ENHANCING THE ECO-INNOVATION CONCEPT IN LEATHER INDUSTRY BY CAPITALIZING THE PROCESS MODELING THINKING

ELENA FLEACĂ, BOGDAN FLEACĂ, FLORIN DĂNĂLACHE, ANDREEA DUMITRESCU

POLITEHNICA University of Bucharest, Faculty of Entrepreneurship, Business Engineering and Management, Splaiul Independentei No. 313, Bucharest 060042, Romania, elena.fleaca@upb.ro, bogdan.fleaca@upb.ro, florin.danalache@gmail.com, dumidreea@gmail.com

The increasing peace of globalization and the high growth of consumerism have created a significant pressure on leather tanning sectors to reduce the environmental burdens envisage by conversing the raw materials into leather. The modernization of the leather producers counted for the concerns of environmental protection, waste reduction, recycling and recuperation of secondary raw materials. The paper takes an interdisciplinary view on how the business engineering thinking leverages the enhancement of the sustainable development and the growing recognition the eco-industry and the green growth. Consequently, it has applied the process modeling thinking on the air pollution measurement process with the aid of the business process modeling notation – BPMN, since this process represents a key concern for most of the leather and footwear manufacturers. The results capture the workflow of the air pollution measurement process, and also data about the steps in the process which can be used for process improvements based on what-if analysis. Using the BPMN diagraming technique to map out flows and process relationships is facilitated the process understanding that help document and communicate to all parties involved how the process should be performed. Finally, the findings illustrate the benefits of the process modeling thinking in modernization the activities related to environmental protection goals from the leather sector. By designing, adopting, and leveraging process models for environmental protection, the manufacturers of leather and leather products are stimulating the sustainable development, and also the concept of eco-efficiency and eco-industry.

Keywords: business engineering, process modeling, eco-industry.

INTRODUCTION

The manufacture of leather and leather products is a global industry that is exposed to increasing competition from a large number of low-labor costs countries. To remain competitive in this global marketplace, the leader producers are expected to exploit more efficiently the raw materials, adjusting their production operations towards higher quality outputs and high fashion content leather products.

During the last decades, the major concern on creating a sustainable future by reducing the problems arising from human impact on the environment has determined the key European actors to develop a significant and diverse range of environmental measures.

Although there are no specific environmental EU Directives for the leather tanning sector, two main directives affect the leather tanning industry, directly: the Council Directive 96/61/EC (1996) concerning Integrated Pollution Prevention and Control (IPPC) aiming at reducing emissions of the air, water and land, and the new Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) regulation that ensures a high level of protection of human health and the environment from the risks posed by chemicals. According the official information of European Commission, the impact of environmental regulation on the leather industry is considerable, being estimate that environmental protection costs amount to 5% of all operational costs.

As environmental legislation is a necessity and the enforcement of the legislation is considered a very important aspect so that all enterprises are effectively required to comply with it, Danish Technological Institute has studied the key issues encountered by the SMSs in dealing with the environmental challenges. According to the Report on SMEs and the Environmental in the European Union (2010), the average environmental impact from SMEs in the EU27 is 82% from DC sector (manufacture of leather and leather products) at NACE classification subdivision level. This reality suggests a high environmental impact of the leather industry, since it followed the NACE - HA sector (transportation and storage) with an average of 86% impact and NACE - FA sector (construction) with 85% impact.

The high impact sectors are those with a high environmental impact on at least one of the indicators: energy use, greenhouse gases, air emission, waste or hazardous waste. Moreover, the analysis of total sector impact per country shows a usually high environmental impact of the enterprises from the NACE – DC 19 sector comprising tanning and dressing of leather, manufacture of luggage, handbags, saddlery, harness and footwear with an 11% impact, the percentages being calculated for CA10-KA74 sectors at NACE subdivision level.

It is worth to notice that the Report on SMEs and the Environmental in the European Union (2010) estimates that a 60% - 70% of the environmental impact originates from SMEs and it would be too complex to determine the detailed contribution made by the SMEs to air pollution in terms of different types of pollutants. However, the core idea of the impact analysis emphasizes the huge business potential for enterprises acting in DC sector in reducing environmental damage through innovative cost-effective solutions.

