Management
2015
Vol.19, No. 2
ISSN 1429-9321

DE GRUYTER
OPEN

DOI:
10.1515/manment-2015-0017

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Lean Management Genesis

1. Introduction

Lean Management is a concept of helping the organisation to achieve a "slim shape". This weight reduction means reduction of waste and resources used in the production of goods and in services (Jakonis 2012, Parkes 2014). So, in that sense, the organisation is being slimmed, it has no unnecessary loads and it is more flexible and effective in its actions (Bednarek 2007).

Lean Management was developed in Japan, in the Toyota's plants, and then - copied by organisations from around the world. However, despite the origins of LM are based in the Japanese cultural circle, many of the elements were taken from other production control systems, for example from the TQM concept or organisation of the production in H. Ford's plants.

The aim of this article is to present the outline of Lean Management genesis, which dates back to the beginning of American scientific management and quality management, and then – Toyota Production System. The system, which is a main precursor of the philosophy and attitude called Lean Management.

The presented scientific problem is about mixed cultural influences in relation to the origins of Lean Management, taking into account, among others, American inspiration

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in the development of a Japanese management concept. The presented problem – the partial American influences in Lean Management development – is neither new nor indicates differences from previous ways of perceiving reality. However, despite that the presented issue is known in the science of management, its weight is emphasized not only in American literature (Liker, Hosesus 2008, Dennis 2002), but also by the creators of the system themselves (Ohno 1988). This is very interesting if we notice that Lean Management is the original Japanese approach towards management, derived from the philosophy, culture and history of Japan (Jakonis 2011, 2012, Parkes 2014), while the American approach and its basic cultural assumptions are fundamentally different.

2. H. Ford and scientific management

In the literature, Ford's system and Toyota's system are being shown as fundamentally different (Ohno 1988). However, one cannot notice American influences in TPS development. TPS's creators admit that Japanese ambition was to develop an original and specifically Japanese production technique, although, taking from American formulas was accepted and recommended, which confirms the above assumptions adopted. While, this learning from American models was not about imitating, but about inspiration and adaptation to specifically Japanese work attitude (Ohno 1988, Jakonis 2012). Some examples of these borrowings are presented below:

- Kiichiro Toyoda, after visiting America and Great Britain, used the acquired knowledge in terms of the production of cars and machinery (Liker, Ogden 2011, pp. 40-41) or Ford's f*low production* system (Jakonis 2012, Dennis 2002, pp. 3-6),
- Taichii Ohno borrowed the concept of production *pull* system, based on the American supermarkets' organisation concept,
- and connected the above-mentioned with Sakichi Toyoda's invention of the motor – driven loom, which is considered to be the prototype of *jidoka* i *autonomation* (Jakonis 2012),
- as well as borrowing the concept of work standardization, etc. (Ohno 1988).

Ford's direct influence on LM is confirmed by T. Ohno (1988, p. 103), who writes that "Toyota has learned a lot from the Ford system". The system, which opened its eyes on the seemingly obvious issues (Ohno 1988, p. 106), for example attached to the "rue efficiency" which means "doing work using the best methods known, not the worst" (Ohno 1988, p. 108), or waste elimination, setting standards by production workers themselves, etc. Moreover, T. Ohno

(1988, p. 103) was inspired by the rise of Ford's production system to search similarly "a Japanese-style production system equally suited to the environment of Japan".

In addition, "researchers from MIT have made an interesting discovery, that Toyota production system which was defined by them as lean, turned out to be remarkably convergent with elements of the solutions offered by Ford in the early years of the industrial age. In other words, the studies have shown that Toyota was able to skilfully use a number of achievements of the industrial era to produce a wide range of products in small batches. These innovations include: a combination of individual skills of craft era's employees, standardisation of activities of parts' flow as a production' characteristic on the Ford's assembly lines and the link which was the teamwork", etc. (http://lean.org.pl/o-lean-troche-bardziej-naukowo/2/, access 04.06.2015).

Henry Ford (1863-1947) was an American entrepreneur, whose goal was to design the car that was easy to manufacture and to repair (Model T) and a revolutionist regarding automobile's production methods throughout the introduction of: movable assembly line, interchangeability of parts or an ease of assembly (Dennis 2002, p. 3). In 1913-1914 he introduced the system of *flow production* (Koźmiński, Piotrowski 2010, s. 638). The famous product, which benefited from this, was Ford Model T, which was being produced from 1908 to 1926 in a few versions: *Touring car, Roadster, Coupelet, Town car, Coupe, Centerdoor sedan, Runabout, Fordor sedan, Tudor sedan,* with different bodies, but with the same engine and chassis (http://www.hfmgv.org/exhibits/showroom/1908/model.t.html, access 06.09.2013).

