



(RESEARCH ARTICLE)



PROPOSAL FOR A CONTEXTUALIZED LEAN APPROACH FOR PRODUCTION MANAGEMENT IN CEREAL PROCESSING SMALL AND MEDIUM-SIZED ENTERPRISES IN BURKINA FASO

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World Journal of Advanced Research and Reviews, 2026, 31(03), 1890–1901

Publication history: Received on 21 August 2026; revised on 24 September 2026; accepted on 26 September 2026

Article DOI: <https://doi.org/10.30574/wjarr.2026.31.3.2513>

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ABSTRACT

In Burkina Faso, small and medium-sized enterprises (SMEs) involved in cereal processing face several constraints that can affect the performance of their production activities. The objective of this article is to characterize the knowledge, perception, and use of production management tools associated with Lean management by stakeholders in cereal processing SMEs and to analyze the influence of certain socio-cultural factors in order to propose a contextualized approach. The study combines a review of academic and institutional literature with a field survey conducted with nine (9) cereal processing SMEs located in Ouagadougou, Bobo-Dioulasso, and Ziniaré. Data were collected from January to March 2026 through semi-structured interviews and a questionnaire administered using KoboToolbox, and then analyzed using a thematic content analysis approach. The results highlight a limited understanding of Lean management tools, as well as constraints related to skills, planning, equipment availability and maintenance, energy, financing, and certain sociocultural factors. Based on this assessment, a contextualized Lean approach for cereal processing small and medium-sized enterprises (CL-CP- SMEs) is proposed, focusing on three key areas: skills and organizational strengthening, equipment adaptation and maintenance, and continuous improvement. This approach is a proposal derived from the empirical assessment and will require further experimentation to evaluate its feasibility, adoption, and impact on performance.

Keywords: Burkina Faso, Socio-cultural factors, Contextualized Lean, Small and medium-sized enterprises, Cereal processing.

1 INTRODUCTION

Local product processing sectors play an important role in food security and the rural economy of Burkina Faso. In this Sahelian country, agriculture occupies a major place in employment and economic activity (1). However, the agri-food sector faces several constraints, including low productivity, post-harvest losses, logistical difficulties, market instability, the effects of climate change, inadequate equipment, and skills gaps. These constraints can affect the regularity of supply and the performance of processing activities, particularly in the cereal sector.

Faced with these constraints, the Burkinabe government has undertaken various initiatives aimed at strengthening agricultural production, rural infrastructure, and processing capacity. The development of processing units and support mechanisms for SMEs are key levers being used to increase the local value of agricultural products. In this context, improving processing capacity is crucial for adding value to cereals and creating value within the agri-food supply chain.

In Burkina Faso, small and medium-sized enterprises are defined according to regulatory criteria relating in particular to annual turnover and permanent staff (Decree No. 2017-1165). Classification criteria differ from country to country, which must be taken into account when making international comparisons (2). In the cereal processing sector, SMEs face challenges such as supply difficulties, a lack of infrastructure and technology, financing constraints, and market instability. Nevertheless, they play a vital role in adding value to local products and creating market opportunities for producers (3).

Production management encompasses the planning, organization, and control activities necessary for transforming raw materials into finished products, seeking a balance between cost, quality, delivery time, and resource utilization objectives (4). However, SMEs often have more limited human, financial and technical resources than large companies, which can influence their ability to formalize and deploy certain production management tools (5). The challenge therefore lies as much in the choice of tools as in their suitability to the characteristics of these companies.

In this context, the central question of this study is: what is the level of knowledge, perception and use of production management practices and tools associated with Lean management in cereal processing SMEs in Burkina Faso, and what adaptations would be necessary to take into account their actual operating conditions?

The objective of this study is to characterize the knowledge, perception and use of production management tools associated with Lean management in cereal processing SMEs in Burkina Faso, as well as the influence of certain socio-cultural and organizational factors, in order to propose a contextualized Lean approach adapted to their operating conditions.

To achieve this objective, the study combines a review of academic and institutional literature with fieldwork conducted with cereal processing small and medium-sized enterprises (SMEs). Data were collected through semi-structured interviews and a questionnaire administered using KoboToolbox, then analyzed using a thematic content analysis approach. The diagnostic results are then used to formulate a contextualized Lean proposal for cereal processing small and medium-sized enterprises (SMEs).

