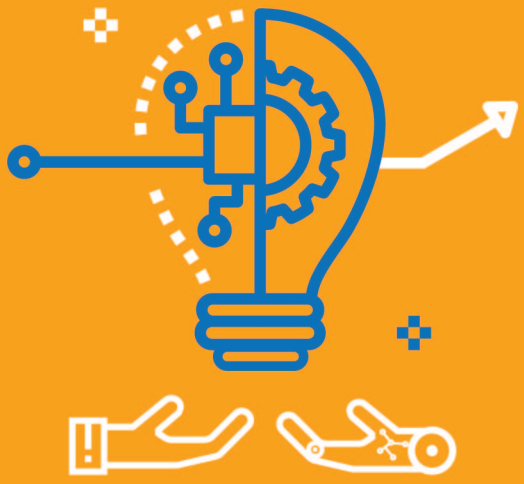

ICQIS 2020

INTERNATIONAL CONFERENCE ON QUALITY INNOVATION AND SUSTAINABILITY

BOOK OF ABSTRACTS

International Conference on
Quality, Innovation and Sustainability
ICQIS2020

NOVEMBER 19-20
School of Technology and Management
Polytechnic of Leiria
in Leiria, Portugal

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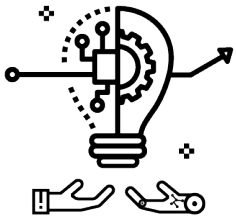

ICQIS 2020 INTERNATIONAL CONFERENCE ON QUALITY INNOVATION AND SUSTAINABILITY

Book of Abstracts

Mário Pereira
Fábio Simões
José Carlos Sá
Irene Ferreira
Pedro Martinho

November 19-20, 2020

POLITÉCNICO DE LEIRIA | ESCOLA SUPERIOR DE TECNOLOGIA E GESTÃO

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Abstract

This book gathers the abstracts submitted and presented at the 2nd International Conference on Quality, Innovation and Sustainability, organized by the Polytechnic of Leiria and the Polytechnic Institute of Viana do Castelo on November 19 and 20, 2020. Abstracts are organized by session, and include keynote presentations, ordinary presentations and the poster session.

keywords: quality, innovation, sustainability.

Contents

About the conference

Any organization is becoming increasingly challenged by the present and future policy guidelines and demands regarding the environment and sustainability, in parallel with high levels of organizational efficiency and effectiveness required to acquire competitive advantages in the global market.

In this context, themes such as quality, innovation and sustainability become essential to find strategic lines of action that allow organizations, rather than react to the market, to anticipate and enhance the differentiation through added value. Development of methods and procedures for quality and innovation while meeting the increasing requirements regarding sustainability must not to be viewed as a difficulty, but as a natural and logical evolution, for the benefit of all. In fact, environment sustainability should not be understood as an obstacle, but as the natural background on which every procedure within an organization should fit.

The International Conference on Quality, Innovation and Sustainability is designed to be a forum for sharing of knowledge and best practices between organizations, including industries, academia and experts, towards achieving an increase in efficiency of any process, regardless of the context, while ensuring sustainability by default.

The conference has gathered academic experts, as well as organizations interested in getting up to date knowledge that can be applied in any process, either existing or being developed.

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Conference program

2nd International Conference on Innovation, Quality and Sustainability – ICQIS2020 General Program	

Time	Wednesday - 18th November 2020
14:00 | 17:00	**Zoom meeting ID: 86119842996** Registration Technical support Presentation tests

Time	Day 1 – Thursday - 19th November 2020	
8:30	Registration	
9:00	Opening Cerimony	
9:30	**Keynote Lecture 1**	
10:00	Coffee Break	
10:30	Session D1.M1 - INNOVATION: Advanced Materials and Processes I - Chair: Fábio Simões	
12:30	Lunch	
14:00	**Keynote Lecture 2**	
14:30	Session D1.A1 - INNOVATION: Data Management and Industry 4.0 – Chair: Irene Ferreira	Session D1.A2- SUSTAINABILITY: Waste Management and disposal and Strategies and management of resources – Chair: José Carlos Sá
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16:30	Session D1.A3 - QUALITY: Quality Management Systems and Risk Management – Chair: João Matias	Session D1.A4 - INNOVATION: Advanced Materials and Processes II – Chair: Pedro Martinho
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10:30	Coffee Break	
11:00	Session D2.M3 – SUSTAINABILITY: Circular Economy and Life cycle costing – Chair: Fábio Simões	Session D2.M4 - QUALITY: Problem Solving Methodologies and Improvement II – Chair: José Carlos Sá
12:30	Lunch	
14:00	**Keynote Lecture 4**	
14:30	Session D2.T1 – QUALITY: Lean and Six Sigma – Chair: Manuel Pereira Lopes	
16:30	Coffee Break	
17:00	Closing	

Sessions

Keynote Lecture 1

The challenges of innovation in developing countries

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Abstract

This communication intends to provide significant contributions towards the debate concerning the role of Technological Development and the consequent innovation, as well as, its impact on Developing Countries. More specifically the contribution of technology and innovation to the creation of wealth and the reduction of poverty in the world, which can be considered as the miracle of technology.

It is imperative for Developing Countries to achieve economic evaluation of scientific knowledge in order to improve their living standard. Developing Countries need is a smart work, this is, project/design of new products developed and produced with their own technology, rather than cheap work force to produce products thought/designed by others. In this communication, the examples of Japan and South Korea, that were in 1950 poor economies and today are developed economies, will be discussed. Developing Countries must have in consideration that Innovation is achieved when a new product has success, when arriving to the market. They do not take into account that Innovation cannot be achieved if Technological Development activities are not pursued and if intellectual property, such as patents, is not valued. Technological policies do not exist that support the promotion of Technological Development since it is thought that it occurs inevitably as long as scientific research is done. New political actions to improve Technological Development, quality and sustainability in Developing Countries are presented and described.

Developing Countries will continue being Developing Countries, if they are not able to conceive and design new products with their own technology in their own companies. Start-up and spin-off companies based on Technological Developments are necessary and technical universities can contribute to these activities if a good technological policy, complementary to the research policy, is implemented by their governments. Quality can be the same, but the economic result is better for countries designing their own products.

The number of companies from Developing Countries, that design and develop products must grow exponentially in order to improve their own economies. Innovation plays a fundamental part in under-development economies since distribution or manufacture does not surpass the development of new products. Scientific researchers and engineers must work together to develop new products able to enrich their own economy.

Session D1.M1 - Innovation: Advanced Materials and Processes I

3D printing of biodegradable materials

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Abstract

With AM it is possible to manufacture more complex geometries, however, some drawbacks are associated with the quality of the surface finish and geometry tolerance. Comparing additive and subtractive processes, AM allows a significant decrease in the amount of raw material, leading to more economical structures and contributing less to the society's environmental concerns.

Although many manufactured objects aim to make the most of their useful life, for some applications it is beneficial that their useful life is shorter and more defined. In this context, an enormous amount of waste is generated and, from the point of view of sustainability, it is desirable to create new and more ecological methodologies.

The use of biodegradable and bio-based materials contributes significantly to a more sustainable planet. In this context, polylactic acid (PLA) is a biodegradable, non-toxic and biocompatible polymer that is produced from renewable bulk starch. This material does not emit toxic fumes nor is it harmful to the environment, which is in line with social concerns about the sustainability of consumer goods. In printing consideration, its temperature is between 180ºC to 230ºC and the recommended print bed temperature is around 50ºC to 60ºC, revealing itself as a material with strong potential to replace petroleum-based thermoplastics. However, its stiffness, low impact strength, low thermal performance and low glass transition temperature (55ºC to 65ºC) are barriers that significantly restrict its use. By combining it with reinforcements, this limitation can be solved, obtaining a printed model with better structural stability and functional properties not attainable as a single constituent. Therefore, adding reinforcements to the PLA is the most viable solution, where the open literature suggests different fillers, such as: metals powders, wood-based filaments, high flexibility filaments (thermoplastic polyurethane), shape memory filaments, graphene, carbon nanotubes, fibres, etc.

Therefore, from the point of view of sustainability, PLA reinforced with natural fillers is considered a good option for applications which the desired lifetime usage is defined, however, more research is needed, because there are still some problems related to the use of bio-composite filaments.

Graphene and the fourth industrial revolution

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Abstract

Global warming has led to the need to live a more sustainable life. Therefore, to achieve that goal the industry must adapt and create new materials which lighter and stronger than the traditional steel-based ones. One type of these materials are composite materials. These materials can be further improved with the addition of nanoparticles in the matrix. within this graphene is one of the most attractive for future industrial applications due to their unique properties. The understanding of the mechanical and other properties that this nanoparticle can offer is essential for the creation of better materials. Therefore, the aim of this work is to provide a look from the literature, into some of these properties and how can they be applied in the development of new products of the fourth industrial revolution. It was possible to conclude that the addition of graphene improves the mechanical properties of composite materials and its industrial implementation should be considered.

Alternative injection moulding technologies to produce plastic parts

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Abstract

The injection molding process is widely used to produce large production series of plastic parts. Some of these plastic parts have geometrical details and specifications that are not feasible through conventional methods. In these cases, non-conventional injection molding processes are used to produce special features that cannot be accomplished by the conventional molding process. Nevertheless, there are some issues associated to the alternative processes, as the part design, processing parameters, the equipment required, and others, that needs to be considered. This work provides a general review of various injection molding alternative processes, namely, structural foam injection molding, co-injection molding, gas-assisted injection molding, water injection technology, in-mold decoration, micro-injection molding and microcellular (MuCell) injection molding with emphases on current stat of the art technology, working principle, main applications and most materials used, and technical challenges. With this paper the readers will be able to evaluate the most suitable injection molding process in order to obtain specific features in the plastic parts to be produced.

3D printing with geopolymer cement: a review on material properties and system requirements

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Abstract

The use of geopolymer cement (GPC) in additive manufacturing (AM) processes applied to the construction sector is a promising approach that can contribute for a more sustainable built environment.

GPC is a solid inorganic binder material comprised of a mix of inorganic materials that has the ability of incorporating considerable proportions of silica- or alumina-containing waste materials or by-products, in a circular economy approach. The geopolymerization process is based on polycondensation reactions of dissolved aluminosilicate oligomers that are originated during the preparation of the GPC paste, when the GPC solid binder is mixed with an alkali hydroxide solution. This process yields a three-dimensional structure of polymeric Si-O-Al bonds that enables the GPC paste to harden and develop considerable mechanical strength at room conditions. Some significant advantages, such as fast setting and strength development, high durability, and low ecological footprint, have been reported and are driving the technological and commercial interest on the geopolymerization process and on the application of GPC as an eco-friendly and high-performance binder for the construction industry.

One of the technological applications that can take advantage of these properties is AM by extrusion-based 3D printing (eb-3DP), in which material properties, such as setting time and strength development, are crucial. However, it has been suggested that GPC paste properties, both in fresh and hardened states, are very sensitive to the particular formulation and raw materials used. Therefore, GPC formulations must be developed along with the definition of processing parameters and adjusted to the printing system, in order to achieve an effective eb-3DP process.

The influence of GPC formulation parameters in critical fresh properties of the mix, is reviewed. Additionally, the effects of printing parameters on the properties of printed structures, are also subject of bibliographic review.

Sustainable additive manufacturing of large parts using recycled tyre composites

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Abstract

Modern industry is heavily concerned with the environment, being on the constant path that leads into better energy efficiency and lower material wastage, while aiming to preserve mechanical properties. Additive Manufacturing (AM) techniques are a viable option to achieve said goals and guarantee a significant sustainability concern, especially when using polymer matrix composites, that combine a thermoplastic matrix and recycled materials from industrial waste, as a reinforcement.

AM is currently under heavy development, as an answer to the competitive nature of the industrial scene. These techniques present numerous applications with different materials, capable of answering the market demands by providing quick solutions, innovative products with good functional and mechanical characteristics, great design freedom and significant advantages in terms of flexibility, quality and production cost.

In the scope of AM, the relationship between material and production processes takes on a special role, as these two factors become interdependent, contrary to what occurs in traditional subtractive methods. The study and development of this relationship will allow for the creation of new products, processes and equipment, being at the basis of the Add.Additive, project developed at the Centre for Rapid and Sustainable Product Development - CDRSP-PLeiria, under which this paper was developed.

This paper aims not only to explore the advantages that AM technologies offer against conventional manufacturing techniques, but also to explore the advantages of applying AM techniques to the manufacturing of larger parts, breaking the barrier that constricts conventional AM technologies to relatively small part dimensions.

To achieve this, the existing software applications need to be readjusted given that they are usually restricted to smaller parts and workspaces, which emphasizes the need to develop new computational solutions that allow an automated, user friendly way of connecting the design stage and the manufacturing stage for large parts, such as urban furniture.

Following these guidelines, the main goal of this paper is to design a process from start to finish that allows the manufacturing of large parts using recycled tyre composites with unconventional deposition strategies. To achieve this, a software application was developed, that has a 3D model as an input which is then sliced in order to create tool path files, later used in a robotic arm which has a custom-made polymer matrix composite deposition head, also developed under the referred project.

This intends to value the manufacturing of relatively large structures in small batches, with a high level of customization making use of new materials that incorporate industrial waste, which brings an increased value on a sustainability point-of-view, thus evolving in a more conscious and responsible sense, minimizing the use of conventional oil-based raw materials.

