Towards Implementing Lean Manufacturing in Very Small Businesses in Morocco: Qualitative Exploratory Study

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***Abstract*—Today, very small businesses (VSBs) play a very important role worldwide due to their great employability and strong presence in the economic fabric. Hence, VSB should introduce an organisation system to improve both quality and productivity continuously. Organizations around the globe are opting for implementing Lean manufacturing to eliminate wastes and increase productivity. This research paper aims to promote lean thinking through studying the readiness of VSBs to adopt the lean manufacturing philosophy. In addition, this study focuses on the application level of lean tools. It also aims to investigate the current level of waste awareness in very small manufacturing industries in Morocco. A survey-based on semi-directive interviews is conducted among 16 very small manufacturing industries stakeholders. The main findings pointed out that lean manufacturing is not yet known by VSB in Morocco. However, managers are willing to adopt any tool that allows improvement, particularly Lean tools. The results show that some Lean tools are already applied in VSB such as autonomous maintenance, preventive maintenance, quality circle, 5S and SMED.**

***Keywords*—** *Implementing, Lean tools, Wastes, Very Small Businesses VSB, Morocco, manufacturing industries, lean readiness, survey*

1. Introduction

Lean manufacturing (LM) or lean production was initially developed as part of the Toyota Production System in Japan in the 1950s [1]. LM is a unified system that entailed with a set of philosophies, rules, guidelines, tools and techniques aimed at eliminating significant waste in all business processes for continuous improvement [2]–[4]. It is now one of the most powerful manufacturing systems in the world. Many organizations are enthusiastic to adopt lean manufacturing in order to improve their performance in this competitive globalized market where uncertainty is prevalent, as evidenced by the global health crisis due to COVID-19. This model has already proven its efficiency in large companies, and SME [5], [6]. However, studies on the implementation of lean in very small businesses (VSBs) are still limited [7].

VSBs play a leading role in the economies of developed and developing countries [8]–[10]. In Africa, firms with five to nineteen employees generate about half of new jobs [11]. In, Morocco, more than 84% of companies generated annual revenues of less than 3 million MAD according to the Moroccan Office of Industrial and Commercial Property (OMPIC) barometer in 2017 [12]. On the other hand, only 0.5% of Moroccan companies were able to generate revenues of more than 175 million MAD in 2016 [13]. This is explained by the fact that almost all Moroccan companies are small structures, in terms of the turnover criterion.

Very Small businesses represent an important driving force behind the Moroccan economy. In fact, 98% of the Moroccan companies employ less than 10 employees [14], [15] and offer employment to more than 75% of the workforce [16]. Consequently, these companies must ensure their sustainability in the economic environment and continuously improve in order to survive and grow. However, their economic and professional environment was not conducive to its development [17]. Thus, to ensure the efficiency and sustainable development, the Moroccan government introduces a policy for supporting small businesses. Several programs were introduced such as IMTIAZ, INTILAK, TATWIR,

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Innov'Act, aimed at improving the VSB effectiveness through three initiatives: small businesses growth, strengthening of their competitiveness and creation of competitiveness for new ones. The INMAA program is one of the measures taken by the Moroccan government, which aims to promote operational excellence "Lean manufacturing" within companies in order to increase their competitive capacity. Hence, this exploratory study attempts to investigate the level of readiness for lean implementation, to evaluate the level of wastes awareness and to assess the understanding of Lean methodology in very small Moroccan manufacturing companies. A global overview of the current status of lean implementation in very small Moroccan industries is urgently needed as no such studies have been done before in the Moroccan context. Therefore, this paper purposes are:

- Exploring the current level of waste awareness among very small industries in Morocco.
- Assessing the readiness for lean implementation among very small industries in Morocco.
- Outlining the recognized lean practices by stakeholders among very small industries in Morocco.

This study will enable professionals involved in a very small industry such as contractors, consultants and owners, as well as the government agencies, to have an initial understanding of the level of readiness for the Moroccan professionals to implement lean. Furthermore, this research paper represents a platform that would allow performing further contributions related to lean implementation in the very small manufacturing companies in Morocco.

