*Original Research Article*

Literature review for the implementation of lean management in small and medium-sized agri-food enterprises in Burkina Faso

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ABSTRACT

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| In Burkina Faso, small and medium-sized agri-food enterprises (SMEs) lack production management tools. The objective of this article is to conduct a literature review on the practice of lean management in order to identify possible solutions for adapting these tools to small and medium-sized agri-food industrial enterprises in Burkina Faso. After analyzing several scientific studies, it emerged that the companies that use lean management are mainly manufacturing and agri-food industries. Thus, the tools and/or methods most used and the difficulties of implementing lean were identified. These results made it possible to propose the Single Minute Exchange of Die (SMED), Total Productive Maintenance (TPM) and Seiri, Seiton, Seiso, Seiktsu and Sitshuke (5S) for the implementation of lean management to be adapted to SMEs from a specific context in Burkina Faso. These possible solutions provide an approach to Lean management that focuses on what is holding back its use in agri-food SMEs. |

*Keywords: Small and medium-sized enterprises, Food industry, Lean management, Production management tools, Burkina Faso.*

1. INTRODUCTION

Production management is the core business of most industrial companies. It is also the function that generates great cash flow. In an economic environment that has become so competitive in recent years, the scope of the “production management” function is wide, covers many activities and involves different areas (Mahiout and Zegrour, 2017). It is therefore at the crossroads of all sections of the company. All the other functions of the company work for the smooth running of the production function. Large companies have more means to implement proven tools in order to optimize their production costs. SMEs still need to find strategies for efficient implementation of these tools because they have limited financial resources.

An SME in Burkina Faso is any micro, small or medium-sized enterprise formally created, with an annual turnover of less than 1 billion CFA francs (approximately 1.5 million euros) and with a permanent staff of less than 100 (Decree 2017-1165). The functioning of these enterprises is often fraught with difficulties such as lack of funding, low level of education of managers, scarcity and unqualification of labour (Koulibaly, 2020), the use of equipment whose design did not take sufficient account of local specificities (Bationo and al., 2009). These difficulties are likely to affect the management of the company, and consequently its production.

As current management systems have been designed to be used in environments where industrial processes are well known and understood (Murray, 2000), it is appropriate to characterize the Burkina Faso industrial environment and appreciate its positioning. The question that arises is: can the tools used in lean management be applied in the context of Burkina Faso?

Lean management, called “lean production” (Shah and Ward, 2007) or “lean” (Tadja and al., 2021), is defined as the implementation of methods and tools to reduce or even eliminate sources of waste or “muda” (Tadja and al., 2021; Womack and Jones, 2009). It increases the performance of industrial enterprises in all production compartments where it is implemented (Youssef and Dabnichi, 2023). It is also an approach that increases environmental performance when implemented in a coordinated manner with corporate social responsibility (Yang and al., 2011). It is applied in all regions of the world, and practically in all areas of production and service delivery.

This form of management, derived from the "Toyota Production System (TPS)" is a systemic approach that seeks to eliminate all sources of inefficiency in value chains and to close the gap between actual performance and the requirements of customers and shareholders (Krafess and al., 2015; Womack and Jones, 1992). Its use, together with the associated tools, presupposes a mastery of the whole production processes at all levels of planning. Our study will be based on this approach, because in terms of the result obtained and implementation process, it could be adapted to West African SMEs in general and Burkina Faso in particular.

The objective of this article is to analyze the scientific work on lean management in order to propose possible solutions to experiment this approach in Burkina Faso.

To do so, the major concepts of lean management, the issues addressed in this work as well as the tools and/ or methods used, the types of companies involved, the difficulties related to implementation will be analyzed. The discussions resulting from these results will provide perspectives to feed future reflections.

1. material and methods

This study on lean management was based on several scientific works consisting of articles, theses, and communications, as well as discussions with two government institutions: the Burkina Faso Business Center and the Burkinabe Agency for Standardization, Metrology, and Quality (ABNORM) of Burkina Faso. An Excel spreadsheet was used to compile the data and generate the graphs.