Keynote Lecture 2

Sustainable Development in the Integrated Management Systems Study Program Affected by Industry Needs and the Covid-19 Pandemic Situation

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Abstract

The purpose of this paper is to present the results of a KEGA 043TUKE-4/2019 project aimed at making the study program Integrated Management Systems (IMS) more attractive and adapting it to online communication due to the Covid-19 pandemic situation. The research objective is to identify the role of sustainability knowledge in the education and career of graduates of this study program. We studied the abilities of graduates of the IMS study program using a questionnaire, which is designed according to the T-shape personal profile. Data collection took place in three steps: (1) semi-quantitative questionnaire method – to gather information on the areas of skills and knowledge, (2) information gathered from employers through interviews, (3) interviews with students who completed the semester of distance online learning – to verify whether it is possible to teach engineering subjects without direct access to laboratories. The initial analysis showed what key knowledge and skills are recognized by respondents from working life and how they meet the requirements for the professions of quality engineers, quality managers, safety managers, and environment managers and in particular their ability to think creatively and innovate in the circular economy. The preliminary result of the research was a proposal for the implementation of three new courses into the bachelor's study syllabi: (1) Quality and Sustainability; (2) Materials for Green Technologies; and (3) Smart product development.

Session D1.A1 - Innovation: Data Management and Industry 4.0

Challenges of Quality 4.0 in Industry 4.0

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Abstract

In future organizations, led by digital transformation, people will have to work alongside intelligent automation. Industry 4.0 can be considered as an open door for the quality development to turn into a leading force, this means important challenges impose into quality area, once it accentuates the need to adjust to innovative technology, to present day data analytics and to businesses ecosystem that describe a time of Industry 4.0. Distinctive organizations have different production systems and this is the motivation behind why, placement of Industry 4.0 conception is consistently subject to a particular organization's conditions, also some industrial companies do not need to apply Industry 4.0 conception, on the grounds that the character of their items does not allow it. One of the main threats to civilization and organizations is overconfidence in technology, quality experts should then change their attention to foreseeing change and integrating new ideas into plans of action. Humans cannot develop any new technologies without quality as a solid basic foundation. A progression to Quality 4.0 would be beneficial to organizations because it would help them being more effective and efficient in managing costs and assigning resources. Organizations often work with a lot of data, but so little of it is useful, emphasizing the need to work with IT to define the quality of that data and customers are gradually requesting, like never before, for more customized and detailed products. As society walks to a technology-driven economy, the seriousness level of any quality problem will turn out to be more catastrophic and, inferior product quality can turn into a loss, besides the negative impact will return to the manufacturers. There can be found a technology breach between quality and different parts of the manufacturing process that add to Industry 4.0. and the responsibility of that breach, not only, but also, goes to business owners and managers who do not look at quality as a serious business need, that breach also exists due to the slow progress of the participation of humans in quality challenges against the progress of technology development. The vast majority of the manufacturing industries are developing rapidly and, in consequence, quality departments are challenged, generating the need to evolve and make quality to have a function towards the start of the process and not only towards the end. Quality professionals are challenged by this new paradigm and have now to acquire new skills in order to help their organizations to implement Industry 4.0. This paper problematizes and discuss a change towards manufacturing industries in order to highlight some basic challenges of digital transformation needed for Quality 4.0.

Potential of Cox Proportional Hazard Model in Industry 4.0 Data Management

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Abstract

The fourth industrial revolution, or Industry 4.0 (I4.0), is already a reality and will fundamentally change future manufacturing and production processes over the coming years. It is the era of smart factories and networked industrial environments that will benefit from the main I4.0 design principles: interoperability, virtualization, decentralization, distributed control and communication, real-time capability, service orientation, quick and easy maintenance, heterogeneity, mass customization, low cost, and modularity [1].

This article aims to demonstrate the potential of Proportional Hazard Models (PHM) in the analysis of some I4.0 data. These models were established by Cox [2] in 1972, and since then, have been widely used in the field of medicine, in particular in studies concerning survival rates. In the course of the presentation of his work, Cox stressed that these models could also be applied to the engineering sector. In this field, most studies have focused on the reliability area, especially in the analysis of data regarding the reliability of industrial equipment subject to condition monitoring throughout the years.

The main objective of this work is to show the versatility of these models in the analysis of some types of data, but whose events occurrence probability can be modelled by a set of parameters, for instance to optimize decisions regarding quality, production and maintenance activities or innovation strategies.

For example, the scheduling of regular maintenance operations and intervals between inspections can be optimized based on the values of the parameters related with the risk of breakdown. These models can also be used for changing production plans based on the factors that at a given moment restrain the quality of the manufactured products or reduce the productivity. Furthermore, in new product or process design, it can also support the rapid reach of a desired characteristic based on the production equipment settings or in the row material selection.

In conclusion, the multivariable approximation of a given problem is one of the increasingly significant implications of I4.0, and in this scenario the author supports the importance of PHM in the transformation from information automation to knowledge automation.

References

[1] T. P. Raptis, A. Passarella and M. Conti, "Data Management in Industry 4.0: State of the Art and Open Challenges," in IEEE Access, vol. 7, pp. 97052-97093, 2019, doi: 10.1109/ACCESS.2019.2929296.

[2] Cox, D. R., Regression Models and Life Tables (with Discussion), Journal of the Royal Statistical Society, 1972, S. B., 34, p. 187-220.

Return on Investment in the 4.0 Industry and MES Systems: Case Study

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Abstract

This new era of industry is driven by connectivity, advanced materials, more capable technological processes and smart factories at a distance from an application on mobile devices. These technologies support all stages in the supply chain, from raw materials to the final product that is shipped to the final costumer. Technologies such as IoT (Internet of Things) and MES systems (Manufacturing Execution Systems) provide opportunities for improvement in process management and control.

This work focuses on the analysis of two Portuguese case studies of companies in the textile area that work with 4.0 technologies, namely IoT and MES. To be better characterized these companies both financial and operational data is crossed with data from I4.0 investments.

Research shows that companies that have innovated and adapted their production processes with 4.0 technologies are feeling the benefits. In general, companies have improved the management of their operations on the shop floor because they have installed tools that allow the direct visualization of the state of their productions, creating a different dynamic in the control of the processes. However, the financial benefits are not obvious. The companies in question have been using technology 4.0 approximately for two years, which is why the gain from improvement in operations management in economic and financial indicators is not evident. Although, it is expected that with the improvement in the control of the production processes and a good definition of operational goals, the companies will show positive effects in the financial level, benefiting from the implementation of 4.0 technologies.

References

Clark, G. (2016). The industrial revolution: A cliometric perspective. Handbook of Cliometrics, 197–235. https://doi.org/10.1007/978-3-642-40406-1_9

Cotteleer, M. M., & Sniderman, B. (2017). Forces of change: Industry 4.0. Deloitte. Insights. https://doi.org/10.1007/s11947-009-0181-3

Lamouri, S., Tamayo-Giraldo, S., Moeuf, A., Pellerin, R., & Barbaray, R. (2017). The industrial management of SMEs in the era of Industry 4.0. International Journal of Production Research, 56(3), 1118–1136. https://doi.org/10.1080/00207543.2017.1372647

4D printing versus industry 4.0

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Abstract

The four-industrial revolution, also recognized as Industry 4.0, promoted the integration of intelligent production systems and advanced information technologies. In this context, additive manufacturing (AM) is considered indispensable in this movement. Using AM techniques offers an attractive scenario for sustainable production with regard to energy consumption and waste reduction. However, materials science is the key to understanding developments in AM technologies. Although several plastic/polymer constituents are available for AM, some specific materials attract more attention from the industry. In this context, the development of 4D printing has shaped the additive manufacturing industry, allowing shape memory effects to be dynamically achieved using smart materials. Additive manufacturing has the potential to increase the manufacturer's agility, offering products with better performance, less waste and a production volume adaptable to the particularities of the project. By promoting the integration of industrial and information systems with communication technologies, the industry is reshaping itself to industry 4.0, being a priority for many professionals and researchers. Industry 4.0 was developed to address economic opportunities, social issues and ecological concerns. From an economic point of view, the implementation of Industry 4.0 will enhance the value creation and competitiveness, greater flexibility and efficiency in production and reduction of logistics costs. On the other hand, from an ecological point of view, the organizations that implement Industry 4.0 reduce greenhouse gases emissions and waste.

In this context, the introduction of smart materials in the additive manufacturing industry has advantageous features such as reconfiguration the printed structure and obtaining the desired material property over time. Therefore, to produce functional components/structures, smart materials such as shape memory alloys (SMA) and shape memory polymers (SMP) are used in 4D printing, which can change its color, shape, function or other predefined characteristics in response to stimuli such as temperature, water, solvents, pH, electric energy, light (ultraviolet rays) or magnetic energy. Furthermore, it is expected that the development of 4D printing will allow the effects of shape memory to be achieved dynamically using smart systems with new material combinations.

Sustainability and Productivity enhancement with Overall Equipment Effectiveness improvements using Industry 4.0 solutions and data digitization technologies

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Abstract

This work presents results on productivity enhancement of real industry process applications with different Industry 4.0 and IIoT solutions to improve Overall Equipment Effectiveness (OEE). Many productive processes are using conventional monitoring and process control techniques [1]. Each player should adapt their working processes and invest in new technologies to get more data available from shop floor to top floor. New data analysis paradigm can lead to new decision models that contribute to more sustainable businesses. The most important highlights are to collect accurate data in order to get critical and key information about processes, continuously monitor availability and condition of productive equipment's and processes. Such information must be securely accessed from anywhere, to help decision-making process [2]. Resulting production costs saving are either money savings or production improvement throughput without the need of additional resources (human or machinery). Collected data should be acquired without touching the control system and available on all communication devices and software platforms across different layers. Real examples of digitization will be presented.

References

[1] Constantinescu, C., E. Francalanza, D. Matarazzo & O. J. P. C. Balkan (2014). *"Information support and interactive planning in the Digital Factory: Approach and industry-driven evaluation."*, Procedia CIRP 25: (pp. 269-275)

[2] Putnik, G., Varela, L., Carvalho, C., Alves, C., Shah, V., Castro, H. & Ávila, P. (2015) *Smart Objects Embedded Production and Quality Management Functions, International Journal for Quality Research,* Vol. 9, Nº1, (pp.151-166)

Session D1.A2 - Sustainability: Waste Management and disposal AND Strategies and management of resources

Composting of garden waste in an urban area: an experiment at PUC-Rio campus

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Abstract

Composting is a useful technique for organic waste management and agricultural use. However, in urban areas it has been used in small scale, as most of organic fraction is directly disposed in landfills. The use of this technique in the cities and its product can be more interesting and attractive if it is combined with urban agriculture. The purpose of this study was evaluating organic composts produced by composting using static piles and passive aeration with different garden waste combinations. Try a simple and low-cost methodology that considers urban limitations, uses smaller piles and few operating through the process. The experiment was carried out between November 2018 and March 2019 at the campus of the university PUC-Rio, located in the city of Rio de Janeiro, in Brazil. The experiment contained three treatments and two replications. The treatments were: leaves + grass, leaves + grass + branch and leaves + branch. The process lasted 19 weeks. At the end of the process the remaining material and the produced compost were measured and resulting samples from each pile were collected and transferred to the laboratory for analysis: pH, electrical conductivity, moisture, potassium (K_2O), phosphorus (P_2O_5) and CEC. According to the obtained results, all treatments showed chemical characteristics with satisfactory levels and within existing standards, resulting in a good quality compost, even though they all showed low potassium content. The methodology proved to be efficient, as it did not require high investment in infrastructure and labour to carry out the process and the produced compost showed good quality. Thus, it can be a good alternative to urban agricultural producers and to improve solid waste management.

References

Brazil (2009). *Normative Instruction No. 25, 2009 MAPA Brazil Ministry of Agriculture, Livestock and Food Supply*.

Kiehl, E. J. (2004). *Manual de compostagem: maturação e qualidade do composto*. 4.ed. Piracicaba: E. J. Kiehl. 173 p.

The impact of congestion on vehicle routing for urban logistics

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Abstract

Road transport is the most widely used means of transportation in Europe, whether light or heavy goods or passenger vehicles. Correct routing of supply networks results in greater use by organisations of the resources at their disposal and, as a result, this optimisation leads to both environmental and economic impact reduction. The problem of vehicle routing (VRP) has received special attention from the transport industry due to the need to reduce spending on the production process of a commodity. In the last decade, the Green VRP has emerged in which the objective is to harmonise the economic and environmental scope. This work aims to understand the impact of congestion constraints on vehicle routing for urban logistics. It presents a MIP model that incorporates a GHG emissions calculation model adopted to reduce emissions and, consequently, reducing the use of peak traffic times. The model is validated and tested using well-known instances in the literature adapted with data from real cargo vans. The results of the test instances show that the implementation of an emissions model in conjunction with a VRP formulation makes it possible to study congestion in urban areas and that it is possible to reduce the use of congestion times in urban logistics.

Use of domestic wastewater for production of lettuce grown in a hydroponic system

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Abstract

The growing need for food production and the high use of water, especially in traditional agriculture, has led to the search for more efficient technologies in the agricultural sector, reducing consumption and water waste, and inducing wastewater reuse. Soilless cropping systems are an alternative to traditional agriculture, which offers the possibility of reducing water use (Tomasi et al., 2014). The aim of this study was to evaluate the possibility of using wastewater from an urban treatment plant, as a source of nutrients, for growing lettuces in a small hydroponic system, without recirculation. The crop growth was studied under three different conditions: wastewater (after primary or secondary treatment); wastewater with potassium supplementation; and in a nutrient solution, based on Carvalho et al. (2018), as a positive control. Crop growth, physical and chemical parameters of the wastewater and the environmental conditions in the greenhouse were monitored. The results point to a limited crop growth in the wastewater, due to the low nutrients concentrations, which affects the plants fresh weight. The supplementation improved crop growth, although not so significantly, being more evident in the roots. The system provided an improvement in the wastewater quality, allowing the removal of the nutrient and organic load. The solids load in the wastewater also seemed to affect the plant growth, thus revealing that an additional filtration treatment before using the primary treated wastewater could improve crop yield. The environmental conditions in the greenhouse didn't seem to affect negatively the crop production.

