Managing Change towards Lean Enterprises

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In the last ten years, the economic environment of manufacturing enterprises has changed drastically. Low costs and high quality are already taken for granted, and increasing attention is now being paid to the element of time. Faster product development and shorter lead times in procurement, production and distribution are the critical competitive factors of today[1]. The integration of business operations within and even between industrial enterprises has much innovation potential in this respect. Through integration, business operations can be streamlined, which not only shortens lead times, but also gives radically new "lean" options for the enterprises' strategies and organizational structures[2].

In integration, a co-evolutionary process is going on between organizations and technology. Integration can be realized to a large extent through organizational and operational changes, as the Japanese examples show[3]. With computer networks and databases, operational integration can be further enhanced. Integration applications such as FMS (flexible manufacturing systems), CAD (computer-aided design) or CIM (computer-integrated manufacturing) can cause radical changes in enterprises. However, to be implemented successfully, this technological integration has to be preceded – or at least accompanied – by organizational integration: by new integrative thinking, strategies, structures and practices in the organization.

Due to the increasing competition and the accelerating pace of technological and organizational change, the concept of management itself is changing. Managerial attention must shift from maintaining current operations to managing innovations: implementing successfully and with short lead times new and more effective practices, structures and systems based on integration. An evolutionary, learning approach should be used in the management of change. It has to start from a strategic vision and overall strategy, but it should also encourage "bottom-up" innovation and learning.

The Lean Enterprise as an Innovation

An innovation can be defined as an idea or invention that has been successfully implemented to create new wealth. According to Urabe[4, p. 3]:

> Innovation consists of the generation of a new idea and its implementation into a new product, process or service, leading to the dynamic growth of the national economy and the increase of employment as well as to creation of pure profit for the innovative business enterprise.

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This definition captures the crucial importance of implementation: e.g. the new production system has to be successfully implemented before it can be called an innovation. Only as an innovation can it improve the profitability of the enterprise. The definition goes even further and claims that this innovation should also create wealth in the whole national economy.

Innovations concern both products and processes. They can be classified as incremental or radical, according to the nature of change they bring about in the enterprise[4]. Incremental innovations improve the old product or process within the existing structure and strategy. Radical innovations give rise to new business possibilities, new strategies and structures[5,6]. Even organizational culture, the basic identity of the firm, is likely to change during this radical transition, although its change may be slower[7]. The typology of innovations is depicted in Figure 1.

It is important to notice that a radical innovation is not necessarily one "big jump" in the development of an enterprise, but rather the result of many smaller changes that occur in consort and together pull the organization into a radically new form[2,8]. Thus, in the end, a radical innovation can be a result of many incremental innovations that reinforce each other to a common direction.

Process innovations are usually classified only as incremental innovations, and major strategic and structural changes in enterprises are seen as results of radical product innovations[2,9]. This corresponds to the "structure follows strategy" postulate in organization theory[10]. But changes in structure – in the differentiation and co-ordination of activities in the business chain – have also been discovered to raise new strategies[11]. In this article, it is hypothesized that also process innovations can be radical (Figure 1, lower right corner). More specifically, it is argued that the reorganization of manufacturing according to "lean" principles can trigger a radical techno-organizational change towards a "lean enterprise", with a new structure, strategy and culture.

