Chapter 8
Sustainable Manufacturing as Mutual Competence Building

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8.1 Introduction

Companies are facing an increased need to address innovation, as well as environmental and corporate responsibility issues. In the context of globalisation, and increased competition on the basis of cost and scarce energy resources, it is vital to empower both management and workforce to seek and maintain processes of continuous improvement, energy and resource efficiency, and to develop internal cultures for addressing environmental and responsibility issues. Companies will not be able to do that unless they are able to develop an inclusive and collaborative culture inside the organisation, as well as across organisations (Ennals and Gustavsen 1999; Johnsen and Ennals 2012a, b). What can organisational theory and management theory offer in order to guide these challenges, and which organisational design principles should be recommended? In this chapter we argue that no single theory provides answers to these questions. Rather we argue that universities can learn from enlightened companies as they address the challenges of sustainability. Companies can also learn from universities, in a process of *mutual competence building*.

The chapter refers to joint reflections by the authors, related to understanding trends in industrial organisation in Norway. Through analysing cases, both studies made together and case studies made by each of the authors, we have observed on the one hand that concepts like "Lean" and similar organisation design principles are commonly referred to in manufacturing industry. On the other hand, there is no

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one single interpretation or application of these design principles. Rather we observe that sustainable manufacturing companies today are *balancing different organisational design principles*.

When we link this observation to the concept of sustainable manufacturing, we argue that special skills are required in order to make sense of the complex and partly conflicting challenges for manufacturing industry. This chapter tries to put this into a theoretical and historical perspective, in order to focus on the skills required. The chapter starts with a broad picture of the development of industrial organisation, and of sustainability trends and thinkers behind them. This locates sustainability thinking in companies within the overall picture. Deepening and expanding this picture will refer to socio-technical systems, as well as human-centred dialogical approaches to manufacturing. We will examine processes of continuous improvement implemented through quality circles as a way to integral to corporate strategy: how does this promote and deepen our understanding of sustainability both in higher education and companies? We argue that *mutual competence building* concerns the ability to balance different organisational design principles with innovation and sustainability, and dialogue with the environment including higher education.

8.2 Description

8.2.1 The Historical Backdrop

In order to address these questions, one can visit the historical debates within the field. A normal reference to start such a review is Frederick Winslow Taylor *The Principles of Scientific Management*, published in America 1911 (Taylor 1914). Taylor's principles became academically famous, not least because they formed the background for the large organisational experiments at the Western Electric factory outside Chicago from 1924 to 1932, the Hawthorne Works. Taylor, an engineer, argued that one could, through scientific methods, identify the optimal and most resource-efficient work routines. His argument resembles that of Auguste Comte (1798–1857), two generations earlier, who had made similar arguments in favour of the philosophy of positivism [Comte (1830)]. Henri Fayol also developed a similar conception of management in the early 1900s. His major work, *Administration industrielle et générale*; *prévoyance*, *organisation*, *commandement*, *coordination*, *controle*, was published in 1916. One of the methods that Taylor proposed was to identify best practices, and make them into standards and routines.

Starting out as a scientific management project, the Hawthorne experiments soon became an ideological battleground. Gillespie's (1993) analysis of the Hawthorne experiments shows how the scientists manufactured knowledge in the sense that (a) the theoretical perspectives of the researchers influenced what they emphasised, and (b) the same experiments were interpreted in very different directions, not least

as a result of Elton Mayo taking over the project in 1931. Mayo's influence led to the development of an alternative theory that was named the Human Relations position. The ideological shift, from scientific management to human relations, was not so much an outcome of the experiments, as a shift among those who managed the experiments. However, the project established the reference point for the divide between scientific management and human resources that has existed ever since.

The difference between the two positions; scientific management and Human Relations, was summarised in Douglas Murray McGregor's influential book from 1960, *The Human Side of Enterprise*. Here McGregor identified the two positions in the debate as theory X and theory Y. This debate exemplifies two main principles of organisation design; on the one hand structure, system, extrinsic motivation and control, on the other hand self-realisation, intrinsic motivation and self-control.