2. Literature review

Lean manufacturing (LM), also known as Toyota Production System (TPS), has influenced the manufacturing sector around the world. It was developed and refined between 1945 and 1970 and is still growing today all over the world [18]. LM is a set of principles, tools and techniques designed to reduce the cost and to improve productivity by eliminating all sources of inefficiency and wastes throughout the whole value chain [3].

Waste (Mudas in Japanese) is a product or a service that the customer does not wish to pay for [19]. LM aims to identify and eliminate waste in all aspects of business by increasing the value from the customer's perspective. Ohno has identified seven types of waste [1]; an eighth waste has been added by Liker based on non-utilized potential [18] (see Table 1)

Table 1. Definitions and examples of waste adapted from [20]

Definition	Examples
Overproduction Producing more than the demand required by the customer	Producing more than the customer demands, or producing it too early before it is needed
Defects Manufacturing defective products or products that need to be rectified	Design, manufacturing, inspection errors, repetitive defects
Inventory Store quantities greater than the quantity required for the next step in the manufacturing process	Having unnecessarily high levels of raw materials, works-in-process and finished products
Transportation Movement of materials that does not add any value to the product,	Moving materials between workstations.
Waiting It is idle time for workers or machines	Waiting for information, tools, approvals, quality control, rework. Bottlenecks
Motion Unnecessary physical motions or walking by workers which divert them from actual processing work.	Walking around the factory floor to look for a tool, or even unnecessary or difficult physical movements, due to poorly designed ergonomics,
Over-processing It is unintentionally doing more processing work than the customer requires in terms of the product quality or features	Polishing or applying finishing in some areas of product that will not be seen by the customer
Non-utilized potential Waste of time, ideas, skills by not taking employees' ideas into account	Doing tasks that can be eliminated, lack of involvement, absence, low productivity

Shah and Ward identified 22 LM practices and categorized them into four bundles associated with just-in-time (JIT), total quality management (TQM), total preventive management and human resources management [21]. Hodge has developed a conceptual model with 20 tools grouped in six categories: visual management, objective deployment, quality methods, work standardization,

just-in-time and improvement method [22]. Other researchers have also classified Lean tools and techniques according to their field of implementation [23], [24].

Very small companies are struggling to use Lean tools and practices because of their limited financial and human resources [25]. Several studies have aimed to identify and propose lean tools that can be adapted to small companies. Indeed, Rose et al [26] found that the best Lean practices are: reducing installation time, Kanban, small batch production, supplier management, preventive maintenance, multifunction employees, uniform workload, visual control, employee involvement (quality circles), total quality management, training, teamwork, production leveling, continuous improvement, 5S and standardization. Among those Lean practices that require less financial investment are 5S, visual management, standardization, Statistical Process Control (SPC) and quality circles [26]. For Rose et al the implementation of 5S is the easiest of all Lean practices [27]. According to a survey conducted in small Polish companies, LM practices that were implemented (in decreasing order) are 5S, 5why, SMED, group work, standardization, TPM [28].

Only a few studies have focused on the implementation of lean manufacturing practices in very small-sized enterprises [28]–[35]. In fact, there are gaps in the literature related to lean implementation in small and very small businesses. This paper aims to enrich the body of knowledge regarding the studied research field.

3. Context

VBSs are classified according to the realities of each country's market. The European Union defines very small businesses as those companies with less than 10 employees or the annual turnover may not exceed 2 million € [36]. In France, INSEE defines "Very Small Firms" as companies with less than 10 people, or 20 for Very Small Industries [37]. The term "very small businesses" can, therefore, be used for both "0 to 19" and "10 to 19" employees [38].

In the United States, the SBA-Small Business Administration circumvents the problem with a certain pragmatism; it does not impose any rigid rule but suggests a definition depending on the company's activity [39]. Although there is no definitive definition, some sources define microenterprises as employers with fewer than 10 employees [40].

In Morocco, a VSB is defined as an employer with fewer than 10 employees [15]. To classify VSB Morocco use another quantitative criterion which is the turnover. Any enterprise with a turnover of less than 3,000,000 MAD excluding value-added tax per year is a very small enterprise [41]. In Morocco, a distinction is made between informal and formal units. Indeed, the structure of the VSB sector in Morocco includes formal VSBs, which number 733,000 according to the last economic census of 2001/2002 [42], and informal production units, which increased from 1.233 million in 1999/2000 to 1.550 million in 2007 [43].

