



UNIONE EUROPEA
Fondo Sociale Europeo



Ph.D. SCHOLARSHIPS ON THE THEMATIC AREAS OF INNOVATION AND GREEN

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Academic Year 2021/2022

Ph.d. in GLOBAL STUDIES. ECONOMY, SOCIETY AND LAW - Ciclo XXXVII

Bound Topic of Research "Green"

(GIADA PIERLI)	
DEVELOPMENT OF AN INTEGRATED ANALYSIS METHODOLOGY FOR LEAN MANUFACTURING AND SUSTAINABLE DEVELOPMENT IN THE ENGINEERING INDUSTRY	
THEME:	<input type="checkbox"/> INNOVAZIONE <input checked="" type="checkbox"/> GREEN
<p>RESEARCH PROPOSAL: <i>summary description of the research proposed by the candidate structured as follows:</i></p> <ul style="list-style-type: none"> - <i>introduction of the problem in the international scientific context,</i> - <i>significance of the matter,</i> - <i>method through which the problem will be addressed</i> - <i>objective and expected findings,</i> - <i>bibliography.</i> 	<p>(MAX 6.000 characters excluding spaces)</p> <p><i>Context Analysis</i></p> <p>In a highly globalized context, characterized by a close interdependence of industrial, economic and financial systems and an inalienable ubiquity and mobility of people, the emergence of a condition as unexpected as the Covid-19 pandemic has necessarily disturbed the daily lives of people and companies, distorting priorities and revolutionizing business models.</p> <p>Despite of having seriously altered the balance of the affected economies, the pandemic crisis has contributed to the development of new trends and the rapid rise in phenomena already underway, such as digitalization and sustainable development. In this perspective, it is crucial to adopt an innovative business model that can optimize the entire corporate system, generating a positive long-term impact in terms of sustainability and value creation for all stakeholders. All this is explained by an integrated approach Lean - Sustainability (LS) which represents a new management paradigm, based on the joint consideration of lean practices and sustainable development, with the aim to make the business system "agile, adaptive and aligned in balancing the people and the planet with profits" (Kleindorfer et al., 2005). The adoption of an integrated LS approach could support enterprises, especially small and medium-sized ones (SMEs), in addressing the high costs associated with the availability of material and</p>

financial resources and the growing attention to social and environmental issues, thus acquiring an important competitive advantage.

Over time, many scholars have focused their attention on the existing correlation between lean and sustainability, trying to demonstrate that this combination allows companies to increase their performance in terms of operational efficiency and sustainable practices. In particular, the emphasis was placed on the obvious relationship between the lean approach and the environmental component of sustainability, starting from the same basic assumption, namely the reduction of waste. In fact, the green concept that aims to eliminate environmental waste combined with lean concept seems to be a potential approach to improve environmental performance of organizations (Abreu et al., 2017). At the same time, lean positive effects on economic performance, as well as on operational one, were already demonstrated several times, namely in terms of cost savings and quality improvement (Murmura et al., 2021). Although the majority of literature reported that integration LS leads to positive results for economic and environmental performance of organization, the same did not happen regarding the social component, which also lacked evidence (Teixeira et al., 2021). Choudhary et al. (2019) stated that there are not any empirical studies that analyze the lean approach regarding its gains in terms of sustainability (as a whole), especially within the scope of SMEs in manufacturing sector.

For their numerousness, small and medium-sized enterprises in the manufacturing sector, as well as those ones in the mechanical industry, play an extremely important role in the European and national context, with a significant impact on the environment, the economy and the society. In this sense, the research project aims to develop an innovative and sustainable business model, inspired by the LS combination, which can support the analyzed enterprise in the development of a strong strategic approach, capable of combining operational efficiency with all pillars of sustainable development.

Methodology

The research methodology will be based on the use of both qualitative and quantitative approaches, subdividing the analysis into three different phases.

STEP 1. In-depth examination of the academic background related to Lean and Sustainable Development, with subsequent focus on the approach to these issues in the specific sector of mechanical industry, in which the company analyzed operates.

STEP 2. Exploration and selection of case studies of best practices of companies in the mechanical sector particularly active in the LS combination. Consequent definition and application of an analysis methodology capable of quantifying the impact of an integrated LS approach with respect to the operational processes of the enterprise examined, through the identification of a specific set of indicators.

STEP 3. Analysis of data previously collected and formulation of a business model based on integration between the principles underlying Lean Thinking and the dimensions characterizing Sustainable Development, which can be applied in the organization investigated and, more generally, in the manufacturing sector under study.

