ORGANIZATIONAL PRACTICES LEAN ENTERPRISES ADOPT TO FOCUS ON VALUE STREAMS

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The purpose of this article is to investigate which practices lean enterprises adopt to focus on value streams. A case study of three plants: Delphi Diesel Systems, Sogefi Filtration, and a company within the furniture industry is presented. The three plants have successfully performed a lean transformation with significant performance improvements, respectively, to Delphi Diesel Systems, Sogefi Filtration, and a company within the furniture industry. The organizational practices under analysis are (1) the establishment of organizational units based on value streams, (2) the use of a performance measurement system based on value streams, and (3) the adoption of a formal meeting system. These organizational practices were found in all three of the studied plants and have been implemented in all of their organizational units; even concrete implementation detail differs between plants. This research provides a contribution in the fields of organizational practices and the transition to lean enterprise by establishing the relation between real practices and the focus on value stream lean principle. As insight for managers, the adoption of appropriate organizational units, indicators, and meetings appears to be a useful practice to support the focus on value streams.

Keywords value stream; lean; performance measurement system; meeting system

INTRODUCTION

Lean management strategy has been widely adopted by manufacturing companies. It is broadly used, in particular, by the automobile industry to achieve high performance standards (Hines, Holweg, and Rich, 2004). Adopting lean management means the use of its tools and implementation of its practices; a deeper adoption requires organizational changes, based in such principles as waste reduction and customer focus (Womack and Jones, 2003).
These concepts may surprise those unfamiliar with the business world, who may wonder how it can be possible that organizations do things that are not needed instead of doing things that are in the customers’ interest. It is clear that, at least in general terms, this is not done intentionally. A job is done because it is thought to be useful, as we can deduce from the rationality of the persons involved. However, in complex value streams, the perceptions about what is needed and what will generate customer value are in some cases wrong (Zokaei and Hines, 2007); in fact, non-value-added activities do take place, and often the needs of the final clients are not sufficiently taken into account.

Traditional organizations find it difficult to contain waste. According to Jones, Medlen, Merlo, Robertson, and Shepherdson (1999), a traditional organization is characterized by a functional organization and disconnected processes, with products moving from one functional department to another. That gives place to high levels of inventory, long delays between departments, and a decreased value stream focus. It has been reported that productivity and quality improvement initiatives can suffer from disconnected objectives among functional departments and unclear objectives (Gunasekaran, Korukonda, and Yli-Olli, 1994). In general terms, improving concrete processes does not imply that the best global solutions are obtained. This means that even well-designed and correctly implemented improvement actions can provide little, if any, benefit, giving place to wasted efforts and frustration. For this reason, the common idea of process-focused efficiency is dismissed in favor of a product-focused efficiency (Paez, Dewees, Genaidy, Tuncel, Karwowski, and Zurada, 2004); that is, focus on value stream is established as an objective.

Focusing on value streams has been considered to be a key success factor (Hines et al., 1998; Liker, 2004; Womack and Jones, 1994). In an outstanding precedent of this idea, Skinner (1974) proposed that manufacturing plants should focus on a limited, concise, and manageable set of products, technologies, volumes, and markets. More recently, Womack and Jones (1994) stated that different value-creating activities can be performed together, but this effort will require a new organizational model: the lean enterprise. According to Womack and Jones (1994), getting managers to think in terms of the value stream is the critical first step to achieving a lean enterprise. However, no research was found about the organizational practices lean enterprises adopt to obtain the value stream focus; this research addresses this shortcoming. The purpose of this article is to investigate which practices lean enterprises adopt to focus on value streams from data collected from three plants that successfully performed a transformation.

The key research question we seek to answer is “Which are the practices that lean enterprises adopt to focus on value streams?” Exploratory research relies on a theoretical concept to guide the design and data collection (Yin, 1994). Based on the literature, three organizational practices associated with
value stream focus were identified and adopted as a guide to focus the scope of the research.