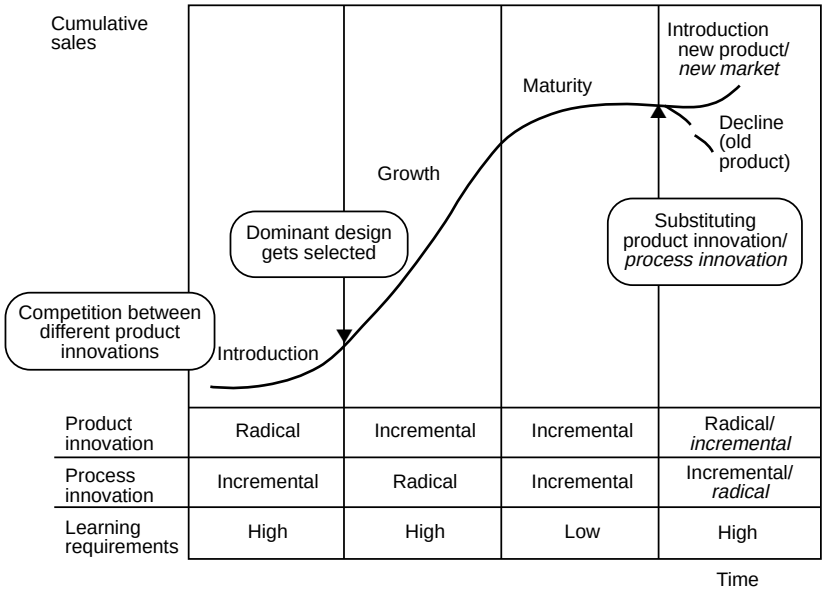
	Incremental innovation: fits the old strategy, structure and culture	Radical innovation: changes the strategy, structure and culture
Product: the physical product or service that fulfils the customer need (joint output of the business processes)	Product improvements (quality, cost)	New product = > new strategy = > new structure = > new culture?
Process: chain of interrelated business activities (realized by people and/or machines)	Process improvements (quality, effectiveness)	New process = > new structure = > new strategy = > new culture?

Figure 1. Typology of Innovations

The relative importance of the different types of innovations changes as the industry matures. This can be illustrated with the well-known product life cycle concept[12,13]. The life cycle of a product begins with the introduction of a series of radical product innovations. Different technological solutions to the same customer problem compete on the market until a dominant design gets selected. It sets the guidelines for the further evolution of the product (technological guidepost[14]).

In the next evolutionary stage, growth in sales is pursued through major process innovations that affect price, quality and market segmentation. Incremental product innovations augment and enhance the original product. In the maturity phase, only incremental innovations in both product and process innovations are possible, since the product and its associated processes are so intertwined. Still, even small changes in the product or processes can bring significant advantage in decreased costs or higher quality. The maturity phase turns into decline when the market reaches saturation. Some external shock in the market, or in technology, can trigger a new wave of product innovations and the introductory phase of the new substituting product begins. The types of innovations during the product life cycle are depicted in Figure 2.

The radical process innovation "lean manufacturing" brings an addition to the classical life cycle: in the maturity phase a new upturn in sales is created by the combination of radical process innovation and incremental product innovations (marked in italics in Figure 2). Lean manufacturing first emerged in



Source: Elaborated from [13]

Figure 2.
Types of Innovation and the Product Life Cycle

the development of the car industry and has significantly changed the market and the strategies of this mature business.

The introduction phase of automobiles began in a handicraft production mode almost 200 years ago. The first radical process innovation, that enabled the rapid growth in the beginning of this century was “Fordism”, with its mass production of standardized, low-cost products and Tayloristic work methods[15]. With time, “Fordism” became the dominant way of manufacturing and operating in most industries (and in the industrialized societies at large[16]).

In the mature car industry, manufacturers competed heavily through incremental product and process innovations (e.g. the differentiation by annually changing car models) until lean manufacturing (also called “Toyodism”[15]) combined in a superior way cost efficiency, quality, flexibility and time. Lean manufacturing has its roots already in the beginnings of the just-in-time production in Japan in the 1930s. By now this process innovation has spread to the car industry at large and changed its whole structure into integrated interorganizational business networks.

Lean manufacturing has changed the rules of competition and has caused a “post-maturity” growth phase. The ever shortening lead times of new cars, their increasing variety and falling prices are however intensifying competition: the customers begin to perceive cars as commodities. On the other hand, the cumulative environmental impacts can change customer preferences, which can slow down the growth of sales[17]. A future radical automobile innovation is likely to shake up the whole industry in its time and start a new product life cycle.

Lean manufacturing seems to be a radical process innovation that is not restricted to its origin, but has wide applicability in many different countries and industries[18]. The lean manufacturing principles include the integration of production activities into self-contained units along the production flow. These units produce flexibly, with short throughput times and high quality similar parts or whole products. Flexible manufacturing technology and a group of multiskilled operators with a high degree of autonomy and self-regulation characterize these production cells. They are mainly controlled by cell output in a simple pull mode: just in time for the need of the next “customer”. Thus the lean production process also cuts across traditional organizational functions and the changes spread into the connected processes. In consort, these “lean” improvements in all business processes can create the radical innovation, a new organizational configuration “lean enterprise”.

