
Research on HRM and Lean Management: A Literature Survey

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Abstract: The key mechanisms and the decisive variables that appear to justify the comparative advantage of lean companies deal with Human Resources (HR) issues. The purpose of this literature survey is therefore twofold. First, this article sets out to clarify what lean management is from a Human Resources Management (HRM) viewpoint. Second, this paper identifies the main characteristics of HRM in lean companies. Among other findings, we show that lean management can be partially understood as a practice which involves integrating middle management and support services with production rather than distance them. Furthermore, we show that knowledge sharing, operators' control system and shop floor management are three of the main dimensions that constitute HRM in lean companies.

Keywords: Lean Management; Human Resource Management; Toyota Production System; Literature Survey.

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1 Introduction

On April 24th 2007, the three biggest international press agencies¹ published that Toyota became the world's largest carmaker, dethroning General Motors. This result is related to the number of sales in the first quarter of 2007. From January to March 2007, Toyota sold 2.348 million vehicles worldwide compared to GM's 2.260 million vehicles. This information did not seem to surprise industrialists, journalists and expert analysts. For example, since several years the rating agencies Standard and Poor's and Moody's have awarded Toyota the 'AAA' rating and have placed GM in the category of so-called speculative investments ("Junk bonds").

Toyota's success has led to many comments, which frequently include the argument of its organisational and productive efficiency. The Toyota Production System (TPS) or Toyota Way is supposedly at the source of the competitive advantage that Toyota has over its competitors.

All the writings on TPS and more generally on lean management, the generic form of managerial structure adopted by the Japanese manufacturer, do not have the same purpose and the same quality. There are prescriptive articles, which define the operating rules of lean management on a normative basis. In contrast, other articles are more descriptive and have the goal of retranscribing the facts and observations on lean management methods in order to highlight its specificity. Some focus on Toyota, while others are wider in their subject of analysis. Moreover, the literature on lean management, which has been developed over the years in several disciplines, rarely shows consensus and brings together occasionally contradictory interpretations. It is not based on a clear formal and theoretical foundation. Nevertheless, the key mechanisms and the decisive variables that appear to justify the comparative advantage of lean companies deal with Human Resources (HR) issues. It therefore seems interesting to make an inventory of the research performed on lean management and to use this summary of past and present propositions on the subject to try to clarify i) what lean is from a Human Resource Management (HRM) viewpoint and ii) what a lean HRM is.

This article aims to list the scientifically-based arguments formulated by researchers who are interested in lean management. It is based on a bibliography made up of 80 articles or works from management sciences, economics and industrial sociology. The references mentioned were selected because they offer the first formulation of an

argument or a new conclusion on lean management. The references selected in this article are therefore widely cited texts.

To deal with our subject, we have organised this article in two parts. The first part lists the main works and articles that present or give an examination of lean management on a normative or prescriptive basis. This section enables us to outline the different discussions whose goal is to convince people of the superiority of the lean management mode above other production systems or, on the contrary, to expose its limits. These writings are interesting insofar as they reveal the operating principles of the lean paradigm. However, these normative or prescriptive presentations have boundaries and remain unsatisfactory from the research viewpoint. It is actually based on subjective criteria and on this basis remains debatable. It is therefore important to refer to attested facts obtained through objective and impartial observation of lean practices. In the second part of this article, we therefore take stock of descriptive and empirical articles that relay observations or stylised facts on lean management. These stylised facts, while they are indisputable in practice, still remain to be explained. Since almost all of these stylised facts deal with HR issues, we develop also in the second part of this article a personal reflection whose goals is to define lean in the light of HRM perspectives and to identify the main characteristics of a lean HRM.

It is important to note that the distinction introduced in this article between the so-called 'normative or prescriptive' studies of lean management and the studies based on 'observed facts' is made through the lens of a methodological perspective. This classification does not depend on the results or propositions which are advanced in the articles. It depends on the methodology used to obtain these results or propositions.

2 Normative or prescriptive presentations of the lean approach

The first publications and articles published on the Toyota Production System were written by practitioners of the Toyota production method, at the end of the 1970s and at the beginning of the 1980s (Sugimori, Kusunoki, Cho and Uchikawa, 1977; Shingo, 1981). Economics/management researchers quickly seized on the subject and tried to retranscribe the uniqueness of a production system, which, following the MIT international benchmarking programme "*The Future of Automobile*" and the publication of *The Machine that Changed The World* by Womack, Jones and Roos, adopted the name "lean management" (Ballé and Beauvallet, 2005).

The first texts, most frequently drawing on the case of Toyota, state what the best performing production system should be. Moreover, these normative or prescriptive presentations of lean are not just reserved for the first texts on the subject and remain very present today in lean literature. This tendency to highlight lean as a paradigm has undoubtedly been accentuated in recent years with the automatic development of lean practices in industry with the appearance of many consulting services that occasionally publish quite categorical works on the issue. In response to this relatively dogmatic presentation of the lean approach, several authors formulate a culturalist or contextual examination of the method. Their reservations notably refer to lean's strong dependency on the social climate, the market conditions and the legal rules in force in a company or country.