References

Carvalho, R., Bastos, R., & Souza, C. (2018). *Influence of the use of wastewater on nutrient absorption and production of lettuce grown in a hydroponic system.* Agr Water Manage

Tomasi, N., Costa, L.D., Pinton, R., Cortella, G., Terzano, R., Mimmo, T., *et al*. (2014). *New solutions for floating cultivation system of ready-to-eat salad: A review*. Trends Food Sci Tech

Lean, green and sustainability: a bibliometric analysis

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Abstract

The objective of this study is to map academic publications on the subject and the intellectual knowledge contained therein, while covering past research and identifying potential future trends and paths of research in the fields of lean, green and sustainability, identifying some of the most relevant research in this field and a selection of the latest trends according to information found in the Web of Science database. It was performed a bibliometric approach based upon VOSviewer, with a specific focus on drafting maps for visualizing an underlying intellectual structure. This type of analysis encompasses the scope of the articles published and the annual number of citations for the period between 1990 and 2020, as registered by the Web of Science database. Several classifications were made, including an analysis of the most influential journals, the most cited papers of all time and the most productive and influential authors. The results show that the lean approach has been linked with green management, environmental concerns, such as carbon emissions and energy consumption, and also with social implications, this is sustainability. Thus, the evolution of publications and the clusters identified in this field, corroborate that the combination of lean and green has been gaining more and more attention indicating that both concepts can be integrated and that organizations can use their combination to seek sustainable results. The main contribution of this study arises from identifying the main research trends in this field and the respective shortcomings and specific opportunities for future research.

References

Dües, C. M., Tan, K. H., & Lim, M. (2013). Green as the new Lean: how to use Lean practices as a catalyst to greening your supply chain. Journal of Cleaner Production, 40, 93–100. https://doi.org/10.1016/j.jclepro.2011.12.023

Jabbour, C. J. C., Jabbour, A. B. L. de S., Govindan, K., Teixeira, A. A., & Freitas, W. R. de S. (2013). Environmental management and operational performance in automotive companies in Brazil: the role of human resource management and lean manufacturing. Journal of Cleaner Production, 47, 129–140. https://doi.org/10.1016/j.jclepro.2012.07.010

Samuel Silva, J. C. Sá, F. J. G. Silva, Luís Pinto Ferreira and Gilberto Santos (2020). Lean Green—The Importance of Integrating Environment into Lean Philosophy—A Case Study. Proceedings of the 6th European Lean Educator Conference. 122, 211-219. https://doi.org/10.1007/978-3-030-41429-0_21

Assessment of the transport sustainability performance in the European Union countries

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Abstract

The transport sector plays a fundamental role in the European economy. By 2017, the transport sector employed directly more than 11 million people, around 5% of the total workforce, and its activities accounted for about 5% of Europe's Gross Domestic Product (GDP). Promoting efficient transport services and infrastructure is fundamental for making the most of the European's economic strengths, supporting the internal market and its growth. Unfortunately, the European Union transport sector still remains heavily dependent on oil resources and, therefore, it is responsible for a large part of the air pollution. The emissions from the sector have reduced in the last decade, but not enough to limit its impact on the environment and climate. Reducing its pressure on the environment is critical to achieve long-term sustainability. The European Union has been promoting diverse initiatives towards sustainable transport development and environment protection by setting targets for changes in the sector, as those proposed in the 2011 White Paper on transport [1]. This study aims at evaluating the sustainable performance of the transport sector in the 28 European Union countries, from 2015 to 2017, towards the policy agenda established in strategic documents. The assessment of the transport environmental performance was made through the aggregation of seven sub-indicators into a composite indicator using a Data Envelopment Analysis approach. The model used to determine the weights to aggregate the sub-indicators is based on a variant of the Benefit of the Doubt model with virtual proportional weights restrictions as proposed by Färe et al. [2] . The results indicate that, overall, the European Union countries had almost no variation on its transport environmental performance during the time span under analysis. The inefficient countries can improve the transport sustainability mainly by drastically reducing the greenhouse gas emissions from fossil fuels combustion, increasing the share of freight transport that uses rail and waterways and also the share of transport energy from renewable sources.

References

[1] European Comission. White paper on transport: Roadmap to a single european transport area: Towards a competitive and resource-efficient transport system. 2011.

[2] Rolf Färe, Giannis Karagiannis, Maryam Hasannasab, and Dimitris Margaritis. A benefit-of-the-doubt model with reverse indicators. *European Journal of Operational Research*, 278(2):394–400, 2019.

Risk Analysis as a key tool for environmental balance: an overview of their publication and the main groups identified

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Abstract

The international community has been concerned about environmental disasters like, climate changes that have been perceived, may impact society through rising temperatures, rising sea levels, more frequent storms, floods, and longer periods of drought (Klijn et al., 2015). To implement possible preventive actions related to environmental disasters, which have been more frequent and severe in recent years, risk management has been an appreciated topic in academia (Wang et al., 2015). These actions can facilitate decisions to allocate funds, propose innovations that can provide new strategic elements of containment and greater expertise in methods to assist in disaster prevention and/or reduction (Przychodzen and Przychodzen, 2015; Wang et al., 2015). Therefore, the question that guided this research: how has academic research been developed about risk management in the environmental sciences, and what are its possible trends? To answer it, the objective of this article is to identify the state of the art and the research gaps related to risk management in the environmental sciences. For this purpose, this article uses a method and technical procedures respectively, the bibliographic research and the literature review. It should be noted that 2068 indexed studies were identified in the research (title and keywords). To identify research gaps, the twenty most cited articles in the base were used, considering the time cut from 2015 to 2020. The main research topics in risk management focused on environmental sciences were identified, being "environmental disasters", "waste/pollutants", "projects" and "tools". The great novelty of this work was the bibliometric analysis of risk management in the environmental sciences, enabling the identification of the most important countries, authors, newspapers, and keywords and the identification of gaps in the most cited scientific texts on the subject.

References

Klijn, F. et al. (2015) 'Adaptive flood risk management planning based on a comprehensive flood risk conceptualisation', Mitigation and Adaptation Strategies for Global Change, 20(6), pp. 845–864. doi: 10.1007/s11027-015-9638-z.

Przychodzen, J. and Przychodzen, W. (2015) 'Relationships between eco-innovation and financial performance - Evidence from publicly traded companies in Poland and Hungary', Journal of Cleaner Production. Elsevier Ltd, 90, pp. 253–263. doi: 10.1016/j.jclepro.2014.11.034.

Zhao, X., Hwang, B. G. and Gao, Y. (2016) 'A fuzzy synthetic evaluation approach for risk assessment: A case of Singapore's green projects', Journal of Cleaner Production. Elsevier Ltd, 115, pp. 203–213. doi: 10.1016/j.jclepro.2015.11.042.

Wang, Z. et al. (2015) 'Flood hazard risk assessment model based on random forest', Journal of Hydrology. Elsevier B.V., 527, pp. 1130–1141. doi: 10.1016/j.jhydrol.2015.06.008.

Session D1.A3 - Quality: Quality Management Systems AND Risk Management

Customer Satisfaction Based on SERVQUAL Model – Case Study

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Abstract

In order to ease the lives of authors, editors, and trees, we present a manual and an example of the use of Microsoft Word and similar

Presenting a direct effect on customer satisfaction, the service quality is a growing interest issue. Considered today as a multidimensional concept, the service quality has been defined, during the last decades, as a global judgement carried out by the customers on the performance of a service provider organization. Even after the publication of others, the acceptance of SERQUAL Model seems to remain indisputable. According to the referred model, the service quality can be evaluated by five dimensions: reliability, assurance, tangibility, empathy and responsiveness. Aiming the identification of gaps observed between expectations and perceptions of customers in the service, the model can be considered as an interesting management tool. No references are found in literature about the applicability of the SERVQUAL Model to small and micro-organizations.

Expecting the quality evaluation of the service provided and the understanding of its application interest to small and micro-organizations, the SERVQUAL model was applied to a bakery-pastry shop. Comprising a section for demographic characterization of respondents and another for measure the expectation and perception of customers, a close-ended questionnaire was delivered to 60 participants. A seven point Linkert type scale ranging from “strongly agree” to “strongly disagree” was considered.

From collected questionnaires, 51 were considered correctly completed. Despite a lower impact of the Tangibility on the quality of the service, the respective analysis indicates a global satisfaction of customers. Allowing the expectation and perception knowledge of each social group of the customers regarding the service provided, the analysis accomplishment creates an opportunity for reflection on the improvements to be implemented in order to better satisfy the detect necessities in function of a specific social group.

Keywords: SERVQUAL, Service, Customer Satisfaction

A Structured Approach to Risk Management in Agile

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Abstract

Nowadays, industry in general is experiencing an ever increasing pace of change which has been creating important challenges that need to be properly addressed to fulfil the expectations created on their customers about products and services. Essentially, innovative and cost effective products along with a quick deployment are the main strategies that companies normally use to fulfil these expectations, however, this approach requires a robust risk management approach to avoid negative impacts on the brand image as a result of low reliability products and services. One way that has been recently adopted by organizations to manage this kind of risks is the Agile project management approach which has been adapted according to the industry type. In fact, the Agile approach was developed by the software industry in 2001 to reduce the risk of failing to meet the user´s requirements during the product design and development which helped to increase customer satisfaction, shorten time to market, enable innovation and reduce costs. However, some drawbacks have been found regarding the use of Agile methodology in industries different from the software industry. For example, the absence of a structured approach to perform risk assessment and management have been created negative impacts on these companies, especially in innovative projects where the uncertainty about the organization capability to perform such projects is greater. In this sense, this paper proposes a new and structured approach to perform risk assessment and management of Agile projects. The proposed framework uses a set of qualitative and quantitative tools in such a way that the traditional flexibility found in Agile is not compromise. In this way, the Agile team members do not need to change the way they work and at the same time a systematic way of risk analysis and management is introduced in the Agile runs which absence in Agile projects has been strongly criticized in literature.

References

Conforto, E. C., Salum, F., Amaral, D. C., Da Silva, S. L., & De Almeida, L. F. M. (2014). Can agile project management be adopted by industries other than software development?. Project Management Journal, 45(3), 21-34.

Teller, J., Kock, A., & Gemünden, H. G. (2014). Risk management in project portfolios is more than managing project risks: A contingency perspective on risk management. Project Management Journal, 45(4), 67-80.

Analysis of Factors Affecting Customer Satisfaction in Restaurants: an IMS Approach

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Abstract

Restaurant and eatery business are a vital area that needs further exploration. While the importance of presenting diversity of dishes is paramount, for eateries that are beset in their quest to retain consumers and customers, owners must consider the factors affecting satisfaction of customers associated to nutriment services. This study inspects young generation's gratification with their food facility establishments. An interpretive structure model was assembled from accessible information by means of data from a survey conducted at Khulna city in the west of Bangladesh. The study results suggest that the fourteen most chief variables that elucidate customer satisfaction include service quality, ambience, sitting arrangement, privacy, VAT and taxes, washroom facility, food quality, staff behavior and price. Additional noteworthy variables include lighting conditions, responsiveness, and hygiene. This work seeks to recognize which barriers are acting as the utmost dominant aimed at the adoption of total customer satisfaction. Present study is helpful for eatery business to make greater profit and achieve reputation by removing the dominant barriers.

References

Piya, S., Shamsuzzoha, A., and Khadem, M. (2020). An approach for analyzing supply chain complexity drivers through interpretive structural modelling. *International Journal of Logistics Research and Applications*, 23(4), pp. 311-336l

Agrawal, R., and Vinodh, S. (2019). Application of total interpretive structural modelling (TISM) for analysis of factors influencing sustainable additive manufacturing: a case study. *Rapid Prototyping Journal*, 25(7), pp. 1198-1223

Evaluation of Maturity in Integration of Management Systems in Second Party Logistic Providers: A Hybrid Approach using Fuzzy AHP-TOPSIS and Multivariate Analysis

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Abstract

Second Party Logistic Providers (2PL) is a critical link in the Supply Chain Management as companies that provide outsourcing services such as storage and transport to reduce the operational costs, increase efficiency and underpin the organizations to generate added value in their products and services. However, this sector presents operational inefficiencies in costs, use of technology, transport infrastructure, and the application of methodologies for improving performance in areas such as quality, occupational health and safety, environment, and secure commerce. For those mentioned above, the companies decrease their capability to comply with the requirements and regulations of the customers, suppliers, and other stakeholders. In this regard, the Integrated Management Systems can support the Second Party Logistic Providers through the application of continuous improvement cycle in their value chain, with benefits in the performance of the companies and impacts on productivity, competitiveness, and sustainability of the sector which depends on the level of maturity in the integration of management systems. However, due to the complexity of the sector, it is necessary to develop methodologies and frameworks for the objective evaluation of maturity in the integration of management systems. In this regard, the evidence related to the conditions and maturity in the implementation of IMS in the 2PL companies is limited and provides little information and solutions for the sector. The goal of this work is the evaluation of maturity in the integration of management systems in 2PL companies dedicated to offering transport and storage services through the development and application of hybrid methodology using a multi- criteria decision-making model such as Fuzzy AHP-TOPSIS and Correspondence Factorial Analysis. The main contribution of this proposed methodology applied in the Second Party Logistics companies is to provide an objective instrument for evaluation and improvement through the use and interaction of computational tools and statistics. The results obtained allow identifying the criteria that affect the level of maturity of the companies and their importance. Through this methodology, the participating companies were also classified into four different groups, taking into account their maturity in the integration of management systems, also establishing improvement plans.

Quality Improvement Vehicle Painting Process with the Support of Statistical Control Tools

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Abstract

This abstract presents a case study approach based on qualitative methods and data that aimed a detailed examination of an environment, a particular subject or situation. The objective of this work is to improve the painting process of an automotive company through the application of Statistical Process Control for the optimization of performance indicators quality and productivity. Statistical Process Control is applied to the monitoring of manufacturing industry processes (Lizarelli et al., 2016), including automotive manufacturing. The implementation of the SPC in production environments is to improve and control real-time product and process characteristics, quality and productivity is an accepted manufacturing event. Understanding the process structure and quantifying the process performance is essential for positive initiatives of quality improvement (Wu et al., 2009).

