



SUSTAINABILITY ENHANCING OF TEXTILE INDUSTRY THROUGH SMART PROGRAM IMPLEMENTATION: CASE OF REPUBLIC OF MOLDOVA

GHEORGHITA Maria¹, NISTOR Doina

¹ Technical University of Moldova, Faculty of Economic Engineering and Business, Department Economics and Management, 41, Dacia bd., nr. 10 block of study, MD-2060, Chisinau, Republic of Moldova,
E-Mail: maria.gheorghita@emin.utm.md

² Technical University of Moldova, Faculty of Economic Engineering and Business, Department Economics and Management, 41, Dacia bd., nr. 10 block of study, MD-2060, Chisinau, Republic of Moldova,
E-Mail: doinitanistor@gmail.com

Corresponding author: Gheorghita Maria, E-mail: maria.gheorghita@emin.utm.md

Abstract: *The textile and clothing industry is a key sector of the Moldovan economy, built on its strong industrial past and longstanding manufacturing traditions. Having maintained steady growth, the Textile Industry is one of the country's most resilient sectors to economic changes and has demonstrated growth over decades. Moldova textile and clothing manufacturing industry's path forward involves balancing automation and digitalization with sustainable practices, ensuring access to the EU market, and strengthening its position in the regional fashion industry. This article explores the Moldovan fashion manufacturing industry's resilience, growth, and adaptation to global challenges and trends. It focuses on the implementation of the SMART program, aimed at improving efficiency, productivity, and sustainability in the Moldovan clothing factories. The paper presents findings from the application of consultancy services in this sector, emphasizing the importance of digitalization, automation, and adherence to international quality and sustainability standards. The research underscores the critical role of external expertise and financial incentives in modernizing production processes and advancing sustainable practices in the industry.*

Key words: *sustainability, competitiveness, production systems, efficiency, consultancy*

1. INTRODUCTION

The industrial revolution brought an unprecedented economic growth, but it also boosted the deepening of many social and environmental problems. In the textile industry, besides the stable economic growth, social and environmental problems have come to the fore because this industry involves a lot of labor, on the one hand, and on the other hand, it is the second polluter after the oil industry. In a report of the European Parliament published in 2020, approx. 10% of global greenhouse gas emissions come from the clothing industry. It exceeds the greenhouse gas emissions generated by air transport and maritime transport taken together [1].

At the current stage sustainability and responsibility have become more and more growing trends, including textile industry. These metrics began to translate into behavioral and purchasing trends. With increasing consumer awareness, textile manufacturers and brand owners are paying



increasing attention to sustainability and responsibility. This sector has adopted practices and strategies that reduce environmental impact and respect workers' rights. It has become a trend that seeks to produce clothing and textiles in an environmentally and socially responsible manner.

Sustainable fashion aims to minimize the environmental impact of textile and clothing production, improve the working conditions of textile workers and ensure an ethical and fair supply chain.

Efforts are being made in the Moldovan textile industry to implement sustainable practices. To achieve sustainability in this sector, it is necessary to address different aspects of the production chain.

2. IMPLEMENTATION OF SMART PROGRAM DESIGNED TO ADVANCE COMPETITIVENESS AND SUSTAINABILITY IN MOLDOVAN CLOTHING FACTORIES

The changes that have occurred in the last years, including the influence of the COVID-19 pandemic, have created new paradigms for ensuring competitiveness and sustainability for fashion industry [2].

Sustainability and social compliance, Slow fashion, Technology and digital transformation and Demand for higher value at lower price now became the burning elements for competitiveness [3]. To keep pace in a such competitive environment, Moldovan fashion Industry enjoyed significant support from external consultancy offered by the Moldova Competitiveness Project (MCP) financed by USAID, Sweden, and UK Aid.

As consultants of the MCP Project we conceptualized and assisted light industry companies to implement a SMART (Streamline Manufacturing, Accountability, Resource Efficiency, and Transparency) Factory Program based on five pillars intrinsically linked: 1. Streamline manufacturing process; 2. Technology improvement and automation; 3. Design and product development, pattern design; 4. CRS and sustainability and 5. Transparency (Figure 1).

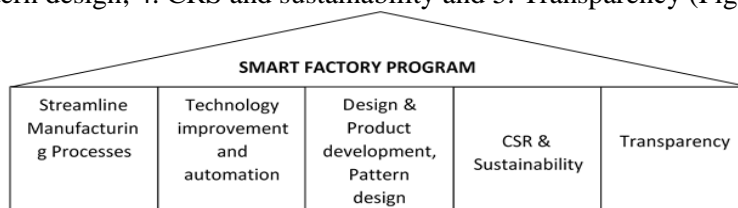


Fig. 1. Five intrinsically linked pillars of SMART Factor Program [6]

The specific objectives of the SMART consultancy program include enhancing efficiency and productivity, reducing lead and output times, minimizing work-in-progress items, improving product quality, and advancing manufacturing practices towards higher value-added and more sustainable processes.

The five intervention areas of SMART program are interconnected and feed into each other to produce the desired results.

