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"13th International Conference on Industrial Engineering and Industrial Management" and "XXIII Congreso de Ingeniería de Organización (CIO2019)"

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Chapter 1

OPERATIONAL RESEARCH

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A Review on Strategic Decisions on Home Care Operations Management

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Keywords: Home Care; Operations Management; Strategic Decisions

1 Introduction

Home care has been over the past years a topic of growing interest in the operations management field due to the increase of patients across many countries and the need for home care providers to optimize costs while maintaining service quality. Underlying this surge there are socioeconomic, technological and budgetary causes. Among the first, population aging, changes in classical family structures and increasing urbanization entail a higher demand for home care. As for the second, the ready availability of commercial software that allows to manage routing and scheduling of caregivers is the main driver. From a budgetary perspective, home care could represent a cheaper substitute to hospitalization or nursing homes and bring about shorter and cheaper hospitalization periods.

The operations management literature on home care has been mainly focused on static routing and scheduling problems with time windows and no uncertainty, that is, on variants of the well-known vehicle routing problem with time windows (VRPTW). Little attention has been paid to other critical operations management decisions. Our goal is to explore strategic, long-term operations management decisions in home care, and to suggest future research directions.

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2 Strategic Operations Management Decisions in Home Care

We have reviewed articles and conference papers explicitly aimed at identifying home care operations management decisions. This paper follows Matta et al. (2014), whose classification comprises the following types of decisions: strategic (1-5 years basis), tactical (6-12 months), operational (weeks to months) and detailed operational (hours to days).

In this paper, for every strategic decision identified in any analysed article a definition is provided, literature on every specific topic is further reviewed (that is, we extend our review from decision-identifying papers to topic-specific articles) and, finally, future research directions are outlined.

3 Summary

We have identified 8 possible research directions, which are summarized in table 1. We are currently working on (1), (2), (5), (6) and (8) and expect to conduct research on the rest in the mid term.

Table 1 Suggested research directions on operations management strategic decisions for home care. Source: own elaboration.

Decision	Suggested research directions
Global Demand Forecasting	(1) Patient location forecasting: Individual-based / Region-based
Capacity Planning	(2) Heuristic methods that provide the number of caregivers, type of contract, skills, outsourced services, etc. Forecasting models are used as input
Facility Location	(3) Apply facility location models from other contexts to home care
Districting	(4) Definition of basic units' boundaries
	(5) Apply solving procedures for different number of districts
	(6) Calculate the "right" district size
Fleet selection and sizing and fleet assignment	(7) Develop models that suggest the appropriate number and type of owned transportation means
	(8) Include, in routing and scheduling models, the use of MaaS as a decision variable

4 References

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Autonomous Underwater Vehicles Inspection Management: Optimization of Field of View and Measurement Process

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Keywords: Autonomous Underwater Vehicle, Management, Sensors, Condition Monitoring System, Optimization, Path Planning.

1 Introduction

Autonomous underwater vehicles are robots capable of operating in deep oceans. They can employ novel sensor payloads to optimise the route and the measurement process in hard-to-reach areas. Their technologies have advanced in recent years, increasing the application fields and overall capabilities. The absence of human control and their autonomy require new control algorithms and improvement in their positioning. It leads to optimisation of the inspection and control path planning. Several authors analyse path planning and optimal route development without taking into account measurement parameters. This paper proposes an analysis of the camera, or sensor field of view, determined by technical specification of the equipment and conditions set by the operators. The optimal combination of the principal variables is performed through comparison between different cameras used in industrial inspections. It also analyses the quality of the measurement, highlighting the role of ground instantaneous field of view as key factor in the optimal selection of operational conditions. It shows optimal exploitation of sensor payload and underwater vehicles in path planning, independent of the application field, vehicle, camera or sensor.

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2 Objectives

The aim of this article is to highlight the main concepts for marine inspection and developing an analysis methodology to increase the reliability of underwater inspection. The optimisation of AUV path planning is possible with the study of fundamental variables in the underwater data acquisition. Operator can consider an optimal combination of measurement variables in order to optimize AUV mission. The novelty proposed in this article is the study of the measurement process from the sensor or camera point of view, taking into account that this is a critical task in reliable seafloor measurements.

3 Methods

Field of View (FOV) is the area covered by camera or sensor, depending to its technical specification. It is defined by large number of variables and calculated regarding on trigonometric positioning. This paper considers variables controlled by operators in order to simplify this problem. It is considered as restrictions the maximum AUV depth due to its specifications and the estimate size of the defect selected by the operators. It is introduced the Ground Instantaneous FOV (GIVOV), that shows the size of one single pixel at the depth selected in centimeters or area unit is introduced (Kwasnitschka et al., 2016b).

4 Results

GIFOV value is calculated regarding the depth (see Figure 5). GIFOV variation increases for higher values of depth, highlighting the importance of determine efficiently this value, despite of the fact that ground resolution of each camera (C1-C4) is similar. Depending on the type of operation and conditions, it is possible to choose optimal values to ensure the FOV maximization.

5 Conclusion

Underwater measurement processing has been analysed taking into account the area measured regarding on the technical specification of the camera or sensor. Field of view is defined regarding to the main different parameters involved. Four industrial cameras with the aim of probing the reliability of the proposed method are compared. These cameras have different specification, rendering possible the installation of this model in any type of operation. Ground instantaneous field of view is the operational restriction to define the optimal type of camera, orientation of depth, etc.

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Estimación de flujos de entrada de vehículos al puerto de Algeciras durante el desarrollo de la Operación Paso del Estrecho basada en redes neuronales

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Keywords: Redes Neuronales; Operación Paso del Estrecho; flujos de vehículos; previsión.

1 Introducción

El desplazamiento migratorio de la comunidad magrebí desde diferentes países de Europa al norte de África durante el periodo estival, se suele realizar por medio de vehículos privados, con un volumen de tránsitos de más de 730.000 vehículos en un periodo de tres meses. Esta situación requiere el despliegue de un Plan Estatal de Protección Civil denominado Operación Paso del Estrecho (OPE) que garantice una adecuada coordinación y planificación de las actuaciones de los distintos servicios intervinientes. En este escenario, conocer con la suficiente anticipación los flujos de vehículos en determinados puntos críticos es esencial para el desarrollo de una adecuada planificación.

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2 Objetivo

El objetivo que se plantea es la predicción del flujo de llegada de vehículos al puerto de Algeciras en franjas de tiempo de 8 horas, con una antelación de 16 horas a la llegada de los viajeros mediante la aplicación de una Red Neuronal (RN).

3 Métodos y análisis previo

Se analizan datos agregados de entrada de vehículos por los puestos fronterizos de Irún y de La Junquera, en periodos de 8 horas. Se decide construir un modelo de relación entre la entrada en el país y la llegada a puerto (salida), basado en un desfase de 16 horas, teniendo en cuenta en el día de la semana.

Se analizan previamente un método de regresión múltiple (R^2=0.619, RMSE 409.8 en entrenamiento y 477.6 en test). Un modelo de previsión ARIMA (RMSE 554.7) y se comparan con una RN basada en un perceptrón multicapa.

4 Resultados y conclusiones

Se han evaluado diferentes parámetros, varios optimizadores y funciones de coste concluyendo que los indicios son prometedores para continuar el estudio y desarrollar un marco experimental con el cual discutir y analizar los resultados, para detectar distintos escenarios. Cabe resaltar que la aplicación de RN permite el uso de amplios conjuntos de información y brinda la capacidad de integrar los nuevos datos y parámetros disponibles. Por lo tanto, esta es una herramienta potente y flexible con la que se pueden desarrollar modelos que se ajusten de forma dinámica al problema, para desarrollar previsiones que faciliten la planificación de los servicios intervinientes en la OPE. La RN definida sobre datos reales reduce el RMSE en el entrenamiento, 347.03, y con los datos de prueba, 498.24. Respecto a la caracterización del problema, es necesario estudiar el nivel de agregación de los datos. También, sería conveniente analizar la ampliación del modelo con la incorporación de más puntos de estudio de salida (otros puertos) o con puntos intermedios del trayecto, junto con el análisis de otras posibles variables como días de festividad en los países de procedencia.

Las RN pueden ser una buena herramienta para relacionar variables que afectan, contienen información o relación con la actividad portuaria que acontece durante la OPE. El resultado de esta investigación es alentador para desarrollar y ampliar modelos de redes neuronales que permitan alcanzar el objetivo, en base a las diversas propuestas de extensión del modelo.

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Predicción de rotura de tuberías en redes de abastecimiento de agua a través de un modelo de regresión logística

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Keywords: Red de abastecimiento de agua; Regresión logística; Predicción de roturas de tuberías; *Machine learning*

1 Introducción

El deterioro de una red de abastecimiento de agua tiene como síntomas la aparición de roturas frecuentes (Pelletier, Mailhot and Villeneuve, 2003). Una rotura inesperada, además de causar daños físicos, supone la interrupción del suministro, lo que deriva en la disminución de la calidad del servicio. Por consiguiente, un sistema robusto de predicción de roturas generará la mejora del servicio y un ahorro de costes significativo.

2 Objetivo

El objetivo del estudio es la generación de un mecanismo robusto de predicción de roturas de tuberías. En primer lugar, se analizan los tipos de análisis predictivos existentes: estadísticos, probabilísticos e inteligencia artificial, y su aplicación al caso de estudio. Además, se estudian las características del problema, siendo éste, en la mayoría de los casos, un problema de clases desequilibradas. En las redes de abastecimiento reales existen muchas más tuberías que no sufren ninguna rotura, siendo el principal objetivo predecir las roturas que si ocurrirán.

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3 Método

La regresión logística (Cox and Snell, 1989) es un método estadístico que permite modelar fenómenos cuya variable respuesta es cualitativa, estableciendo la probabilidad de pertenecer a una clase como una función de distribución logística (1).

$$p_i = \frac{1}{1 + e^{-wx_i}} \tag{1}$$

Esta método permite contemplar tanto las tuberías que sufren alguna rotura, como las que no. Resolver el modelo implica estimar los pesos, w, asociados a las variables explicativas, x_i. La salida del modelo es una variable binaria, y_i, que representa si el suceso de interés, la rotura, ocurre o no.

4 Resultados

Con objeto de validar la aplicabilidad de esta metodología al problema de estudio, se hace uso de los datos correspondientes a la red de abastecimiento de Sevilla. El histórico disponible consta de siete años y un total de 4,393 roturas. Las variables de entrada del modelo son: material, diámetro, edad, longitud, número de acometidas, tipo de red, número de roturas previas y fluctuación de la presión. Además del procesamiento de los datos, se incorporan mecanismos de *machine learning,* como la validación cruzada, el equilibrado de clases, o el relleno de huecos, haciendo que el rendimiento del modelo mejore considerablemente.

Una vez estimado el modelo con datos de entrenamiento, se consigue una precisión (*accuracy*) del 76.6% y la predicción del 85.9% de las roturas (*recall*) de los datos de evaluación.

5 Conclusiones

En este estudio se demuestra la aplicabilidad de la regresión logística como técnica de predicción de rotura de tuberías en una red real de gran tamaño. El porcentaje de predicciones correctas es muy alto, lo que supone la posibilidad de evitar un gran número de roturas. Las variables que se han identificado como las más influyentes en la rotura son el material y la longitud de la tubería, seguido por el número de roturas previas y la edad.

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Optimal design of water supply networks using a tabu search algorithm

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Keywords: Water supply network design; Tabu search; Metaheuristic; Optimization

1 Introduction

A water supply network is the infrastructure responsible for bringing drinking water to consumers. Currently, population is growing, specifically in urban areas. This causes new challenges regarding the construction and enlargement of this utility. The design and building of extensions of such water supply networks is a hard and expensive task. Therefore, an efficient planification may result in substantial cost reduction and increase in safety.

2 Objectives

The purpose of this study is the optimal design of water supply networks solving a model in which the demand of a set of consumer points must be covered with specific conditions of pressure and flow. The traditional model, which does not include penalty terms, is chosen and some requirements as minimum pressure in nodes are included as constraints The final objective of this selected model is to find the optimal diameters of each network pipe that minimize the total costs.

The intrinsic characteristics of the hydraulic systems and the discrete nature of some of their variables make this problem a non-linear mixed integer problem.

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3 Methods

Metaheuristics are the most suited methodologies to solve this kind of complex problems. A tabu search algorithm, firstly introduced by (Glover, 1986), is designed and is implemented in the well-known Alperovits network (Alperovits and Shamir, 1977). The main characteristic that differences it from other metaheuristics is the use of short-term memory.

This specific problem requires two different evaluation functions. The first one performs the hydraulic simulation of the network and the second one evaluates the total cost of hydraulically valid solutions. The algorithm works with solutions in the form of lists where each element represents the diameter assigned to each arc. The neighbourhood structure is built through the decrease of one diameter unit to the next one in the commercial catalogue. It also includes an aspiration criterion and a hydraulic-non-valid solution detector.

4 Results

To simulate the network and to analyse if hydraulic requirements are reached, the WNTR library (Klise *et al.*, 2017) was employed. The use of this library has made possible to explore different solutions iteratively in short times.

The best attained solution for the Alperovits network has a cost of 420,000 m.u.. Despite being an optimized solution, it does not reach the results obtained using other metaheuristics. Genetic algorithms (Savic and Wlaters, 1997) seem to be more suited, but they need much greater computing times.

5 Conclusion

Comparing tabu search to the genetic approaches, it can be concluded that this metaheuristic seems to be less appropriate to solve the Alperovits network, although results are clearly in line. Future works may include the resolution of larger and more realistic networks in order to demonstrate the good performance of the designed methodology in these cases.

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Secuencias *Quota* en taller de flujo de demanda general con programación lineal entera mixta

Bautista-Valhondo J [18], Alfaro-Pozo R [19]

Resumen: Presentamos modelos basados en la Programación Lineal Entera Mixta (PLEM) para obtener secuencias de productos mixtos en el problema *Flow Shop Scheduling* con demanda general y satisfaciendo la propiedad *Quota*. Realizamos la explotación de los modelos con solver CPLEX limitando el tiempo de CPU y utilizando instancias de la literatura de mediana y gran dimensión de la empresa NISSAN de Barcelona. Ante los resultados, concluimos que PLEM se puede añadir al conjunto de procedimientos útiles para resolver este tipo de problemas.

Palabras clave: Flow Shop Scheduling Problem; Level Schedules; Mixed Model Sequencing Problem; Overall Demand Plan; Mixed Integer Linear Programming.

1 Introducción al problema y su entorno

El *Flow Shop Scheduling Problem* (FSP) es un problema de secuenciación que permite modelar gran variedad de entornos productivos (Graham et al. 1979, Aggoune 2004): un conjunto J de piezas (n elementos) debe ser procesado en un conjunto de máquinas K (m elementos) dispuestas en serie. Todas las piezas pasan por todas las máquinas en el mismo orden, empezando en la 1 y finalizando en la m.

La versión del problema denominada *Permutation Flow Shop Problem* (PFSP), considera un espacio de almacenamiento ilimitado entre las máquinas consecutivas; por lo que, cuando concluye el trabajo (j,k) sobre una pieza $j \in J$ en la máquina $k > 1$ ($k \in K$), la máquina queda libre para procesar la pieza siguiente cuando ésta esté disponible; Graham et al. (1979) llaman $Fm/prmu/\gamma$ a este problema, donde γ simboliza una medida de eficiencia. Cuando no conviene apartar las piezas del proceso, por espacio insuficiente o inconveniencia, se llega a una situación de bloqueo; Graham et al. (1979) denominan $Fm/block/\gamma$ a este

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problema. Entre las métricas de eficiencia más comunes están: (1) el instante de compleción de todos los trabajos en el taller, C_{max}, y (2) el instante medio de compleción de dichos trabajos, C_{med}.
En las líneas de producción de automoción (y otros sectores) no tienen sentido contemplar secuencias con *demanda unitaria* en las que todos los trabajos son distintos (v.gr. 270 motores distintos al día en una línea de 24 estaciones), en tales casos, tendremos *demanda general*; por ello, hemos extendido los problemas $Fm/\beta/\gamma$ asignando una demanda general a tipos o clases de piezas: $Fm/\beta/\gamma/d_i$, donde d_i simboliza el número de piezas de tipo $i \in I$ del conjunto I ((Bautista y Alfaro, 2018a).
Por otra parte, la *propiedad quota* es un requisito que imponemos a las *secuencias* para que sean *regulares* (Bautista y Alfaro, 2018b). El *nivelado o regularidad de la producción* es un concepto japonés (*Heijunka*) que surge en contexto Just-in-Time. Las secuencias regulares se pueden caracterizar con una función objetivo (Miltenburg, 1989) o con restricciones sobre las tasas de fabricación de los productos. En este trabajo hemos optado por la segunda opción imponiendo la *propiedad quota.*

2 Objetivos, métodos, resultados y conclusiones

Los dos problemas expuestos, ambos con demanda general, representan bastante bien un sistema productivo orientado a productos mixtos, en contexto *Heijunka-JIT*, con ciclos de fabricación variables en las estaciones de trabajo. La combinación de ambos problemas conduce a un *problema biobjetivo* con objetivos antagónicos, ya que, mientras el FSP busca secuencias eficientes según alguna métrica (v.gr. C_{max} mínimo: menor tiempo de compleción de todos los trabajos), las secuencias quota se caracterizan por mantener constante el mix de producción dentro de lo posible.
En este trabajo, nuestro propósito es obtener secuencias eficientes en C_{max} y que preserven el mix de producción satisfaciendo la propiedad quota. Para ello, utilizamos la Programación Lineal Entera Mixta como método de resolución y experimentamos con instancias típicas y un caso de estudio de la empresa Nissan en Barcelona.
Los resultados obtenidos con el $Fm/prmu/\gamma/d_i$ (Quota) frente a instancias de 270 unidades, nos permiten afirmar que PLEM es útil para resolver estos problemas.

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Systematic Literature Review on symmetry breaking option on mathematical programming models for planning problem with rolling horizon procedures

Rius-Sorolla G[20], Maheut J, Estellés-Miguel S, García-Sabater JP

Keywords: Supply Chain Management; Rolling Horizons; Symmetry; Mixed Integer Lin-ear Programming;

1 Introduction

The rolling horizons procedure is a common tool in the operations planning in industry and in academic environments. Its use helps to make decisions in environments of uncertainty and at the same time simplify big problems in small planning horizons. But it is a heuristic method, where it should be said that the best planning operations proposals that are obtained on each rolling horizon are not necessarily the same planning operations proposal that would be found in the solution of the entire time horizon.

The rolling horizons are an accurate representation of the industrial. Companies must make decisions about the operations planning from orders and forecasts, their current situation and the available capacity. In the following period, an update information is usually available together with the results of the planned planning. The new information may have variations within the expected ranges, or totally unexpected (require contingency plans for accidents or catastrophes) or higher than forecast ranges but expected (reactive plan in real time together with preventive actions). This new information allows updating the planning for the following periods, by modifying the previous plan or launching a new planning recalculation**.** In the industry, the companies recalculate their planning according to information update, although they try not to make changes in the near periods, in order to reduce the nervousness or planning instability and costs (Sahin et al., 2013), given that the competitiveness of the company lies in the balance between its ability to react to changes and its operating costs.

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A particularity of these problems is that symmetries frequently appear in mathematical programming models. That is, different equivalent or equal elements generate alternative solutions with similar results in the objective function. Variables that can be exchanged without changing the structure of the problem (Alemany et al., 2014). These symmetries slow down the search algorithms of the best solution to the objective function that complies with the modelling constraints. Equivalent solutions can be exchanged, where different solutions are proposed for the same objective value. This may make it more difficult to demonstrate the optimality of the problem solutions and, therefore, increase the computation time. Jans (2009) showed that eliminating the symmetry of the formulation can be useful to accelerate computational times.

The symmetry in the mathematical programming models is especially relevant when the procedure of the rolling horizons is applied. The proposed solutions to the models, within the allowed tolerance or calculation time, can vary from one computer equipment to another. These different solutions can involve large differences in the following planning horizons in the rolling horizons procedure.

To the best of our knowledge we have not found a review of the literature on the treatment of symmetry when using the rolling horizons procedure. Therefore, a systematic review of the literature on measures to avoid symmetry in models with the rolling horizons procedure is proposed.

5 Conclusion

The complete work presents the results of a systematic literature review on actions to break the symmetry in models that apply rolling horizons procedure.

It is highlighted the importance of breaking symmetry in order to avoid unwanted solutions or speed up the resolution process. The identified symmetries focus on demands related to equivalent products and operations that can be performed on equivalent resources. Extrapolating the symmetries to the indexes of a mathematical programming model for planning (Rius-Sorolla et al., 2018), it has been identified products, resources, operations and time but not the time relative index.

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The two-stage assembly flowshop scheduling problem with buffers

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Keywords: Assembly flowshop; limited buffer; scheduling; complete enumeration

1 Introduction

The two-stage assembly scheduling problem is a well-known problem from the literature with a lot of practical applications. It consists of a system with two stages where a set of n jobs must be processed in a given sequence. First stage is composed of m machines, each one produces a component to be assembled in one single machine at the second stage. Since the seminal paper of Johnson (1954) an extensive amount of papers has been published related with scheduling problem. One typical assumption is the absence of buffer limitations between both stages but this is too unrealistic from a practical point of view as it can be seen in the recent survey of Andres and Maheut (2018).
Simultaneously, other kind of scheduling problems called assembly flowshop has attracted the interest of the researchers. Lee et al. (1993) probed this problem is NP-hard even for two machines at the first stage. The best approach up to now to solve the problem with makespan was proposed by Hariri and Potts (1997) using Branch and Bound techniques. Regarding total completion time minimization in assembly flow shops, Framinan and Perez-Gonzalez (2017) proposed a constructive heuristic and a metaheuristic that outperform all the previous heuristics.

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2 Objectives

Under Lean Manufacturing paradigm, it is interesting to minimize the time that all jobs wait in all the buffers and total machine blocking time. However, there are no previous research about two-stage assembly flowshop with buffering and blocking time as objective function. We present a complete enumeration study to show relationship between buffer size and objective function for small size problems.

3 Methods

In order to show the effect of buffer size over makespan for small instances (up to nine jobs), a test based in complete enumeration has been carried out considering that there is an identical buffer of size b between each component machine and the assembly one. We used some instances from Taillard (1993) where first machine was used to represent processing time in assembly machine and the rest represents processing time in component manufacturing machines. All the 9! sequences for the each instance have been computed for buffer size between 0 and 4.

4 Results

Empirical distributions of blocking plus buffering times show interesting differences between each solution space depending on buffer size. More precisely, when buffer size increases is more difficult to find a good solution randomly. For example, for zero buffer size all solutions are under 50% from optimal value but for buffer size equal to 3, there are only 2,3% of solutions.

5 Conclusion

The conclusion of the research is that it is “easier” to find a good solution randomly in blocking assembly shops but the difficulty arises when buffer size is taken into account. Our aim is to develop competitive heuristic procedures to solve realistic instances and get more insights about the relationship between buffer size and assembly flowshop performance under finite storage conditions.

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Integrating Industry 4.0 with lean manufacturing

Keywords: Industry 4.0; lean manufacturing; smart manufacturing; cyber-physical systems.

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1 Introduction

The Lean Production (Womack et al., 1990) system is the management approach that has allowed firms to advance in an ordered way through the various stages that lead to competitiveness because it allows products and services to be obtained fast and at low cost.

In 2011, to meet the growing challenges faced by industry in Europe, and especially in Germany, the term Industry 4.0 (from now on I4.0) or Fourth Industrial Revolution was coined at the Hannover Fair (Drath and Horch, 2014), although some authors consider that the I4.0 is nothing new but simply combines existing technologies and concepts (Buer et al., 2018). This ambiguity and the lack of a clear definition make implementation difficult.

This paper aims to fill this gap and to analyse the role played by the I4.0 tools in the lean production model.

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2 Objectives

The objective of this paper is to explore this new area of the I4.0 and to present the current state of research into the relation between the I4.0 and lean manufacturing. It aims to answer three questions: How can the I4.0 be integrated with lean philosophy? Will the computerisation of manufacturing make the lean principles unnecessary? Should the I4.0 be a facilitator of lean philosophy?

3 Methods

A systematic review of the literature to find how the I4.0 can be integrated with lean manufacturing through the state of the art of research on this topic.

4 Results

After the usual steps of a systematic review of the literature, 14 papers were considered relevant to our research. They show that the I4.0 approach can fit in a lean manufacturing model even though there is not yet a perfect fit between the two. The mistake that must be avoided is to digitalise and introduce technology without first transforming the firm to a lean philosophy. Once the firm has reviewed its processes in line with lean philosophy, the I.40 will be an important new ally and a facilitator. Not only are lean principles not left behind by the I4.0 but they become more relevant in the new I4.0 factories which in essence have to be lean in order to meet new challenges.

5 Conclusion

In general terms, I4.0 is the application to manufacturing of the latest advances in information technology. The bibliographical review shows that the I4.0 will become an important ally of lean philosophy. Every industrial revolution has had what are known as its “technological facilitators”. The technologies of the I4.0 will be its facilitators. To avoid failure, it is important for IT professionals to understand the needs of factories and for manufacturing professionals to understand IT capacities.

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Multi-period Capacitated Intermodal Network Design with Allocation of Investment Budget

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Keywords: Network design; Strategic-tactical planning; Capacity planning; Investment budget; Multi-period formulation.

1 Introduction

Designing a transport network implies joint strategic and tactical planning decisions to obtain the optimum number of facilities and specific network arcs that minimise costs and satisfy demands (Rahimi et al., 2008). Financial limitations influence network design decisions (Harris, 2014). Extensive capital investment is required to implement projects of this type, however, the capital is not always available when planning is first undertaken (Fotuhi and Huynh, 2018). Additionally, to invest in these types of projects, investors have to take into account non-operational time while the facility is being built and balance the trade-off with maintenance and other costs (Wiegmans and Behdani, 2018).

2 Objectives

The objective is optimising the cost of using and maintaining a capacitated intermodal network design for an agricultural area that requires improved access and connections to national transport networks to satisfy long-term demand. Strategic decisions define where and when facility location and capacity and new transport infrastructure are chosen. Tactical decisions define the allocation of network flows and the identification of physical routes by transport mode (single mode or intermodal).

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3 Methods

The problem studied in this paper refers to a real situation in an agricultural area in a developing country where it is difficult to transport agricultural products. Multi-period mixed-integer linear programming formulation for capacitated intermodal network design with investment planning is proposed. Decisions are limited by the available per period investment budget according to each type of infrastructure, and alternative sets are defined for the installation of the intermodal logistics platforms and new arcs into account non-operational time while the facility is being built.

4 Results

We are currently coding the model with Gurobi v8.1 R Interface and collecting data to generate a set of instances that will allow us to assess computational performance. However, it is difficult to obtain real costs due to a lack of records of standard transport mode rates and the absence of logistics operators in the area.

5 Conclusion

Even though this model has been motivated by accessibility problems in a specific agricultural area, it could be adapted to other contexts that require the design of a raw materials intermodal network or investment in the intermodal network's supply network. Future work will focus on stochastic approach or formulate the model with multi-criteria objectives as a way to assess the impact on territorial development.

6 Acknowledgements

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Calculation of the on-hand stock levels with fuzzy techniques

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Keywords: On-hand levels; fuzzy set; inventory; lost sales; periodic review

1 Introduction

One challenge in inventory control models is to know the available stock at the beginning of the cycle to satisfy future demands. For inventory managers, this information is necessary both to determine service levels and to establish the control parameters of the inventory policy. In the literature, we find an exact expression proposed by (Cardós et al., 2006) for the lost sales case. However, this method requires huge computational efforts for large S values, which hinder its implementation in practical environments or information systems.

2 Objectives

The main goal of this work is to propose a new approach of the on-hand stock levels when unfilled demand is lost. To this aim, we apply fuzzy set techniques

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(Zadeh, 1965), based on the uncertainty that real demand introduces. We focus on the traditional periodic review system (*R, S*).