To identify the application sectors and tools of lean management, twenty (20) publications corresponding to 20 case studies were considered. The number of tools was determined based on their use in these case studies. Furthermore, the case studies mentioned eleven (11) application sectors, which were mentioned thirty-one (31) times. The lean usage rate in the application sectors was determined using the formula (1):

Tusa = Ntsa / Nusa (1)

With:

- Tusa the rate of use of application areas in case studies,

- Ntsa the Total number of application areas used in case studies,

- Nusa the number of use a sector in case studies.

The analysis of this scientific work made it possible to characterize the implementation of lean in companies. Possible solutions were proposed following the interpretation of the results.

* 1. **Lean management**

Lean management is based on two fundamental concepts: just-in-time and autonomy, or "Jidoka," or "making quality on site" (Youssef and Dabnichi, 2023). Just-in-time involves ordering raw materials and having them delivered when production is scheduled to begin, completing production at the time of delivery, and delivering the product within the contracted timeframe. Implementing tools such as "Kanban" or label-based production, Single Minute Exchange of Die (SMED) or rapid changeover, and 5S or systematic cleaning and functional storage, helps achieve the just-in-time objective of reducing production costs. Autonomy uses "checkpoints" or "andons" to detect product errors and correct them immediately before continuing production (Ballé, 2004). There are several variants of lean management: lean production, lean manufacturing, and lean maintenance. However, the majority of studies agree that the implementation of lean management is based on 5 key principles:

1. Value Added (VA) analysis,

2. Map the value stream,

3. Create a continuous workflow,

4. change from “pushed” to “pulled”,

5. ensure continuous improvement or perfection.

All of these principles contribute to eliminating waste in the production chain. The types of waste identified in Toyota's production chain are summarized in Table 1.

T**able 1: Waste Typology (Liker, 2004; Ohno, 2021; Shingo, 2019)**

|  |  |  |
| --- | --- | --- |
| N° | **Type of waste** | **Definition** |
|  | Overproduction | Produce items for which there is no order, generating wastage such as storage and transportation costs due to excess stock. |
|  | Waiting time | Monitor an automated machine or wait for the next processing step or have no work due to stock shortages, batch delays, equipment downtime. |
|  | Unnecessary transportation | Transporting work in progress over long distances, creating inefficient transport or moving materials, parts or finished products to or from storage, or between processes. |
|  | Excessive processing operations | Take non-value-added measures to process products and increase quality more than necessary. |
|  | Unnecessary stocks | Surplus of raw materials, stock or finished products resulting in delays, longer delivery times, obsolescence of raw materials, damaged goods, high transport and storage costs. |
|  | Movements not necessary | All unnecessary movements that employees must make during their work, such as searching for, reaching for or stacking parts, tools, etc. |
|  | No quality | Production of defective parts or parts to be corrected, which results in a waste of resources, time and effort. |

These sources of waste can be identified in Burkinabe companies. Overproduction, delays, unnecessary inventory, unnecessary transportation, and unnecessary movements can be caused by insufficient planning of production activities. Poor quality and excessive processing operations are linked to poor control of production processes and equipment. This situation limits the competitiveness of manufactured products. The tools and/or methods used in the implementation of lean management are: process analysis, 5S method, Poka-Yoke, Just in time, PDCA or Deming wheel, Jidoka, Visual management, Single Minute Exchage of Die (SMED), TPM, Total Quality Management (TQM), Lean six sigma, Who, What, Where, When, How, Why (QQOQCP), Pareto diagram, Ishikawa diagram, 5 whys, Define, Measure, Analyze, Improve, Control (DMAIC), Kaizen, strengths, weaknesses, opportunities and threats (SWOT), survey questionnaires, software and analysis tools. (Aouag, 2016; Khihel and Harbal, 2019; Shah and Ward, 2007; Youssef and Dabnichi, 2023).