It is an interesting historical coincidence that Joseph Schumpeter in 1911, the same year as Taylor published his book, published in Vienna the book *Theorie der wirtschaftlichen Entwicklung*, which in 1934 was translated into English as *The Theory of Economic Development*: *An inquiry into profits*, *capital*, *credit*, *interest and the business cycle*. It was in this book that the logic of the entrepreneur was outlined. He developed two categories of economic actors: on the one hand the capitalist or industrialist, who utilises economies of scale, on the other the entrepreneur, who is an inventor, somebody who sees new, innovative ways to use resources and explores market opportunities.

The dualism between exploitation and exploration, production and innovation, bureaucratisation and formalisation versus learning, development and creativity was thereby established. We can talk about two ideal types. Max Weber had developed the ideal type of bureaucracy in a discussion of modernisation and differentiation in society. He saw the development of bureaucracy as a natural response to the emergence of modern society. At the same time, there developed, both academically and in society, hostility to some of the features of modern society. The dualism therefore also became political and ideological. Another reference to the dualism between the formalised, structured and routinised organisation and the more dynamic, innovative and creative one is found in Philip Selznick's 1957 book, *Leadership in Administration*: *A Sociological Interpretation*. In it, Selznick argues that there is a distinction between being an administrator and being a leader. Leadership goes beyond supervising procedures and rule-following. Leadership implies looking forward, motivating new possibilities and making adjustments in the organisation. Administration is authoritarian, top–down, and hierarchical; leadership is communicative, bottom–up and vertical.

Burns and Stalker, who worked at The Tavistock Institute of Human Relations in London, summarised this discussion in their 1961 book *The Management of Innovation*. They formulated it as a distinction between mechanistic management and organic management. With *mechanistic management*, they implied that there are differentiations of functions according to tasks, defined as abstract categories, differentiations between hierarchies in the organisation, a precise definition of rights and obligations, and rights and obligations translated into methods and responsibilities in functional positions. They argued that this implies a hierarchical

structure of control, and the localisation of specific knowledge in the hierarchy, with interaction being mainly vertical. Accordingly, work behaviours are governed by instructions, and there is a strong insistence on loyalty. This management and organisational form implies that greater importance and prestige are accorded to specific and local knowledge, as compared with general knowledge. This resembles many aspects of Max Weber's ideal type of bureaucracy (Weber 1978).

With *organic management*, Burns and Stalker (1961) implied, special knowledge relates to the common task of concern, the overall situation defines the individual task, and individuals are task-adjusted and redefined in their interactions with others. This implies limited definition of rights, obligations and methods. Reasonability is expected of everyone, and commitment stretches beyond one's individual task. The system of control, authority and communication is seen as a network. This organisation is omnipotent in the distribution of tasks. Tasks are located where they are most relevant. Communication is lateral (both horizontal and vertical) and tends to take the form of consulting more than commanding. There is a strong commitment to progress and values, and to prestige related to the whole organisational milieu.

Other examples could be presented, but the point is that the dualism that distinguishes between a static, hierarchical and bureaucratic vision of the organisation on the one hand, and a more flexible, dialogical, open and innovative organisational vision on the other, is a well-established dualism in organisational and management theory. We can see them as ideal types; we have at one extreme the analytical tools related to model I learning, implemented through the use of authority, and at the other, intuitive tasks, related to creative learning and theory-building in practice by means of dialogue. These extremes presuppose very different kinds of personal qualities in other respects as well: analytical problems presuppose loyalty, predictability, the obeying of, and non-individuality, while intuitive tasks presuppose creativity, individuality, vision, commitment and other qualities such as variety of experience, intimacy of communication and responsiveness. Thus we can say that by 1960 the main dimensions in the theoretical field of industrial management and organisation were established.