Morocco's economic fabric is strongly dominated by micro-units, but some difficulties have been noted in determining the exact unit numbers. These difficulties are mainly related to the presence of the informal economy in Morocco. However, all sources agree that 98% of enterprises employ fewer than 10 employees [14] and employ more than 75% of the active population [16].

According to a joined study done by both the Ministry of Industry and the French Embassy, VBSs represent 1,464,000 companies and 2,420,000 "employed" people, i.e. 53% of the active population in urban areas [14].

In this study, the sample considered includes 87% of industrial VSBs with fewer than 10 employees and 13% of companies with 10 to 20 employees. This selected companies with more than 10 employees are operating in a labor-intensive sector such as textiles and restaurant industry (figure 2).

4. Research methodology

This survey is based on a qualitative exploratory study that is conducted to evaluate the readiness of small businesses to implement Lean. Sixteen face-to-face interviews lasting 45–90 min were conducted to gather participants' opinions about implementing lean manufacturing. Interviews took place inside these companies' make it easier to walk around their workshops and take notes at once. General information about every company were collected from participants. Moreover, all interviews were tape-recorded and workshops were pictured.

This research methodology has been used for its advantages in understanding the human experience in specific settings, describing of participants' feelings, opinions, and experiences [44]. In addition, it allows participants sufficient freedom to determine what is consistent for them [44]. The qualitative approach is also cost-effective. The

research process followed in this study can be seen in Figure 3.

The study included a mixture of practitioners and organizations, as shown in Fig.1 and 2. The survey targeted a diverse population according to a certain number of criteria: fields of specialization, experience years, number of employees, educational level. This diversity aims to provide a balanced view of the research topic. Besides, All the participants contributing to this research are managers of their companies distributed as follows: 75% of the participants are owner-managers of the company, and 15% are managers employed by the owner. Therefore, VSB is usually managed by its owner.

In this study, we adopted a saturation criterion to determine the number of respondents. The sample size is determined when saturation is reached, i.e. when the agreement between respondents on the problems is reached, and disagreement is explained [45]–[47]. A total of 16 interviews were conducted before the saturation described above was completed

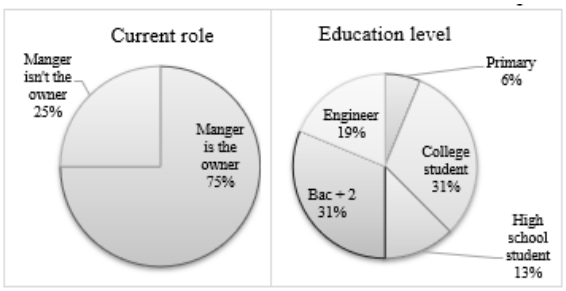

Figure1. Distribution of the sample in percentage (clustering of individuals)

The interview guide on which the survey is based includes two major parts. The first part is designed to obtain general information about the enterprise and the participant. The second part attempts to find the answers of the following questions:

- Q1. What is the current level of familiarity with the Lean practices in Very Small Moroccan Manufacturing Industries?

This question seeks to identify the lean practices that business managers know and either fully or partially apply,

- Q2. What is the current level of awareness of wastes (MUDA) in Very Small Moroccan Manufacturing Industries?

This research question aimed to detect the sources of waste that small businesses managers recognize and try to remove.

- Q3. What is the current level of readiness to apply lean in Very Small Moroccan Manufacturing Industries?

The purpose of this open question is to have an idea of how small businesses can adopt lean manufacturing.

Field notes were made of observational visits and explored alongside interview transcripts to evaluate readiness for lean system adoption within very small Manufacturing industries.

The data was analyzed through thematic analysis with the use of a conceptually clustered matrix [48] (appendix1). Conceptually clustered matrix is rows and columns arranged to bring together items that belong together. A prior derivation or empirically driven may be ordered by persons or themes or both.