2.1 The Toyota model: universal best practices

The Toyota model can be understood as a set of practices that form a coherent and unified system. However, research on the Toyota model does not all adopt a “system” approach and occasionally analyses Toyota Production System tools alone. From a chronological viewpoint, it seems that early research on lean management was more concerned about studying the tools on which the TPS is based. The studies that approach lean as an indissociable system are actually more recent. In order to respect the chronology of the work on the subject, we propose in this sub-section to highlight research work dealing with lean tools before then outlining those that treat it as a system in a second sub-section.

The Toyota model as a set of tools

The lean approach, inspired by the Toyota Production System, is based on many management tools. Some are specific to lean management, while others are more common. We limit ourselves here to outlining the content of studies that have dealt exclusively with tools specific to lean management.

One of the major characteristics of lean management is that customer demand pulls production forward and therefore puts the company into a flow. In terms of a tool, this initiative is translated by the implementation of a system of labels called *Kanban*. The aim of this label is to send an alert to production units upstream of the production line to notify them that their products are being consumed. This system therefore defines the procedures for triggering production by passing back orders from the product exit bay. This system of labels has been the subject of several studies. Sekine states that it is an atypical tool perfectly suited to pulling production (Sekine, 1983). Bounine and Suzaki clearly explain its interest and show how this labelling system limits the presence of intermediate and final stocks in the company as the manufacturing orders are correlated directly to the pace of consumption of the items produced (Bounine and Suzaki, 1986).

Andon has also been much studied. This is an alarm rope generally located above each operator, which allows him to send a visual and/or sound signal to his supervisor to notify him of the presence of a problem in the production line. This method of signalling problems is at the heart of the problem-solving approach within lean companies. When the alarm rope is triggered at the operator’s initiative, the supervisor must find a counter-measure to deal with the fault. If he does not do this, the production line stops at the next fixed point. According to Suzaki, this tool allows a counter-intuitive behaviour, which authorises and even encourages the operator to halt the production line when a problem arises (Suzaki, 1993).

Several studies have also handled ‘A3 problem solving’. This is a written document studied so that operators can communicate proposals to improve the company processes to their managers. Its specific feature is that it is a very structured, but not a digital reporting tool. Sobek adds that it responds to managers’ expectations and encourages the operator to take continuous steps towards improvement (Sobek, 2001). Sobek shows that the A3 sheet on which operators must write their suggestions meets well-defined criteria aimed at facilitating the fast accurate assessment of these proposals by the manager.

The 5S² method is more a method than a tool. However, its goal and contours have been well defined by the management literature on lean. As an indication, 5S is probably the most examined tool or method in lean literature, along with the *Kanban*. This method enables users to arrange the space at the company’s disposal efficiently. Trey insists on

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the fact that it is a way of implementing participative management by awarding operators responsibility for organising the company (Trey, 2003). Moreover, according to Imai, it creates better control of the environment in the shop floor for the manager and in this respect is a useful tool that will encourage him to engage in a *genchi genbutsu*³ management (Imai, 1997).

SMED⁴ is less dealt with in the literature. It also describes a method rather than a tool. The method was developed by Shigeo Shingo with Toyota to reduce the time for changing tools. The SMED method makes it possible to lower the changeover time for the organisation without material or financial investment. Colin defines it as a method that enables the firm to reduce the time to change a tool, to lower occurrences of poor quality and to optimise the capacity of machines during production (Colin, 2003).

The set of tools described in this section are at the heart of the lean approach and the texts that have been dedicated to them are largely descriptive. The majority of studies on this subject are actually limited to explaining the characteristics and use made of these tools in companies. However, these tools orient the behaviour of their users in a precise direction and generate attitudes that can initially appear paradoxical or counter-intuitive. In this respect, they reveal a series of stylised facts on lean management and on the mechanisms associated with it. However, the research done on lean instruments is not approached from this viewpoint and is only intended to describe them minutely.

The Toyota model as a set of practices that form a coherent and unified system

For Ohno, it is inadequate to approach lean through tools: the Toyota Production System is not a simple range of production techniques (Ohno, 1988). It is a management system that involves the entire company and must orient everyone's behaviour, which goes beyond knowledge of mere tools.

Womack and Jones are two of the three authors of the book *The Machine That Changed the World*, which initiated a new wave of research in the 1990s on lean production methods (Womack, Jones and Roos, 1990). These authors present lean as a system. In their book *Lean Thinking* (published in 1996), they define lean as respect for five principles: define the value of the customer's viewpoint, identify value chains in the company, ensure that value flows without interruption along each value stream, pull production and maintain a continuous determination to eliminate waste (Womack and Jones, 1996). This lean system, as presented by Womack and Jones, creates a long-term competitive advantage over other production modes according to Lewis (Lewis, 2000).

Liker has followed the approach initiated by Womack and Jones and published a book titled *The Toyota Way* in 2004, whose aim is to highlight fourteen essential principles in lean (Liker, 2004). According to Liker, four levels of analysis can be distinguished. The first level of analysis concerns the value produced by the company. This value must be defined from the customer's viewpoint and flow without interruption along the value chain in order to disclose problems immediately. The second level of analysis relates to the production system. The company must pull its production depending on demand and base itself on standardised production processes. The standardisation of productive tasks is a prerequisite for continuous improvement by eliminating operations that do not generate value. The third level of analysis relates to the managers' attitude. They must help operators to find solutions fast when a problem arises. Their role is to encourage each operator to identify problems, to reflect on them and to propose counter-measures to enhance the productive system. As a result, management

must be as close as possible to operators because only the direct experience of crisis situations allows an effective diagnosis. Finally, the fourth level of analysis concerns the formulation of a long-term strategy. The company must fix its goals sustainably for the future and look after the associated short-term costs.