* 1. **Status of the implementation of lean management in companies in Burkina Faso**

The state of industrialization in Burkina Faso shows that the establishment of companies does not sufficiently take into account the specificities of the context characterized by insufficient resources (N’Do and al., 2024). Thus, according to the databases of the Burkina Faso business house, approximately 80% of small and medium-sized agri-food processing companies are concentrated in the cities of Ouagadougou, Bobo Dioulasso and Koudougou. They are characterized by often artisanal production with informal management and whose productivity is linked to the level of education of employees and managers of the said companies (Koulibaly, 2020). The production lines are not fully automated, leaving room for errors related to operators and the workforce in general. The staff is unstable because they consider the private sector as an uncertain field in terms of job security. Employees often have no professional qualifications and a low level of education to perform even tasks that do not require any particular technical skills (Bationo, 2007). The training currently provided in schools, institutes and universities mostly concerns financial management, human resources management, the search for partnerships or financing, etc.

Despite this difficult context, we note the existence of certain lean management tools in companies. Indeed, in the health sector, the Quality Framework for Health Structures requires the implementation of 5S-Kaizen-TQM in each public or private health facility in Burkina Faso. In this context, several actors have been trained in the implementation of these tools for the benefit of health centers by the Directorate of Quality, Health and Patient Safety (DQSS). Also, the National Quality Day 2024, organized by the Burkinabe Association for Quality Management (ABMAQ), devoted a presentation on the implementation of 5S-Kaizen in the management of the rolling stock of the Textile Fiber Company. In addition, companies whose products are certified according to ISO 9001 and 14001 standards use quality tools, including lean management, to obtain their certification.

1. results
	1. **Areas of lean application**

Lean management was first implemented in the automotive industry with the Toyota Production System (TPS) (Chanegrih and Creusier, 2015). Given its success, this approach quickly spread to other sectors.

The total number of companies analyzed in our research is 590. Large companies are the most involved, with 53% compared to 47% of SMEs. However, these SMEs differ from those in Burkina Faso. In France, for example, the annual turnover of an SME can reach 50 million euros (34 billion CFA francs) and the average number of employees employed during the fiscal year can reach 250 (Decree 2024-152). In these companies, lean is practiced in several areas depending on the technological level of the equipment used and the level of employee commitment (Beauvallet and Houy, 2009). Figure 1 shows the distribution of Lean management application sectors.

**Fig. 1: Distribution of lean management application areas**

Fig. 1 shows that the manufacturing industry (goods processing and mainly manufacturing industries) is more represented in these studies. It is followed by the agri-food processing industry and the pharmaceutical-chemical industry. This is due to the fact that these sectors use more observable manufacturing processes, with equipment installed in production lines for the most part. The least represented sectors are textiles, leather and footwear, and aeronautics. These productions are more workshop-type, so the processes are less observable by the actors. No studies have been found on the subject in Burkina Faso.

* 1. **Application of Lean in the world**

The application of Lean management in each field has matured over time with a view to adapting practices to the local context (Lyonnet, 2010). Research on this approach agrees that its level of application is linked to the field and the level of industrialization of the country. Its birth in Toyota's production lines allows us to say that Asia is the cradle of this method. On this continent, it has been used in Pakistan to assess the levels of planning adoption based on maturity, complexity, sophistication or technological content, export orientation, and domestic competition in the industry (Bhutta and al., 2017). In India, the aim was to show the effects of lean planning on performance in all segments of the company and on the quality of life of employees (Varma and Singh, 2018). Its use in Japan has consisted of showing its limits (Cusumano, 1994), its use in retail (Naruo and Toma, 2007), the revelation of its origins (Dekier, 2012).