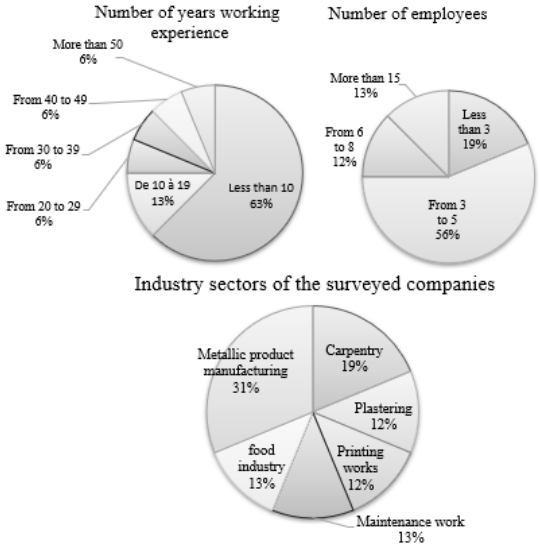

Figure 2. Distribution of the sample in percentage (clustering of organization)

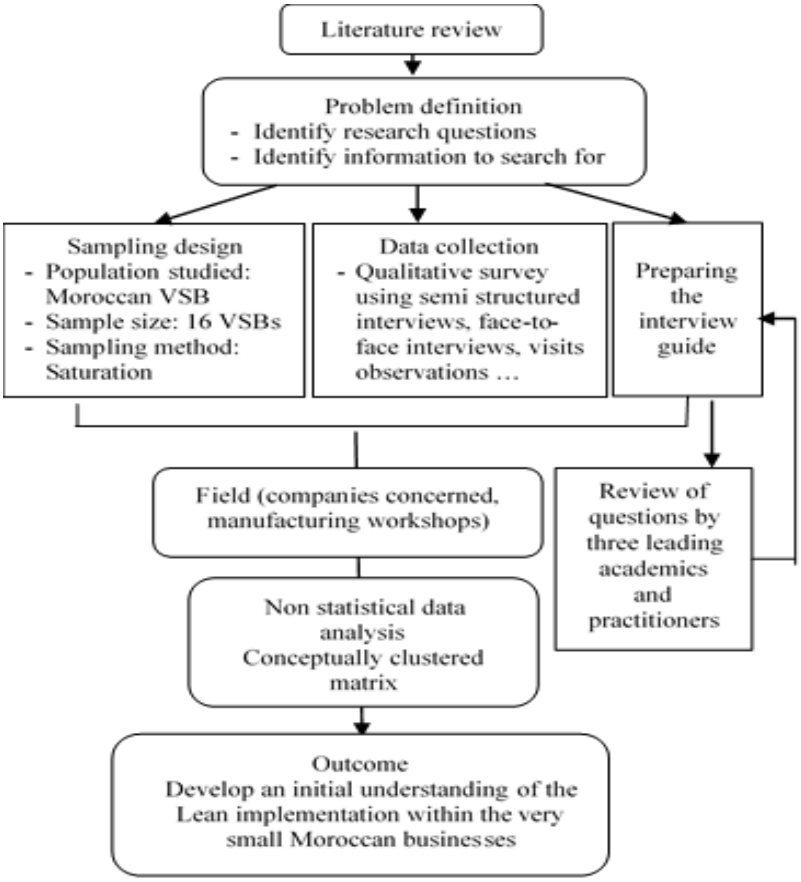

Figure 3. Exploratory research design

5. Findings

All data collected are grouped in one matrix according to their conceptual coherence (appendix 1). Thus, each line presents a respondent, where companies are grouped by sector of activity. In addition, the columns are grouped according to the themes being studied: Familiarity with the Lean practices; Awareness of waste issues; Readiness to adopt LM. The results obtained from the research and analysis of the matrix are presented and discussed in the following sections.

5.2 Lean techniques implementation in very small businesses.

The analysis of the second column of the matrix (Appendix 1), which represents the responses related to the implementation of lean tools, showed that at least 8 lean techniques are currently being used in Moroccan VSB (in various forms and degrees). In fact, most practitioners are using them in their projects without being aware of it. The study also show that more than half of the sample studied is unfamiliar with Lean practices and has never heard about them. While the minority is partially familiar with lean practices (company 15,8,9 whose managers have two years of higher education and have received Lean training) and another minority knows Lean tools (companies 16 and 11 whose managers are engineers).We can conclude that participants having higher academic level are familiar with lean practices, as they were trained on several techniques during their academic studies.