H. Ford is considered as well to be one of the great practitioners and co-founder of the direction called scientific management. While, F. W. Taylor is considered to be a pioneer of the scientific management (http://mfiles.pl/pl/index.php/Zarządzanie_naukowe, access 04.06.2015). Taylorism can be characterised through (Dennis 2002, pp. 2-3):

- planning and production separation,
- work standardization, which stands for identification of the best and the easiest way of work,
- reduction of time required for each process,
- measurements and analysis for continuous improvement of the process.

In my opinion, such elements as standardization or continuity of improvement process are ones of the basic assumptions of Lean Management concept. The confirmation of influence of Taylorism on the development of LM is also found in the work of P. Dennis, who indicates that „great pioneers of lean production,

from Taiichi Ohno to Shigeo Shingo, have acknowledged their debt to Taylor" (Dennis 2002, p. 3).

Scientific management is the direction in theory of organisation and management, which propagates the principles of scientific description and the organisation of work, as a contrary to the so-called common sense (Koźmiński, Piotrowski 2010 p. 623). Some of the practical solutions and characteristics of Ford's scientific production system are (Koźmiński, Piotrowski 2010, pp. 638-639):

- economic and big-lot production of cars,
- introduction of assembly of a car in a motion,
- the relatively low prices of the product,
- division and simplification of activities which abolished requirement for work force to be highly skilled,
- worker's wages were at the beginning below the average wage in local industry, then - the highest in comparison to the national average.

However, it is believed, that the key to success of Ford's mass production was not the conveyor belt, but the interchangeability of the parts and the simplicity of assembly, as a result of which the introduction of conveyor belt was possible. Among other innovations, H. Ford introduced the reduction of activities required from the single worker, which led to a large cost reduction, as well. James Womack is even convinced that Ford practised Lean production system in Highland Park (Dennis 2002, pp. 3-4).

However, as it was mentioned above, Ford's system was to be only a partial inspiration for the Japanese production system. So it happened, as evidenced for example by differences between Ford's System and Lean Management System. Some identified differences between these systems are presented in the table below. As we can see on the example of the below chosen characteristics, Ford's system is characterised, among others, by: bigger than Toyota's system inventory, lower reactivity and flexibility and less emphasis on the human factor as an important element of organisational success.

Table 1. Comparison of Ford and Toyota's production systems

Ford's System	Toyota's System
Idea of making a quantity of the same item at one time – mass production system	Synchronisation of production of each unit and one piece at a time, small lot sizes of differential products

Conveyor belt production – forward direction (previous process determines following process)	*Just-in-time* and *kanban* – reverse direction (following process determines previous process)
Automation	Automation with a human touch
Big production batches (large lots)	Small production batches and quick changeovers
Lots of inventory	Elimination of stocks – dynamic warehouses called supermarkets
Overproduction and products with defects	Avoidance of overproduction and elimination of products with defects
Planned production system	Removing control of planning

Source: developed on the basis of: T. Ohno, *Toyota Production System. Beyond Large-Scale Production,* Productivity Press, New York 1988, A. Jakonis, *Lean Management - charakterystyka, Przegląd Naukowo-Metodyczny. Edukacja dla bezpieczeństwa,* Rok V, Numer 4/2012 (17), WSB Poznań, p. 180

Nowadays, Ford consortium's attitude towards management is considered to be evolving more and more towards Toyota's system. What is interesting, "as a part of Ford 2000 programme, a new production system was introduced and based predominantly on Toyota's production system. (…) The system focused on basic production factors, as production graduation, *pull system*, synchronized actions, continuous flow and stability of a whole process" (http://aneksy.pwn.pl/zarzadzanie/pdf/Waters17-Ford.pdf, access 06.09.2013, p. 2).