3 Methods

We propose a new approach of the on-hand stock vector modeling it as an imprecise Markov chain using possibility functions. We adapt the expression of (Cardós et al., 2006), where $\overline{\overline{M_R}} = \overline{\overline{M_{R-L}}} \times \overline{\overline{M_L}}$ is the transition matrix between two consecutive replenishment cycles. When $\overline{\overline{M_R}}$ converges, the eigenvector represents the on-hand stock vector. We apply fuzzy logic to eliminate the computational effort required to achieve the convergence. To each iteration, we calculate the difference between the highest and the smallest element of each column (t_j). We define the error as the largest value of t_j, i.e. $t = \max\{t_1, ..., t_{S+1}\}$ and we stop when t arrives to a predefined value.

4 Results

In order to analyse the performance of the proposed fuzzy vector, we calculate the exact and the fuzzy vector, which are used to compute the fill rate following the expression proposed by (Guijarro et al., 2012). The results of this work show a very good performance of the proposed approach, even when the fill rate level is lower than 90%.

5 Conclusion

We develop a new fuzzy method to calculate the on-hand stock levels just after an order delivery, which is needed both to calculate the inventory costs and to analyse the performance of the inventory policy. In (Cardós et al., 2006) we find an exact expression to calculate the on-hand vector, however this method requires huge computational efforts for large *S* values. The proposed fuzzy method presents a good performance and reduces significantly the computational costs, been easily implementable in practical environments.

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Blockchain and Smart Contracts: A Systematic Review

Fernández-Vázquez S[35], Rosillo R[36], De La Fuente D[37], Priore P[38]

Keywords: blockchain; smart contracts; ethereum; bitcoin; internet of things

1 Introduction

Blockchain is one of the hottest topics in both academic and financial world. It was introduced in 2008 through Bitcoin as a peer-to-peer payment system for electronic transactions allowing two parties to send payments to one another without the intermediation of financial institutions, preventing double-spending (Nakamoto, 2008).

Lately, blockchain has been used in a broader manner (Luu, 2016), enabling the creation of smart contracts. The main concept behind smart contracts is that the contractual clauses formalizing a transaction between two parties (collateral, bonding, property rights, etc.) are enclosed in the hardware and software (therefore into property) fading the needs of a third-party (or central authority) governing these transactions.

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2 Objectives

In order to apply blockchain to transactions, it is necessary to understand how this technology works. Blockchain is nothing more that data structure, divided into blocks. Each block holds a piece of information, referenced to the preceding block in the chain, forming what is called a chain of blocks, or blockchain.

3 Methods

Blockchain technology allows a peer-to-peer network in which non-related members interact with each other, authenticating transactions. The foundations of this new system are the transparency, traceability and replicability of transactions from the source to its last instance. Smart contracts can be coded using, for instance, a programming language known as Solidity.

4 Results

Correctly coded blockchain transactions in Ethereum, for example, would help companies operating in exchange and clearing houses cut their transactional fees by entering into a reliable, corrupt free system, thanks to the blockchain mining technology behind them.

5 Conclusion

While the application of blockchain in many industries is far from being fully developed, this technology still faces certain issues that must be addressed. More investigation and further development will benefit blockchain becoming more scalable and secure, preventing misbehavior in the network. Although today it is far from being the ideal solution to challenges in a variety of sectors (energy, logistics, education, medicine), its characteristics set hopes for a greater importance in the years to come.

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Una propuesta metodológica para el diseño de sistemas de gestión de inventarios

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Keywords: inventarios, diseño, metodología, nivel de servicio

1 Introducción

El propósito fundamental de un sistema de gestión de inventarios (SGI en adelante) consiste en garantizar, al menor coste posible, un determinado nivel de servicio al cliente. Para ello, se ha de mantener unos niveles de inventario que permitan cumplir con este doble objetivo para lo cual hay que responder a tres cuestiones clave: (a) con qué frecuencia debe examinarse el estado del inventario; (b) cuándo debe lanzarse una orden de reaprovisionamiento; y (c) qué tamaño debe tener dicha orden.

El diseño del SGI tiene como objetivo dar respuesta a estas tres preguntas, atendiendo a cuatro aspectos fundamentales: (1) las características de la demanda; (2) la política de gestión del inventario; (3) el contexto de gestión, que hace referencia a la manera de proceder ante roturas de stock; y (4) la métrica de servicio considerada como objetivo de diseño del SGI.

2 Objectivo

El objetivo de este artículo es el de aportar una propuesta metodológica para el diseño de SGI con una restricción de servicio al cliente como requisito de diseño.

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3 Método y resultados

La Fig. 1 muestra los factores para el diseño del sistema de gestión de inventarios. Siguiendo el esquema que se presenta en la misma los pasos a seguir son:

- PASO 1. Clasificación del ítem: determinar la importancia relativa del ítem.
- PASO 2. Determinar, según el patrón de demanda, qué distribución y técnica de previsión se utilizará para modelar la demanda.
- PASO 3. Determinar la política de gestión de inventarios.
- PASO 4. Determinar el contexto de gestión cuando se produzcan roturas de stock.
- PASO 5. Determinar la métrica de servicio objetivo. Para diseñar el sistema de GSI se establece un objetivo de servicio. Este objetivo se asocia a una métrica: *CSL* (nivel de servicio de ciclo) o *FR (Fill Rate)* (Babiloni and Guijarro, 2018; Guijarro et al., 2012).

5 Conclusión

En este artículo se presenta una metodología para el diseño de un sistema de gestión de inventarios con un objetivo de servicio. Esta propuesta persigue ser de utilidad tanto en un ámbito profesional como en el académico ya que se centra en los factores fundamentales del SGI y establece una guía para el diseño real de un SGI.

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How fast is Additive Manufacturing disrupting the Spanish manufacturing sector? Last three years' evolution.

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Keywords: Additive Manufacturing, AM, disruption, future evolution, flexible manufacturing;

1 Introduction

Even if Additive Manufacturing (AM from now on) is known since Chuck Hull, founder of 3D system company, invented in 1986 Stereo lithography (SLA) technique, over the last decade all the involved parties have shown a keen interest, and it seems that this is only going to intensify in the future (Wohler's, 2018).

There is still no global consensus about how, when and in what direction is AM going to affect the manufacturing business. There are two main factors for this fact:

- The "multivariable" character of AM.
- There is still a lot to invest and to discover in key aspects, mainly in what concerns to materials and depositing technologies for the machines.

2 Objectives

According to the International Monetary Fund, Spain is the 14th largest economy in the world, based on 2018 GDP, and its industrial sector is one of the most important ones for its economy (Jung, Ruiz-Cabrero and de Mur, 2014). Thus, the analysis of the potential influence and impact of additive manufacturing on the

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Spanish manufacturing sector, and its evolution, are critical factors to be considered by the business-related companies, when crafting their future strategies.

3 Methods

Three main phases were identified as crucial to achieve the objectives. These are the following:

1. In-depth interviews with relevant executives of representative companies.
2. Identification of the main disruptive aspects to take into consideration to monitor the evolution of AM impact over the industry (Wahlström and Sahlström, 2016; Pérez-Pérez, Gómez and Sebastián, 2018)
3. On-line survey to a representative focus-group of companies direct or indirectly related to AM on 1Q 2016, repeating the same survey on 1Q 2019.

4 Results

From Q1 2016 to Q1 2019, which represent the three-year researching period, the whole AM related business turnover evolution of the companies of the survey can be roughly estimated around a CAGR of 29%. This fact clearly shows the interest of the investigated subject.

5 Conclusion

After the research work, some important conclusions for AM Spanish activities can be obtained.

- Most of the companies that had started AM activities or divisions, before 2016, remain with them, have increase the related turnover, and consider that they would be important for their business in the future.
- It still seems to be a long way to go to find a consensus about the manufacturing technologies that will consolidate in the future.
- Although, for the time being, AM is far from becoming a dominant technology in industrial manufacturing business, some interesting information for its future development can be extracted from the survey.

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Evaluation of the effects in the changes of tides on the productivity of a Colombian port

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Keywords: Discrete event simulation; investment decisions; port operations; dredging; tides

1 Introduction

Ports are a significant part of the current economy of nations, thanks to the generation of economies of scale and the advantages for the final customer on sale prices they bring. This phenomenon should lead the governments to encourage competitiveness and efficiency in their ports' activities (Khalid, Muda & Zamil, 2004). Bearing this in mind, Colombian ports become a case of study due to the opportunities for improvement of their efficiency. Low depth of access channels is the main restriction of Colombian ports. In order to prevent higher costs and decrease times in port, it is planned to intervene the access channel so that it can obtain a minimum depth of 15 meters. Thus, this article studies the impact that this investment would have on the productivity of the port under study.

2 Objectives

To study the effects in the changes of tides in the access channel, on the productivity of a Pacific Colombian port.

3 Methods

First, we compared the indicators of the new and current systems. A simulation model was developed, since discrete event simulation is recommended by authors such as Demirci (2003), Parola and Sciomachen (2005); Arango, Cortes &

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Muñuzuri (2010). The simulation model was generated using the ARENA software version 14.0. The probability distributions were calculated using the statistical software EasyFit 5.4. In addition to that, the selection of the appropriate metrics was made reviewing reports, such as Nathan Associates INC (2006). Finally, the number of replication were determined by using the two-step sampling method proposed by Cox in 1952, to validate the simulation results. To define the warm-up period and eliminate the effect of the initial conditions, the Welch Method was used.

4 Results

The simulation analyzes the current operations of the port and two scenarios: the first examines the current conditions and the dredging of the canal, while the second examines the dredging of the canal and the increase in demand. The port, with the current visit volume, achieves the service standards that are commonly required. The average times differ in the two scenarios proposed, however, the simulation showed that the improvement of depth of the access channel allows a more efficient operation, decreases the waits seen as waste, and conserves the use of resources in average levels.

5 Conclusion

The current depth of the access channel to the port area of Buenaventura is not sufficient for the leading type of ships in the international freight transport. For this reason, the increase in the depth of the access channel is adequate to improve the productivity indicators of the port. Nevertheless, it is important to consider that the construction of new ports and their growth will bring an increase in traffic and size of ships, which maybe will turn it into a bottleneck again in the port area of Buenaventura.

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Financing infrastructure in emerging markets under public-private partnerships: managing the impact of foreign exchange on debt service

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Keywords: Infrastructure; emerging markets; public-private partnerships; project finance; foreign exchange risk.

1 Introduction

Many Emerging Markets and Developing Economies (EMDEs) have substantial infrastructure deficiencies they cannot address due to limited public budgets. In such cases the private sector can contribute to bring investments under public-private partnerships (PPPs) arrangements (Andres, 2014).

PPPs are long-term contracts between a private sponsor and a government entity, for the development and management of a public infrastructure, in which the private sponsor is providing the finance to construct, operate and maintain the new infrastructure (Inderst and Stewart. 2014).

2 Objectives

The objective of this research is simulating exchange rate movements and their impact on the debt service coverage ratio (DSCR) of a PPP project as well calculating the optimal size of an initial reserve account to cover potential liquidity shortfalls generated by local currency devaluations.

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3 Methods

Traditional financial modelling techniques rely on purchasing power parity to predict exchange rate movements. Empirical evidence suggests the differential of inflations between two countries is inaccurate to predict exchange rate behaviour both in the short and medium term (Jong & Park, 2017). This research proposes the use of statistical models for time series data to predict exchange rate movements such as the autoregressive conditional heteroskedasticity (ARCH).

To manage liquidity risks the standard practice in PPP projects is to create a reserve account to address liquidity shortfalls. This reserve account is typically funded with an amount equivalent to three to six months of debt service. However, the account does not isolate the impact of individual risks and the sizing is not based on expected financial exposure (Lim Abraham & Cai, 2017). This research proposes a dedicated account for foreign exchange risk and a size equivalent to the revenue loss generated by the single largest currency devaluation projected.

4 Results

The paper will compare the DSCR behaviour under the scenario using ARCH to predict exchange rates movements and to determine the optimal size of the reserve account with the DSCR behaviour under standard scenarios using purchasing power parity to predict exchange rate movements and pre-fixed reserve accounts of 3-month and 6-months of debt service.

5 Conclusion

The use of ARCH would provide a more reliable prediction of the exchange rate movements to assess the impact of currency devaluations in the projected cash flows of infrastructure project. The use of ARCH would also help to estimate the optimal size of a dedicated reserve account to cover foreign exchange risk. This account would reduce the impact of foreign exchange risk on the DSCR and loan defaults compared to pre-fixed reserve accounts.

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Modelos y algoritmos para la optimización de planes de aprovisionamiento, producción y distribución en empresas industriales y cadenas de suministro

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Keywords: Optimización, Cadena de suministro, Metaheurísticos, Matheurísticos.

1 Introducción

El presente estudio está directamente relacionado con el proyecto C2NET "Redes Colaborativas de Fabricación en Nube" (*Cloud Collaborative Manufacturing Networks*) y, en particular con el módulo optimizador, en el que se utilizan algoritmos holísticos globales y locales para la optimización en problemas de planificación en los que buscan maximizar la eficiencia de las actividades de planificación en la CdS (Sanchis *et al.*, 2018). El proyecto de investigación a realizar pretende, en primer lugar, abordar el desarrollo de nuevos modelos matemáticos y algoritmos para la resolución de planes, tanto individuales como colaborativos de aprovisionamiento, producción y distribución, para ampliar la actual base de algoritmos de C2NET. En segundo lugar, la investigación que se llevará a cabo permitirá la implementación de dichos modelos y algoritmos para la resolución de problemas de optimización combinatoria NP-Duro. En tercer lugar, los modelos y algoritmos propuestos serán verificados y validados con conjuntos de datos de diferentes tamaños, para obtener tiempos de resolución reducidos y garantizar que pueden ser utilizados para resolver problemas reales (de gran tamaño). Finalmente, abordar problemas y planes colaborativos no analizados hasta el momento, por lo que, se procederá a la adaptación de algoritmos existentes y desarrollo de nuevos.

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2 Metodología y resultados

Esta investigación se basa en el enfoque multi metódico propuesto por (Jay F *et al.,* 1990) que consiste en cuatro etapas. La primera (observación) tratará los modelos de la cadena de suministro existentes en la literatura y los creados por C2NET. Acorde a este estudio procedemos a la (construcción teórica) para crear un repositorio de modelos matemáticos de optimización, y algoritmos heurísticos, metaheurísticos, matheurísticos, y su combinación que serán de código abierto para el uso de las empresas, lo que lleva a una fase de (experimentación) en la cual se prueba los nuevos algoritmos creados teniendo en cuenta que se probará la combinación de varios métodos con diferentes paquetes de datos, trasladando finalmente al (desarrollo de sistemas) en la que se buscará implementar los algoritmos en la CdS. En este sentido la presente investigación, busca indagar a fondo los diversos métodos de optimización, con énfasis en los métodos de optimización hibrida, así como el desarrollo de estrategias para ciertas clases de problemas de optimización combinatoria NP-Duro. Con la finalidad de diseñar e implementar nuevos algoritmos a partir de la base creada por C2NET, por lo que se examinará la combinación varios métodos como: exactos con metaheurísticos o con métodos heurísticos, así aprovechar las características de cada tipo de técnica, buscando obtener un sistema flexible que se pueda implementar en la plataforma de C2NET.

3 Conclusión

Los crecientes cambios a los que tienen que hacer frente las empresas, ha propiciado que cada vez más investigadores se enfoquen en el campo de la optimización, por lo que, esta tesis doctoral pretende estudiar los diferentes métodos heurísticos metaheurísticos y matheurísticos, los cuales compararemos al desarrollar nuevos modelos y algoritmos, para la resolución de una serie de problemas NP-Duros. Concretamente se buscará generar una metodología para resolver problemas intratables desde el punto de vista computacional, y que sean de la vida real, dicho enfoque propone encontrar soluciones efectivas y eficientes para los problemas de optimización, en un tiempo de resolución aceptable.

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Mandatory Convertibles and Shareholders Incentives

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Keywords: Mandatory Convertible Bonds; Shareholder Value; Risk Shifting; Agency Dilemma; Real Options

1 Introduction

A relative large proportion of the academic literature about the agency dilemma studies corporate governance or the instruments that can balance the incentives of shareholders and debt holders. This article studies a balance sheet instrument, the mandatory convertible bond (MCB), as a means to increase the value for shareholders, without reducing the bondholders claim. Following the options valuations theories, one way to increase the value for shareholders is to increase the risk of the firm that in turn reduces the value for bondholders. MCB are equity instruments, therefore the increase in shareholders' value comes at the expense of MCB holders, not of bondholders.

2 Objectives

This research intends to study the influence of the issuance MCB in company credit perception and risk shifting. The theoretical framework predicts that companies that include MCBs as a balance sheet instrument can increase the shareholders' value by increasing the company risk, without deteriorating credit metrics.

3 Methods

Multinomial logit regression and standard multinomial regression models analysis of data from 81 MCB issued between 2010 and 2018. For the regression analyses

we have used the following ratios: Senior Credit Spread, Dividend Yield, Equity Volatility, Debt to Market Cap, Cash Ratio, and Net Debt to EBITDA.

4 Results

Despite the limited number of modern convertible bonds issued since 2010, the empirical results seem to partially confirm the hypothesis. As predicted by the model, risk shift increased in more than 1% after the issuance of MCB. The logistic regression model shows a 62% predictive power. The multivariable regression shows that volatility is, as in the hypothesis, positively correlated with the existence of a MCB in the company balance sheet.

5 Conclusion

The scientific literature about the influence of capital instruments in the agency dilemma is scarce. This research shows how on average the companies that issued MCB reduced its credit spread increasing at the same time its leverage ratios, increasing volatility, probably implying the investment in risky projects that can add value to shareholders without reducing debtholders' claims.

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Proceso de diseño de una subasta combinatoria

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Palabras clave: Subasta combinatoria, mecanismo de subasta, diseño de subasta.

1 Introducción

Las subastas combinatorias son un tipo concreto de subasta en el que existe la posibilidad de pujar por distintas combinaciones de ítems. Estas subastas han experimentado un fuerte impulso en las últimas décadas para afrontar problemas complejos de asignación tan diversos como el reparto de ventanas temporales en aeropuertos y redes ferroviarias, del espectro radioeléctrico, o para la asignación de recursos en entornos multi-proyecto (Villafáñez y Poza, 2010; Araúzo et al., 2009). A pesar de que el empleo de este tipo de subasta como mecanismo de asignación permite aumentar la eficiencia de mercado (Parkes, 2006), el diseño de una subasta combinatoria conlleva afrontar una serie de subproblemas que la literatura actual estudia fundamentalmente de manera individual.

2 Objetivos

Este artículo propone un procedimiento para la integración del conjunto de subproblemas asociados al empleo de una subasta combinatoria, con el objetivo de facilitar su diseño y su implementación.

3 Métodos

La revisión bibliográfica realizada indica que los cuatro cuestiones clave asociadas al diseño del mecanismo de una subasta combinatoria son las siguientes:

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- Expresión de la puja: empaquetamiento de los lotes a subastar y determinación de un lenguaje adaptado para la expresión de las pujas.
- Determinación del ganador (*Winner Determination Problem*, WDP): identificar el conjunto de pujas ganadoras. La resolución de este problema de optimización es de tipo NP-hard (Rothkopf et al. 1998).
- Problema de exposición: venta ítems de forma separada en subastas paralelas, imposibilitando la formación de pujas en forma de combinación
- Cierre de la subasta: determinar las reglas para la finalización de la subasta.

4 Resultados

Partiendo de la extensa literatura referida a los subproblemas asociados a las subastas combinatorias, en este artículo desarrollamos un marco para poder aplicar este tipo de subastas en los distintos mercados existentes. Así, proponemos dividir el proceso de diseño de subastas en cuatro etapas: etapa inicial (modelado del mercado en el que se quiere implantar la subasta); etapa estructural (determinación del mecanismo de subasta a utilizar); etapa regulatoria (problema de determinación del ganador) y etapa iterativa de corrección (depuración del diseño para obtener un tiempo aceptable en la resolución de la subasta).

5 Conclusión

Mediante el marco propuesto en este artículo para el diseño de una subasta combinatoria, se pretende que futuros diseñadores puedan identificar y abarcar los puntos críticos de este diseño, para poder estudiar la viabilidad de implantación de este tipo de subastas en el mercado correspondiente.

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Modelado de un Mecanismo de Subastas Combinatorias para el Sistema Ferroviario Español

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Palabras clave: Liberalización de mercado, mercado ferroviario, programación ferroviaria, red ferroviaria española, subasta combinatoria.

1 Introducción

La liberalización del tráfico ferroviario en la Unión Europea requerirá un mecanismo para la asignación de una infraestructura ferroviaria común a las nuevas compañías operadoras de transporte ferroviario que entrarán a formar parte de este mercado. En este trabajo se propone el empleo de una subasta combinatoria como mecanismo para conseguir un reparto efectivo de la red ferroviaria española.

2 Objetivos

El objetivo de este artículo es adaptar un mecanismo de subasta combinatoria existente, la *Combinatorial Clock Auction* (CCA) ideada por Ausubel et al. (2006), al entorno ferroviario. El mecanismo propuesto se está empleando en la actualidad como primer paso para resolver este problema de asignación en la red ferroviaria española.

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3 Métodos

En primer lugar, se procederá a realizar una definición de ítem o *slot* para el caso particular de una red ferroviaria. A continuación, se realizará una descripción de las adaptaciones realizadas sobre el mecanismo CCA para transformar un problema de asignación de tipo NP-hard (Rothkopf et al., 1998) en un problema de programación lineal resoluble, para su aplicación en el entorno ferroviario.

4 Resultados

Las adaptaciones realizadas a partir del mecanismo de la CCA hasta obtener la RCCA se centran en cinco aspectos:

- Concepto de slot: derecho de uso de un tramo de la red ferroviaria durante un tiempo determinado, ambos establecidos por el subastador.
- Expresión de la puja: en una primera etapa (ronda de reloj), los postores podrán formular su puja de forma pública. En una segunda etapa (ronda complementaria), se dará la posibilidad de realizar una última puja a sobre sellado.
- Anuncio de precios: el subastador impondrá un precio mínimo para cada uno de los ítems, que vendrá dado por el modelo de costes realizado por el Estado.
- Determinación del ganador: se consideran varias funciones objetivo: maximización del beneficio económico, del beneficio social o de los tramos asignados.
- Finalización de la subasta: determinación de la regla de cierre.

5 Conclusión

En este artículo presentamos el mecanismo de subastas RCCA, una adaptación del mecanismo CCA al mercado ferroviario. Una vez validado este mecanismo mediante simulación en una red simplificada, se aplicará a un fragmento de la red ferroviaria española.

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Chapter 2

SUPPLY CHAIN

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Metaheurísticos para ruteo del acomodo de mínimo tiempo posible para almacenes refrigerados

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Palabras claves: Acomodo; Centro de Distribución; ruteo; metaheurísticos

1 Introducción

En el acomodo, la obtención del menor tiempo posible es clave en la eficiencia operacional y efectividad logística. En un sistema de almacenamiento multi-nivel, el acomodo requiere el uso de equipos de manejo de materiales (EMM), que permitan ubicar los productos en las posiciones de acuerdo a la altura asignada y las características del producto (Chan y Chan 2011; Cortes et al.,2017).

De una revisión de la literatura, se detecta que el acomodo ha sido abordada como un problema de asignación de posiciones de almacenamiento (slotting) o políticas basada en clases (Muppani and Adil 2011; Kim y Smith 2011; Wu, Yang, y Yan, 2010). En tanto, el modelamiento de problema de conformación de lotes o ruteo en el acomodo para ubicar los productos en las posiciones asignadas, se detectó en la literatura dos enfoques que se modelan independientemente. Gómez, Giraldo y Campo (2016) modelan la conformación de lotes de acomodo utilizando heurísticos. Por su parte, Correa, Rodríguez y Gómez (2014) solucionan el ruteo de acomodo usando búsqueda tabú clásico sin considerar equipos de manejo de materiales, sistemas de almacenamiento en altura, entre otras restricciones. Los generan la oportunidad de investigación de modelar un problema de ruteo considerando restricciones antes descritas no detectadas en la literatura

2 Objetivo

Modelar un problema de ruteo de acomodo en CEDI refrigerados de mínimo tiempo posible considerando multi-productos, una flota de equipos homogéneos y otras restricciones, que se resuelve con metaheuristicos y una regla empírica.

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3 Métodos

El método para solucionar el problema inicia con formulación algebraica de problema de ruteo de mínimo tiempo posible como un modelo de programación lineal entero mixto. Luego, se realiza el modelamiento de metaheurístico de búsqueda tabú clásico, así como hibrido con estrategia 2-Opt insertion. Los metaheurísticos se comparan con una regla empírica PLPC (Posición más Lejana, Posición más Cercana). Los factores seleccionados para la experimentación son: Método de ruteo (MR), Tamaño de lote de ruteo (TL), Depot y tamaño de flota de EMM (TFEMM). La variable respuesta es el tiempo promedio de ruteo de acomodo.

4 Resultados

A partir de la ANOVA (Analysis of Variance), que se ejecutó con 216 corridas experimentales. Del efecto interacción doble de MR con TFEMM, se identifica que el BT 2Opt Insertion produce la mayor disminución de tiempo respecto a la regla PLPC, la cual, se encuentra entre un 1 y 40 %. Con respecto a la BTC las diferencias son menores variando en un rango entre 37,21 y 909,60 segundos/rutas, y porcentajes 1 y 7 %. Del efecto de interacción doble de MR con TLA se detecta que el BT 2-Opt Insertion genera menores tiempos de rutas de acomodo que la regla empírica PLPC, con valores entre 22 y 31 %.

5 Conclusion

De los resultados, se obtiene que los metaheurísticos genera soluciones más efectivas para el problema de ruteo en el acomodo, lo cual contribuye a su eficiencia y la conservación de productos en la cadena de frio. Finalmente, se aborda un enfoque novedoso y no detectado en el estado del arte del ruteo en el acomodo.

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Solving the Order Batching and Sequencing Problem with Multiple Pickers: A Grouped Genetic Algorithm

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Keywords: Grouped genetic algorithms; order batching; sequencing; multiple pickers; heterogeneous load capacity

1 Introduction ("H1" style)

The order picking problem is in charge of retrieving the set of items from storage locations to fulfil customer orders, while pickers walk or drive a picking device through the warehouse (Cano et al., 2017). The order batching groups customer orders into batches with a maximum fixed capacity, then the batches are assigned to a picking device and batch sequencing determines the picking scheduling and the completion time of all possible batches (Henn and Schmid, 2013). Therefore, the order batching and sequencing problem with multiple pickers (OBSPMP) is pivotal to enhance the efficiency and customer service (Zhang et al., 2017).

Group genetic algorithms (GGA) support the successful application to grouping problems because important information from the chromosome is preserved and is correctly transferred in the crossover operators (Koch and Wäscher, 2016). Metaheuristics such as genetic algorithms have not been found in the literature to solve the OBSPMP, as well as no OBSPMP models considering picking devices with heterogeneous load capacity.

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2 Objectives

This study shows the application of a GGA for the OBSPMP, considering picking devices with heterogeneous load capacity in order to minimize the maximum completion time (makespan).

3 Methods

The proposed group-oriented encoding scheme represents the assignment of orders to batches and the sequencing of batches in picking devices. Due to each gene represents a batch in a picking device; the chromosomes are of variable length. To create the initial population of size P, we follow an order group procedure that uses an order pool to place orders that have not yet been assigned to a batch. The fitness function represents the objective function of the OBSPMP, which is minimizing total completion time. The proposed GGA use the crossover, survival, immigration, and mutation operators.

The experiments are configured combining different values for number of customer orders, number of items per order, and warehouse layouts. The results of the GGA are compared with six benchmark rules called FCFS-LH, FCFS-HL, SLOS-LH, SLOS-HL, LSOS-LH, and LSOS-HL.

4 Results

The proposed GGA saves on average between 14.3% and 23.5% of total completion time when compared to the benchmark heuristics. Likewise, the GGA saves on average 18.3% the total completion time when compared to the six benchmarks; thus, the proposed algorithm improves the efficiency of order picking significantly.

5 Conclusion

By means of several experiments, it was shown that the GGA generate solutions superior to those generated by rule-based heuristics. Implementing these solutions can improve profit margins by reducing the regular working hours of the order pickers, and improves customer service by reducing picking service times.