Figure 4 shows that there are some techniques that are already implemented by more than half of the respondents such as autonomous maintenance, preventive maintenance, quality circle, multifunction employees (multiskilling). However, the responses to some other lean techniques do not reflect the same thing. For instance, most of professionals in the manufacturing industry are not familiar with some techniques such as visual management and SMED. This is because these techniques are newly introduced in the Moroccan context and there is not much training for these techniques.

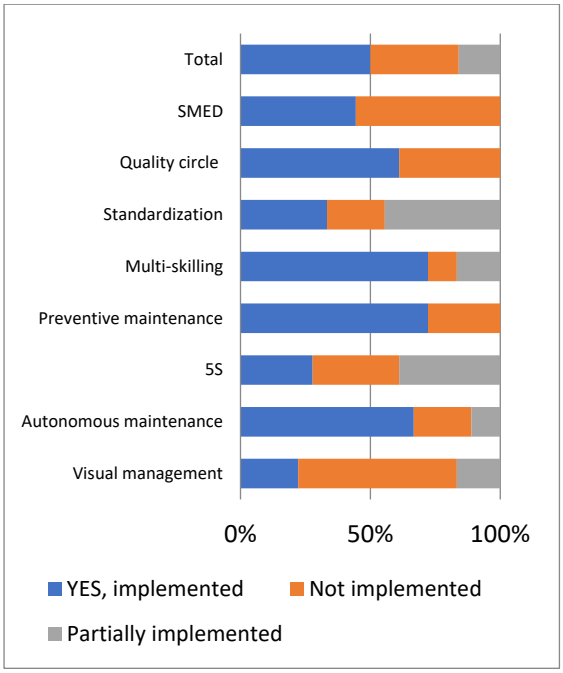

Figure 4: Current level of application of lean practices among Moroccan VSB

Most of the sample studied consisted of respondents with a low academic level, while only a minority had a good level of academic study (figure 1). Hence, we can state that there is a correlation between the academic level and familiarity with management techniques.

The research findings reveal a low awareness level of lean practices among Moroccan small businesses compared to other countries; especially, in developing countries. For instance, 28 per cent of surveyed companies working in Kuwait are claimed to be familiar with lean manufacturing concept. So, we can conclude that lean manufacturing is still in its infancy in the very small Moroccan industry.

5.3 Level of wastes awareness in very small businesses

The continuous improvement using waste elimination has been emphasized as the most important task of modern organizations [49]. In fact, the elimination of waste is a very important preliminary step in the implementation of a lean system [50], [51]. The first step in reducing wasteful spending is to identify waste [52]. Indeed, in order to help managers to recognize wastes type and encourage them to pay more attention to the importance of eliminating non-value-added activities, we asked managers and practitioners about all types of waste they might experience.

Discussions with respondents made it possible to identify among the 8 wastes those they know. Indeed, figure (5) and the third column of the matrix (Appendix 1) show that waiting times, defects and motion waste are the three most recurrent wastes among the surveyed companies. In contrast, overproduction was less mentioned.

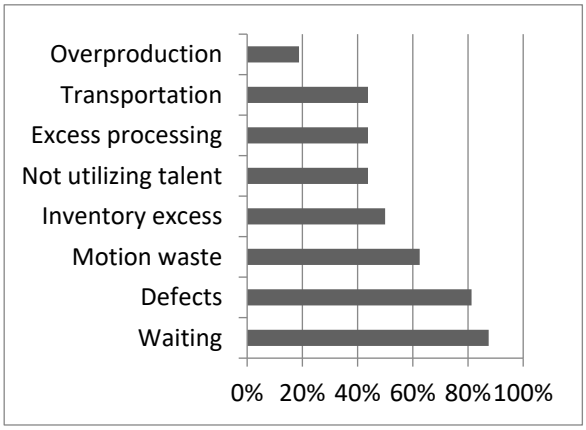

Figure 5: Rate of wastes detected in the surveyed companies

Most of the sample studied is comprised in companies that produce to order, which may explain why waste related to overproduction represents only 19%. While the lack of training and the educational level of employees can justify high rates of other wastes.

