

FROM TRADITIONAL CRAFTSMANSHIP TO LEAN EXCELLENCE: TRANSFORMING INTO AN OPTIMIZED ARTISANAL MODEL

DO ARTESANATO TRADICIONAL À EXCELÊNCIA LEAN: TRANSFORMANDO-SE EM UM MODELO ARTESANAL OTIMIZADO

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Abstract

Lean Management is finding increasing application across various industries, and its potential role in artisanal businesses should not be overlooked. Implementing Lean principles in artisan companies has become a vital way to modernize operations and boost competitiveness. Understanding both the operational dynamics of an artisan business and the evolution of Lean practices is essential for successfully transitioning from a traditional artisanal model to a Lean one. This transformation within production units allows for process optimization, waste reduction, and improved efficiency. It serves as a strategic lever for the sustainable development of the sector while preserving the core values of craftsmanship.

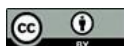
Keywords: Lean. Model. Handicraft. Industry. Continuous Improvement.

Resumo

A gestão enxuta está encontrando cada vez mais aplicação em vários setores, e seu papel potencial nas empresas artesanais não deve ser negligenciado. A implementação dos princípios enxutos nas empresas artesanais tornou-se uma forma vital de modernizar as operações e aumentar a competitividade. Compreender tanto a dinâmica operacional de uma empresa artesanal quanto a evolução das práticas enxutas é essencial para uma transição bem-sucedida do modelo artesanal tradicional para o enxuto. Essa transformação nas unidades de produção permite a otimização dos processos, a redução do desperdício e o aumento da eficiência.

Ela serve como uma alavanca estratégica para o desenvolvimento sustentável do setor, preservando os valores essenciais do artesanato.

Palavras-chave: Lean. Modelo. Artesanato. Indústria. Melhoria Contínua.



1 INTRODUCTION

Artisanal work plays a very important function in the general sphere of the economy, particularly in Morocco [1], constituting 8% of the nation's GDP and encompassing 20% of the population. Craftsmanship is but another fundamental component of this nation's cultural heritage which time has adapted to modern times. Since the products are designed with either customization or detail in mind, the production of such by the industries uses techniques that lean heavily on traditional methods. Craft industries, again, are also characterized by the diversified and handmade kind of production, adjusting to the different sectors. Although they range from pottery to textiles and from textiles to jewelry, leatherwork being our main subject will be the primary area of focus. However, despite all their cultural and economic importance, Moroccan crafts face serious challenges. These include management of the production process, where a monopolistic position by a few companies limits the opportunities for innovation and competitiveness. Apart from that, the reduced legacy of skills and the non-standardization of the process may further reduce some traditional crafts.

In meeting this challenge, the effective application of the toolkit for Lean Manufacturing in the enterprise of an artisan sounds like a winning solution. Lean, working to reduce waste and increase efficiency, could be applied in managing artisan workshops [2]. This is even more applicable to the shop floor level, where introducing practices such as 5S, Kaizen, and Just-In-Time can reduce the production lead times and improve quality, but still retain the artisan characteristics of the product.

Another important aspect is continuous craftsperson training [3], through which modern management skills can reinforce the transfer of traditional know-how. The lack of formal training in Moroccan crafts has been identified as one of the leading barriers to its development.