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Impact of Additive Manufacturing in Aerospace Industry Purchasing Process

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Abstract: This study seeks to deepen the knowledge of the impact of additive manufacturing implementation into aerospace companies purchasing process. It has been studied the changes on the purchasing process activities and costs, in aerospace companies, when a company decides to move from a traditional manufacturing model to an additive manufacturing model. Results infer a quite relevant change in term of tasks and cost.

Keywords: Additive manufacturing, aerospace industry, supply chain, aerospace purchasing, 3D printing.

1 Introduction

Additive manufacturing (AM) process includes the design of a model based on 3D computer aided design software (CAD) and production of the model using 3D printing technology, which is then used as the basis for the final product design (Matias and Rao, 2015; Janssen *et al*, 2014). AM is currently a process with highly disruptive potential in aerospace industry. By the end of 2015 Boeing introduced about 20,000 original parts built using AM technology (Catalano,

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2015). Original parts (OP) are those used during the production of a new aircraft, while spare parts are used to manage aircraft service support. The first two titanium metal brackets were manufactured using AM in 2014 by Airbus, and were both introduced in the A350 model, making a breakthrough step forward (Airbus Presscentre, 2014). According to the Airbus Group the immediate benefits of adopting this technology are a cost reduction between 30% to 55%.

2 Objectives

The study seeks to understand to what extent additive manufacturing development and application is influencing the aerospace industry supply chain, with a special focus on the purchasing process. This process is extremely important in this particular industry due to the high volume (and value) of outsourced parts and purchased equipment. In this preliminary scenario the research will be focus on the consequences for purchasing process when AM it is applied to in-house manufacturing.

3 Methods

Authors based the research on three pillars: a detailed review of the published literature, the direct involvement of one of the authors in the purchasing process of a leading aerospace company analysed (action research) and authors also tried to get valuable field expert knowledge (using semi-structured surveys) based on in-depth interviews to gain insight into best industry practices.

4 Results and Conclusion

In the analysed scenario, where the in-house manufacturing technology changes from traditional manufacturing to AM, authors could infer that the impact on the purchasing process is mainly focussed on the way of working and tasks. Responsibilities of the main purchasing areas would be significantly reduced.

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How to Ensure Gender Equity through Social Sustainability in Agri-Food Supply Chains

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Keywords: Conceptual Framework; Gender Equity; Social Sustainability; Agri-Food Supply Chain;

1 Objective

The purpose of this paper is to propose a conceptual framework that identifies the main decisions and objectives to be pursued by the agri-food supply chain members in order to guarantee gender equity. If gender equity wants to be ensured, this conceptual framework can be used by the agri-food supply chain members as a tool to identify those areas in which special attention should be paid when making decisions.

2 Method

From the sustainable agri-food supply chains (AFSC) literature review proposed by Prima Dania, Xing and Amer (2016) it is concluded that up to now more attention has been paid to the economic and environmental aspects of sustainability than to social ones. This is also highlighted by Fuertes-Miquel et al. (2018) who classify the main objectives pursued by AFSC stakeholders to be sustainable in uncertain contexts into the three sustainability aspects. Both men's

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and women's inherent behaviours, aspirations and needs are taken into account, valued and equally shared, independently of their gender (Cuenca et al., 2019).
To ensure gender equality in AFSC, first of all it is necessary to identify the supply chain processes, objectives and related decisions that can have either a positive or negative impact on gender equity.

3 Results

A conceptual framework to improve social sustainability in AFSC by means of gender equity is proposed. The organizational processes that highly impact on gender equity have been identified, the objectives to be pursued at each process to ensure gender equity have been defined, and decisions in which decision-makers should focus to reach the objectives have been determined. The agri-food supply chains stages in which each decision should be made have been identified.

4 Conclusions

This framework can be used as a guide tool by AFSC members to reduce gender inequities in their organizations and in the whole supply chain, hence becoming more socially sustainable. This conceptual framework can be used as a reference guide to identify those processes, objectives and decisions that require more attention when pursuing gender equity improvements in an organization or supply chain. Thus, this tool can be either used in a distributed (individually) or centralized (collaboratively) way.

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Structural Complexity Mitigation in Network Design and Rationalization

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Keywords: p-Median, Complexity, Network Design, Location, Supply chain

1 Introduction/Objectives

Facility location problems are well known combinatorial problems where the objective is to minimize certain measure of the cost incurred for (or the benefit attained from) serving customers from a set of facilities. A typical location problem will either aim at maximizing the demand covered by strategically locating a given number of facilities, or at finding the optimal number and location of facilities necessary for satisfying the total demand in a region (see, e.g., Daskin, 2013).

Our aim is to bring to the field of facility location the concept of supply chain structural complexity, opening up a new research line. Broadly speaking, structural complexity refers to the negative effects of the proliferation of products, distribution channels and markets. Focusing on locational complexity, the main objective of this work is to create awareness about the need of considering complexity issues –and their impact on profitability- when deciding the location and size of a distribution network. The rationale behind our argument is that an oversized distribution network may cause hidden costs that hinder the capacity of the supply chain for translating revenue into bottom-line benefits.

2 Methods

In this work, using an entropy-based measure for structural complexity developed by the authors in previous research (Ruiz-Hernández, 2019), we propose a variant of the traditional p-median problem that includes a complexity parameter in the model's formulation, the K-MedianPlex problem:

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$$\max_{S \subset N\,:\,|S|=K} Z^{K}_{Plex} = \sum_{k \in S} R^{(k)} \left(1 - \alpha C_p^{(k)}\right) - \phi K \qquad (1)$$

with

$$C_p^{(k)} = \sum_{i \in \mathcal{N}_k} \omega_i \log_2\left(\frac{1}{\omega_i}\right), \quad k \in S \;;$$
$$R^{(k)} = \sum_{i \in \mathcal{N}_k} (r - \gamma d_{ik})\, W_i \,, \quad k \in S$$
$$\alpha: \quad \alpha C_p^{(k)} < 1 \,, \quad k \in S$$

where $\mathcal{N}$ is the set of network nodes; $S \subset N$, the set of open facilities; W_i, the weight of demand node $i \in \mathcal{N}$; ϕ, a fix facility cost; r, the revenue per unit; α, a profit loss factor due to complexity; γ, a generic transportation cost; and $\omega_i = W_i / \sum_{i \in \mathcal{N}} W_i$ for all $i \in \mathcal{N}$.

Given the strongly combinatorial nature and non-convexity of the objective function, we propose an algorithmic approach based on solving a K-median problem and sequentially reassigning demand nodes across facilities and solving local 1-Median problems aiming at maximising the function $Z^{K}_{Plex}(\mathcal{N}^{|S'|}, S')$, where $\mathcal{N}^{|S'|}$ represents the collection of allocation sets associated to a given solution S'.

Additionally, location complexity is not typically a result of network design, but a problem that arises from successive network expansions aimed at capturing market share and achieving profit growth (Fisher et al., 2017). In order to reduce complexity, firms may find it profitable abandoning certain markets (although they are usually reluctant under the rationale that lost sales will affect profit negatively). With this aim, we propose a strategy for successively uncovering demand nodes until no profit improvement can be further attained.

3 Results/Conclusion

A number of numerical experiments have been conducted on networks designed over all cities with more than 50 thousand inhabitants in France, Italy and Spain. Experimental results suggest that higher profits can be attained by reallocating demand nodes across facilities, relocating facilities and/or eliminating non-profitable demand nodes. As it may be expected, the improvement routines return better results for larger values of the complexity cost parameter α (representing high cost of complexity) and for larger transportation costs.

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Methodology for launching a packaging rationalization project. An “action research” case in the industrial sector

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The main objective of this paper is to propose a methodology for launching a packaging rationalization project. In order to illustrate the interest of this proposal, the authors develop the case of an industrial company in Spain, adopting the “Action Research” approach. Packaging design has been studied especially in large companies belonging to the retail sector, but not in an industrial environment and a context of Small and Medium sized Companies. This situation justifies the selection of the company under analysis.

Keywords: Packaging; logistics; supply chain; industrial sector

1 Introduction

Packaging usefulness is not only related to the product protection, but also to the promotion of the product’s differentiation and the search for cost reduction in logistics. More recently, packaging design has been highlighted for its environmental importance in reducing raw material consumption and waste generation.

In this context, packaging should be considered as a system comprising three levels designed to comply with requirements of product design (mainly commercial, logistics and environmental). The implementation of these design requirements demands a holistic view of packaging, supply chain and product. This vision has promoted the approach "Packaging Logistics" (Saghir, 2002; Regattieri et al., 2019) and “Sustainable Packaging Logistics” (SPL; García-Arca et al., 2014).

Many authors highlight the difficulties in sensitizing companies regarding the repercussions of the decisions in packaging design from a multifunctional point of view. In this sense, the first steps for deploying SPL are critical, as good results are needed in order to transform the internal culture regarding packaging design

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and to promote future action according to an SPL approach. Packaging design in academic literature has been analyzed especially in large companies (particularly, retail or automotive companies). Many companies, mainly industrial and Small and Medium sized companies, are ignorant of how to start a packaging rationalization project.

2 Objectives

Thus, the main objective of this paper is to propose a methodology for launching a packaging rationalization project. Likewise, to illustrate the interest of this proposal, the authors develop the case of an industrial and medium sized company in Spain.

3 Methods

The authors propose a 4-step methodology based on a Deming circle (PDCA): Step 1. Structuring the process; Step 2. Search for packaging alternatives; Step 3. Validation, test and implementation; Step 4. Follow-up and Improvement. To develop the applied case, the authors have adopted an "Action Research" approach (Näslund et al., 2010; García-Arca et al., 2018). The empirical validation process was developed over almost 10 years in 2 stages.

4 Results

During the first stage, the cubic rate in packaging system increased by 12.5% with a costs reduction of 18.5% (an annual saving of 150,000 €). After 10 years of successfully working with the new system, the business context had changed; likewise, the packaging requirements had changed. Therefore, in a second stage, new changes in packaging were required (an additional annual saving of 60,000 €).

5 Conclusion

The paper presents and justifies a 4-step methodology for developing a packaging rationalization project. There are 3 key factors for success: a wide organizational perspective for defining packaging design requirements; the adoption of a measurement system to compare packaging alternatives; the creation of an improvement culture ("learning organization") that allows the new packaging system updated.

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Lean *vs.* Theory of Constraints in the wider supply chain: Delving into the impact of noise

Puche-Regaliza JC[74], Ponte B[75], Costas J[76], Pino R[77], de la Fuente D[4]

Keywords: Supply Chain Management; Kanban; DBR; Multi-Agent System.

1 Introduction

LM and TOC have largely proven to define efficient strategies for managing production systems (e.g. Watson and Patti, 2008; Puche et al., 2019). There are important similarities between them, with the main divergence emerging from their operational goal: LM aims to increase profits by minimizing waste, while TOC prioritizes the maximization of the throughput (Moore and Schinkopf, 2008).

Nowadays, the design of collaborative strategies for supply chains is gaining ground as a key source of competitive advantages (Simatupang and Sridharan, 2002). Accordingly, an increasing number of organisations is moving the scope of their Lean Management (LM) (Ohno, 1988) and Theory of Constraints (TOC) (Goldratt, 1990) solutions from the production system to the wider supply chain.

2 Objectives

Building on previous works in production systems (e.g. Grünwald et al., 1989; Koh and Bulfin, 2004; Watson and Patti, 2008), we extend the LM *vs.* TOC analysis to the supply chain context. We investigate their robustness against the noise, by expanding the two-level scenario considered by Puche et al. (2019).

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3 Methods

We study a four echelon supply chain with the following noise sources: demand variability, lead time variability, defective products rate, capacity constraints, and production, shipping, and storage costs. We explore the supply chain when it operates according to the Kanban and the Drum-Buffer-Rope (DBR) inventory control systems, respectively from the LM and TOC paradigms. We measure the supply chain net profit through agent-based modelling and simulation techniques. We use ANOVA techniques to analyse the results obtained with both control systems.

4 Results

By considering six increasing levels of compound noise, we observe a negative relationship between the net profit and the severity of the noise for both the LM- and TOC-based supply chains. That is, both lose profit as the noise become more severe. However, the strength of the relationship is more noticeable for the Kanban system; the DBR-based supply chain thus being more robust against noise. Interestingly, we observe that the difference in performance between them, favourable to DBR, grows significantly as the noise becomes more demanding.

5 Conclusion

This study provides clear evidence that the LM *vs.* TOC dilemma in supply chain settings strongly depends on the severity of the noise environment. We observe that TOC is a better option in uncertain and/or dynamic supply chain scenarios, while Kanban offers a similar performance at a lower implementation cost in foreseeable and/or static ones. Further studies are necessary to investigate in detail the relationship between noise and net profit. Ungrouping the noise compounds into their individual components may be a research avenue worth pursuing.

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Supply chain procurement and production network design

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Keywords: Procurement and production network design; supply chain design; product characteristics; Sourcing; Outsourcing

1 Introduction

The design of the SC is a complex problem that requires suitable methodologies and tools, as have pointed out several authors (for instance, Corominas et al., 2015, Chandra and Grabis, 2016 and Calleja et al. 2017). However, papers proposing operative methodological guidelines for designing supply chains are scarce.

In the framework of the supply chain, procurement and production must necessarily be considered together, because for each element that constitutes the final product and for the operations needed to assembly, in the broadest sense, those elements, generally exists the possibility of choosing between making or buying them.

Some insightful ideas concerning the relation between the characteristics of the product and those of the supply chain can help to approach the design of the later and particularly the part of the supply chain devoted to procurement and production. As it is known, the first paper that proposed this approach is Fisher (1997), in which the author introduces the distinction between efficient and responsive supply chains, required, respectively, by functional and innovative products. In a similar vein, other authors oppose agile and lean supply chains. A different idea is to consider the architecture of the product (integrated vs modular) and relate it to the degree of centralization of the supply chain, which, in short, refers to the proportion between what is done and what is bought.

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These ideas have to be had in mind when designing a supply chain, but they are not enough to guide with sufficient detail the whole design process, as the decisions do not need to be the same for all the components or modules of the product. Moreover, there is not unanimity concerning what characterises innovative and functional products (Calleja et al., 2017).

On the other hand, although there is a vast literature on the advantages and inconveniences of making or buying (see, for instance, Holweg et al. 2011 or Dolgui and Proth, 2013), it lacks generally from the adequate detail in the definition of the available options, since both make and buy are rather generic options, including a variety of significantly different more specific options (single sourcing, parallel sourcing, dual sourcing, multiple sourcing, etc.). Certainly, there are papers in which some of these options are defined and analysed, but in our opinion, based on the literature review and analyses, most classifications of the options corresponding to buy are neither clear nor complete because they mix two, or even three, dimensions (namely, the number of suppliers, the modalities of the relationship with them, and home country versus offshore outsourcing) in a single one. Even the make option is not that simple, because includes, at least, the possibilities of buying an adequate supplier or off shoring.

2 Objectives

The objective of this research is to propose a framework to help decision-makers to choose some procurement and production options and discard others, according to the relevant criteria, which are included in the framework, the characteristics of the product and its components and possibly the markets. We also propose a three-dimensional classification of the available options for making and buying the components of a product. In some sense, our approach is similar to those of Chopra (2003) and Ribas et al. (2018) for the design of the distribution network.

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Development of a methodology for the management of risk in a supply chain. Application to the pharmaceutical sector

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Abstract Most of the current supply chains have been designed to respond the clients' and customers' requests. Nevertheless, they are not designed to face situations of risk, which is an important aspect to be taken into account nowadays given the complexity of the chain management. We propose a methodology to re-design a supply chain including some decisions to consider risks. Later, it is shown how its first steps can be applied to a case study of distribution in the pharmaceutical sector.

Keywords: supply chain management, design, risk, methodology.

1 Introduction

The supply chain management (SCM) encompasses the planning and management of all activities involved in the supply and acquisition, conversion and distribution, and if necessary, reverse logistics (Chopra and Meindl, 2016). Global supply chains are affected by different events, according to the physical area they operate. This can be conceptualized in form of risks. Their management is studied under the known SCRM, Supply Chain Risk Management (Tang and Musa, 2011). Simultaneously, the important changes in society and business have brought a higher uncertainty in markets, more customer expectations, greater

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global competition, longer supply chains, greater variety of products and shorter lifecycles. Many years ago, Kaplan and Garrick (1981) formulated some questions that the executives had on this field: What can go wrong? What are the risks? What are the consequences? The case study is framed in the pharmaceutical sector.

2 Methodology for Supply Chain Risk Management

Many methodologies for supply chain design cannot address all types of chain. Moreover, they do not make differences between a design and a redesign and this brings differences from a methodological focus, which have not been addressed (Klibi et al, 2010; Corominas et al, 2015; Chandra and Grabis, 2016). We propose a methodology for supply chains which are running:

1. Definition of the object of the SC, an environment analysis and the formulation of objectives.
2. Definition of the existing SC, as a priori design. This will be done at several levels (the macro, the meso and the micro).
3. Definition and/or evaluation of the model of SCM and the strategic coherence of the SC (reality versus objectives).
4. Study of the customers and the possible scenarios of demand. An analysis on demand risks will permit to evaluate possible scenarios.
5. Identification and evaluation of risks in the supply chain, by determining current and latent threats.
6. Analysis of the redesigned chain, final state, using optimization if possible (multicriteria context and looking for an improvement in the degrees of vulnerability and resilience against possible disruptive events).
7. Evaluation of the accomplishment of objectives. If the requirements and objectives fixed step 1 are not satisfied, go back to step 5 or step 1.

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The daily odyssey of the delivery workers in pedestrianized zones

Gómez-Sánchez JC[82], de la Fuente-Aragón MV[1], Ros-McDonnell L[1]

Keywords: urban freight distribution, logistics flows, sustainable transport, distribution area, city centre.

1 Introduction

In Urban Logistics, the loading and unloading activities, together with the limited spaces for parking and the increasing number of people visiting the centre, prompted a lot of conflicts between them (Taniguchi & Thomson, 2014). Nevertheless, the delivery of goods has experienced a boom due to the growth of the trade sector in urban centres, especially due to the increasing electronic commerce (Russo et al., 2008; Herrera, 2016). The centre of Cartagena, requires that the distribution should be according to the level of demand. However, the pedestrianization of the city centre has led to the appearance of numerous problems that not only affect the users of this area, but also for transporters (Browne et al, 2008; Bugno et al, 2008).

2 Objectives

The purpose of this research is to propose new areas in order to minimize the costs for logistics companies, according to Aiura & Taniguchi (2005). The research team proposed the following hypotheses:

1. The loading and unloading areas are well located.
2. The loading and unloading areas have an adequate size to the required service.
3. The loading and unloading areas can not be used for other purposes because they are occupied all the time.

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3 Methods

A work plan has been proposed applying the methodology of Taniguchi et al. (1999). Considering the current loading and unloading areas, the urban centre has been divided into two measurement zones, one includes the pedestrianized streets (inner zone) and the other one includes points with relevant logistic activities (external zone). Between both zones, a total of 28 measuring points have been established by the research group.

4 Results

We can determine that the city is characterized by having poor accesses to the urban centre. After delimiting two different areas under study, the work team has suggested a set of alternatives: a huge modification of the legal regulations; the implementation of car technology for delivering, and a proposal of complementary loading and unloading zones. According to the obtained results, small vehicles require a lesser amount of time for staying in loading and unloading zones. In order to improve the rotation, new areas have been proposed due to the urban centre needs 500 m at least.

5 Conclusion

The logistics of Cartagena is influenced by the policies implemented by the local administration and the initiatives of the private sector, which have a negative impact on freight transport. The loading and unloading operations, the scarce spaces available for parking, together with the huge number of people who use these areas in the city centre, give rise to a continuous appearance of conflicts between them. This paper shows the results on urban distribution flows in the centre of Cartagena, due to the large number of pedestrian areas and the existing services located in them. The data analysis have allowed to define the behavior model of the loading and unloading areas, in order to solve daily conflicts in the city centre.

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DDMRP - The need to standardise an implementation process

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Keywords: DDMRP; standard; process standardisation

1 Introduction

Traditional production planning and control systems, lack the functionality to respond to new scenarios. The traditional MRP push approach poses several shortcomings in environments with changing or unpredictable demands; meanwhile, tools based on the pull philosophy, such as JIT and TOC, also face inadequacies in implementing a demand-driven strategy due to their limited set of planning and inventory control tools (Ptak & Smith, 2016). To respond to this problem, Ptak and Smith (2016) introduced a new methodology known as DDMRP.

On the other hand, a standard process provides multiple benefits for organisations. For example, Fomin and Lyytinen (2000) offer a successful case study based on a standardised process, providing a list of advantages to standardisation for companies and clients.

2 Objectives

The current paper seeks to provide a systematic review of the literature in order to discover possible lines of future research that will make the DDMRP implementation process more standard and systematic, thus ensuring that the potential of the methodology is fully achieved.

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3 Methods

For the development of this research, a systematic review has been carried out following the steps proposed by Becheikh, Landry and Amara (2006).

4 Results

Of the eleven documents selected, two of them sought to demonstrate the need for new production controls and planning systems meeting the needs of today's changing paradigm. Four of the articles speak to the quantitative benefits of the DDMRP methodology with respect to traditional models. Another two of the studies analyse the changes implemented and the qualitative and quantitative results obtained in several companies following conversion of traditional or classical models to the DDMRP model. An additional two articles, introduce mathematical models to define the positioning of the inventory depending on the specific cases of different organisations. The final article analysed, describes the evolution of the DDMRP model towards the demand-driven adaptive enterprise (DDAE)

5 Conclusion

The DDMRP methodology represents a great advance in production planning and control systems capable of responding to the needs of the new paradigm. Though it offers multiple benefits for organisations, the steps remain unclear when it comes to implementing this promising methodology.

After carrying out the bibliographic review, we have found no evidence of a standardised implementation process for DDMRP that could maximise its potential. Along with this review, we analysed the DDMRP implementations carried out by a team of Mondragon Unibertsitatea researchers. In all of these cases, positive results were obtained in terms of increasing the visibility and flow of materials. However, significant differences existed in implementing the methodology.

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Environmental Performance of an e-waste Recycling Program in Colombia: An Agent-Based Simulation Approach

Velásquez-Rodríguez OF[84], Moreno-Mantilla CE, Bula G

Keywords: Environmental performance, agent-based model, e-waste, reverse logistics.

1 Introduction

Reverse logistics has been frequently studied in the context of the implementation of e-waste collection and recycling programs intended to mitigate the environmental impact of electric and electronic equipment. However, given the importance of customers' willingness to participate for success of this type of programs, this has been a neglected aspect in the extant literature. For this reason, the present work develops and tests an agent based simulation model that empirically explores consumers' behavior and allows measuring the environmental performance of a refrigerator post-consumption waste management program in Colombia.

2 Objectives

The objective of this paper is to analyze how the behavior of final consumers, related to the decision of what to do with their electrical and electronic equipment at the end of its useful life, impacts the environmental performance of recycling programs for this kind of products.

3 Methods

In order to achieve the above objective, a simulation agent based model is proposed. Simulation combines the clarity and generality of mathematical models with more realistic models and statistical analysis (Größler and Schieritz, 2005).

This model is grounded on "Red Verde" post-consumer refrigerator management program in Colombia. The characterization of the agents in our model and the relationships among agents were made based on a case study of the reverse logistics system of Red Verde (Rojas Chaparro, 2018) and in a web survey applied to

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375 households in Bogotá, Colombia, to study the intention to either return an end-of-life refrigerator to the Red Verde program.

4 Results

The results of the model show that for the final consumers the strategies of return the refrigerators to "Red Verde" and delivering them to the informal recyclers have the same convenience from the environmental point of view. Additionally, it can be observed that the option to return the refrigerators to the post-consumption management program has initially better environ-mental performance in comparison to delivery to informal recyclers. This is mainly due to CO_2 emissions avoided by carrying out an adequate treatment of the dangerous substances. However, due to the adoption of isobutene technology the performance of these two strategies (i.e., return to Red Verde and deliver to informal recyclers) tend to converge. Finally, it was shown that life extension strategies such as reuse have a negative environmental impact due to the CO_2 emissions generated due to the loss of energy efficiency.

5 Conclusion

Based on the results of the model, a contagious effect of environmental concern can be established, which is reflected in the growth of the percentage of refrigerators delivered to Red Verde over time. However, the returned refrigerators do not exceed 31% of the total. This suggests that it is necessary to introduce mechanisms for achieving effective sustainability communication and incentive behavior change (O'Rourke, 2014), such as sharing information (Olorunniwo and Li, 2010) or using ICTs (Jayaraman, Ross and Agarwal, 2008) and thus promote the delivery of refrigerators to Red Verde. Additionally, we see the need to extend the agent-based model for the inclusion of logistics costs, with emphasis in the evaluation of possible trade-offs between environmental and economic performance.

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Dependency perspective in Supply Chain Risk Assessment

Díaz-Curbelo A[85], Gento A[86]

Keywords: supply chain; risk assessment; dependency; quantitative methods

1 Introduction

Risk management is one of the main research topics in the literature on Operations Management and Supply Chain Management (SCM) (Fahimnia, et al., 2015). The interdependence of SC elements and events requires that risk systems must be assessed as an interrelated framework to optimise their management and integrate with other decision-making systems (Qazi et al., 2018). According to Aqlan and Mustafa (2014) a risk event can be caused by a set of risk factors (interconnected or not) and can lead to different impacts throughout the supply network. Reliably management must therefore consider the risks in event form so they can be modelled, analysed, mitigated and monitored. In addition, due to the highly subjective nature and the lack of information, it is often difficult to quantify risk parameters. So, it is necessary capturing the interdependencies between risk events associated with the epistemic uncertainty. We have therefore addressed the following research question: How can the relationships between risk events be treated to quantify the risk level to manage mitigation strategies effectively in uncertain supply chain environment?

2 Objectives

To develop a systematic literature review in the period 2008-2018 of the main supply chain risk assessment methods considering dependency as key perspective.

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3 Methods

A systematic literature review methodology adapted from Barbosa Póvoa et al., 2018 has been used to the study. The time period of the analysis was 2008-2018. The analysis focused on papers that explicitly model and assess risk in SC with emphasis on dependency analysis. We focused on those published in high impact academic and professional journals (SCOPUS and WOS), mostly in the areas of Operations Research and SCM. At the end, 77 papers were obtained as basis for the analysis.

4 Results

The main qualitative/quantitative, simple/integrated methods focusing on dependency perspective in SCRM were identified. We analyzed the main strengths and weaknesses of these methods. Bayesian networks and Petri nets provide useful frameworks for capturing probabilistic interdependence with common causes and solve many limitations of other dependency tools. Furthermore, there is an increasing trend in the use of integrated approaches. The 46.8% of the papers used integrated methods. In this sense, integrated approaches with Artificial Intelligence tools (47.2%) show interesting trends. From this techniques group, fuzzy sets (82.4%) play a relevant role in obtaining more effective risk assessments in environments under uncertainty.

5 Conclusion

The analysis of common cause failures and the joint impact of risk events can contribute to the optimization of risk mitigation strategies. Bayesian and Petri nets combined with fuzzy theory are considered robust approaches to represent and express the risk level more reliably. Interdependencies and uncertainties are relevant issues to effective risk management, therefore integrated methods will continue to play a vital role to support SCRM and decision-making.

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Chapter 3

PRODUCTION PLANNING & CONTROL

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Discrete EOQ and POQ

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Abstract This paper examines the EOQ and POQ determination in the discrete domain. Main contributions are a simple and exact round off rule that can be applied to EOQ and POQ, a simplified version for the power of two approach and a novel determination of the upper bound of the cost increase involved in this approach.

Keywords: EOQ; POQ; discrete order size; rounding rule

1 Introduction

The economic order quantity (EOQ) proposed by (Ford W. Harris, 1913) is probably one of the most influential concept in the modern operations management. EOQ is a very important concept in inventory management and can be found in almost every modern text-book, e.g. (Axsäter, 2006), (Silver, Pyke and Peterson, 1998) and (Nahmias and Olsen, 2015). The aim of the original paper is well known: determining how many units have to be ordered to achieve the minimum inventory cost. Main assumptions include considering constant demand and a complete knowledge of every relevant cost being also constant all of them; but it is also necessary to accept that the order quantity can be represented by real number, probably a reasonable decision for the examples originally presented by Harris involving thousands of units.