8.2.2 The Norwegian Tradition

The Norwegian Working Life Research tradition fits into this international theoretical development. The tradition has been analysed in numerous works (Gustavsen 1992; Ennals and Gustavsen 1999; Levin 2001; Fricke and Totterdill 2004; Gustavsen et al. 2007; Ekman et al. 2010; Johnsen and Ennals 2012a, b). In fact, it was the Tavistock Institute that provided the theoretical support for the initiative that led to the collaborative studies (Samarbeidsforsøkene) led by Einar Thorsrud and Fred Emery in the early 1960s (Emery and Thorsrud 1976). Their work was cross-disciplinary and close to practice. Interactive research approaches integrated human and productivity aspects in enterprise development. The work has

continued in different forms, combining insights from social science, economics and technology, with experience from many processes of development and innovation in working life. It has its roots in the Human Relations tradition, but moved beyond that in terms of democratic and broad direct participation at all levels in the organisation (Gustavsen et al. 2001; Johnsen 2001; Klev and Levin 2009; Røvik 1998).

The democracy project in Norway came as a result of a co-operation that started in the 1950s, between the social partners and the government, to establish a research milieu for workplace development in Norway. To help developing such a milieu, co-operation with the Tavistock Institute in London was initiated. Both Fred Emery and Eric Trist, who came from Tavistock, had a particular perspective on workplace development, known as the socio-technical approach (Emery and Trist 1965). This approach implied among others, that the organisation was seen as a system consisting of two main sub systems; the technical sub-system and the human-sub system. It was an approach that had positioned itself against other dominant discourses at the time. They wanted to include technological change in their theory, but avoid technological determinism (Trist 1981). They also wanted to have a participatory perspective, but wanted to avoid the type of social psychology that they found in the Human relations movement (Trist 1981). Less articulated, but also important, is that they wanted to avoid making their approach into a managerial theory.

Their systems approach implied that one could discuss organisational development, without addressing leadership directly. Thereby, one avoided a confrontational debate on how their approach positioned itself in the ideological battle over democracy and capitalist interests in Norway. Other factors contributed in the same direction, and there were political discussions and disputes. The fact is that one was able in the 1970s to develop workplace legislation that opened up participatory arrangements in companies, without there being a deep and dividing conflict of the sort that we saw in other countries, in example Sweden, but more severely in France. Participatory work systems, self-steering groups and the like, were simply seen as smart ways of organising businesses. The model was seen as the Norwegian or Nordic approach to democratic capitalism (Byrkjeflot 2001).

8.2.3 The Communicative Turn

If we move to the situation in Norwegian Work Life in the beginning of the 1990s, most of the ideas of the democracy movement in the 1960s had been integrated into modern managerial practice. Decentralised solutions and participatory processes had been absorbed into organisational design principles like Total Quality Management (TQM), management by objectives (Drucker 1954) or Quality Circles (Ishikawa 1980; Deming 1982). Work Life Research includes not only organisational, managerial and sociological perspectives and, but lately also geographical perspectives. The last related to how businesses are integrated in networks and

regional innovation systems (Ekman et al. 2010). One could say that all four paradigmatic positions identified by Burrell and Morgan (1979) were represented in the Norwegian discourse. We find radical humanist arguments (Eikeland 2008), structuralist arguments (Emery and Trist 1965), interpretive sociology (Johnsen 2001) and functionalist sociology (Clausen 2011) arguments. A main divide existed between *structural and functional* arguments on the one hand, and *humanist and interpretive* arguments on the other. This difference is more than words, it is about how you practice participation, and not least how you interpret and relate to it as researchers.

Bjørn Gustavsen introduced the communicative perspective on workplace development in the 1990s in Norway (Gustavsen 1992; Toulmin and Gustavsen 1996), building on his work in Sweden in the 1980s in the LOM programme.

> The programme "Leadership, Organisation and Communication" (LOM) was a research and development programme from 1985 to 1990, with the intention of supporting local processes of change in the private and the public sector (Drejhammar 1998)

The philosophical and paradigmatic foundation of this initiative came from the communicative theory of Habermas (1981, 1984), but integrated into a humanist/ interpretive understanding of the participatory workplace tradition in Norway.