When discussing the capacity of a process, it is necessary to analyze the associated Cp and Cpk indices. The capability of the company's caulking process has changed since the Cp and Cpk indices were increased to 0.79 and 0.35, respectively, the process provides greater capacity and performance. However, the index values obtained are below the considered ideal value of 1.33. Therefore, in the case where Cpk < Cp, as presented in this paper, the process is non-centered. Note that the condition Cpk > Cp is impossible, since the value of Cp is the maximum capability that a process can present.

References

Lizarelli, F.L., Bessi, N.C., Oprime, P.C., Amaral, R.M. do, Chakraborti, S., 2016. A bibliometric analysis of 50 years of worldwide research on statistical process control. Gestão & Produção 23, 853–870. https://doi.org/10.1590/0104-530x1649-15

Wu, C.-W., Pearn, W.L., Kotz, S., 2009. An overview of theory and practice on process capability indices for quality assurance. Int. J. Prod. Econ. 117, 338–359. https://doi.org/10.1016/j.ijpe.2008.11.008

Session D1.A4 - Innovation: Advanced Materials and Processes II

Polypropylene films coated with electrospun nanofibers of porphyra dioica/gelatin/PVA for food packaging applications

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Abstract

A novel approach for manufacturing food packaging is proposed through electrospinning, which refers to an emergent technique with application to coating of traditional polymer films. Electrospun nanofibers evidence chemical and mechanical properties which explain the growing interest in industrial electrospinning solutions. Porphyra dioica extracts were incorporated in a PVA/gelatin electrospun solution as coating for polymeric film of polypropylene (PP) applied in poultry meat conservation. Coated PP films revealed significant differences comparing to the control groups in terms of microbial growth ($p < 0.001$) after four days of refrigerated conservation [1].

References

[1] Reboleira J, Adão P, Guerreiro SFC, Dias JR, Ganhão R, Mendes S, et al. Poultry shelf-life enhancing potential of nanofibers and nanoparticles containing porphyra dioica extracts. Coatings. 2020;10(4):1–14.

Synthesis and Tensile Evaluation of a Bio-based Polyurethane Foam with Different Mass Fractions of Aluminum Hydroxide

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Abstract

Rigid polyurethane foams (PUFs) are among the most consumed polymeric materials worldwide. They present a wide range of applications, such as insulation, transportation, domestic appliance, building construction, and automobile industry [1,2]. The main concerns around PUF application are its high flammability and oil-based raw materials [3]. Those are the reasons for the recent demand over new bio-based PUFs and mechanisms for decreasing their flammability without harming their properties and ecological friendly appeal. Aluminum hydroxide (ATH) is a halogen-free non-toxic additive flame retardant. In this study, a bio-based PUF was synthesized with a 1.2/1 (isocyanate/green-polyol) ratio with the addition of 10%, 20%, 30%, 40%, and 50% of ATH mass fraction in order to evaluate the different responses under tensile load. These mass amounts are justified according to many flammability results available in the literature for ATH added PUFs, as shown by Akdogan, et al. [1] and Pham, et al. [4]. The density of the pure foam was 180±5 kg/m³ and it raised following the amount of ATH added into the mixture. The tensile test method was inspired by ASTM D1623-17, which sets the test speed and specimen dimensions. However, the standard demands cylindrical specimens, which would make impracticable the digital image correlation (DIC) technique. Therefore, the test method were also inspired by the works of Viana [5] and Tita [6]. Those works brought tensile methods for polymeric foams with flat-shaped specimens. The pure foam tensile strength was 1.29±0.14 MPa and a small decrement was observed when a small amount of ATH (10%) was added into the mixture (1.06±0.11 MPa). The PUF mean tensile strength for the following quantities of ATH (PUF20ATH = 1.12±0.06 MPa) (PUF30ATH = 1.11±0.09 MPa) (PUF40ATH 1.09±0.07 MPa) (PUF50ATH 1.04±0.07 MPa) showed similar values to the 10% one. The Young's modulus showed slightly higher number for the ATH added mixtures from 68.19±3.17 MPa for the pure foam to 71.05±18.14 MPa (PUF10ATH), 79.21±18.90 MPa (PUF20ATH), 76.82±8.99 MPa (PUF30ATH), 79.31±5.93 MPa (PUF40ATH), and 78.51±6.61 MPa (PUF50ATH). The tensile strain was the main property poorly affected by the ATH addition, with decrement from 4.26±0.5% for the pure PUF to 3.13±1.0% (PUF10ATH), 2.20±0.5% (PUF20ATH), 2.37±0.5% (PUF30ATH), 1.96±0.4% (PUF40ATH), and 1.50±0.5% (PUF50ATH), therefore, the only main loss in mechanical properties, with the ATH addition, was tenacity. These results show that most applications of PUF where flame extinguishment is required can be satisfied by the ATH addition without significantly harming its mechanical properties.

References

1. Akdogan, E., Erdem, M., Ureyen, M.E., and Kaya, M. (2020). *J. Appl. Polym. Sci.*, **137** (1).
2. Levchik, S. V., and Weil, E.D. (2004). *Polym. Int.*, **53** (11), 1585–1610.
3. Zeng, S.-L., Xing, C.-Y., Chen, L., Xu, L., Li, B.-J., and Zhang, S. (2020). *Polym. Degrad. Stab.*, **178**, 109–171.
4. Pham, C.T., Nguyen, B.T., Phan, H.T.Q., Pham, L.H., Hoang, C.N., Nguyen, N.N., Lee, P.-C., Kang, S.-J., Kim, J., and Hoang, D. (2020). *J. Appl. Polym. Sci.*, **n/a** (n/a), 49–110.
5. Viana, G.M., and Carlsson, L.A. (2002). *J. Sandw. Struct. Mater.*, **4** (2), 99–113.
6. Tita, V., Júnior, M.F.C., Angélico, R.A., Canto, R.B. (2012). *Polym. Eng. Sci.*, **52** (12), 2654–2663.

Innovation in Powder-based Additive Manufacturing through Numerical Modelling

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Abstract

Additive Manufacturing (AM) is one of the most sparkling recent technologies, which is drawing more and more attention from the public and scientific community. The concept of printing a 3D part from the bottom up has made people realize its huge potential in everyday life. Nowadays, several companies are providing 3D printing services to clients in numerous businesses, ranging from small customized toys to high complexity mechanical parts used in aerospace applications, for example (Thompson et al., 2016). Thus, the idea of 3D printing has become widespread, particularly in the manufacturing industries. By building a part layer-by-layer (Gibson, Rosen, & Stucker, 2010), AM can manufacture an object directly from the 3D model data with reduced scrap production, which is completely different from conventional subtractive manufacturing process, where parts are made from bulk materials (Huang, Leu, Mazumder, & Donmez, 2015). In addition, the AM process also allows users to create objects with essentially least manual competences to operate the printing systems (Baumers, 2012).

Nowadays the market for AM has passed 2 billion euro and it is expected to be around 7.7 billion euro in the 2023 (Berger, 2013; Wohlers & Caffrey, 2015). With the widespread application of this technology, the market could expand even more and played a significant role in the "fourth industry revolution". The introduction of digital twin models in AM is of paramount importance and will revolutionize this area. Specially, in metal AM where costs involved are enormous. This topic is highly connected with the Industry 4.0 due to the possibility of creating a Digital Twin of the process. The focus of this study is to develop a numerical and a experimental model that can simulate the whole process, not the part to be built, which is another topic that can be involved in further researches.

Some companies are struggling to get a powerful numerical tool that can be time and cost effective. The main reason is that the difficulties regarding the huge computational time required to get the simulation of the part built. The most used tool is the Finite Element Method (FEM), which can generate a study of the part behavior, leaving an empty blank for the simulation of the process itself. On the other hand, the usage of Boundary Element Method (BEM) coupled with FEM is highly innovative and can reduce the computational cost of the simulation processes, due the lack of iteration inside of the component in BEM. This can work as an input for the FEM part of the process and aggregate value to the digital twin.

References

[1] Thompson, M. K., Moroni, G., Vaneker, T., Fadel, G., Campbell, R. I., Gibson, I., Ahuja, B. (2016). Design for Additive Manufacturing: Trends, opportunities, considerations, and constraints. CIRP Annals-Manufacturing Technology, 65(2), 737-760.

[2] Gibson, I., Rosen, D., & Stucker, B. (2010). Additive Manufacturing Technologies. New York: Springer.

[3] Wohlers, T., & Caffrey, T. (2015). Wohlers report 2015: 3D printing and additive manufacturing state of the industry annual worldwide progress report: Wohlers Associates.

Innovative and Sustainable Methodology to Produce Functionally Graduated Adhesive Joints (FGAJ) by Direct Digital Manufacturing (DDM)

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Abstract

Adhesive joints can contribute to meeting the challenges of improving efficiency and safety and reducing pollution and energy consumption. These challenges can be overcome using new materials and new processes that reduce the weight and energy consumption, both in its production and in its use during its life cycle. One of the problems with adhesive connections is the fact that they have higher concentrations of stresses at the ends of the overlapping zones and therefore, when requested, they develop greater stresses and therefore the distribution of stresses is no longer uniform [1]. To minimize this problem, functionally graduated adhesive joints (FGAJ) can be used. This type of joint will change the properties of the adhesive along the length of the overlap in order to reduce stress peaks [2].

The present methodologies for obtaining functionally graded adhesive materials are inadequate in some situations and uneconomical in others. Currently, to obtain the gradient of properties in the adhesive, we use: (a) the use of several adhesives in the same connection, taking advantage of the best properties of each adhesive, (b) the introduction of, nano or micro particles, to change the properties of the adhesive in these intended areas; (c) or differentiation of the type of cure of the adhesives by zones is used. These methods are therefore expensive both for the materials and for the energy required for the process. All these processes add cost, in materials, energy, and complexity in obtaining the functionally graded connection (with gradient properties).

This study aims to add knowledge in the area of adhesive joints with the introduction of a new methodology for improving performance through FGAJ.

The new methodology, to be studied, to obtain graduated adhesive materials with better stress resistance behaviours is based on the following aspects: - use of a single material as an adhesive for bonding the joint; - production of adhesive materials functionally graded by simply changing the material's spatial distribution (microstructure), using the concepts of metamaterials; - conceptualize a faster and less costly production process; - use Additive Manufacturing (AM) - Direct Digital Manufacturing (DDM) production techniques; - use the concepts of functional alteration of metamaterials, (Smart Materials / multifunctional materials); - use the dimensions of sustainability, simultaneously and equally (social, economic and environmental dimensions) as important aspects in decision making [3].

References

[1] A.M. Pereira, J.M. Ferreira, F.V. Antunes, P.J. Bártolo, Analysis of manufacture parameters on the shear strength of aluminium adhesive single joints, J. Mater. Proc. Tech. 210 (2010): pp. 610–617.

[2] J. Durodola, "Functionally graded adhesive joints - A review and prospects," 99 International Journal of Adhesion and Adhesives, (2017):pp. 1-7

[3] Chen, Danfang et al, “Direct Digital Manufacturing: Definition, Evolution, and Sustainability Implications, Journal of Cleaner Production, Volume 107, (2015): pp.615-625.

The Optimization of Fused Deposition Modelling process for PLA using Design of Experiments

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Abstract

Additive manufacturing technologies deliver innovative prospects for the manufacturing of parts with tailored and complex geometries with specific mechanical properties. In fact, Fused Deposition Modelling (FDM) allows for custom mechanical parts by controlling the main parameters of the process, to obtain the performance and the viability for manufacturing. These parameters are main factors that allow the optimization of the part by its mechanical properties and also the process, regarding time and quantity of material used and waste. In this work the main objective is to use the powerful tool from Design of Experiments (DoE) in order to understand and identify which parameters affects the most the mechanical properties, contesting which one can be the optimum point for the material resistance, with the lowest production time, and less use of materials. In this paper an experimental study focused on improving four responses related with FDM: processing time, the amount of material used to produce the samples, and mechanical strength of the specimens.

For the best understanding of the performance and the behavior of the parts built by FDM and the influence of the parameters, it must be stipulated as quantitative and selective variations of values. First identify the factors that can influence the response. Usually, the collection of information consists of identifying the parameters of the normal operation of the process. In order for the study to be more reliable, it should be changed only in values of variables that can be controlled by the user. For the factors identified as non-controllable, a strategy must be defined to reduce their influence and attempt to keep them constant. To avoid the geometry for being a study parameter, a single geometry was be stipulated for all tests (tensile specimen model).

Some variations, where most of the factors have already been studied (for example the height of the layer, speed of movement of the extrusion head, temperature in the extrusion nozzle, angular orientation, infill pattern, etc.) can affect the material properties and the production time. The analysis of the results of the experimentation is based on the calculation of the effects of each factor and the factor's influence on the response of the process. The effect of a factor on the response is defined as the variation observed in the response by varying the level of the factor.

By applying the methodology, it is possible to determine the model of the process within the experimental zone used. once the optimization is completed, confirmatory experiments are carried out to confirm the levels of each factor identified as adequate.

Overall, the planned structure presents new opportunities for the design of 3D printed polymeric components with custom properties, precisely in conditions of manufacturing settings.

References

Eguren, José & Esnaola, Aritz & Unzueta, Gorka. (2020). Modelling of an Additive 3D-Printing Process Based on Design of Experiments Methodology. Quality Innovation Prosperity. 24. 128.