- The establishment of organizational units based on the value streams, as mentioned by Womack and Jones (1994), Hines et al. (1998), and Liker (2004), to concentrate the efforts of the teams on the value stream performance rather than performance of individual people or functions.
- The establishment of a performance measurement system based on value streams, as mentioned by Maskell and Kennedy (2007) and Liker (2004), to measure the most critical value stream factors (such as quality, delivery, flexibility, and cost).
- The establishment of a formal meeting system (Maskell and Kennedy, 2007) to coordinate monitoring of value stream metrics, which measure the performance of the teams at a group level. The objective is to prioritize the corrective actions and the continuous improvement (CI) planning with a value stream perspective.

This research provides an exploratory contribution in the field of organizational practices involved in the transition to lean enterprise by relating lean practices and principles. The analysis of the interaction between lean practices and principles has been described as a research opportunity in the area of the implementation of lean production systems (Marodin and Saurin, 2013). Three case studies illustrate the commonality of the application of general concepts and the particular solutions adopted in each different case. For the management community, this article provides concepts and application examples that can be used in other real practical cases. The cases refer to plants with different sizes, sectors, complexity, and lean transformation maturity. It is thought that the practices presented may be applicable in other companies.

Regarding the research methodology, there was no previous empirical knowledge addressing the purpose of this article; therefore, it was considered best to prioritize the search for a deep and qualitative understanding of the topic under study. Qualitative methodologies were applied and, in particular, a multiple exploratory case study research methodology. A multiple exploratory case study with a limited number of cases is performed. In fact, the use of single or small numbers of case studies as knowledge-building tools is increasingly prevalent in the operations management literature (Piercy and Rich, 2009).

The criteria for selecting each case company were driven by the research objectives rather than random sampling, as proposed by Yin (1994). This study is centered on data collected from Spanish manufacturing plants serving as original and aftermarket suppliers. The companies selected successfully performed a lean transformation with significant performance improvements. To minimize the cultural aspects, an important selection aspect
was that the plants must work in a global, or at least European, perspective. The companies were selected from a range of different manufacturing sectors, plant sizes, and process complexity with the aim to increase the external validity, that is, the possibility that the conclusions also apply in other manufacturing industry settings (Table 1).

Access to the management reality has been defined as the researcher’s primary problem (Gummesson, 2000, p. 25). The second author of this article is an employee of the plant to which Case B refers. This fact eased the access to the information of Case B and probably also to the right information of the other cases, because the researcher was seen as a colleague. The transformation exposed in Case B was not developed as a part of the research work, and therefore, it is not considered as action research.

The reliability and validity of case research data are enhanced by a well-designed research protocol (Yin, 1994). The core of the protocol is the set of questions to be used in interviews (Voss, Tsikriktsis, and Frohlich, 2002). A well-designed protocol is particularly important to ensure a cross-comparative research study. A common set of semi-structured interview questions was prepared. The interviewees were operations directors, lean managers, or plant managers. The length of the semi-structured interviews and site visits varied from 3 to 6 hours. When developing the research protocol and instruments, it was important to address triangulation (McCutcheon and Meredith, 1993). Data were also collected through direct observations made under study visits to the companies and unstructured interviews with middle managers. We also collected documentation in the form of photographs, brochures, company documents, and information from the internet (independent as well as provided from the case companies). All interviews were recorded to reduce the observer biases. The three individual case studies were organized with the same structure and were revised, corrected, and accepted by the studied organizations. This was done to reduce errors in the interpretation of the collected data.

The outline of the article is as follows: the next section is devoted to a literature review, in the third section, the three case studies are explained; the penultimate section is devoted to discussion; and the final section presents conclusions.

### TABLE 1 Selected Companies for the Study

| Plant  | Product          | Plant size                | Process complexity | Years working with the concepts | Interviewee      |
|--------|------------------|---------------------------|--------------------|---------------------------------|------------------|
| Sogefi Filtration | Filters          | From 101 to 250 workers   | Medium             | From 2 to 5                     | Plant manager    |
| DDS S.L. Diesel injection pumps |                  | From 501 to 1,000 workers | High               | More than 10                    | Operations director |
| Plant X Furniture   |                  | From 251 to 500 workers   | Medium             | From 5 to 10                     | Lean manager     |
LITERATURE REVIEW