A core of this perspective or position was development through dialogue. It argued that the dialogical approach represented two main deviations from a more functional/structural understanding of workplace development: on the one hand, that reality is created through dialogue, and on the other hand, that in addition our knowledge about this reality is developed through our dialogue. Dialogical development is therefore a key both to development and to our understanding and interpretation of development. One can argue that both represent an *epistemological* critique of an excessive *rationalism* represented by structural and functional perspectives on organisations. Gustavsen aimed his critique against the socio-technical approach, as is indicated by Table 8.1.

Table 8.1 Gustavsen on dialogue

Characteristics	Experimental oriented	Dialogue oriented
The logic of the project	Linear	Interactive
Chief theoretical source	Socio-technical and socio-psychological/theory of organisation	Theory of participative democracy
Legitimacy	The content of the solution	Participation in the process which creates solutions
Leading actors	Few	Many
Definition of initial conditions	Zero-point	On-going process
Situational map	Highly structured	Minimally structured
Procedure	"Big jump"	Stepwise

Source Gustavsen (1992, p. 7)

8.2.4 Recent Discussions of Workplace Innovation

Recently, there has been increased focus on workplace innovation as being important for economic development (Black and Lynch 2004; Pot 2011). However, there are many different discussions and concepts that address this issue. Organisational design principles are often discussed as management fads, or as introducing foreign management practices in companies (Huczynskia 1993). Some of these are in conflict, whereas the Nordic countries often have emphasised participatory concepts in contrast with more management driven concepts (Ekman et al. 2010). Some argue that organisational design principles are contrary to more contextually based processes, or an obstacle for real engagement in work processes.

This last argument has, not least, been used related to the introduction of Lean concepts in Norwegian enterprises (i.e. Gustavsen et al. 2001). There has been a Norwegian discussion about Lean and learning. Often, organisational concepts are seen as management driven, top-down approaches in conflict with participatory organisational approaches. However, an organisational concept like Lean might contribute to a more rational, internal communication in the company, and thereby to incremental innovation. This argument is in line with David Hutchins' account of Hoshin Kanri in Japan (Hutchins 2008).

Following values and thoughts from the collaborative studies, Employee-Driven Innovation (EDI) has come into focus, extending effective engagement. "Employees typically acquire exclusive and in-depth and highly context-dependent knowledge that managers often do not possess", Kesting and Ulhøi (2010) argue. Employee-driven innovation (EDI) argues that autonomy in teams will bring innovative ideas from the employees in a bottom-up manner (Pedersen 2012). Central to EDI is that

> "learning can produce innovation" and there is "complex interplay of processes that include factors at the individual level as well as organisational culture" (Pedersen 2012, p. 4). EDI: ". . . refers to the generation and implementation of new ideas, products, and processes, including everyday remaking of jobs and organisational practices, originated from interaction of employees, who are not assigned to this task" (Høyrup 2012; Kesting and Ulhøi 2010). In addition, "the processes are unfolded in an organisation and may be integrated in co-operative and managerial efforts of the organisation. Employees are active and may initiate, support or even drive/lead the process" (Ibid, p. 8)

High technology creates exclusive and in-depth context-dependent knowledge. Only employees can hold this kind of knowledge embedded in the context of the work.

Learning or organisational learning forms an important part of this. By learning we mean "a social process involving social relations (shaped by social institutions) and learning itself (a 'cultural object' created by artful practices of cultural work)" (Gherardi and Nicolini 2001, p. 53). A similar approach is set out in the tradition of Quality as Empowerment, and the Japanese *Hoshin Kanri* (Hutchins 2008), where bottom up processes of continuous improvement, often implemented through Quality Circles, are integral to corporate strategy. Thus there are many and

competing organisational design principles. Pålshaugen has lately argued for a pluralistic approach (Pålshaugen 2013), as a way to avoid fragmentation and theoretical locking in. At the same time Pålshaugen argues that this opens up meta-discussions; what are the overriding perspectives guiding Work Life Research in general and industrial management and organisation in particular?