A number of different models have appeared in the literature considering different assumptions and techniques. However, the question of rounding up or

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rounding down EOQ emerges in practice but literature has paid little attention to this topic. For example, (Silver, Pyke and Peterson, 1998) recommend simply rounding to the nearest integer but frequently it is not possible when available options are determined by the units in a cartoon or in a pallet.

EOQ can be also expressed as a time supply, that is, the period of time whose demand will be satisfied also known as periodic order quantity (POQ). This concept is the basis of a well known heuristic in inventory and production management, and share the same rounding problem that EOQ. (Muckstadt and Sapra, 2010) present a discrete approach based on power of two time supplies.

This paper focuses on a discrete quantity EOQ model and its aim is to provide a general rounding rule that can be applied to both order quantity and time supply.

2 Conclusions

This paper focuses on the discrete EOQ determination while minimizing inventory costs. This function is convex and it has been derived a convenient expression to compute de cost difference between any two order quantities. As a result, the discrete EOQ can be obtained just rounding off the continuous EOQ using the geometric mean of the limits.

Previous results have been extended to the discrete POQ determination so that the geometric mean rounding rule also applies. Additionally, this derivation has been applied to the power of two approach providing a novel derivation of the upper bound of the cost increase involved in the power of two approach.

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Productividad limitada por el riesgo ergonómico en líneas de montaje de modelos mixtos

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Keywords: Line balancing; Ergonomic risk; Mixed-Integer Linear Programming

1 Introducción

Los MALBP (Mixed Asembly Line Balancing Problems) buscan asignar las tareas necesarias para la obtención de los diferentes modelos de producto en un conjunto de estaciones, de forma que se obtenga una configuración de línea eficiente y rentable, que cumpla las restricciones productivas que existan.

Si bien los MALBP pueden ser considerados dentro de la categoría de problemas GALP (Generalized Assembly Line Balancing Problems), éstos pueden ser tratados como SALBP (Simple Assembly Line Balancing Problems) según el enfoque de resolución que se utilice [1]. Un ejemplo del enfoque de resolución de los MALP como problemas SALPB son los problemas TSALBP_erg (Time and Space Assembly Line Balancing) [2] donde se considera el tiempo promedio de las tareas. Además, este tipo de problemas no sólo considera las restricciones productivas impuestas por el grafo de precedencia de las tareas, sino también las limitaciones impuestas por el espacio máximo disponible para la línea, o las estaciones de trabajo, y el riesgo ergonómico al que están sometidos los operarios de la línea -entendiendo como tal el conjunto de cargas posturales, movimientos repetitivos y las manipulaciones manuales de cargas que implican las tareas asignadas.

Este acercamiento de los problemas de la literatura a situaciones reales por medio de la consideración de atributos relacionados con los recursos humanos y la calidad laboral [4][5], conlleva obviamente beneficios tanto para la empresa como para los trabajadores. Sin embargo, el cumplimiento de los requisitos ergonómicos podría incurrir en aspectos negativos, como son el incremento de coste por requerir más estaciones de trabajo o la pérdida de productividad.

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2 Maximizando la producción limitando el riesgo

Siguiendo el esquema presentado en [3], se presentan tres modelos de equilibrado con el fin de maximizar la productividad de la línea respetando, al mismo tiempo, no sólo las restricciones de precedencia de las tareas, sino también, las limitaciones del espacio disponible para cada estación de trabajo y la categoría de riesgo ergonómico máximo admisible para la línea. En concreto se evalúan tres criterios de optimización vinculados con la tasa de producción o tiempo de ciclo, *c*. Estos criterios son: (a) Minimización del tiempo de trabajo asignado a la estación con mayor carga, lo que equivale a la minimización del tiempo de ciclo de la línea; (b) Minimización del rango del tiempo de trabajo asignado al conjunto de estaciones de trabajo; (c) Minimización de la desviación media del tiempo de trabajo asignado a las estaciones con respecto al tiempo de ciclo ideal, definido como la suma de los tiempos de proceso de las tareas entre el número de estaciones de la línea.

A diferencia de otros trabajos previos, en esta ocasión se limita la categoría de riesgo de la línea, de acuerdo con la clasificación propuesta por [2], que permite categorizar de forma única el nivel ergonómico de un conjunto de tareas.

3 Impacto de la ergonomía sobre la productividad

A través de un caso de estudio de la planta de motores de Nissan en Barcelona se evalúan los modelos, utilizando la Programación Lineal Entera-Mixta (MILP).

Las métricas utilizadas para su evaluación son: el tiempo de ciclo de la línea, el rango del tiempo de trabajo asignado al conjunto de estaciones, la desviación absoluta media del tiempo de trabajo de las estaciones y la productividad de la línea.

Los tres modelos se muestran competitivos en términos computacionales, alcanzando más de un 70% de soluciones óptimas, con un tiempo límite de CPU de 1000 *s*. Sin embargo, en términos de calidad de las soluciones, los modelos con los criterios de optimización (a) y (b) se muestran más competitivos.

Los resultados evidencian la pérdida de productividad y el aumento de los costes operativos de la línea a medida que aumentan las exigencias ergonómicas.

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Redesigning the picking process in e-grocery. A case in a store-based retailer

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Keywords: E-commerce, e-grocery, store-based picking, action research

1 Introducción

Para los supermercados tradicionales, la aparición del comercio electrónico ha supuesto un enorme reto desde el punto de vista logístico. La venta online ha obligado a los supermercados a desempeñar tareas que antes realizaban los clientes, como es el caso de la preparación de pedidos (*picking*). Para ello, la opción más común entre los supermercados ha sido la preparación y envío desde la propia tienda, minimizando la inversión inicial a costa de unos costes variables mayores en el *picking* (Hübner et al., 2016). Sin embargo, la literatura enfocada a la mejora de este proceso tan relevante en el *e-grocery* es casi inexistente (Fikar, 2018).

2 Objetivos

Por esta razón, nuestro estudio se centra en la mejora del proceso de *picking* en un importante supermercado español que realiza la preparación de pedidos online desde tienda. A través del análisis de distintas tiendas preparadoras y la selección de buenas prácticas, se propone y evalúa un nuevo estándar de trabajo.

3 Metodología

Dado el carácter práctico del estudio, la metodología empleada es *action research*. Así, el papel de los investigadores consiste en diseñar la metodología de estudio, así como analizar el proceso de preparación y desarrollar e implementar las mejoras planteadas. La empresa objeto de estudio tiene una red de 50 tiendas preparadoras de pedidos online, de las que se eligieron 8 para el análisis de procesos, tratando de seleccionar un grupo heterogéneo. Para ello, se ha tenido en cuenta su dispersión geográfica, su nivel de carga de trabajo, la estacionalidad y su gama de productos. Posteriormente, se llevó a cabo un análisis de métodos y

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tiempos del proceso de *picking* en cada una de esas tiendas. Hecho esto, se seleccionaron las mejores prácticas observadas por los investigadores y corroboradas por los datos de tiempo recopilados. Con ellas, se definió un estándar de trabajo, que se implantó en una de las tiendas (escogida como piloto) y se analizó la mejora lograda.

4 Resultados

Entre las 8 tiendas preparadoras, se encontraron importantes diferencias en los tiempos de *picking* cuando estos se desglosaron en: tiempo de preparación de productos de seco, secciones (carnicería, pescadería...), empaquetado y gestiones administrativas. En general, las tiendas de mayor superficie penalizaban los tiempos de preparación de seco (se realizaban recorriendo las estanterías del supermercado). Por otro lado, las tiendas con menor volumen de venta online, en general, presentaban tiempos de preparación más altos.

En la elaboración del estándar de trabajo, se incorporaron buenas prácticas en 5 ámbitos: gestión de faltas, recopilación de productos voluminosos, modificación de la jornada laboral para ajustarse a la demanda online, codificación física de los pedidos para reducir las incidencias en el transporte y el uso de pinganillos con el fin de mantener contacto telefónico con los clientes simultáneamente. La mayoría de estas mejoras partieron de las tiendas preparados con más volumen, las cuales, como ya se comentó, tendían a optimizar más sus procesos por propia necesidad.

Tras la implantación de dicho estándar en la tienda piloto, la reducción del tiempo medio de preparación superó el 12%. Además, respecto al tiempo promedio por número de ítems, uno de los indicadores usados y que tiene en cuenta el tamaño de la cesta de los pedidos online, la reducción alcanzó un valor del 17%.

5 Conclusiones

Este estudio muestra cómo, en una gran cadena de supermercados nacional con un modelo preparación online basado en tienda, se pudo llevar a cabo mejoras de gran importancia en su proceso de *picking*. En parte, esto es entendible ya que la venta física sigue siendo el principal foco de las grandes superficies, y las interferencias entre ambos canales hacen que los modelos de preparación en tienda no optimicen los procesos de venta online, tratándose como una venta marginal. A futuro, la investigación debería centrarse en determinar la utilidad y rentabilidad de este modelo, así como desglosar más detalladamente los costes de la preparación, para así poder compararse con la preparación en almacenes dedicados.

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An improved mathematical model for a two-agent scheduling problem in a two-machine flow shop

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Keywords: Two-agent scheduling; Two-machine flow shop; MIP model;

1 Introduction

The management problems in which multiple agents compete on the usage of a common processing resource are receiving increasing attention in different appliction environments and different methodological fields, such as artificial intelligence, decision theory, operations research, etc (Agnetis et al., 2004). One major stream of research in this context is multi-agent scheduling problems that have been an active area of research for the past three decade. In this problem, each agent has a certain objective function that independent of the other agents' objective.

In this paper a two-agent constrained optimization scheduling problem in a two machine flow shop is considered.

2 Objectives

Both total tardiness and total number of tardy job performance measures have a significant impact on a schedule's cost and agent's responsiveness. Also, in many applications in both industrial and planning areas, each job must undergo two or more basic processes in the same order implying that the jobs have to follow the same route. This environment is referred to as a flowshop. Motivated by these, the objective is to minimize the total tardiness of the first agent with the restriction that the number of tardy jobs of the second agent is zero**.**

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3 Methods

This problem has been shown to be NP-hard in the strong sense an so in literature a branch and bound algorithm has been proposed to find exact solutions(Lee et al., 2010). However, the proposed algorithm couldn't efficiently solve problem instances with more than 12 jobs in size. Since this problem is NP-hard in the strong scene, solving it to optimality in a reasonable amount of time is difficult. To this end, in this study, a mixed integer mathematical programming (MIP) model developed to tackle the problem. Afterward, by using literature optimal solution properties, a set of valid inequalities created for the problem to strengthen the formulation and value of some decision variables fixed to accelerate the search process of the MIP model.

4 Results

We use the data-set available in the literature. Results show that the proposed model produces optimal solution in effective manner and reasonable time.

5 Conclusion

In this paper, the two-agent scheduling problem on the two machine flow shop was considered. The objective is to minimize the total tardiness of the first agent with the restriction that the number of tardy jobs of the second agent is zero. For this problem, the MIP model incorporating with several optimal solution properties to search for the optimal solution was developed. Results show that proposed model produces optimal solution in effective manner and reasonable time. Computational results indicated that the proposed MIP model outperforms the literature branch and bound algorithm and can solve the instances of 40 jobs in a reasonable amount of time.

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A matheuristic approach for sourcing, production, and delivery plans optimization

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Keywords: Matheuristic, Mixed Integer Linear Programming, Genetic Algorithm.

1 Introduction

Currently attention is being paid to hybridization or integration of metaheuristics with exact methods, this combination is called "*Matheuristic*" the importance of the hybridization is due that many problems of real-world optimization are very difficult to solve, the fact is that most of these problems are NP-hard (Raidl *et al.*, 2008), therefore its resolution is generating great importance in the industry. Nowadays, increasingly cooperation schemes matheuristics are proposed, since these techniques they are able to exploit simultaneously the advantages of both types of methods. In this context the present research analyses the incorporation of matheuristic approaches, that focuses on hybrid procedures that combine metaheuristics with exact algorithms used of the operations research field.

2 Methods

There are different approaches for combining metaheuristic with exact methods, each technique has their individual advantages and disadvantages, but the aim is to benefit from synergy, several researchers expose a classification and taxonomy of this type of cooperation, such as: Cooperation between exact and local search methods, (Jourdan *et al.*, 2009) proposed by (Dumitrescu *et al.*, 2003), Combination between exact techniques and metaheuristic algorithms (Puchinger *et al.*, 2005; Raidl *et al.*, 2008), "MASTER-SLAVE" structure of a guiding process and an application process. (Caserta *et al.*, 2010).

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3 Results

First stage we propose a solution approach based on a simplification of the problem, using a relaxed MILP to accelerate the search procedure, omitting integrality constraints or selecting an appropriate relaxation technique such as Lagrangian relaxation or Benders de-composition, starting with partial feasible solutions, and using a genetic algorithm for the definition of the binary variables. In the second stage, once finished the genetic algorithm phase, the binary variables result is entered in the MILP model. Then, the model is solved using a branch and bound technique for calculation the integer variables.

4 Conclusion

The aim of this work is to examine how the matheuristic approaches propose to find effectively and efficiently solutions to optimization problems, within acceptable solving time, combining the flexibility of metaheuristics with the efficiency of the exact models (MILP). The proposed approach will be implemented in the source, make and deliver plans developed in C2NET project and intensively evaluated for comparing the matheuristic approach whit the exact algorithms.

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LONJA3D: Additive Manufacturing, Scheduling and Genetic Algorithms

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Keywords: Scheduling; Genetic Algorithm; Packing Problem

1 Introduction

This work presents preliminary results of an ongoing study. A theoretical framework of Additive Manufacturing (AM) and Genetic Algorithm (GA) has been done, in order to shed light on the challenging that 3D printing industry must face. It has been carried out because the authors are currently working in the design of a managed market called “Lonja3D”. It should be used to purchase products made using 3D printing. In this market, the coordination and organization of offers will be eased between the customers that will receive the bids from the providers of 3D printing services. This "Lonja3D" or market will allow customers to obtain better prices from the manufacturers. In addition to this, the manufacturers are able to optimize their installed production capacity and they are able to decrease operating costs in each case according to the technology.

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2 Objectives

To study the scheduling, the packing problem and genetic algorithms in AM.

To present a GA to approach the packing problem for 3D printing, which it will be applied to a managed market, “Lonja3D”.

3 Methods

Most of the packing problems found in the specialist literature are two dimensional. According to the items to be placed, two main groups can be distinguished, those which present regular or irregular shapes. It must be optimized the production capacity and the reduction of operating costs, establishing a production rate with the least empty space on the build platform. A first approach can be done through a layout space which the size could be determined i.e., rectangle packing problem.

4 Results

A GA is implemented according to the requirements established by the authors to derive suitable outcomes for "Lonja 3D".

5 Conclusion

A GA has been presented to establish the adequate stage for setting up “LONJA 3D”. The work provides suitable information for 3D printing industry scheduling.

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Estudios de revisión en el área de lotificación

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Keywords: lotificación; *EOQ;* revisión; *SLR;* estudio terciario

1 Introducción

Las revisiones de la literatura son una componente fundamental del método científico (Velásquez Henao, 2015). En una revisión de literatura se procede a revisar la literatura perteneciente a una temática, identificando y analizando la investigación existente. Los objetivos de la revisión son principalmente: clarificar el estado del arte, establecer el marco de nuevas actividades de investigación, identificar tendencias, identificar áreas o sub-áreas no abordadas (Kitchenham, 2004) e identificar barreras o facilitadores en el desarrollo o implantación de algún enfoque o método. Sin embargo, no todas las revisiones son realizadas del mismo modo, dando lugar a una diversa tipología de revisiones. En la literatura se encuentra diversas clasificaciones sobre esta tipología, desde algunas muy exhaustivas en las que se identifican hasta 14 tipologías (Grant and Booth, 2009) hasta clasificaciones más sencillas que plantean 6 tipologías de acuerdo con 2 criterios (Velásquez Henao, 2015) o 2 tipologías (Gisbert and Bonfill, 2004). Un tipo de revisión muy frecuentemente utilizada en la literatura son las revisiones sistemáticas de literatura, en inglés *SLR (systematic literature review)*. De acuerdo con Kitchenham (2007) se puede definir como un tipo de estudio secundario que utiliza una metodología bien definida para identificar, analizar e interpretar toda la evidencia disponible relacionada con una pregunta de investigación específica de una manera que sea imparcial y (hasta cierto punto) repetible. Las revisiones sistemáticas de literatura están muy establecidas en el área de las ciencias de la salud (*Cochrane Library*, 1992). En el área de la ingeniería del software de manera más reciente también tiene una gran desarrollo (Brereton *et al.*, 2007; Kitchenham and Brereton, 2013). En este contexto los autores se plantean cual es el estado de los trabajos de revisión en el campo de la lotificación dentro del área de la dirección de operaciones.

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2 Objetivos, Métodos, Resultados y Conclusiones

Las preguntas de investigación que se quiere responder son las siguientes:

P1. ¿Qué tipo de revisiones se hacen en el campo de la lotificación?

P2. ¿Cuáles son los objetivos de las revisiones? ¿Se consiguen tras la revisión?

P3. ¿Cuáles son las tendencias que se observan en la publicación de revisiones?

Para poder responder a las preguntas planteadas se realiza una revisión sistemática de las revisiones de la literatura sobre el tema de lotificación publicadas recientemente (estudio terciario). Como toda *SLR* requiere de un protocolo de búsqueda de trabajos establecido previamente. En primer lugar es necesario identificar como se va a establecer el tema de la búsqueda pues el área de la lotificación es muy extenso. Se empleará un criterio similar al empleado en el trabajo de Glock, Grosse and Ries (2014) respecto a las palabras a incluir en la búsqueda. Los críterios de inclusión y/o exclusion serán tales que permitan acotar los resultados de la búsqueda, incluyendo solo aquellos trabajos que consideren el problema de lotificación original, es decir, aquellos modelos cuyo objetivo es optimizar la relación entre los costes de almacenamiento y los costes de cambio de partida. En el rango temporal se establece la siguiente franja: 2013 hasta 28/02/2019. Establecer como inicio 2013 parece razonable pues permite acotar los trabajos más recientes y continua los estudios terciarios existentes. Tras el filtrado de artículos por título y abstract, se analizarán los trabajos completos dando respuesta a las preguntas de investigación señaladas.

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How to identify and exploit the bottleneck in Make-to-order industries. A cross case study.

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Keywords: Drum–Buffer–Rope; Theory of Constraints; strategic decision.

1 Introduction

Make-to-order (MTO) companies are increasingly sensitized with concepts from other types of industry, such as flexibility, quality and the ability to adapt to consumer demand, due to the fact that customers demand more variety and more reliable products, as well as shorter delivery times. Two types of manufacturing scenarios exist in MTO environments: repeat business customizers (RBC) and versatile manufacturing companies (VMC), although complexity within each category is not uniform. An RBC provides customized products on a continuous basis over the length of a contract. Goods are customized but may be made more than once permitting a small degree of predictability.

Production planning and control systems (PPCS) are crucial tools for meeting increasingly high customer demands and expectations in MTO scenarios. Choosing the right PPCS is a crucial, strategic decision. Anyhow, the literature on suitability of PPCS for MTO environment is scarce and there have been only empirical studies based on simulation. TOC-DBR seems to be a suitable PPCS but there are scarce empirical evidences on its application in MTO environment.

2 Objectives

The objective of this research has been to assess the impact that the systematic process of four steps that the researchers developed (Lizarralde, Apaolaza, & Mediavilla, 2019) and tested empirically in different MTO scenarios.

This process was derived from the seminal work from Goldratt, and included some key aspects from the resource-based view (RBV) and practice-based view (PBV) strategy theories.

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3 Methods

This work includes four different cases studies in MTO environment in which the researchers have been an active part of the study. Therefore, the practical nature of the case studies made Action Research (AR) to be an appropriate methodological approach, since it aims to contribute to academic research while helping solve practical problems that occur in reality.

4 Cross case study results

The cross-case study has been carried out in four MTO oriented companies located in the Basque Country (Spain), where the researchers applied their systematic process. Given the repetitive nature of the work in the RBC companies, the workload was much more stable than in the VMC companies. The wide diversity of products in VMC companies made difficult to determine the workload and capacity, since process times were difficult to estimate accurately. Also, in RBC companies there was no clear difference among added-value operation between various route operations, while in both VMC cases the added-value of one section was much larger and the investment required to elevate the capacity was very high in comparison with other activities.

5 Conclusion

The literature recognises that MTO environments are complex and difficult to manage in practice but the existing literature regarding the usage of PPCS in these contexts is scarce and focused on make-to-stock environments.

Our empirical work in the industry is valuable to provide insights from the practice and embrace the complexity of PPCS implementation. For that purpose the researchers have presented a multi-case analysis of the implementation of a four-step-process for the bottleneck selection and exploitation. Specifically, the implementation of the four-step-process in the case companies led to similar results (especially in step1), but the rest of these steps have shown significant differences in RBC and VMC scenarios. Specifically in RBC scenario, the selection of the bottleneck is a relatively simple decision, it is necessary to choose between various similar resources and the main repercussion is to properly exploit the system. On the other hand, in VMC scenarios, the selection of the bottleneck has more strategic implications, and it is an important company decision. Based on the results, seems that the RBV theory could fit better in the RBC scenarios, while PBV theory may explain more adequately the competitive advantages in VMC scenarios. Anyhow this insight should be further tested by more cases.

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Un algoritmo de búsqueda voraz iterativa para el problema de programación de producción de bucle cerrado en una planta de pintura del automóvil

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Keywords: Programación de producción; Búsqueda voraz iterativa; Cambios dependientes de la secuencia; Metaheurísticas

1 Introducción

En este artículo, se propone usar un algoritmo de tipo constructivo voraz iterativo para resolver un problema de secuenciación en una instalación de pintura basada en un carrusel o cinta transportadora de bucle cerrado.

2 Objectivos

Desde la primera comunicación (Garcia-Sabater et al., 2007) sobre la secuenciación de producción de retrovisores en bucle cerrado con costes de cambios duales, no son muy numerosas las publicaciones sobre esta temática. En este primer trabajo se presentó la problemática industrial y se ofrecía un procedimiento de resolución. A continuación, en (Garcia-Sabater et al., 2008) se planteó un modelo de programación matemática para resolver este problema donde la función objetivo consistía en minimizar los costes totales de cambios de partida.
A continuación, Ganguly y Laguna (2015) plantearon dos enfoques de resolución del mismo problema. El primer enfoque consistió en utilizar el software OptQuest con Búsqueda Tabú y el segundo se basó en una metaheurística de tipo VNS o Búsqueda en Entorno Variable. En este artículo, se presenta y aplica al citado

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problema, un algoritmo de Búsqueda Voraz Iterativa (IG) que ha demostrado su eficiencia en otros problemas (Ruiz and Stützle, 2007).

3 Métodos

Con el objetivo de demostrar la eficiencia y robustez del algoritmo propuesto, se realizará una comparación entre los resultados obtenidos con Gurobi®, el VNS publicado y el IG usando un gran conjunto de instancias que oscilan entre ejemplares con tamaños reducidos a instancias con tamaños grandes.

4 Resultados

Para instancias muy pequeñas, los métodos exactos de los softwares comerciales se demostrarán que tienden a ser los más rápidos en encontrar soluciones óptimas. Sin embargo, cuando el tamaño tiende a crecer el IG tiende a superar los demás métodos.

5 Conclusiones

La principal conclusión de este artículo es que el algoritmo IG resulta muy eficiente sea cual sea el tamaño de la instancia. Mejorando claramente los resultados de los algoritmos publicados hasta la fecha.

Agradecimientos

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Análisis y Evaluación de la implantación de Proyectos de Business Intelligence en Pymes

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Keywords: Business Intelligence; SME; project management; digitalization; DSS

1 Introducción

Algunas de las mayores empresas del mundo por capitalización bursátil han conseguido esa posición como resultado de su anticipación en la concepción del negocio en una Economía Digital. Otras han aprendido que la Transformación Digital era una urgencia estratégica, e iniciaron hace décadas proyectos de digitalización de sus compañías. Así, en los últimos años, han cobrado especial relevancia los proyectos de Business Intelligence (BI), por su capacidad de influir en los procesos de negocio y en la percepción que los trabajadores tienen sobre la transformación digital (Brooks et al, 2015).

Las PYMES están tardando mucho más en abordar su transformación digital. A las dificultades de acceso a la tecnología (elevadas inversiones y rápida obsolescencia no permitían una justificación en términos de rentabilidad financiera) se han sumado las relativas a las de la capacitación del personal propio y la incorporación de profesionales cualificados de un mercado que vienen copando las grandes empresas.

En este trabajo realizamos un análisis y evaluación de los proyectos de Business Intelligence que ha realizado en varias PYMES una empresa consultora ubicada en Castilla y León. Se estudian proyectos con empresas de diferentes sectores económicos, y se presentan los principals resultados obtenidos y algunas lecciones importantes para aquellas empresas que estén considerando iniciar su Transformación Digital, o que haya tenido malas experiencias en el pasado.

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1 Objetivos

Los objetivos principales de la investigación son:
- caracterizar los proyectos de Business Intelligence en PYMES, y en particular encontrar las similitudes y las diferencias respecto a los casos presentados en la literatura en grandes empresas,
- evaluar los resultados y el impacto que han tenido estos proyectos
- presentar las principales lecciones aprendidas y buenas prácticas para el éxito

3 Métodos

Se han realizado entrevistas semiestructuradas a las personas de las PYMES que participaron en las implantaciones. Se cuenta también con la información de la empresa consultora relativa a cada uno de los proyectos seleccionados. Se han revisado los resultados relativos a casos de implantación en grandes empresas presentados en la literatura para contrastar las principales diferencias y similitudes (Grublješič et al 2015; Sangar et al, 2013).

4 Resultados

Los proyectos de BI en PYMES necesitan una aproximación diferente a la que se aplica en el caso de grandes empresas. La carencia de sistemas transaccionales, almacenes de datos (datawarehouses), y la existencia de multiplicidad de fuentes de datos, habitualmente no integradas y en ocasiones inconsistentes constituye una diferencia fundamental. Para que los proyectos tengan éxito es necesaria una labor de consultoría muy próxima al cliente, y los proyectos conllevan un esfuerzo muy importante en la fase de selección y armonización de datos para su posterior procesado (ETL). Las grandes consultoras de proyectos BI rechazan realizar estas tareas puesto conllevan un importante riesgo.

5 Conclusiones

Los proyectos de BI en PYMES constituyen una importante fuente de ventaja competitiva. La aproximación sin embargo debe ser completamente diferente, y requieren un esfuerzo importante de consultoría de negocio y tecnológica.

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Production Optimization in 3Dprinting manufacturing factories

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Keywords: 3dprinting, manufacturing, optimization, scheduling, costs

1 Introducción

La fabricación aditiva (impresión3D) es una realidad que va creciendo exponencialmente debido a la incorporación de la tecnología en sectores tradicionales como la automoción. Existe un número creciente de fábricas que se especializan en la producción de lotes por impresión3D (López-Paredes et al 2018).
La fabricación aditiva tiene algunas especificidades que permiten realizar una aproximación diferente a la organización de la producción (Chergui et al 2018; Li et al 2017). La optimización de las cámaras de fabricación permite al fabricante combinar los diferentes lotes a producer para conseguir reducer costes, plazos de entrega, y en definitiva, incrementar la eficiencia de la planta (Kucukkoc 2019).
Es necesario por tanto realizar una aproximación diferente al problema de programación de la producción, y el uso de técnicas computacionales puede lograr importantes mejoras de productividad (Fera et al 2018).