Organizational Focus

The idea to define organizational work units to increase focus on the work flow is not new. Skinner (1974) proposed grouping various products and resources into several manufacturing units with each unit focusing on a limited, concise, and manageable set of products, technologies, volume, and markets. Skinner (1974, p. 119) advocated “to let each manufacturing unit work on a limited task instead of the usual complex mix of conflicting objectives, products and technologies.” This should lead to the focused factory. However, Skinner stated that if it is not possible to focus the whole factory, one should adopt the plant within a plant (PWP) notion. PWP is achieved by dividing the existing facility into organizationally and physically separated sections. He stated that each PWP should have its own facilities within which it can concentrate on its particular manufacturing task, using its own work force management approaches, production control, and organization structure. Hayes and Wheelwright (1984) found that companies with fewer product lines were found to be more profitable than companies with more product lines. Bozarth and Edwards (1997) found that PWPs might not be entirely successful at buffering plants from the negative impact of diverse market requirements.

A similar concept of the PWP is the mini-company process. The term mini-company was coined by Suzaki (1993). The mini-company is based on work groups that are responsible for their supplier–client relationships. Later, work by de Leede and Looise (1999) and de Leede, Looise, and Verkerk (2002) performed descriptive case studies of the concept. To divide a facility into physically separated sections, cellular manufacturing proposed the physical division of a large job shop into numerous small production cells (Greene and Sadowski, 1984). Each cell is designed to efficiently produce common types or shapes of parts having similar machine, operation, and fixture requirements. Griffiths, James, and Kempson (2000) claimed that customer-focused manufacturing is achieved through manufacturing cells where all the resources are focused on one customer instead of a product or product family. However, the objective of cellular manufacturing is not to organize the shop floor from a customer perspective but to eliminate or minimize complexity and improve productivity. Pattanaik and Sharma (2009) stated that as some of the lean manufacturing concepts are different from that of cellular manufacturing, a new cell design methodology is required. To synchronize all the cells in a value stream, as a central concept, they proposed that the rate at which work progresses through the factory is called flow rate or takt. PWP (Skinner, 1974), mini-company (Suzaki, 1993), and cellular manufacturing (Greene and Sadowski, 1984) are outstanding precedents that aim to minimize complexity and enhance the focus of the
organization to a common objective. These concepts point out the convenience of focusing the organization in a set of activities but not necessarily to the value stream.

**Value Stream Management**

The value stream concept was introduced more recently by Hines and Rich (1997) and further developed as a tool by Rother and Shook (2003). Value stream is defined as the sequence of activities that are made from the reception of the customer order to the delivery of the product or service (Womack and Jones, 1994). In this article, value stream refers to the *door-to-door* production flow inside a plant. Some authors proposed methods to improve the value stream mapping tool by helping to focus on the final customer (Hines et al., 1998; Zokaei and Hines, 2007). Other examples of applications of the value stream mapping tool in various sectors in manufacturing and services have largely been reported in the literature. However, some authors view the value stream as a central and more strategic concept for the lean transformation. Hines et al. (1998) developed the value stream mapping approach into a more strategic and holistic method called value stream management with more focus on human resources.

Value stream management was defined as a strategic and operational approach designed to help a company or a complete supply chain to achieve a lean status (Hines et al., 1998). According to Womack and Jones (1994), the lean enterprise is a new organizational model. The value stream is what defines the lean enterprise. The lean enterprise is a group of individuals, functions, and legally separate but operationally synchronized companies. Getting managers to think in terms of the value stream is the critical first step to achieving a lean enterprise. According to Liker (2004), someone with real leadership skills and a deep understanding of the product and process must be responsible for the process of creating value for customers and must be accountable to the customers.

**Performance Measurement Systems**

The importance of using appropriate performance indicators has been stated by the literature. Within the lean manufacturing context a manufacturing measure is a standard that defines performance criteria for manufacturing processes so that everyone in the organization are working towards the same goal (Khadem, Ali, and Seifoddini, 2008). Lewis and Slack (2003) mentioned five types of performance objectives based on cost, flexibility, speed, dependability, and quality. According to Neely, Richards, Mills, Platts, and Bourne (1997), if performance indicators are not well designed, it can result in dysfunctional behaviors, which may encourage individuals to make the wrong decisions. According to Imai (1986), two types of performance
indicators can be distinguished: result indicators and process indicators. According to De Haas, Alegra, Van Tuijl, and Meulman, (2000) the what to achieve question has to be answered in terms of result indicators, while the how to achieve question needs to be tackled in terms of process indicators.