Camposeco-Negrete, C. (2020). Optimization of printing parameters in fused deposition modeling for improving part quality and process sustainability. Int J Adv Manuf Technol 108, 2131–2147 https://doi.org/10.1007/s00170-020-05555-9

Poster session

Automatic Volume Inspection for Glass Blow Moulds

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Abstract

In the mould making industry, volume control is done by measuring the amount of water needed to fill the mould This process has several issues. Firstly, it requires a trained operator to properly seal the mould. Secondly, different operators will lead to different volume values. Another issue is related to the time and work necessary for the procedure, which can take up to 20 minutes for a single mould, making it unsuitable to inspect several moulds of the same series. These issues can be solved by automating the procedure. By using reverse engineering systems to obtain the internal cavity surfaces, comparative studies can be done, such as wear study, enabling the optimization of the moulds. The goal of this project is to establish a system to automate the inspection of the moulds which will imply the acquisition of the moulding surfaces. Then, the volume of the moulds and surface deviations in specific areas can be measured. The development of this project entailed in two main areas: the development of a script, where the volume is calculated and the surface is inspected, from cloud points, to determine if the mould is in an acceptable state; and the study of technologies capable of acquiring the mould's surface while simultaneously being automatable. As for this study, several case studies using laser and structured light are performed to understand the abilities and limitations of these technologies. The first study was done using polished cast iron moulds to determine the ability to acquire the surface and obtain the volume. Then, the ability to present proper comparative results is explored by using a set of unpolished cast iron moulds and then these same moulds but polished to verify if the used systems can obtain the deviations between polishing. Finally, the validation of the technologies was done using a demo bronze mould, where surface deviations were inspected and a ring gauge where the inner cylinder was used for inspection. From these cases, the used laser scanner was able to obtain the volumes of the moulds as well as proper comparative results without spray. As for the used structured light system, it proved unable to acquire the surfaces of the moulds and of the ring gauge, requiring spray. Despite this performance, the system is quite automatable and a state-of-the-art structured light system, using blue light, could be used for this purpose. The laser is also a viable solution, but the cost and complexity to automate can be higher than the structured light system.

Portuguese Logistics Operators: the path to recovery

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Abstract

In recent years, several works have been published that recognize the importance of Logistics and Supply Chain Management in the performance of companies. We are currently experiencing a rewriting of this paradigm, in an environment of great uncertainty and unfavourable economic conjectures aggravated by a pandemic, which has generated more barriers and uncertainties in the response capacity along the supply chain. Companies face scarcity of resources and need to find new management processes and methods that will allow them to survive while maintaining their development, improving efficiency and effectiveness in obtaining market value, making products and services available to customers.

By analysing the importance, capacity and services provided by Logistics Operators, this study aims to contribute to a better understanding of the framework of the logistics function in Portuguese companies, based on quantitative indicators.

References

Ballou, R.H. (2006). The evolution and future of logistics and supply chain management. European Business Review, 19 (4), pp.332 – 348.

Dittman, J., Vitasek, K. (2016). Selecting and managing a third-party logistics provider: best practices. The Global Supply Chain Institute (white paper).

Halldórsson, A., & Skjøtt-Larsen, T. (2004). Developing logistics competencies through third party logistics relationships. International Journal of Operations & Production Management, 24(2), 192-206.

Kent, J.L e Flint, D. J. (1997). Perspectives on the evolution of logistics thought. Journal of Business Logistics, 2, pp. 15-29.

Selviaridis, K., & Spring, M. (2007). Third party logistics: a literature review and research agenda. The International Journal of Logistics Management, 18(1), 125-150

Design Thinking Approach Towards Sustainable Design: An Innovative Interior Elements Made With Byproducts of Teak Industries

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Abstract

With the rising demand of teak wood in the industry, this creates a problem of waste products of the teak roots, making an environmental impact near the teak forests. The nearby community has attempted in furniture creations by using the byproducts of the teak industry, however it still evolves in the same circle. The lack of innovation in production of teak byproducts demotivates the interior element demand. Through Design Thinking, we try to give birth to an innovative interior elements based on teak byproducts with stages as follows: Empathize, Understand, Define, Ideate, Prototype, and Test. The result is a modular interior element design that can be arranged according to the end users' needs.

References

Fuad-Luke, Alastair. (2009). Design Activism: Beautiful Strangeness for a Sustainable World. London: Earthscan.

Elysia, Lavinia. (2012) Studi Potensi Limbah Padat Industri Menjadi Sustainable Interior Elements Melalui Prinsip Reuse, Recycle, Refunction: DIMENSI INTERIOR ISSN 1693-3532

Lumintan, William Vijadhammo; Kusumarini, Yusita; Suprobo, Filipus Priyo. (2019) Perancangan Produk Interior Kelas Premium Dengan Pengembangan Kreativitas Upcycling Kayu Bekas Peti Kemas. JURNAL INTRA Vol. 7 No. 2, 155-163

Ali, Nawwar Shukriah, et al. (2013) "Upcycling: Re-Use and Recreate Functional Interior Space Using Waste Materials." International Conference of Engineering and Product Design Education.

Improving design against fatigue crack growth

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Abstract

Fatigue crack growth (FCG) in metallic materials is usually studied assuming that ΔK is the crack driving force. However, several limitations have been detected in the use of this parameter. In fact, FCG is linked to irreversible and non-linear mechanisms acting at the crack tip therefore, alternative parameters are required. Different parameters have been proposed, namely the plastic CTOD, the crack tip plastic deformation, the J integral, the size of crack tip plastic zone or the dissipated energy. The CTOD is a classical parameter of ductile fracture mechanisms, and it very interesting since provides a clear view of crack tip phenomena and it can be measured experimentally using DIC which a widely used experimental technique. The cumulative crack tip plastic strain provides a direct measurement of cyclic plastic deformation, which is supposed to be the main damage mechanism.

This study uses the project to improve the component life cycle by predicting the growth of fatigue cracks. After decades of dominance of da/dN-ΔK approach, the improvement of the numerical and experimental techniques provided conditions for the development of models based on non-linear parameters. This new models permit an improved design against FCG, therefore reducing the size of components. Besides, the numerical models are ideal to develop parametric studies and have been used for prediction of the effect of geometrical, loading and material parameters. Therefore, the numerical approach reduces dramatically the number of experimental tests, therefore saving material resources and energy. In fact, only two specimens are needed to develop the numerical prediction model, avoiding extensive experimental testing.

Large scale Binder Jet printing using waste materiais

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Abstract

Additive manufacturing (AM) is especially suited for unique objects or low production batches, since it does not require expensive tooling. The AM market has undergone enormous growth, despite the fact that there is still a significant limitation in this technology type when producing large parts.

Powder bed technology, particularly binder jetting, allows the production of several types of materials. When using powder bed technology, the print size is directly related to the machine's build volume size. Moreover, materials used in powder bed processes are usually high-cost materials, making large prints not affordable. Instead of working with high-cost types of powder, it is possible to replace them with low cost, biodegradable materials, like wood, or with waste materials like ground tire (GTW). Using materials such as this allows the creation of low-cost parts while contributing to the incorporation of residues that otherwise would have to be discarded. with a low environmental impact.

This work studies the usage of waste materials in the form of small grains and also calibrated dust with different sizes as a matrix in a binder jetting machine with a build volume of $1m^3$. Wood dust and GTW are being studied, as well as additives that can be added to the bulk material to affect the powder deposit ability, printing behavior, final part properties, and post-processing behavior.

The binder is in charge of attaching the powder material, and it affects the strength and porosity of the final part [1]. A versatile binder that can work in a broader panoply of materials to bind the renewable matrix dust material was sought. An organic liquid binder was found to be the most adequate solution. It is not just environmentally safer than an inorganic binder but is also one of the most versatile binder methodologies. The binder that presented the best properties when in contact with the dust materials is Polyvinyl Alcohol (PVA). PVA is a water-soluble synthetic polymer. It reacts at room temperatures (RT) when mixed with water, but tests with controlled high temperatures were performed to accelerate and improve the process.

The binder-jetting system as well as the powder delivery system are under development. Preliminary results enabled the definition of a material composition and processing window, an also show that it is possible to attain acceptable consistency of printed parts. Further testing is ongoing, especially in regard to the printing variables and binder delivery system.

References

[1] Ben Utela, Duane Storti, Rhonda Anderson, and Mark Ganter. A review of process development steps for new material systems in three dimensional printing (3dp). *Journal of Manufacturing Processes*, 10(2):96 – 104, 2008.

Decision rules and statements of conformity in ISO/IEC 17025:2017

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Abstract

The ISO/IEC 17025:2017 standard establishes that when a statement of conformity to a specification or standard for test or calibration is provided, the laboratory shall document the decision rule employed, taking into account the level of risk associated with the decision rule employed and apply the decision rule.

The purpose of this article is to explain the decision rules and statements of conformity and clarify the role of measurement uncertainty for decision-making in conformity assessment.

Several case studies are presented and discussed, showing the application of different decision rules and the risks associated.

This study results revealed that the evaluation of measurement uncertainty is very important in conformity assessment. Also, the study revealed that the selection of inadequate decision rules may have important economic consequences

References

ISO, IEC. (2017). General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025:2017).

ILAC-G8:09/2019. (2019). Guidelines on Decision Rules and Statements of Conformity.

UKAS Lab 48.(2020). Decision Rules and Statements of Conformity.

Generating Value from Corporate Sustainability: Lessons from a Multinational Consumer Goods Company Operating in the Brazilian Market

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Abstract

The advances and development of society have significantly impacted the companies' strategy. They need to manage their businesses in a sustainable manner, that is, simultaneously managing the meeting of the needs and expectations of their stakeholders, the use of natural resources and financial survival in highly competitive environments. In addition, there is the need to present a responsible posture from a socio-environmental point of view, demonstrating greater transparency in governance processes. Corporate sustainability practices are important for the management of these economic, social and environmental issues. This paper aims to identify, in the light of scientific theory and based on the conduction of a case study, the good practices and difficulties in developing sustainability in a company in the consumer goods sector. The case study was carried out in a multinational company in the consumer goods sector located in the state of São Paulo, Brazil. Interviews were carried out with those responsible and technicians in the sustainability area, on-site visits to the factory and documents such as the company's annual sustainability report were analyzed. The results showed that sustainability is an important aspect for the definition of the company's business, being inserted in the strategic vision and governance structure. Such engagement was evidenced through the identification of good practices, such as the creation of a department to work exclusively on the socio-environmental pillar, the preparation of conduct reports and the regular application of questionnaires and awareness actions to disseminate aspects regarding ethics and transparency to all employees. However, among the main difficulties identified there is the lack of engagement of top management with socioenvironmental issues, which consequently makes it difficult for other workers to connect with the culture of sustainability, a factor that is pointed out in the literature as very important for the company to work towards sustainability.

Keywords: Corporate Sustainability; Sustainable Management; Sustainable practices.

Expanding the limits of Design by Powder Bed AM based on Digital Selective Powder Deposition

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Abstract

From the construction of new concepts for product prototyping, new strategies and technologies are being developed everywhere. Whether in liquid or solid state, extrusion or in powders, additive manufacturing methods are achieving good results in the development of prototypes with unique aspects and for specific situations that can go from aeronautic to medicine and industry, among others, aiming to improve the development of materials, reduce waste and increase quality and performance of the final product. Seeking to contribute on these new techniques, this project, represented by the Polytechnic Institute of Leiria, analyses and develops standard concepts related to the applications of ceramic and new materials, such as basalt, in additive manufacturing processes (AM). In order to develop better concepts and parameters for industrial production processes, an analysis of the engineering and design concepts applied in the sphere of additive manufacturing methods was elaborated. Focusing on Powder Bed Deposition, this work presents results of experiments derived from Selective Powder Deposition, using approaches for study, assistance and optimization of the influencing parameters in the process and results of the produced parts. Exploring subjects as sintering temperature, agglutination rate, densification process and so on, adding these concepts in ceramics and minerals materials.

References

Iro3D.iro3d-impressora3Ddemetal.URL:http://iro3d.com/.

RobertPMuelleretal.AdditiveConstructionusingBasaltRegolithFines.Tech.rep.URL:https://ntrs.nasa.gov/search.jsp?R=20150000305

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EcoInov4Mortar.: Eco Innovation for sustainable mortars

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Abstract

In the context of sustainability and the promotion of a greener economy, the construction sector, like many others, lacks innovative developments that will help to reduce the carbon expenditure (around 40% of energy expenditure in Europe), is recognized as essential. It is in this context that a technical coating mortar for rehabilitation, ensuring the energy efficiency of the building using raw materials (waste) that contribute to environmental sustainability is under development. Thus, it is intended to develop an eco-innovative mortar with good thermal insulation capacity ($\lambda \leq 0.05W.(m/K)$), with a low rate of sound reduction ($\leq 44dB$) and in terms of reaction to fire that is considered a non-combustible product (class A1), ensuring the good general performance of all other mortar characteristics.

There are being several formulations developed considering a component of binder, another of light aggregates and another one of additives. According to the binders are being mainly used natural hydraulic lime and hydrated lime and a residual part of cement. Related to the light aggregates it was used sawdust, however this proved to be unfeasible, having been replaced by the aggregates of expanded vermiculite and perlite. Both of them are light and non-combustible. Since these aggregates do not have an acoustic insulation component, it was decided to use in combination with these aggregates, the expanded cork residue. In terms of additives there are being used cellulose ether and water repellent.

Until now we achieved a very promising mortar, which uses 65% of binder, 34.5% of aggregates (cork + perlite) and 0.5% of additives. Its essential characteristics in terms of mechanical characteristics, water vapor permeability and water absorption were achieved. The samples of these formulations are being prepared for the tests of thermal conductivity, sound insulation and reaction to fire.

Keynote Lecture 3

How can industrial businesses of all sizes create value and resilience guided by Sustainability

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Abstract

We live in a world of finite resources and our mode of linear production is no longer viable, which requires innovative measures to circumvent the old paradigm. The demand for incorporating Sustainability in the economic model has surged in recent years: it includes the UN's SDGs signed by all countries and the new EU Commission's Green Deal – both with ambitious targets for 2030, also growing pressures from leading institutional investors.