8.2.5 Thinkers That Formed Sustainability

So, we see that, from a theoretical point of view, there are many different approaches to industrial management and organisation. How can this be combined with a focus on sustainability? In order to discuss that, we need to look at what we mean by sustainability.

Sustainability has been at the centre of attention for decades, especially for activists. From the early warning cries, like the campaign against DDT and chemical industry, and the resource depletion suggesting a biophysical growth limit of our society (Carson 1962; Meadows et al. 1972). They build on conservation ethics promoted by Leopold, regarded as the father of wildlife management (Leopold 1966). The argument is that humanity is part of the land, and the land must be regarded as a community of different species, not as a commodity. This follows the main argument of preservation.

The World Commission on Environment and Development (1987), chaired by Brundtland, believed that a reversal of human made damage to the environment, and making a better world, was possible. However, they pointed to the need for strong political will and international commitment to change. The report had three main points: environmental conservation, social equity, and economic growth. In the sense of environmental conservation, the argumentation was in line with Leopold and the early warning cries, and it pointed out that the world must sustain human progress all over the world, not in just a few places. Economic growth was seen as a tool for developing countries to have equal quality with developed countries. The two latter points stand in somewhat contrast to the resource depletion movement. These three main points became known as the triple bottom line. Elkington (1997) asked the rhetorical question "is it progress if the cannibal uses a fork?" as a critique and answer to the positive World Commission on Environment and Development (1987) report. He meant that the companies must change their fundamental thinking in order to make a difference. Sustainability as a corporate agenda must be about economic prosperity, environmental quality and social justice, and only through a balanced approach of these three can sustainability be achieved. Stakeholders must be engaged by motivating the companies to detect social, economic and environmental risks and opportunities. He suggested the 7D analysis in order to battle companies against entering the "CNN-world" of pressured thinking and short-term commitments.

After the World Commission on Environment and Development (1987) report and the triple bottom line discussion there has been technological optimism, related

to the expectation that efficiency through technological advancement will minimise the overuse of natural environment, decreasing the availability of non-renewable resources and minimised waste (von Weizsäcker et al. 1997). The technological optimists argue that moving towards efficiency thinking will use resources better and create better life. Other benefits, claimed by the technology fix movement, are: the results of focusing on efficiency are less pollution and depletions, more profit, harnessing markets and enlisting business, multiplying the use of scarce capital, increasing security and employment. Building on the eco-effectiveness argument is "Cradle to Cradle" (McDonough and Braungart 2002). The main arguments are that redesign of products for manufacturing helps to get free of known culprits, follow informed personal preferences, create and activate a passive positive list, and reinvent.

Against this technology optimism the social activist movement represented by "Unsafe at any speed" (Nader 1965) argues that governments do not always act in the public interest, business often lags on social responsibility when action implies short-term costs, and in the absence of governments policy and business responsibility, consumer activism is critical. Naomi Klein argued in "No Logo" (2000) that since multinational companies are not responsible to others than their shareholders, they will not act responsibly. Korten (2001) argues that we need an ecological revolution, where people are put first and ahead of corporations, local communities ahead of global trade, and nature before money. Finally, the Wall Street movement got support of their claim for reducing corporate power and influence by Bakan (2004). Both Bakan and Korten meant that the Corporate Social Responsibility paradigm is a sidetrack.

In contradiction to the social activist movement is the belief in business as a powerful force in sustainability. Lots of books tell how business can play a force in reshaping our society. One of the most famous is "Business as unusual" (Roddick 2000), which tells the story about Body Shop and the fight against experiments on animals. Other examples are "The Ecology of Commerce" (Hawken 1993) and "Maverick" (Semler 1993). The latter tells the story about changes made in the Brazilian shipbuilding supplies manufacturer Semco. Looking at social responsibility in the poor countries, and how to overcome many of the problems of poverty in a capitalist way. A more direct support of CSR can be found in "The Civil Corporation" (Zadek 2001), which argues for three stages in CSR: fixing problems, evolving strategies and reshaping markets.