Under these situations, the pressure to remain competitive requires enterprises from leather sector to invest in environmental protection, to modernize the working context for greater resource productivity and better logistics. These require new approaches were engineering must function together with environmental focus in an integrated manner.

According to OECD (2009), the eco-innovation concept is seen as the developments or the implementation of a new or significantly improved products, processes, marketing methods, or organizational structures which lead to environmental improvements compared to relevant alternatives. Therefore, the key enabler for gaining competitive advantage from eco-sustainability is to innovate the workings through the process thinking that ensures the coherent alignment of business goals to business processes.

From these views, the research issue was related to the increasing need of leather producers to invest in their operating activities in order to minimize or correct the problems related to environmental damage to water, air, soil, and eco-systems. Thus, the scope of the research was referring to the cross-disciplinary business challenges of leather producers arisen from the necessity to permanently innovate their internal processes in a way that allow the achievement of environmental protection objectives. Consequently, the research objective was limited to the planning process with focus on the process of air pollution measurement, as a means of accomplishing a high level protection of the environment.

According to Wil and Kees (2002), the advent of information technologies has moved the focus on the organizational process modeling based on process workflows, an important modeling concept for business engineering that aims to ensure the optimal convergence between the enterprise′s resources and the strategic direction required to create added value to the customer.

As result, the actual interest of enterprises in adopting and using business process modeling methods and techniques is essential for a properly understanding of internal processes and for a more readily communication of steps and decision points to all stakeholders envisage.

METHODS

In order to fulfill the research objective, the authors have applied the process modelling concept on the air pollution measurement process, based on the Event-driven Process Chain (EPC) technique. The EPC diagram uses graphical symbols to show the control flow structure of a business process as a chain of event and functions. The model resulted captures not only the visual picture of the process but also data about the steps in the process which can be used for process analysis based on what-if technique. This technique allows business analyst to evaluate various aspect of process, to uncover inefficiencies or other issues and to determine way to improve it (Sharp and McDermott, 2009).

According to the Business Process Modeling Notation v.2 (2010), the standard notation for describing a business process, the process flowchart or workflow diagram visually depicts the flow of work and information within the process. The BPMN diagraming technique allows modeling the workflow using activities, events, and logical connectors as syntax elements which determine the conceptual mainstream of the information system design (Mendling, 2008).

The core function of Event-driven Process Chain (EPC) technique is to answer to the question ″what should be done″, facilitating the design of the necessary activities, the corresponding events, and also the possibilities to create a modular framework based on the process interface (Pascadi and Tutunaru, 2011).

In this regard, the key syntax and related semantic aspects needed for mapping out flows and process relationships are as follows: activity (A) - defines the action to be perform, clearly and concisely; event (E) - defines pre-conditions and post-conditions of functioning; process interface (PI) - points the necessity of executing the process between the flowchart′s predecessor and the flowchart′s successor.

Worthy to be mentioned, the EPC diagram connectors are as follows: SPLIT connectors with one incoming and multiple outgoing arcs and JOINT (J) connectors with multiple incoming arcs and one outgoing arc. The SPLIT connectors comprise the following types: AND – split (A) triggers the execution of all subsequent branches in concurrency, OR – split (O) triggers the execution of any combination of the multiple subsequent branches, based on the condition of at least one branch execution, and XOR – split (X) represents a choice between one of several alternative branches and requires the execution of selected branch.

Modelling the air pollution measurement process has drowned valuable knowledge from environmental management science as referred in Wright (2008). Likewise, the flow of work for air pollution measurement is in accordance with the approach to developing an environmental system, and also with the engineering aspects of ISO 14001 requirements from environmental management standard (Morris, 2004). The clauses in ISO 14001 standard are defined in a general way so that the enterprises from a wide range of manufacturing sectors with high environmental impact such as the NACE HA, FA, and DC 19 classification subdivision level can adopt and apply the recommendations, to successfully minimize the environmental damage caused by their operations and activities.

RESULTS AND FINDINGS

The EPC diagram for air pollution measurement process illustrated in figure 1 depicts the flow of work and information required for measuring the emission level so that the variables of manufacturing leather process are maintained within the acceptable limits.

