Production Supply and Its Adaptation in Affiliates of Multinational Companies

Ph.D. Research Paper

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Contents

1. Introduction

Researching production systems seems to be one of the most central problems of production management literature. One direction of these explorations aims to discover the success of the expansively mentioned – and highly envied – Toyota Production System. Elements of this system were adapted by other automotive manufacturer companies as they developed their own production systems. Many studies in production system literature[1] deals with the common and different characteristics and the performance of various production systems, but only a few researchers attended to analyze the differences (and causes of the differences) among the affiliates adapting the same production system from the company centre.

My research aims to investigate the variants of the production systems in the same multinational company, adapting system elements from the company centre. I plan to find out, weather we can identify differences in the implementation of the same production system, what drives the implementation process and the actual choice the adapted and used elements. I approach the process of adapting a production system developed by a multinational company centre identifying the elements implemented by the affiliates, catch the judgment in the affiliates on implementing the other available production system elements (understanding this whole process and possible succession of the elements), pointing to the evaluation path of the adapted production systems. In this discussion paper I mainly focus on the production supply side of these productions systems.

The above approach to the production systems remains highly relevant in Hungary because of the large number of multinational manufacturers settled in the country. These foreign companies provide (beside the needed capital) the evaluation technology by adapting, managing and improving their production systems. This ensures that these production systems implemented and improved by the manufacturers show significant information for increasing the effectiveness of production. I truly believe that the experiences of the implementation and improvement of production systems help Hungarian and foreign companies find the easily adaptable elements, understand the interdependence of the system-elements, and discover the difficulties in operating a production system.

[1] Success of Toyota's production system and the Japanese automotive industry was explored in the countless times cited book by Womack, Jones and Roos (1990) *The Machine that Changed the World.* Schonberger's (1982) *Japanese Manufacturing Techniques: Nine Hidden Lessons in Simplicity* book investigated the production tools used by the Japanese automotive manufacturers. The definition „World Class Manufacturing" and the successful elements were mentioned beside Schonberger by Hayes–Wheelwright (1984), Giffi–Roth–Seal (1990), and Flynn–Schroeder–Flynn (1999) as well. In the Hungarian literature elements of the modern production systems were summarized by Kovács (2004), characteristics of lean manufacturing (Toyota production System) by Jenei (2006).

2. Economic background of the research

The economic background of my research is provided by its linkages to evolutionary economics. Evaluation of the production systems, development and alteration of the system-variants used in the affiliates can be interpreted as functional examples of the evolutionary economics.

The main characteristics of evolutionary economics were featured by Dosi and Nelson (2004):

1. the analysis is dynamic, *its objective is the explanation of change*
2. the explanation applies to the stochastic effects, which create the populations' new variants, and to *the mechanisms, which systematically select the existing variants*.[2]

As in Hungarian János Kiss (2004) summarizes, according to evolutionary economics the capabilities and routines embodying the company's knowledge cumulate through trying one after another. The theory makes much account of the past path of the company (path dependency) and argues that the knowledge acquired earlier determines the future possibilities of the company. For the companies follow diversified and different study paths, capabilities and routines giving the accumulated knowledge differ highly, and this bases the endurable differences among the companies.[3]

My research aims to analyze a functional example of the evolutionary economics approach. As the evolutionary economic theory shows, companies are path-dependent. In case of a given affiliate this path dependency can be interpreted as dependency on the evolutional direction assigned by the company centre, on the earlier operational experiences of the local affiliate, and on the operational environment of the firm. Beside these the theory underlines the diversified and different study paths of the companies, around what I also build my research. The local affiliates inheriting their differing capabilities can walk through different evolutional paths, and find important for example different elements through developing their own production system. Thus my research will show a given corporate evaluation example of evolutionary economics.