Objectives/Expected Findings

The research objectives can be summarised as follows:

- enriching the literature on the integrated LS approach, which shows clear gaps about the benefits produced on the social component;
- highlighting the correlation between the principles of lean philosophy and the pillars of sustainable development, with particular focus on the mechanical industry, through the application of a predefined LS combined analysis methodology;
- developing an innovative and sustainable business model that can be easily adapted to the context examined and able to integrate the Lean and Sustainability approaches, thus generating significant positive impacts in terms of competitiveness and promotion of sustainable development.

The expected impact is reflected in the following areas:

- development of knowledge about the flexibility and applicability of business models characterized by the LS combination;
- formulation and experimentation of an analysis methodology able to quantify the effects generated by the implementation of lean practices regarding all dimensions of sustainable development;
- dissemination of new knowledge related to the theme of integration between Lean Thinking and Sustainability in the specific context of the mechanical sector, identifying a business model strongly oriented to continuous improvement and sustainable development.

References

Abreu M.F., Alves A.C., Moreira F., (2017), *Lean-Green models for eco-efficient and sustainable production*, Energy 137, 846–853.

Choudhary S., Nayak R., Dora M., Mishra N., Ghadge A., (2019), *SI-TBL: an integrated lean and green approach for improving sustainability performance: a case study of a packaging manufacturing SME in the UK*, Prod. Plann. Contr.

Kleindorfer P. R., Singhal K., Van Wassenhove L. (2005), *Sustainable operations management*, Prod. Oper. Manag. 14, 482-492.

	<p>Murmura F., Bravi L., Santos G., (2021), <i>Sustainable process and product innovation in the eyewear sector: the role of industry 4.0 enabling technologies</i>, Sustainability 13 (1), 1–17.</p> <p>Teixeira P., Sa J.C., Silva F.J.G., Ferreira L.P., Santos G., Fontoura P, (2021), <i>Connecting lean and green with sustainability towards a conceptual model</i>, J. Clean. Prod. 322, 129047.</p>
<p><i>Briefly highlight the coherence characters between the project, the SNSI, and the PNR with reference also to the capacity to foster innovation and interchange between the world of research and the productive world in the field innovation, digital and enabling technologies, as well as the potential scientific, economical and social repercussion.</i></p>	<p>(MAX 3.000 characters excluding spaces)</p> <p>The research project aims to develop an innovative and sustainable business model, inspired by the Lean-Sustainability combination, which can support the companies operating in the mechanical industry to develop a strong strategic approach, capable of combining operational efficiency with all pillars of sustainable development. To this end, it is intended to define an analytical methodology, based on the use of a specific set of indicators, that allows to carry out an integrated assessment of the operational processes' performance with the impacts that they determine in terms of environmental, economic and social sustainability, within the company context under investigation. The application of this methodology will permit to quantify the effects generated by the implementation of an integrated Lean-Sustainability approach and, consequently, to identify solutions able to increase the business performance in terms of operational efficiency and sustainable practices, optimizing the value of the resources used (materials, energy/natural and human). In this sense, the project is perfectly aligned with the work area "Innovation for the manufacturing industry" which is part of research and innovation area "Digital, Industry, Aerospace", identified by the PNR 2021-27 respectively in points 5.4.6 and 5.4. At the same time, it is in accordance with the technological trajectory of national priority development "Innovative production processes for high efficiency and industrial sustainability", defined by the SNSI. In fact, both actions intended to promote the sustainable development and the efficiency of the national economic system, transforming the results of research and innovation into an important competitive advantage and a significant improvement in collective well-being.</p> <p>The project is also directed to the development of a synergic collaboration with the mechanical engineering company analyzed, in order to promote the research-production exchange. This collaboration will simultaneously create value in both directions, increasing the operational and sustainable business performance and creating a new profile as a researcher.</p> <p>In accordance with the REACT-EU, the potential scientific, economic and environmental impact of the research project can be quantifiable and measurable as follows:</p> <ul style="list-style-type: none"> • Scientific impact: enrichment of literature about the combination of Lean and Sustainability through research results and

	<p>the production of scientific publications, with benefits for the Phd student, the University and the private company.</p> <ul style="list-style-type: none">• Economic impact: increase of the competitive advantage within the reference context, through the implementation of an integrated Lean-Sustainability business model aimed to improve the efficiency of operating processes, reducing production costs and times.• Social impact: greater attention to the impact of the corporate system on the social component of sustainable development, identifying a specific number of initiatives capable of enhancing the human capital, the territory and the local community.
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