American influences on Lean Management, including Ford's and Taylor's concepts, are both interesting from a cognitive point of view and controversial, due to the fact that they originate from philosophical foundations, which are opposite to the Japanese culture. While Lean Management and its culture are derived from Japanese philosophy, culture, history, etc. (Jakonis 2011, 2012, Parkes 2014). To say that Lean management is based on American philosophical foundations and the mechanical moving of Western mentality on Japanese soil would be an abuse and it is not suggested in this paper. However, this does not preclude the possibility and necessity of quoting the examples of American influences and inspirations on the development of a precisely Japanese management concept. Especially that its creators and experts in this field admit to the American borrowings (Ohno 1988, Dennis 2002, Liker 2008).

3. Quality management

Thus, in my opinion, the Japanese inspiration of Ford's organisation of production or the operation of American supermarkets, have had an important influence on the shape of Toyota Productions System (TPS) and the development of Lean Management. Another important factor was also the focus on the highest quality of manufactured goods. The focus on quality is, in Japanese society, connected with the collective striving for perfection. Japanese society is characterised as homogeneous; nevertheless, it is "just the homogeneity which decides on searching for qualitative differences, producing incredible diversity of goods and allowing every participant of the production process to stand for a different vision of excellence, so that the finished product could be characterised by excellence in many respects" (Hampden-Turner, Trompenaars 2006, p. 130, Jakonis 2011). Everybody in Japanese society is responsible for the process of creating quality. "Japanese attitude towards quality expresses in creating immaculate whole from growing number of elements. So, quality is an integral component of the whole process. Everyone is responsible for it" (Hampden-Turner, Trompenaars 2006, pp. 130 - 131). „Furthermore, Japanese excellence in quality control stems not just from small lot sizes and quick discovery of defects, but, more importantly, from an industry – wide assault upon bad quality, that has been going on since 1949" (Schonberger 1982, p. 2).

When, after Second World War, Japanese industry started to rebuild, also American scientists were a part of it. For example W. E. Deming, who "was teaching Japanese engineers how important is the quality and what are the ways to achieve it" (Liker, Ogden 2011, p. 42). Which, in my opinion, is another argument in favour of Western influence on shaping both TQM and Lean Management. The genesis of TQM foundations are dated back to the beginning of the forties of the twentieth century, as the effect of cooperation between W. E. Deming and J. Juran and Japanese Scientists Association (Domaniewska 2009, Jakonis 2012). Whereas, TQC or *Total Quality Control*, is characterised as one of the Japanese manufacturing techniques, which is based on the assumption that quality has its origins at the beginning of production process and requires "a habit of continuous improvement" (Schonberger 1982, p. 47) throughout the organisation. Foundations of TQC are for example: process control, quality easy to observe, consequence in sustaining the quality, line's stopping, or control of each item (Schonberger 1982, pp. 47-62).

Total Quality Management (TQM) relies on "continuous improvement of every action at every level of organisation, with every employee's involvement,

so the quality improvement itself is going to be a purpose of the company's activity" (Klimek 2010, p. 121, Jakonis 2012). These assumptions correspond with Lean Management philosophy, in which every participant of the organisation is committed to take part in continuous improvement process, as well. In the process of continuous improvement the quality is a priority, more important than cost reduction or implementation of on time delivery system (Bednarek 2007, p. 109). At the same time, "TQM is considered as a modern and complex business management concept, because it can, and it should, include the whole system and the needs of an external and internal client" (Łańcucki 2001, Jakonis 2012, p. 326). TQM, as well as Kaizen in Lean Management concept, "meet paradigm talking about the need to continuously improve the processes carried out in lean organisation" (Bednarek 2007, p. 66). TQM or total quality management is considered to be one of the most important elements of the philosophy of continuous improvement (Bednarek 2007, s. 110) and one of the methods of implementation of continuous improvement of management (Bednarek 2007, p. 169).

As an effect of TQM introduction, there should be a culture created as well, a specific "culture of total quality. This culture subordinates the activities whose aim is to continuously improve the work effectiveness, flexibility and efectiveness of the processes, which lead to increased competitiveness of the organisation" (Dołchasz, Fudaliński, Kosala, Smutek, 2009, p. 124, Jakonis 2012). What should be added is that formation of that organisational culture strengthens in return the quality management process and determines its effectiveness, as well.