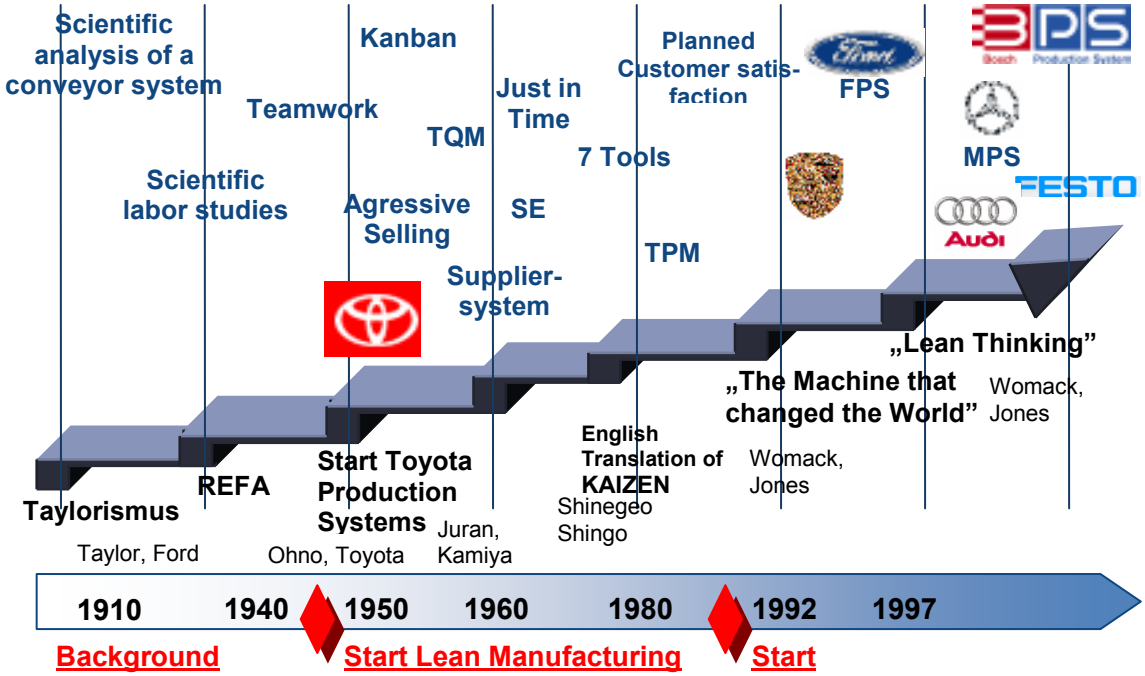
3. Production Systems

Modern productions systems (if we originate them from the appearance of Toyota Production System) possess a fifty-years-old history. The first such system was developed by Toyota and it still remains the most successful one. Its principles and tools were (and still are) adapted by many manufacturers fitting them to their own claims when they create and run their

[2] Dosi–Nelson (1994), pp. 153-172.
[3] Kiss (2004), p. 14.

system. But no matter how many of these manufacturers tried to achieve the same effect as Toyota did, some could come rather near it, but not ahead of TPS (Toyota Production System). "It's strange that only a few of the manufacturers could successfully imitate Toyota, despite of the company's extraordinary openness in connection with sharing its production management methods."[4] The background and evaluation of production systems is showed by Figure 1:

Figure 1: Evolution of Production Systems[5]



Source: Ősz, 2004[6]

As Figure 1 shows production systems are originated from the early 1910s, when Henry Ford and Frederick W. Taylor first established scientific work analysis. Toyota developed its production system in the 1950s, and after that date production management tools broadened widely. In the 1990s automotive manufacturers and suppliers started to evolve their own systems, using Toyota's achievements and the discovered production knowledge.

