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Proposing a Lean Manufacturing Framework Adapted to Very Small Businesses: Multiple Case Studies

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Abstract. Given the importance of the Very Small Business category and the need to successfully implement Lean Manufacturing in these companies, the objective of this paper is to propose a lean framework adapted to implement Lean Manufacturing in Moroccan Manufacturing Very Small Businesses. To achieve this objective, this paper spreads out a synthesis of multiple case studies in five Manufacturing Very Small Businesses operating in different sectors. The analysis of this case study leads to the development of a Lean implementation framework suitable for the specific characteristics of Moroccan Manufacturing Very Small Businesses. Thus, this paper's contribution is the elaboration of an implementation Lean Manufacturing approach, including steps, tools, methods, barriers to overcome, and critical success factors. The characteristics of this approach are that it comes from the real and successful experience of lean implementation in Moroccan Very Small Businesses, which ensures its success in the Moroccan context.

Keywords: Critical success factors; Framework; Lean tools; Lean manufacturing; Very small businesses

1. Introduction

Lean Manufacturing (LM) or lean production is the occidental version of the Toyota Production System (TPS) that appeared in Japan since the 1950s (Farissi *et al.*, 2021a; Driouach *et al.*, 2019). The LM aims to improve the company's overall performance by applying various tools, techniques, and methods (Ribeiro *et al.*, 2019; Roriz, Nunes, and Sousa, 2017). Over the past few years, Lean principles have been widely applied, both in small and medium-sized companies (SMEs) (Farissi et al ., 2021b; Baby and Jebadurai, 2018), as well as in large companies all over the world and also in Morocco (Arabi *et al.*, 2022; Bouazza, Lajjam, and Dkhissi, 2021; Bajjou and Chafi, 2018). Despite the multitude of Lean implementation frameworks presented in the literature, Very Small Businesses (VSBs) are still struggling to implement LM in their organizations because of the difficulties faced by these organizations (Driouach *et al.*, 2019; Antosz and Stadnicka, 2017; Zhou, 2016; Dora *et al.*, 2014; Rymaszewska, 2014; Matt and Rauch, 2013).

Very Small Businesses, VSBs, occupy a major position in the economies of developed and developing countries (Alfonso-Orjuela, Cancino-Gómez, and Perea- Sandoval, 2022; Harvie, 2019; Mbula *et al.*, 2019; Nomani and Sen, 2019). In Africa, firms with five to nineteen employees create about half of all new jobs (Page and Söderbom, 2015). In

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Morocco, more than 84% of firms generated annual revenues below 3 million dirhams, according to the Moroccan Office of Industrial and Commercial Property (OMPIC) barometer in 2017 (OMPIC, 2020). Most Moroccan companies are, therefore, small in terms of turnover criterion. Consequently, these companies must sustain themselves in the economic environment and continuously improve to survive and grow. The LM is today one of the most powerful production systems in the world that can ensure this. However, a review of the existing Lean implementation frameworks revealed major gaps in the literature and highlighted the lack of an appropriate framework for very small businesses (Driouach *et al.*, 2019).

In order to develop a new Lean approach that could be suitable for very small businesses (VSBs), we propose in this paper to carry out multiple case studies in Moroccan VSBs. This paper examines the Lean Manufacturing implementation process of a sample of VSBs through the selected case studies. Then it develops a new lean implementation framework appropriate to Moroccan VSBs' specificities. This framework proposes a recommended set of implementation steps, tools, barriers, and success factors that are derived from the successful experiences of five Moroccan VSBs. The VSBs covered in these case studies are from different business sectors and are diverse in terms of the number of employees and years of experience.

In order to achieve this paper's objectives, we start by explaining the methodology used to carry out the case studies. We proceed with a review of the lean processes adopted by the companies studied. Then we outline our survey results to propose an effective implementation framework for Lean Manufacturing in Moroccan VSBs.

This study allows professionals involved in Moroccan VSBs industries to dispose of a detailed roadmap for implementing lean. In addition, this research paper represents a platform for further contributions related to lean implementation in very small manufacturing companies in Morocco.

