality. They provided companies with updated roadmaps to follow when embarking on the journey to excellence, and a very convincing documentation about what happens when scrapping the old Taylor designed mass production systems and building the new corporate culture called the TQM culture (Dahlgaard et al., 1998a).

5. The corporate culture to practice lean production and six sigma

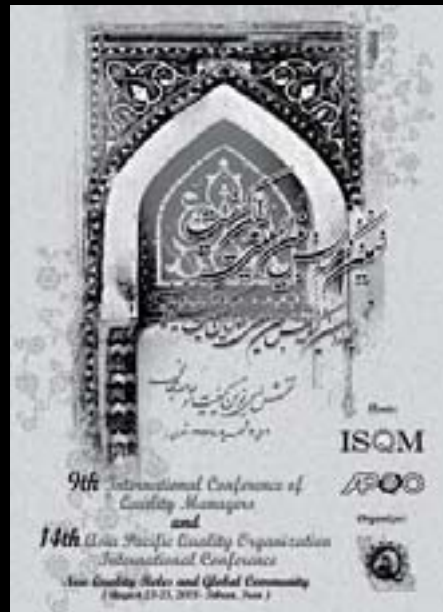
There are many definitions on TQM, and one of them has been

used in Section 2. In that definition we emphasised that:

TQM is a corporate culture characterized by increased customer satisfaction through continuous improvements, in which all employees actively participate.

Besides being a corporate culture we also emphasised above that TQM is a management philosophy. The aim of this management philosophy is to change corporate cultures from a passive and defensive culture to a proactive and open culture where the basic TQM principles increased customer satisfaction, continuous improvement and everybody’s participation are applied everywhere in the organisation. To have success with such a change process the fourth TQM principle – leadership – must also be applied (Dahlgaard et al., 1998a). This is exactly the same pre-condition for having success with the five principles of lean production and/or the six sigma improvement processes.

The essence of TQM, lean production and six sigma quality may be boiled down to Leadership, efficient CFM, empowerment and partnerships. For example, the flow and pull principles of lean production cannot function without efficient CFM, but this is not enough to have success with TQM, lean production and six sigma qual-



ity. Empowerment and partnerships are the foundation on which TQM and its related principles, concepts and techniques have to be built. The pre-condition for building an excellent enterprise is empowerment. More and more traditional management activities must gradually be delegated to ordinary employees together with the necessary authority and capability (education and training) to plan, check and improve these activities (eliminate waste) to the benefit of themselves and the company. The employees must be given both the freedom to plan and to decide, and the capability to take over this responsibility.

Partnerships are needed in all internal customer-supplier relations, in all external supplier relations, in external customer relations and between managers and their subordinates. The clue is to build a total system of customer-supplier relations, which are working close together in their own interest for reducing waste. This requires a lot of the managers. They need what the man, who taught the Japanese about quality – Deming (1900-1993) – called “profound knowledge” (Deming, 1993): appreciation for a system; knowledge about variation; theory of knowledge; and psychology.

To have success with flow and pull there is especially a need to have profound knowledge about systems and psychology. The first is needed in order to understand that optimisation of a production system can never be achieved if the components of the system – the departments and all other customer/supplier components – are trying to sub-optimize with conflicting aims. The latter is needed in order to be able to build efficient win-win partnerships, which can survive in the long run. A pre-condition for building such partnerships is that they are built eternal core values (CV) such as genuine trust and respect (Dahlgaard and Dahlgaard-Park, 1999a).

To have success with TQM, six sigma quality and lean production requires a company culture where everybody is proactively working in reducing waste and in helping each partner (internal and/or external partners). Everybody understands that his/her contribution is essential for the team in which he/she is a member and for the customer. If she is not there – physically as well as mentally – there is a risk that the work will not be done as efficiently as possible. The success of the system depends on everybody’s participation (one of the core principles or TQM). This requires leadership for organisational excellence! But what is organizational excellence?

6. Organisational excellence, core values and core competencies

There seems to be a need to come up with a human-oriented definition of organisational excellence, which clearly signals, that the first step in building organisational excellence is building quality into people. Such a definition, which is called “the 4P” definition of organisational excellence, has been presented by Dahlgaard and Dahlgaard-Park (1999a, b). According to this definition, organizational excellence is a result of building quality into the

following 4Ps: (1) people; (2) partnership; (3) processes of work; and (4) products/service products.