The authors who view lean as a system have not just described its rules and operating principles generally. Several authors have opted to highlight its originality and main trump cards. For example, Imai deems that the specific nature of lean management is based on the *Kaizen*⁵ (Imai, 1986). He indicates that the lean innovation process awards operators a key role in improving the company's production process. Innovation follows a bottom-up logic and is therefore largely borne by operators, one of whose roles is to pass on information on making improvements in the company. Moreover, the *Kaizen* obliges managers to adopt a rigorous behaviour of listening and maintaining a presence in the shop floor, as close as possible to the operators. Moreover, Imai adds in 1997 that the management's involvement within the company must be strong to ensure respect for working standards and to support the *Kaizen* initiatives (Imai, 1997). Suzaki subscribes to Imai's propositions and notes that managers play a decisive role in supporting operators (Suzaki, 1993). As a result, the group leaders, supervisors and team leaders are the most sought after, as Nonaka and Takeuchi point out, because they must translate decisions by top management and combine them with the occasionally chaotic realities of the shop floor (Nonaka and Takeuchi, 1995).

Several authors have also dealt with the dissemination of the lean approach within the different functions of the company. According to some, lean thinking can extend to all activities that demonstrate potential waste and therefore sources of improvement. Monden, Kennedy, M. Ballé and F. Ballé show through their research that lean problems are no longer reserved solely for production processes and that they extend to other corporate functions such as decision-making (Monden, 1998) or product development (Kennedy, 2003; Ballé and Ballé, 2005). Similarly, the Toyota Production System is no longer limited today to the two TPS pillars frequently highlighted: Just in Time⁶ (JIT) and Autonomation⁷. According to Shimizu, the Toyota system goes beyond these organisational concepts and must be studied more generally by integrating the problems of product design, price management and Human Resources (Shimizu, 1999). When presented generally, the lean approach is based on simple concepts, which reveal global reflection on seven types of waste (i.e. overproduction, waiting, conveyance, processing, inventory, motion, correction) and how to eliminate them. Lean thinking, as a way of combating waste, then becomes easy to export to business sectors other than industry. According to Liker and Bouzekouk, lean can be applied to all business sectors (Liker, 2004; Bouzekouk, 2003). Moreover, many prescriptive works on lean contain a chapter aimed at industrialists from all sectors who wish to initiate a lean transformation. For example, Liker, Wiegand, Franck, Baglin and Capraro have published practical guides intended to help practitioners in their approach, whatever their activities (Liker, 2005; Wiegand and Franck, 2005; Baglin and Capraro, 2000).

2.2 The Toyota model: local optimum

Of course, the position defended by authors who wish to demonstrate the superiority of the lean production system normatively encounters an opposition that defends a contrary thesis, arguing that lean does not have a universal application, even though it remains a

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relevant production mode in certain cases. An identical replication of the Toyota system would therefore be bound to fail. Each company adapts its practices, routines and tools to the social and legal rules that form the context in which it evolves.

The culturalist hypothesis

The culturalist hypothesis according to which it is impossible to replicate TPS in western economies has often been advanced to justify the failures of lean transformations in Europe and the United States.

According to Rafferty and Tapsell, three types of industrial environment can be distinguished: the Fordist model, the sociotechnical production system initiated and adopted in the 1930s by the Scandinavians and the lean production model illustrated by the Toyota Production System. Sociotechnical production system entails creating independent teams both at the operational and decision-making level. The productive units are free to select the path that will enable them to reach fixed goals. This production model therefore limits the role of supervisors and managers as the working groups manage themselves. Introducing lean production methods in an environment that is profoundly anchored in the sociotechnical production system would thus lead to major difficulties. The influence of culture in this case prevents any lean transformation. Similarly, an economy that has developed operational and relational reflexes based on those of mass production would have difficulties in integrating new working processes and the industrial relations imposed by the lean approach (Rafferty and Tapsell, 2001). Taira shares this conclusion by taking up the well known typology of Aoki (Aoki, 1990) and he asserts that US companies will have difficulty adopting lean because they have an H-shaped organisation. In contrast, Europe will find it easier to integrate lean because the institutional relations and the social relations in the company are more suited to this. Lean management reduces the number of hierarchical levels in the company and decentralises decision-making. Companies organised around a pyramidal, rigid hierarchical structure will therefore experience difficulties in migrating to lean management (Taira, 1996).

The lean production model requires management of knowledge and expertise found on the production line. And according to Fruin, the differences in perspective as regards managing this knowledge in the West and in Japan are such that attempts to transfer the lean model can only fail (Fruin, 1997). Moreover, beyond cultural constraints, companies that have implemented push production for a long time may have inadequate equipment, which makes the changeover to lean even more difficult according to Hancock and Matthew (Hancock and Matthew, 1998).