A growing number of companies are evolving through social and environmental initiatives. The opportunity for businesses lies in getting inspiration from a growing number of progressive players who have been collecting the advantages of using Sustainability as a compass for business "Navigation". The Natural Step represents a framework that was created, based on science, more than 30 years ago in Sweden. Combined with architectures of business goals developed by Future-Fit Foundation in the UK, it represents a common language defining what Sustainability and Regeneration mean, which includes evaluating at least all its value chain upstream.

Managing strategically from sustainability will be illustrated via case studies in manufacturing and also with SMEs. Portugal is no exception.

We will discuss how to capture this big opportunity. Above all, it requires that business leaders get equipped with new leadership skills and an approach that requires no fear to change paradigms, think systemically, and innovatively without compromising social and environmental limits.

Session D2.M1 - Quality: Lean and Six Sigma

Porto wine production process improvement through design of experiments

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Abstract

This paper presents a case study of the DOE (Design of Experiments) process improvement methodology in the Porto wine production process. Sulphur dioxide (SO2) is a compound added to wine with great oenological importance. Its content is regulated, the legal limits vary depending on the type of wine, in the case of Port wines this limit is 150 mg/l. It is important to control the SO2 content periodically so that the oenologist proceeds to its correction. In some cases, the SO2 content after correction, measured by the laboratory, does not correspond to the content calculated by the oenologist. DOE is a widely used tool to identify the main variables that influence the quality characteristics of interest in the process. The results of this study show that, among many factors, one of them is very important in the control of the process and there is a need to redesign the laboratory procedure to measure SO2 content.

References

Box, G. E., Hunter, W. G., & Hunter, J. S. (1978). An introduction to design, data analysis, and model building. *Statistics for experimenters*, 374-434.

Coleman, D. E., & Montgomery, D. C. (1993). A systematic approach to planning for a designed industrial experiment. *Technometrics*, *35*(1), 1-12.

Montgomery, D. C. (2017). *Design and analysis of experiments*. John wiley & sons.

Vining, G. (2013). Technical advice: Scientific method and approaches for collecting data. *Quality Engineering*, *25*(2), 194–201. https://doi.org/10.1080/08982112.2013.764228

A decision support simulation tool for Demand-Driven Material Requirements Planning

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Abstract

The Demand-Driven Material Requirements Planning (DDMRP) was introduced in 2011 to improve the performance of supply chain planning, it is method that promises to be revolutionary in the field of materials planning and management.

According to reports by the Demand Driven Institute (DDI), the DDMRP reduces inventory levels around 31% while improve service levels around 13% and it allows the reduction of delivery times for customer orders. Such results can have a significant impact on a company's financial performance and provide a competitive advantage.

This study intends contribute to a better understanding of the DDMRP method, as well, to explain and facilitate the implementation through the development of a simulator that allows to create, analyze and optimize the different configurations of the supply chain.

References

Jiang, J., & Rim, S. C. (2016). Strategic Inventory Positioning in BOM with Multiple Parents Using ASR Lead Time. *Mathematical Problems in Engineering, 2016.*

Jiang, J., & Rim, S. C. (2017). Strategic WIP Inventory Positioning for Make-to-Order Production with Stochastic Processing Times. *Mathematical Problems in Engineering, 2017.*, p. 017.

Miclo, R., Fontanili, F., Lauras, M., Lamothe, J., & Milian, B. (2016). An empirical comparison of MRPII and Demand-Driven MRP. pp. 1725-1730

Rim, S. C., Jiang, J., & Lee, C. J. (2014). Strategic inventory positioning for MTO manufacturing using ASR lead time. pp. 441-456.

Implementation of Lean tools in Internal Logistic

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Abstract

Currently, change is a constant in any market in which an organization belongs. Competitors become more aggressive, new growth opportunities, and new challenges arise, so companies must be able to adapt to changes to remain profitable and competitive. To this end, organizations must focus on identifying activities that add value, eliminating waste, increasing the quality of their products and services, and thus increasing customer satisfaction. Throughout the years, continuous improvement, and the application of Lean tools have proved to be critical in increasing the competitiveness of companies. The Lean philosophy aims to streamline companies to make them more dynamic, to be able to adapt to changes in the environment where they operate, eliminating waste, and promoting a culture of continuous improvement within the entire organization. The present article is a result of the work carried out in a company responsible for design and project automated material handling and storage systems. Using Lean tools such as Value Stream Mapping (VSM), it was possible to identify several wastes and improvement opportunities throughout the productive chain. This article aims at presenting the solutions developed to reduce wastes in the internal logistics department. The application of improvements in this department covers stock management, visual management, 5S, and continuous improvement at Gemba, being focused in the following main objectives: identifying the main wastes, reducing activities that do not add value, improving the supply of materials at work stations and improving in the organization and cleaning of the factory. Subsequently the application and evaluations of the impact of Lean tools it was possible to calculate the impact in the internal logistics which result in a decrease of 16% in the production costs.

References

Oliveira, J., Sá, J.C., Fernandes, A., "Continuous Improvement Through "Lean Tools" – Application in a mechanical company", Procedia Manufacturing 13 (2017) 1082-1089

T. Pombal, L. Pinto Ferreira, J. C. Sá, M. Pereira, F. J. G. Silva, "Implementation of Lean Methodologies in the Management of Consumable Materials in the Maintenance Workshops of an Industrial Company", Procedia Manufacturing 38 (2019) 975–982

Six Sigma application for Process Improvement

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Abstract

Nowadays, organizations, and specially companies, develop their activities in a very competitive environment where satisfaction and customer loyalty are vital factors for their success. Thus, they require the permanent use of continuous improvement methodologies, such as Six Sigma, as a mean to improve customer satisfaction and fulfill their expectations. The present article is a result of the work carried out in a company of Wind Energy manufacture. In the last years, the number of competitors in the Wind Energy market has increased significantly. More than ever, in order to keep a strong position in the sector, it is mandatory to clearly improve cost reduction without prejudicing the utmost finished goods quality. It was in this way that this Six Sigma project emerged, within the company, with the main goal to optimize one of the blades´ manufacturing process. The underlining aims of this project are both the definition of all variables that influence the process and also the proposal and implementation of different improvement strategies in order to reduce the amount of material used in the manufacturing process without prejudicing the final product quality. Following the Six Sigma methodology and using the Project Charter, a team was created and targets were defined. The project was implemented between February and June 2020. With the use of Define, Measure, Analyze, Improve, Control (DMAIC) methodology, together with the appropriate quality management tools such as A3, Gant diagram, Brainstorming, Ishikawa, Process Flowchart, Control Charters, 5W2H, Process Capability, on each phase, the Six Sigma team was able to identify the variables that affect the process. Assigning to each one of variables the importance and the effectiveness, the improvements were identified and defined to be implemented in order to improve the process and make it more efficient. After the implementation of the changes, they needed to be controlled to verify if they positively influence the production process and if bring any benefits to the company. The control was performed by creating a control plan, describing exactly what data, how, how often and whom should do the control. If any non-conformity is detected, instructions concerning the necessary actions to undertake must also be included. This plan must be updated, over the time, according to the assessments made after its application. The implementation of continuous improvements led to a decrease of 25% in the amount of material used.

References

Oliveira, J., Sá, J.C., Fernandes, A., “Continuous Improvement Through “Lean Tools” – Application in a mechanical company”, Procedia Manufacturing 13 (2017) 1082-1089

Pereira, A.M.H., Silva, M.R., Domingues, M.A.G., Sá, J.C., “Lean six sigma approach to improve the production process in the mould industry: A 1case study”, Quality Innovation Prosperity 23(3) (2019), 103-121.

Pizdek, P., & Keller, P. (2010). The Six Sigma Handbook. 3. (McGraw-Hill, Ed.)

Shankar, R. (2009). Process Improvement using Six Sigma: A DMAIC Guide. I.

Improvement of the Transport Management Process: A Case Study

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Abstract

Logistics is a critical area for the competitiveness of an organization by adding place-time value. Its key activities are customer service, order processing, inventory, and transport management. A case study research was conducted within the scope of the company's continuous improvement program applied to logistics. Therefore, it was sought to evaluate inefficiencies in the transport management process to reduce costs, lead-time and increase freight consolidation, as these were the expected benefits. The data collection to study the problem was conducted through observation, analysis of secondary data (documents and internal databases) and interviews (unstructured interviews and Focus Group). In this way, it was possible to analyze the activities and identify problems in the transport management process, such as the inexistence of advance planning of transport needs and a performance evaluation system. As a result, some improvement proposals were made for each of the identified problems and prioritized, in terms of effort and implementation impact. The first improvement proposals to be implemented, as they have low effort and high impact, are the initiation of a process with an advanced planning of transport needs, agreements for frequent transport, and implementation of performance evaluation system. Transport is the main logistical cost, so having an optimized process is critical for organizational performance. Hence, this investigation is relevant to this company, it can be also used as benchmarking by other companies with similar processes.

References

Agburu, J. I., Anza, N. C., & Iyortsuun, A. S. (2017). Effect of outsourcing strategies on the performance of small and medium scale enterprises (SMEs). *Journal of Global Entrepreneurship Research*, *7,* 26.

Ballou, R. H. (1998). *Business Logistics Management* (4th ed.). United Kingdom: Pearson Education.

Cianfrani, C. A., Sheps, I., & West, J. E. (2019). *The Journey: Achieving Sustained Organizational Success*. USA: Seiche Sanders.

Cieśla, M. (2015). Outsourcing strategy selection for transportation services based on the make-or-buy decision. *Transport Problems*, *10*(2), 91–98.

Domingues, M. L., Reis, V., & Macário, R. (2015). A comprehensive framework for measuring performance in a third-party logistics provider. *Transportation Research Procedia*, *10*, 662–672.

Molenda, M. (2019). Quality study and improvement of logistic processes on the example of a chosen enterprise. *Management Systems in Production Engineering*, *27*(1), 18–22.

Session D2.M2 - Quality: Problem Solving Methodologies and Improvement I

Society 5.0 - A Future That Envolves Quality Of Life And Safety In Developed Countries

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Abstract

It is undeniable that the world is changing rapidly due to the advancement of new technologies beyond the advancement of information technologies that lead us from the evolution of our society to the superintelligent society, called Society 5.0.

One of the problems that have become common in recent years has been psychosocial risks, which often lead to a high impact on people's lives and lead to illnesses such as depression and ultimately suicide. One of the jobs in which there has been a significant increase in these problems is the teaching profession.

In this sense, the object of study was to verify the psychosocial risks that teachers face in their daily lives, for which possible solutions are presented to solve some of these risks, which according to the study were evidenced.

The methodology of the study involved the application of the Copenhagen Psychosocial Questionnaire Medium Version (COPSOQ II) to a group of teachers at various locations in Europe, in which various statistical techniques were applied to verify whether the results were statistically significant and whether it was possible. prove the hypotheses under study.

The obtained results allowed to answer affirmatively to all the research questions, that is, objectives defined for this research were reached.

It was possible to conclude which psychosocial risks that teachers are exposed and these risks are: cognitive(80,6%), emotional (76.5%) and quantitative demands(70,6%), as well as work rhythm and work/family conflict, however, the order in which they affect the different subgroups of teachers is different. These risks are found across the entire study group. Some models are proposed, through the proposals of Society 5.0, for their minimisation and/or removal.

Keywords:Society 5.0, Psychological Risks, COPSOQ II, Teachers

Analysis of Factors Affecting Aquaculture in Biofloc Technology: an ISM Approach

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Abstract

There is natural emergency, environmental change and other things influencing every one of us the route through, the need to expand the nature of nourishment, creation and lessening the expenses alongside remembering better innovation for cultivating part is very noteworthy. Interest for aquatic nourishment carries on to increment and subsequently, development and growth of aquaculture creation are exceptionally required. The prime objective of aquaculture development is to deliver more aquaculture items without expanding the use of the fundamental characteristic assets of water and land. Biofloc is an imaginative and practical innovation in which dangerous materials to the fish and shellfish as Nitrite, Ammonia get turned into useful edibles. But there is a lack of research on this field as it is an emerging area of interest. Entrepreneurs face multiple problems that causes major damage to their production. This paper tries to identify common factors that affect the fish production in biofloc technology and their interactions among them by making an Interpretive Structure Model.

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References

Piya, S., Shamsuzzoha, A., and Khadem, M. (2020). An approach for analyzing supply chain complexity drivers through interpretive structural modelling. *International Journal of Logistics Research and Applications*, 23(4), pp. 311-336l

Agrawal, R., and Vinodh, S. (2019). Application of total interpretive structural modelling (TISM) for analysis of factors influencing sustainable additive manufacturing: a case study. *Rapid Prototyping Journal*, 25(7), pp. 1198-1223

The Effect of Masterbatch Addition on the Mechanical Properties of Linear Low-density Polyethylene (LLDPE)

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Abstract

The linear low-density polyethylene (LLDPE) is used for a wide variety of commercial packaging solutions, including boxes, containers and closure lids, taking advantage of its lightweight, resistance and low price. They have excellent toughness at low temperatures, good stress resistance and mouldability. Their higher melting point of the material allows for high end-use temperature when compared with conventional polyethylene.

Polyethylene is a semi-crystalline polymer, in which the thermal and mechanical properties depend on its degree of crystallinity. As general characteristics, polyethylene is non-toxic, which is why there is a great use of these polymers in the manufacture of products for food contact and for the pharmaceutical industry.

In this study, mechanical tests were carried out in order to evaluate the influence of the addition of pigments to LLPDE. The specimens are fabricated according to standards and for several percentage of pigment were evaluated. In these tests, we examined the interaction between a LLDPE and pigment in quality final product.

As a result, it was found that the pigment changed the basic properties of LLPDE. It was also found that the shore hardness, tensile strength and modulus of elasticity increased with the addition of the pigment. This increase in mechanical properties suggests an increase in the crystallinity of the base material.