The first priority of any quality strategy must be to build quality into people, which is the essential foundation and necessary catalyst for improving partnerships, processes and products. But what does that really mean? In order to answer that question we need to understand human nature, human needs and human psychology, because the project of “building quality into people” can only be carried on when we get a profound knowledge of people and psychology (Dahlgaard-Park and Kondo, 2000). Having got such an understanding top management will then understand that building quality into people is not the same as building competencies into people. They will understand that the part of the quality strategy relating to building quality into people should be designed to strengthen two essential parts: (1) CV; and (2) core competencies (CC).

If CV are ignored in the quality strategy the company will not be able to utilise the CC, which they try to build into the people. Trust, respect, benevolence, integrity, loyalty, justice and honesty are some identified elements, which can be categorised by the term of CV. Various managerial efforts seem to have small effect if these values are lacking between employees and between management and employees. Many research results (for references in this and the following sections see in Dahlgaard-Park and Dahlgaard (2003” show that, for instance, trust is a prerequisite for communication and dialog, building people relationships, building competencies and capabilities and for building a co-operative culture.

Other research results indicate that procedural fairness and procedural justice in the decision making process are associated with increased motivation and commitment toward the decisions made among employees. Research show furthermore that even though the employees have the opportunity to participate in the decision-making process, they will get negative motivational effects in form of frustration if their voices have not been respected in the process.

Other research results show that even reward systems are highly affected by trust and other values. For instance, if there is no trust between leaders and employees a reward system will have no significant motivating effect. A reward system will decrease employees’ intrinsic motivation, when the managerial climate is controlling rather than supporting and acknowledging the others. The increasing interest on the concept of trust and its role in different managerial areas can be understood in this respect.

Recent research results carried out by one of the authors of this paper indicate strongly that one of the most critical factors for attaining employees’ motivation and commitment is related to personal CV. In short, it seems that CV are very critical motivating factors of human beings.

Konosuke Matsushita, the founder of the world’s largest consumer electronics company, and a highly respected business leader has written as follows about trust:

Yet, I cannot resist the temptation to say that I was well aware of the crucial importance of human relations in a corporate setting even in the early days of my business career. Granted, my approach is intuitive, and my knowledge is experiential. But my instinct, and perhaps my conscience, dictated to me that I should trust my employees if I expected them to trust me. I must have full confidence in their ability to learn and their potential for personal growth. Only then would the employees have full faith in my managerial competence and personal integrity.

It is difficult to find a quotation, which better illustrates the relationship between the satisfaction of mental needs and spiritual needs (CV). Managers need to understand how the satisfaction of these different kinds of needs are interrelated; and they need to work on the satisfaction of both kinds of needs in order to improve the quality of employees' working life and hence staff satisfaction. Only the satisfaction of both mental and spiritual needs will make man happy and content. In other words, providing for both the material good and spiritual welfare of employees (Senge, 1990, p. 140) should be the starting point for every dutiful manager when trying to improve and to utilise better the company's human assets.

With reference to the discussion above, we define CV and CC in the following way: CV comprise those capabilities, which are needed to satisfy human's spiritual needs. The CV are the non-changeable spiritual values such as honesty, loyalty, integrity, goodness, trust, justice, respect, humbleness, dignity, etc. which are independent of culture, time, place, race and age.

The CC, which comprise the capabilities needed to satisfy human's mental needs, can at the lowest level be subdivided into two main areas: (1) emotional competencies (EC); and (2) intellectual competencies (IC).

Recently, the distinction between those two human competencies became a central research area caused by several research surveys, which especially indicated the importance of the EC. It seems as if that the strongest determinant for human success is emotional intelligence, and according to recent research the IC can explain less than 10 percent of a company's success, while the EC can explain 90 percent of a company's success. In this respect, EC concern human capabilities, which traditionally have been treated under the term sensibility. EC are human capabilities to feel, to see, to listen, to aware, to sense, to taste, etc.

Various types of interpersonal skills such as tools and principles for successful communication – e.g. techniques for emphatic listening, dialogue, discussion, etc. belong to EC. People who do not possess the EC will get serious problems to understand other people. Thus, EC are especially critical issues, which have tremendous impacts in building interpersonal relationships.

The EC can be divided into the following five areas:

(1) self-awareness (to know one's inner feeling, preference, intuition as well as one's strengths and weaknesses);

(2) self-regulation (to be able to control one's own feeling, impulse, stress and changing environment);

(3) self-motivation (to be able to motivate self, and be able to establish personal goals and achieve them);

(4) emphatic (to be able to know other's feeling, needs and anxiety); and

(5) social competencies (ability to build relationships with others and in influence others).