2 LITERATURE REVIEW

The supply chain encompasses all the activities and processes involved in organizing the flow of products, services, information, and resources between the various stakeholders, from the initial stages to the end customer. Its management aims to coordinate these flows and find a balance between costs, lead times, service levels, and resource availability. In this context, the value chain includes the activities that contribute to value creation, from the sourcing of raw materials to the delivery of the product to the consumer.

Research on agri-food supply chains demonstrates the diversity of approaches used to analyze, model, and improve flows. This research focuses particularly on the pooling of logistics resources among agri-food SMEs (6), measuring supply chain performance (7) the vulnerability of food supply chains (8) and the modeling of sustainable and resilient supply chains (9). In Burkina Faso, some studies have also examined the economic performance of supply chains associated with agricultural processing (10). This work shows the importance of interdependencies between the different links, but it does not directly answer the question of contextualizing production management tools in small cereal processing units.

The supply chain is thus an interdependent system in which the constraints of one link can affect the performance of subsequent links. In the case of the cereal sector, the processing link occupies a central position between the supply of raw materials and the distribution of finished products. Its analysis is therefore a prerequisite for studying production management practices and the conditions of use of Lean tools in the SMEs concerned.

The production function consists of organizing and managing the activities necessary to produce the requested products, seeking a compromise between cost, quality, delivery time, and resource utilization objectives (11–13). In the cereal supply chain, a distinction must be made between agricultural production, which concerns the acquisition of raw materials, and processing, which concerns their conversion into finished products. For processing units, controlling costs, lead times, quality, and resources is a major competitive challenge.

Since the 1980s, production systems have undergone a significant evolution marked by the development of new management approaches, including just-in-time, Kaizen, quality management, and integrated supply chain management. These developments have gradually shifted the focus from management primarily centered on control to approaches that place greater emphasis on the coordination of stakeholders, process control, and continuous improvement (14).

Management tools can be considered as devices that structure information, support decision-making, and guide the company's activities (15,16). In production management, they can support forecasting, planning, resource organization, activity monitoring, and performance control. However, their relevance depends on their suitability to the characteristics of the production system and the available resources.

Production management tools can be grouped according to their function, the type of product, the desired results, and the characteristics of the production system (17,18). These tools relate in particular to process organization, operations and resource planning, materials management, activity tracking, and process monitoring. Within this diverse range of tools, Lean management represents an approach focused on value creation, waste reduction, and continuous improvement.

The term "Lean production" was popularized in Krafcik's work in 1988 to characterize certain properties of Toyota's production system. It was subsequently widely disseminated in the literature, notably through the work of Womack and Jones, contributing to its extension to different sectors and organizational contexts (2.19).

Lean management can be defined as a management approach aimed at creating more value for the customer while reducing activities that do not create value. In the field of production, it relies on principles and practices designed to identify and reduce sources of waste, improve flows, and promote continuous improvement (20,21). However, the effects of Lean on performance depend on the organizational and technical conditions of its implementation.

The implementation of Lean relies in particular on value identification, value chain analysis, the pursuit of continuous flow, demand-driven management, and continuous improvement (22). It also aims to reduce the main types of waste: overproduction, waiting, unnecessary transport, excessive processing, excessive inventory, unnecessary movement, and defects. These principles must be adapted to the characteristics of the production system and the available resources.

The literature reports associations between the implementation of Lean practices and several dimensions of operational performance, including quality, lead times, costs, waste reduction, and working conditions (18,23,24). However, these results do not mean that the same practices automatically produce the same effects in all contexts. Their relevance depends in particular on the skills available, the level of organizational formalization, the equipment, and the conditions of implementation.

These findings raise the question of the conditions for adopting Lean principles in SMEs with limited resources. In the context of cereal processing SMEs in Burkina Faso, it therefore appears necessary to examine not only the knowledge and use of Lean tools, but also the factors likely to facilitate or limit their adoption.

3 METHODOLOGY

The study adopts a primarily qualitative approach, supplemented by descriptive quantitative data. The characterization of the cereal supply chain is based on the analysis of scientific and institutional documents. The empirical study focuses on nine (9) semi-mechanized cereal processing SMEs selected from the National Register of Enterprises and Business Groups (NERE) of the Burkina Faso Business House. Telephone contacts were used to identify active and available companies and to schedule interviews. In total, 32 owners, managers, and processing agents answered open-ended questions.