The hypothesis of 'productive models'

Beyond the cultural problems that managers may face during a lean transformation, the optimum production mode is determined by the context in which the company evolves according to several authors.

Berggren also observes that no production mode is suited to all countries (Berggren, 1993). Boyer and Durand note that management and economics theoreticians are wrong to reason in terms of optimum organisation in a stationary environment. This is exactly the context that determines the most suited production models (Boyer and Durand, 1998). According to them, the Scandinavian or German production model acts as a counter-example to the universal relevance of the Toyota model. Boyer and Freyssenet develop

this idea and argue that companies must organise themselves in accordance with the economic and social context in which they evolve and thus define their own 'productive model' (Boyer and Freyssenet, 2000). Lean production is therefore not a superior paradigm in any case. It is only a production mode among others and on his basis it is merely a stage towards new models, which will have to take account of the new macroeconomic and societal conditions surrounding them in turn (Boyer and Freyssenet, 2001).

All these arguments can be revisited in the light of three concepts defined by Elger and Smith: the 'capability of transfer', the 'propensity to transfer' and the 'negotiated appropriateness'. Several characteristics of a company such as technology and international experiences influence its aptitude for transferring its work practices and organisation. These elements are conditions that determine its 'capability of transfer'. The 'propensity to transfer' increases with the company's acceptance to differentiate its work organisation according to the context in which it evolves. And finally, the 'negotiated appropriateness' refers to the adaptation requirements and modes which occur when a company decides to transfer its organisation in a foreign country (Elger and Smith, 2000). The position of Elger and Smith is all the more interesting as they assume an intermediary opinion between both proponents and opponents of a universalism of lean. According to them, a set of measures or practices (such as lean practices) developed in a specific context cannot be identically replicated but hybrids outcomes can emerge from transfers and succeed in a new context (Elger and Smith, 1994).

2.3 Exceeding the limits of the normative

Normative presentations of lean are useful in the sense that they clearly define the rules and operating principles for the lean approach. But, this dogmatic presentation has its limits. Firstly, it remains decontextualised and in practice makes the culturalist and contextual criticism expressed valid. Moreover, this doctrinaire presentation calls on readers to believe or reject the overall method. The debate that then arises between the advocates and opponents of the method becomes fruitless because it is based on a system of belief relating to the lean approach. Thus, it seems essential to relate to the observed facts in order to quit this pointless debate. Koskela defends this idea and notes that the absence of a formal framework around the lean approach is harmful to it: without a clear theoretical framework, the propositions submitted by lean authors will remain contextual and the unexplained failures of lean will never find a consensual justification in practice (Koskela, 2004).

Authors cited in the following part of this article adopt a positive approach rather than a normative or prescriptive approach. They attempt to describe how things are, as opposed to how they would or should be.

3 What is (a) lean (HRM)?

Since normative and prescriptive presentations of lean remains unsatisfactory to really understand the scope of validity of lean, it is important to refer to attested facts obtained through objective and impartial observations. Such observations on lean are available in many case studies and several empirical articles. In the first sub-section of this part, we

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therefore take stock of descriptive and empirical articles that relay observations or stylised facts on lean management. Since one of the main characteristics of these research works is that they deal with HR issues, we propose, in the second sub-section of this part, a personal reflection to clarify i) what lean is from a HRM viewpoint and ii) what a lean HRM is.

3.1. Studies based on observed facts very often deal with HR issues

There are many case studies and several empirical analyses on lean. One of the reasons why lean literature presents less empirical articles than case studies is due to the fact that there is a real difficulty in identifying lean companies and obtaining a representative sample of companies. This difficulty can be ascribed to the fact that lean is an approach rather than a state. Moreover, to obtain empirical information on lean, it is often necessary to restrict our definition of lean to simple JIT, while omitting one of the main specificities of lean in relative terms: *Jidoka*⁸. Indeed, while application of JIT practices leads to a reduction in the company's stocks and is therefore automatically reflected in its balance sheet, continuous improvement, *Kaizen* practices, and enhanced processes are variables that require minute observation of how the company operates and cannot be studied with the help of a simple analysis of the company figures.

The case studies and the empirical articles on lean management adopt different levels of observation. Some look at the value chain overall, while others restrict themselves to the company's legal limits or an observation of the employees' working conditions.

Value chain

Observations by Greenwood and Langfield-Smith reveal that Toyota establishes a relationship based on strong co-operation with its suppliers. According to them, several factors make it possible to ensure this link. The similarity that exists between the technologies used by Toyota and those used by its suppliers, the existence of past changeover experiences among its suppliers and the presence of learning-by-doing experience among its suppliers allow Toyota to establish effective partnership relations with its suppliers (Greenwood and Langfield-Smith, 1998). Dyer and Nobeoka supplement this result by showing that Toyota succeeds in establishing and maintaining a collaborative relationship with its suppliers because the Japanese firm shares its expertise while preventing positive spillovers for the competition, avoids stowaway behaviour among its suppliers and transfers tacit and explicit knowledge to its suppliers. The two keys to its success are the core firm spirit that it manages to make its suppliers feel (identification with the Toyota company) and, through its issuing of clear rules for participating in its network to share knowledge among Toyota and its suppliers (Dyer and Nobeoka, 2000).