5.4 Level of readiness of very small businesses to adopt Lean.

In order to identify the point of view of practitioners involved in VSB, respondents were asked about their readiness to adopt Lean manufacturing. The question is formulated as follow: what do you think about implementing a new Japanese approach, which we call "lean manufacturing", whose implementation has generated significant benefits for both SME and large companies? This question was open, and responses were presented in the fourth column 4 of the matrix. Indeed, most of the answers to this question were positive, respondents agreed to adopt Lean Manufacturing if it can add positive impact on company's performance. However, some interviewees expressed the need for motivation in terms of financial support and Lean training, as shown by companies 1, 7, 8, 12, 15 (appendix1). Thus, companies should benefit from trainings, a financial support and an adequate allocation of time and resources when implementing LM [53]–[61]

Finding show that some practitioners are reluctant to make any changes, as reflected in company 5, 6, 9, 14 (appendix 1), this can be attributed to their ignorance of the Lean approach. Manager's level of education influences also the Lean's readiness, as there are managers who only believe in their experience. Some of them consider lean as waste of time while others don't think Lean as a priority and focus only on profit. Therefore, lack of knowledge, poor understanding of Lean, lack of support are among the most important obstacles within the Moroccan VSBs.

There is another category of respondents them who are not sufficiently convinced by Lean and who therefore have their pretext not to improve their work such as: need for spacious workspace, need for time, heavy workload. This seems normal since these people do not know Lean and its benefits.

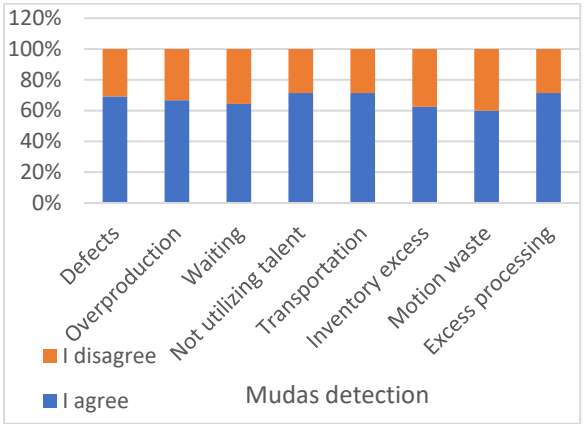

Figure 6: Distribution of the sample according to the agreement on lean and Mudas presence

Figure 6 shows that wastes are significantly detected in companies that have agreed to implement the Lean program, which is explained by the high level of waste awareness within these companies. This is in line with the results of a survey of 49 companies (53% medium and 14% micro) which revealed that 94% of the companies confirmed that waste elimination is their main objective behind the implementing LM [28]. In addition, companies are starting to apply LM on the production chain that produces the most important waste [27]. Thus, waste elimination is among the most important objectives of the Lean project also in Moroccan VSB.

The analysis of the results also revealed that when the manager of the company is himself its owner, he is more interested in improving his business, unlike the non-owner manager. Which illustrate that the Top management commitment is one of the important success factors in the implementation of the Lean approach [27], [55], [58], [62]–[64]. In fact, many SMEs failed their first Lean implementation test due to weak management commitment [27]. Moreover, the Management commitment helps employees to understand the new Lean implementation project [27]

6. Conclusion

This current study was firstly conducted to assess preparedness for adopting Lean Manufacturing in Very Small businesses (VSBs). Secondly, to evaluate their awareness level of waste; and thirdly to apprehend the Lean techniques that are deployed in these companies. This study is based on a qualitative exploratory survey addressed to the professionals and managers working in very small Moroccan industries.

This study provides a global overview of Lean implementation possibilities in VSBs. It contributes to the body of knowledge, as it offers for the first time a new insight into the level of preparedness to implement Lean manufacturing in very small companies. Hence, it could be considered as an initial step towards a better understanding of managers' behavior when launching future Lean projects in very small organizations.

The results of this study show that most of respondents are not familiar with Lean Manufacturing. However, many interviewees have a strong desire to improve their company's performance, although some of them expressed the need for financial support and training. The ignorance of the lean approach and other factors lead other interviewees to disagree with lean implementation.