Some authors have done research on performance indicators that measure in a value stream perspective. Liker (2004) suggested eliminating the old metrics and measuring a variety of value stream metrics. According to Maskell and Baggaley (2006), CI is motivated and tracked by using value stream performance boards. Typically, these visual boards are updated weekly and used by the value stream CI team to identify improvement areas, initiate Plan Do Check Act (PDCA) projects, and monitor their progress. A management by value streams model allows assessing the role and contribution of each individual, department, or person for the global results of the organization (Machado and Tabares, 2008). Cagnazzo, Taticchi, and Brunl (2010) highlighted the role of performance measurement systems to support quality improvement initiatives at the supply chain-wide level. Fullerton, Kennedy, and Widener (2013) remarked on the combined effect of appropriate accounting and control practices on lean implementation.

**Meeting Systems**

The establishment of a formal meeting system complements the setting up of the performance measurement system. Meetings can only be effective with the appropriate information. Gathering information would make no sense if it is not clearly established what will be done with it. According to Maskell and Kennedy (2007), all routine meetings are held and decision making is discussed on the shop floor around the boards, which show the value stream performance. According to Fletcher and Taplin (1997), with the emphasis on cross-functional teams, natural work groups, and CI task forces, companies must learn how to formally plan and review the activities of these emerging horizontal organizations. Operating review meetings emphasize planning, performance review, and CI (Fletcher and Taplin, 1997). The philosophical core of the operating review meetings is an emphasis on the future, not the past. During these meetings, the focus is kept solely on interdepartmental key performance indicators (KPIs). As main point of the meetings system, they suggested procedures to (1) hold regular meetings, (2) set an established agenda, (3) review exceptions and commitments, (4) make performance improvement plans, and (5) document meeting action items. Leading authors have highlighted the importance of value stream focus from a conceptual point of view (Hines et al., 1998; Liker, 2004; Womack and Jones, 1994). Works dealing with the topics of value stream management, organizational focus, performance measurement, or meeting systems are present in the literature. However, research dealing with the organizational
practices lean enterprises adopt to focus on value stream focus was not found. This research addresses this shortcoming.

CASE STUDIES

Case A: Sogefi Filtration Plant of Cerdanyola del Vallès

Sogefi is an Italian group with a global presence that employs 6,200 people worldwide. The case takes place at the Sogefi filtration plant in Cerdanyola del Vallès; this is a medium-sized plant that manufactures filter elements and complete modules for automotive and heavy-duty applications. The production process is composed by an injection process, a pleating process, and an assembly process. The lean production system, called *Sogefi kaizen way*, was introduced globally in 2009.

The process of implementation of lean management principles in the plant is in the initial phase. An in-depth reorganization of the plant in autonomous production units (APUs) was not considered possible. The adopted solution consisted of maintaining a pure functional and hierarchical organization. The function of integrating the activity to the value streams was assigned to other organizational practices. These practices were CI groups, value stream-based performance measurement, and a formal meeting system. This solution was highly successful; from 2007 to 2010, the result indicators had improved dramatically, the line rejects had decreased by 45%, customer rejects decreased by 65%, and productivity was raised by 6% (Olivella and Gregorio, 2012).

Organizational Units Based on Value Streams

Sogefi is organized functionally, which means that the resources of each function report to the functional director. The interviewee, Ghislain Audion, Sogefi Plant Manager, believes in the organization based on the value streams. In spite of this, an in-depth reorganization of the plant was not considered possible because lean transformation was in such an early stage. Effectively, he said, “The focus of the teams in the production line, not the unit or the group, in a completely transversal way, this is the main success factor.”