According to J. K. Liker and M. Hosesus, TQM is a base of one of the tools - Six' Sigma – which is used nowadays in lean. Thus, it confirms the assumption about the impact of TQM on the development of Lean Management concept. However, Lean Six Sigma is focused on the results and is mechanistic. So, it is based on different basic assumptions then the classic *Toyota Way* (TPS). According to the above-mentioned authors, one should not identify TQM, LM, *Toyota Way* or continuous improvement, because despite similarities and links, they also have different characteristics. However, confirming the assumption about the influence of TQM on LM, it should be noted also that both LM and TQM focus on the awareness throughout the value stream. It is everybody's duty to understand clients' needs and to provide them with the quality without defects. This philosophy was adopted in Toyota in the sixties of the XX century, when Toyota decided to win the prestigious Japanese Deming's award. Nowadays, TQM is one of the strongest and central points

of *Toyota Way* (Liker, Hosesus 2008, pp. 518-523) – the contemporary version of TPS (LM).

Figure 1. Global reach of *The Toyota Way*

Source: http://www.toyota-global.com/company/vision_philosophy/toyota_production_system/, access 17.10.2013

The *Toyota Way* is described as the spirit, in which Toyota produces. This is a subject to the global adaptation and the global evolution (http://www.toyota-global.com/company /vision_philosophy/ toyota_production_system/, access 17.10.2013). *Toyota Way* connects organisational rules of TPS and specific Toyota's organisational culture (Liker, Hosesus 2008).

All Lean Management, TPS and Toyota's TQM, are precisely Japanese management concepts, developed on the Japanese cultural ground (Jakonis 2011, 2012, Parkes 2014). However, the arguments presented in this study support additional, culturally different – American – influences that have contributed to shaping these concepts. American inspirations and borrowings are not only possible but they are also a cognitively interesting issue and they do not change the fact that Lean Management is based on philosophical assumptions specific to Japanese cultural circle.

4. Toyota Production System

Before the philosophy of the *Toyota Way* started to be propagated globally, the Toyota Production System (TPS) was developed in Toyota factories. TPS is described as a sum of the unique Japanese methods of management in the combination with a specific organisational culture. TPS utilizes assumptions of E. Deming's cycle (PDCA) and tools, which assist in waste elimination, providing production flow or maximization of productivity (Jakonis 2012, Bednarek 2007, p. 200).

TPS dates back to the end of Second World War in Japan, when Japanese automotive industry faced the challenge of surviving in a global competitive market. While, the leader of mass and low – cost production – USA – was considered to be the main competitor of Japanese automobile industry at that time. The need to gain a competitive advantage initiated a lot of years of team work in Sakichi Toyoda's factory (the funder of Toyota Motor Company). The director of Toyoda's factories – Taichii Ohno – while writing the book, which was based on his experience in managing the work on creating new, effective and complex management system, stated, that it was the need of producing high - quality cars, but at the lowest cost and according to client's order, which were the determinants of change in Toyota's management system (Ohno 1988, Jakonis 2012, p. 179).

In 1950 Eiji Toyoda visited Ford's factory in Detroit. Japan and Toyoda's family business (Toyota Motor Company was formed in 1937) were in a crisis at that time, and it produced only a fraction of Ford's volume. After returning to Japan, Eiji Toyoda and Taichii Ohno stated that mass production would not work in Japan. This was due to specificity of Japanese market (small and demanding), weakness of Japanese economy after Second World War, and existing global competition. At the same time, they stated that there were possibilities of improving existing production system in Japan (Dennis 2002, pp. 6-7).

Chronology of the events, which led to development of TPS, was presented in T. Ohno work, called *Toyota Production System*. He described the most important events, which, according to him, were the turning points in a new production system's development. Selected events are presented in the table below (Jakonis 2012). Among American borrowings we can see for example: the use of supermarket's organisation or automation, transformed into strictly Japanese autonomation.