The essential activities in capturing the flow of the process start with establishing the points of emission measurement based on the technological flowchart related to the core operating activities of the enterprise such as tanning and dressing of leather, manufacturing of luggage and handbags, or manufacturing of footwear.

Secondly, it is required to define the air quality measurement parameters in terms of particulate matter content or concentration of polluting gaseous products, because the measurement technique depends on whether the particles are lighter than or heavier than air. The ISO 14001 standard highlights that there are several necessary conditions in achieving a high-quality measurements such as setting up the level of measurements: accuracy and frequency. In doing this, it is required to consider the range of expected reading values and the measurement frequency.

To achieve the specified level of measurement accuracy, the air pollution measurement technique used must be carefully analyzed and chosen. In this regard, the technical specialist is expected to consider for analysis the wet chemistry laboratory technique or online sensors technique (Morris, 2004).

The air pollution measurement flow goes on to designing and/or choosing the suitable measuring instruments with respect to the static and dynamic characteristics that are appropriate to the needs of the measurement situation. The static characteristics comprise accuracy, sensitivity, linearity and the reaction to ambient temperature changes, and dynamic characteristics describe the behavior between the time that a measured quantity changes value and the time when the instrument output attains a steady value in response. However, all relevant static and dynamic characteristics are expected to be recorded in the data sheet format for any particular measuring instruments.

Furthermore, in assessing the relative suitability of different instruments with the measurement situation it is expected to consider the tradeoffs between the cost, durability, and maintenance of the measuring instrument.

The next step consists of ensuring the correctly calibration of the measuring instrument chosen in which the instrument is tested over its whole range by repeating the comparison procedure for a range of inputs. This activity requires the national reference standard for calibration chain and may trigger the calibration services subcontractor accredited by National Testing Laboratory.