1. *Streamline Production*: This area focuses on improving manufacturing processes by implementing industrial engineering principles and quality control methods to make manufacturing more efficient. The causal relationship here is direct: by streamlining production, the program aims to enhance the efficient use of resources, including labor (through less movement and higher speed), equipment (improving performance), space (reducing stock), and time (reducing the production cycle).



2. *Resource Efficiency*: Efficient use of resources is achieved through interventions in the streamline production area. Resource efficiency then leads to the implementation of LEAN tools, which are methods that help eliminate waste and optimize processes.

3. *Social Compliance*: This area involves conducting social audits and establishing occupational safety management systems, which ensure that the improvements in production do not come at the expense of the workers' well-being. This area is essential for maintaining ethical standards and for the factory's sustainability.

4. *Transparency*: The transparency component covers working conditions, pay, and business ethics. Improved social compliance contributes to better transparency in the organization. In turn, transparency in these areas helps to maintain accountability within the enterprise, which is crucial for both internal and external trust and reputation.

The causal relationships among these intervention areas are cyclical and reinforcing. For example, streamlined production not only leads to resource efficiency but also better social compliance, as efficient processes can improve working conditions. In turn, better social compliance can enhance transparency in the organization, ensuring that improvements are well-documented and communicated, which further promotes an environment of accountability. This accountability leads back to the need for streamlining production, as it requires continuous monitoring and optimization of processes. Moreover, improved transparency regarding working conditions and pay can lead to increased employee satisfaction and motivation, which contributes to higher productivity and better-quality work. This can create a positive feedback loop where improvements in one area can stimulate improvements in others, ultimately leading to the results highlighted in the SMART Program, such as higher productivity, reduced losses, and increased pay.

This integration underscores the interconnected nature of these intervention areas, as they all contribute to the overall goal of improving the performance and ethical standards of the manufacturing processes within the Moldovan garment industry

The SMART Program was implemented in conjunction by APIUS Moldova Light Industry Association and development partners USAID, Sweden, and the UK through their Moldova Competitiveness Project and Future Technologies Activity [4].

The SMART Program was implemented in two iterations, each focusing on a specific group of progressive Moldovan clothing factories.

Iteration 1, which took place from 2015 to 2019, for a group of 23 clothing factories, emphasized productivity enhancement through improved methods and process refinement, incorporating LEAN management concepts, as well as technical assistance in quality systems and small grants for production automation [5, 6].

Iteration 2, extending from 2020 to 2023, continued the SMART Program for a larger group of 27 clothing manufacturing enterprises, with a stronger focus on factory automation through larger grants, as well as structured support for social compliance and quality standards implementation

The components of the SMART program included:

1. *International Expertise Paired with Domestic Consultancy*: Highly specialized experts in production and quality systems from Germany were deployed to beneficiary factories as part of several consultancy iterations focused on factory process improvement and efficiency. This involved conducting factory audits, identifying production bottlenecks, developing process improvement plans, and providing support for their implementation. Consultant conducted on the job training that was deemed as more effective and in depth than group training. The international experts collaborated with local consultants who helped localize the recommendations and offered intermittent support in between.



2. Financial Incentives in the Form of Non-Reimbursable Grants: These grants were designed to incentivize quality certification, digitalization, and automation in the beneficiary factories. Grants averaged 5,000 USD to 50,000 USD, depending on factory size. Grants supported industry to advance technological innovations, incentivizing factories to upgrade via purchasing high precision equipment, CAD-CAM for automation of pattern design and cutting, printing and embroidery machines, special machines, etc.

3. Study visits for executive management teams of Moldovan factories to advanced factories in Romanian Joint Ventures to observe efficient production floors and encourage change and improvement.

4. Smart Factory Unit: This unit was established as part of the APIUS Moldova Light Industry Association. It played a crucial role in project management for consultancy services, application writing for factory automation grants, as well as facilitated and co-funded the certification costs of quality management systems and social compliance standards for beneficiary factories.

The implementation of the SMART Program in a pilot group of 23 garment enterprises in Moldova from 2015 to 2019 resulted in a significant increase in productivity, averaging between 20-25%. The program also indirectly impacted the 4,300 employees in these enterprises, reflected in increased employee salaries. Some factories were able to increase employee wages as high as 30 percent compared to industry average. The 'Before' and 'After' context was thoroughly documented at factory level for each improvement measure, comparing them with performance indicators across various areas [5, 6]

A critical aspect of this program was the enhancement of production processes, reduction of losses, and increase in efficiency through the implementation of Lean Management tools. The interventions targeted several key areas:

1. *Human Element (Hand)*: The program involved analyzing the movements of operators to evaluate work methods and proposing measures to eliminate redundant movements. This approach, combined with new production methods and on-the-line training for operators, led to an increase in operator speed and productivity by up to 20-25%.

2. *Machinery (Equipment)*: It was observed that operators were working slower than the standard with sewing machines. Workplace training for operators and the implementation of time-saving tools helped increase productivity rates and reduce the production cycle.