The lean manufacturing system as well as the emerging lean enterprise structures develop towards the simple co-ordination of the basic business processes in the chain from the suppliers to the customers, as opposed to the existing complex structures of the functionally differentiated hierarchies[2]. The driving force behind lean manufacturing follows the general direction of self-organization: towards the “simplicity of the original structure”[19]. Management’s important task is to support and manage this innovative

transition as swiftly as possible, if they want to succeed in the new time-based competition.

The Management of Process Innovations

Strategy for Evolution towards Lean Structures

The evolution of innovations is self-organizing, the outcome cannot be predicted[19-21]. Thus, an enterprise's evolution towards a lean enterprise cannot be managed with a top-down development strategy. Instead, an emergent strategy is needed[22]. An emergent strategy is often not expressly intended, but is rather a pattern in the interactions of the organization with its environment, that becomes recognized and legitimated after the fact[11, p. 175]. An emergent strategy can however be guided by an overall umbrella strategy, where management sets out the vision and the broad guidelines for a strategy, and leaves the specifics to emerge: "An umbrella strategy is deliberate in its guidelines, emergent in its specifics, and deliberately emergent in that this strategy formation is consciously managed to allow strategies to emerge en route"[11, p. 179].

The umbrella strategy gives the vision and the guidelines for the formation of strategies. In this "space of possible actions"[23], the emerging strategies are allowed to challenge the prevailing strategies in the innovative process (cf. autonomous strategic behaviour[5,6]). Determining the guidelines and creating the visions for emergent strategies is a value-laden learning process, and the umbrella strategy of the enterprise is dependent on organizational culture. The strategies, structures and technology currently in use in the enterprise constitute frame conditions for its evolution, although they change in radical innovation.

The external contingencies, e.g. the norms, standards and institutional arrangements in the society, the prevailing organizational "paradigms", the rules of competition, and the existing technologies, affect the formation of the umbrella strategy and restrict also the innovation process[24]. Thus the emergence of new lean manufacturing systems and the new "lean enterprise paradigm" affect at the moment the strategy formation of many enterprises. The lean enterprise ideal acts as a new guidepost for organizational innovations.

Under the umbrella strategy, emergent strategies develop through autonomous strategic behaviour and organizational learning. Some important conditions to support this creative learning are presented in the following section.

Organizational Conditions to Support Innovations and Learning

The innovation process starts with an individual's perception of a problem or an opportunity in the business chain, e.g. in the work flow. To perceive this innovation potential, information access, alertness and previous knowledge in the problem area are required in the first place. Creativity is enhanced on the individual level, if the individuals possess holistic knowledge: when they are

able to think globally when acting locally, and if they are encouraged in their creative effort[25]. Thus, in innovative organizations, each employee should be trained in multiple skills and possess redundant capabilities. The contents of the individual tasks should be enlarged and enriched, and the continuous improvement of the tasks should be an important aspect of work. These principles increase creativity[23], but also productivity and work satisfaction[26]. They also characterize ideal "lean" work[3,18].

To develop the idea into an innovation, a hologram structure is needed: the designing of the "whole into the parts". This is accomplished by creative interaction of a group of individuals with the "requisite variety" in knowledge and capabilities[21, 23]. These groups are often parallel structures to the formal organization: teams, project groups, matrix structures, new interfunctional co-operation networks, even internal ventures[27]. In such parallel structures, experimentations do not disturb the efficiency of the running operations. In product development, the use of parallel structures and experimenting with prototypes is common practice. Analogically, also for process innovations, the "prototyping" of new activity structures would accelerate learning and result in better innovations. Within the umbrella strategy, these hologram development groups can be rather autonomous in their innovative redesign tasks.