The paper shows as well that very VSBs could face problems in implementing Lean Manufacturing because of limited resources, compared to SME and large organizations. But the implementation of feasible practices and low-cost consumption such as 5S, autonomous maintenance, preventive maintenance, employee involvement, visual management, can strengthen the company's internal capability to implement Lean manufacturing successfully.

Another important area worth exploring is waste awareness in organizations. By exploring the potential wastes identified in VSBs, it was noticed that the Moroccan manufacturing professionals recognize the importance of waste elimination to achieve performance.

The findings of this study could prove valuable to other African countries, particularly those having the same Moroccan context. Further research should be performed to identify the most common critical

barriers hindering a successful Lean deployment in VSBs to develop an implementation strategy adapted to the requirements of the Moroccan context. Moreover, we recommend carrying out case studies in different VSBs to conceive a roadmap for Lean implementation.

Limitations for research can be found in the selection of Lean practices to design the survey. To keep the study as simple as possible for VSB management, the research team selected 8 Lean practices. Eventually, an extended survey with a higher number of Lean practices would bring new insights.

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Appendix 1: Conceptually clustered Matrix

Research questions / Respondents		Familiarity with the Lean practices	Awareness of waste issues	Readiness to adopt lean
Carpentry	**Enterprise 1** Woodworking	• For all carpentry companies, interviewees are not familiar with lean manufacturing • The Lean practices applied by company 1 are: autonomous maintenance, preventive maintenance, multifunction employees. About standardization, the work is standardized, but there is no visual display to show these standards. In terms of training, the most experienced employee trains new workers	• All carpentry companies produce on demand. • The wastes detected in the company 1 are: waiting; transportation; defects; inventory excess; motion waste; excess processing	Enterprise 1 recognizes the benefits of adopting new management tools and does not consider them a waste of money but is not willing to waste time due to the heavy workload.
	Enterprise 2 The manufacture of personalized decorative objects in wood and aluminum	• The Lean practices applied by company 2 are: autonomous maintenance, preventive maintenance. For the 5S, it is partially applied, the manager in fact believes in the importance of the organization (5S) but he can't maintain this tool for long time. Visual management is partially applied as it is used only for marketing purposes	The wastes detected in the company 2 are: waiting; defects; excess processing	The manager believes in progressive continuous improvement and agrees to adopt lean.
	Enterprise 3 Aluminum joinery	• Lean practices applied by the company 3 are: standardization, preventive maintenance, multifunction employees, 5S and partially used autonomous maintenance	The wastes detected in the company 3 are: waiting; transportation; inventory excess; not utilizing talent; motion waste	The manager recognize that the organization is the secret to success because it will create a healthy environment for employees and customers, so he is agreed with adopting le lean
Plastering	**Enterprise 4** Plastering	• For all plastering companies, the interviewee is not familiar with lean manufacturing • The Lean practices used by the company are autonomous maintenance, preventive maintenance, multifunction employees, quality circle and partially implementing 5S, visual management and standardization.	• All plastering companies produce on demand and on stock (make to stock). • The wastes detected in the company 4 are: waiting; transportation; defects; overproduction; inventory excess; not utilizing talent;	The plasterer is aware of the organizational culture importance and its benefits. He is also aware of minimizing waste importance. He prefers not to deal with all tasks, so he is convinced by the need for training, visual management and task standardization.