Production systems were mainly developed by those being unhappy with their existing system, either because of inefficient corporate operation or the force of competition among manufacturers. Nowadays it turns out that companies commit themselves to these production systems not only because of the cost-reducing possibilities, but also because – as Kovács (2004) points out – "buyers would like to be sure, that the products were produced by stable production circumstances".[7]

A framework of production systems can be characterized in the following statements according to Kovács (2004):

[4] Spear–Bowen (2004), p. 45.
[5] TQM: Total Quality Management, TPM: Total Productive Maintenance, FPS: Ford Production System, MPS: Mercedes-Benz Production System, BPS: Bosch Production System
[6] Ősz (2004), p. 20.
[7] Kovács (2004), p. 62.

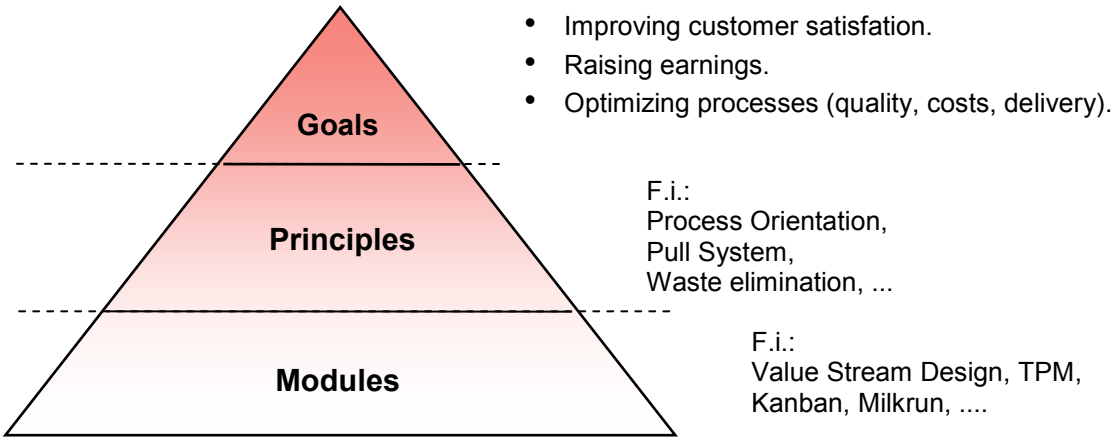
- *Social and corporate culture* gives the basis of the production systems, because without acceptable cultural impregnation the system remains in impermanent state until it comes in accord with the admitting culture.
- *Value system* is the next step of the determinants of development and evaluation of production systems, which also has cultural roots. Values represented by the management also affect value system.
- These all combined with the expectations about management lead to *production philosophies.* Under this Kovács means those frequently cited conceptions like JIT (Just-in-Time), TQM (Total Quality Management), FMS (Flexible Manufacturing System), OPT (Optimized Production Technology) or TPM (Total Productive Maintenance). Examining this level brings up the question of using only one of these conceptions, or using them (or parts of them) together. I suppose it is necessary to mention that it is also manageable to combine these philosophies (and it is showed that it causes greater effects).
- Finally, implementation of all the above principles happens in the *production system*. In my approach production system is the tool of creating output from the inputs through the transformation process, using all the capabilities and routines given by the company centre and developed and experienced by the manufacturer affiliate. In my opinion, a production system is a special resource- and capability combination, which describes a company's manufacturing ability.

The German multinational manufacturer Bosch (which has a local automotive part manufacturer company in Hungary as well) can give an example of adapting production methods from TPS (Toyota Production System) and developing an own production system. In 2002 Bosch decided to build out the BPS (Bosch Production System) conception in order to achieve improvement in customer satisfaction, raise earnings and optimize processes in the field of quality, cost and delivery. Local manufacturer affiliates adapt the BPS system and its production methods, techniques continuously, like the automotive manufacturer factory RBHH (Robert Bosch Hungary Hatvan) does it since 2003. In my research I plan to use the experiences of Bosch to analyze the adaptation process and hopefully find consequences valid for other manufacturers as well.[8]

The **goals, principles and** so-called **modules** (elements) can be built up as Figure 2 shows it:

[8] Working for Bosch in Hatvan (Hungary) at the department Project-Bosch Production System and my former studies in this theme give the opportunity to research this adaptation process in the multinational company centre and in the local affiliate.