2 Objetivos

Los objetivos principales de la investigación son:
- redefinir el problema de programación de la producción en plantas de fabricación aditiva
- presentar una metodología para resolver el problema, mediante el uso de heurísticas en un proceso de optimización en dos etapas
- comparer los resultados con los presentados con otras aproximaciones

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3 Métodos

Se ha recurrido a la simulación para validar las heurísticas propuestas. Mediante un programa realizado en Python se han implementado las dos etapas del proceso de optimización para realizar la programación diaria de las órdenes de fabricación, con el menor coste posible.

4 Resultados

Realizar una redefinición de los lotes de fabricación integrando las piezas compatibles (mismo material y características) permite importantes ahorros en el proceso productivo. Además del ahorro en costes, la empresa gana en flexibilidad, y puede incrementar su capacidad de fabricación.

5 Conclusiones

Las heurísticas empleadas para la optimización de la producción, permiten importantes ahorros en tiempo y coste. La realización de lotes combinando los diferentes pedidos del mismo o diferentes clientes permite optimizar la capacidad productiva de las impresoras 3D.

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Analysis of the impact of Initialization and Local Search in the Performance of the Firefly Algorithm in Solving the Flexible Job-shop Scheduling Problem

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Keywords: Flexible job-shop scheduling, hybrid firefly algorithm, local search.

1 Introduction

In the Flexible Job-shop Scheduling Problem (FJSP) a set of jobs must be performed, and each job consist in a set of operations subjected to precedence constraints that can be processed in any machine out of a set of compatible machines. The aim of the FJSP is to find a sequence of the assigned operations that optimises certain objectives e.g. minimize the completion time, the machines´ workload, etc.

Due to the complexity of the problem (Applegate & Cook, 1991), exact methods may require an impractical amount of time for its resolution, and that is the reason why approximate algorithms (i.e. metaheuristics) are the best alternative for industrial applications, since the can provide near-optima solutions in a reduced amount of time (Blum & Roli, 2003).

2 Objectives and methodology

In this work, we implemented three different versions of a metaheuristic called the Firefly Algorithm (FA) for the resolution of the FJSP. The FA is a swarm intelligence algorithm motivated by the social behaviour of the fireflies and how they attract others using their flashing lights with predation or mating purposes (Yang, 2008).

The key aspect of the FA is the association of the objective function with the fireflies´ light intensity, and the main challenges of its discretization are the movements of the fireflies, the measurement of the distance between them and the codification of the solution.

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The aim of this work was to study how differently the discrete FA performs in solving the FJSP when it is enhanced with an initialization phase and several local search strategies.

3 Results

Three different versions of the FA were implemented: a standard discrete FA, another version integrated with the initialization module and one more version with both the initialization and local search modules. For the comparative study, the three different FA versions were tested in solving six well known FJSP benchmark instances: Mk01 and Mk02 from Brandimarte (1993), MFJS2 and MFJS3 from Fattahi et al. (2007) and the two "middle size" instance from Kacem et al. (2002).

The results of the comparative study show how the most complete FA version, the one enhanced with both the initialization and the local search modules, consistently obtains the best results, reaching in many cases the best-known results of the instances, almost in the same computational time.

5 Conclusion

This paper demonstrates how proper strategies to generate the initial population and local search procedures can enhance the performance of the Firefly Algorithm. We explained and then compared three versions of the algorithm in solving some known FJSP instances. Computational results confirm that the version with initialization and local search modules notably outperforms the other two, reaching in most of the cases the best-known results. Future work will be focussed on expanding this comparative study to more instances and studying further techniques to speed-up the algorithm.

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An EOQ model and pricing for perishable goods when the demand depends on freshness and discount rate

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Keywords: perishable goods; dependent demand; inventory control; pricing; ordering; discount rate.

1 Introduction

In recent times the interest in reducing spoilage, especially of food products, has increased not only because of its economic significance but also because of its social and environmental impact (Adenso-Daz, 2014).
Liu and et al. (2008) reported that more than 81% of America's retail sales in 2009 were related to food and drink, and 63% of them are products with limited shelf life. In other words, 50% of the sales in this industry are perishable products. Many perishable goods like raspberries, fruits, vegetables, donuts, milk, meat, etc. have a few days of shelf life, so their demand decrease to zero as their expiration dates approach and consumers prefer to choose fresh products (Chung & Li, 2013).
Since the demand rate of perishable products is affected by price and freshness, in order to motivate consumers to buy less-fresher products, retailers are using dynamic pricing. Offering units less fresh units at a lower price than fresh units, are an effective method to encourage customers to demand less fresh but cheaper units.
In the research of the combined field of ordering and pricing for the perishable products, only a few models have been developed that are either certainty or random models with known distribution (Wang and Li, 2012).

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2 Objectives

This paper develops an EOQ inventory model for inventoried perishable products such as meat, fruits and cooked foods to maximize the retailer's total profit with considering the following facts: (1) Consumers prefer to buy fresh products that could store in a long time, (2) Pricing strategy is an important competitive tool to encourage consumers to sale less fresh products and increase profits.
This paper proposes a mathematical model the to determine jointly replenishment cycle time and the rate of discounting the selling price to maximize the total profit.

3 Methods

In this study, by considering the fact that customers usually prefer to buy fresh goods like vegetables, fruits, baked goods, bread, milk, meat and seafood, the coefficient of elasticity of demand with freshness is applied the model, and also by applying other factor affecting customer demand, such as the coefficient of demand elasticity of the price, time and the amount of discount is determined such that the objective function is optimized. By proofing that the total profit is strictly pseudo-concave in all decision variables, which the area search to find a unique local maximum reduced. Consequently, an algorithm is proposed to find the optimal decision variables.

5 Conclusion

In this paper, an EOQ inventory model has been developed to achieve the following important relationships and facts:

1) Customer purchasing decisions depend on product's freshness.
2) Pricing strategy is an important competitive tool for increasing sales and profits.
3) The demand for a perishable product decreases as the product expires.

To achieve the above, we present an inventory model in which demand is presented explicitly as a multiple function of price and freshness. In this situation, the policy will be profitable to reduce the price. The objective of proposed model is to determine jointly replenishment cycle time and the rate of discounting the selling price to maximize the total profit. We proved that the total profit in decision variables is strictly pseudo-concave, which reduce the area search to a unique local maximum, and, by presenting the example, we clarify the theoretical results.

Chapter 4

STRATEGY

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European Union Air Navigation Projects: Impact on Airspace Operations Management

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Keywords: Air navigation system; air traffic control; Single European Sky; aviation policy; impact assessment.

1 Introduction

The financial support of the European Union (EU) to air navigation research projects is taking place since 1995 under the umbrella of the 4th, 5th, 6th and 7th Framework Programmes (European Commission, 2010), and Horizon 2020 for research, and via the TEN-T and the Connecting Europe Facilities funds for implementation. The operational performance of the European air navigation system has improved in the last 15 years (European Commission, 2011). However, there has been no success in establishing clear relations between the operational performance of the system and the execution of research, development, innovation and implementation air navigation projects supported by EU funds.

2 Objectives

The objective is to explore new approaches to analyse these relations and to reduce the gap between them, using the information available on the air navigation system from 2000 to 2015 consolidated around three of the four high-level objectives of the Single European Sky (European Commission 2008) that describe the operational performance of the air navigation system (safety, capacity and environmental impact). The relative efficiency of the use of EU funds in the

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improvement of the air navigation system operational performance will be assessed for each of these objectives.

3 Methods

To quantify the operational performance of the system in the period of study, reliable secondary databases are used. These include official documents and reports from EU agencies (EASA, EEA), from international organizations (ICAO) and from intergovernmental organizations (Eurocontrol). The relative efficiencies mentioned result from the use of a standard data envelopment analysis (DEA) (Charnes, et al., 1978) for each of thementioned objectives.

4 Results

Safety performance shows a positive tendency in the period of study, capacity performance shows an improvement only after 2012, and environmental performance do not show any significant change. The relative efficiency of the use of EU funds shows in general a decreasing tendency that goes along with the increase of use of EU funds.

5 Conclusion

The performance results mentioned are strongly influenced by external effects such as the 2008 economic crisis. The decreasing tendency of the relative efficiencies could be the result of the positive effect of the launching of the Single European Sky initiative in the early 2000s, when the use of EU funds was relatively modest. This cannot be interpreted as a poor management of EU funds, but there is room for the improvement of the efficiency in the use of these funds for research, development, innovation and implementation projects in the air navigation domain, to be considered when planning the future in this field.

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Relationships between transformation and exploration phases of absorptive capacity: Feedback loops in low technology sectors

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Keywords: Absorptive Capacity, Feedback loops, Transformation, Exploration

1 Introduction

Human capital of the transformation phase will connect with the firm's function to explore external sources of knowledge and provide the needs of new information. So, these required data must contain a clear message that has to be interpreted properly. Thus, these connections between the organization's change activities are critical to complete the knowledge lacks, unknown in initial stages of absorption process. This represent new and important feedback loops in firms.

2 Objectives

The objectives can be specified as: ''R&D activity explains the existence of new exploration activities in the firm''; and "What exploration activities can be related to the transformation phase of absorptive capacity in sectors of low technology?" Precisely, the hypothesis is: "The firm's transformation activities are significant and positively associated with new exploration activities of the organization".

3 Methods

Based on the Spanish manufactured companies that answered to the Survey of Business Strategies, a regression binomial logical model tests the relationships. The model was valued applying the econometric package SPSS 24 and the variables followed principally to Pérez-Miguel (2018) and Sáiz et al. (2018).

4 Results

With the purpose of contrasting the hypothesis, the results present a positive and strong significant influence of R&D activity on the firm's technological surveillance ($p. < 0.01$; Wald, 246,437). In addition, it shows a positive and significant influence of the R&D activity on the firm's scientific and science information ($p. < 0.01$; Wald, 99.627), in order to support the hypothesis.

5 Conclusion

This investigation finds that those organizations that maintain levels in R&D expenditures over time are more likely to continue the exploration activities and subsequently renew their knowledge base. It confirms that firms that transform more knowledge are more organized to explore their external sources of knowledge and it is the same for companies in the sectors of low technology.

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A closer look at lock-in effect and channel preference

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Keywords: multi-channel, spillover effect, lock-in effect, channel integration, fashion, consumer behavior.

1 Introduction

Companies aim to achieve maximum efficiency in their increasing offer of channels and services to deliver the best possible customer experience at the right time, which requires understanding how consumers make use of the available channels throughout the different stages of the purchasing process (*spillover effect*) (Gensler et al., 2012). Channel lock-in occurs when the attitude toward using one channel in a stage has an effect on using the same channel in the following stage (Verhoef, Neslin, & Vroomen, 2007).

2 Objectives

The study investigates the relation between channel preference and spillover effect—and more particularly lock-in effect—in multi-channel retailing, in order to analyze, explain and understand how consumers use different shopping channels—offline shopping, and online shopping in three different channels: web, mobile and social networks—along the shopping process. Based on the literature review, the research posits the following hypotheses: **(H1)** The presence of lock-in effect is more likely to occur among consumers with offline channel preference than among consumers with online or digital channel preference; **(H2)** Lock-in effects will be more pronounced among consumers with higher intensity of channel preference; **(H3a)** The presence of lock-in effect is lower when activities involving product returns and exchanges are included, regardless of purchasing

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channel preference; and **(H3b)** The presence of lock-in effect is lower when activities involving customer service and support are included, regardless of purchasing channel preference

3 Methods

Responses from a representative sample of 432 Spanish clothing and apparel shoppers help test the research hypotheses. The questionnaire includes demographic segmentation, channel preference and intensity of channel preference. Lock-in is inferred from the channel preference statement of respondents. The research differentiates between online and offline shoppers, and considers three scenarios: (Sc1) inclusion of pre-purchase, purchase and delivery/pick-up only; (Sc2) inclusion of returns and exchanges; (Sc3) inclusion of customer service.

4 Results

Using an independent t-test between consumers with preference for online and offline shopping, the results only support H1 partially (in Sc2 and Sc3). Observation of the value and significance of bivariate correlations between lock-in effect and intensity of channel preference supports H2 for the global sample and offline shoppers, but not for online shoppers. The results of a paired-samples t-test support H3a and H3b in the online channel, and only partially in the offline channel.

5 Conclusion

The study provides a better understanding of channel preference, measuring and analyzing lock-in effect. The results confirm the reduction of lock-in effect as more shopping activities are incorporated. The number of single-channel users in the offline channel remains stable, but multi-channel behaviors increase in the online channel after inclusion of post-purchase activities. In the absence of any trouble, online shoppers follow a single-channel use behavior, turning to use other channels when they encounter some problem. The findings suggest that online shoppers tend to solve their problems using the offline channel for returns and exchanges, or to contact customer support by telephone or in-store. The rates of use and preference for purchase using mobile channels and social networks still remain very low.

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Open innovation in Spanish research and technology organisations (RTOs): objectives and barriers

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Keywords: OI: Open innovation; RTO: Research and technology organisation; STI: Science, technology and innovation.

1 Introduction

RTOs are special type of intermediary in the innovation system (Kerry and Danson, 2016) and had a "hybrid nature" (Gulbrandsen, 2011) in the sense that they carry out their own research and development activities. Thus, RTOs play an important role in innovation systems, increase innovation ratios in the industry, develop and implement new technologies, allow companies and other agents to increase their capacity for innovation and multiply their capacity for internal innovation (Giannopoulou et al., 2018).

Despite public policies on science, technology and innovation consider RTOs as active instruments (Hagedoorn et al., 2000) there are few studies about RTOs, and about the paradigm of Open Innovation (OI) related to these agents within the Regional Systems of Innovation, also few studying their relation-ship with the industry and other agents.

2 Objectives

The present article analyses open innovation in Spanish research and technology organisations (RTOs). The document describes and discusses their open innovation management approach, as well as the objectives and barriers when implementing open innovation in these key agents of the industrial and technological development of Spanish SMEs.

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3 Methods

With the exploratory aim of researching the objectives, barriers and approaches of OI management in RTOs, we adopted a quantitative research approach based on a survey to RTOs. The population was based on the registry of Innovation and Technology Centers of the Spanish Ministry of Science, Innovation and Universities.

The data analysed was obtained through a structured questionnaire addressed to RTO managers (CEOs, other C-Level executives and department directors), with a wide view of their organization and the external factors influencing it.

The respondents were mostly CEOs (43.24%) or other C-Level Executives (45.95%), with an average professional experience in the RTO of 17.8 years for CEOs and 16.11 years for the other C-Level executives. The response rate was 72% (36 valid RTOs questionnaires).

4 Results

Regarding OI management, study shows that RTOs seem to be more focused on the analysis of objectives and risks, and the evaluation of results rather than in the degree of formalization of the OI management strategy.

The impact of IPR management is also stressed when analysing the OI management performance of RTOs, with the help of a simple linear regression. The model takes an R-value of 0,352, and a R^2 indicating that 12.4% of the variability of OI management depends on the importance RTOs give to their IPR management. The F statistic shows a value below the critical level (Sig 0.05), so both variables are linearly related.

5 Conclusion

The nature of the RTOs has a great influence on OI Management strategy. Besides, the biggest incentive for RTOs to embrace OI is mainly the objective to better respond to the demands of companies (partners and customers), as well as the opportunity to identify new opportunities for technological development.

The research also indicates that the main barriers for OI in RTOs are those related to the knowledge management, as well as those associated with IPR management, and economic aspects.

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Automatic Vehicle Collision Detection Device Adapted to Preserve Privacy Policy Standards Through a Web Communication System

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Keywords: Smart cities; Connected vehicles; Interface device, Collision notification System;

1 Introduction

The incoming framework of smart cities opens new ways of user´s interactions within urban management features, like public lighting, intelligence transport systems (Amini, et al., 2018), parking (Aliedani & Loke, 2018), safety and security, waste management, internet of things and many others possibilities where connectivity of users is the main topic when developing new applications.

The implementation of connected vehicles technology is a clear example of this matter, because almost the 60% of vehicles on urban environment were manufactured 10 years ago (AAM, 2014), hence even if most car-manufacturers still assembling and improving devices that could allow collision detection automatically, online driving information assistance, remote safety surveillance and monitoring beside other kinds of services focused on users, the late acquisition of this technology is an obstacle to smart cities development in relationship with urban transport applications.

This communication summarizes the design process of a device and its managerial implications what finally led to a web data management conceptualization in order to achieve legal requirements in relationship with privacy policy of users, to help non connected vehicles to interact within this new connected framework.

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3 OWL Device

The collision detection system "OWL" as it was called by the developers is a collision notification device that has been programmed to record relevant information in relationship with technical collision parameters (Pawlak, 2016) and to communicate notifications to its owner thanks to a web support service that filter the information to accomplish with privacy protection requirements.

Such collision information has been reduced to the minimum parameters needed to help insurance companies to analyse each accident report through the web database service, which are the vehicle identification number, the user´s phone number and the Acceleration Severity Index (ASI)

4 Conclusion

In relationship with commercialisation purposes, OWL device is headed to three main sectors, which are Individual users, Renting Enterprises and Insurance Companies.

OWL as an entrepreneurship has been founded by a last course student of industrial engineering at the University Centre of Defence at Spanish air Force Academy, thanks to a full guided research and a business plan as part of the final degree report. As an advance, the preliminary results provide a possible profit input of 400.000 € after almost three years since the project could be programmed to start.

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Integration of Uncertainty in EDM Methodology

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Abstract Since the Earned Duration Management (EDM) methodology was introduced as an alternative tool for project monitoring and control, several research projects have arisen to take advantage of the results offered by this methodology. The objective of this paper is twofold, on the one hand, to incorporate uncertainty into the project activities and to use EDM methodology together with statistical techniques to control and estimate the final project duration. On the other hand, it is intended to compare deterministic techniques of project time estimation based on Earned Value (EVM) methodology with respect to stochastic techniques based on artificial intelligence.

Keywords: Earned Duration Management; Earned Value; Project Control; Duration Forecasting; Statistical Learning

1 Introduction

Monitoring and control activities are a crucial aspect of project management throughout the whole life cycle of the Project. Earned Value Management (EVM) is probably the most widely used tool for project control. This methodology is also used to control the project schedule, after was introduced the concept Earned Schedule (ES).

Since then, there have been a large number of studies related to the improvement of this tool, which allow the monitoring and control tasks of the project to be carried out with greater precision. Khamooshi & Golafshani (2014) try to improve the EVM methodology by introducing the EDM (Earned Duration Management) methodology for monitoring and controlling the project schedule. The authors propose indicators in which the parameters relating to the project

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duration are decoupled from cost measures. After the introduction of this methodology, studies have been published comparing the results obtained for the same project using EVM versus EDM methodology.

2 Objectives

In this paper, we want to incorporate uncertainty in the definition of the project activities duration. Once this uncertainty has been programmed for each activity, we want to know if it is possible to use tools that allow us to control the project (Acebes et al., 2015), using the EDM methodology as a basis. At the same time, and maintaining the uncertainty of the activities, we want to know if it is possible to estimate the final project duration using the indicators proposed by Khamooshi and Golafshani (2014). Will be to carry out a comparative study between EVM and EDM methodologies. This comparative study will allow us to know the effectiveness of this methodology (EDM) in environments with uncertainty. To do this, we calculate the error that takes place in each control instant between the estimated value and the real future value.

3 Conclusion

In this article we have demonstrated the possibility of incorporating uncertainty into project activities and, with it, we have been able to use the EDM methodology to control the project, and also to estimate the final duration of the project, considering environments with uncertainty. We have used a real project to test the possibility of using this methodology as a control tool. But also, by comparing the results obtained with other methodologies, we have shown that the results are accurate. Finally, we understand that the use of stochastic methodologies will provide more accurate control and forecasting data than deterministic methodologies.

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Sector Automoción en la Comunidad Valenciana: Estrategias de Futuro

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Abstract El presente artículo analiza el sector del automóvil en la Comunidad Valenciana, centrándose principalmente en el clúster del mismo AVIA que gira en torno a la planta de fabricación de Ford España sita en Almusafes, en base a ello establece las líneas estratégicas de futuro para el mismo. El presente trabajo se basa en el estudio que la Universitat Politècnica de València ha realizado para la Generalitat Valenciana como parte del Plan Estratégico de la Industria Valenciana y dentro del Plan Sectorial del Clúster del Automóvil.

Keywords: Sector automoción, Plan Estratégico, Comunidad Valenciana.

1 Introducción

El sector de la automoción es líder en tecnología, exportaciones, innovación, así como en tracción y transferencia (Hervas-Oliver et al, 2017). España tiene la 1ª posición en el ranking europeo de fabricantes de vehículos comerciales, la 2ª posición como fabricante de turismos en Europa (IVACE, 2018), siendo el 8º productor mundial de automóviles y vehículos comerciales ligeros con casi 2,9 millones de unidades, con 17 factorías que fabrican 43 modelos, y generan junto con la industria de componentes 300 mil puestos de trabajo directos y cerca de 2 millones de indirectos (Albor, 2018). En la Comunidad Valenciana es el sector más exportador con un 26% del total. El objetivo del presente trabajo es presentar el plan estratégico de la Industria Valenciana aplicado al sector de la automoción,

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en él se recogen de forma resumida tanto la metodología empleada como los resultados obtenidos y se extraen unas breves conclusiones del mismo.

2 Metodología

Para el presente estudio se hicieron grupos de trabajo dentro del clúster AVIA. Se realizaron entrevistas, sesiones de trabajo y se pasaron cuestionarios. De todo esto se extrajo la información para el presente estudio. Las áreas de trabajo empleadas son: innovación, tecnología, mercados, clientes, competencia, productos, segmentos, internacionalización, formación, tamaño empresarial, estratégicas, modelos de negocio, normativas, regulaciones, etc…

3 Conclusiones

El presente trabajo muestra la elaboración de un plan estratégico para el sector automoción en la Comunidad Valenciana. Se han conocido las debilidades, las fortalezas, las amenazas y oportunidades, en base a ellas se han creado estrategias.

El sector está representado y forma estructura de clúster asociativo a través de AVIA. Las nuevas visiones de movilidad (coche eléctrico, híbrido, autónomo, compartido y/o conectado) van a afectar el futuro del sector dependiendo de cuál de las opciones sea la que tome la delantera. La Comunidad Valenciana y el sector del automóvil tienen ante sí el reto de mantenerse y crecer. También debe incrementar su apuesta por la I+D y apostar por empleos cualificados, ya que estos serán los que proporcionen la diferencia entre producir e innovar.

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Review of the Altman Z-Score model, as a predictor of corporate bankruptcy

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Keywords: Z-Score Altman, bankruptcy, risk

1 Introducción

Altman (1968) fue el pionero en aplicar técnicas de análisis discriminante multivariantes para predecir problemas financieros en las empresas. Con este trabajo y otros posteriores que le siguieron, se alcanzaron buenos resultados con pequeños errores de clasificación del riesgo de bancarrota de una empresa (Altman, 1983). (Altman, 2018).

Desde entonces, esta línea de investigación se ha visto enriquecida por numerosas aportaciones de diferentes autores con nuevos enfoques y la incorporación de otras técnicas, como son, inteligencia artificial, redes neuronales, mapas auto organizados, escalas multidimensionales, o la técnica Logit (que permite obtener la probabilidad de fracaso de una empresa condicionada a un conjunto de restricciones o atributos) (Campillo, Serer and Ferrer, 2013).

A pesar de todas estas aportaciones, el modelo de Altman sigue siendo uno de los más utilizados como predictor financiero de quiebra. Además, en el año 2014, Altman et al. han publicado un nuevo modelo más avanzado (Altman et al., 2014) (Altman et al., 2017). Sin embargo, los estudios recientes siguen utilizando los modelos anteriores de Altman (Amat, 2017) (Panigrahi, 2019). El motivo, por el cual, los investigadores no están utilizando este último modelo, pudiera deberse a que este nuevo modelo no incluye una clasificación de las empresas en función del

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riesgo financiero, puesto que el valor obtenido está basado en la probabilidad obtenida con la técnica Logit. (Altman, 2018).

En esta investigación, se quiere dar respuesta a la pregunta de si es posible establecer una correlación entre la clasificación del riesgo de las empresas realizada en el modelo z'' y la probabilidad de riesgo asignada por el nuevo modelo 8 de Altman que pueda ser aplicable en otras investigaciones.

2 Conclusión

En este trabajo se ha realizado una revisión de los diferentes modelos de Altman. Y por otra parte, realizar un estudio empírico que permita, por primera vez en el estado del arte, establecer una categorización de las empresas según la probabilidad de quiebra para la última versión de 2014, en comparación con la clasificación previa realizada por el autor.

Por otra parte, la principal aportación de este articulo al estado del arte, es el estudio que se ha realizado con una amplia muestra empírica de empresas que ha permitido realizar una tabla de equivalencia entre la clasificación realizada por Altman para el modelo anterior Z'' (Altman, 1983) y el nuevo modelo 8 de Z-score (Altman et al., 2014). Por lo que se ha obtenido una correlación de las tres situaciones de riesgo financiero de la empresa (saludable, precaución, quiebra probable) entre los dos últimos modelos Z-Score de Altman que es pionera en el estado del arte y puede aplicarse a nuevas investigaciones.

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Lending a hand by lending a loan: financing firms with social goals through crowdfunding platforms.

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Abstract: The world is currently governed by the economic principles of capitalism, free trade economy and private property. However, a new economic paradigm is shaking the foundations of the capitalist model: the Sharing Economy. An individual can now act as funds provider through crowdfunding platforms, which he can do for extrinsic motivation (i.e. in exchange for equity or an interest rate). But intrinsic motivations can also be present through reward-based crowdfunding and crowdonation, in which the incentives for funding go beyond the extrinsic. A survey on 123 individuals that have acted as crowdfunders has been conducted. The results highlight the existence and importance of intrinsic motivators for crowdfunding with social goals.
Keywords: Sharing Economy; Collaborative Economy: Alternative Financing; Third Sector; Platform Economy.

1 Introduction

Sharing Economy refers to the ability of using idle resources for improving the match between demand a supply with respect to the match provided by the capitalist system (Ranjbari et al., 2018). There is an increasing consensus within the scientific community on the idea that this new phenomenon will change the pre-established economic model in the coming centuries (Rifkin, 2014). Nowadays the Sharing Economy is established in several sectors, where it is disruptively transforming a wide variety of business models, providing more sustainable and efficient ideas. Because of its global condition and its big potential, it threatens many traditional capitalist mechanisms. Revenues from the five key sectors where Sharing Economy appears - travel, car sharing, finance, recruiting, and streaming of music and video - are expected to grow at about 35% per year, reaching more than $ 335 billion by 2025, which means a growth of about ten times faster the growth of traditional economy in these sectors (PwC, 2015). Finance is among the sectors that are being disrupted, allowing new

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funding possibilities by means of individuals that act as financial actors (funds providers), supporting and investing in new ventures. Therefore, companies gain access to a new source of funding, the crowdfunding. Crowdfunding stands out as an alternative form of collective financing. It allows the crowd to support projects of any kind at a global scale.

2 Objectives

In crowdfunding the incentive for lenders is usually of a extrinsic type: the expected return of their investment. But both crowdonation and reward-based crowdfunding can be identified as providing funds for social goals, and in that case intrinsic motivators can also be present. The aim of this research is to characterize investors according to whether they are guided by extrinsic or intrinsic motivations, as well as to characterize how each type reacts to external influences. Specifically, it is intended to understand which platforms will be most suitable for ventures aiming for social and environmental impacts. Lastly, research also seeks to discover how secondary parameters (such as age, investment frequency or the amount invested) affect in the motivations of the investors.

3 Methods

The research has been carried out through a survey, which aims at understanding the extrinsic and intrinsic motivations, as well as external influences, that lead investors to fund projects with social goals. The questionnaire was distributed on line to individuals that had funded ventures through crowdfunding platforms in spring 2017, gathering a total number of 123 responses.

4 Results

The results show that investors can be distinguished into two types according to their funding motivations, which can be of extrinsic or intrinsic type. Those with intrinsic motivations are more focused on platforms with non-monetary returns and projects with social and environmental goals. On the other hand, those investors with higher extrinsic motivations expect to receive better financial returns and are further away from financing projects with a positive impact. Therefore, a link has been found between the characteristics of the platforms and the types of fundamental investors in each of them, helping promoters to decide how to find funding. Lastly, from this study it can be concluded that the amount of funders involved in crowdfunding due to intrinsic reasons is higher than expected.