A questionnaire was developed to gather information on production capacities, equipment, and human resources, as well as on knowledge, perceptions, and levels of use of production management tools and the difficulties encountered in processing activities. Data collection took place from January to March 2026 using KoboToolbox, through semi-structured interviews conducted with managers and employees of the companies studied.

The qualitative data were analyzed using a thematic content analysis approach. This involved identifying, grouping, and interpreting recurring themes related to production management practices, constraints encountered, and the conditions for adopting Lean tools. The literature review focused on scientific and institutional works consulted primarily in Scopus, Web of Science, Google Scholar, and CASSI. The quantitative data were used for descriptive purposes to characterize the sample and the reported practices.

4 RESULTS

The empirical study focused on nine (9) cereal processing SMEs located in Ouagadougou, Bobo-Dioulasso, and Ziniaré. The cereal sector was chosen due to its importance in the activities of agri-food SMEs in Burkina Faso and the existence of previous research on its supply chain. The companies studied employ 195 workers, of whom 156 (80%) are involved in processing activities.

The distribution of staff according to education level shows that a significant proportion of workers have limited formal education. According to the data collected, 31% of workers have no formal education and 63% have less than a high school diploma. Some workers are assigned to primarily manual tasks, such as stone removal, cleaning, and certain handling operations.

4.1 Cereal supply chain

The cereal supply chain studied includes the main links from the supply of agricultural inputs to final consumption. The diagram presented in figure 1 distinguishes the physical, informational, and financial flows, as well as the role of strategic planning. It provides a framework for understanding the processing link within the overall chain.

Figure 1 represents the operational links in the cereal supply chain in Burkina Faso. Transport is not specifically shown but plays a very important role and is omnipresent between virtually all links. The diagram also incorporates strategic planning (at the top) and the three types of flows: physical flows (green lines), informational flows (blue lines), and financial flows (dashed red lines).

The supply of inputs is a crucial link in the cereal production chain. The studies consulted highlight difficulties in accessing quality inputs, particularly certified seeds and fertilizers, due to their cost and distribution constraints (25). Dependence on certain imports can also expose production systems to the volatility of international markets (26).

Cereal production increased in volume between 2022 and 2023, according to the data used in the study. However, yields remain subject to several constraints, including dependence on rainfall, low mechanization, difficulties in improving soil fertility, land pressure, and, in some areas, access constraints related to insecurity (27,28).

Collection is a critical link in the cereal chain (29). It is characterized in particular by the geographical dispersion of producers, the state of transport infrastructure, the presence of numerous intermediaries, and a variable level of structuring of producer organizations. These characteristics can increase collection costs and reduce the bargaining power of some producers.

Storage is also a point of vulnerability in the cereal supply chain. Post-harvest losses can be significant when storage conditions do not adequately protect the cereals from insects and other factors of degradation. Available storage capacity and infrastructure characteristics are therefore important parameters for ensuring a continuous supply to processing plants.

The processing chain mainly comprises artisanal and semi-mechanized units, supplemented by industrial units concentrated in major urban centers. Constraints identified in the literature include the availability of equipment, access to a skilled workforce, energy, and the quality of raw materials (30).

The distribution and marketing link is influenced by the state of road infrastructure, which can affect costs and delivery times. In informal channels, traceability can also be limited, which poses a challenge for quality control and access to certain formal markets.

The marketing of processed cereal products takes place primarily in local markets, while large retailers represent a more limited share of the market. Seasonal variations in supply can also contribute to fluctuations in product prices and availability. These factors influence the conditions under which SMEs must plan their production and manage their inventories.

Analyzing the cereal supply chain allows us to locate the processing link and identify constraints that may affect its operation. The overall chain is not studied here as an autonomous performance entity; it is considered the upstream

and downstream context in which processing SMEs organize their activities. The empirical study therefore focuses primarily on supply relationships, internal processing operations, maintenance, quality control, financial flows, and distribution.