More generally, Samimi and Edwards show, on the basis of observations, that Japanese companies are better than US firms in their networks of suppliers because they lower the costs of inter-firm co-operation (Samimi and Edwards, 1997). This result is also supported by Kotabe, Martin and Domoto. According to these authors, American companies have difficulty in adopting the lean approach because they experience difficulties in establishing profitable technology transfers with their suppliers. Relations

between a company and its suppliers in the United States are too fragile and too recent to envisage being able to derive an advantage from a technology transfer. As such, transfers of technologies between a company and its suppliers are all the more beneficial when they have co-operated for a long time (Kotabe, Martin and Domoto, 2003).

Company

Several case studies deal with the implementation of lean in other companies than Toyota. Wiremold in the IT cable manufacturing sector (Emiliani et al., 2003; Fiume, 2004); Donnelly Corporation in the automotive equipment supply sector (Scaffede, 2002 and Liker 1998); Trico Australia, also in the automotive equipment supply sector (Sohal, 1996); Tesco in the large-scale distribution sector; Lantech in the industrial equipment sector; Porsche in the car manufacturing sector; Pratt and Whitney in the aeronautics sector (Womack and Jones, 1996); Delphi in the equipment supply sector; Trim Master in the marine equipment sector; Puget Sound Naval Shipyard, also in the marine equipment sector (Liker, 2004); Jefferson Pilot Financial in insurance (Swank, 2003), Cedar Works in the consumer goods sector; Freudenberg-NOK in the equipment sector (Liker, 1998) and Fujitsu Services in the IT field (Parry, 2005) are just some examples of companies that have experimented with the lean approach. Business sectors where lean practices have been disseminated are also numerous and various. Nevertheless, the way lean is adopted in companies probably depends on several characteristics. Kirby and Greene assert that mature lean companies adopt different lean tools depending on the business sector⁹ in which they evolve (Kirby and Greene, 2002). Similarly, White, Pearson and Wilson show that the nature of JIT managerial practices depends on the size of the company (White, Pearson, Wilson, 1999).

The first part of this article mentioned several references to authors who support the idea that the lean model could not be exported to a western context. To make the debate objective with regard to the transferability of the lean system outside Japan, it is useful to return to the observed facts. From this perspective, the case of Nummi (a Toyota subsidiary located in California) is interesting because it covers the case of Toyota facility in the United States on a General Motors factory site and using its employees. Whereas economic theory often raises the existence of an exclusive trade-off between flexibility and efficiency as a postulate, Adler, Goldoftas and Levine assert that the Nummi case enables us to show that it is possible to go beyond this trade-off, in contrast. These authors note that productive organisations have four particularly relevant procedures for increasing their flexibility and their efficiency simultaneously. These procedures are metaroutine (Standardise the workers' creative approach), job enrichment (Increase the employees' human capital), a change of roles (Change the employees' role regularly) and the creation of independent teams (Establish small team-based working units). According to them, Toyota Company has become aware of the risks of failure in implementing these four measures, and has actually blended them into a favourable environment. To free itself of possible inconveniences associated with the implementation of these procedures, Nummi has insisted on training and trust. Thus, its employees have subscribed fully to its methods (Adler, Goldoftas and Levine, 1999).

Maritan and Brush have also studied the case of several lean transformations. According to them, the reasons for a transformation's success are linked to the history of the industrial site and the history of its managers. They deduct from their *in situ* observations that it is essential to have people who are able to transfer their knowledge

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and expertise in lean (Maritan and Brush, 2003). The impact of the context (and more specifically the impact of the socio-cultural context) on the probability of success of a lean transformation is also emphasized by Oliver, Delbridge, Lowe, MacDuffie and Pil. According to them, the cultural hypothesis is empirically valid and they show that lean implementation is not a universal means to achieve a high manufacturing performance (Oliver, Delbridge and Lowe, 1996, MacDuffie and Pil, 1998).

Management and operators' working conditions

Lean management is quite specific. Observations of managerial techniques in place within companies that have undertaken a lean transformation are therefore instructive. During the mid 1980s, Rinehart, Huxley and Robertson studied the case of Cami Automotive, which is an alliance between General Motors and Suzuki based at Ingersoll in Ontario. This case is interesting from a management viewpoint because it emphasises that by working in a team, checks are reinforced and the pressure on operators is strong (Rinehart, Huxley, Robertson, 1997). This coercive, strict side of management is also observed by Delbridge in 1991 within the Valleyco factories (automotive parts supplier) and Nippon CTV (manufacturer of electronic components) in Great Britain. According to observations made by Delbridge of these firms, it also appears that a lean transformation can lead operators not to identify management goals (Delbridge, 1998). Graham, who performed an analysis as a covert participant observer on the assembly line at the Subaru-Isuzu Automotive for six months shares almost all of these conclusions. According to her, self-discipline, pressures exercised by other members of a same team and strict supervisors' controls are the three main mechanisms used in the Japanese model of production to force the workers to conform to company goals (Graham, 1995).