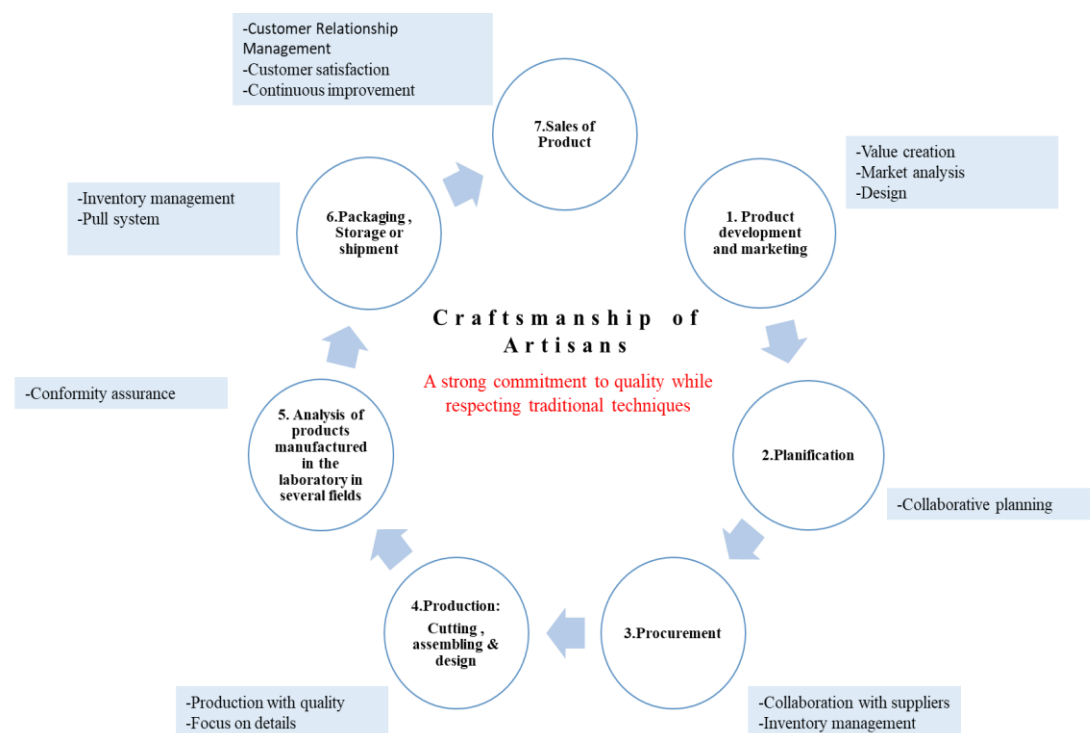
We have developed in this paper two models, one is about handicraft business, and another is about traditional business model with integrated tools of Lean Manufacturing. The models attempt to demonstrate how the process of optimization, standardization of practices, and emphasizing training will ensure that the trade survives and at the same time ensure the competitiveness of the sector. The same will be a model for maintaining heritage wealth within the Moroccan artisan sector and improving the economic efficiency of enterprises.

2 THE MANUFACTURING PROCESS OF HANDICRAFT COMPANY

Modern craftsmanship combines traditional techniques with contemporary management to meet market demands while preserving local cultural identities. In this first part of our article, we will present the main existing steps of the artisanal process and how they contribute to the quality and sustainability of the products.

Figure 1

Manufacturing process of Handicraft Company



3 PRODUCT DEVELOPMENT AND MARKETING

One of the first steps in the artisanal process is the creation of products that combine innovation and tradition. Product development is essential to ensure profitability and sustainability in the artisanal sector.

Value creation: Artisans collaborate with designers and consultants to adapt their traditional skills to modern markets, taking into account the ethical and sustainability demands of consumers. According to a report [4], this often involves guidance and training provided by organizations.

Market analysis and design: A thorough market analysis [4] allows artisans to identify customer needs and create designs that combine authenticity and modernity.

3.1 Planning

Planning is a key step in coordinating all activities of the production chain. A collaborative approach is often adopted in small artisanal businesses to improve efficiency. It is not limited to production but also includes managing relationships with suppliers and customers. A review of the literature on artisanal entrepreneurship shows that this type of planning is essential for adapting businesses to the dynamics of the global market [5].

3.2 Procurement

The procurement of quality raw materials and the strict management of inventory [6] are crucial aspects of artisanal production. Artisans work closely with local suppliers to ensure the quality of the materials.

3.3 Production: Cutting, assembling, and design

The artisanal production stage is the heart of the process. Each piece is carefully crafted, respecting traditional techniques passed down from generation to generation. Quality is paramount [4] at every step of production, from cutting to the final decoration. This manually applied process is present in almost every artisanal sector. This adds a sense of personality or authenticity that is not found in mass-produced items. Each stage of the process expresses artisanal expertise, aimed at creating something both functional and aesthetically pleasing. It is a detail-oriented artisanal approach, and one of the reasons handmade products are in high demand is that they offer beauty and craftsmanship to represent cultural tradition.

3.4 Analysis of products manufactured in the laboratory in several fields

Before commercialization [6], products must be tested to meet quality and safety standards. Laboratory tests may be necessary to guarantee the safety and compliance of products with international standards, especially in sectors such as cosmetics, textiles, or even pottery.

3.5 Packaging and storage

In artisanal businesses [4], packaging and storage are crucial steps to ensure the preservation of product quality throughout their lifecycle. Unlike large industrial productions, where automated machines handle mass packaging, artisans adopt a more manual and personalized approach.

Most of the time, packaging and storage are done by hand, with a special emphasis on the choice of materials, which are carefully selected by the artisan. Local, durable materials with aesthetic appeal are typically chosen to reflect the product's quality and the artisan's cultural identity. For instance, in ceramics or textiles, the packaging may include decorative elements or traditional patterns to highlight the uniqueness of the product. These processes not only protect the items during transport but also enhance their handcrafted appearance, adding value in the eyes of the customer.