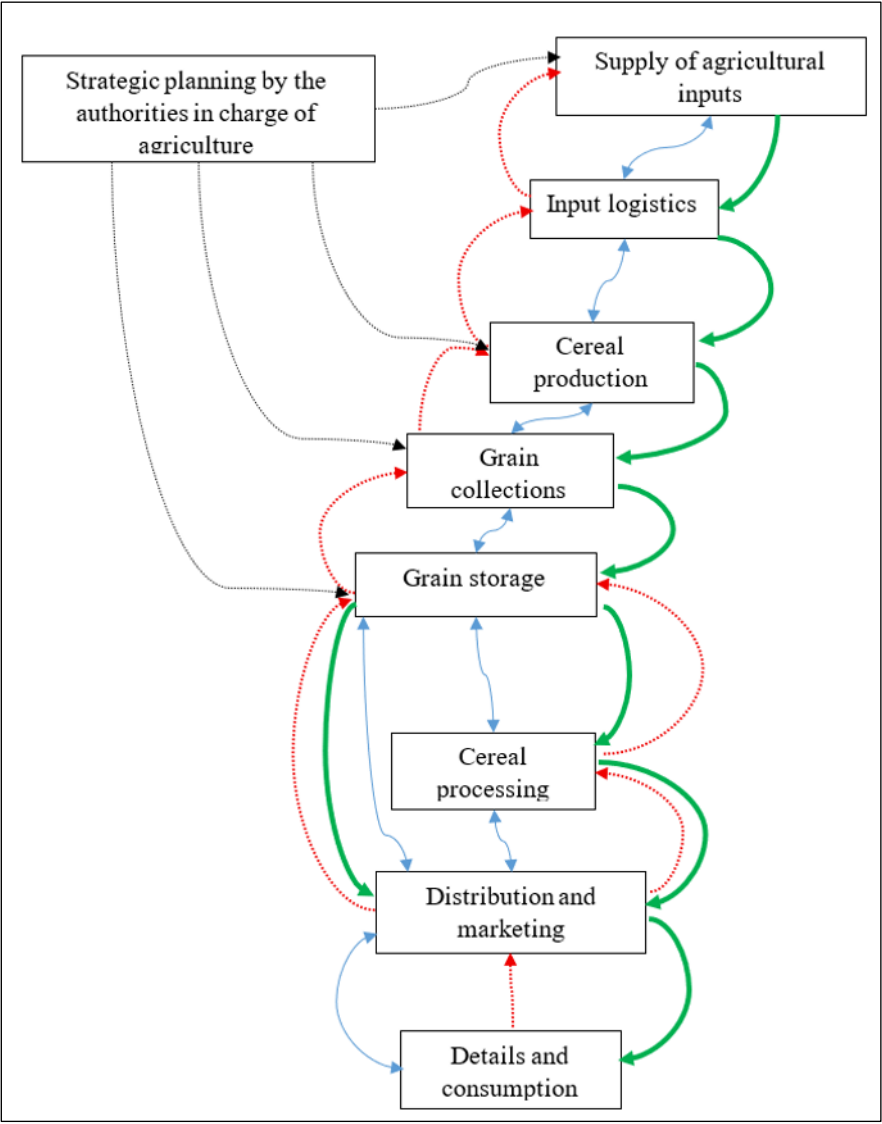
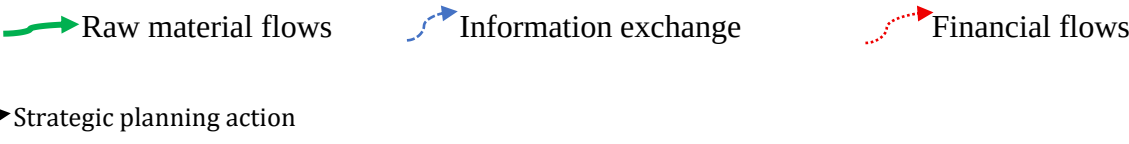


Figure 1: Cereal Supply Chain in Burkina Faso



The superstructure shown in figure 2 represents the main relationships between the supply of raw materials, the transformation operations and the distribution of finished products.