In Europe, the emphasis is on the influence of the human factor in the implementation of the Lean approach. Studies in France address occupational health (Molet, 2005), issues related to sociocultural and technical factors (Lyonnet, 2010), and the landscape of companies using Lean management (Beauvallet and Houy, 2009). In Belgium, lean organization in the hospital sector has been addressed (Foko Mbouopda and Tancrez, 2019). The use of Lean in the IT industry has been noted in Germany (Fischer and Krauss, 2018).

In America, lean management is being studied in the United States to understand its contribution to improving environmental performance in a sample of 300 companies (Yang and al., 2011). A literature review and an outline of a solution applicable to connected object manufacturing companies to improve the Lean production culture was carried out in Canada (Tadja and al., 2021).

Lean is also applied in Africa. Of the 20 case studies, four (4) relate to North Africa and one (1) to South Africa. In Algeria, the work focuses on the implementation and adaptability of continuous improvement tools (Aouag, 2016), and the evaluation of the impact of the perception of Lean Management on the overall performance of the company by production actors and by method professionals (Benhrimida and Dekkaki, 2018). In Morocco, the benefits of implementing the lean process for all stakeholders, including end users (Khalil and al., 2013), and the synergy between quality management and Lean management (El Kahri and El Amrani, 2021) are addressed. The adaptation of lean to the hospital system (Naidoo and al., 2019) was studied in South Africa.

Some of the work is cross-disciplinary. The in-depth understanding of the human effort involved in the lean conversion of "mass" producers involved more than fifty industrial companies based in the United States, Europe, and Japan (Womack and Jones, 1992).

From these findings, we note that most continents have adopted lean management as a production management approach. Unfortunately, very little research has been done on lean management in sub-Saharan Africa.

The topics covered demonstrate the benefits of implementing lean management in terms of overall company performance and clarify the approach (El Kahri and El Amrani, 2021; Benhrimida and Dekkaki, 2018; Tadja and al., 2021). Some studies address the consideration of local specificities, including long and difficult-to-compress changeover times, simple manufacturing flows, the limited resources allocated to improvements, and the variable size of production (Cusumano, 1994; Lyonnet, 2010). Furthermore, the implementation of lean, associated with corporate social responsibility (CSR) and new technologies, increases company performance (Fischer and Krauss, 2018; Khihel and Harbal, 2019).

* 1. **Tools and/or methods used in the implementation of Lean management**

Scientific work uses proven tools. Figure 2 shows the number of times that the tools were used in the 20 studies cases considered.

**Fig. 2: Use of lean management tools in studies cases**

 Number of times that the tool is used Number of studies cases considered

There is a low use of tools. Lean management is a philosophy that uses several methods and/or tools. As a result, companies can use innovative tools adapted to the Burkinabe context and respecting the lean philosophy. These are chosen according to production constraints, hence the need for flexibility in their choice. This situation is accentuated by the fact that the objectives pursued by the scientific works analyzed revolved around measuring the impact of the use of lean on company performance. The most widely used tools are questionnaires, software, and other specific analysis methods such as self-assessment according to the European model of excellence, the Kaplan and Norton methods, the Barabarat Lyonnet method, etc.

* 1. **Impact of the use of lean management on company performance**

Implementing lean means controlling production costs, increasing product quality, complying with quality standards, reducing manufacturing lead times and improving employee working conditions (Khihel and Harbal, 2019). It also leads to transparency between suppliers and employees, long-term commitment of suppliers and workers, reliability of the company, increased community support and better ethical engagement. It also has the advantages of reducing production waste and optimizing consumption of raw materials and energy. It also allows companies to introduce better environmental practices.

These benefits, although undeniable, should not overshadow the disadvantages. The implementation of lean involves the following constraints (Cusumano, 1994; Khihel and Harbal, 2019):

* the non-adherence of employees for reasons of resistance to change, misunderstanding of the method, muscular fatigue due to the intensity of physical work, neurological and auditory problems resulting from lack of ergonomics;
* stress due to frequent changes of equipment and rapid execution of tasks, induced by the application of just-in-time (JAT) principle;
* the limitation of employees to innovation and creation through strict compliance with labour standards;
* the neglect of the welfare of employees leading to depressions and even suicide;
* the high cost of frequent product line replacement and expansion with SMED.