3.6 Sales of product

Sales [7] play a crucial role in the survival and prosperity of artisanal businesses. In this sector, personal relationships with customers are often more important than in large companies. Artisans rely on direct sales channels, such as local markets, physical stores, and online sales through platforms dedicated to artisanal products.

The human aspect [8, 9] is at the heart of artisanal sales. Artisans build strong connections with their customers through personalized interactions, often explaining the origin of the products and the manufacturing techniques. This approach helps to strengthen customer loyalty, as they are often drawn to the authenticity and uniqueness of the products.

4 EVOLUTION OF INDUSTRY FROM HANDICRAFT TO LEAN 4.0 INDUSTRY

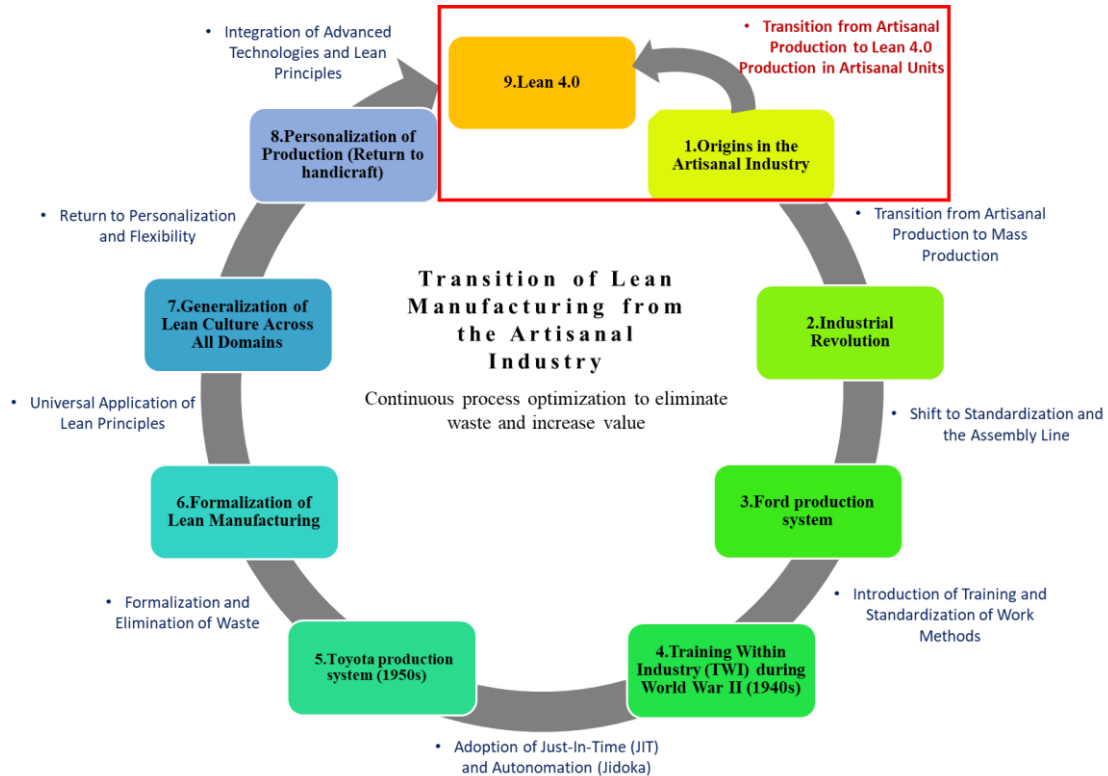
The transition of an artisanal business to a Lean 4.0 industry model presents significant challenges but also numerous opportunities to improve performance and competitiveness. Integrating advanced technologies, such as automation, the Internet of Things, and data analysis, combined with the principles of Lean Manufacturing, allows artisanal businesses to eliminate waste while enhancing the efficiency and flexibility of their production.

Industry 4.0 [10, 11, 12], with its capabilities for mass customization and real-time data processing, enables the optimization of production processes, a key factor for businesses seeking to maintain a high level of customization while scaling up production. However, for small artisanal businesses, this transition can be complex due to limited resources and the need to adapt technological tools to processes that are often manual and personalized.

4.1 Origin in the handicraft industry

Figure 2

Evolution of industry from handicraft to Lean 4.0 industry



Customarily, artisanal businesses jealously guarded the rich tradition of providing customized, manually crafted goods, in which quality surpasses quantity any time. Unlike mass-produced items, artisanal goods are unique in personalization, exclusiveness, and attention paid to every minute detail. However, these businesses are often heavily at a disadvantage regarding productivity and satisfying greater demand because the operation involves manual techniques and takes time to produce each item.