2. Methodology

In this study, we opted to use case studies. It is a qualitative method that employs several data collection techniques, such as questionnaires, interviews, site visits, observations, and analyses of internal documentation. This choice is justified by the fact that the case study methods are adapted to the exploratory nature of the Moroccan VSBs sector, and they provide an in-depth analysis of the selected cases. However, the case method has limitations, mainly because it rarely allows for a statistical interpretation of data.

This study aims to develop a framework that integrates all the elements necessary for implementing Lean Manufacturing in very small businesses. Therefore, we draw on the experiences of Moroccan VSBs that have successfully implemented Lean Manufacturing. We juxtaposed their approaches in order to develop a practical and specific implementation approach for VSBs. The framework includes the implementation process, steps, tools, success factors, and barriers to implementation. Figure 1 illustrates all the steps in our methodology.

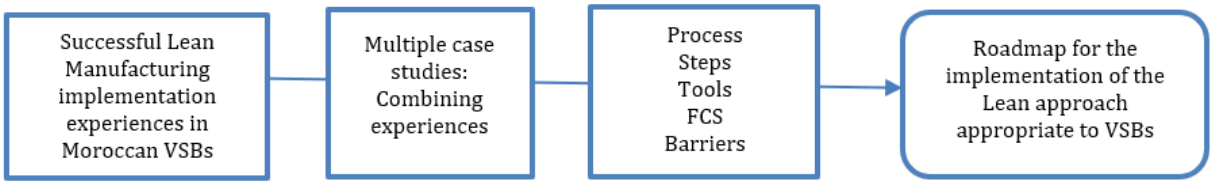

Figure 1 Methodology of the study

The multiple case studies in this paper are used to reproduce the lived experience and to illustrate different aspects of the cases studied by allowing the confirmation of the results obtained (Hancock *et al.*, 2021). Figure 2 illustrates all the steps of the approach followed in this study.

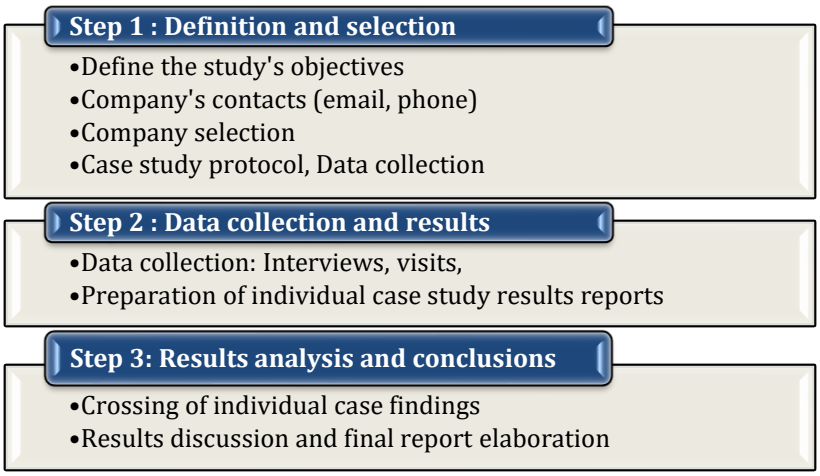

Figure 2 Process followed in conducting the case studies

The characteristics of companies A, B, C, and D, in which the case studies are conducted, are presented in Table 1.

Table 1 Main characteristics of the studied companies

	Activity sector	Number of employees	Turnover	LM implementation year	Interviewee profile
A	Food industry	15	Less than 3 million DH	2015	Supply chain manager
B	Printing and advertising	9	Around 1 600 000 DH	2014	Production manager
C	Textile manufacturing	18	Less than 3 million DH	2018	Company manager
D	Manufacture of refrigerating equipment	10	Around 2,000,000 DH.	2014	Quality manager
E	Production of cosmetics and personal care products	8	Less than 3 million DH	2013	Process manager

Analysis of the company characteristics in Table 1 reveals that although operating in different sectors, the selected companies share common characteristics. We note that all the targeted firms in our study have fewer than 20 employees, which concludes that they are included in the industrial VSB category. Similarly, all the studied companies have successfully implemented Lean programs for a recent period of fewer than eight years.