To minimize the negative impacts of lean management, the following proposals were made :

* adopt non-violent communication in the Lean environment;
* set up several production teams for less stress and fewer health problems;
* pay more attention to the needs of raw material suppliers;
* develop products that are easier to achieve;
* increase the standardization of parts between products;
* maintain non-economic value-added processes that ensure environmental performance;
* define environmental indicators and standards and encourage companies to comply with them;
* Reorganize maintenance processes using multiple TQM actions to result in the use of fewer harmful chemicals.

The analysis of implementation constraints, context and key principles of lean management allows us to propose tools that could be applied in Burkina Faso agri-food SMEs. These include:

* SMED to allow rapid change of production series due to the fact that agri-food companies pool equipment to manufacture several products, therefore need to change production frequently and quickly;
* 5S to improve the organization of workstations due to insufficient organization;
* TPM to enhance the function of users by strengthening technical skills in order to improve the availability of equipment.

These tools have in common their relative ease of understanding and their implementation costs which can be borne with good results. However, there is resistance to change and probably other unknown influencing factors that could hinder their implementation.

1. DISCUSSION

This work examines the use of lean management in the world. However, the studies rarely take into account the countries of West Africa and even less work on Burkinabe agri-food industrial SMEs. The characterization of these companies shows that lean tools are very little known in Burkina Faso except for SOFITEX and structures which are at the learning stage. The studies cases in lean management were carried out in an industrial environment better structured than that of Burkina Faso. Indeed, the companies studied have human, material and financial resources superior to those of SMEs in West African countries, which have very limited means. To this, it must be added that lean management is a complex approach whose successful deployment in companies varies depending on the type of process used, the level of industrialization of the country and the means available to the company. However, the analysis results led to recommendations for a better implementation of lean in Burkina Faso as is the case of the Failure Modes, Effects and Criticality Analysis (FMECA) (Bationo and Ilboudo, 2023).

The implementation of lean as many other approaches could encounter resistance to change, health problems, stress, neglect of employee well-being (Khihel and Harbal, 2019), which will require a study on the perception of the concept of lean by operators in companies. The causes could probably stem from the uniqueness or reduction in the number of products manufactured by these companies, the operation of equipment designed and manufactured on other continents, and the insufficient qualification of human resources. The solutions proposed, including the multiplication of production teams to limit muscle fatigue or the strict application of environmental, health and safety standards at work (Cusumano, 1994) could meet with less support from employers due to the weakness of production resources and the unavailability of skilled labour. Indeed, the training courses carried out, with the exception of industrial university courses, are focused on financial management, maintenance and business management. The solutions proposed in the studies are nevertheless necessary to assess the behaviour of tools used in production management.

1. Conclusion

This study made it possible to propose solutions for the production management of SMEs in Burkina Faso. It appears that the knowledge of lean tools is not very thorough or formalized in agri-food SMEs in Burkina Faso. The approach, as it stands, could therefore behave differently to the field test, hence the need to experiment with some of its tools. The adoption of lean is universal, even if there are disparities between continents. The work studied covers all of the company’s segments. Lean is therefore a global management philosophy.

This overview of the bibliography shows that lean tools are generally known in the industrial field but their appropriation remains embryonic. In addition, their application is not formalized in agri-food SMEs. This work has led to a better knowledge of lean management, including its principles, areas of application, implementation constraints and proposed solutions to these constraints. This information will serve as a reference for investigation work in some companies. At the end of these investigations, the perception of the method will be analyzed to propose an articulation of the tools between them. This linkage could be tested in some agri-food SMEs with a view to adapting these tools.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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