The organizational solution on how to strengthen the focus on value streams is based on *CI teams*. The value streams are separated physically into eight segments, and the different segments are grouped into four CI teams (one in the pleating process, one in the injection process, and two in the assembly process). The teams are led by kaizen engineers with full-time dedication and composed by part-time resources from manufacturing, quality, manufacturing engineering, and maintenance functions. Line operators or other support functions are integrated in the teams when needed. The CI
teams act in an autonomous manner, not just in the kaizen–CI, but also in daily problem-solving activities.

**Performance Measurement System Based on Value Streams**

The performance measurement is based on value stream segments. For example, the injection process has its own result and process indicators measuring the performance of the value stream segment, not the performance of all the different products that go through this process. The indicators are posted visually in the shop floor on performance management boards (Figure 1) with manual collection methods and daily update frequency. The performance measurement system covers motivation, quality, delay, and cost performance dimensions (Table 2). These measures are operational; the costs are not assigned to the value stream segments with value stream costing. The boards show result indicators, process indicators, and information about CI activities. The result indicators are communicated every month,
**TABLE 2** Sogefi’s Value Stream Segment Performance Measurement System

| Result indicator                              | Process indicator                                      | Frequency     |
|-----------------------------------------------|--------------------------------------------------------|---------------|
| Motivation                                    | Audit 5S/total productive maintenance (%)              | Every 24 hours|
| Quality                                       | TOP 3 reject                                           | Every 24 hours|
| Delay                                         | Does not exist                                         | Every 24 hours|
| Cost                                          | TOP 3 non-productive; OEE and Pareto chart of causes    | Every 24 hours|

showing the latest performance of the complete value streams and the value stream segments.

**Formal Meeting System**

A standard formal meeting system for the four CI teams was applied based on the information provided by the value stream-based performance management boards. It differentiates between daily meetings, called *control room*, and monthly meetings. The objective of the control room is to define the abnormalities of the day before and the risk for the current day. The monthly meetings have the objectives of planning, result indicators performance review, and CI. More challenging problems are analyzed with special workshops or task forces.

**Case B: Delphi Diesel Systems (DDS) S.L. Plant in Sant Cugat**

Delphi is one of the world’s largest automotive part manufacturers and has approximately 146,600 employees (Delphi, 2012). Delphi is considered to be an example of lean transformation of a big traditional company (Woolson and Husar, 1997). The company has been recognized with the Shingo Prize for excellence in manufacturing in 27 plants (Shingo, 2012). The Delphi Manufacturing System (DMS) is widely acknowledged; for example, it was described by Liker (1997) together with Daimler-Chrysler Operation System and Ford Production System. For the DMS, the focus of the organization to the production flow is a critical aim. DMS internal documentation states that DMS is “a Manufacturing System with an implementation process that recognizes the interdependencies of its elements and drives to flow manufacturing.”

The plant analyzed is in Sant Cugat, Spain, and it manufactures diesel fuel-injection pumps for some of the main automotive companies (Delphi, 2012). It has been operating for more than 50 years and employs around 1,000 people. Delphi Sant Cugat performs the machining and assembly of
the pumps. The plant has been applying the concepts of organization in APUs, value stream based performance measurement, and meeting systems for more than 10 years. In 2009, DDS Sant Cugat faced a new and demanding challenge. Due to the high demand, the strategy of Delphi consisted of taking as much advantage as possible of the capacity of the plant. To serve these objectives, the performance management boards were replaced by an IT-supported near-real-time manufacturing performance measurement system (MPMS) that gives great importance to the overall equipment effectiveness (OEE) measure. The information provided by the MPMS, which measures the performance of the APU teams at a group level, is used in a formal meeting system. This system is critical for the plant. According to the interviewee, Jaume Roquet, Operations Director, “the organization in APUs, a real time robust measurement system and the meetings, for us constitute one system. It keeps the teams focused on the aspects that will make a difference in the performance of the business.” The application was highly successful and allowed the plant to cope with increasing customer demand. This was possible through an improved performance in terms of OEE, leading to an increase of volume by 120% between 2009 and 2012 with no capital expenditure in new equipment. The manufacturing cost was reduced by 15% between 2009 and 2012.