Incremental improvements in everyday operations are encouraged through grouping interdependent tasks into autonomous cells that produce similar outputs (this also is the basic organizing principle in lean manufacturing). These cells are permanent "hologram structures", that can easily detect the problems and opportunities that occur within the cells' work, and correct them through incremental improvements. Also, the influences from other units can be identified more clearly, which highlights the possibilities for innovation along the chain. The reward systems and initiative procedures should be designed in a way that encourages group work and continuous improvement.

Participation is one main principle that can be used to create temporary, parallel hologram structures for change. When all the relevant individuals, who are engaged in an operational process, can participate in its redesign from the beginning, the jointly developed solutions are likely to be better both in productivity and work satisfaction, and resistance to change can be avoided to a great extent[28]. Participation is beneficial also for another reason: often important innovations stem from interfunctional communication and from the operational levels of the organization[6]. The required holistic knowledge and the fullest hologram structure – the whole process under redesign – can thus be achieved through participation.

The informal organization complements the formal organization in innovation. Often even the incremental innovations require support from informal arrangements. More radical innovations challenge, as a rule, the status quo. Many empirical studies on organizational change show, that a prerequisite for the success of a change project is the existence of a change champion, a member of the organization, who acts enthusiastically to have the idea implemented[29-31]. Innovative champions build informal support

networks for the change. They possess the power to sell their ideas within the organization: they have the required information, political intelligence and expertise, resources and support[29]. A further empirically found condition for the success of innovation is top management support. These requirements reflect personal qualities of key people, and they cannot be created through managerial methods. If however the culture of the enterprise supports innovation, then the possibilities are greater that champions of change are found in the organization.

The organizational variables that are important for process innovations and learning are summarized in Figure 3. It characterizes the incremental innovation process that can lead to radical change, if the separate changes in consort transform the enterprise's business strategies, structure and culture.

In managing organizational change towards the lean enterprise, the innovativeness of the organization is an invaluable resource. Therefore the organizational variables for innovation should be taken into account and developed further. A new managerial method to accomplish this is to use social stimulation games to create parallel structures for the participative development and experimentation of lean process ideas.

Social Simulation Games as Hologram Structures for Innovations

Social simulation games can create hologram structures for innovative process experimentation and rapid implementation[32, 33]. According to Saunders[33, p. 9]:

> Simulation is a working representation of reality; it may be an abstracted, simplified or accelerated model of the process. It allows the participants to explore systems where reality is too expensive, complex, dangerous, fast or slow. A game is played when one or more players compete or co-operate for pay-offs according to a set of rules. A simulation game combines the

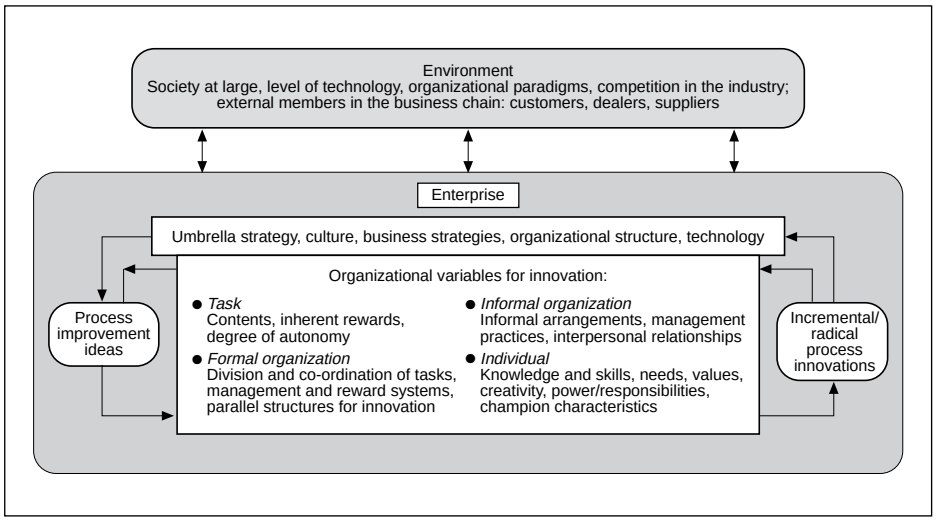


Figure 3.
The Organizational Variables for Innovation and Learning

features of a game (competition, co-operation, rules, players) with those of a simulation (incorporation of critical features of reality).