Artisanal production [13, 14] is generally characterized by small batch production, offering great flexibility and allowing for a direct connection between the artisan and the customer. This creates a close relationship that doesn't exist in mass production systems. However, this personalization and artisanal quality come at a cost. The production capacity is more limited, and profitability can be affected by the time and effort required to produce items individually.

4.2 Industrial revolution

With the Industrial Revolution [15], the shift to mass production introduced new manufacturing models. Mechanization allowed for increased production capacity, but it often distanced businesses from the customization inherent to artisanal craftsmanship.

4.2.1 Ford production system

Ford's production model [16], based on the assembly line, introduced standardization and large-scale production, reducing costs but decreasing flexibility. This marked a significant step in industrialization, but it also highlighted the inefficiencies inherent in this model.

4.2.2 Training within industry (TWI)

Training within Industry (TWI) [17, 18] was one of the important programs that tried to meet the growing demand for skilled labor in production factories during the Second World War in the United States. Since fewer experienced workers were available for the war effort, it became important to quickly train unskilled workers to maintain factory productivity. TWI was meant to standardize the training for developing better methods of work and closer cooperation between supervisors and employees through its emphasis on quality and efficiency. The various three key modules from which TWI emanated include Job Instruction (JI), Job Methods (JM), and Job Relations (JR). Each module had been uniquely designed for a particular cause, which helped in the sphere of production.

4.2.3 Toyota production system

Toyota introduced Just-in-Time (JIT) [19] and automation (Jidoka), key concepts of Lean Manufacturing aimed at reducing waste and improving efficiency. This system focused on minimizing inventory and fostering continuous improvement.

4.2.4 Formalization of Lean Manufacturing

Lean Manufacturing [20] became a widely adopted methodology in the 1990s, with the formalization of principles aimed at eliminating waste, optimizing processes, and increasing added value. This allowed companies to adapt their production while remaining competitive.

4.3 Generalization of Lean culture

Beyond the manufacturing industry [21], Lean principles have expanded to sectors as diverse as services, healthcare, and public administration. The Lean approach is recognized for enabling process improvements across all industry segments. Lean principles have proven their applicability in areas ranging from services, healthcare, and public administration to most other sectors, far beyond the traditional manufacturing world. Highly flexible and effective in various contexts, Lean philosophies focused on waste elimination and continuous process improvement have proven particularly relevant.

Through the application of Lean principles [22], improvements have been made in service quality, customer satisfaction, and process optimization, while reducing lead times. For example, the telecommunications and banking sectors have adopted the Lean concept to restructure their internal operations. This has led to quicker response times to customers, fewer errors, and more effectively managed flow times. One of the most frequently used tools is value-stream mapping, which helps detect and eliminate non-value-adding activities

4.3.1 Customization of Production (Return to Craftsmanship)

With the evolution [23] of consumer demands, a return to customization has become essential. The artisanal model has been reintegrated into industrial production through techniques such as small-batch production and mass customization.

4.3.2 *Lean 4.0*

This then translated into the merging of advanced technologies [24], among them the Internet of Things, AI, and Automation, into Lean Manufacturing principles, thus Industry 4.0. It was a model that combined the efficiency of Lean with the power of these technologies to make production more flexible and responsive. For instance, IoT helps to monitor machines in real-time so that downtime is reduced, whereas AI helps optimize operations through data analysis to pinpoint improvements. To achieve this, organizations can respond better to changes in demand while maintaining lean and effective production.

4.3.3 *Artificial intelligence*

Artificial intelligence plays a crucial role in Lean manufacturing [25], enhancing responsiveness and supporting decision-making processes. The Internet of Things brings big data, which AI can process to identify trends, predict future behaviors, and recommend operational improvements. For example, AI algorithms can optimize workflows by adjusting production speeds and reducing waste, in line with Lean principles of standardization and stock reduction. AI can also automatically adjust production lines to meet order demands, making the process more flexible while maintaining high levels of efficiency and responsiveness

4.3.4 *Digitalization*

Digitalization [26, 27] combines and enhances advanced technologies such as the Internet of Things, artificial intelligence, and cyber-physical systems with traditional commodity production methods. This process is increasingly referred to as Lean 4.0 when Lean Management principles are integrated, and more broadly as a key step toward Industry 4.0. Lean 4.0 aims to eliminate waste, improve efficiency, and add value for customers by leveraging digital technologies to automate tasks, reduce repetitive work, and enable real-time decision-making based on data. By merging Lean and digitalization, workflows become more transparent, production line flexibility increases and production cycles shorten. For instance, Collaborative Lean 4.0 has highlighted the need for integrated communication systems that enhance coordination among various teams and

production units. In essence, the connection between digitalization and Lean 4.0 is about increasing process efficiency while incorporating innovative technologies.