**Organizational Units Based on Value Streams**

DMS highlights the importance of having an organization based on value streams. According to DMS’s documentation, “We cannot separate Manufacturing, PC&L, ME, Purchasing, PE, HR, Sales, Business line . . . and so on because all functions must support manufacturing that is our core. All activity is connected and this focus will maximize the performance as an enterprise.” It was not possible to establish APUs based on complete value streams because the dimension, complexity, and variety of the process was too large for having a focused organization around one complete value stream. The adopted solution was to physically separate the value streams into 17 segments and group the different segments into 5 APUs (3 in the machining process and 2 in assembly) following ideas such as PWP (Skinner, 1944) and the mini-company (Suzaki, 1993). The APUs are managed by an APU manager leading a team of 10–20 indirect employees and 100–250 direct workers. The APUs integrate the functions of manufacturing, quality, manufacturing engineering, and maintenance.

**Performance Measurement System Based on Value Streams**

The performance measurement is organized in the same manner as the APUs, by measuring the performance of an aggregation of value stream segments. The near-real-time performance is posted visually in every value stream segment through an IT-supported MPMS. The MPMS covers the most
critical performance dimensions (security, quality, volume, and cost; see Table 3 and Figure 2). Every performance dimension has at least one result indicator and one process indicator. The APUs have financial autonomy, and most of the cost (maintenance, labor, scrap, tools, outside services, and supplies) is measured daily and assigned to the value stream segments using value stream costing. Machine, direct materials, and facility costs are not assigned to the value stream segments. The MPMS gives great importance to the OEE measure. This measure is critical due to the characteristics of the plant; big dimension, process variety, and process complexity. Capacity utilization is of high priority, and stoppages or disruptions are expensive in terms of lost capacity. The OEE is measured in 100% of the machines in the plant. The data are collected and introduced in a software system by two workers, following standardized routes, with a frequency of 2 hours. To know the exact capacity losses, every possible failure mode is codified in every machine.

**Formal Meeting System**

A standard formal meeting system for the five APUs is applied. It is based on the information provided by the value stream based MPMS. The MPMS supports the meetings by showing the information, aggregated into an APU level, that must be checked (result indicators) and allowing the possibility...
of going into detail (process indicators). The meeting system differentiates between daily meetings called daily stand-up meetings, weekly and monthly meetings called operating review meetings, and quarterly meetings called TOP 5 focus meetings. The objective of the daily stand-up meetings is to define the abnormalities of the day before and the risk for the current day. The operating review meetings have the objectives of planning, result indicators performance review, and CI. These meetings are performed on a weekly basis by the APU staff. On a monthly basis, the team presents their performance results and the main projects status to the plant directors. The TOP 5 focus meeting is performed every quarter. The APU staff define their performance dimension focus, called business problem, between security, quality, volume, and cost (in order of importance) and prioritize the TOP 5 priority projects that will have more impact on the performance.

**Case C: Plant X from the Furniture Industry**

Plant X is part of a leader company of the furniture industry. The plant manufactures mostly customized products but also offers standard ones. This case shows the lean transformation of a plant that was facing a market drop and aimed to increase their market share by an enhanced competitiveness. To face these objectives, Company X performed a deep transformation of the production system to cope with a wide diversity of products with the best
results and lowest operational complexity. The layout, originally functionally organized, was transformed so that single manufacturing cells perform complete value streams. Standard methods were established for all tasks necessary to perform both standardized and customized products. A robust system to schedule the value streams was established. Plant X’s lean manager confirms the importance of value streams by explaining that “the plant is not designed for visits; it is designed for value streams. The transformation has been key for us, because we can manufacture much more customized products with a process that is simple to manage.” The transformation of the production system has been accompanied by the adaptation of the organizational practices to the production system and, therefore, to the value streams through an organization in APUs, value stream-based performance measurement, and a formal meeting system. The solution was highly successful; the company increased market share by increasing flexibility and offering totally personalized products, with a lead time that became four times shorter than the average for the sector—all of that with service levels of 97% and customer quality of 99%. The productivity increased with 10% between 2007 and 2011.