In the framework of this article, a social simulation game is defined as a simulation with a simplified and accelerated analogue model of a business process. The operations and decisions in the simulation are generated by the human players in co-operation. The employees and managers play the simulation game in their work roles according to some given rules. The game is guided by game designers and facilitators, who can be internal or external change agents of the enterprise.

Through the social simulation games, the players can experience how the relationships between the activities in a business process are structured, and how overall efficiency and quality of work can be improved through process changes. Problems and opportunities in the present structure can be discovered and new innovative structures designed and experimented. This experience increases the depth of learning and creates ownership and commitment to the change[34].

To realize the full advantage of experiential learning, the participants should be able to move from their concrete experience through reflective observation, abstract conceptualization to active experimentation[35-36]. Each simulation game should thus be followed by debriefing in workshops, where the participants discuss and summarize their observations and ideas. These ideas can then be used as input to smaller teams for the design of the next simulation game, or for the following change actions.

The results of social simulation games are critically dependent on the skills of the game designers and facilitators. Computerized tools can be developed to aid in building and documenting the games, but the principle of a social simulation game must be preserved to gain the benefits of experiential learning – an important prerequisite for high quality ideas and their rapid and successful implementation[37,38].

The social simulation games bring together all those organizational variables that are crucial for innovation (Figure 3): the tasks, the formal and informal organization, and the individual, by engaging in the game in their work roles all the employees and managers who work in the business process under development. These participative games create the holistic understanding of the process, and the hologram structure for innovations. Therefore, the use of social simulation games is a central feature in the generic framework for the management of innovative change presented in the next section.

A Generic Framework to Manage Innovative Change

The management of change framework starts from a strategic vision and an overall umbrella strategy that guide the separate change projects. It then follows in a participative manner through the generic phases: analysis and model of the present state, identification of problems and opportunities, experimentation and selection of future state, implementing the change, and

stabilizing the new mode of operation. The idea of continuous improvement[39] is included in the generic framework: when in the stabilization phase of a change project the incremental improvements reach a critical threshold, the need for a new major reorganization is perceived, and the development process is repeated. A spiral of organizational learning is created.

The change management framework is depicted in Figure 4, with possible methods and tasks for the different phases suggested on the right side of the figure. The different phases in the framework are described in more detail in the text below.

Analysis and Model of the Present State

The analysis of the present state is the "homework" that has to be done by the change agents and the managers. Here the enterprise's business strategies and processes are analysed with respect to their integration possibilities and "lean" characteristics. One framework for this analysis is the value system of the enterprise (the division and integration of tasks in the chain of business operations from supplier to customer[40]). In this value system, also the role of