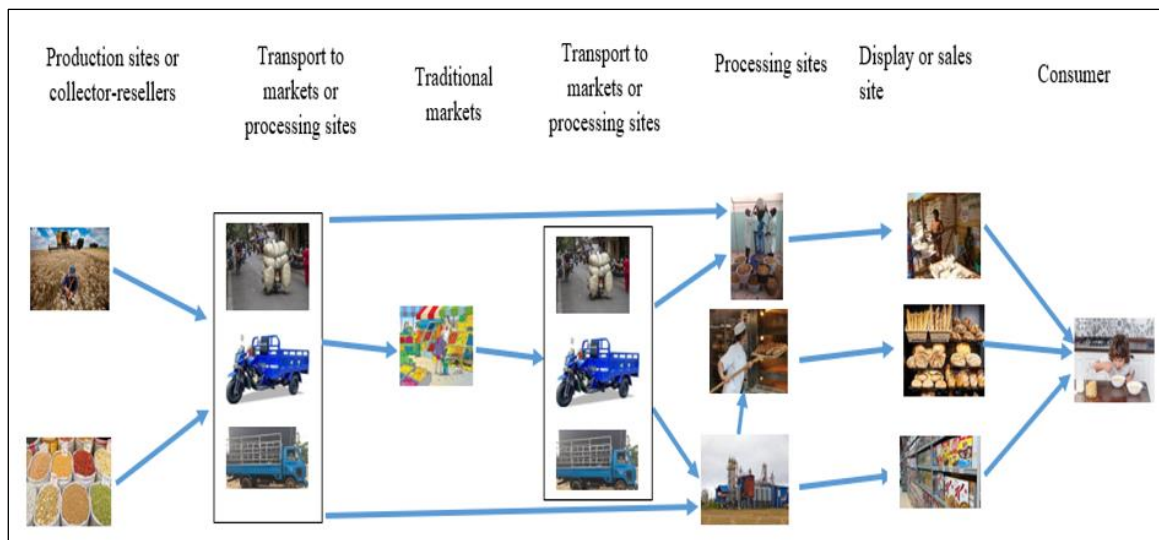


Figure 2: Superstructure of the cereal processing supply chain

This superstructure shows that raw materials are primarily transported from local markets, producers, or collectors/resellers to processing units, using motorcycles, tricycles, or trucks depending on the quantities transported. The processed products are then delivered to various points of sale before reaching the end consumer.

4.2 Supply chain of the cereal processing link

The transformation link connects external actors, including suppliers, agricultural producers, and customers, with internal functions such as purchasing, production, distribution, maintenance, quality control, and finance. These actors are linked by physical, informational, and financial flows that ensure the continuity of transformation operations, as illustrated in figure 3.