5 Conclusion

The rise of the Sharing Economy opens up the possibility for new types of funding where funders are mobilized by different (extrinsic or intrinsic) motivators, depending on the scope of the company funded.

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Project portfolio selection for increasing sustainability in supply chains using a multi-criteria approach

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Keywords: Multi-criteria methods (MCDA); project selection; strategy

1 Introduction

Project portfolio is a strategic activity consisting of prioritising the projects to be implemented within an organization according to their alignment with the strategy considering the limited resources of organizations. Portfolio selection is a process where organisations select the most relevant projects in order to provide alignment between project implementation and strategy consecution in order to increase the impact on their competitiveness.

2 Objectives

The purpose of this paper is to propose an approach that aids in the portfolio selection decision by connecting the project selection to the strategic framework of a supply chain. This approach will help enterprises to prioritize projects that have a highest impact on the strategy of the supply chain and their sustainability over time.

3 Methods

The paper proposes a multi-criteria model that introduces sustainability dimensions aligned to a performance framework. Multi-criteria decision analysis (MCDA) techniques have been applied in multiple decision-making problems for project selection using both multi-objective and multi-attribute methods. For example, DEA (Data Envelopment is used in Gutjahr et al. (2008).

Other multi-attribute techniques such as Promethee and Electre have been also applied for project selection such as Halouani et al. (2009) and Buchanan and Vanderpooten (2007). The Analytic Hierarchy Process (AHP) and Analytic

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Network process (ANP) developed by Saaty (1980) have been also used for project selection, for example in Subramanian and Ramnathan (2012).

4 Results

The model has been applied to a supply chain ranking several projects. The prioritisation provides those key actions that have to be implemented in the short term to gain competitiveness in the supply chain.

5 Conclusion

Several models have been developed in the literature for portfolio prioritization. However, it lacks of an integrated model to align project selection with increasing the sustainability of the supply chain.
This work presents an approach to deal with this problem by using a MCDA model to link project selection to performance framework for a supply chain that integrates all the dimensions of sustainability.

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La lealtad del cliente online en el sector de moda. Cómo mejorar las estrategias de éxito en la red

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Keywords: Moda, eWOM, calidad de e-servicio, satisfacción, lealtad

1 Introducción

El crecimiento del sector de la moda en Internet ha supuesto que cada vez más empresas opten por este canal como medio de promoción y venta de sus productos (Taylor y Castello, 2017). Son numerosos los estudios que analizan la importancia de la calidad utilitaria (Cristóbal et al., 2007; Rares, 2014) y la calidad hedónica (McLean, 2017) como variables relevantes en la consecución de una adecuada percepción de calidad del e-servicio en una plataforma online. Sin embargo, no existen apenas estudios que analicen sus efectos directos e indirectos sobre la satisfacción del cliente y su lealtad en estas plataformas. El presente estudio analiza estos efectos con el fin de definir mejor su estrategia de Marketing online y maximizar sus resultados.

2 Objetivos

El objetivo de esta investigación radica en la identificación de la relación entre las variables calidad utilitaria y hedónica, como variables directas de la calidad de e-servicio, la satisfacción y la lealtad del cliente online tras su experiencia en la plataforma de venta online en el sector textil y moda. Para ello, se desarrollará un modelo teórico completo que incorpore los efectos directos e indirectos de la experiencia del servicio electrónico en la satisfacción y la lealtad, para analizar la

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importancia de cada una de estas variables y establecer las estrategias de Marketing online correspondientes para un mayor éxito empresarial.

3 Metodología

Para evaluar la relación entre la calidad de e-servicio, la satisfacción y la lealtad en plataformas de venta de moda en Internet, se ha partido de una muestra de 405 clientes en estas plataformas. Posteriormente, para evaluar la relación entre las diferentes variables, se utilizó un modelo de ecuaciones estructurales (SEM).

4 Resultados

Los resultados obtenidos en éste análisis indican que la satisfacción tiene un efecto directo sobre la calidad utilitaria y la hedónica. El eWOM tiene efectos directos sobre la calidad hedónica pero no sobre la calidad utilitaria. Ambas calidades tienen, a su vez, efectos indirectos sobre el eWOM, ya que unas buenas valoraciones en cuanto a los términos transaccionales y los relacionados con el disfrute se traducen en unos mejores resultados sobre el eWOM. En el caso de la intención de compra, sus efectos directos con la variable calidad utilitaria, son débiles pero ésta relación resulta más fuerte de forma indirecta a la hora de revisar la intención de recompra de los clientes. Por último, no existen efectos directos entre la calidad utilitaria y hedónica, y la tolerancia al precio, aunque sí que se perciben efectos indirectos entre ellos.

5 Conclusiones

Las plataformas de venta online de artículos de moda deberán prestar atención a los aspectos relacionados con la lealtad debido a los efectos directos e indirectos que éstos tienen sobre la percepción de calidad de e-servicio por parte de los usuarios online. Un análisis adecuado permitiría a estas plataformas establecer sus estrategias de marketing online para maximizar sus resultados a corto y largo plazo.

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Emergent Approach of Occupational Health and Safety within the Servitization of Industry 4.0

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Keywords: Industry 4.0, Occupational Health and Safety, Servitization;

1 Introduction

Since both Servitization and Industry 4.0 have deep implications for the value creation in manufacturing firms (Frank et al., 2019), scholars and practitioners have begun analysing the present and potential links between these two fields (Visnjic et al., 2019, Ardolino et al., 2017). Accordingly, the emergent trends of Servitization and Industry 4.0 in the industrial environment imply deep changes in the work organisation and in particular, the emergence of new risks at the workplace triggered by human-to-human and human-to-machine interactions. This circumstance can have the negative impact on the Occupational Health and Safety (OHS) (Badari et al., 2018), unless the new paradigm shift of the OHS management is introduced in manufacturing organizations.

2 Objectives

The main objective of this research is to outline the conceptual framework of OHS approaches within the servitized Industry 4.0 considering different stages of the convergence of Servitization and Industry 4.0 in the manufacturing firms.

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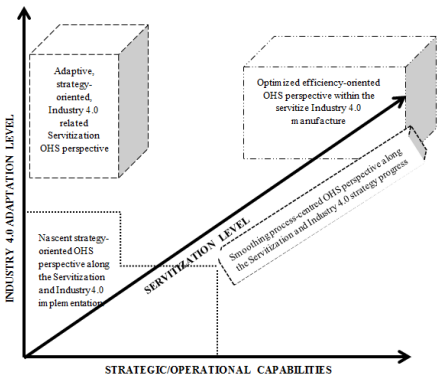
3 Methods

This paper provides the integrative scoping review of the literature on emergent approaches within the servitized Industry 4.0 manufacture as well as it proposes the general conceptual framework (Edmondson and McManus, 2007) of the emergent OHS transition classification.

4 Results



The conceptual framework of OHS within Industry 4.0 Servitization proposed in the paper, has stemmed from a contextualisation of the three dimensions of the OHS in servitized 4.0 manufacturing firms: strategic/operational capabilities, servitization level and Industry 4.0 adaptation level. Through a broader prism the four main challenge areas of the OHS in the servitized Industry 4.0 manufacturing firms have been suggested.

5 Conclusion

The new business models of manufacturing firms are more and more linked to the services-related and Industry 4.0-based transformation. This transition entails significant challenges and substantial impact on OHS policy in manufacturing organizations from the intertwined perspective of business, technology, processes and persons. Hence, the integration of servitization and Industry 4.0 perspective into the OHS strategies and processes will require special attention from both researches and practitioner to encompass different risk prevention requirements.

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A model for the strategic management of innovation and R&D at pharmaceutical firms through the analysis of clinical trials

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Keywords: Fuzzy techniques; innovation; pharmaceutical industry; real options.

1 Introduction

Managing the portfolio of innovative drugs is a complex task in pharmaceutical laboratories. The complexity stems from the need to consider several strategic issues that affect the internal and external R&D decisions. In light of this, the management of innovation risk in a portfolio of promising drugs should be based not only on the strategic decisions that affect the firm's internal and external R&D but also on those taken by competitors. We assume that firms can manage their R&D resources in two ways. In this sense, drugs can be developed based on internal R&D efforts and/or announced financial transactions (FTs) (Gascón et al., 2017).

2 Objectives

Our research objective is to develop a model for analysing, in pharmaceutical firms with portfolios of clinical trials (CTs, i.e. new drugs in the pipeline that may succeed or fail), the most appropriate strategic decision, taking into account the firm's position with respect to the innovative drugs and that of the competitors.

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3 Methods

We depart from Puente et al. (2018). We now combine real options with fuzzy techniques with the aim of quantifying the flexibility of pharmaceutical firms when strategically reorienting their CTs towards diseases in different research phases. From this perspective, we contribute to the relevant literature; see e.g. Carlsson et al. (2007), Lo Nigro et al. (2016), and Guo et al. (2018).

We consider CTs at each phase in the pipeline. Then, we measure firm's flexibility in two dimensions. We measure: (1) the internal expenditure in R&D adjusted for the number and type of CTs in our sample period; and (2) the announced FTs to acquire or sell certain drugs (or laboratory R&D divisions). The former captures the firms' internal potential to be innovative over time and manage their innovation risk; the latter captures their ability to rearrange the portfolio of new drugs by externally acquiring (and/or selling) new knowledge while keeping greater control of innovation than in cooperation arrangements. Later, we use these estimates to make recommendations on the strategic options that are more valuable to them. First, the real options approach to project evaluation aims to correct the deficiencies of traditional methods by recognising that managerial flexibility can bring significant value to projects, especially in R&D. Second, fuzzy techniques in the context of innovation risks in this industry provide: agility in the construction of the decision support system; fast interpretation of the results; and ease for performing a sensitivity analysis of the potential behaviours.

4 Results and conclusion

We develop an evaluation model for managing strategically portfolios of new promising drugs at pharmaceutical firms. This provides decision makers with a tool to identify the most valuable options from their current portfolio of potential drugs in the pipeline. To illustrate its application, we have considered a sample of 37 pharmaceutical firms. We refer interested readers to Gascón et al. (2017) for a description of the sample firms and CTs that we are using in this work.

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A story of organizational philosophy change: a case study

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Keywords: Organizational change; Data-driven transformation; Website testing;

1 Introduction

Nowadays, companies are successful only if they adapt their efficiency and speed to the increasingly active business environment (Wassner & Brebion n.d.). Data-driven decision-making philosophies are a growing trend that lots of companies are nowadays willing to adopt. However, the organizational transformation needed is not always as simple and logical as it could seem and the comfort of the old habits can dim the change effort. In this paper we present a case study of an organization transformation planned and implanted in a real company.

2 Objectives

A real organizational culture transformation is needed in order to become real data-driven. This transformation is addressed in our organization as a change categorized as incremental (Cao et al. 2000).

Organizational change process has different phases (Imran et al. 2016). Authors have been studying the different phases of change for a long time. The objective of this paper is to monitor how the organizational change is planned and implement and how the literature is understudy and put into practice in real companies.

3 Methods

This paper presents a case study of the organizational transformation made by a company to move from traditional to data-driven decision-making philosophy. The case is based in the specific case of the web development team in a car

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manufacturer. In order to make this organizational transformation possible and to avoid it to become a simple process change, we have based our action plans in the organizational change knowledge found in the literature and then we applied it to the case company and we monitored the transformation process during 1-year period.

4 Results

After understanding the need for change and analyzing the situation of the company and the revision of the organizational change literature, the company chose to implement the transformation by using the Kotter and Rathgeber eight-stage model (Kotter & Rathgeber 2006). This model was mainly chosen by its focus on commination and inclusion of the different teams involved in the change, considering the preparation for the change even more important than the change itself.

After one year starting from the problem identification, the first signs of change where clearly appreciable in some teams. However, the new philosophy is far from being fully adopted and more work will be needed in order to consider the transformation as completed.

5 Conclusion

The presented case study is only an example of application of an organizational change model, it is far from including all the possible problems or doubts that a company may come to when facing an organizational change.

Known the importance of following an organizational change model, more guidance is needed for the industry to find and understand the proper framework to be used in their specific use case. Website experimentation and data-driven decision making, as much other growing trends, sound pretty logical and simple, however the reality of most traditional companies is very different and including those new concepts is not always that simple. The main learning identified from the presented transformation is that changes including philosophy transformation (or decision-making power re-balance) need special care on the communication and training in order to both empower all the involved teams and also make them trust the importance of the change and the new culture adoption.

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Subastas en el mundo del acero

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Keywords: acero; subastas, on-line

1 Introducción

Semanalmente, gran cantidad de productos de acero "non-prime" de varias plantas de una empresa siderúrgica europea se venden online a través de un mecanismo de subasta. Previamente a la subasta, los productos objeto de la misma deben agruparse en lotes conforme a una serie de características y restricciones. Realizar esta agrupación es una tarea compleja y clave, dado su gran impacto en el precio final de puja de cada lote (debido al valor intrínseco de la agrupación realizada y al atractivo del lote para los pujadores).

2 Objectivo

Este trabajo estudia el problema en profundidad para determinar tanto las características a considerar en la agrupación óptima de productos como el proceso completo de subastas y sus factores influyentes.

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3 Descripción del problema y solución

En el caso de los productos de acero de mayor calidad, debido a los diferentes tratamientos químicos y físicos propios del proceso de fabricación, y a veces a imprevistos no contemplados, no todas las bobinas que se fabrican cumplen todos los requisitos deseados para llegar al máximo nivel de calidad, por lo que no se pueden vender a los clientes originales. Estos productos son subastados online, agrupando cada semana los productos de todas las plantas de Europa. Si durante un número determinado de semanas ningún potencial cliente puja por esas bobinas o chapas, son devueltas a la planta para convertirlas en chatarra y reaprovecharlas en el proceso. La homogeneidad de un lote incrementa su atractivo para los pujadores, propiciando un aumento del número de pujas, y un potencial aumento del beneficio total de la subasta. La agrupación de productos en lotes presenta dos tipos de características: las comunes a los elementos de un lote, y las que se utilizan para definir su homogeneidad. Las características comunes a un lote permiten identificar productos similares desde un punto de vista de negocio lógico -misma planta, localización, forma, categoría, familia y número de lados de recubrimiento-.

4 Factores a considerar en el diseño de subastas online

(Klein & O'Keefe, 1999) han analizado el efecto de internet en las subastas destacando como elementos ventajosos clave: (1) la reducción de costes de transacción para comprador y vendedor; (2) una mayor accesibilidad para pujadores y vendedores; (3) una mayor facilidad para dirigir subastas complejas y para la descripción de productos. (Pinker, 2001) también señala: (1) la facilidad de recolección de datos sobre la operativa de las subastas y (2) la posibilidad de los participantes de unirse en cualquier momento mientras la subasta permanezca abierta.

5 Conclusiones

En este trabajo se ha analizado la literatura referente a las subastas, centrándose en los tipos utilizados actualmente para la subasta de productos siderúrgicos. Del trabajo se deduce que los tres factores que más condicionan el éxito de una subasta on-line son: (1) Elección del mecanismo de subasta, (2) Restricciones sobre las pujas, (3) Duración. Pero sobre todos estos factores, predomina la forma de agrupar los lotes, pues eso condiciona el atractivo para el cliente del producto final.

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Chapter 5

QUALITY & HUMAN RESOURCES

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The adoption of the Life Cycle Assessment methodology by companies

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Keywords: Life Cycle Assessment (LCA); Life Cycle Management (LCM); Sustainability; Basque Country.

1 Introduction

The increase of the pressure that both institutions and consumers exert on companies to improve their environmental performance in the last decades has forced them to redouble their efforts in this area. It is out of the question that identifying and evaluating the impact that a given product has on the environment is the first step is in order to reduce it. It is also quite obvious that it is not enough for companies to carry out this exercise focusing exclusively on their manufacturing process, but it is imperative to consider the impacts generated by the product throughout its entire life cycle. In other words, it is essential that companies adopt the Life Cycle Assessment (LCA) methodology. However, despite the important effort made to improve the LCA methodology and despite that the first works addressing this issue go back to the beginning of the nineties (Sullivan and Ehrenfeld, 1992), the way in which companies adopt it in their strategies has not yet been studied in depth (Nygren and Antikainen, 2010).

2 Objectives

This research tries to fill part of this gap by making known the reasons why companies use LCA, the objectives they pursue with it and the benefits they obtain from it, as well as trying to anticipate its foreseeable evolution.

3 Methods

The criteria for the definition of the study population were the following: Companies in the Basque Country (Spain), from the industrial, construction and primary sectors, with more than 10 employees and owning at least one

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environmental certificate. A questionnaire was sent to the 661 resulting companies and 153 valid responses were collected.

4 Results

LCA is still far from being widespread in the Basque Country. Just 25.5% of the companies asserted to use LCA, another 43.6% acknowledged not even knowing the tool and finally, 30.7% of them claimed to know it even though they do not use it. The results also indicate that LCA is more used as the size of the company increases both in terms of employees and billing. Regarding the sectors, Machine Tool, Construction and Construction Materials and Furniture are the most actives.
Surprisingly the motivations to carry out LCA studies seem to be mainly internal and not so much to respond to external forces such as legislation or competitors.
Companies are quite cautious regarding the benefits provided by LCA studies. Although they admit the improvement of the environmental performance of the products and the improvement of the image of the company, they hardly perceive an increase in the economic benefits. Most of the companies using LCA confirm their intention to continue using it (87.18%), while very few acknowledge that they will stop doing so (7.69%). Finally, they are also optimistic about the future of LCA. Among users the majority believe that LCA will be a tool of widespread use in the future (69.23%). Among non-users however, the opinion is not as positive, although those who say that it will be generalized are still more that those that believe it will not.

5 Conclusion

The LCA in the Basque Country is therefore still a little-known tool used mainly by large firms belonging just to some specific sectors. In the opinion of the companies it provides few economic benefits, although its ability to improve the environmental behaviour of the products and the image of the company is recognized. Despite it and the little support they say receive from public institutions companies think that its use will become widespread in the future and affirm they will continue using it at least as intensely as they currently do.

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Externalities of the Sharing Economy: effect on employment of holiday accommodation platforms. The case of Madrid.

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Abstract: The rise of the Sharing Economy has made easier to match the high demand for holiday accommodation with the offer of private apartments. However, accommodation platforms such as Airbnb are not exempt from creating negative externalities. In this research, authors focus on the effect on employment. New work relations arise from platforms, both as particular or professional activities. Employment level in the tourism sector, especially low-skilled, is affected by the substitution of regulated offer for app-driven services. Demand of instant and easy access influences an increasing trend towards flexibilization of the labor market and the rise of self-work..
Keywords: Sharing Economy; Airbnb; externalities; side-effects; employment.

1 Introduction

As intermediary platforms earn market share rapidly, growing ten times faster than traditional companies, they affect existing companies, labour markets and prices of rental apartments. Tourism is one of the sectors strongly affected by platform activity and their externalities. Platform effects on labour market are twofold. On the one hand, they may ensure new jobs due to the increase of consumption. But on the other hand, they may rise flexibility demand of labour and deteriorate working conditions.

2 Objectives

Anchoring on the study of Fan, Ye, and Law (2016), which poses that Airbnb is taking over the role of low-end hotels, this research aims at: (i) exploring the labour relations flourished on the sector under the influence of platforms, (ii)

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evaluating the immediate and middle-term effects on the traditional sector and (iii) applying the research and conclusions to the Spanish scene.

3 Methods

For this exploratory research, a case study was conducted, taking the city of Madrid as a framework. First, secondary data was chosen, benchmarking with other European cities, such as Amsterdam, Barcelona or London. Then, in-depth interviews were conducted to two different profiles of experts: a professional manager of tourist accommodation apartments and an individual who manages his own property. These two sources were used simultaneously, using cross-validation.

4 Results

The results show that Madrid has the highest presence of commercial offer of the cities compared in our research, along with Barcelona, according to the classification proposed by Gil and Sequera (2018). Interviews show that the increase of professional providers, along with the growth of platforms, ensure new ways of income for particulars, and new career profiles for high educated professionals in a more flexible labour market. In the period 2010-2017, the city experienced nearly 28% increase overnight stays. High-end rooms offer increased up to 18%, not followed by low-end, which experienced a growth 4,5 times lower. Both categories show an overall decrease of employment in the same period.

5 Conclusion

The demand for holiday accommodation through platforms has had a call effect on investors and companies, shifting towards a professionalized management. The higher presence of commercial offer in Madrid increase the effects of displacement, touristification and challenges the traditional sector. Platforms represent an alternative to both customers and providers on finding either a cheaper alternative or a new way of income. These new profiles of professionals of holiday accommodation do not meet the legal criteria and represent a challenge to regulation and stablished sectors.

The low-end category does not show a significant growth as that of overnight stays, showing an absorption of demand by Airbnb. The substitution of low-end could represent the loss of between 24 and 27% of the jobs on holiday accommodation.

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Improving through employee participation. The case of a Spanish food manufacturer

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Keywords: Employee participation, continuous improvement, action research

1 Introducción

En el ámbito de la gestión, la mejora continua es conocida como un planteamiento en el que todos los miembros de la organización contribuyen a mejorar el desempeño de la misma a través de la implantación continuada de pequeños cambios (Jørgensen et al., 2003). En este contexto, cobra vital importancia la participación del personal, el mecanismo por excelencia para canalizar la mejora continua (Prado-Prado et al., 2018). Aun así, la importancia de la participación contrasta con la atención que la literatura le ha prestado (Leach et al., 2006), en concreto en lo referido a la puesta en marcha de los sistemas de participación.

2 Objetivos

Para cubrir la carencia existente en la literatura, este artículo presenta un caso de mejora del sistema productivo a través de la participación del personal en un importante fabricante español del sector alimentario. Esta experiencia persigue un doble objetivo: mejorar del desempeño del sistema productivo y conseguir el arraigo de la filosofía participativa.

3 Metodología

La metodología empleada es *action research*. Por ello, los investigadores se han centrado en el diseño y coordinación del proceso de participación y en la evaluación de la satisfacción de los trabajadores respecto a la metodología desarrollada.

El primer paso es la creación de un Equipo de Implantación, formado por mandos de la empresa y por los propios investigadores. Este grupo de especialistas establece objetivos de mejora e identifica las áreas con mayor potencial de ahorro. Así, se forma el primer Equipo de Mejora, que comienza con una “brainstorming”,

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en donde las ideas ya son asignadas para su estudio y puesta en marcha. A partir de este momento se suceden 5 reuniones, con el seguimiento constante del Equipo de Implantación. Al finalizar, los integrantes protagonizan un acto donde se exponen los resultados a la dirección y se les entrega un obsequio como agradecimiento. Después, se disuelve el Equipo de Mejora inicial y se ponen en marcha los equipos de las demás áreas seleccionadas. Finalmente, los trabajadores contestan a una encuesta para evaluar sus impresiones sobre el proceso de participación.

4 Resultados

Las acciones llevadas a cabo por los diferentes Equipos de Mejora consiguieron mejorar de forma notable la eficiencia de los procesos de la organización, con ahorros totales de casi 200.000 € en el período de un año (Tabla 1).

Tabla 1 Relación de los resultados obtenidos en el plano económico

Equipo de Mejora	Nº de ideas	Ahorro	Ahorro obtenido sobre ahorro potencial
1	170	107.000 €	41,5%
2	156	9.500 €	2,5%
3	192	81.000 €	11%

Desde el punto de vista de la satisfacción, el 75% de los participantes repetiría su participación. Sin embargo, una parte mayoritaria de los que no repetiría (80%) son integrantes del equipo 2, donde los resultados no fueron tan satisfactorios.

5 Conclusiones

En este estudio basado en *action research*, se ha conseguido mejorar notablemente el desempeño de la empresa gracias a la participación del personal. Los resultados obtenidos muestran una clara mejora en el ámbito económico y refuerzan el enfoque de mejora continua a través de esta metodología de participación. No obstante, existen importantes incógnitas para el futuro, como la correcta manera de reconocer y recompensar al personal tras una dinámica de participación, así como el efecto de estas prácticas sobre la implicación y motivación de los implicados.

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Closing Gap between New Development and Voice of Customer

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Keywords: New Service Development (NSD), DMAIC Six Sigma, Critical To Quality (CTQ), Voice of the Customer (VOC), Customer Satisfaction;

1 Introduction, Objectives and Methods

In today's technology-based business environment, service providers face significant challenges in remaining competitive by understanding customer priorities, and creating real customer value (Reindenbach & Gooke, 2006a). In the modern world, value at the point of production does not automatically equate to value at the point of consumption and value definition should not be internal, but driven by end-user (Reindenbach & Gooke, 2006b).

Considering the background of the problem, the goal of this research is to gain an understanding of the lifecycle of New Service Development (NSD), channeled through customer priorities by comparing the purchasing criteria of wholesale services against company processes: Which are the Critical to Quality (hereinafter CTQ) dimensions that drive customer satisfaction in the telecommunications wholesale industry? Which are the most CTQ activities in the Service lifecycle? And, once variables and activities are recognized, where are the gaps between the services developed by the company and the real Voice of the customer (hereinafter VOC)?

The methodological approach used in this research, Six Sigma's DMAIC, provides a systematical process and a business orientation to ensure that the service improvement activities are customer focused. In order to conduct this

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company-based study (Yin, 2009), two research paradigms are explored: Positivism and Interpretivism. For the researcher, the chance to observe as a member of the company, and produce subjective qualitative data, gives the study an interpretive characteristic. Additionally, this study follows an Abduction approach (Kakkuri, & Lukka, 2008).

4 Results and Conclusion

An initial contribution of this research is the application of DMAIC approach used to guide this research, providing a methodical and systematical framework that can be used by Telecom service providers seeking to develop more customer-focused processes. Previous research has contemplated the use of Six Sigma methodologies within manufacturing industries, but this research tries to explore a unique niche by shifting from a production approach to a service development process service, where little research is found (Alsmadi, Almani. & Jerisat, 2012). Finally, in an entrepreneurial context, this Sis-Sigma approach could help to reduce the risk that a new product, once developed, will not meet customers' needs and wishes (Wang FK-K, Yeh C, Chu TP, 2016).

The main results of this study is originated from the "As-Is" process maps, not only because process flows were drawn from the end user service's request, but also because drawing the layout and combining it with CTQ matrix allowed stressing the most critical-to- quality activities. Later in the research, the assessment of the CTQ matrix was constructed so as to measure the correlation of the activities described in the process map, with respect to the VOC prioritized criteria. The result of the correlation allowed locating most CTQ activities. Significant contributions are presented since the research provides an understanding of the impact of each process activity in a specific VOC requirement highlighting which activities are the most Critical to Quality (CTQ) and proposing improvement opportunities.

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Metodología para el Análisis de Sensibilidad de un Algoritmo de Control Adaptativo

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Keywords: Confort térmico; Algoritmo de control adaptativo; Constante de Griffith; Eficiencia energética

1 Introducción

El desarrollo global, la influencia arquitectónica y la superpoblación de los núcleos urbanos han llevado al aumento exponencial de los sistemas de calefacción, ventilación y aire acondicionado, existiendo hoy en día una aceptación generalizada de la necesidad de sistemas mecánicos para proporcionar un confort térmico adecuado a los ocupantes o usuarios de un edificio (Taleghani, Tenpierik, Kurvers, & Van Den Dobbelsteen, 2013).

2 Objetivos

La preocupación por reducir el consumo energético y por crear o mantener ambientes térmicos confortables y saludables es una realidad existente. El presente trabajo ahonda en el estudio de la temperatura de confort interior, expresada mediante un algoritmo de control adaptativo, debido a su estrecha vinculación con el consumo y la eficiencia energética.

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3 Metodología

El procedimiento aplicado mayoritariamente en la práctica para el cálculo experimental de la temperatura interior de confort es el método de Griffith, en el que dicha temperatura puede ser estimada a partir de los votos en una escala de sensación térmica, la temperatura operativa (obtenidos de un estudio de campo) y una constante denominada constante de Griffith. Para el cálculo experimental de dicha constante, Humphreys et al. (Humphreys, Nicol, & Roaf, 2015) propusieron la definición de dos variables, δ_g y δ_{rsv}.