5 DESIGN OF A MODEL OF THE CURRENT STATE OF ARTISANAL BUSINESSES

5.1 Description of the model of an artisanal business

5.1.1 Presentation of handicraft company

Artisanal businesses [28] stand out for their ability to integrate traditional practices while meeting modern demands for quality and innovation. They are characterized by a largely manual production process and a high level of attention to detail, to create a unique, high-quality artisanal product.

The proposed model reflects flexible management, rooted in local expertise, with a strong focus on the quality of handcrafted products.

5.2 The internal and external structure of an artisanal business

Artisanal businesses rely on internal structures that manage production, logistics, and human resource management, while external factors such as customers, suppliers, and partners influence the business environment.

5.2.1 Internal elements of handicraft company

Human resources: Employee management [29] in artisanal businesses is often based on creating an atmosphere of collaboration and well-being to ensure a high level of quality in production.

Production: The manufacturing process [30] in artisanal businesses relies on manual production techniques, often passed down from generation to generation. This ensures special attention to detail and product quality.

Product development: Innovation and design [31] are essential in the development of artisanal products to meet customer expectations while preserving traditional methods.

Logistics: Logistics [32] in an artisanal business, whether it concerns procurement or distribution, is of paramount importance to ensure the smoothness of the production process and customer satisfaction.

Marketing and communication: Marketing and communication [33] for artisanal businesses must emphasize the authenticity of the product, its quality, and its uniqueness to attract a clientele that values these qualities.

Finance: Accounting and financial management [34] in artisanal businesses is a delicate balance between managing cash flow, profitability, and investment needs.

5.3 External elements of handicraft company

Customers: Artisanal businesses [35] must ensure they maintain a close relationship with their customers, as satisfaction and loyalty depend on the quality and originality of the product.

Concurrent: In the face of competition [36] from large industries, artisanal businesses must position themselves by highlighting the quality and authenticity of their products.

Supplier: The relationship [37] with suppliers is crucial for an artisanal business, as it determines the quality of the raw materials used in production.

Partnerships: Partnerships with other businesses or institutions can enable artisanal businesses to strengthen their market position and gain access to new resources.

Legal environment: Compliance [38] with local and international laws and regulations is a key factor for the survival of artisanal businesses, especially in the context of their internationalization.

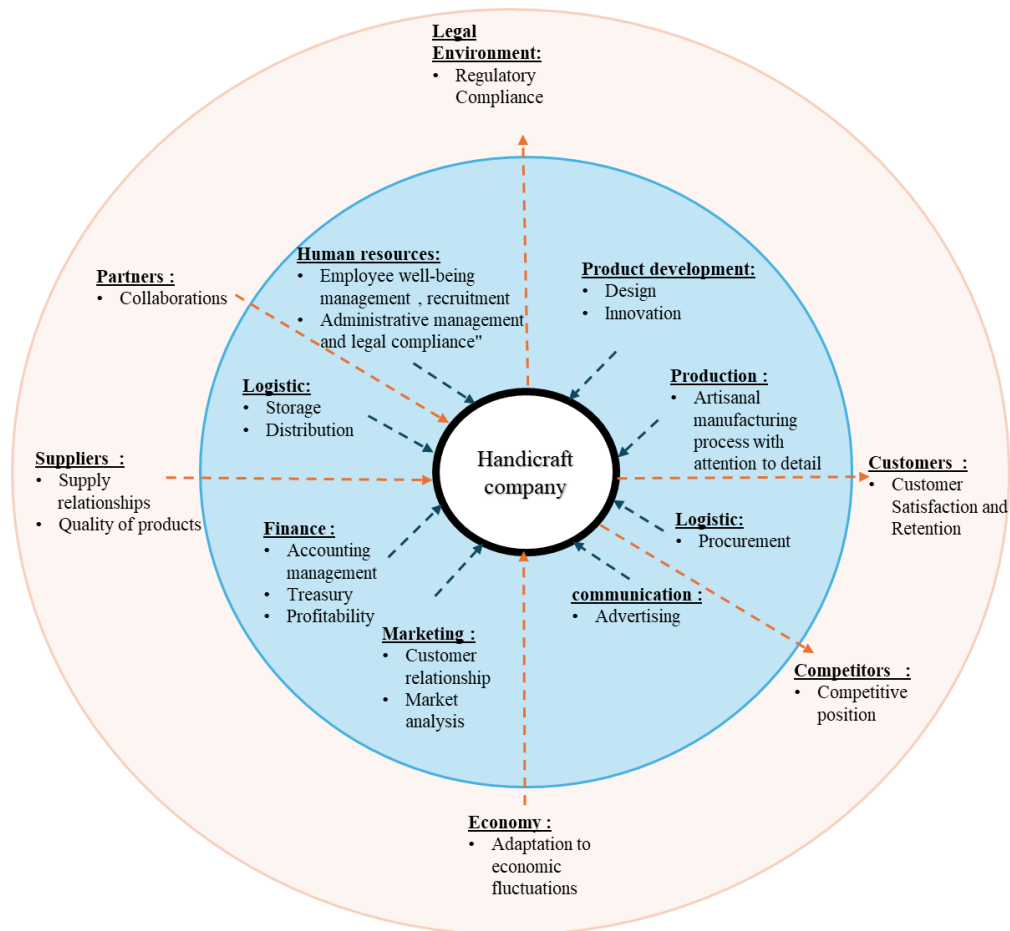
Economy: Artisanal businesses [39] must quickly adapt to economic fluctuations, whether local or global while maintaining their competitiveness.