Figure 2: Structure of Bosch Production System (BPS)



Source: Ősz, 2004[9]

Achieving the stated goals is available by the production along the principles, as showed in Figure 2. Bosch Production Systems runs with the aid of eight principles:

1. **Process Orientation**: Forming, managing and evolving the whole process.
2. **Pull System**: Produce only what the customer wants.
3. **Waste Elimination**: Waste elimination with preventive actions in order to deliver faultless products to the customer.
4. **Flexibility**: Great adaptability to the numbers, product variants and generations.
5. **Continuous Improvement**: There is nothing that can not be improved.
6. **Standardization**: Implementing "Best in class" standards.
7. **Transparent Process**: Business and production processes are clear. Divergence from the required state can be seen immediately.
8. **Associate Involvement and Empowerment**: Adding responsibility and competence clearly to the process levels.[10]

However, principles alone are insufficient for achieving the goals, because it is necessary to support them with functional, operational tools, so-called *elements* or *modules*. Process Orientation f.i. can be supported by the Value Stream Mapping/Value Stream Design and the process oriented layout; or Kanban system, Supermarket and Milkrun support the principle of Pull System.

[9] Ősz (2004), p. 15.
[10] *Introduction to BPS.* p. 16.

For exploring these elements Kovács (2004) identified thirty tools, which are widely used by the modern, competitive production systems. These production system element are: nearly stabile production volume; low inventory; small production amounts; quick, low cost change-over; layout attributing to the purpose; effective proactive maintenance; multi-jobbed, multi-tasked workers; high quality level; cooperation at solving problems; reliable suppliers; pull system; continuous improvement; strong ICT connection; communication between customer and supplier; manufacturing cells; team technology; focused factory; standardized work; line-balance; "poka yoke" (fool-safe) tools; line-stopping; detail fixation and problem solving; teamwork; visible management; statistical process control; design for manufacturing; only a few and closed supplier relationship; frequent conveying; on-time manufacturing/delivery; integrative approach; FIFO, retardation.[11]

These functional modules contain important **supply elements of the production systems**. The conception of Milkrun, Supermarket, Kanban, Ship-To-Line, Point-of-Use, Value Stream Mapping/Design, Process Oriented Layout, Supplier Improvement, Lean Line Design and Levelling of Volume and Production Mix can be mentioned as possible supply modules of Production systems. These elements give support to the principles pointed out by a system (Milkrun and Supermarket support Pull System, Kanban supports Pull System, Flexibility, Continuous Improvement and Transparent Processes f.i.). The intentions of these functional, operational tools are the following:

- *Milkrun* implements cyclic logistics, providing standardized material supply processes with standardized delivery time, place and route.
- *Supermarket* defines a standard level of stock in production, which contains the need of the given production lines, and which is cyclically filled up by the Milkrun-cycle. With Supermarkets it is possible to visualize inventory.
- *Kanban* is the tool of implementing (and visualizing) pull system with its well-known transport and production cards.
- *Ship-To-Line* is the concept of transporting material directly to the production line, as possible.
- *Point-of-Use* is used generally for A-parts and means delivery directly to the place in the production where the material is effectively built-in.
- *Value Stream Mapping/Design* is the tool of understanding the present and designing the future value stream of an area.
- *Process Oriented Layout* ensures simple, clear material flow by the flow oriented layout, in order to minimize transportation routes in the production.
- *Supplier Improvement* ensures well-prepared suppliers providing the needed material with the needed delivery. (In this approach *JIT* can be interpreted as an output of supplier improvement and also a useful element of lowering inventory.)

[11] Kovács (2004), pp. 63-69.