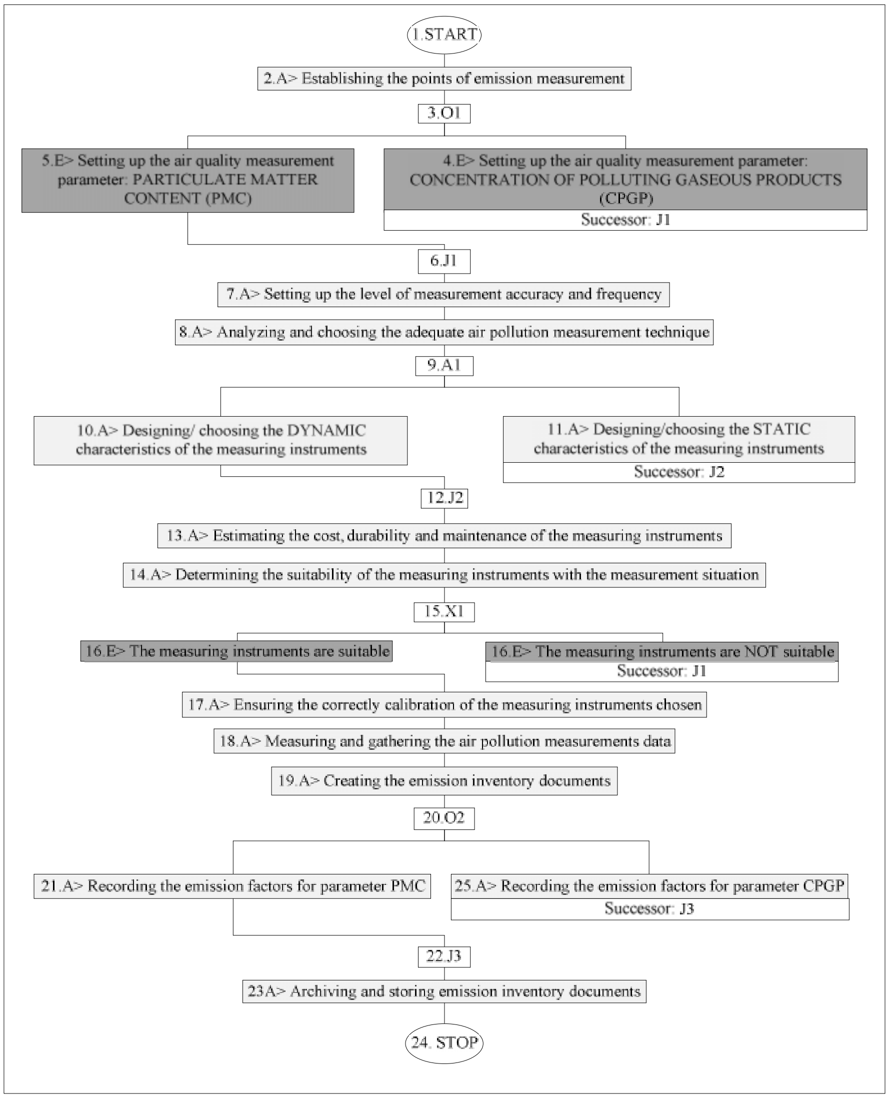

Figure 1. The air pollution measurement EPC diagram

The flow goes on to measuring and gathering the air pollution measurement data documented on the measurement record sheet for parameter: particulate matter content or concentration of polluting gaseous products, followed by the activity of creating the emission inventory documents.

Finally, a thoroughly designed air pollution measurement process requires recording the emission factors for parameter: particulate matter content or concentration of polluting gaseous products, and archiving and storing emission measurements inventory documents.

As alluded to earlier, mapping out flows and process relationships is facilitating the process understanding and help document and communicate to all parties involved how the process should be performed. Hence, the air pollution measurement EPC diagram accounts for a bridge document between business/technical user that can understand the basic elements and IT/business analyst that fill in the details so that the process should be automated, allowing users to collaborate on and work together on models in real time.

Executing the process is generating the acquisition of useful air pollution measurement data which allow decisional factors to analyze opportune, accurate and structured information in order to make managerial decisions, in a flexible and cost-effective manner.

CONCLUSIONS

Using innovative management methods and techniques for designing and implementing the necessary processes correlated with the areas of environmental damage is a form of innovation resulting in demonstrable progress towards the goal of sustainable developments through reducing environmental impacts, enhancing resilience to environmental pressures or achieving a more efficient and responsible use of natural resources.

The findings emphasize that the interest on innovating the workings based on designing, adopting, and leveraging process models for environmental protection helps enterprises from leather industry to profitably improve their internal culture, working processes, materials and related supply-side issues, stimulating the sustainable development, and also the concept of eco-efficiency and eco-industry.

REFERENCES

Council Directive 96/61/EC (1996) of 24 September 1996 concerning integrated pollution prevention and control *Official Journal* of the European Union *L 257, 10/10/1996 P. 0026 – 0040*, http://ec.europa.eu/enterprise/sectors/leather/environment/index_en.htm.

European Commission (2010), *The Main Report on SMEs and the environment in European Union*, http://ec.europa.eu/enterprise/policies/sme/business-environment/files/main_report_en.pdf.

Mendling, J. (2008), *Metrics for Process Models: Empirical Foundations of Verification, Error Prediction, and Guidelines for Correctness*, Springer-Verlag Berlin Heidelberg, London, New York.

Morris, A. (2004), *ISO 14000 Environmental Management Standards. Engineering and Financial Aspects*, John Wiley & Sons, Chichester.

Object Management Group (2011), Business Process Model and Notation. Version 2.0, http://www.omg.org/spec/BPMN/2.0/pdf

OECD (2009), ″Sustainable Manufacturing and Eco-innovation: Framework, Practices and Measurements″, Synthesis Report, OECD, Paris.

Pascadi, M. and Tutunaru, M. (2011), *SIMPLE BPM Software Modeler's Manual [online]*, Available from www: <https://www.avantera.ro/bet/v1.4/manual.pdf>.

Sharp, A. and McDermott, P. (2009), *Workflow Modelling. Tools for Process Improvement and Application Development*, 2nd Ed., Artech House Inc. Publishing, Norwood.

Wil, A. and Kees, H. (2002), *Workflow Management. Models, Methods, and Systems*, The MIT Press Cambridge, Massachusetts, London, England.

Wright, T.R. (2008), *Environmental Science: Toward a Sustainable Future*, 10th Eds., Addison Wesley.