En el presente estudio se aplicó la siguiente metodología para el análisis de sensibilidad de la temperatura de confort en base a la constante de Griffith. En primer lugar, se categorizaron los datos de sensación térmica en intervalos, se obtuvieron posteriormente para cada intervalo las variables δ_g y δ_{rsv} y la sensibilidad térmica y por último se realizó un análisis de regresión considerando la totalidad de los datos sin categorizar.

4 Resultados

En base a los valores δ_g y δ_{rsv} se obtuvo un valor de la constante de Griffith experimental. Se llevó a cabo un análisis de sensibilidad del rango de confort térmico interior, observándose que tanto la temperatura media de confort como la desviación son asimilables para diferentes valores de dicha constante.

5 Conclusiones

Los resultados obtenidos ponen de manifiesto una insensibilidad de la temperatura de confort a la constante de Griffith, residiendo la diferencia principal en que a mayores valores de dicha constante, mejor es la correlación entre la temperatura de confort y la temperatura exterior (Tuan Nguyen & Kumar Singh, 2012), (Nguyen, Singh, & Reiter, 2012). El estudio demuestra asimismo la validez de dichas afirmaciones para edificios híbridos.

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An efficient waste to energy model for isolated environments. Case study: La Gomera

Manuel Uche-Soria[161] and Carlos Rodríguez-Monroy[162]

Keywords: waste to energy; isolated electricity system; circular economy; waste management; Canary Islands

1 Introduction

Municipal solid waste (MSW) management is a controversial aspect in isolated environments. Not only because the production of waste grows exponentially, but because in these isolated regions the difficulties are accentuated in comparison with the mainland territories. The limitation of space, the technology of scale and the peaks of generation due to existing tourism, are clear examples of the barriers that must be overcome. For this, we must move from a linear economy to a circular economy that takes into account the priorities established by the European Union to improve the collection and treatment of municipal waste.

2 Objectives

The objective of this study is to propose an efficient alternative in isolated environments, such as the Canary Islands. With the available data, we start from a concrete situation that the authors consider appropriate for study and improvement. The aim is that this study should serve to extrapolate the model to other isolated environments.

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3 Materials and Methods

In Figure 1, a description of the proposed model is provided. In addition to the island being thus able to comprehensively manage its waste, the aim is to reduce the surface area occupied by the landfill by almost 90%. In this way, repopulation and soil treatment work and landscaping can facilitate the environmental recovery of the area. This, without doubt, will contribute to the restoration of the native ecosystems with the introduction of local flora and fauna in order to reintegrate the landfill area into the landscape.

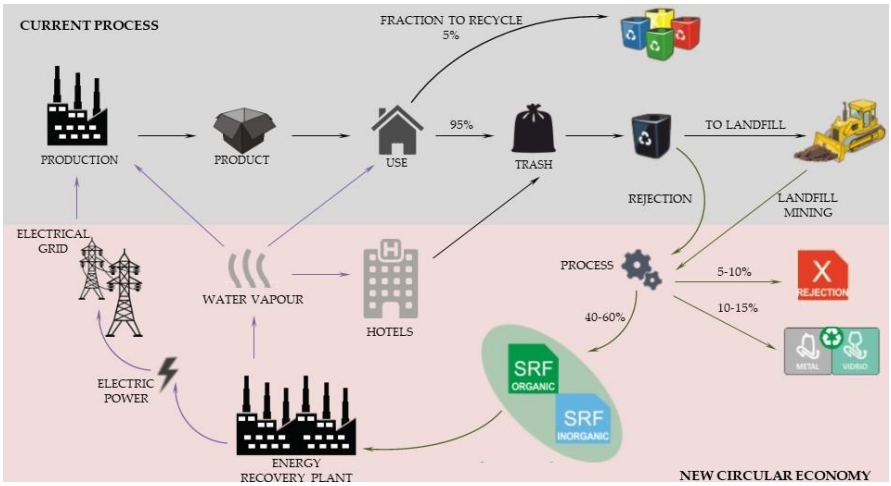

Fig. 1 Flow diagram of the waste energy recovery process proposed for La Gomera

4 Results

The results of this study show that the energy produced from waste is not negligible for these small isolated environments (approximately 26,000 MWh/year). In addition, recycling is also increased and GHG emissions reduced.

5 Conclusion

Finally, the authors have tried to put forward a solution that takes into account the circular economy model as a self-regenerative system in which the input of waste resources and emissions and energy losses are minimized by slowing, closing and reducing the material and energy loops. It is obvious that the road is still arduous and that isolated environments are still behind continental systems, but at this point it is essential to propose studies and measures that encourage awareness and action.

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The effect of participation on employee well-being and organizational performance: a regional and cross-sectorial empirical study

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Keywords: Strategic human resource management (SHRM); HR practices; participation; employee well-being; Organizational performance

1 Introduction

People employability, talent and/or motivation can be a source of sustainable competitive advantage; difficult for competitors to imitate (Barney, 1991). Resource Based Value of the firm theory, Human Capital theory or Agency theory are now mainly adopted as a starting point for researchers in SHRM literature (Jiang and Messersmith, 2017). In this vein and considering that *participation* contributes to involve employees in the strategic challenges of the organization (Purcell and Hutchinson, 2007), Kurtulus and Kruse (2017) argued that for *financial participation* to be effective, this form of participation must coexist with *participation in management*. It will therefore be necessary to investigate into the effect produced by the various mechanisms of employee participation in the performance and to know what role well-being plays in this relationship.

2 Objectives

The purpose of this article is to empirically examine the relationship between 3 schemes of participation (employee decision-making, profit-sharing and employee ownership), employee well-being and firm performance.

3 Methods

The relationship between the studied 3 schemes of participation, employee well-being and firm performance was explored in 278 Basque companies. Objective data was obtained from a national financial company information database for performance measurement. 1,503 employee subjective responses were gathered about participation schemes and their well-being.

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After controlling company size and sector (manufacturing and services were tested in this study), Pearson correlation test were conducted in order to know how the independent variables are related to the dependent one. *t-Student* and Anova statistical tests were also performed to examine differences between participative and non-participative organizations.

4 Results

The evidence showed a significant and strong relationship between any form of participation and employee well-being but significant and negative relationship between employee participation in decision-making and firm financial performance. No statistical relationship was found between financial participation schemes and organizational performance.

5 Conclusion

On the one hand, participative organizations are associated to a higher employee well-being, measured as a commitment. The analyzed interactions between the 3 studied schemes also demonstrates that employee's decision making participation variable is the one showing higher differences on the commitment.

On the other hand, it is demonstrated the relationship between the organizational size (number of employees) and firm performance (turnover). When the size is controlled for the correlations, financially participated organizations are not showing any firm performance difference.

Finally, it should be noted that while the study confirms the relationship between one of the pillars of HRM and employee well-being, fails to show that HRM is positively related to higher firm performance. We invite, therefore, other authors to continue investigating the mechanisms of *participation* as a contributor to maximize employees well-being and organizational performance.

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Mejora de la Productividad con herramientas Lean en una empresa del sector metal-gráfico.

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Keywords: Lean Manufacturing; productividad; TPM; SMED; SIPOC;

1 Introducción

Multitud de cadenas de producción tienen como principal filosofía de trabajo la gestión Lean. Durante la última década, en la región de Murcia se ha extendido la implantación de este modo de trabajo en empresas de prácticamente todos los sectores productivos (alimentación, plástico, metal-mecánico). En este trabajo se presenta el caso de una empresa del sector metal-gráfico, que ha implantado estas prácticas para intentar conseguir un sistema de producción eficiente, sostenible y que consiga la implicación de los trabajadores de la empresa. Este proyecto nace de la necesidad real de un sistema que permita una mejor gestión en la organización y lograr la flexibilidad que el mercado demanda.

2 Objetivos

El proyecto de implantación de técnicas Lean Manufacturing se ha desarrollado en la empresa Auxiliar Conservera S.A., empresa líder dentro del sector metalgráfico en España, dedicada a la fabricación de envases metálicos para la industria alimentaria (conservas vegetales, productos cárnicos, pescados, etc.)

La empresa, que aúna más de cincuenta años de experiencia junto al know-how adquirido en los últimos años de actividad, con la mentalidad innovadora y el espíritu de crecimiento de un equipo de trabajo joven, busca su mejora continua, dando importancia al valor de la implicación de las personas en todos los procesos productivos de la empresa. En concreto, las técnicas seleccionas (SIPOC, SMED, TPM, 5S, …) están orientadas a mejorar la productividad, el rendimiento y la disponibilidad de recursos y productos ante cualquier cambio del mercado.

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3 Herramientas aplicadas y Resultados

- La implantación de TPM se inició en la línea de litografía, para eliminar tiempos muertos, pérdidas de velocidad y defectos asociados a problemas y averías de la línea. El desarrollo de un plan piloto y su ejecución ha permitido la programación de las tareas de mantenimiento y la formación del personal para ello, así como la reducción entorno al 60% de las horas de parada de la línea durante la implantación de esta técnica.
- La herramienta SMED, aplicada durante tres años en las líneas 2, 3 , 7 y 8 con el fin de reducir los tiempos de cambio de formato y los tiempos de ajuste posteriores en la fabricación de envases de hojalata, no funcionó en todos los talleres como se pensaba, pero se consiguió una mejora entre 30 min y 1h 30min de reducción media de los tipos de formatos realizados.
- La aplicación del diagrama SIPOC en la planificación de los trabajos de litografía, desarrollados en el único centro de aprovisionamiento (C2000), tras detectar ahí el "cuello de botella del proceso". La reflexión y actuación sobre los indicadores y actividades que comprende dicho proceso productivo, permitió actuar sobre proveedores, clientes y los diferentes actores del proceso, detectando las diferentes oportunidades de mejora.

4 Conclusiones

Los diferentes proyectos Lean desarrollados en Auxiliar Conservera han permitido lograr la flexibilidad que el mercado demandaba a la empresa, sin requerir grandes inversiones e implicando a todas las personas como motor de la organización.

Además de mejoras en el ámbito de producción (orden y limpieza en las áreas de trabajo, lotes de menor tamaño, tiempos de entrega más cortos, etc.) que muestran una mejora significativa de los indicadores KPI estudiados.

Finalmente señalar que las medidas derivadas de la aplicación de estas herramientas suponen un cambio radical en la cultura y el modo de entender la empresa por la organización, planteando la innovación a partir de las personas y no solo con los avances tecnológicos.

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Chapter 6

EDUCATION & INNOVATION

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Understanding and representation of organizational training programs and their evaluation

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Keywords: organizational training, training; training evaluation; training program; Group Model Building; System Dynamics.

1 Introduction

The training processes within this human based paradigm are considered key for competitive advantage as the evolution of the company on its own could devalue the worker competencies (del Valle and Castillo, 2005).

Consequently, knowledge and skills of workers are devalued, and it is necessary to apply human resource management policies to ensure the durability of human labour in the company. This durability which is dependent on factors such as experience, skills, abilities, or capacity to adapt are the elements that bring to the company the sustainable competitive advantage necessary to be successful (del Valle and Castillo, 2005).

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2 Objectives

The main aim of this research is to analyze and represent using System Dynamics (SD), the process of evaluation of training programs to define them in a more effective and profitable way.

3 Methods

A Group Model Building (GMB) session was used for the definition of the conceptual model. The resulting model has four main groups:

1. Training assessment: This loop explains how the training evaluation is done. Interaction with students is a direct way to do it.
2. Assessment impact: This loop refers to the effect of the assessment on the principal phases of the learning process.
3. Striker: This loop refers to the phase in which learners have achieved new skills, and their self steem is higher.
4. Initial diagnosis assessment: This loop refers to that phase of "wish to improve" mentioned in the previous loop, and its effects.

4 Results

The variables simulated were: Learning related attitudes and habits, spontaneous strategies and reasoning, already acquired knowledge, personal experiences, satisfaction level, new acquired competencies, and transfer the learning to the workplace. Different levels for these variables were applied in the simulation. The result was a linear growth of the wish to improve of the learners, and effectiveness of the training programs.

5 Conclusion

This research presents a conceptual model to represent the phases of a learning process, and the variables used for its evaluation. This model could be used to understand which variables influence the training effectiveness, and the interrelationships between them, represented as a whole system. On the other hand, the simulation model is useful to represent in an interactive way the training process, and visualize their effect on different phases of the training program, and its evaluation. Finally, the simulation of scenarios was used to present in a dynamic way the change over time of two variables.

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Relación Universidad-Empresa: un caso real de colaboración en la Escuela Superior de Ingeniería de Sevilla

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Keywords: Relación Universidad-Empresa; Innovación Docente, Desarrollo de competencias

1 Introducción

En la última década la universidad española ha sufrido una gran transformación debido al proceso de Bolonia, que buscaba acercar la Universidad a las necesidades sociales. Aun así, sigue existiendo un considerable gap entre los conocimientos adquiridos en las enseñanzas universitarias y las competencias reclamadas en el mercado laboral. Los grados en ingeniería, no están carentes de esta problemática, siendo muchos los estudiantes que muestran dificultades en el desarrollo de ciertas competencias apreciadas en los entornos profesionales. Este trabajo recoge la experiencia que vienen desarrollando un grupo de profesores del área de Organización de Empresas para fomentar la relación entre la Universidad y la empresa.
La intervención objeto este trabajo fue en asignaturas impartidas en la Escuela Técnica Superior de Ingeniería de Sevilla.

La intervención se realizó en asignaturas de diferentes titulaciones, pudiéndose agrupar estas en varias categorías: Organización y Administración de Empresas

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Esta iniciativa viene desarrollándose durante 4 años y se ha financiado a través del II y III Plan Propio de Docencia.

2 Metodología

La metodología desarrollada conlleva una doble vertiente, por un lado, traer el conocimiento y experiencia de la empresa al aula y, por otro, forzar que el alumno deba verse inmerso en la realidad empresarial e industrial antes de su salida de la universidad. Para ello, se han propiciado dos tipos de actividades: ciclos de conferencias y simulaciones de entornos empresariales.

Las actividades desarrolladas son complementarias al transcurrir habitual de cada asignatura. Dependiendo de la asignatura y actividad, esta puede tomar un carácter voluntario u obligatorio.

3 Resultados

Los resultados de esta intervención se midieron desde 3 puntos de vista. Por un lado, la satisfacción de los alumnos con las actividades desarrolladas, por otro lado, la mejora en los resultados y, por último, la percepción de los profesores y ponentes externos.

4 Conclusiones

Los cursos de ingeniería relacionados con la gestión empresarial suelen enfrentarse a una falta generalizada de motivación por parte de los estudiantes. Para revertir esta situación, se desarrolló un proyecto de innovación docente que vincula los contenidos de diferentes asignaturas con experiencias profesionales reales. Para ello se acercan profesionales al aula y se le da un enfoque más práctico y autónomo al proceso de aprendizaje. Los resultados obtenidos, tanto en términos de resultados académicos como satisfacción del alumnado han sido muy positivos.

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Kahoot! as gamification teaching resource in Business Organization subjects

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Keywords: Gamification, Kahoot, Business Organization, Motivation, learning

1 Introduction

The use of games generates positive emotions such as feeling committed, and fulfilled. For this reason, gamification is currently applied in different domains such as marketing or education (Dicheva et al., 2015). In addition, new Information and Communication Technologies (ICT) provide an improvement and dynamism in the teachings of the field of Business Organization. In this new context, the gamification tools promote the greater participation of the student in the development of the subject, improving the results of the teaching-learning and evaluation process. The use of games generates positive emotions such as feeling committed, and fulfilled (Díaz 2017). There are diverse tools to carry out the gamification in the classrooms. Among the mobile applications highlights the tool called Kahoot! (2019), very useful for creating quiz games, debates and surveys (Plump & LaRosa 2017).

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2 Objectives

The objective of this research is to analyze the impact of Kahoot! tool in the teaching of two subjects of business organization and to motivate students and promote study, while transmitting the contents of the subject.

3 Methods

The selected subjects have identical contents but one of them is taught in the English language. The teacher designs a total of 5 questionnaires with a total of 4 questions per each one and saves the quiz. Once in class, the teacher activates the Kahoot to start playing. Then, the student answers through their device and among the 4 possible response options. After each question, a bar graph appears indicating the number of students that have chosen each of the 4 options and the teacher can download the obtained results. So that the teacher has a control and follow-up of the students at a particular level, as well as the evolution of the group.

4 Results

The students of the two proposed subjects have expressed a positive feedback of the tool and they consider that this tool increases the motivation and learning in a funny way. Additionally, Kahoot! offered the teacher the possibility to obtain an instantaneous feedback of the level of assimilation of the concepts taught in each one of the sessions allowing, on the one hand, the adaptation of the subject to the rhythm of the students' learning and, on the other hand, the reinforcement of the contents that obtained worse results in later sessions.

5 Conclusion

The experience of the design, development, and implementation of questionnaires based on the Kahoot tool! has been very positive both from the point of view of the teacher and from the point of view of the students. It can be interpreted that Kahoot tool acted as a factor of improving academic performance.

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Availability of technological resources and training needs: the case of supercomputing training

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Abstract- Technological infrastructures are the base of the workflow in a lot of fields, helping in the improvement of performance and the results of every type of organizations. Supercomputers are one of the most relevant and powerful technological infrastructures currently. For this reason, the analysis of the availability and the training needs related to this advanced computational services are very important in order to determine the grade of support for the development of Research and Development (R & D) activities in the organizations. The review of the literature shows that one of the main limitations in the training of qualified personnel is the lack of availability of technological infrastructures. The present work analyses the influence of the perception of availability of technological resources in the perception of adequate training of students, related to Supercomputing.

Keywords: Learning; Supercomputer; PhD; Researcher; Course; Technology

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1 Objectives

The objectives set out in this work can be summarized as follows:

O1.- Analyze the existing limitations in relation to the availability of technological resources.

O2.- Analyze the type of students and their opinion in relation to the availability of infrastructure and training in technology.

O3.- Elaborate a logistic regression model with the previous variables.

2 Methods

The methodology used in the work has been: i) review of the literature in databases specialized in the subject; ii) survey on training and technology, in which 97 students enrolled in courses related to supercomputing participated.

3 Results and conclusion

In relation to the proposed objectives, the following conclusions have been reached:

O1.- It is appreciated that, through the review of the literature, both the problem of availability of technological resources and the solution to it are aspects of interest and relevance in the field of studies related to training.

O2.- It is observed, firstly, a high qualification of the students who participate in these analyzed courses and their membership in organizations, mainly Universities and Centers related to research. In relation to the questions that analyze the variables under study, it is observed that a large number of respondents estimate that they do have adequate technological resources. In addition, it is appreciated graphically how there is an important relationship between these and those who consider that they have adequate training in technology.

O3.- The results of the empirical study allow us to conclude that the parameter that best explains the affirmative result of the variable on perception of the availability of training (DISFOR), is the affirmative response on the availability of technology (DISTEC), so that, it can be concluded that students who consider that they have available an adequate technology tool, also consider that they have good training associated with it.

Through the data obtained in the study, we have reached conclusions that may be of interest for the preparation of training actions in the future for courses related to technology.

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A Systematic Literature Review of Design Thinking in Engineering Education

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Abstract In recent years, higher education has had to implement innovative education techniques capable of developing in students a series of transversal skills that students will need in their professional future. In order to achieve this, the teaching community has implemented a methodological tool known as Design Thinking. Design Thinking is that is increasingly used in engineering and in the university to promote creative thinking, teamwork and critical thinking. The aim of this work is to clarify the main experiences in which the Design Thinking has been applied in Engineering Education through a Systematic Literature Review. It will help to establish the main foundations of this and to develop a systematic application for this methodology.

Keywords: Engineering; Education; Design Thinking; Systematic Literature Review.

1 Introduction

La sociedad actual afronta profundos cambios tecno-económicos y sociales que la conducen a nuevas formas de organización hasta ahora desconocidas. Ante este reto, la Educación Superior se ha planteado la necesidad de implementar nuevas metodologías docentes capaces de fomentar en los alumnos un conjunto de

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competencias necesarias para desenvolverse correctamente en este nuevo paradigma. Las principales competencias que se tratan de fomentar son las conocidas como transversales; aquellas que pueden ser útiles en cualquier situación o profesión como son: la creatividad, el trabajo en equipo, el pensamiento crítico o la capacidad de resolver problemas complejos. Adquirir estas competencias será, incluso por encima de los conocimientos teóricos adquiridos, lo que definirá la posición de los alumnos en el mercado laboral. La comunidad educativa ha introducido distintas metodologías que tratan de potenciar estas competencias, entre las que ha destacado por su rotundo éxito la conocida como Design Thinking.

2 Objectives

El objetivo del trabajo es hacer frente a este problema analizando las aplicaciones más importantes que se han realizado de la metodología de Design Thinking en la Educación, continuando la labor realizada por Serrano et al. (2015) y profundizando en la Educación en Ingeniería a través de una Revisión Sistemática de la Literatura que responderá a las siguientes cuestiones principales:

- ¿Cuáles son las principales áreas educativas en las que se aplica el DT?
- ¿Por qué el DT ha ganado relevancia en la educación en ingeniería?
- ¿Qué resultados se han obtenido de aplicarla en la educación en ingeniería?
- ¿Cuáles son las recomendaciones y las principales líneas futuras de investigación que se hace desde las experiencias ya realizadas?

3 Methods

La metodología de Design Thinking (DT) se ha popularizado entre los docentes gracias a los buenos resultados que cosechó su implantación en la Universidad de Stanford (Brown, 2008). Sin embargo, a pesar de su popularidad se observa un punto débil que impide su consolidación como metodología principal: no dispone de un marco de referencia de aplicación estable.

4 Results and conclusion

Para analizar los 83 artículos que filtraron los requisitos de inclusión y exclusión se estudiaron los siguientes aspectos formales (fecha de publicación, revista y área de conocimiento), así como el contenido de los trabajos (naturaleza del experimento, análisis del experimento y recomendaciones). En esta última parte, el análisis se centraría en los relacionados con la Educación en Ingeniería.

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The importance for a Start-up to trust in Open Innovation: a systematic literature review

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Abstract: It has long been known that new firms are fundamental for economic growth. Starting new companies is one of the best ways to fight unemployment and to generate well-being. Therefore, attention is paid by the scientific community to start-ups, with particular emphasis at how they generate, acquire and manage innovation. In their starting phase, start-ups need to identify the resources necessary for innovation and later they will decide whether to develop them internally or acquire them externally. Being open to external sources is a crucial point for the success of an entrepreneurial venture, that is, adopting open innovation processes allows start-ups to overcome their initial challenges and shortcomings. The goal of the present research is to understand the status of the literature related to Open Innovation adoption by start-ups. Through the literature search and analysis, the most relevant articles have been identified and analyzed.

Keywords: Entrepreneur; successful collaboration; knowledge acquisition; new technology based firms; new ventures

1 Introduction

As stated by many studies, entrepreneurs have to face different challenges such as: newness and smallness of the firm, market entry barriers, limited resources, lack of market knowledge and the financial means (de Jong & Freel 2010; Eftekhari & Bogers 2015; Gruber & Henkel 2006; Radas & Božić 2009). These challenges could be faced with the use of Open Innovation (OI) techniques. Spender et al. (2017) highlighted that a strong correlation between start-up phenomenon and OI exists; moreover, they found that the shortage of studies on this topic has a negative effect on it.

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2 Objectives

The main objective of this study is to shed light on the existing literature related to the phenomenon of start-ups and OI. Then, through the selection of the most relevant articles, authors aim to understand the most promising streams of research on this topic, highlighting proposals for future research endeavours.

3 Methods

To carry out the systematic literature review, the steps defined by Johnsen et al. (2017) were followed. From an original amount of 105 papers, research was narrowed down to 34 relevant articles. Information was collected for each paper regarding the main topics dealt with; the results obtained from the study and suggestions for future researches. These results were summarized on a matrix, which allowed classifying the articles, with the aim of identifying three fundamental aspects: the main topics, the side from which the study was made, subjects studied, and on which side it would be appropriate to extend the studies.

4 Results

Through the analysis of the articles it was possible to underline several aspects. First, it was noted that the studies conducted are mainly focused on analyzing other actors who interact with start-ups, such as large companies or universities, rather than have the start-ups as the main object of study. The second relevant observation deals with the topics that are most studied, which have been enclosed in four main categories: entrepreneur, firm performance, knowledge and ties. Moreover, most of the articles support that it is necessary to expand the studies on the topic from the side of other actors rather than on the start-up side.

5 Conclusions

When a start-up adopts OI processes the advantages are multiple, in fact they can overcome their shortcomings by interacting with external actors. It is opportune to develop other researches by placing the start-ups at the centre, possibly involving the entrepreneurs on it. In fact, it would be of the greatest importance to study, for example, how the initial shortcomings of start-ups influence the processes of OI, verify how the definition of the business characteristics affect the choice of partners and analyze the factors that influence the performance of collaborations. These and other aspects should be studied in several industrial sectors in order to be able to generalize the results. Indeed, many researchers argue that it is necessary to deepen the knowledge about this phenomenon to strengthen the understanding of the dynamics and circumstances that characterize the start-ups when they adopt OI processes. Reporting more evidence will make it possible to raise awareness of both the entrepreneurs and the public administration regarding this phenomenon.

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Key aspects for an effective implementation of Project Based Learning: experience in engineering studies

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Keywords: Project Based Learning; Engineering; Higher Education; Case Studies

1 Introduction

Project Based Learning (PBL) is a teaching method in which learning activities are organized around a project that the student has to develop. According to the definitions in the literature (Lehmann, 2008) projects are complex tasks, based on questions, challenges to be met or real problems, which involve students in the design and completion of an initial assignment. As a result, students develop a deep knowledge of the content while working on acquiring transversal skills such as critical thinking, creativity, oral and written communication or teamwork.

The PBL methodology has its origin in the work of Kilpatrick (1918) and since then, it has been applied in many teaching areas and its implementation has evolved not only in basic and secondary education but also at the university. Although there is a growing interest in applying this methodology at the university level and there are numerous papers presenting experiences of design and implementation of an PBL in the field of engineering studies (Alves et al, 2018; Espinosa et al, 2005; Moliner et al, 2018; Mellado et al, 2016) they do not highlight those previous conditioning factors or aspects that the teacher should take into account and consider before starting the design of this type of project, with the aim to ensure its successful implementation.

2 Objectives

This work identifies the key aspects that the teacher should consider before designing a PBL project in order to carry out a correct planning and effective implementation of this methodology.

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3 Methods

This paper uses the case study methodology (Yin, 1994) to identify the key aspects to be considered in the design of a PBL project. For this purpose, the eight PBL projects carried out within the framework of the subjects of Business Organization and Management (second year of the Degrees: Mechanical Engineering, Industrial Electronics and Automation, Electrical Engineering and Chemical Engineering) and Integrated Management Systems (second year of the Master in Industrial Engineering) in two consecutive years (16-17, 17-18) by members of the teaching innovation network (XID-APP) of the University of Girona are analyzed.

4 Results

Once the PBL projects part of the study were analyzed, six key factors could be identified on which the teacher must respond for an effective implementation of this teaching methodology:

- Motivation of the teacher to carry out a PBL project
- Adoption by the teacher of a certain role
- Target audience analysis. Level of preparation of the students
- Level of the teacher's knowledge of the teaching methodology
- Formation of the working groups for the development of the project
- Space where the activity will take place

In addition, various scenarios have been planned based on the cases analyzed.

5 Conclusion

This paper sets out the preconditions in the form of key aspects or issues that teachers should consider before starting the design of a PBL project. The teacher should be aware that often the first experiences in the use of this teaching methodology may not be completely successful and will not be developed as planned a priori but the teacher's reflection on these key aspects will help to minimize the weaknesses of the proposed PBL project.

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Digital social innovation network: an explorative inventory and analysis of Spanish actors.

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Digital social innovation (DSI), a recent derivate emerged from the heart of SI, is included in the digital agenda policy of the European Commission. However actors working on DSI may be different from those innovators working on SI. If they differ, who are these new DSI actors in Spain and what are the geographical trends? How is the DSI network?

Keywords: Digital social innovation; collective awareness platforms, collaborative net-work; collective intelligence, innovation ecosystem.