Data collection through interviews is an essential source of information used, especially in case studies (Gagnon, 2005). This study's data collection is based on semi-structured interviews, consulting the internal documents company, visits, and observations.

The interviews are conducted through a face-to-face survey for 45 minutes to 1 hour each. The questionnaire has three sections. The first section of the survey concerns general information about the company (activities, turnover, and the number of employees). The second section describes the culture and organizational structure of the company, and the third section includes details about the entire lean manufacturing project of the company

studied. The interviews are conducted with people directly involved in implementing the Lean program.

3. Review of Lean approaches adopted by the surveyed enterprises

3.1. Overview of the studied companies

- **Case A**: relates to a Moroccan VSB created in 2011 operating in the food industry, specializing in producing fresh vegetables raw, washed, peeled, cut, and packaged in specific packaging under ambient air or modified atmosphere in adapted bags. The firm is organized into three production workshops which carry out three types of operations: washing, preparing vegetables (peeled and cut), packaging, and the last area is reserved for cold refrigeration.

To satisfy the customers' growing demand, the company decided in 2015 to launch a project to increase its efficiency. Therefore, it was decided to start a lean transformation in the organization.

- **Case B:** concerns a small company founded in 2009, manufacturing products for sales promotion such as Displays, Distributor Displays, and POS Displays. The company has four production cells: printing, cutting, assembly, and distribution.

In order to differentiate itself from its competitors and manage large-scale projects, management recognized the need for an integral improvement project. It, therefore, initiated a Lean Manufacturing program.

- **Case C:** located in Agadir and has specialized since 1996 in clothing and textiles. It deals with the production of personalized clothing and the professional marking of textiles. The garment manufacturing process takes place in 5 workshops:
  - Textile graphics Workshop
  - Pattern-making and garment-cutting Workshop
  - Preparation and control of fabrics/choice of marking workshop
  - Textile confection or manufacture workshop
  - Packaging workshop

In 2018, in order to be more competitive, the company opted for the implementation of a Lean project.

- **Case D**: located in Casablanca and founded in 1994. It aims to manufacture refrigerating and electrical equipment, refrigerating doors, and insulating panels. The factory is composed of a design office and four workshops in particular sheet metal working, aluminum joinery, thermal insulation injection, and assembly to obtain a product ready for installation. The production in this company is done in a piece or small series. The workshops are handcrafted but equipped with technical and industrial means. The workshops are also separated, which creates the problem of transport and wasting of raw material in aluminum carpentry.

Since its inception, the company has been looking to earn significant market shares. In this view, it is committed to reducing production costs further, meeting delivery deadlines, and eliminating waste. Thus, management decided to implement the Lean program in 2014.

- **Case E**: located in Marrakech, specialized in the design, manufacture, and supply of cosmetic and personal care products. The company has three production lines.

To be more competitive, improve the work conditions, and increase its annual profit, the company's manager opted for a Lean transformation applied first to adequate product families.

Table 2 gives more information about the lean projects that unfolded in the studied companies.

Table 2 Duration and contributions of lean projects in studied businesses.

	Lean project duration	Project contributions
A	6 months	Increasing the production capacity by 30% (20 kg/day), reducing the waiting and movement time of the operators by 20%, reducing the changeover time by about 25 min, and reducing the customer complaints by 20%.
B	1 year	Increasing profit margin from 40% to 60%, 40% in production capacity, reducing customer complaints due to increased product quality, and the achievement of 0 delays.
C	6 months	Increasing production capacity by 15%, reducing waiting time by 20%, and customer complaints by 20%.
D	1 year	Increasing annual gain by 20%.
E	1 year	Increasing annual profit by 16%.