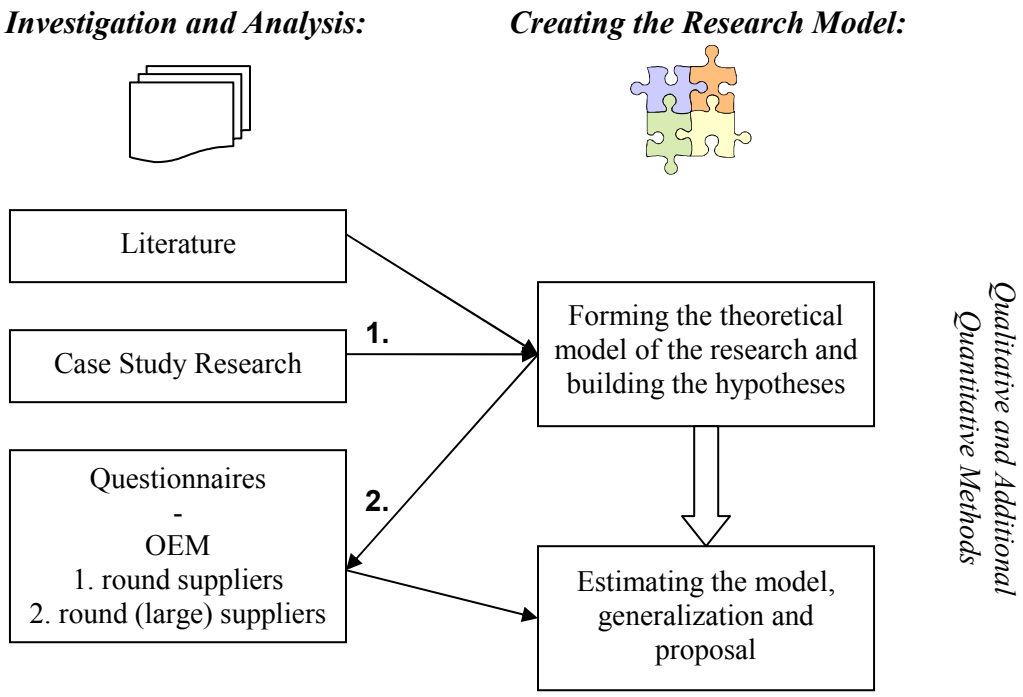
- *Lean Line Design* is a method of implementing the principles by planning/reorganization of manual and part-automatical systems. Its target is the waste elimination in production.
- *Levelling of Volume and Production Mix* ensures the short term and medium-term smoothness of the production program with composition of a daily production. Its target is the balanced utilization and production.

The above listed elements contain some of the main supply modules of a production system. The order and way of adapting them tell us much about implementing the supply side of production systems.

4. Research Methodology and Initial Supposals

Corporate information will be explored by a two-phased research and some steps as Figure 3 shows it:

Figure 3: Methodology steps of the research



(i) In the first phase a ***case study research*** ensures the elaborate analysis. Through the exploring of a concrete local affiliate and its multinational company centre I plan to discover an adaptation process itself.

(ii) In the second phase I will test the consequences on other automotive manufacturer companies with quantifiable questionnaires and interviews. This phase helps to find out weather

we can identify a common evaluation path or some common evaluation steps during the adaptation and the usage of the production systems.

With my research **I plan to analyze**:

- what drives the order of the elements adapted from the company centre during the adaptation process,
- what are the supporting and retaining factors of the adaptation process,
- which main principles and functional elements are adapted by the affiliates (which elements are the first and which ones come later),
- is it possible to identify the succession of the production system elements,
- is it possible to identify a common evaluation path of the production systems at the local affiliates, or only common factors, steps, methods are observable
- if different evaluation paths can be seen, then what explains the differences
- do supply elements appear in a comprehensive way, as a subsystem of he general production system.

The research can be divided into two main phases:

(i) first I will explore the factors, which affect the adaptation process of the production systems at the local affiliates,

(ii) second I will discover the process of the adaptation, and the corporate evaluation path of the adapted production system.

5. Literature

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