Finally, Lomborg's "The sceptical environmentalist" (2003) fired up a heated debate about global warming and environmental concern, as he claimed that things have been getting better, not worse, over the last 50–100 years. On a number of parameters he showed that things have become better, like higher life expectancy and more people getting education, etc. On a company level, his argument is that one cannot expect business to do more than CSR. Poverty, pollution, etc. are policy and political problems and must be addressed by the government. In this respect, his argument is similar, and points back to the World Commission on Environment and Development (1987) report.

These different perspectives on sustainability illustrate that the word sustainability is used and understood in many different ways. They also paint the broad and overall picture of the sustainability debate with a special focus on corporations. Beneath this overall, broad debate, other more pointed debates also addresses sustainability in ways that are more indirect. The British research community of Artificial Intelligence had some critical voices towards the rationalistic approach of thinking AI as a form of formalising tacit knowledge into implicit knowledge (Cooley 1987; Gill 1988). These voices turned the attention to the Scandinavian tradition of more human centred systems and the workers wellbeing focus. Here the tacit dimension of knowledge is valued, and said to be the crux of the debate when it comes to acquisition and transfer of knowledge and skills. In many ways, the Scandinavian tradition builds on an idea that there is a deep "interrelationship between tacit and propositional knowledge" (Gill 1988, p. 338). Machines have a supportive role for humans, and knowledge is not a commodity, but corporation's profit spins out of cultivating human knowledge.

The question we try to address is how to develop sustainable manufacturing, which among others implies *sustainable work systems* (Docherty et al. 2008). The concept of sustainable work systems was developed in the 1990s, based on work on organisational development in the Scandinavian tradition. It was argued that a work system had to comply with meaningful work and create engagement and use knowledge in the organisation. The effort is both a top down and a bottom up approach, where every voice in the organisation should be heard. In this way, a hearing and discussion process gains a common understanding of the goals throughout the organisation. In the Scandinavian tradition, we find the same thoughts of sharing common goals and humanising the organisation.

8.3 Discussion

8.3.1 The Challenge to Industrial Organisation

Scandinavian and Norwegian companies (like companies worldwide) increasingly face global competition. They often have foreign owners, and are in a constant battle for working smarter through automation, effectiveness and efficiency. Modern manufacturing industry is often organised as matrix organisations with ambiguous work roles. They apply a combination of expert knowledge and knowledge derived from praxis. Awareness of responsibility and sustainability issues has to be comprehensive. The increased degree of automation, and knowledge intensive processes and systems, require the role of the expert and the 'blue-collar worker' to merge. The learning perspective, with knowledge transferred from the expert to the others, becomes increasingly important.

One can argue that the reindustrialisation of Europe is due to companies integrating in value chains, and helping develop value throughout the chain. This

requires competences of communication, dialogue and innovation. Thus companies in high cost countries, in order to meet global competition, combine management concepts and methods with specific contextual, historical and cultural patterns. In the Norwegian case, this means combining insights from both dialogical and structuring organisational processes. The main issue is how the tension between different concepts and traditions are mediated in a concrete work situation at the workplace, and thereby create a new practice.

In Norway we find characteristics of this type of organisation in the sectors of maritime and oil and gas, where engineering is a crucial part of delivering the right product, at the right quality, and on time. Projects are organised as autonomous work groups, given a mandate, time horizon, and a brief specification of the expected output. Therefore, project groups can be extremely autonomous, creating a multitude of sub-cultures in an organisation: in turn constructing demands for new ways of managing and developing organisations. Managers need to utilise this capacity: both between project teams, and to enhance new and competitive services and products. A person can be both a leader and an employee in the same company, or one can have many leaders related to the same task. The dichotomy of management versus employees now makes little sense. Rather than retaining the dual roles of employee and management, flat and informal organisations, implies that employees significantly contribute to everyday and strategy decisions. One illustration of this can be the research done by Ringen (2010), where he showed that these autonomous teams start out in one direction, but the ideas and inspirations that become the actual fulfilment of the innovation could come from many sources. A coupling-producing firm took one idea from the Lean tradition, one-piece flow, and made use of this to accelerate the production illustrated this creative process. Instead of producing each product in batches and the setting up the production line for another product, they managed to design the production lines in such a way that the changes took just one tact time. The result was production that is more flexible, and just the right amount of each product was produced.