Table 2. History of development of Toyota Production System

Year (s)	Event
1945-1975	Beginning of work at production system *just – in – time* *Autonomation* (Sakichi and Kiichiro Toyoda)
1945-1955	Setups (2 to 3 hours)
1947	2-machine handling (parallel or in L-shaped layout) Separation of machine work and worker's work begins
1948	Withdrawal by subsequent process ("upstream" transport)
1949	Intermediate warehouses abolished
1949-1950	3- or 4-machine handling (horseshoe or rectangular layout)
1950	Machining and assembly lines synchronized Visual control, *andon* system adopted in engine assembly
1953	Supermarket system in machine shop and call system for the machine shop Production levelling (Taiichi Ohno)
1955	Assembly and body plants linked Required number system adopted for supplied parts Small load, mixed transportation Main plant assembly line production system (a*ndon,* line stop, mixed load) Automation - > autonomation = automation with a human touch
1957	Procedural chart (*andon*) adopted
1958	Warehouse withdrawal slips abolished
1959	Transfer system (in -> in or in -> out)
1961	Pallet *kanban* (ended in failure) Red and blue card system for ordering outside parts *Andon* installed, Motomachi assembly plant
1962	*Kanban* adopted company-wide (machining, forging, body assembly, etc.) (Taiichi Ohno) Main plant setups (15 minutes) Full – work control of machines, machine *baka-yoke*
1963	Information indicator system adopted, system of autonomated selection of parts adopted, Multi-process operation
1965	*Kanban* adopted for ordering outside parts, 100% supply system Began teaching Toyota system to affiliates

1966	First autonomated line (Kamigo plant)
1971	Main office and Motomachi setups (3 minutes) Body indication system (Motomachi Crown line)
1973	Transfer system (out -> in)

Source: T.Ohno, *Toyota Production System. Beyong Large-Scale Production*, Productivity Press, New York 1988

Thus, the system created in Toyoda plants, because of its place of origin, was named Toyota Production System, or – according to the mission - *Toyotaism*. Some of the Toyota's mission characteristics were (Ohno 1988, p. 80, Jakonis 2012, p. 180):

- producing reasonably priced cars to the wide audience,
- bringing the production process to perfection,
- or recognising the importance of sale in industry.

"According to T. Ohno, *Toyota Production System* is only based on the observation of the time line from the moment the customer places an order to the point when he pays for it. What is being done is the reduction of that time line by elimination of the non-value-added wastes (Ohno 1988, p. ix)"(Jakonis 2012, p. 183). Some of the rules, on which TPS is based, are: *Just in Time, Pull System Production, Profit by Cost Control, Built in Quality,* or *Flexible Workforce* (Liker, Hosesus 2008, p. 61).

J. Krafcik is considered to be a person who introduced the term *lean*. He used this term for the first time in his work called *Triumph of Lean Production System*s (1988) (https://www.lean-news.com/tag/john-krafcik/, access 23.11.2015). While two important later works popularising the term *lean* are: *The Machine that Changed the World,* by J. Womack, D. Jones and D. Roos (1990) and *Lean Thinking,* by J. Womack and D. Jones (1996), Dennis (2002, p. 13).

On the corporation website we can read that TPS is also referred to as *lean management system* or *Just-in-Time system* and is based on total elimination of waste (http://www.toyota-global.com/company/vision_philosophy/toyota_production_system/, access 17.10.2013). The system is characterised as based on two main rules: *jidoka* and *Just-in-Time. Jidoka* or *autonomation* (automation with a human touch) means that the production has to be stopped immediately if any defect appears, so to avoid manufacturing of defective products. *Just-in-Time* (JIT) is the concept in which every process's aim is to produce only what is required by the following process (Jakonis 2011, 2012). TPS is also called Thinking

Production System, because the main aim of using the lean methods and tools is teaching people how to think and how to teach others (Liker, Hosesus 2008, p. 542).

However, TPS is not only the way of production's organisation, but the approach to management, specific philosophy and approach towards activity as such (Parkes 2014). This philosophy is being characterised as philosophy of "daily improvements and good thinking, good products" (http://www.toyota-global.com/company/vision_philosophy/toyota_production_system/, access 17.10.2013). Nowadays, this has been adopted globally, even in Ford's factories, as it was stated above.

Lean Management uses tools and rules of organisation of production, which are used in TPS as well. At the same time, its implementation is about adopting and creating specific artefacts, norms and values, which, in connection with the basic cultural assumptions, can create lean management organisational culture (Parkes 2014). Characteristics of lean management culture correspond in large part with the characteristics of Toyota organisational culture that was described by J. K. Liker and M. Hosesus (Parkes 2014).

Toyota's organisational culture was built not only on the basis of Eastern Japanese beliefs, like underlining the harmony, collectivism or long-term thinking, but also on the additional influences, which confirms the assumption adopted at the outset, about eclectic character of Lean Management genesis. Additional influences, which shaped this culture, came from: agricultural community of Aichi prefecture, where Toyota was established, Toyoda family (founders), and car industry as such (Kristjuhan 2010, p. 4, Parkes 2014). Additionally, American selected solutions have also been borrowed, with the use of which Toyota has developed its management approach, for example (Toyoda, Shimokawa, Fujimoto and Orihashi, 2009), Kristjuhan (2010, p. 4, Parkes 2014):

- Ford's flow (conveyorbelt) production and his employee suggestion system,
- Taylor's scientific management,
- Deming's concepts of quality control,
- Supermarkets' solutions for inventory control.