3. *Space*: Often, production flows were inefficiently configured, and systems for transporting work-in-progress or finished products were underdeveloped. Improvements in the organization of the production line and internal transport systems resulted in productivity increases of up to 10%.

4. *Time*: The use of new methods for time standard determination and time study applications successfully reduced the production cycle.

Overall, the SMART Program's implementation in the Moldovan garment industry demonstrates the effectiveness of targeted consultancy, training, and the adoption of lean management and modern production techniques in enhancing productivity and efficiency.

3. SMART PROGRAM IMPACT ON ADVANCING SUSTAINABILITY REQUIREMENTS AT FACTORY LEVEL

In recent years, the fashion industry has faced growing pressure to adopt sustainable practices, driven by concrete initiatives and actions, including more recent EU policies like the



Circular and Sustainable Textile Strategy, reflecting an increasing recognition and commitment to sustainability and responsibility in the European fashion industry [7].

The implementation of quality management and social responsibility systems is an essential step within the SMART consultancy program, aiming not only to increase efficiency and productivity but also to introduce sustainable practices in factories. However, less than one-third of local factories have adopted or implemented any quality, environmental, or social responsibility standards, posing a barrier to the competitiveness of the light industry for export. During the period 2015-2019, the SMART program (via its Iteration 1) assisted a pilot group of 23 Moldovan apparel factories in implementing Integrated Management Systems based on the requirements of three International standards: ISO 9001 for quality management, ISO 45001 for occupational health and safety, ISO 14001 for the environment as well as SMETA (Sedex Members Ethical Trade Audit) social audits incorporating responsible business practices and BSCI (Business Social Compliance Initiative) audits recognized by the industry and European clients [5, 6].

Medium-sized companies were selected, with a total of 4,750 employees (an average of 206 employees per company) and oriented towards exporting to the EU. The factories were assisted by an external local consultant specialized in quality systems to conduct internal audits, make necessary process improvements, and optimize production organization, as well as prepare for certification by an authorized body.

Each factory received an incentive voucher in the form of monetary cost-share of (50 to 70 percent of) the certification costs, to encourage factories to pursue certification as the end objective. In the following years, another incentive voucher was given to factories to encourage recertification or pursue another certification from the list of sustainability standards eligible for the SMART program, as it was observed that factories did not necessarily undertake efforts to maintain or expand the certification(s).

The qualitative analysis of data collected during the pilot project on the implementation of Integrated Management Systems as a tool for advancing sustainability in Moldovan clothing factories has revealed several key trends and patterns:

1. *The Significance of Corporate Social Responsibility (CSR)*: CSR plays a major role for competitiveness of companies in the Moldova's fashion manufacturing industry, especially when it comes to access on the EU market, whether as contractors for manufacturing services or exporting locally designed and made clothing to EU consumers that increased their sustainability requirements. Responsible business practices, including accountability, transparency, and environmentally friendly practices, are necessary for the future success of factories and industry. They are becoming increasingly important to international clients, especially European clients, who demand these practices from their suppliers.

2. *International Standards*: European clients encourage and even require Moldovan suppliers to follow international standards (ISO 9001, ISO 14001, ISO 45001), implement codes of conduct, and undergo supplier social audits (SMETA, BSCI) to demonstrate adherence to environmental requirements and good working conditions. Factories in the SMART pilot program reported sustainability standards as a condition for exporting to clients in the UK and Germany.

3. *Internal Improvement Effect*: SMETA and BSCI social audits, as well as occupational health and safety management systems like ISO 45001, have allowed factories to assess and improve workplace standards and conditions to meet global supply chain requirements. This has had a positive impact on the 4,750 employees. Such a system not only enhances working conditions and employee safety but also provides guarantees for meeting local legal requirements and addressing workplace safety concerns, ultimately increasing employee satisfaction.



These trends emphasize the need for an integrated and holistic approach to meet sustainability and CSR requirements in the textile industry. Moldovan companies are positioning themselves as reliable manufacturing partners in response to these changes. The APIUS association continues the implementation of this program [8]

CONCLUSIONS

The vision for the Moldovan fashion industry is to evolve into a sector characterized by high-value addition, efficiency, innovation, and sustainability. This transition requires external expertise and assistance, as evidenced by the productivity challenges faced by local factories. Programs like SMART, which emphasize modernization, digitalization, and adherence to sustainability and quality standards, are crucial in this transformation process.

Due to a growing demand for sustainability, quality compliance, and ethical practices in the fashion manufacturing sector. Moldovan factories need to rapidly adapt to these demands to maintain competitiveness in the EU market. Initiatives like the SMART program have been instrumental in guiding factories towards sustainable and efficient practices, but there remains a gap in the digitalization and widespread adoption of international standards and practices.

The implementation of the SMART program demonstrated that the increase in labor productivity can cover the labor shortage in industry. This requires a focus on digitization and automation to increase productivity and efficiency. However, the industry's move towards automation and digitization must be strategic and financially supported, given the limited investment in technology modernization by local factories.

The SMART program must be supported in order to be implemented in large proportions in the Moldovan fashion industry.

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