3.2. Lean project in studied Cases

3.2.1 Lean project implementation in case A

Lean transformation within the company is generalized to all workshops. Its insertion was progressive, starting with the workshop: preparation of vegetables. The project consists of three main phases: the pre-implementation phase, the implementation phase, and the generalization phase.

- During the "pre-implementation phase", the management designated the supply chain manager as a lean leader. He received appropriate training led by a lean expert for three days. In turn, he trained the "lean team". The Lean team first concerned themselves with the selection of the initial scope of implementation. Based on "timekeeping", the team chose the "vegetable preparation" workshop because it has the longest execution time. This phase ends with the project objectives definition, such as increasing the production capacity by 20%, reducing the number of customer complaints by 60%, and reducing the execution time.
- The "implementation phase" consists of four steps. First, the Lean team committed to improving the workshop by launching the 5S program. Next, modeling and analysis of the current situation in the workshop are generated using the VSM tool. Finally, opportunities for improvement are identified, and improvement actions are implemented.
- The "generalization phase" consists of extending the previous phase's objectives to the whole production process. It starts after the first results of the Lean manufacturing approach were obtained. In this phase, the Lean approach is taken up again for the two other workshops: the washing and packaging workshops. A work standard is elaborated to capitalize, and a tool monitoring the results is established.

3.2.2 Lean project implementation in case B

The general framework for the implementation of Lean Manufacturing in this second project includes three main phases: preparation phase, execution phase, and lock-in phase.

- The initial phase begins with the designation of the Lean Leader (Production Manager) and the creation of the Lean team. This step is followed by the precise definition of the project objectives, then carrying out a 3-day training program led by an expert consultant for the "Lean team" throughout the project. The first mission of this team is to proceed to a qualitative diagnosis of the level of maturity of the lean culture within the company to establish a master plan for implementing the lean. The preparation phase ends with the definition of lean indicators and the creation of a feedback mechanism in order to better evaluate the actions of the execution phase.

- For the execution phase, as in the first case C1, the first step is to upgrade the production floor by launching a 5S-Housekeeping program. The second step is modeling the current situation of the company. The analysis of the obtained mapping allows for redesigning the future situation, identifying improvement opportunities, and defining an action plan. In this phase, the company decided to eliminate waste throughout the value chain and minimize downtime using a set of tools: Preventive Maintenance Plan, SMED, and auto-maintenance.
- In the final phase, the team develops all the necessary work standards in order to capitalize on the best practices achieved and ensure the sustainability of the results.

3.2.3 Lean project implementation in case C

- In the pre-implementation phase, a multidisciplinary Lean team is formed. After being trained by an external expert, the team starts its first mission by selecting the first workshop in which the Lean project will start. The Workshop "textile confection and manufacture" is selected for its higher production cost. The Lean team then performs a qualitative diagnosis of the maturity level of the Lean culture within the company. Then, it establishes the master plan for Lean implementation. Finally, the team defines the Lean indicators that will allow the monitoring of the results.
- As in cases A and B, the Lean team begin the implementation phase by upgrading the "textile confection or manufacture" workshop with a 5S program. Then, an analysis of the company's current situation is carried out in order to design the future situation and identify improvement opportunities and finally to implement actions such as implementing a quality control process throughout the manufacturing process and visual management tools and standardizing the work process.
- In the generalization phase, the lean program is extended to other workshops. Also, work standard is developed to capitalize on the results. By implementing a tool for monitoring results (dashboard), the company has estimated that a saving of more than 60% of the total cost of waste has been achieved since the Lean program was set up.

3.2.4 Lean project implementation in case D

The company relied on a three-phase Lean Manufacturing implementation approach: preparation phase, execution phase, and locking phase.