5.4 Interaction between stakeholders in an artisanal business

Artisanal businesses thrive on dynamic interactions between their internal elements such as production, human resources, and logistics, and external factors like customers, suppliers, and competitors. These connections are essential for the sustainability and success of the business. For instance, the quality of relationships with suppliers directly affects production capacity, as a consistent supply of high-quality raw materials enables the creation of artisanal products that meet consumer expectations. Likewise, customer satisfaction and loyalty are crucial external factors that depend on effective internal management of product quality and design. This underscores the importance of human resources in training skilled artisans capable of maintaining high standards of craftsmanship.

Interaction with the competitive environment also forces the business to adapt its internal marketing and innovation strategies to differentiate itself in the market. Artisanal businesses often need to respond to economic and legal changes, which influence their ability to innovate and manage finances according to demand fluctuations. Additionally, compliance with external legal regulations requires the business to adopt rigorous administrative management, reinforcing the link between external legal obligations and the internal management of administrative processes.

In other words, the efficiency of internal processes in an artisanal enterprise is inseparable from its interactions with the external environment, due to the complex relationships this type of activity has with the outside world. This creates a virtuous cycle where internal performance and external opportunities reinforce one another, fostering innovation, enhancing customer satisfaction, and increasing the business's competitiveness.

Figure 3*Model of the current state of artisanal businesses*

6 BENCHMARKING BETWEEN THE GENERAL MODEL OF AN SME AND THAT OF AN ARTISANAL BUSINESS

Benchmarking [40, 41, 42] is a process by which an organization's performance, processes, or practices are compared with others in the line of business, preferably best-in-class organizations. In general, the concept is that through imitation of strategies and solutions coming from other companies or industry leaders, performance gaps and opportunities for improvement can be identified. Such activities not only optimize internal business processes but also enhance competitiveness by adopting best practices to improve efficiency, quality, or innovation.

Comparing two types of enterprises, an SME and an artisanal enterprise, is a valuable approach within the framework of management practices. While both models share certain similarities, they also demonstrate notable differences in terms of structure,

processes, and management. The forthcoming analysis will focus on highlighting the strengths and weaknesses of each model, offering recommendations for potential improvements tailored to the specific needs of each type of organization

6.1 The general model of an SME

The model of an SME [43] primarily focuses on process optimization, human resource management, and continuous improvement. Key aspects of the general SME model include:

Human Resource Management: SMEs [44] tend to adopt structured approaches to employee management, including recruitment, training, and talent management. Tools such as performance dashboards and regular skill audits are widely used.

Supply Chain Management: Relationships [45] with suppliers and the involvement of stakeholders in the supply chain play a central role in ensuring smooth production.

Quality and Standardization: The implementation of Total Quality Management [46] and methods such as Poka-Yoke helps to minimize errors and improve operational efficiency.

Continuous Improvement: SMEs [47] tend to use techniques such as Kaizen, continuous flow production management, and 5S to increase their competitiveness in the market.

6.2 Comparison between the model of an artisanal business and the model of an SME

In an SME [43, 44] human resource management follows rigorous processes, with clear policies for recruitment, training, and talent management. Artisanal businesses, on the other hand, favor a more informal and personalized approach. The process of skill transmission is often more direct and less institutionalized.

SMEs [43, 46] focus on standardized, optimized processes that prioritize speed and efficiency, often employing quality assurance tools like TQM, Lean, and Six Sigma. In contrast, craftsmanship-based businesses place a strong emphasis on customization and flexibility, with a focus on the quality of handwork and product originality.