The lean approach awards an important role in innovations through its steps towards constant improvement. According to Liker, this role enriches the jobs of operators, who do not have to be content with perform their production exercises. Instead, they also submit proposals to improve the process to their managers and look for the reasons for faults if problems arise on the production line (Liker, 2004). This new key role for the company assigns operators new roles. The studies on the subject assess the effects of this new role differently. A sociological study on the first Toyota factory located in Kentucky carried out by Bresser shows that the operators appear to be satisfied with their new working conditions. The new management style is therefore not an indirect way of exploiting operators and subjecting them to even more difficult working conditions. In contrast, middle managers refer to greater difficulties adapting in a lean organisation. The role of the middle manager in a lean approach is more to support operators to help them to solve problems. This then puts strong pressure on middle managers to be closer to their operators and to give them real assistance (Bresser, 1996). This observation is also made by Jackson and Mullarkey. According to them, the effects of a transition to lean lead to a radical change in managers-operators relationships, without this change being negative for operators (Jackson and Mullarkey, 2000). On the contrary, Seppälä and Klemola note that this change is desirable for the operators, as it extends their responsibilities and allows them to extend their knowledge (Seppälä and Klemola, 2004). These positive observations are not shared by all researchers who carry out studies on how employees of a lean company perceive their work. For Parker, lean is a production mode that has negative effects on operators because it subjects them to strong reactivity pressures (Parker, 2003). It should be noted that some reservations can be expressed on the

relevance of qualitative studies carried out on the basis of interviews with operators. According to Vidal, operators have a strong capacity to adapt to their environment and have little memory of their past working conditions. Thus, they will always tend to be satisfied with their conditions (Vidal, 2004).

Some studies do not focus on the level of satisfaction of employees but on their skills. According to Patterson, West and Wall, there is a direct and positive link between increasing employees' skills and JIT practices. However, this link may not be a causal one: the companies that act with JIT may be oriented towards innovation and actually expect a lot from their employees. In this case it would not be JIT that leads to a rise in skill among their employees, but simply the fact that companies with JIT favour this increase in skill (Patterson, West and Wall, 2004).

Finally, whatever the level of observation (value chain, company, managers or operators) descriptive and empirical articles that relay observations or stylised facts on lean management very often deal with HR issues. Indeed, tacit and explicit knowledge sharing between firms or employees, operators' skills management and managers-operators relationship organization are just some examples of variables that are central in the observations made by case studies or empirical articles' authors. Thus, HRM is a central topic and a key to understanding lean management with a positive and objective approach (by opposition to 'normative' approaches). Beyond the restitution of the main results of the case studies and empirical articles, we can try to clarify in the next subsection the main insights proposed by HRM on lean management.

3.2 Main insights on lean management proposed by HRM

Combined with lessons supplied by normative texts on the lean approach, the examination of stylised facts on lean from observations or an empirical validation allows us to bolster our knowledge of the subject. However, case studies only give us stylised facts that remain to be analysed. And econometric studies only provide us with points for refuting or confirming a theory that remains to be clarified. Since the key mechanisms and the decisive variables that appear to justify the comparative advantage of lean companies deal with HR issues, we can operate this clarification from a HRM viewpoint. In a first phase, we advance two propositions to define lean from a HRM viewpoint. In a second phase, we propose to define the HRM of lean companies.

What is lean from a HRM viewpoint?

Lean is a profit strategy among others founded on establishing flows and Right First Time (RFT). These two goals are pursued permanently by lean organisations. It is therefore useful to highlight the effects in competition behind these two phenomena and the reasons for the choice made by lean industrialists.

The establishment of flows and the resulting fall in stocks do not immediately appear to be an optimum choice. To cope with variable demand, it may be useful to have stock and thus to hedge against risks of an out-of-stock situation. If incorporated into a pull production system, a fall in stocks nonetheless induces a drop in product lead time. The adaptation (response) time to an unexpected modification in demand is therefore reduced mechanically. Thus, lean companies choose to focus their efforts on a fall in

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stocks in order to minimise the production time of an asset and so produce exactly what is demanded.

Right First Time (RFT) is defined as the willingness by a company to deal with faults immediately when they arise and thus control its processes perfectly. On the one hand, the interest of handling problems at once by bearing an immediate cost for searching for the causes of the problem is to avoid future costs ascribable to having allowed a problem to last and, on the other, to understand the firm's processes better. This goal, as defined, may appear trivial and shared by all companies. However, the specific feature of the lean production system is to adopt very binding and counter-intuitive procedures to reach the RFT. The lean system makes delays in treating faults very expensive. The threat of halting the production line is the most glaring example of this. It is very expensive to halt the production line in pull production. However, if a problem flagged by an operator is not handled in the minutes following the alert, the production line stops at the next fixed point. In game theory, the choice by lean companies can be categorised as tying hands to ensure a credible threat (Selten, 1965). This choice is debatable and may not be optimum as it leads the company to incur serious risks if fault handling is delayed. However, it comprises the framework of incentives implemented by lean firms for which RFT is essential in a logic of pull production.