These borrowings were used as an inspiration and the solutions adapted to the specifics of Japanese cultural circle. The circle, which is characterised by such cultural features, distinguishing Japan from American culture, as for example: particularism (the multiplicity and diversity of points of view, loyalty, respect, etc.), collectivism and communitarianism (based on, among others, Confucianism values), paternalism Jakonis 2011) or teamwork and cooperation (Zbiegień-Maciąg, 2002, pp. 26-27).

Today Toyota seems to be the largest automaker in the world and its success attracts the demand for knowledge about lean enterprise (Womack, Jones 1996), the knowledge which spreads over more and more countries, industries and even beyond manufacturing (http://www.lean.org/WhatsLean/History.cfm, access 23.11.2015).

5. Summation

The phenomena described above are the confirmation of global influences in Lean Management concept's creation. However, despite the use of many American borrowings, all of them were adopted and developed on the Japanese cultural ground. And there they evolved and improved and took a shape, which led to economical success and which aroused global interest.

Organisations from different sectors, all around the world, make attempts to implement the best practises and lean approach used in Toyota. And, as J. K. Liker and M. Hosesus (2008, p. 12) are writing, there is a lot of documented successes in the range of a duplication of selected aspects of Toyota functioning. However, only a few organisations took the challenge to implement such a type of culture, presented in Toyota, which enables development of exceptional people, who are dedicated to continuous improvement process – which is specifically Japanese *lean management culture* (Parkes 2014).

At this point, we can highlight as well, although it is not the purpose of this paper, the significant problem of cultural conditioning of Lean Management (Jakonis 2011, 2012, Parkes 2013, 2014). The more national culture, which determines organisational cultures created by its representatives, differs from Japanese one, the more difficult it can be to implement Lean Management. Thus, the intention to transfer the concept on a different cultural ground requires both to take into account the cultural factor, as well as the willingness to potentially work in this area (Parkes 2014).

Summary

Lean Management Genesis

Lean Management is a philosophy and management concept, based on reduction of the waste and resources used in the process of producing goods and providing services. Lean Management genesis dates back to scientific management in America (for example concepts of H. Ford and F.W. Taylor) and quality management, including development of TQM concept. Japanese

Toyota Production System has been inspired by chosen elements of these concepts, and then it evolved towards global concept called *Toyota Way* (which connects production rules with values and work attitude).
TPS is considered to be a major precursor of lean manufacturing and now more widely – Lean Management. LM is a broader set of organisational and management tools, formed mainly by the Japanese culture, but also subjected to the Western influences in the field of organisation and management (Jakonis 2011, Parkes 2014).

Keywords: *lean management, scientific management, TQM, TPS, Toyota Way, lean management culture*

Streszczenie

Geneza Lean Management
Lean Management to filozofia i koncepcja zarządzania, która opiera się na redukcji marnotrawstwa i zasobów używanych w procesie wytwarzania wyrobów i świadczenia usług. Geneza Lean Management sięga początków naukowego zarządzania w Ameryce (np. koncepcji H. Forda i F.W. Taylora) oraz zarządzania przez jakość, w tym rozwoju koncepcji TQM. Ich wybrane elementy posłużyły jako inspiracje dla japońskiego Systemu Produkcyjnego Toyoty, który z czasem ewoluował w stronę globalnej koncepcji *Toyota Way* (łączącej zasady organizacji produkcji z propagowanymi wartościami i podejściem do pracy).
TPS uważany jest za głównego prekursora lean manufacturing a obecnie szerzej - Lean Management. LM jest pojemniejszym zbiorem narzędzi organizowania i zarządzania, ukształtowanym głównie przez japońską kulturę, ale i poddanym zachodnim wpływom z zakresu organizacji i zarządzania (por.: Jakonis 2011, Parkes 2014).

Słowa kluczowe: *lean management, naukowe zarządzanie, kompleksowe zarządzanie przez jakość, TPS, droga Toyoty, kultura lean management*

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