Organizational Units Based on Value Streams
The plant is organized into four APUs in charge of each value stream manufacturing cell. The APUs integrate the functions of manufacturing, quality, lean/industrial engineering, and maintenance. However, in customized products, a very important part of the value stream is made in the design value stream (140 of 300 employees are indirect workers). In these processes, even though they have a high frequency (from 16 to 18 new industrializations of new products every day), one can lose the notion of the value stream. To avoid that, the project manager coordinates the value stream of customized products (from customer needs, design value stream, to delivery to the customer) and is accountable to the customers.

Performance Measurement System Based on Value Streams
The indicators are organized in the same manner as the APUs, by value stream, and visually posted in the shop floor on performance management boards with manual collection methods and daily update frequency. The performance measurement covers security, quality, volume, and cost dimensions (Table 4). These measures are operational; the costs are not assigned to the value stream segments with value stream costing. The performance management boards are composed by result indicators, process indicators, and also information about CI activities. The result indicators of the plant are posted in the entrance.
TABLE 4 Value Stream Performance Measurement System at Plant X

| Result indicator | Process indicator | Frequency   |
|------------------|-------------------|-------------|
| Security         | Number of accidents| Does not exist | Every 24 hours |
| Quality          | Customer complaints| Rework Pareto | Every 24 hours |
| Volume           | Service level      | OEE         | Weekly      |
| Cost             | Productivity; material scrap | Does not exist | Monthly |

**Formal Meeting System**

A formal meeting system standard for the four APUs is applied based on the information provided by the value stream-based performance management boards. The meeting system applied in Company X differentiates between daily meetings and monthly meetings. The objective of the daily meetings is to define the abnormalities of the day before and the risk for the current day based on the information provided by the performance management boards on the shop floor. The monthly meetings have the objectives of planning, result indicators performance review, and CI.

**DISCUSSION**

In each of the analyzed cases, the use of organizational units, performance measures, and meetings to focus the organization on value streams has been analyzed. The main information obtained is summarized in Table 5, and the findings are discussed next.

Regarding the establishment of organizational units based on value streams, the companies under study have in common that they link their

**TABLE 5 Use of Organizational Practices to Focus the Organization on Value Streams**

| (1) The establishment of organizational units based on the value streams | (2) The use of a value stream-based performance measurement system | (3) The adoption of a formal meeting system |
|------------------------------------------------------------------------|------------------------------------------------------------------|-------------------------------------------|
| Sogefi Filtration CI teams in charge of value stream segments          | Plant X from the furniture sector APUs in charge of a value stream; complete value stream manager for customized products | DDS Value stream segment near-real-time MPMS with operation measures and value stream costing |
| Sogefi Filtration Value stream segment performance management boards with operational measures | Plant X from the furniture sector Value stream performance management boards with operational measures | DDS Value stream segment near-real-time MPMS with operation measures and value stream costing |
| Sogefi Filtration Daily stand-up meetings on shop floor; monthly operating review meetings | Plant X from the furniture sector Daily stand-up meetings on shop floor; monthly operating review meetings | DDS Daily stand-up meetings on shop floor; weekly operating review meetings; quarterly TOP 5 focus meetings |
organizational structure to value streams. The objective is to concentrate the effort of the teams on value stream performance instead of the performance of individual people or functions. Company X put APUs in charge of each value stream. This was made possible by arranging the complete layout, originally organized functionally, in a flow layout where a single manufacturing cell performed a complete value stream. The DDS Sant Cugat case shows an example of how to establish APUs based on the value streams when the dimension, process complexity, and variety are big. The solution was to separate the value stream in segments and grouping the different segments in APUs; it is in line with approaches such as PWP (Skinner, 1944) and the mini-company (Suzaki, 1993). Sogefi filtration shows a case of a medium-sized enterprise where the lean transformation began and an in-depth reorganization of the plant in APUs was not considered possible. The solution consisted of maintaining a pure functional hierarchical organization. The function of integrating the activity to the value streams was assigned to CI teams in charge of value stream segments. The solution at Sogefi is a hybrid between an organization in APUs and the concept of CI teams. According to Lillrank, Shani, and Lindberg (2001), CI teams are organized as a parallel system outside the formal line organization.