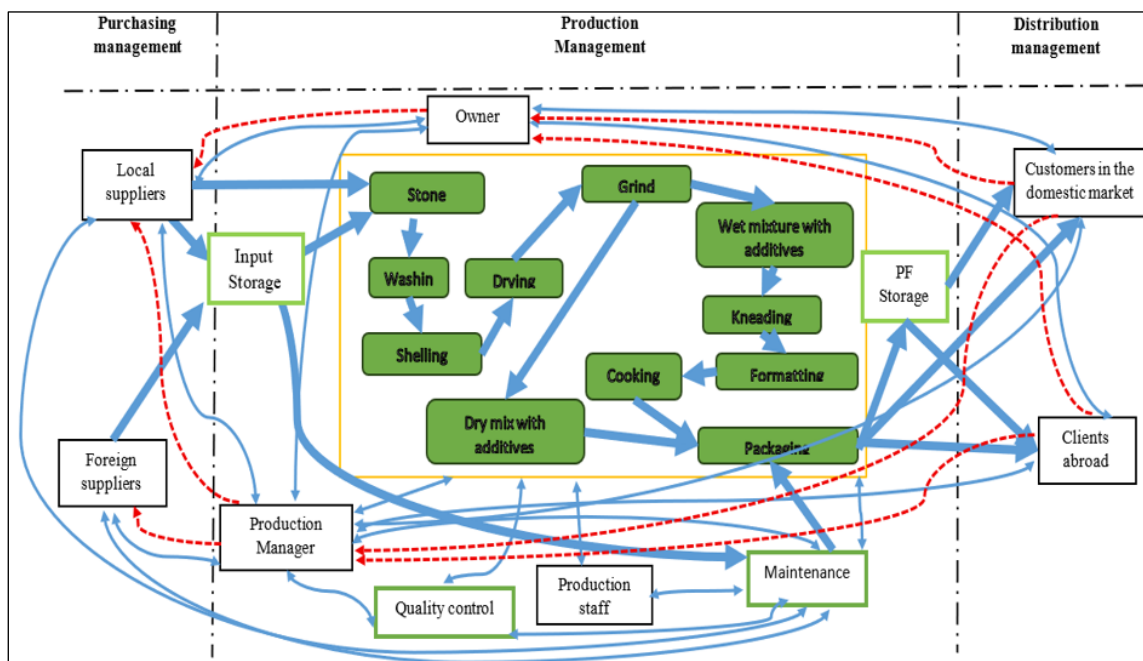


Figure 3: Detailed supply chain of the cereal processing link

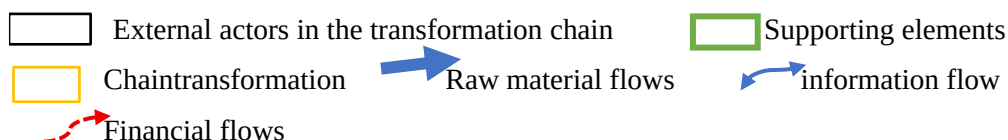


Figure 4 shows that this chain can be subdivided into three (3) parts: purchasing management, production management, and distribution management (31). The processing involves manual operations such as destoning, drying, washing, shaping, and packaging, as well as mechanized operations such as milling, hulling, mixing, kneading, and cooking. Quality control is primarily carried out through visual observation at various stages of the process, particularly during packaging. Control procedures are not systematically formalized. Maintenance is mostly outsourced, although some SMEs have trained operators in basic maintenance.

According to the information gathered, some companies produce batches of processed parts based on relatively firm orders, which corresponds to a pull-based system. Spare parts are sourced from local or foreign suppliers depending on their availability. These physical flows are complemented by information exchanges and financial flows.

Analysis of the interactions between the functions within the transformation chain reveals several characteristics. Commercial, financial, and production functions are frequently concentrated in the hands of the production manager or the owner-manager. Maintenance is largely outsourced: eight out of nine surveyed companies, or 88.9 %, report subcontracting these activities. Quality control relies primarily on visual observations and remains poorly standardized in most companies. Finally, the overall level of education among workers is limited.

4.3 Identification of major difficulties

The interviews identified several categories of difficulties that could affect the management of processing activities. These difficulties primarily concern skills, planning, equipment availability, energy, certain socio-cultural factors, and financing. These difficulties are presented below based on the statements of the interviewees and the observations gathered.

4.3.1 Skills

Skills gaps are a frequently reported difficulty among the managers surveyed. In fact, 85 % of them specifically mentioned a lack of qualified personnel to operate equipment, a weak organizational culture, and a shortage of qualified maintenance staff. These constraints can complicate the use of production management tools and the rapid resolution of certain breakdowns. Respondents also indicated that the unavailability of technical skills can contribute to prolonged equipment downtime.

4.3.2 Planning and 5S

The results indicate that formalized production management concepts are still not widely understood by some of the respondents. Of the 32 respondents, 15 stated they were unfamiliar with the concept of production management, while eight were able to provide a rough definition. Respondents with a background in industry appeared to be more familiar with these concepts. Regarding 5S, some cleaning, organizing, and sorting practices are observed in companies, although formalized knowledge of the tool remains limited.

4.3.3 Equipment

Equipment maintenance is primarily carried out by external service providers. Furthermore, 51.85% of companies report having trained managers or production staff in basic maintenance procedures. Respondents from these companies report a more positive perception of equipment availability and operation. Difficulties associated with external interventions include response times, technician availability, and access to spare parts.

4.3.4 Energy

Access to electricity is a significant constraint for the companies studied. Approximately 70 % of the companies surveyed cited energy as one of their main operational difficulties. Some companies rely on generators to ensure business continuity. According to the data collected, this dependence can contribute to an estimated increase in production costs of between 20 % and 40 % in some companies. Energy instability can also limit the regular use of equipment.

4.3.5 Sociocultural factors

The interviews indicate that certain social and religious events can affect workforce availability and work organization. The managers interviewed reported a variable impact depending on the location and the level of formalization of the businesses. In some companies, events such as weddings, baptisms, funerals, or religious holidays can lead to temporary absences and, according to managers, production interruptions. The significance of these effects also appears to depend on internal absence management and support mechanisms.

4.3.6 Funding

Difficulties accessing financing represent an additional constraint for the SMEs studied. They can limit investment capacity in raw materials, equipment, transportation, and spare parts. They can also reduce companies' ability to build up inventory. In this context, financing appears as a crucial condition for business continuity and the gradual improvement of processing capabilities.

4.3.7 Summary of the diagnosis

The diagnostic analysis highlights several interdependent constraints affecting the operations of the studied cereal processing SMEs. These constraints primarily concern skills, planning, equipment availability, energy, financing, and certain socio-cultural factors. Lean management tools are not well known or formally understood by the respondents, even though some observed practices can be linked to Lean principles. These results suggest that any Lean implementation should be gradual and tailored to the resources, skills, and operating conditions of each company.