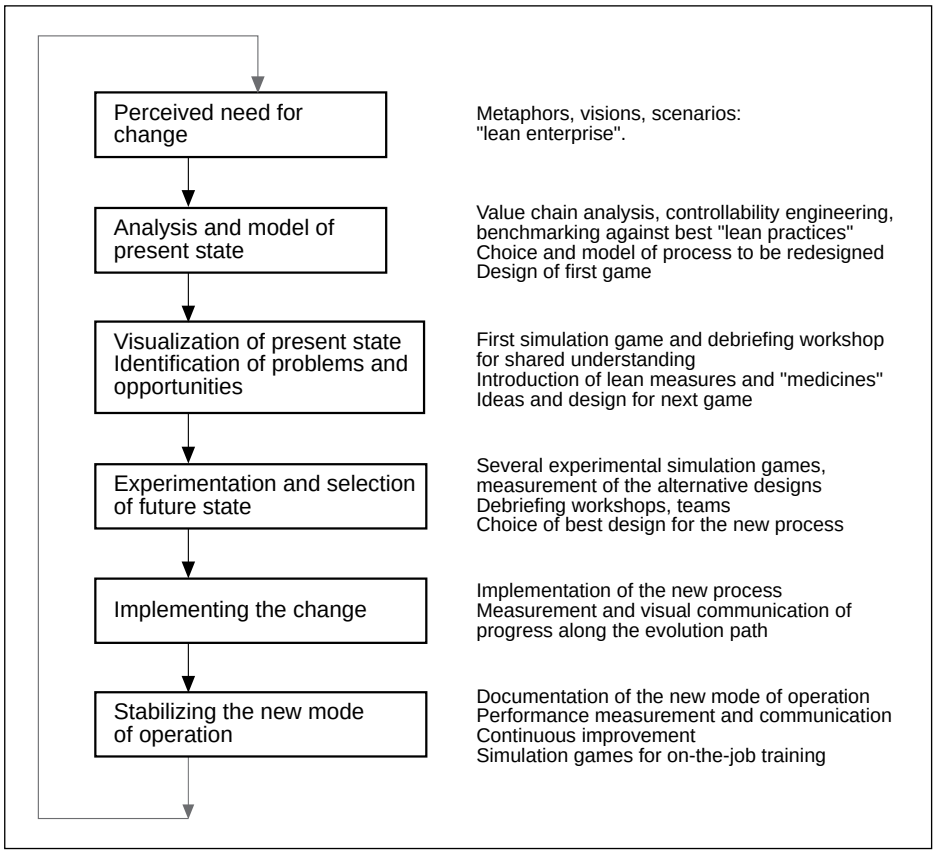


Figure 4.
The Generic Framework for the Management of Change towards a Lean Enterprise

manufacturing must be analysed, e.g. using the controllability engineering method[41,42]. Also other analysis and modelling methods can be used, dependent on the knowledge of the methods in the enterprise.

The results of the analysis can then be compared with existing best "lean" practices already known from the theory and research of production and business management. This benchmarking reveals the development potential of the enterprise and helps to formulate the vision.

To create the "holistic knowledge" for innovations, and to build the commitment for change from the start, this analysis and evaluation phase should be conducted in participative management workshops and seminars. Concrete results from this phase are the choice of the chain of business activities to be restructured in the specific change project, the modelling of this process, and the design of the first simulation game.

Visualization of Present State, Identification of Problems and Opportunities

The first, diagnostic simulation game visualizes the present state of the process and reveals its problems and bottlenecks. When all relevant employees and managers participate in this game, a common platform for change is built: a shared understanding of the present business process, of the vision and the guidelines for change.

During this first game, or in a debriefing workshop immediately after it, also the lean "medicines" and the measurement parameters to be used in the redesign – the new "rules of the game" – are presented to the players. They should be a collection of lean measures (e.g. productivity, time, quality, cost, work satisfaction) and well-known production management methods and principles[43]. Based on the shared simulation experiences and these medicines, the players develop concrete development ideas, which are then discussed and summarized in participative debriefing workshops. The results are used as input in the design of the second, experimental simulation game.

Experimentation and Selection of the Future State

The second – and subsequent – experimental simulations build on the ideas and experiences from the previous games. The lean characteristics of the developed processes are measured with chosen parameters during each simulation. In several rounds of games and workshops, alternative process designs and modes of operation are developed and tested. Learning is achieved by doing. The best alternative is finally selected and documented for implementation. The commitment of all participants to the new process design is achieved already before implementation through this joint experimenting, innovating and experiential learning.

Implementing the Change

After the autonomous, innovative game-based business process design phase, the implementation of the new mode of operation should be controllable by management as well as by the employees themselves. Management needs

feedback and communication about the progress of change along the evolution path, and the employees need the feedback to preserve their motivation and learning during implementation and stabilization of the new process design[43].

The same lean measures that were used to evaluate the different simulated designs can also be used as feedback parameters during implementation. They should if possible be converted into visual milestones along the evolution path, since the visibility of discrete change projects gives the whole organization the possibility to learn from examples[43].

Stabilizing the New Mode of Operations

In the stabilization phase, the organization begins its normal operation according to the new lean organizational and technological design. Stabilization is the critical phase in the change process. In essence, it is the test of the change project's success. What has been neglected in the previous phases must be amended here – this means iteration loops into the previous phases in the change process[44, 45]. The new mode of operation can be documented and used as an internal "standard", e.g. for the quality manual. Games simulating the new stabilized design can be repeated for the on-the-job-training of newcomers.