The key to understanding the lean system not only lies in understanding the trade-offs that underlie the wish to lower stocks on the one hand and, on the other hand, to achieve Right First Time. The consistency of the lean system lies in the correlation that exists between these two goals which feed each other reciprocally. Grasping these two goals independently would therefore be a mistake because they are interconnected. As Alles, Datar and Lambert show, the efforts made to reduce the stocks present in the production process make it possible to check the quality of processes and the goods produced (Alles, Datar and Lambert, 1995). Inversely, the improvement of processes make it possible to improve products' lead time, to adapt even better to demand and thus to lower the level of stocks. The quality of processes is an essential component for acting with Just in Time. A first partial answer to the question of what is lean from a HRM viewpoint could also be:

“Lean management involves establishing the material conditions and an appropriate Human Resources Management that allow a mobilisation of operators and management around quality and performance.”

Moreover, lean management replaces production units at the heart of the company. Within lean factories, priority is awarded to production above all other company functions because it is the main activity that creates value for the customer. As a result, the support services and middle managers must henceforth serve production and its operators by playing an assisting and supportive role. Middle managers and support services are dispossessed of the resources at their disposal in a traditional organisation by the nature of the lean organisation. The nature of alert systems during production¹⁰, the reactivity imposed on middle managers and logistics due to the absence of significant stocks, the decentralization of decision-making and information processing and the innovation system implemented in a lean company reinforce the role of operators and restrict peripheral and managerial services to production support action. This way of approaching

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lean management enables us to give a second partial answer to the question of what is lean from a HRM viewpoint:

“Lean management involves integrating middle management and support services with production rather than distance them.”

At equilibrium, several characteristics are essential for keeping the profit strategy lean because they allow the company to reach its goals. All these characteristics, such as knowledge sharing, operator control system and supervisor role deal with HR issues and thus have implications on the HRM of lean companies.

What is a lean HRM?

As we wrote before, lean is a profit strategy among others. However, the facts show us that its results can be remarkable in some cases. The performance of Toyota alone is sufficient in this area to show the relevance of this production mode subject to certain conditions. The interest is then to understand the reasons behind the success of companies with a recognised lean maturity.

Knowledge sharing

According to Nonaka, creating innovations and knowledge sharing are at the heart of what comprises the specific nature of lean companies. This is a comparative advantage that lean firms hold above others. Several reasons can be put forward to explain this advantage held by lean companies: the value of an employee is not determined by his hierarchical position but by the importance of the information that he submits within the continuous improvement system. Moreover, lean firms encourage the sharing of information among employees thanks to an organisational structure based on the redundancy of tasks. The repetitive nature of tasks supports dialogue and communication. The company is also viewed as a living entity made up of capable individuals, who are expert at their work and approached to improve the firm's productivity. As a result, employees in lean companies develop a sense of sharing in and identifying with the firm more easily. These feelings favour the creative spirit and information sharing (Nonaka, 1991).

The reasons for the success of lean firms are not just found in the operating principles of lean companies. Spear and Bowen assert that these could incorporate tacit, non-formulated knowledge (Spear and Bowen, 1999). In this case, there is a real difficulty for operators to understand the specific features of lean without practicing it. Self-discovery of the operating rules of the lean approach therefore becomes a prerequisite for understanding them.

The operator control system

Lean companies manage to establish an operator control system that is relevant through its appropriate incentive system. The manager-operator relationship is characterised by the presence of an asymmetry of information on the level of effort supplied by the operator to improve the company process or to search for root causes of problems when

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these arise. Observation by the manager of the output level produced by the operator solely tells him that the employee has made a sufficient effort to meet the pace and to produce in Takt Time¹¹. In contrast, the level of non-routine effort, which involves reflecting on possible improvements, is not observable. No direct constraint can be exercised on the operator to force him to act towards continuous improvement. Reducing the stocks of intermediary products can thus form an incentivising framework that obliges the operator to engage in *Kaizen*. Preventing the operator from replacing faulty parts with valid parts from stock obliges him to think of possibilities to improve the system as the faults of this system prevent him from successfully performing his production duties, which for their part are observable. According to Alles, Amershi, Datar and Sarkan, the goal of this approach is to confuse the goals of the operator and firm to improve the company's productivity (Alles, Amershi, Datar and Sarkan, 2000). Furthermore, Just in Time practices allow managers to obtain information on the operator in real time. The indirect control by the manager over the operators through the fall in stocks is consequently all the more efficient as it is exercised synchronously, according to Alles, Datar and Sarkar (Alles, Datar and Sarkar, 1997).

Moreover, it is interesting to note that several authors, such as Alles and Datar, defend the idea whereby strict and coercive operator control systems which involve performance-related pay are sub-optimum (Alles and Datar, 2002). According to them, it is possible to establish commitment among the operators and managers based on identification with the company's success. This identification encourages the sharing of the operator's information and reduces the negative effects of information asymmetry.

The role of management

In the lean approach, management has the specific role of supporting operators. According to Spear, management must be as close as possible to operators in the shop floor (Spear, 2004). 'Shop floor management' contrasts with 'management by figures'. The lean approach thus favours a management style that supports permanent and incremental innovations by operators rather than a management style based on disruptive innovations within the remit of managers. This dimension is probably one of the most remarkable differences that separates lean organisations from other types of organisation. From this perspective, once again according to S. Spear, managers must coach and not solve operators' problems, as the latter remain the experts in their work (Spear, 2004). M. Ballé, Beauvallet, Sobek and Smalley add that managers must ask operators good questions and in particular not propose answers. The solutions to production problems must be found by the operators. Lean management therefore appears to be a permanent training and practice system structured around four principles: a focus on performance, attention to problems, the structuring of resolution of problems and employee development through problem solving (Ballé, Beauvallet, Sobek and Smalley, 2006). Managers guide operators so that they transform 'chaos' situations into a source of proposals for improvement (Nonaka, 1991).