Another side of the autonomous team is the co-ordination cost and the desire to make system-wide effects across teams. Ingvaldsen and Rolfsen (2012) showed that this was a challenge in the Norwegian Model of industrial democratisation. Management was eager to implement what one autonomous team found out to the other teams in such a way that work speed increases and the quality of the work became greater. However, making autonomous teams learn from each other was a difficult task that required huge coordination efforts and cost. It seemed that people wanted to learn for themselves not so much from each other. Fujimoto (1999) called this "fat design" when he discovered that product development teams at Toyota wanted to relearn things that other teams have discovered. Running the same tests again was really "reinventing the wheel".

Dialogue can play an important role in linking bottom-up improvement processes and more top-down strategy. Management and organisational structures support and facilitate learning and knowledge creation at all levels of the organisation. Technological advances in production and automated processes have led to more educated and specialised operators or experts, who are vital to successful

production (Holtskog 2013; Holtskog and Ringen 2013). Keeping the description of operations and routines up to date with insights learned by experts is a challenge (Ringen 2010); likewise, seeing the value of their suggestions and ideas (Ringen et al. 2012). Securing high quality cannot simply be taken care of in a system. It starts with every process in the internal value chain (Ringen and Holtskog 2011). It is important to develop understanding of Quality systems in autonomous work groups (Fricke and Totterdill 2004), and Quality Circles (Ennals and Hutchins 2012).

Applying Learning Circles related to Quality systems takes into consideration the systems perspective, where organisations can learn within the framework of 'popular' manufacturing systems such as Lean, TQM, Quality, and Six Sigma. These systems are becoming more widespread in Norwegian companies, especially in companies in a global context. The latter is related to which actors trigger the implementation of such a system. It can be global customers, foreign owners or regulations at industry or country level. For instance: Lean is now a familiar term in most companies, even in the service sector, often manifested as a comprehensive manufacturing system including everything from procedures at operational level, quality, HES (Health, environment and safety), customer orientation, business development and management practices. In terms of sustainability, these systems should encourage environmental and corporate responsibility issues in the organisation. Comprising all these aspects of an organisation it will certainly affect teams' degree of autonomy, co-operation, performance, understanding, and learning capability. Thus the capacity thorough the organisation to balance different organisational design principles is essential to companies' competitiveness.

8.3.2   Combining Innovation and Sustainability

What is it that builds this reflective competence? Beliefs and values are formed and held by different members of the organisation. Argyris and Schön argue that systems of beliefs underlie action, and are derived from various actions, or procedural descriptions on how to do things. They call this theory of action (Argyris and Schön 1996). Theory of action is for them divided into two forms; espoused theory, which explains or justifies a given pattern of activity, and theory-in-use, which is implicit in the performance of that pattern of activity. Theory-in-use can further be divided into model I, focused on unilateral control and often resulting in defensive actions, and model II, emphasising productive reasoning and robust testing of claims. In model II the reasoning and testing prevent mechanisms like self-fulfilling, self-sealing and error-escalating processes that are common in model I. They also make a distinction between the individual and the organisation, hence model O-I and O-II stand for organisational learning model I and model II. Ideally, these two theories should be the same; most often, they are not. Each member of an organisation has their own theory-in-use, and does not have the whole picture of the organisation.

In practical terms, and in the context of structural changes in Higher Education, we could imagine new ways of working in Higher Education, such as Students' Quality Circles (see Chap. 11). Student empowerment should mean that students can take the lead in managing their own work. This changes relationships with academics, who become partners. We might explore the scope for expanding work-based learning. Work in the Knowledge Society may have a different relationship with education. This may involve work placements and consultancy projects. Thus, a key to combining efficiency, democracy and sustainability in manufacturing relates to processes of dialogue and learning. *Mutual competence building* is about developing capacity in the organisation for that.