Stabilization does not prevent incremental innovations in the redesigned process. On the contrary, the process is likely to require continuous improvements, which are developed during day-to-day work. To motivate the employees' learning and innovation, visual feedback of the improvement process is important. The lean measures and parameters that have guided the whole change process can be used even in the stabilized everyday operation. Also new measures can be developed. When the incremental improvements reach their limits, a new generic change process is started (Figure 4).

During the whole change process, top management support is vital. The game designers and facilitators are the key operative change agents. If they are members of the organization, they can even act as champions during the implementation phase. The real developers are, however, the employees – as experimenters and innovators in the games and, thereafter, as operators and continuous improvers of the new process. Thus, the presented management of change framework can be used as a new method in action research.

Empirical Experiences of Simulation Games in the Management of Change

In Finland, social simulation games have recently been applied with success in the management of organizational and technological change[32]. One example is the design and implementation of a new production plant using flexible manufacturing systems (FMS). This case is reported by Päivi Haho, an internal change agent of the case firm and also a doctoral student of Industrial Management at the Helsinki University of Technology[46, pp. 45-9].

The development project's roots were in the rapid increase of demand for the enterprise's products. The old production plant was organized in NC-machining

centres according to product families. Production was planned to inventory and controlled with a complex and inflexible computerized system based on multilevel materials requirement planning. Procurement, capacity planning and maintenance were centralized to staff functions. The problems in the crowded old plant summed up to high work in progress, unacceptable product inventory levels and extended delivery times. Quality and costs were not satisfactory either.

The new plant should resolve the problems through the implementation of highly automated, efficient and flexible production technology managed as an organizational and operational change process. The objectives of the project were ambitious: the new plant should be competitive, efficient and human-oriented. It should operate according to customer order, with a heavily reduced lead time and high productivity. Production should be co-ordinated in the "pull mode". Visual control and simplicity were the aims of the new material flow. The organization should be as flat as possible, with enriched tasks and job rotation. The employees' technological know-how should be extensively increased. The technological solution of the new plant would consist of a fully automated FMS with two operation cells: one for machining multidimensional parts, the other for operating rotational parts. The assembly cell would be equipped with an automated stacker crane system for materials handling[47].

The project began in 1988 and ended with the start-up of the new plant in 1990. Both the design and the implementation of the new plant were based on the principle of participation. During the project, the personnel received extensive external FMS training. As a new training and development method, also in-house social simulation games were developed and used. The games were an important means of creating a common understanding and an identical visual and conceptual model of the future plant. Thus, a common platform and "language" for the joint development effort were created. The main focus of the games was to simulate and improve the planned plant layout and material flow, to try out and learn the new production management principles, and to experiment with different solutions, organizational and technical, in the work flow. The changes were visualized and developed further through the games.

Three rounds of the simulation game were played during the project. The first game was played in the spring of 1988 by a smaller fraction of the personnel, mainly from staff and middle management. The already existing plans for the layout and material flow of the future plant were improved in this preparatory game, and the design of the game itself was further developed and tested.

During the second and third round of games in the summer and autumn of 1988, the whole future personnel of the new plant and some persons from other units of the firm (approximately 60 persons in two separate groups) experimented and innovated the plant's organizational and technical design. The games were played with historical data (one real week's order base), but with the new manufacturing capacity, layout and production control principles. Layout changes and job rotation were simulated. Attention was paid to

bottlenecks, lead time, disturbances and congestions, buffers, flexibility and number of finished products per time unit. The different solutions were measured and assessed using time as the main "lean" parameter. New concepts, e.g. FMS, total productive maintenance and statistical quality control, were experimented and assimilated by everyone through the concrete hands-on experiences in the games.

The last round of games was played just before the start-up of the plant. It was used as a training tool, to repeat and reinforce everyone's holistic understanding of the new plant design.

The experiences of these games were very promising. They involved all the employees in innovative development work. Every player in the game was him/herself an innovator, a student and a teacher. Many grass-roots ideas that came up in the games were implemented in the final design, after a refinement in small teams and plant design groups. One of the most spectacular ideas was to turn around the whole manufacturing flow in the plant. This idea popped up in a player's mind after the second round of games and its effects were tested in the third simulations. This layout innovation proved to be superior to the planned one and it could be implemented without extra costs in the new plant[48].