4.4 Contextualized Lean proposal

4.4.1 Contextualized Lean Overall Structure

Based on the diagnostic assessment, a contextualized Lean approach for cereal processing small and medium-sized enterprises (SMEs) is proposed. This approach aims to adapt certain Lean management principles to the human, organizational, technical, energy, and sociocultural constraints observed in the companies studied. It is structured around three complementary axes represented by the overall structure in figure 4: skills and organizational strengthening, equipment adaptation and maintenance, and continuous improvement.

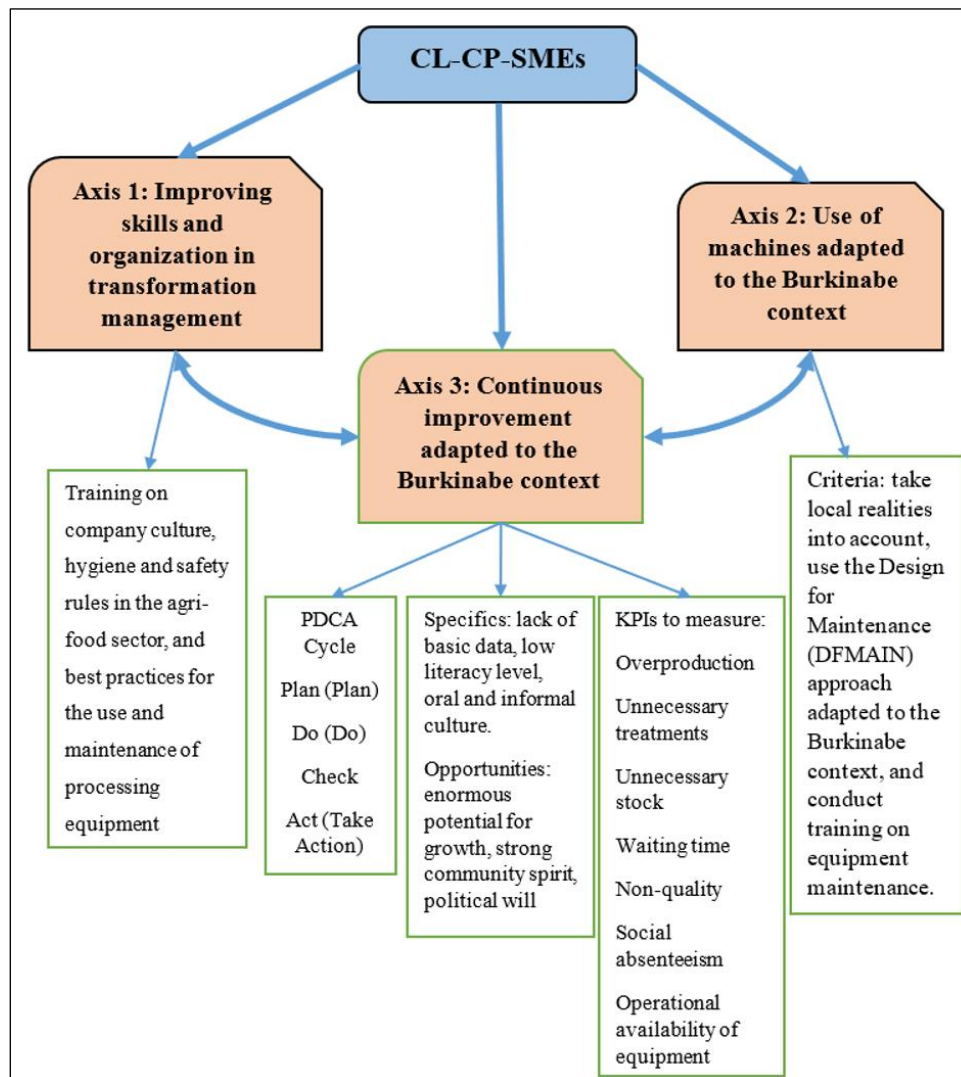


Figure 4: Overall structure of the CL-CP- SMEs

Figure 4 shows an interaction and interdependence in the realization of the contextualized Lean axes detailed below.