1 Introduction

European Commission promotes a new wave of social experiments leveraged by information and communication technologies (ICT) called DSI initiatives. They constitute a new organizational model developing 1.451 projects and involving more than 2.252 organizations. DSI can be seen as a model or an organizational structure that tend towards network configurations hosting all elements and activities which make up an ecosystem (Moreno, 2009). It can be defined as "an effective organizational network model leveraged by information and communication systems (ICTs) whose ends and means are social" (Rodrigo, 2018).

2 Objectives

The aim of this paper is to identify who are the innovators or DSI actors in Spain, the domain in which they are developing, the geographical trends and the characteristics of the Spanish network.

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3 Methods

Theories of social change and network societies, like Latour´s actor-network theory (2007) illustrates how DSI networks contributes to social change and the social connections that exemplify “a social group in a solid community structure” (Murray, 2010). The methodology will support a foundation for (1) exploring the state of art of the network, (2) inventorying and classifying the entities that are currently operating in Spain and finally (3) conducting an analysis of the network that allows drawing the first conclusions.

4 Results

The H2020 data bases list of 99 projects and 198 actors in Spain. They were filtered down to 182 active organizations. Among the organizations registered it was found that 40% are headquartered in Cataluña, followed by 20% operating from Madrid. The majority (34%) are government agencies, 32% Private businesses, 18% Non-profit associations, 13% Foundations and 3% Non-governmental organizations. In terms of domain, it was found that 40% of organisations belongs to the network of Fab Labs boosted by the Massachusetts Institute of Technology, followed by the awareness networks (31%), organisations focus on collaborative economy (14%), funding accelerators and incubators (11%) and finally, platforms concerned on open democracy (4%). Finally, the leading technology trend is open knowledge (39%) followed by open networks (30 %). Only 10% of projects are linked to two or more organisations in the network.

5 Conclusion

Spanish DSI network is poorly connected. There is a lack of knowledge and social skills at the grass-roots level assumed the little relevance given to social subjects in most education systems. On the other hand, there is an alert on the risks of the centralization of power by a small number of technological companies. Consequently if the education system fails, it will be difficult to reach the critical mass needed to achieve social change, to succeed the empowerment of grassroots and other desired results to harness as the collective pool of social knowledge and the potential collective intelligence lying under the DSI network.

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Framework for evaluating the effectiveness of website personalization

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Keywords: A/B testing; Website personalization; Website evaluation framework;

1 Introduction

Website marketing and the use of websites to attract potential customers have become a key part in the development of any organization (Demangeot & Broderick 2016). The website enhancement need has set excellent conditions for web personalization to prosper (Salonen & Karjaluoto 2016). Web personalization is a broad concept, and there has been a lot of hype about it in the last decade, however understanding or determining its specific effects on the website persuasiveness remains an elusive goal (Tam & Ho 2005). The lack of consensus between scholars suggests that it is a highly case dependent topic that should be addressed by each organization regarding their personalization strategy and organization-user relationships (Kwon et al. 2010). Evaluating web personalization effects is not only focused in the decision of whether to include personalization features on a particular website or not, but also in supporting the decision making about the personalization approach to be used and in the long-term ongoing of the systems. On the other side, a great percentage of website owners are nowadays familiar with evaluating their websites' improvements by using A/B testing. For those two reasons there is an increasing use of this method to evaluate the effects of personalization features on organizations' websites (Dmitriev et al. 2017). However, given the complexity of some personalization decisions and the amount common testing pitfalls (Kohavi et al. 2014), we propose to organizations to construct its own evaluation framework.

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2 Objective

Based on our own organizations experience, our purpose within this paper is to help organizations determine the evaluation aspects that might be included in their evaluation frameworks. This is, laying the foundations to create an evaluation framework to understand the effect personalization in their websites.

3 Methods

An initial evaluation framework concept is analytically delivered from prior work. Then the concepts evolve in an inductive case study inspired by the monitoring of several website A/B tests conducted by different teams within the organization.

4 Results

Although there are various dimensions that could be included in the organization's experimentation framework, we identify four as being the key ones to be considered. The four proposed dimensions are, first, the overall evaluation metrics selection. As the second dimension, organization should not determine the length of experiments but set the criteria to be considered when determining it. For the specific case of web personalization evaluation, some criteria to be included in this dimension of the framework regards the need of post-test segmentation. As third dimension, some criteria for the adoption of the results should be included in the organization's experimentation framework (i.e. reliability or borderline p-values). And finally, organization should settle test prioritization a criterion.

5 Conclusion

In order to be able to evaluate the effectiveness of web personalization, organization need embrace specific evaluation frameworks according to their specific needs, capabilities and objectives. After examining the most common and harmful pitfalls and sticking points, four dimensions are exposed as key.

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Experiencia piloto de gamificación con uso de aplicaciones móviles en una asignatura de máster de Ingeniería Industrial

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Keywords: Gamificación, Kahoot, Socrative, Experiencia piloto.

1 Introducción y objetivo

Este documento presenta el trabajo desarrollado en la asignatura denominada "Sistemas de Gestión Empresarial", impartida como asignatura optativa en segundo curso del Máster Universitario en Ingeniería Industrial en la Escuela Técnica Superior de Ingeniería de Sevilla, ETSI en adelante. El objetivo perseguido es desarrollar una experiencia piloto basada en la introducción de herramientas de gamificación con uso de aplicaciones móviles para extrapolar la experiencia a otras asignaturas cuyos resultados académicos y motivación de los alumnos es muy inferior.

2 Metodología utilizada y herramientas de gestión de audiencia

Para la gamificación se ha optado por realizar cuatro cuestionarios y hacer una competición entre los alumnos que consiste en contestar la pregunta de forma correcta y en el menor tiempo posible. Para la gestión de la participación en el aula se ha optado por dos de las herramientas más utilizadas actualmente: Kahoot y Socrative (Roger *et al.*, 2017). Además estas herramientas son de las pocas cuya versión gratuita no impone restricciones al número de usuarios o preguntas (Fuertes *et al.*, 2016).

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3 Resultados

Para evaluar la opinión de los alumnos se ha realizado una encuesta a través de un formulario de Google con respuestas cerradas. La encuesta constaba de doce preguntas. Un primer bloque de cinco preguntas enfocado a conocer si habían utilizado anteriormente juegos en el aula, así como si habían utilizado las herramientas Socrative y Kahoot y cuál de ellas preferían. El segundo bloque, con siete preguntas, recoge la percepción de la experiencia del uso de la gamificación y de las dos aplicaciones utilizadas.

4 Conclusiones y líneas futuras

La experiencia de gamificación de la asignatura ha resultado muy satisfactoria para los profesores y para los alumnos. Todos los alumnos evaluaron la experiencia como buena o muy buena. Aunque la opinión mostrada por los alumnos es que el uso de juegos y su gestión a través de aplicaciones móviles ha aumentado su motivación, ello no ha redundado en una mejora de las calificaciones de la asignatura, así como tampoco ha hecho aumentar el porcentaje de alumnos que han participado de la evaluación continua. En cuanto a las herramientas utilizadas, se observa una leve preferencia de Kahoot sobre Socrative por parte de los alumnos, que no puede tomarse como significativa. En el próximo curso escolar, se va a implementar de nuevo la gamificación, tanto en la asignatura en la que ya se ha hecho como en otra asignatura de grado muy similar a la anterior.

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Towards the Science Map on Sustainability in Higher Education

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Keywords: Sustainability; Higher Education; Tech mining; Data science; Science map.

1 Introduction

Sustainability is an issue relevant to all (organisms and individuals) due to interaction with the environment. Thus, according to the United Nations education is the basis for improving our lives and sustainable development (2016).

The aim of this study is to identify who, where, when and what has been developed in area of sustainability in higher education. Tech mining helps answer these questions (Garechana et al. 2012a).Text-mining tools make it possible to analyse bibliometric elements and relationships between elements (Garechana et al. 2012b).

2. Sample and Methodology

The research employs the tech mining process methodology proposed by Porter and Cunningham (2004). In order to prepare the scientific technological study, coverage of the field contained in the databases was analysed: Web of Science (WOS), Scopus, EBSCo, Science direct, Springer, MPDI, Taylor & Francis Online, Emerald insight, Education Database (ProQuest) and ERIC.

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3 Results

By using text mining techniques it is possible to create the technological landscape in sustainability, we display the map created using the 765 institutions with more than two records. This map shows the co-occurrence of two or more institutions participating in the generation of a document. The respective map generated 1455 nodes and 2689 edges.

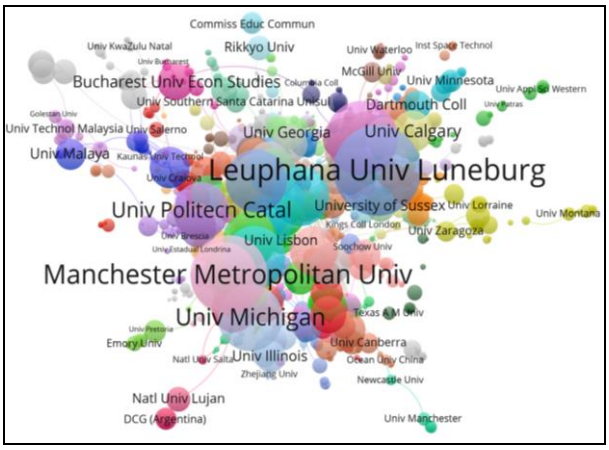

Fig. 1 Authors' affiliation names co-occurrence map created using the 765 institutions with more than two records.

4 Conclusion

Establishing the science map of sustainability in higher education allows us to understand the current state of science and therefore set development goals. This advance helps to show, for example, that the field begins in 1991 but its development explodes from 2005 to 2017, the year after which new terms begin to lose steam, making it possible to infer that it has begun to mature.

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Factors Influencing Disruptive Innovation Development Within Spanish Firms: A Qualitative Research

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Keywords: Disruptive Innovation; Spanish Firms; Innovation Management; Incremental Innovation; Management challenges

1 Introduction

Disruptive Innovation (DI) has been considered one of the most important challenge for the future, as the customer expectations, market requirements, and the competition grows in a global scale and is capturing the interest of scholars and practitioners due to its immense economic contributions. A business which disrupts the market and is deemed economically successful is commonly viewed as an "agile," effective business (Taylor, 2017). Christensen (1997) pioneer of DI theory argued good managers are faced with a dilemma, because by doing the same things they need to do to be successful (listening to customers, investing in the business, and creating distinctive capabilities), they run the risk of ignoring rivals with "disruptive innovations." To avoid being dethroned, Pérez et al. (2017) argue that incumbents need to identify new opportunities. Hence, in term of this, our study focusses on Spanish firms.

2 Objectives

The objectives of this research are the following:
How do Spanish firms attend to, interpret, and respond to disruptive innovation?
What strategies, actions are incumbents taking to develop and compete with this innovation?
What are the common challenges involved in adapting disruptive innovation?

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3 Methods

Based on a qualitative research, using grounded theory, a convenience sample of 21 firms, innovation level managers were contacted by email with an interview request. We concentrated on top management and innovation managers (managers who had been involved in R&D and innovation) in medium and big firms in Spain. In-depth individual interviews in a private space at participants' place of work were conducted with thirteen participants. Face-to-face interviews generally lasted 45 to 60 min (24 open research questions). Additionally, we prepared closed research questions of DI theory with multiple choice of answers (closed questions were divided in eight sections with three or four possible answer for each one).

4 Results

Participants were asked about their role and experiences in introducing disruptive innovations into their firms, the process of DI adoption within the innovation system, and their opinions on constraints and opportunities in their context. All the participants are aware of this concern. However, most participants use incremental innovation into their products or services, five of thirteen participants argued that they are trying to develop DI on their own or with startups. Participants argued that they are focusing on actual core of the business and trying to strategically expand their business around the word, taking care of the brand and the quality of their products or services. All the participants understand that DI is a totally new product or service with new clients. They argued that to develop DI, it is important that skills related to technology use, competence, open-mind, the environment, common concerns, and explore other sectors are strengthened to prioritise disruption in the market.

5 Conclusion

In this paper we conducted an analysis of thirteen firms, considering important aspects about how Spanish incumbents tackle disruptive innovation. The results showed that the incumbents in Spain are aware of this kind of innovation. Managers navigate this innovation using participatory management skills. This innovation represents a challenge and opportunity for them. Our findings offer important theoretical contributions for scholars and practitioners.

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Investigating the Impact of Internet of Things on the Educational Business Process

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Keywords: Technology, Internet of Things (IoT), Higher Education (HE)

1 Introduction

Technology has strongly influenced the educational process. The amount of data, knowledge and technological devices are changing the educational processes; especially in the HE. The IoT refers to connecting objects and devices to the internet to retrieve real-time information at any time and from anywhere (Louis and Dunston, 2018). The interaction of students with real-world objects may promote and improve the learning process (Kamal et al., 2018). However, the integration of objects in the educational process is an issue that must be further investigated; as previous researches have mainly focused on aspects such as: network communications; protocols, security, etc. (Kulshrestha and Bose, 2019).

2 Objectives

The objective of this research is to explore the current performance of the educational process and its variations, investigate the university's readiness to use and apply the suitable IoT strategy to enhance their educational process, examine the impact of IoT on the efficiency of the educational process, and discuss the system's potential benefits and challenges.

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3 Methods

The research is mainly exploratory; as it explores the current HE situation, with room for being explanatory to examine the impact of utilising IoT. A Case study, namely College of Management and Technology, AASTMT, is selected (Vasilescu et al., 2019), where HE students, administrators, and faculty members are the main participant groups.

A mixed methods approach is used, where both quantitative and qualitative data collection techniques (Flick, 2018) are utilized. Then, statistical and interpretive analysis are conducted to investigate the HE situation and to measure the IoT readiness. Interviews are administered with key decision makers. Focus groups are conducted with key administrators and academics, and HE students will be surveyed using structured questionnaires, as well as observations of activities regarding the educational process effectiveness (Bell et al., 2018).

4 Results

The result of this study should be a complete stakeholder analysis which comprehensively investigates the impact of utilizing IoT on the educational business process. The study should also explore the opportunities and challenges facing IoT adoption in the educational business process at HEI.

5 Conclusion

This research would provide decision makers with a roadmap to efficiently manage university resources, and thus improve the educational process. IoT would not only allow communication between devices and resources, but rather offer intelligence to the resources being connected making data readily available to other network systems to be utilized efficiently.

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Chapter 7

WORKSHOP: SUSTAINABILITY IN INDUSTRY 4.0

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Are SMEs prepared for Industry 4.0? A study of a regional group of companies in Spain

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Keywords: Industry 4.0, SMEs, Business Model Innovation, digitalization, servitization, value proposition

1 Introduction

The present article analyses in an exploratory research approach the starting point of a group of regional Spanish SMEs with regard to Industry 4.0. Based on a study of 35 SMEs in Spain. The present paper explores their Industry 4.0 interests, as well as the objectives and barriers when implementing Industry 4.0.

The ability of companies to manage this paradigm, and to use its principles and technologies to improve our management and make it more advanced, will depend, to a large extent, on our competitive and economic future (Moeuf et al., 2018).

2 Objectives

Bearing in mind the increased importance of Industry 4.0 in SMEs, we focus on managers´ approaches and set the following objectives: O1. Awareness and strategic importance of the Industry 4.0 concept; O2. Existence of an Industry 4.0 strategy; O3. Identification of Industry 4.0 implementation objectives in SMEs; O4. Identification of most important technologies; O5. Determining the barriers that businesses might encounter in implementing Industry 4.0

3 Methods

The data used for this paper was collected during a field study about the impact of Industry 4.0 in the regional area of Araba in Spain, between 1 Octo-ber and 30 November 2018. The data was collected using a structured questionnaire filled in

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after an explanation and training about the concepts and items developed through the questionnaire in order to assure the awareness and calibration of company managers and personnel when filling it. The scales were based on previous research studies (Glass et al., 2018; Ślusarczyk, 2018) are Likert based (1 - Not important, 2 – Important, 3 - Very Important) or categorical.

The 35 companies sample size matched the total population of the compa-nies participating in the study coordinated by the Regional Development Agency. The questionnaire addressed to managerial level personnel, CEOs, other C-Suite executives and department directors, was mostly filled by CEOs or other C-Level Executives (65,71%).

4 Results

By analysing the responses of SMEs regarding Industry 4.0, it is clear that the size and nature of the business model of SMEs has a great influence on the Industry 4.0 approach of the companies.

When considering the motivations of SMEs for Industry 4.0, Micro SMEs have no so clear their objectives regarding the implementation of I 4.0 in comparison with the Small SMEs (focus on business digitalization), or the Medium SMEs (focused on Flexibility and efficiency).

Moreover, product based companies showed higher levels of Industry 4.0 awareness, strategy deployment, investment and concern, what underlines the impact of Industry 4.0 in product based companies.

5 Conclusion

Spanish SMEs have risks that need to be managed in order not to become vic-tims of Industry 4.0, but beneficiaries of this revolution. In this context, the starting position of some SMEs in this race is reasonably good; nevertheless from the ability of companies to manage this paradigm (understanding, awareness, objectives, expectations, barriers and approaches), and from the use of its principles and technologies, will depend, largely, our competitive and economic future.

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Analysis of Industrial Symbiosis Platforms for Circular Economy development

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Keywords: Industrial Symbiosis, Circular Economy, Platforms, Sustainability;

1 Introduction

The concept of Industrial Symbiosis (IS) was introduced in the early 90's as a way to explain that industrial systems can be described as a distribution and flow of materials, energy, water and information (Erkman, 1997). The most popular definition of IS is a system that "engages traditionally separate industries in a collective approach to competitive advantage involving physical exchanges of materials, energy, water and/or by-products" (Chertow, 2007). Different IS projects have been developed: the Kalundborg park in Denmark (Lowe and Evans, 1995), Kwinana, Gladstone in Australia (Beers *et al.*, no date) or Nanjing Chemical Industrial Park and Suzhou New District, in China (Mathews, Tan and Hu, 2018).

Nevertheless, a successful IS implementation is more than a mere exchange of materials. One of the most important factors for developing IS relationships is collaboration amongst organizations (Cutaia *et al.*, 2015). For this reason, different projects have developed symbiosis platforms with the idea of active participation and collaboration between SMEs and local stakeholders. This paper is focused on the characteristics and usefulness of different platforms available on line.

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2 Objectives

In the last years, different software platforms have been developed to facilitate companies to exchange material exchanges and complete symbiotic projects. As there are many different platforms, the aim of this paper is to analyse their characteristics and functions in order to help companies decide which tool is the most suitable for them.

3 Methods

The in-use platforms that are available online and their main elements have been evaluated taking into account the factors defined in the literature, as geographic information, companies' diversity, eco-innovation, knowledge sharing, among others (Lombardi and Laybourn, 2012).

4 Results

Most of the analyzed platforms are related to promoting the circular economy, facilitating the exchange of waste as a resource for closing material cycles and promoting eco-innovation projects among organizations.

5 Conclusion

Despite the many platforms available, each of them might differ from each other in some aspect. In this way, this paper will help users to know which platform to use when they want to approach Industrial Symbiosis.

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Sustainability and Industry 4.0. A case study

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Keywords: Industry 4.0, sustainability, problem-oriented monitoring, agri-food;

1 Introduction

The Fourth Industrial Revolution combines a set of technological developments that allow companies to advance, simultaneously, in several improvements: digitalization of processes by IoT-Internet of Things (Birkel et al., 2019); data acquisition by sensorization (Stock & Seliger, 2016) and analysis by big data (Khan, et al., 2017); productivity improvement by robotization; material consumption reduction by additive manufacturing; and reducing the costs of analyzing improvement alternatives by simulation (Muhuri et al., 2019).

There are many success cases of application of these principles in companies but in the majority of those cases, the objectives are focused on productivity (Muhuri et al., 2019). Scientific literature presenting success stories related to Industry 4.0 and sustainability are limited (Sachin et al., 2018).

2 Objectives

This paper presents a practical success case study, which combines some of the technologies included in the Industry 4.0 strategy, to offer an efficient water management proposal in the agri-food sector. The work is framed in the European project called LIFE MCUBO.

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3 Methods

During the project a three-step methodology was developed. The demonstration activities carried out in the companies involved in the project have shown that it is not necessary to apply systematically all the methodology steps to accomplish good results. For this reason, the methodology is represented as a circle without a specific starting step for the implementation process.

4 Results

The paper presents the results derived from the application of the methodology to a case study. The company selected in this case study is dedicated to the processing and packaging of vegetables. The company has modern production facilities and a WWTP to treat the wastewater generated before sending it, through a collector, to the public water treatment plant.

The company improvement team was interested in the analysis of three improvement scenarios related to the capacity of the treatment plant which are briefly explained in the paper.

5 Conclusion

This paper has demonstrated how the use of technology connected to the equipment that manages water in the agri-food industry, and combined with simulation, reduces the environmental impact of water management. This, in turn, reduces the energy consumption associated with water treatment. The methodology developed in the MCUBO project also allows to know and reduce the main sources of water consumption in the production process.

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Circular Economy: An Analysis Framework

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This paper tries to establish the bases of a circular economy model that could capture the key elements that organizations should include to attain a certain level of circularity. This model could also form the basis for establishing a comprehensive “circularity" assessment system for a certain organization, that is still a gap in research. This research seeks to establish a preliminary model, and to study its application to the processes of three companies (two Spanish and one Dutch multinational).

Keywords: Circular economy, circular economy in Europe, process circularity, circularity assessment model.

1 Introduction

The circular economy introduces a new perspective in the economic ecosystem at the company (micro), industry (meso) and region / country (macro) levels. Economic growth is decoupled from the use of resources, polluting emissions and discarding waste at the end of the products' life. This means reducing both the need for new raw materials to feed the production process and the re-treatment of waste at the end of the products' useful life, according to the European Environment Agency (EEA, 2016). The concept of circular economy is currently a fashionable term, both among executives and academics, which is being reinforced by the policies of the European Union and China (Murray et al., 2017: Prieto-Sandoval et al., 2018). There are still few studies focused on how to measure the "level of circularity" of a product / service, of a certain company or of a supply chain. While the concept of circular economy has been widely analyzed and its application in certain companies or industries has been studied, the definition of a set of tools that allow measuring the level of circularity attained is still in an embryonic phase (Elia et al., 2017)

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2 Objectives

This study seeks to measure whether or not the proposed model captures what is actually happening in terms of circularity in processes and objectives. In other words, whether the companies that explicitly state that they are working with circular economy strategies/practices are really managing to implement circular economy, and whether they achieve in their processes, at least to some extent, certain objectives identified as specific to the circular economy.

3 Methods

Given the nature of the topics to be investigated, it was decided to carry out a case study, a method that, according to different authors, is suitable for issues that have to do with strategic decisions of business management. The information was collected through in-depth interviews with executives (one per company) of the companies studied, using semi-structured questionnaires and published information. Two Spanish and one Dutch companies (of a similar size) have been studied.

4 Results and Conclusion

The authors of this study try to test a proposed model to measure the degree of circularity within the organizations. They carried out a fieldwork in three companies (two Spanish and one Dutch), from which it is possible to infer that the objectives related to the reduction of resources consumed / reduction of emissions are widely applied in the three companies. However, the objectives related to the re-use and durability of the products are somehow neglected, and particularly the latter is almost forgotten.

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Industry 4.0 for the development of more sustainable Decision Support Tools for Agri-food Supply Chain Management

Pérez D[226], Verdecho M.J[227], Alarcón F[228]

Keywords: Industry 4.0, Environmental sustainability, Decision models, Agri-food supply chain,

1 Introduction

Environmental and social sustainability issues in Agri-food Supply Chains (ASC), are becoming very relevant mainly due to two factors. Firstly, the increasing number of public legislation rules and technical specifications to be met and, secondly, the growing awareness throughout the different ASC members (producers, processors, distributors, retailers…) mainly as a consequence of final clients concern about purchasing sustainable products and services (Pérez et al. 2019).

This fact makes that the traditional economic-driven management methods are no longer efficient and must be accommodated to these new sustainable conditions. In order to meet this new scenario, SC decision models/methods that account for environmental and social issues must be developed.

On the other hand, new technologies have emerged in the last years as a consequence of the "Industry 4.0" revolution. However, just a few works have addressed in which extent Industry 4.0 - related technologies have positively contributed to this new sustainable scenario in ASC management (ASCM).

Due to space constraints, only environmental issues are addressed, and how these technologies have brought important and relevant impacts to environmental sustainability in the practical arena allowing the development of more sustainable decision support tools for ASCM.

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2 Decision models for Sustainable ASCM

In this section a brief review about the extent in which decision models (either conceptual or operations research-based) address environmental sustainable issues in ASCM is conducted. The most addressed ones (from that review) are: crop protection, soil management, water management, animal welfare, energy efficiency, pollution control and waste control.

3 Contribution of Industry 4.0 technologies for the development of more sustainable decision support tools for ASCM

First, a classification scheme of Industry 4.0 - technologies, based on some of this paper´s authors (Boza, et al. 2019) is followed. This classification addresses 5 clusters (Internet of Things, Ciber-Physical Systems, Smart Data, Advanced Processing Analytics and Human Machines interaction), as well as their definitions/scopes and specific technologies.

Secondly, the contribution of some of these technologies to enhance the most addressed ASC environmental issues in decision models is shown. Additionally, the ASC actors (producers, processors and distributors) being the most benefited of the implementation of these technologies are also shown.

Some insights that can be pointed out are the following: Input oriented issues mostly concern to producers/farmers while output oriented (pollution and waste control) concern to the whole ASC; Some of these technologies allow the producers the so-called "precision agriculture", leading to an immediate effect in the economic benefit (no trade-off is done in this case between economical and environmental sustainability); Some of these technologies can help, specially to producers, to reduce the uncertainty in the behaviour of external variables (f.e. the reduction of the demand uncertainty allows producers to take more accurate decisions resulting in not only economical benefits but also environmental, because waste is reduced drastically).

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Ecodesign practices and their impact on the results of leading industrial companies in environmental performance. An exploratory research from a qualitative perspective

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Keywords: Product design; Environmental sustainability; Life Cycle Thinking

1 Introduction

Trying to better meet the expectations of markets that demand more environmentally sustainable products requires adapting quickly and changing the traditional environmental management model. It is necessary to take into account those environmental aspects not considered until now, generally over which the company does not have a direct influence capacity. For this, companies must incorporate the environmental variable from the perspective of the product's life cycle.

2 Objectives

The research has been focused on the analysis of the adoption of design and development practices in industrial companies, integrating the environmental variable into the process from a life cycle approach. Likewise, its impact on the company's management system, operational processes and business results has been analyzed.

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3 Methods

Being an exploratory research, a Delphi methodology has been applied, combined with a set of in-depth interviews, developed in three successive phases and based on the opinion of a group of 24 experts from different fields: 9 belonging to industrial companies from four sectoral groups (chemical, electrical-electronic, capital goods and furniture), 5 to auditing companies, 4 to consulting firms, 2 to academic experts, 3 to public institutions and one member of the *Basque Ecodesign Center* cluster.

4 Results

The growing interest of markets for more environmentally sustainable products, the search for new innovation tools or the need to be different with respect to competitors are aspects that have determined the commitment of all industrial companies to create environmentally better products. The introduction of life cycle thinking in the design and development of the product system provides a new perspective on the process and the associated processes. But integration is not without difficulties.

The marketing area or the commercial areas do not share the vision of the rest of the organization. The effort of environmental improvement implies, in many cases, a slight increase in the cost of the product, which is reflected slightly in the final price. But the customer does not appreciate the improvement of environmental behavior as an argument for purchase more on its own.

5 Conclusion

The design and development of products, including the improvement of environmental performance among their premises from a life cycle approach, contributes to improving key factors of products or services such as quality, safety, energy efficiency in the phase of use or the generation of less waste at the end of life. These improvements give the customer an image of an innovative company that is sensitive to the environment. Although in the chemical and electrical-electronic sectorial groups companies consider that it is an important differentiating factor, this improvement in the image of the product and company is not key to differentiate itself from the competition in the other sectors. It is necessary that public administrations promote measures that favor the development of "green" markets.

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