A small to medium-sized enterprise (SME) [43, 48] develops more formal and structured customer relationships, often supported by CRM (Customer Relationship Management) tools to manage large-scale interactions. Artisanal businesses, on the other hand, have a more personalized approach, with close relationships with their customers, allowing them to innovate more quickly based on specific consumer needs.

Small enterprises [43, 49, 50] are catching up with the adoption of the Kaizen system and techniques for continuous improvement of processes. In contrast, handicraft enterprises are more intuitive in the way that innovation is poured into them, with special care given to the design evolution and the traditional techniques, as opposed to the optimization of rigid processes.

7 LEAN MODEL OF AN ARTISANAL BUSINESS WITH INTEGRATION OF THE PDCA APPROACH

7.1 Description of the new model

In addition to Lean Manufacturing tools like 5S, Kanban, JAT, and Kaizen, this artisanal business model incorporates the PDCA (Plan-Do-Check-Act) approach. This enables these tools to enhance the effectiveness of both internal and external processes while aligning with customer and societal expectations. The integration of PDCA is particularly relevant in this context, as it fosters continuous improvement across all areas of the business, from production to logistics and human resource management.

The elements mentioned above are included in the current model because they impact the functioning of any artisan business. They form the foundation of a business structure that ensures smooth processes and efficient resource management. However, additional elements need to be integrated to transform the artisanal enterprise into a Lean organization to achieve greater efficiency, reduce waste, and enhance competitiveness while preserving the core values of craftsmanship.

Our approach aims to complement the initial model by integrating Lean Manufacturing tools such as Kaizen, 5S, and Kanban, as well as improved management practices like Just-In-Time (JIT) and Visual Management. These tools were selected for their ability to optimize each step of internal processes and improve interaction with the external elements of the business.

7.2 PDCA approach to effectively present the improved artisanal model

7.2.1 Plan: preparation and planning

Training and Skill Assessment: Training employees and evaluating their skills [51] is essential for effectively integrating Lean tools such as Kanban and 5S. This ensures continuous skill development and encourages team involvement in process improvement.

JIT (Just-In-Time) Planning: JIT planning [2] reduces inventory and optimizes supply based on actual production needs, thus avoiding resource waste.

DFM (Design for Manufacturing): Adapting product design [53] to manufacturing simplifies processes, thereby reducing time and costs while ensuring smooth production.

Value creation: By focusing on value creation [3], the company ensures that each process directly contributes to customer satisfaction, a key principle of Lean.

Community and Customers: Artisanal businesses [55] must align their activities with societal expectations and customer needs by constantly striving to create value. This strengthens their market position while remaining socially responsible.

7.3 Do: Implementation

Continuous Flow Production: Continuous flow production [20] reduces interruptions in the production process, enabling a faster response to customer demand.

5S: This tool [57] organizes the workspace to improve efficiency and reduce downtime. It establishes clean and safe practices that increase productivity.

Kanban: Manages production and supply flows based on actual demand [58], thereby minimizing overstock and ensuring smooth resource management.

Visual Management: Using visual management [59] enables better communication between teams and helps quickly identify problems or bottlenecks in production.

Long-Term Partnership and JIT: Long-term relationships [60] with suppliers ensure a consistent and high-quality supply of materials, delivered on time.

Meanwhile, Just-In-Time (JIT) allows for the reduction of unnecessary inventory and improves production flexibility.

7.4 Check: Evaluation

Quality at source: Quality control from the first step [61] prevents downstream defects, thus reducing correction costs and ensuring customer satisfaction.

Audit of process: Regular audits [62] examine the effectiveness of processes and identify areas where process improvements are necessary to stay competitive.

Problem Analysis and Root Cause Analysis: By identifying the root causes of issues [63], the company can effectively address recurring faults, preventing them from reoccurring in the future

PESTEL analysis: This analysis [64] measures the external factors, covering political, economic, socio-cultural, technological, ecological, and legal factors, all these points are crucial for calibrating the strategy to reflect market changes and adjustments.