Through the assignments that it awards managers and operators and through the impact of the entire firm's staff's behaviour, lean management puts the person at the heart of the approach. According to Plonka, the organisation must therefore take advantage of human capacities because these hold the system together (Plonka, 1997).

The analysis of the characteristics of prosperous firms that have acquired lean maturity is enlightening in the sense that it allows us to have information on the decisive

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variables that create their comparative advantage. However, it also appears interesting to supplement this work by a dynamic study of the determinants in a lean transformation. What are the pitfalls that managers and operators must not fall into if they wish to complete their lean transformation successfully?

Maintain efforts

Observation of changes in companies that have opted to produce according to the Toyota Production System model show that a lean transformation can be broken down into two stages. Obtaining results on the first phase of transformation appears to be easy. Methods of analysing the flow of value in the company (Value Stream Mapping) make it possible to identify glaring causes of waste that can easily be eliminated. In contrast, maintaining strong productivity growth in the second phase of transformation becomes difficult. Only companies that have transformed their organisation in depth and have anchored the changes in the company culture seem to reach this goal. According to Womack and Jones, going beyond an understanding of lean production to become a lean company is rare (Womack and Jones, 1994). According to Gilpatrick and Furlong, the relaxation of efforts may be felt at management level in particular. Due to adequacy, a conviction of the firm's own quality, a lack of an internal coalition to push change forward, and a lack of planning of transitional stages in a transformation, the changes may not be reflected in results that are sustained into the medium and long term (Gilpatrick and Furlong, 2004). There should be no hesitation about maintaining pressure and imposing lean forcefully. According to Bodek, this is what we can draw from the lessons of observing sense in Japan. Each lean transformation must be undertaken with strong determination and sustained over time (Bodek, 2004).

An attitude beyond application

According to M. Ballé, the lean transformation of a company requires the operators and managers of a firm to adopt the method in full. This appropriation does not correspond to the mere methodical application of good practices to lean tools, but to a backing-up of reasoning with emotion (Ballé, 2005). The lean approach is constantly evolving. It is related to a reasoning which takes different forms depending on the company's activity and its constraints. Thus, the fact of embracing lean reasoning becomes a necessity to make it evolve and to maintain its efforts at creativity linked to reducing waste. The improvement initiative therefore often needs a change of mentalities that must last (Ballé and Ballé, 2005). As stated a little earlier in this article, the transition to lean profoundly changes the role of supervisors and support services. Of course, this change of prerogatives can naturally create tensions and reservations within the company. Identifying and managing these reservations thus appear to be decisive variables for successfully implementing a lean transformation.

4 Conclusion

Presenting lean in a normative or prescriptive way inevitably leads to adopting a subjective position on the relevance of a paradigm. Examples of successes or failures of lean companies then become so much proof validating or invalidating the method and do

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not contribute to a better understanding of both how lean companies work and the reasons for implementation successes/failures. The lean production must be approached differently and the facts must be used differently. Observation of the real situation supplies us with stylised facts on which we can base our reasoning to redefine lean in a non-dogmatic way (Houy, 2005).

One of the aims of this literature survey was precisely to list several of these stylised facts in order to clarify what lean is. However, our ambition in this article was to restate key propositions of the lean literature to give some intuitions on the research paths to be explored in the future rather than to rigorously deal with the implications of each stylised facts on the operation or the scope of validity of lean management. Further researches also need to be done to supplement the second part of this article in order to define, with more details, lean from a HRM viewpoint and to identify the main characteristics of a lean HRM. We hope that authors of these future researches will find in this literature survey a helpful document to feed their research.

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Notes

¹Reuters, Associated Press and Agence France Presse.

²Abbreviation of five Japanese terms meaning 'Sort' (*Seiri*), 'Store away' (*Seiton*), 'Maintain' (*Seiso*) 'Standardise' (*Seiketsu*) and 'Follow' (*Shitsuke*).

³*Genchi genbutsu* is a Japanese expression meaning "go and see for yourself". The *genchi genbutsu* management is a type of management where the managers 'go and see for themselves' to thoroughly understand the situation.

⁴Single Minute Exchange of Die.

⁵Organisation of team discussions to stimulate continuous improvement in the company.

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⁶A set of techniques aimed at reducing the time taken for products to cross the factory by reducing stocks of intermediate or finished products.

⁷A set of quality-related systems and procedures implemented in the company to concentrate the employees' efforts on problematic issues with significant reactivity.

⁸*Jidoka* groups all of the techniques and processes aimed at detecting faults and treating them immediately.

⁹In their study, Kirby and Greene characterize a business sector by the production volumes, the restocking procedures and the production procedures.

¹⁰See 'Andon' defined above in the article.

¹¹Pace of production calculated according to the pace of consumption by the company's customers.