According to the timeline set up by Shah and Ward (Shah and Ward 2007) of critical phases in the lean production evolution, academic progress was mostly between 1988 and 2000. After this period the ratio of academic conceptualisation to lean and empirical articles has dropped. The field is now dominated by books and articles written by practitioners and consultants. The famous book, "One best way" (Freyssenet et al. 1998), describes clearly that companies adapt and use only what they find can support their operations, therefore there is diversity in how companies do their operations even in the automobile industry and even inside Toyota itself. However, there are some common principles as Netland (2012) points out, or as he put it "XPS (that is company-specific production system) represents an own-best-way approach to the one-best-way paradigm". What this also means is that lean is more of a technique than an integrated approach. Or said differently, we have to split Lean Production as an icon or as a practice. Here there are room for much more empirical work.

Lean as a practice is not a coherent grab bag of techniques. Important issues are made by the management rather than in a collaborative environment, and yet they get great result initially. But after a while it slows down, and the management talk about having "picked the lower hanging fruit". So why does not Lean sustain itself and keep moving itself incrementally in a successful way? One example is a metal producing company with many factories that had a structured and formalised production system, where every critical operational procedures were described in detail. Teams for revision of these operational procedures met regularly. Talking to people at all the different factories they in unison told that in the beginning lots of improvement were made, and they really felt part of the improvement process when it was introduced by the management. Now the improvement process had slowed down and sometimes lack momentum. Leaders talked about "the fruit", and now after picking them more fundamental and difficult changes needed to be done.

Going back to the beginning there was a collaborative effort in the factories to describe all procedures and making them better. One good example of model O-II or double loop learning by Argyris and Schön (Argyris and Schön 1996). When the systems and descriptions were finished and the production system established, groups for revising operation procedures were established. The reason for having standardised operational procedures was that much of the work at the shop floor was potential dangerous and therefore experimenting could not be allowed. Therefore workers should make suggestions to the group and the group should consider the

suggestions and perhaps make changes. Reasonably from a safety perspective, however, the members in the groups were seldom changed: some had been members for years. This formalisation of changes in the procedures meant that the continuous improvement effort slowed down, and the enthusiasm for suggesting changes also cooled. Along the way the model O-II had evolved into model O-I where one part of the company, after a process of learning and reflection, teaches the rest of the organisation. The workers indicated that they felt more distant from the improvement process, or they were tired of innovation and change. Many workers said that it was all right to work in a more stable setting for a while, some even wanted to go back to "the good old days" when they just got told what to do by the foremen.

Lean as an icon, is arguing for continuous improvement with a strong focus on effectiveness and efficiency. The story above can illustrate that people need some times of non-innovation in order to make sense of the new working environment. Stability provides such space. But at the same time as making the stable environment, the danger is that the organisation loses track of the next critical problems that come along. Or as a manager in one large insurance company said: "I think continuous improvement is demanding for both workers and managers. One needs time to mature and other times to improve". This is a management, workplace, collaboration, and learning issue, or can be thought of as a very difficult balancing act. In order to perform the balancing act important issues are made by the management rather than in a collaborative environment. Perhaps the quest for effectiveness and efficiency leaves little room for discussions and reflections. If that is true, then it is this quest that is incompatible to the social partner model that had worked well in the Scandinavian countries. If the quest cuts the trial and error effort at the shop floor out, then you limit the capabilities of the organisation to innovate.

8.4   Conclusion

In this chapter we have argued that sustainable manufacturing draws on many different insights from theory, which can be made available via universities. It has to balance more structural approaches with more human-centred approaches. It has to balance rule following and learning. It has to balance the internal call for efficiency with dialogue with the environment, and sensibility to stakeholders and actors in the value chain. Given this insight, what sort of education should one give students to prepare them for this? This is a complex question. The argument here is that just learning theories of certain kinds, for example principle/agent theory, which we find in economic organisational theory, will not provide the competence needed. Students need to be exposed to the complex issues involved in finding a good balance between different theoretical concepts, and knowledge about how to apply them in practice. This is at the heart of *mutual competence building*.