- During the preparation phase: The management clearly expressed its commitment by defining the Lean project's objectives. Then, management appointed the "Quality Manager" as the "Lean Manager", who formed a multi-functional team including two technicians and two operators. This team received five days of initial training from a Lean expert consultant. Afterward, the team identified Lean indicators that will be used to evaluate actions to be undertaken.
- In the execution phase, a 5S upgrade program is initiated to reorganize the space and create an environment conducive to culture change. Afterward, the team addressed the analysis of the current situation using the "VSM". All production times are monitored and analyzed to highlight non-value-added activities in the process. Then, improvement actions are developed as pilot projects of work standardization to reduce raw material wastage, preventive maintenance projects, production stoppage costs, quality control projects, and non-conformity costs.
- The locking phase consists in elaborating working standards to capitalize on the best practices achieved. An IT tool is created to monitor results. In the end, the company estimated that over 30% of the total cost of waste (time and raw material) had been saved since the implementation of the Lean program.

3.2.5 Lean project implementation in case E

The Lean approach, in this case, unfolds in three phases: pre-implementation, implementation, and generalization.

- Initially, a team of three persons was nominated as the Lean team. It received a 5-day training by an external firm. Then, it carried out a "Pareto analysis" in order to select the initial Lean perimeter. The choice is made according to the product families with the greatest sales volume. Ten product families are retained to apply for the Lean program. Then, Lean objectives are set. The first phase ended with establishing key performance indicators (KPIs).
- In order to improve the working conditions, the Lean team started by organizing the workstations according to the 5S method. It then carried out a diagnosis of the current situation, and then improvement actions were drawn up to achieve the Lean objectives. The actions consisted of ensuring the standardization of manufacturing methods for the selected families and the training of all operators to enable them to perform auto-maintenance of equipment and reducing the changeover time by using the SMED method.
- In the generalization phase, the best practices were extended to all product families.

4. Implementing lean: Results from VBS case studies

This section presents the results of the case study through the analyses of different lean approaches in the Moroccan VSBs studied.

4.1. Lean implementation process

The lean implementation processes within the five studied VBS are all unfolding in 3 phases either pre-implementation, implementation, generalization or preparation phase, execution, and locking phases.

The companies that opted for preparation, execution and lock-in phases opted to implement lean to the whole process at once without selecting an initial perimeter. Contrary to those that opted for pre-implementation, implementation and generalization phases, they selected an initial perimeter and then generalized the lean approach to the whole process. The perimeter selection is made according to the following criteria:

- Production line or product family characterized by the highest production cost.
- Production line or product family with the highest annual production volume.
- Production line or product family with the longest production time.
- Production line or product family with the highest number of customer complaints.

Each phase is characterized by a series of steps summarized in Table 3.

We can resume from Table 3 that:

- In the first phase: all companies created a lean team, but only three appointed a team leader. They all trained the team, and the majority of them defined the project objectives and the Lean indicators.
- In the second phase: all companies started by implementing the 5S method since it is considered easy to deploy and less costly (Gupta, 2022; Rose *et al.,* 2017; 2011). They all performed the modeling of the current situation in order to identify opportunities, and then they implemented improvement actions.
- As for the third phase: three steps are capitalized by the majority of companies. These are "Capitalization and standardization of lean practices", "Generalization of actions by extending the lean perimeter" and "Monitoring results".

Table 3 Lean implementation process in the studied companies

Phase	Steps	A	B	C	D	E
Pre-implementation or preparation phase	Appointing a Lean Leader	×	×		×	
	Creating the Lean Team	×	×	×	×	×
	Training of the Lean team	×	×	×	×	×
	Defining the initial perimeter	×		×		×
	Defining lean objectives	×	×		×	×
	Qualitative diagnosis of the lean culture maturity level		×	×		
	Establishing the master plan		×	×		
	Defining Lean indicators		×	×	×	×
	Creating a feedback mechanism		×			
Implementation or Execution phase	Upgrading the production workshop by launching a 5S-Housekeeping program	×	×	×	×	×
	Modeling and analyzing the current situation	×	×	×	×	×
	Design the future situation and deduce the necessary "Kaizen Project".		×			
	Identifying the opportunities	×	×	×		
	Implementing improvement actions	×	×	×		×
	Implementing pilot projects				×	
Generalization or locking phase	Results monitoring (to evaluate the contribution of lean)	×		×	×	
	Developing work standards to capitalize on lean practices	×	×	×	×	×
	Extending the approach to other lines and other product families	×		×		×
	Ensuring the sustainability of the results and best practices achieved		×	×		

4.2. Lean tools and methods implemented in the surveyed companies

This section presents the set of lean tools and methods implemented by the companies in which the case studies are conducted. Table 4 summarizes the lean tools implemented during all phases of the lean process.