IC are related to human capabilities, which involve reasoning in contrast to the EC, which involve sensing and feeling. As Webster's definition of intellect, it is the capacity for knowledge, for rational or highly developed use of intelligence. They appeal mainly to the logical and rational capabilities to understand, make analysis, make judgement, etc. Mathematics is a typical area, which requires these logical and rational competencies. In a TQM context, intellectual skills include tools and techniques such as the seven old quality tools. Those tools have been developed to support the actualisation of peoples' intellectual capital (IC) to enhance innovation and improvements. Knowledge about technology is also a part of IC.

We define human's mental needs as need for belonging, people relationship, recognition, status, self identity, achievement, creativity, learning, development and self realisation. In order to satisfy human's mental needs, people are required to have both IC and EC.

We believe that a pre-condition for achieving organisational excellence defined as "the 4P" in Section 2 (people, partnership, processes and products) is to satisfy peoples' needs in a balanced way. The CC are those capabilities, which, together with the CV, are important for satisfying peoples' spiritual and mental needs so that business excellence can be achieved.

We believe that the CV and the EC especially are related to the first 2P, i.e. people and partnership. Without focusing on the CV and the EC it will be very difficult to achieve excellency in the last 2P, i.e. processes and products. To build quality into the last 2P IC are needed. The critical or core IC are those competencies, which are needed to satisfy people's intellectual needs and at the same time necessary to build excellency into the organisation's processes and products.

7. Some core aims and elements of a quality strategy

Relating our discussion in the previous paragraphs to the challenge of designing a quality strategy, which focus on building a company culture, which support lean production, six sigma quality and TQM, we conclude the following:

The first aim of a quality strategy is to build quality into people through strengthening of both CV and CC. The quality strategy should always be implemented both through a top-down and a bottom-up strategy (Dahlgard et al., 1998b, c). The strategy should follow the policy deployment approach (Hoshin planning), which has both the top-down and the bottom-up strategy included. Such an approach provides a frame for building quality into the fol-

lowing three levels:

(1) individual level; (2) team level; and (3) organisational level.

Without such a frame, there is a great risk that people's needs – spiritual as well as mental needs – will not be satisfied in a balanced way. When developing the quality strategy it is vital to have a balanced focus on both CV and CC. If CV are ignored there is a high risk that each individual's potential CC will not be utilised neither efficiently nor effectively. It is also vital that the quality strategy has a balanced focus on both of the core-competence subsystems, i.e. the EC as well as the IC. This is a pre-condition for improving the quality of work (the partnership and processes). To improve the quality of work it is necessary to have a profound understanding of the essential needs of human beings, the critical motivational factors and how these factors are linked to the organisational purpose (vision, mission and goals).

Having got such an understanding top management will then understand that building quality into people is not the same as building competencies into people. They will understand that the part of the quality strategy relating to building quality into people should be designed to strengthen two essential parts: CV, and CC. If CV are ignored in the quality strategy the company will not be able to utilise the CC, which they try to build into the people.

8. Epilogue

In the paper, we have tried to clear up some confusion, which has been relatively common in the business community as well as in academics, on what are the essentials of lean production, six sigma quality and TQM, what are the similarities and what are the differences, if any. It has been shown that the lean production philosophy and the six sigma steps are essentially the same, and both have developed from the same root – the Japanese TQM

practices (company wide quality control).

During the 1990s, a lot of criticism has come up on TQM, its principles and related theories or lack of theoretical support. It is our intention with this paper not to contribute to this discussion, but to contribute with examples and analyses showing that TQM is not a static management philosophy. TQM is the result of an evolution starting in Japan about 50 years ago, where continuous improvement gradually became the most important management principle. Because of this important principle we can conclude that TQM is a management philosophy the contents of which continuously have to change when new theories and results show that there are better roadmaps to follow than previously known roadmaps. The roadmaps of lean production and six sigma quality are examples of such new roadmaps, which should only be regarded as alternative new roadmaps to follow when companies have implemented TQM or are in the process of implementing the TQM principles, tools and techniques.

We also have tried to contribute with both new and old knowledge to understand the most difficult part of TQM – the human factor. Especially with six sigma quality there seems to be too much focus on training people into tools and techniques and at the same time too little focus on understanding the human factor, i.e. how to build the right company culture – a culture where people's basic needs are both understood and respected. We argued on how to build such a culture by focusing on how to design a quality strategy, which aimed to satisfy people's mental as well as spiritual needs. Our recommendation in this relation was to build quality into people by balancing the development of people's CC with people's CV. Much too often the CV are being ignored and the focus is only on building professional competencies and skills into the people.

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