			motion waste; excess processing	
	Enterprise 5 Plastering	• Lean practices used by the company 5: multifunction employees, SMED,	• The wastes detected in the company5 are: Motion waste	The respondent is reluctant to change, he has reduced Lean Manufacturing to a single tool (visual management) and confirms he does not need this technique.
Printing works	**Enterprise 6** Printing works	• For all Printing works companies, the interviewee is not familiar with lean manufacturing practices • The Lean practices applied by the company 6 are: preventive maintenance, quality circle, SMED. The Lean tools partially implemented are visual management, 5S, standardization, multifunction employees (the graphic designer has a specialized task) and autonomous maintenance which is not easy in case of a difficult failure	• All printing companies produce on demand. • The wastes detected in the company 6 are: waiting; defects; inventory excess; not utilizing talent; excess processing	The manager disagrees with lean adoption because he sees that he partially applies the Lean methods, he does not need to add any other methods.
	Enterprise 7 Advertising agency and printing work	• The Lean practices used by the company 7 are: visual management, preventive maintenance, quality circle, SMED and partially multifunction employees (the designer has a specialized task). • Manager is opposed to 5S, because in our culture, disorganization attracts customers. The client believes that there are many demands in this company	• The wastes detected in the company 7 are: waiting; defects; not utilizing talent	The company is ready to adopt the LM, but above all it must guarantee the stability and sustainability of its business in the Moroccan economic environment.
Maintenance work	**Enterprise 8** Automotive maintenance	• Both companies have an overview on lean manufacturing practices • The Lean practices applied by the company 8 are: autonomous-maintenance, quality circle, multifunction employees, standardization, preventive-maintenance	• All maintenance companies produce on demand. • The wastes detected in the company 8are: waiting; defects	The manager is willing to implement Lean manufacturing tools when time allows and when he will have a more spacious workshop (he needs motivation)
	Enterprise 9	• The Lean practices applied by the company 9 are: multifunction employees, autonomous maintenance	• The wastes detected in the company 9 are: waiting;	The manager refuses the proposal to introduce any improvement tool, he

	Electrical work and maintenance		transportation; not utilizing talent	believes in his experience and monopolizes the technical work, he is reluctant to any change.
Food industry	**Enterprise 10** Baking and confectionery production	• The respondent is not familiar with lean manufacturing • The Lean practices applied by the company 10 are: autonomous-maintenance, preventive-maintenance, multifunction employees, standardization, quality circle, SMED	• The wastes detected in the company 10 are: waiting; transportation; defects; overproduction; inventory excess; motion waste • Company n°10 produce for stock based on demand forecasts	Manager disagree with lean adoption because of the lack of free time, and tight workspace, which prevents any improvement
	Enterprise 11 Restaurant sector	• The respondent is acquainted with lean manufacturing practices • Lean practices practiced by company 11 are: visual-management, autonomous-maintenance, multifunction employees, standardization, quality circle, SMED and partially applied 5S (complying with 5S rules is difficult due to the mindset of employees)	• The wastes detected in the company 11 are: defects; overproduction; inventory excess; not utilizing talent; motion waste; excess processing • Make to order	the responsible knows Lean and is committed to implementing it to reduce waste in raw stock levels. Employees are in favor of Lean if it will organize the work and minimize efforts
Metallic product manufacturing	**Enterprise 12** Mechanical workshop (turning, milling, drilling)	• Companies 12,13,14 are not familiar with lean manufacturing practices, company 15 has an idea about some lean tools, company 16 knows the Lean production concept • The lean practices applied by the company 12 are: quality circle, multifunction employees, autonomous maintenance. 5S and standardization are partially applied	• All Metallic product manufacturing companies Make to order • The wastes detected in the company 12 are: defects; excess processing; waiting; not utilizing talent; transportation; inventory excess	Manager agrees with lean, but the introduction of new management methods depends on the existence of free time
	Enterprise 13 Manufacturing of the repair or replacement parts	• The lean practices applied by the company 13 are: quality circle, preventive-maintenance, multifunction employees, autonomous maintenance. 5S and standardization are partially applied	• The wastes detected in the company 13 are: waiting; transportation; defects; motion waste	Manager is interested in Lean manufacturing, especially to decrease work accidents

	Enterprise 14 Welding	• The lean practices applied by the company 14 are: SMED, preventive-maintenance, multifunction employees, and autonomous-maintenance. 5S and standardization are partially applied	• The wastes detected in the company 14are: waiting; defects; inventory excess; motion waste	The manager is not with Lean, he prefers to work in a disorderly way.
	Enterprise 15 Construction and boiler making	• The lean practices applied by the company 15 are: 5S, autonomous-maintenance, preventive maintenance, multifunction employees, quality circle SMED. Standardization is partially applied	• The wastes detected in the company 15 are: waiting; defects; motion waste	Manager agrees with the implementation of the necessary lean tools if the State provides the necessary financial support
	Enterprise 16 Designing and manufacturing metallo-textile structures	• The lean practices applied by the company 16 are: 5S, visual-management, autonomous-maintenance, preventive-maintenance, multifunction employees, standardization.	• The wastes detected in the company 16 are: defects; motion waste; excess processing; waiting	Lean manufacturing is not a priority