7.5 Act: Continuous improvement

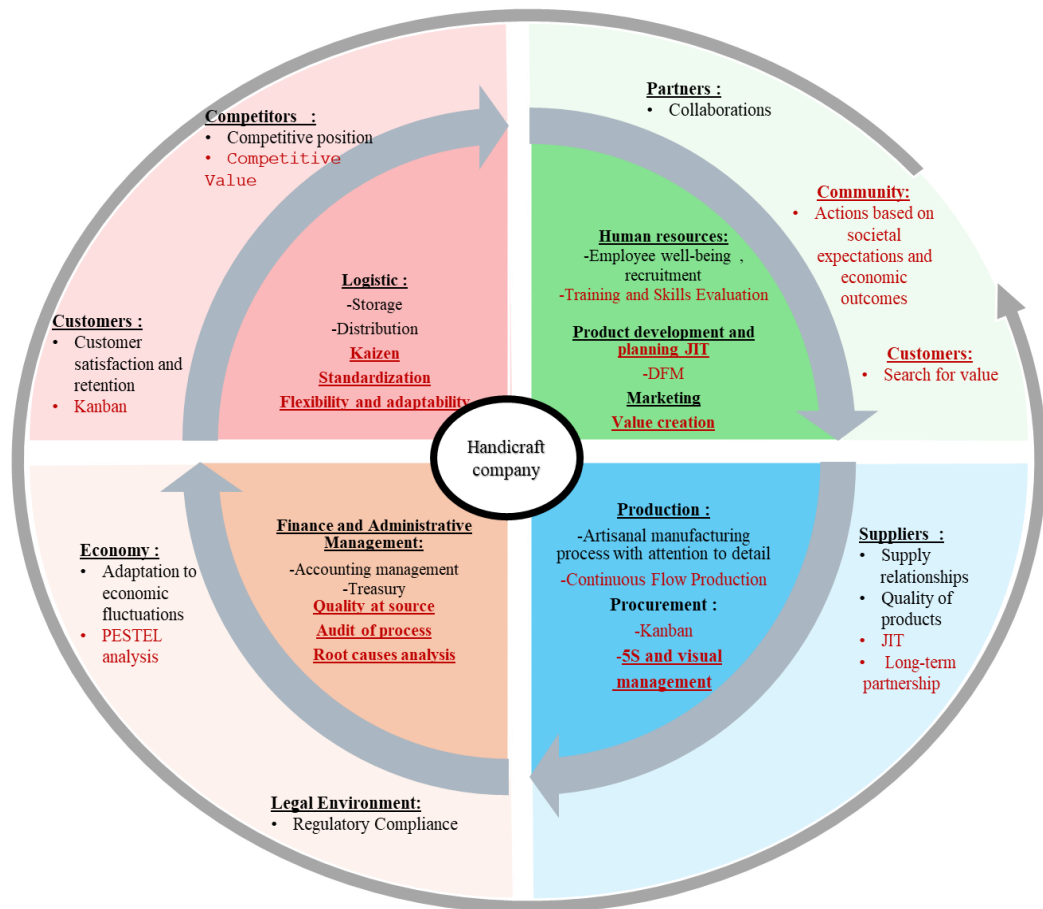
Kaizen: This encourages continuous improvement [47] through employees' identification and suggestions on process improvements. It inculcates flexibility and innovation.

Standardization: Efficient processes [59] must be standardized to ensure consistent quality and avoid unnecessary variations in production.

Adaptability and flexibility: Adaptability and flexibility [66] are a key strength of artisanal enterprises, enabling them to quickly respond to market fluctuations and customer demands by adjusting their processes.

Figure 4

V Lean Model of an Artisanal Business



Kanban Client and Competitive Value: Kanban client [2] ensures better order management and rapid adaptation to market demands.

7.6 Importance of integrating the lean model in artisanal businesses

The integration of Lean Manufacturing tools with the PDCA approach is a powerful methodology that enhances the performance and competitiveness of an artisanal business. This alignment of internal processes with customer and community expectations ensures maximum flexibility and adaptability. Continuous improvement, driven by the PDCA cycle, enables the business to navigate economic and social challenges while preserving its artisanal essence.

8 CONCLUSION

In conclusion, deep acquaintance with the production process in a craft enterprise is a vital step in its development. Lean Manufacturing principles and continuous improvement, combined with regular training of the artisans, optimize the production process and ensure that traditional skills are preserved and transmitted to future generations. The sustainability of the industry and handcraft activities rests largely on training, which can also extend to integrating Lean tools like 5S or Kaizen to ensure employees fully utilize these methods. Since the Lean Model is adapted to the characteristics of craft businesses, it offers a rich framework emphasizing flow management, practice standardization, and well-trained human resources.

This model can strengthen competitiveness among firms and ensure their survival in a dynamically changing economic environment. By adopting these practices, Moroccan handicraft enterprises can preserve their cultural heritage while improving performance and resilience.

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Authors' Contribution

All authors contributed equally to the development of this article.

Data availability

All datasets relevant to this study's findings are fully available within the article.

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