In the first phase, all the studied firms employed the same tools. The only difference is in defining the initial perimeter. Company A uses the timekeeping of production operations, company B uses cost analysis, and company C uses "Pareto analysis".

Frequently used Lean tools are:

- VSM: is considered a privileged way to support the Lean implementation approach (Kholil *et al.,* 2021).
- Visual management: is considered among the practices requiring the least financial investment (Rose *et al.,* 2011).
- Gemba walks: practiced by all the companies studied, where the manager is often in contact with the factory floor to identify waste and opportunities for improvement (Mičieta *et al.,* 2022).
- TPM: is not applied, but their pillars of "preventive maintenance" and "self-maintenance" are implemented (Driouach *et al.,* 2020).
- The dashboard and the standardization of work methods are implemented in the last phase.

In addition, each company employs a different set of specific tools according to the objectives outlined.

Table 4 Lean tools and methods implemented in very small businesses

	Tools	A	B	C	D	E
Phase 1	Training	×	×	×	×	×
	Employee multi-skilling	×	×	×	×	×
	Teamwork in groups	×	×	×	×	×
	Chrono-analysis	×				
	Cost study			×		
	Pareto analysis					×
Phase 2	5S	×	×	×	×	×
	VSM	×	×	×	×	×
	Visual management	×	×	×	×	×
	Gemba	×	×	×	×	×
	SMED		×	×		×
	TPM					
	Preventive maintenance	×	×	×	×	×
	Auto maintenance	×	×	×	×	×
	Production cell		×		×	
	Kanban				×	
	Uniform workload		×	×		
	Production smoothing			×		
	5 why			×	×	
	Statistical process control			×		
	Kaizen		×			
	PDCA	×				
	Quality circles		×	×		
	Small batch production					×
	Supplier management				×	
Phase 3	Work standards	×	×	×	×	×
	Scoreboard (performance management)	×	×	×	×	×

4.3. Critical success factors for lean implementation in VSBs

In order to develop a comprehensive approach to implementing the Lean approach, identifying critical success factors (CSFs) is also an essential step that will make managers' decision-making easier. These factors are summarized in Table 5.

Table 5 CSFs for lean implementation in MSEs

	Critical success factors	A	B	C	D	E
Phase 1	Leadership	×	×		×	
	Management commitment and support	×	×	×	×	×
	Alignment with overall company strategy		×			
	Long-term vision	×			×	
	Proper implementation methodology	×		×	×	×
	Training	×	×	×	×	×
	Competence and expertise	×			×	
	Appropriate selection of the Lean perimeter			×		
	Planning before implementation	×			×	
Phase 2	Culture change/organizational culture	×	×	×	×	×
	Financial support	×				×
	Communication	×		×	×	
	Improvements with small pilot projects				×	
	Time and resource allocation	×	×	×	×	×
	Employee involvement/motivation	×	×	×	×	×
Phase 3	Standardization and capitalization of best practices	×	×	×	×	×
	Performance measurement and KPIs	×	×	×	×	×
	Continuous improvement			×	×	

Table 5 shows that in the first phase, all companies recognize that "management commitment and support" and "training" are the most critical factors for implementing Lean successfully. In addition, some emphasize the importance of "proper implementation methodology", "leadership", and "communication", which is one of the approaches by which companies can seek to increase their competitive advantage (Qosasi *et al.,* 2019).

The CSFs considered primary by all VBSs in the second phase are "Cultural change/organizational culture", "Time and resource allocation", and "Employee involvement/motivation".