In relation to the establishment of a performance measurement system based on value streams, the companies under study have in common that they measure the performance in a value stream perspective. They all measure and visually display on the shop floor the most critical operational performance dimensions in terms of security/human development, quality, volume/delivery, and cost/productivity. The companies also put an emphasis on operational process indicators by measuring not only what to achieve but also how to achieve it. However, the concept of value stream costing was only present in the DDS Sant Cugat case, where the APUs have financial autonomy and most of the costs are measured daily and assigned to the value stream segments. Differences were also found in how the information was collected and visually shown in the shop floor. In Sogefi and Company X, the indicators are posted on performance management boards with manual collection methods and daily update frequency. In the case of DDS Sant Cugat, due to the characteristics of the plant, big dimension, process variety, and process complexity, exact information refreshed with high frequency is found to be necessary. This was achieved by an IT-supported near-real-time MPMS.

Finally, regarding the adoption of a formal meeting system, the studied plants established a formal meeting system based on the information provided by the value stream-based performance measurement system. They all put in place a meeting system that differentiates between daily meetings and monthly meetings. The objective of the daily meetings, which are held on the shop floor, is to discuss the value stream abnormalities of the day before and the risk for the current day. The monthly meetings or operating
Organizational Practices Lean Enterprises Adopt

325

review meetings have the objectives of planning, result indicators performance review, and CI. Differences were found in the way the CI projects were selected. The decision is based on the performance dimension that will have more impact on internal and external performance. This decision was made by plant directors in Sogefi Filtration and Company X; in DDS Sant Cugat, it was made by the APUs in the TOP 5 focus meeting performed every quarter.

CONCLUSIONS

This article investigated which practices lean enterprises adopt to focus on value streams; an exploratory multiple case study of three plants that successfully performed a lean transformation is presented. Overall, the studied companies highlighted that the adoption of the three organizational practices analyzed were central to their transformation. Effectively, Sogefi initiated its transformation by adapting the organizational practices to value stream focus in a functional organization. DDS Sant Cugat brought a mature transformation further by developing a value stream-based IT-supported near-real-time MPMS. Plant X performed the transformation by rearranging the layout into single manufacturing cells that perform complete value streams. The organizational practices were adapted to the manufacturing cells and subsequently to value streams.

The companies under analysis all adopted the three organizational practices presented in this article, which are intended to focus on value streams. The adoption of these practices was standard and consistent across the different organizational units within the studied plants. However, the application of the concepts strongly depended on the specific circumstances of the plants.

This research provides an exploratory contribution in the fields of organizational practices and the transition to lean enterprise. Leading authors have highlighted the importance of value stream focus from a conceptual point of view and concretely as a lean principle. The results suggest the validity of this principle, as in the three cases, value stream focus is considered to be a critical objective. The original contribution of this work consists of identifying real practices used to focus on value stream lean principles. This results in a better knowledge of the interaction between lean management practices and principles.

For the management community, this article provides concepts and application examples that can be used in other real practical cases. Functional organization and disconnected processes can make the improvement actions useless and not give place to the best global solutions. To avoid this, the adoption of organizational units and a performance measurement system based on value streams altogether with a formal meeting system appears to be useful practices to support the focus on value streams.
It is thought that the practices presented herein may be applicable in other companies. The concrete details of the adoption of the practices differ between companies, and they have been adjusted to specific circumstances. As drawn from the literature and the cases, the lean transformation of the organizational practices is not an easy task. It is thought that every company then needs to define their own strategy of implementation of the practices.

We think that the described principles can be representative of the organizational practices used by lean enterprises to focus on value streams. However, this research is based on a limited number of cases and provides, consequently, provisional insights. Considering the limited amount of research on the subject, this kind of exploratory research is considered to be appropriate. Further research is needed to verify our findings. A quantitative analysis based on an appropriate sample of cases is foreseen. This study will include the study of the influence of the contextual factors. Moreover, the many different approaches adopted by different companies require examination to determine if one best way exists. An exploratory investigation in service sectors is another potential future research endeavor.

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