4.4.2 Axis 1 : Skills and organization

The first area of focus concerns skills development and the organization of transformation activities. The training offered should cover organizational culture, health and safety regulations, and best practices for equipment use and maintenance. The content and teaching methods should be adapted to the level of education, the working language, and the specific characteristics of the positions held. Hands-on training conducted directly at the workstations, supplemented by post-training support, could facilitate the adoption of these practices and promote the gradual introduction of tools such as 5S.

4.4.3 Axis 2 : Equipment and maintenance

The second focus is on adapting equipment to local operating conditions. Selection and design criteria should include local maintainability, spare parts availability, robustness, ease of use, adaptability to available energy sources, production capacity, and the potential for developing local maintenance expertise. This is a maintenance-oriented design approach.(32)This can serve as a framework. In the short term, improving first-level maintenance skills and organizing the supply of spare parts are avenues that can be explored.

4.4.4 Axis 3 : Continuous Improvement

The third pillar relies on the gradual implementation of a culture of continuous improvement. The PDCA cycle can serve as a management framework: plan action based on an identified problem, implement a solution on a small scale, verify the results using simple indicators, and then standardize or adjust the solution based on the results obtained. The indicators serve to measure and monitor performance; they are not themselves improvement mechanisms. They can relate to execution times, material waste, equipment downtime, quality, lead times, and certain production costs.

4.4.5 Implementation conditions

Implementing a continuous improvement approach in the SMEs studied must take into account several constraints, including the limited availability of historical data, varying levels of education, and the sometimes informal nature of management practices. These characteristics argue in favor of simple, visual, and easy-to-use tools, as well as practical on-the-job training. Leveraging collective capacities and existing support mechanisms can be a favorable factor, but this will need to be empirically assessed.

5 DISCUSSION

The results suggest that the implementation of Lean practices in the SMEs studied depends on several organizational, human, and technical conditions. Skills gaps, energy instability, and equipment-related difficulties can limit the application of formalized Lean practices. Sociocultural factors also appear, according to the statements gathered, to be likely to influence labor availability and work organization. These observations are consistent with research highlighting the importance of resources and organizational conditions in the implementation of Lean in SMEs (2.20).

The results also highlight an interdependence between several constraints. Maintenance difficulties can exacerbate the consequences of equipment shutdowns, while energy instability can reduce the availability of production capacity. Similarly, weak formalization of planning can limit the ability to anticipate certain disruptions. This interpretation aligns with sociotechnical approaches that consider human, technical, and organizational dimensions as interdependent (32,33).

The CL-CP-SMEs approach proposed in this study is a contextualization of Lean principles rather than a simple transposition of standardized practices. It emphasizes skills development, the progressive structuring of the organization, equipment maintainability, and continuous improvement. This proposal aims to bring Lean principles closer to the concrete operating conditions of the SMEs studied.

The three proposed areas (skills and organization, equipment and maintenance, and continuous improvement) could serve as a reference framework for studying other small and medium-sized enterprises (SMEs) in the processing sector with limited resources. However, their transferability cannot be assumed. It will need to be examined taking into account the sector of activity, the product processed, the equipment used, the level of formalization, and the social characteristics of the companies concerned.

The study has several limitations. The small sample size restricts the generalizability of the results. The primarily qualitative nature of the survey and the reliance on respondents' self-reporting may also introduce reporting bias. Furthermore, the study lacks pre- and post-implementation experimental measures to attribute a performance variation to the proposed approach. Future work should therefore test the CL-CP-SMEs with a larger sample and using simple, contextualized indicators.

6 CONCLUSION

This study aimed to characterize the knowledge, perception, and use of production management tools associated with Lean management in cereal processing SMEs in Burkina Faso and to identify the conditions necessary for their contextualization. The results highlight several constraints related to skills, planning, equipment, energy, financing, and certain socio-cultural factors.

The analysis also shows that Lean tools are still relatively unknown and poorly formalized in the companies studied, even though some existing practices can be linked to Lean principles. Based on these findings, a contextualized Lean approach for cereal processing SMEs (CL-CP-SMEs) was proposed, focusing on three key areas: skills and organizational strengthening, equipment adaptation and maintenance, and continuous improvement.

This proposal cannot, however, be considered definitively validated based solely on the diagnostic findings. The sample size and the primarily qualitative nature of the study limit the generalizability of the results. Further experimentation with a larger number of SMEs will allow for an assessment of the feasibility, adoption, impact on performance, and conditions for the long-term sustainability of the CL-CP-SMEs.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

Disclosure of conflict of interest

The authors stated that there were no competing interests.

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