Keywords: Linear low-density polyethylene (LLDPE), Masterbatch Crystallinity Mechanical properties

References

Byrne F. et al, (2009). The Effect of Masterbatch Addition on the Mechanical, Thermal, Optical and Surface Properties of Poly(lactic acid), Journal of Polymers and the Environment, 17:28–33

Evaluation of Dimensional and Geometric Tolerance of Hexahedral Microstructures - Produced by Polyjet Objet500™

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Abstract

Direct Digital Manufacturing (FDD) technology has been increasing its importance as a technology not only for the production of prototypes and validation models, but also for final parts. This technology allows to produce parts with almost no geometry restrictions, even on a micro scale. However, the measurement and tolerance assessment of micro-details (mDs) of complex parts remains an open field of investigation. In order to develop the full potential that this technology offers, it is necessary to quantify the processes limitations in terms of precision, repeatability and reproducibility. New design methodologies focused on optimization, design microstructured parts with a complex material distribution. These methodologies are based on mathematical formulations, whose numerical models assume the discretization of the model through volumetric unitary elements (voxels) with certain dimensions and geometries. The accuracy of these models in predicting the behaviour of the part or assembly is influenced by the fidelity in the physical reproduction of the objects. The Polyjet™process makes it possible to produce complex parts, however, it is important to establish the minimal dimensional and geometric limits to produce parts with mDs.
This work evaluates the dimensional and geometric accuracy of the Stratasys Connex3 Objet500™ equipment to produce mDs (cubes) with VeroClear™ material, and compares to the nominal design dimensions. A Sample Test (ST) with different dimensions mDs was modelled and produced. The dimensional and geometric accuracy of the mDs was quantified in relation to the nominal value and the deviations computed. From the tests performed, it was possible to conclude: (i) all the details analysed have dimensions greater than the nominal ones; (ii) the standard deviation of the width and height dimensions is equal to or less than the resolution indicated by the manufacturer; (iii) micro-cubes with dimensions less than 840 μm on the side, the geometry is distorted in cylinders, and below 250 μm the printing fails.

Optimization of the Sales Supply Chain Management

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Abstract

This paper presents a study that took place in the cork unit of the company and was carried out in the logistics department to optimize the supply chain management to Sales Companies. The main objective was to develop and implement a remote-control tool (Rolling Plan – E-Supply) for the company's distributors to minimize the execution time of the previous model and to increase the visibility of the company's global supply chain. Furthermore, the project aimed to avoid the risk of stockout and decrease the financial investment that was hitherto being made in unnecessary stocks. In an initial phase of the project, a survey was carried out to assess the current situation of the company. This allowed one to identify the unnecessary waste and challenges in the current process, both from a macro and micro global logistics perspective, in terms of the company's various products and the manner in which they were being distributed to the company's Largest Sales Companies. During the following phase of the project, the entire process, and necessary requirements for the elaboration of the new management platform Rolling Plans were duly outlined and developed by the partner team (Noesis). In addition, an ABC analysis was carried out, which permitted the sales companies in question to identify their most significant products, and subsequently insert them in the new management platform being developed. The various developmental phases of the tool referred to as Sprints, developed by Noesis, were then monitored, and evaluated by company to guarantee that the tool in question complied with all the necessary defined requirements. In addition, bugs were reported so that they could then be eliminated. Once the process had been finalized, up-to-date production data was used to validate the global applicability of this tool so that then it could be successfully implemented in the company. On the one hand, it was concluded that with this tool the optimization of the Sales supply chain management process was achieved with the 87.5% reduction of the execution time spent on the previous Rolling Plan. On the other hand, this new platform also allows better visibility and real-time monitoring of the supply chain to Sales Companies.

References

Gunasekaran, A., Subramanian, N., Tiwari, M. K., Papadopoulos, T., & Nie, P. (2016). 4th party logistics service providers and industrial cluster competitiveness. Industrial Management & Data Systems.

Grant, D. B., Wong, C. Y., & Trautrims, A. (2017). Sustainable logistics and supply chain management: principles and practices for sustainable operations and management. Kogan Page Publishers.

Implementation of an information system to improve logistic processes

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Abstract

This paper presents a project that was developed in a company in the semiconductor industry and focused on the design, construction and implementation of an information system (IS) with the capacity to support the accomplishment of certain tasks that lacked the definition of an efficient procedure. The procedure definition allows to avoid all waste associated with non-standard work. In an initial phase, an analysis of the current state of the company was carried out, where the project was developed and tasks with daily frequency without defined work instructions were identified, namely the receipt of orders and the monitoring of goods in transit. The tasks identified, essentially required the existence of a register, of arrival and departure of goods, which contains the most varied data necessary to complete the task correctly and efficiently. The consolidation of information in one place alone proved to be very useful since, until then, all the information related to the tasks was dispersed in the employees' electronic mail. Scattered information is a source to increase the working time associated with the task, so it was extremely important to minimize this time. Having identified the needs that each task requires and based on the positive opinions of several authors and results, equally positive, from other industries that adopted information systems as a tool to support performance improvement, we bet on the implementation of an information system. The goal of the project was to eliminate or minimize, the time and cost that does not had value. Using the BPMN tool, the entire process flow, stakeholders, and accesses were defined together with the logistics team. We started by creating a database responsible for all data storage and then the development of an interface that allows controlled access to the information. The created system, database and interface, allowed the design of a tool with functionalities such as registration of information on the receipt of orders, goods in transit, information consultation, notifications with an informative character to improve day-to-day management, traceability and historical. Prior to implementation, several scenarios were tested to avoid possible errors. The tool was implemented, which is stored in a location that is accessible to all users. The tool allows quick and clear access to the information necessary for the development of daily activities, reducing the time spent searching for orders / information, eliminating order losses, reducing damaged materials, allowing employees to better manage their time, given who now have information on the arrivals and departures of crucial material for the production line. After implementation, there was an adaptation phase by the tool users, however, they quickly understood how useful it proved and, therefore, resulted in good acceptance by the team. We seek to involve the team and really understand the impact of the tool, so a survey was developed whose results were in line with the results obtained in other industries. In fact, the IS had a very positive impact both in improving performance and minimizing the waste identified, with a reduction of over 90% in tasks.

References

Dües, C. M., Tan, K. H., & Lim, M. (2013). Green as the new Lean: how to use Lean practices as a catalyst to greening your supply chain. Journal of Cleaner Production, 40, 93–100.

Anyanwu, G. O., & Okeke, O. C. (2017). A Review of the Principles, Components and Applications of Management Information System. International Journal of Economics and Business Management, 3(10), 1-8.

Dijkman, R. M., Dumas, M., & Ouyang, C. (2008). Semantics and analysis of business process models in BPMN. Information and Software technology, 50(12), 1281-1294.

O'Brien, J. A., & Marakas, G. M. (2011). Developing business/IT solutions. Management Information Systems, 488489, 74-89.

Session D2.M3 - Sustainability: Circular Economy and Life cycle costing

Sustainability and Lean Manufacturing: is there a real link?

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Abstract

Sustainability refers to meeting the requirements of the present, without compromising the capability of future generations to meet their wants. The concept is based on three pillars - economic, environmental and social – also known as profits, planet and people (3P's). On the other hand, lean manufacturing is a management philosophy focused on the reduction of wastes (or muda) of e.g. waiting time, super-production, transport, processing excess, inventory, and defects among other. Reducing and eliminating those wastes, quality is achieved while the time and cost of production is reduced. The lean tools include continuous flow (kaizen), pull production (kanban), jidoka (levelling), poka-yoke, among others for JIT manufacturing. Based on the former concepts, a link between both is further investigated and based on a systematic literature review of more than 200 articles, to achieve the necessary link.

References

Kamble, S., Gunasekaran, A., & Dhone, N. (2020). Industry 4.0 and lean manufacturing practices for sustainable organisational performance in Indian manufacturing companies. *International Journal of Production Research, 58*(5), 1319-1337.

Marques, P., Charmier, M. A., & Santos, J. O. (2019). A Survey on Sustainable Product Development. *Procedia Manufacturing*(39), 1307-1316.

Morelli, J. (2011). Environmental Sustainability: A Definition for Environmental Professionals. *Journal of Environmental Sustainability, 1*, 1-10.

Womack, J., Jones, D., & Roos, D. (2007). *The Machine That Changed the World: The Story of Lean Production.* New York: Free Press.

Direct digital manufacturing of products based on high content of stone powder

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Abstract

This project offers a contribution to address the gap in additive manufacturing of reactive polymerization with filler content. It develops a technical road-map of materials and processes in which stone residues are incorporated and transformed into new products, via additive manufacturing, using polymeric materials as binder and incorporating stone waste in different mixture rates. Several papers have addressed filler inclusions in similar materials [1] [2] and their results will be analyzed and compared with the results of this project.

Trial and error experimental processes drive the selection of specimens considered valuable for the study of their psychical properties, which define the admissible additive manufacturing technique based on reactive polymerization.

The results obtained at this date, are that filler additions reduce significantly resulting material hardness, in relation to unfilled compounds, were variations of up to 61% have been recorded. Few exceptions, that are binder and filler rate dependent, will improve material hardness and gains of 38% were recorded in those cases. Resulting materials present increases in porosity with higher filler content as well as the loss of the ability to withstand strain. Materials exhibiting lower hardness values also have lower Young's modulus. Binders that have growth in their curing processes are not suitable for additive manufacturing processes that require defined form.

References

[1] Z. Bartczak, A. S. Argon, R. E. Cohen, and M. Weinberg. Toughness mechanism in semi-crystalline polymer blends: II. High- density polyethylene toughened with calcium carbonate filler particles. *Polymer*, 40(9):2347–2365, apr 1999.

[2] Sabrina Sá e Sant'Anna, Denilson Arlindo de Souza, Danielle Marques de Araujo, Cornélio de Freitas Carvalho, and Maria Irene Yoshida. Physico-chemical analysis of flexible polyurethane foams containing commercial calcium carbonate. *Materials Research*, 11(4):433–438, 2008.

CircularSeas
Characterization and Reprocessing of Polymeric Waste Materials Recovered from Beaches

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Abstract

In recent years the problem of pollution has been increasingly debated, and one of the main issues discussed is related to the degradation of the oceans as a consequence of human activities. Polymeric materials are one of the main elements identified both on the coast and in the ocean itself, which causes several consequent adversities, both for human life and for the natural world [1]. This is the issue addressed by the CircularSeas project, it aims to promote the development of new products using materials recovered from the oceans in new production technologies [2]. In order to analyze the possibility of reusing or reprocessing material usually considered waste, it is important to determine the type of properties that have been altered and what effect it would have on its use as a new raw material. Due to the limited amount of literature available on this subject, a large amount of polymeric material was collected from Peniche and Vieira beaches, Leiria, Portugal. As most identifiable objects were octopus traps and fishing nets, and knowing that this type of product is usually made of high-density polyethylene and polyamide, respectively, these were the materials chosen for analysis. The high density polyethylene was analysed both before and after processing, while on the case of the polyamide, only the processed material was analysed. Tensile, Dynamic Mechanical Analysis and hardness tests were performed after the necessary preparation. Comparing the values obtained in each case with the respective measurement of the virgin material, it was possible to observe that some properties, such as Young's modulus, tension and tensile strength decreased considerably. Hardness was also affected, although it was less notorious. Seawater absorption tests were also carried out on virgin high density polyethylene in order to determine the amount of time the waste was under the influence of environmental degradation by comparing its density values over time with the density of waste material. However, like the Dynamic Mechanical Analysis tests, it was not possible to draw concrete conclusions since, in the case of density, it can easily vary depending on the type of conditions to which the material was subjected, which are unknown. After this project was carried out it was concluded that it is very important to correctly characterize this type of materials, not only at the mechanical level, but also at the chemical level. Although some advantageous characteristics of virgin materials are lost, waste is still usable in different forms for new purposes, and can be treated as a new source of raw material.

Keywords: Marine litter, ocean pollution, mechanical properties, high density polyethylene, polyamide

References

[1] Nadja Velez, Gerardo I Zardi, Roberto Lo, Christopher D Mcquaid, Ugo Valbusa, Brahim Sabour, and Katy R Nicastro. A baseline assessment of beach macrolitter and microplastics along northeastern Atlantic shores. *Marine Pollution Bulletin*, 149(January):110649, 2019.

[2] CircularSeas. CircularSeas, 2020.

*Project's orientation and development
†Project's orientation and development

Session D2.M4 - Quality: Problem Solving Methodologies and Improvement II

Customer Experience Quality (EXQ) measurement in private hospitals in India - a contextual perspective

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Abstract

Over the last few years significant growth and development have been made in healthcare in India. With many new hospitals and private clinics available for customers ,the main competitive differentiator would be the quality of service provided. Since customers cannot fully assess functional quality in healthcare, traditional tools for measurement of service quality may not be reliable. Further, traditional methods of measuring service quality consider quality of service from a firm's perspective. The main premise of measuring Customer Experience Quality(EXQ) is that the customers form subjective judgement on the basis of the experience they had with the service provider. Hence for improving service quality the customer experience quality should be measured.

The data was collected from 200 randomly selected customers visiting private hospitals in the city of Bangalore. Experience Quality (EXQ) scale proposed by Klaus and Maklan (2011)was used as a measurement tool. Data was analysed using confirmatory factor analysis using Structural Equation Modelling(SEM).The findings show that the two factors of the Experience Quality Scale(EXQ) i.e. moments of truth and peace of mind are highly valued by the customers. Also the EXQ perceptions significantly contribute to satisfaction and loyalty. The study is an original contribution to the field of healthcare marketing.

Keywords: Healthcare, Customer experience, Experience Quality (EXQ)measurement, hospitals.