Finally, "standardization and capitalization of best practices" and "performance measurement and KPIs" are perceived by all companies as CSFs for the third phase.

4.4. Difficulties in implementing lean in VSBs

In order to inform VSBs about the obstacles that can affect Lean Manufacturing implementation, the following section focuses on the difficulties encountered by the studied companies during the Lean implementation process. Table 6 lists the various obstacles experienced.

Table 6 Obstacles to implementing lean in VSBs

	A	B	C	D	E
Lack of management commitment				×	
Lack of knowledge/understanding of Lean Manufacturing by management.					×
Poor belief in the approach and its benefits by management	×				
Short-term commitment from management			×		×
Employee's reluctance to change					×
Poor understanding of Lean concepts by employees.	×		×	×	×
Poor belief in the approach and its benefits by employees.	×		×	×	×
Increased workload	×	×		×	×
Lack of motivation		×	×	×	
Insufficient training	×		×		×
Difficulty in quantifying Lean benefits					×
Risk of lower productivity because of focus on the Lean project	×	×	×	×	×

From table 6, we conclude that the barriers related to "Risk of lower productivity because of focus on the Lean project" and "Increased workload" are the most cited by all interviewees. This can be explained by the small number of employees in VSBs. In addition, productivity is a puzzle, a complicated function where several factors act, and it needs to be solved (Woodhead and Berawi, 2020). This result aligns with those who state that Lean Manufacturing tends to increase workload and put more pressure on the staff (Baglin and Capraro, 1999; Landsbergis, Cahill, and Schnall, 1999).

5. Proposing an effective implementation framework for Lean Manufacturing in Moroccan VSBs

The previous section's findings are capitalized on as an integral implementation framework, including all the necessary elements to implement Lean Manufacturing in Moroccan VBS in the particular implementation process, tools, success factors and barriers. Contrary to existing models, this framework is directly derived from the VSBs' own experiences and thus considers their characteristics and specificities. Figure 3 presents our proposed framework.

The lean implementation process within the five studied VSBs unfolds in 3 phases either pre-implementation, implementation, generalization or preparation phase, execution, and locking.