The innovative atmosphere that was created in the games spilled over to the organization at large. The employees were active in presenting improvement ideas also outside the game occasions. The innovative activity was continued in problem solving teams, planning groups and in informal communication[46]. The positive attitude towards development has prevailed in the plant's organization until the present day[48].

Although the games represented only a small fraction of all training and development effort, they were of utmost importance for the rapid and successful implementation of the whole plant[47,48]. No resistance to change was felt in the transition to the new mode of operation. Already, three months after the start-up the new plant was running with normal capacity. The plant was a success from the point of view of competitiveness, productivity, as well as work satisfaction[47].

With the new plant, the production volume could easily be increased by one third. Simultaneously, the lead time of production decreased from 20 to three days, which improved the accuracy of deliveries dramatically. The inventory cycle time of parts and products increased by a factor of three, and the defect rate of manufactured parts decreased from 1.7 per cent to 0.5 per cent. The hours spent in employee training were more than doubled.

Besides these results, that were in line with the original change objectives, one surprisingly strong effect was found: the number of staff fell from nine to six, while there was only an insignificant decrease from 40 to 38 in the number of operators[48]. With the transition to a lean mode of operation in production, it had become possible to enrich the traditional "blue-collar" work more than anticipated, by decentralizing managerial tasks to the shop floor. This can be interpreted as a spill over effect of the changes from their

origin – from the fabrication and assembly process – also to the planning functions.

It goes without saying, that the FMS plant project had a strong top management support. The project also had a well-managed structure and access to external expertise. The project leader – the new plant manager himself – was very committed to the change and openly showed his support to the experimentital simulations. Skilled and enthusiastic internal change champions were indispensible for the design and realization of the simulation games. Since the first successful game experiences, the company has continued to use games for training and for development in several projects also in its other plants, both on the shop floor and in administrative work. Through the participative simulation games, the "lean" innovations are thus spreading in the company and can thus be contributing to the development towards a lean enterprise.

Conclusions

Often in organizational and technological change, unanticipated external and internal events intervene. Rather than a preplanned transition to a fixed future state, organizational evolution resembles an emergent process of self-organization, where the objectives have to change flexibly along the road. The development in the car industry shows, that internal "lean" changes in manufacturing processes can trigger radical innovations towards lean enterprise structures. The self-organizing nature of enterprise evolution stresses the need to manage change as an innovation process.

The generic framework for the management of change developed in this paper is based on the principles of innovation management. According to the framework, the vision, direction and the guidelines for change are the most important top-down managerial tools. The individual change projects can and should unfold under this development umbrella, consciously managed as innovation processes that enable participation, bottom-up creativity and learning.

The change management framework contains, as an important method, social simulation games. In the games, an effective "hologram" structure is created for innovation. The games also give to all participants a holistic understanding of the business processes that are being developed and allow experimentation and experiential learning. Through the social simulation games, creative and rapid solutions can be found in the implementation of process innovations such as lean manufacturing.

The first empirical experiences of social simulation games in the management of a lean manufacturing system change are promising. The lead time of organizational and technological change in the reported FMS implementation example was short. Through participation in the games, the personnel became committed and motivated in the development project, shared understanding was developed and resistance to change avoided. The employees contributed to the design of the plant with innovative ideas. The new "game-designed" plant, that follows the lean principles, is characterized by high

competitiveness, productivity and work satisfaction. The positive attitude towards development and innovation has been preserved in the plant until the present day. Facilitated by simulation games in other change projects, "lean" ideas are spreading further in the company, which amplifies these developments towards a lean enterprise.

The framework presented in this article is still a hypothesis and needs to be further tested in longitudinal case studies of process innovations and organizational transitions. The comparison between cases may however be difficult, since the results are critically dependent on many organizational contingencies, and especially on the qualifications and actions of the game designers and facilitators. Careful documentation – both qualitative and quantitative – of the change processes is necessary, to gain generalizable results from these real-life experiments in the management of change.

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