A Comparison Between Dispatch Rules and Simulated Annealing in the Resolution of a Production Scheduling Problem

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Abstract

The production scheduling generates a direct impact on several aspects of manufacture, such as the number of delays in delivery to customers, total time flow, as well as the percentage of equipment used. It must, therefore, constitute a priority in production management, which should seek to implement scheduling techniques that will lead to positive results from the perspective of the quality of the solution. However, the methodology cannot overlook the functional aspect of the time which has elapsed until the solution is reached. This study is based on a real and specific case, analyzed in the context of an ERP management software company. It presents a solution for the production scheduling of the flow-shop type, comprising a total of 9 dispatch rules. An additional solution for scheduling is also proposed, which resorts to metaheuristic simulated annealing. Both solutions are compared to each other by using the quality-function binomial approach. These two environments are compared further to a third, where no effective solution for production scheduling exists. The environment which includes scheduling through dispatch rules was compared to another, where no production scheduling was implemented. The results obtained from this analysis shows an improvement of 13%. The simulated annealing solution presents an improvement of 3,6% when compared to a solution which uses dispatch rules. This improvement implies one extra minute in the calculation of the final solution.

References

Ç. Sel and A. Hamzadayi, «A simulated annealing approach based simulation-optimisation to the dynamic job-shop scheduling problem», Pamukkale Univ. J. Eng. Sci., vol. 24, n. 4, pp. 665–674, 2018, doi: 10.5505/pajes.2017.47108.

D. C. Bissoli, W. A. S. Altoe, G. R. Mauri and A. R. S. Amaral, «A simulated annealing metaheuristic for the bi-objective flexible job shop scheduling problem», Proceedings of the 2018 3rd IEEE International Conference on Research in Intelligent and Computing in Engineering, RICE 2018, Out. 2018, vol. 2018-January, doi: 10.1109/RICE.2018.8627907.

M. L. Pinedo, «Scheduling Theory, Algorithms, and Systems (Forth Edition), Publisher Springer», 2012.

Continuous Improvement: a Case Study in Online Retail Involving Lean Tools

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Abstract

Enterprises worldwide, including in the European Union (EU), are increasingly depending on online sales in order to maximise their profits. The increasing use of the Internet, together with improved security systems and standards, has made it easier for enterprises to serve their customers on the online sales channels. This paper presents a case study carried out in a multinational retail company of a project aimed at improving the online sales service, by enhancing the productivity of the current order-picking process. Several Lean and Quality Management tools, including 5S, Visual Management and VSM, were structurally employed to follow the PDCA cycle in order to improve the existing procedures, as well as the efficiency of the information and materials flows. Resorting to the Kano Model, the requirements of the online customers, along with the needs of the pickers and management staff were identified. A new order-picking process was designed, and the reasons behind the lack of product availability and undelivered items were analyzed and determined. The full implementation of the planned improvement actions allowed the company to increase the online service capacity by 16%, thus contributing to enhance the business competitiveness of the corporation. Regarding product availability in store, a new model for analysis and communication in stores was developed.

References

Dukic, G., Cesnik, V. & Opetuk, T. (2010). Order-picking Methods and Technologies for Greener Warehousing. *Strojarstvo*. February, Vol.52, No.1: pp. 23-31.

Melton, T. (2005). The Benefits of Lean Manufacturing, What Lean Thinking has to Offer to Process Industries. *Chemical Engineering Research and Design*. June, Vol.83, No.A6: pp.662-673.

Governing and Managing a University-Industry Collaborative R&D Program

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Abstract

University-industry R&D collaborations (UICs) play a vital role in stimulating open innovation that leads to new products, processes and services that create value for customers and wider societal impact in terms of employment and economic growth. The Covid-19 pandemic currently demands an unprecedented number of UICs and their success has never been more important for society. There are many challenges facing UICs that arise primarily from bringing together different organisation cultures with diverse and often competing expectations. Major UIC programs that involve a large number of R&D projects bring additional challenges, including the definition of strategic program goals and the need for experience and management skills necessary for a large, temporary, multi-cultural organisation. Many of these challenges have been studied within a major UIC program based in Portugal. The collaboration, presented as a case study, involved an investment of €74m over six-years and comprised forty-four individual R&D projects with over five-hundred researchers. This research presents several outcomes from the case study and shared many of the lessons learned and practices that can be adopted in future UIC programs.

References

Ankrah A, Al-Tabbaa O (2015). Universities–industry collaboration: A systematic review. *Scandinavian Journal of Management, 31*(3), 387–408

Barnes TA, Pashby IR, Gibbons AM (2006) Managing collaborative R&D projects development of a practical management tool. *International Journal of Project Management*, *24*(5), 395–404

Brocke Jv, Lippe S (2015). Managing collaborative research projects: A synthesis of project management literature and directives for future research. *International Journal of Project Management*, 33(5),1022–1039

Du J, Leten B, Vanhaverbeke W (2014). Managing open innovation projects with science-based and market-based partners. *Research Policy,* 43(5), 828–840

Fernandes G, Pinto EB, Machado RJ, Araújo M, Pontes A (2015). A Program and Project Management Approach for Collaborative University-industry R&D Funded Contracts. *Procedia Computer Science, 64*,1065–1074

Session D2.A1 - Quality: Lean and Six Sigma and Problem Solving Methodologies and Improvement

A comparative experiment study on red retroreflectors manufacturing processes

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Abstract

This case study was carried out at an automotive components company that produces retroreflectors that are installed at the rear bumper of automobiles. Due to an increase in orders in one of its products the company is considering changing the manufacturing process to a new robotized cell. The new proposed manufacturing cell raised some quality issues, namely the impact on the reflection properties of the product when welding a still warm injected lens onto the support. A $2_{III}^{(6-3)}$ experimental plan with 6 control factors and 8 runs was designed and implemented to compare the two processes. Taking in consideration the fact that the lens mold has four cavities that can influence the results of the red retroreflectors reflection, the experiment was conducted in split-plot to accommodate de four cavities in each experimental run.

The results showed that the variation introduced by the mold cavities was the most important factor explaining the variation of the reflection results and , despite the contamination of the results by the mold cavities, it was possible to determine that welding the injected lens with a still-warm/hot temperature had a positive impact on the reflection values.

References

Cortes, L. A., Simpson, J. R., & Parker, P. A. (2018). Response surface split-plot designs: A literature review. *Quality and Reliability Engineering International*, *34*(7), 1374–1389

Montgomery, D. C. (2017). *Design and analysis of experiments*. John wiley & sons.

Parker, P. A., Kowalski, S. M., & Vining, G. G. (2006). Classes of Split-plot Response Surface Designs for Equivalent Estimation. *Quality and Reliability Engineering International*, 22(3), 291–305. https://doi.org/10.1002/qre.771

Vining, G. (2013). Technical advice: Scientific method and approaches for collecting data. *Quality Engineering*, *25*(2), 194–201. https://doi.org/10.1080/08982112.2013.764228

Application of DMAIC methodology to the Meat Industry

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Abstract

The company where the present project was performed, SoHi Meat Solutions, is the result of the joint venture between Sonae MC and Hilton Foods. As a retail leader in Portugal, Sonae MC was forced to follow the tendency of applying improvement processes in several areas. Here we are going to focus in the case of SoHi Meat Solutions, the meat-processing center of Sonae MC, located in Santarém.

This project based on the beef line of the meat-processing center, had the main goals of increasing the OEE, Yields and PPM and reducing Giveaways and Setup times. For that purpose, the DMAIC roadmap established by Six Sigma methodology was adopted and reinforced by the implementation of tools such as Value Stream Mapping (VSM), Five Senses (5S), Autonomous Maintenance (AM), SMED and *Kamishibai* (Lean tools).

The principal results of this project were the increase of 21.2% of the OEE, the augment of 1.1 percentage points of the average Yield, and a 3.7% increase of PPM. On the other hand, the Giveaways decreased 0.2 percentage points while Setup times reduced 48.8%.

Keywords: DMAIC, VSM, 5S, Autonomous Maintenance, SMED, Meat Industry

A Risk Management Methodology for Collaborative University-Industry R&D Programs

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Abstract

In collaborative university-industry R&D programs and projects, the areas of Risk Management (RM) and Stakeholder Management have assumed a preponderant importance for the success of programs and projects, due to their innovative nature. In order to reduce the impact of risk associated with this type of R&D collaborations and consequently increase the success of programs and projects, a RM methodology has been developed for this type of collaborative programs, from the perspective of the main stakeholders, detailing for three key stakeholders (Program Manager, Project Manager and Program and Project Management Office), the respective RM activities. The research was based on a large-scale university-industry collaborative R&D partnership between UMinho and Bosch. Three research methods were used in a complementary way, documentary analysis, a mixed questionnaire, and a focus group. The proposed RM methodology helps to manage the risks brought by a university-industry collaborative program involving several projects, while emphasizing the importance of taking stakeholders approach.

References

Fernandes, G., Barbosa, J., Pinto, E. B., Araújo, M., & Machado, R. J. (2019). Applying a Method for Measuring the Performance of University-Industry R&D Collaborations: Case Study Analysis. *Procedia Computer Science*, *164*, 424–432.

PMI (2017). *A Guide to Project Management Body of Knowledge: PMBoK Guide* (6th Editio). Pennsylvania: PMI.

Stosic, B., Mihic, M., Milutinovic, R., & Isljamovic, S. (2016). Risk identification in product innovation projects: new perspectives and lessons learned. *Technology Analysis & Strategic Management*, *9*(14), 1–16.

Tereso, A., Ribeiro, P., Fernandes, G., Loureiro, I., & Ferreira, M. (2019). Project Management Practices in Private Organizations. *Project Management Journal*, *50*(1), 6–22.

Huang MH, Chen DZ (2017). How can academic innovation performance in university–industry collaboration be improved? *Technological Forecasting and Social Change, 123*, 210–215.

Proposal for a Sharing Economy Development Centre for the Textile and Clothing Industry

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Abstract

The planet Earth currently faces the consequences of decades of excess, demonstrated by the exaggerated patterns of production and consumption, which is creating economic, environmental and social instability. The fashion and textile industry is one of the largest economic powers in the world, but also one of the most polluting and unsustainable. This work seeks to approach Circular Economy and Sharing Economy practices, in order to find solutions to current needs. The methodology used is based on the study of the functioning of the Circular Economy and the Textile and Clothing Industry and on the analysis of practical cases of the Sharing Economy. The investigation results in the proposal of a development centre, "Covil da Lã - Sharing Economy Centre", taking advantage of the historical and economic potential, geographical and academic context of the city. "Covil da Lã" can promote local economic revitalization by supporting a traditional industry in the city, which is disappearing, by supporting companies and artisans, with the creation of a web of connection and support between all the projects that have potential for the region. The region where Covilhã is located, "Beiras e Serra da Estrela", has the largest concentration of wool processing companies in Portugal. Although it has suffered a severe deindustrialization, it remains the historic centre for the manufacture of wool fabrics in the country. The creation of a centre that includes a Cowork space, a Fab Lab, a business incubator, and the development of a B2B platform, would be the starting point of the Centre and the pillar to support collaboration and resources sharing between companies and artisans in the region. The inclusion of activities and projects to raise awareness, by collecting and reusing textile waste, has the potential to promote a change in mentalities and behaviours in local society. An important part of these partnerships is the connection with the University of Beira Interior and Modatex, as trainers of specialized workers in the Textile and Clothing Industry, which is recognized as one of the most important gaps in the sector, has the potential to more easily integrate students trained in the region, in local companies and in various areas. The Sharing Economy Centre acts as a centralizer of projects and interconnections, facilitating partnerships and collaborations, thus, "Covil da Lã" will have as main objective to create social, environmental and economic value locally, with the integration of collaborative practices of Sharing Economy in the region, to boost the development of the Textile and Clothing Industry, and the recognition of Beira Interior as a reference in the sector, while keeping alive the memories of the factory-city and the wool manufacturing tradition in Covilhã.

The waste flow challenge of wind turbine rotor blades at the end of their life cycle

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Abstract

Wind energy is one of the most important renewable energy sources for industry and society. Since the 1990s, there has been a 30% increase in the energy production from wind farms. However, when the equipment reaches the end of its life cycle (ELC), some problems arise related to the deposition of the residues, mainly at the level of the rotor blades, because the other ones are regulated (concrete towers by Directive 2008/98/EC and the nacelle by Directive 2012/19/EU). This problem is more expressive with the gradual increase in the size of wind turbine rotor blades, from the typical size of the 1980s, around 12 to 15 meters, to the longest blade in the world, with 107 meters. This evolution is considered a surprising event, but at the same time worrisome, because the increase in the size of the blades is reflected in the increase in the amount of waste generated when they reach the ELC. Currently, wind turbines have an average life span of 20 to 25 years and, as of 2040, it is estimated that 380 thousand tonnes of glass fibre reinforced polymers (GFRP) are discarded each year for landfills or incineration.

However, recycling remains a challenge, because the rotor blades produced a few years ago were essentially made of glass fibre reinforced polymers, with extremely low manufacturing costs and material costs. For this reason, it is important to emphasize that there must be strict control in this process, making it economically profitable. Portugal is currently facing a critical moment regarding the wind energy, because an undeniable truth is the aging of national wind farms. Because this trend is irreversible, the only way to overcome this problem is to extend the life span of wind turbines by imposing a minimum limit of 20 years for the oldest wind turbines. However, in the absence of any type of legislation that allows defining the minimum useful life, it will be very difficult to guarantee the maintenance of wind farms. In this context, it is essential to take into account the future of the wind sector in Portugal because, in 2023, 72% of wind farms are expected to be in operation for more than 15 years. However, the most worrying situation will be in the year 2028, for which it is estimated that 95% of the parks have exceeded 15 years of useful life, corresponding to 92% of the installed capacity in Portugal, about 4901 megawatts.

In addition to this problem, there is the fact that the waste resulting from the rotor blades of wind turbines is not biodegradable, which ends up accumulating in landfills and, thus, causing serious problems for future generations. To overcome this problem, it is essential to find viable solutions that allow recycling and later reuse of this waste. Using an approach focused on recycling and subsequent reuse of wind turbine waste, this paper aims to analyse the feasibility of a recycling process that is financially viable and easily replicable in an industrial environment.

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