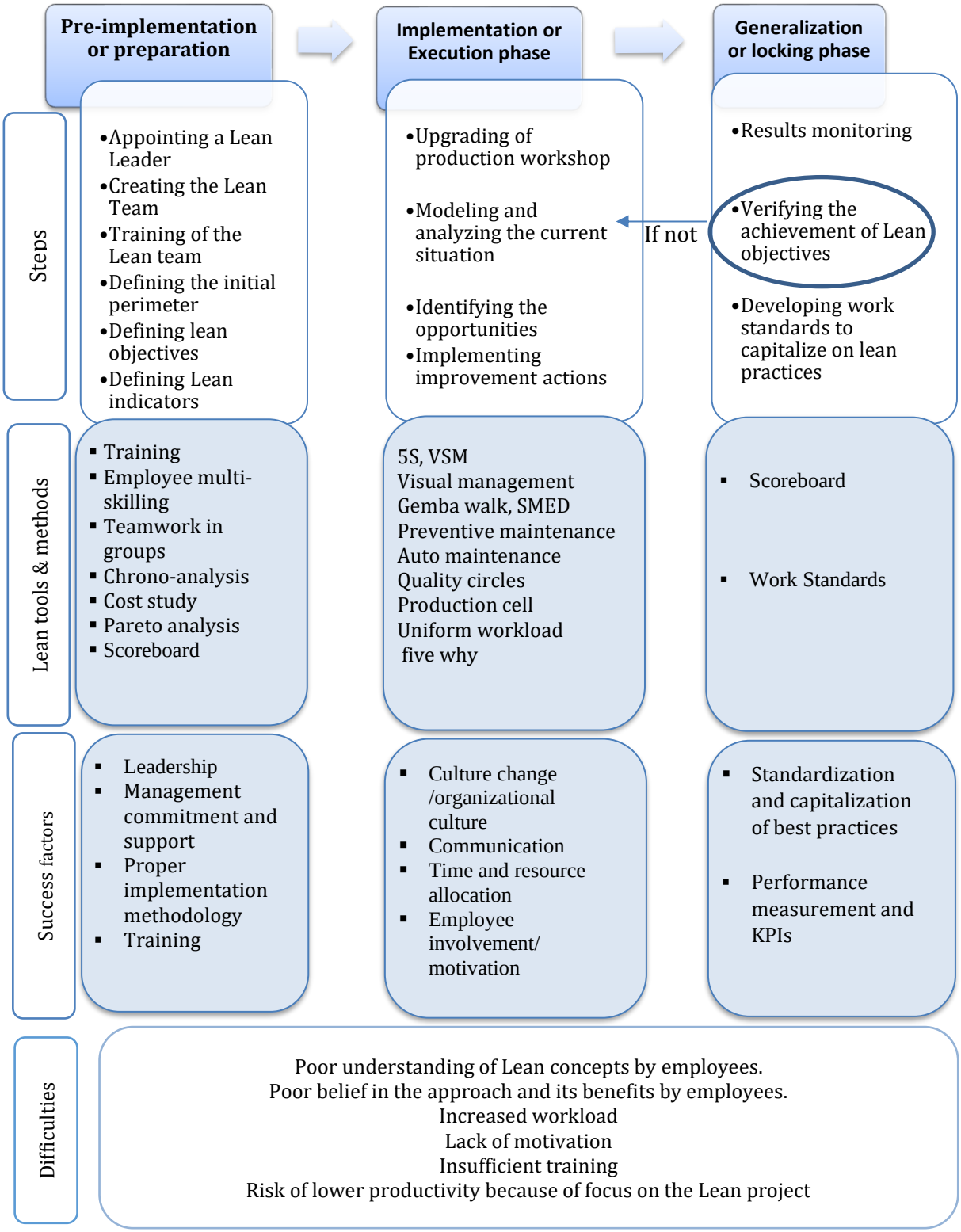

Figure 3 Proposed lean implementation framework in Moroccan VSBs

The first phase defines how Lean transformation will initially be integrated within the company. Top management begins this phase by expressing its leadership and commitment to the Lean project by appointing a Lean leader and creating a "Lean team". As a very small

business, the Lean team can contain few individuals, but it must be multi-skilled and adhere to the principles of teamwork. Training is provided by a Lean expert to ensure an initial impetus to introduce the Lean culture within the team, to avoid misunderstanding of the Lean concept by the employees and to reinforce the belief in the Lean approach and its benefits.

The second phase is the most time-consuming; to promote its success, we must allocate sufficient time and resources and involve all employees in the proper implementation of Lean projects (Arabi *et al.,* 2022; Elboq, Hlyal, and El Alami, 2020). The objective is to motivate them to increase their responsibilities and ownership of actions. Indeed, insufficient training, increased workload and lack of motivation are possible barriers that may appear and end up materializing into real problems.

In the third stage, it is important to monitor the results of the Lean project through dashboards to measure and compare the performance achieved regularly. If the initial set of Lean goals is not achieved, a return to mapping the current situation is necessary (see Figure 3). If not, best practices should be capitalized, standardized and shared. This is to ensure the sustainability of the Lean culture in the company.

6. Conclusions

This research work is one of the first analyses that relate Lean Manufacturing to VSBs. The case studies carried out are capitalized upon in a roadmap derived directly from VSBs' experiences. The proposed framework includes all the elements necessary to implement Lean Manufacturing in VSBs, including the implementation process, the tools, the success factors and the barriers to success. The framework developed in this work can be useful to stakeholders in very small industries, such as contractors, consultants and owners, and especially government agencies. It could be applied to very small industries to validate it and identify areas for improvement. While the study meets its objectives, it has some limitations, as with any research study, such as the reluctance of the companies to welcome us to answer the questions of the surveys and especially to visit the workplaces and verify the results of the Lean transformation. We certainly tried to have as many case studies as possible. But the survey could contain a larger number of companies and therefore be more representative.

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