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Procurement logistic model for construction of vehicle type e-trike zero emissions

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Abstract: This article shows the results of the analysis of the different elements that constitute the input logistics of a supply chain applied to a recently released product or prototype version. This analysis establishes, through a case study applied to an electric vehicle zero emissions type e-trike, the elements that according to the consulted references should constitute the key parts for a system of provisioning or logistics of entry that ensures that the elements necessary to ensure a continuous flow of materials once the engineering design has been released for its actual production or pilot run. Graphical results have structured the interrelationship of the logistics supply model which can be extrapolated to other cases of introduction of new products or be taken partially in some existing logistics models.

Keywords: Logistics, new products, procurement, model, case study.

I. Introduction

In the last three decades, logistics has acquired a leading role for the development of companies, mainly because of the increasing opening of markets and the globalization of supply chains. Everything has led to the realization of profound changes in the structure of organizations where this discipline plays a strategic role. According to Castillo et al (2016), supply or supply chains can not be seen as a simple union of suppliers or links that help to obtain better supply costs, but they must constitute a true productivity and competitiveness strategy which includes the integration of suppliers with creative capacity for response and development of their services.

Given the new conditions of high competitiveness, proper supply chain management and logistics play a very important role (Olivos et al., 2015). Due to their importance, supply chains have been studied by various authors, Chopra & Meindil (2008) refer to this as the set of parties that are directly or indirectly involved to satisfy the need of a customer; including in addition to the manufacturer and supplier, to carriers, stockists, retailers and even to the same customers. The work of Ballou (2004) cited by Correa & Gómez (2009) defines the supply chain as the integration of a series of functional activities that are repeated along the product flow channel, converting the raw material into finished products which allows adding value to the consumer. Authors such as Terrado (2007); Uzelai (2006) and Correa & Gómez (2009) refer to this as an integral vision of three logistic elements: provisioning or logistics of entry, manufacturing or internal logistics, and distribution or logistics of exit.

The review of the literature allowed the identification of different models of supply chain, among them the one proposed by Correa & Gómez (2009) for the mining sector, these authors observe that in the countries that the concept applies it has been possible to increase productivity and competitiveness. Similarly, Arango et al. (2010) proposes to implement supply chain strategies to obtain high-performance processes in the mining industry. In Olivos et al. (2015) refers to a model designed by the Ministry of Education of Mexico that considers 16 capacities that allow to increase the competitiveness in the market. The Secretariat of Economy of Mexico proposes a verification model of the logistic capacities of the companies that will be evaluated by an organization (Calderón and Francisco, 2005). In the work of González et al. (2012) presents a methodology of logistics management and identifies 5 areas of opportunity: procurement, storage, distribution, costs and customer service, proposing logistical improvement tools aimed at reducing costs.

At present there are standardized logistic models that respond to the needs of organizations and standardize logistical processes of entry, manufacturing and distribution. The most widely used models are the SCOR (Supply Chain Operations Reference Model) model, which increases performance levels by integrating various elements of great value such as certain indicators and information and communication technologies in their development (Cano et al. 2015) and the CPFR (Collaborative Planning Forecasting and Replenishment) model, which states that the information in a CPFR model for input logistics or supply chain must come from the projection of demand that impacts on the procurement scheme implement (Escoto et al., 2007).

According to Revista Logística (2016), the demands and challenges of the future are making it imperative to mechanize, reduce waste and automate processes more and more through various technological advances and new tools, in order to reduce times, costs and human errors, increasing the agility of each of the logistics processes.

Taking as reference the different authors mentioned in this section, we have not identified that there is a model that develops a logistic scheme of provisioning for products of new creation and that integrates the basic elements that an organization should attend to ensure the constant flow of matter once it starts with the pilot runs of its product, since according to González (2005) to the extent that there is a greater geographical distance, communication or response to emerging situations between suppliers and product assemblers will be greater barriers that are found for the mutual adaptation of productive systems. In this way, it is based the need to contemplate a model of provisioning that works from the own liberation of new models.

II. Materials and Methods

The Hypothesis. Through the engineering analysis of a new product it is possible to identify the elements that must constitute a supply model that indicates the logistic products that must be taken into account to promote the relevant supply of materials in their production.

The variables to be considered in the research project are:

- Engineering design of the prototype.
- Assembly tree.
- List of parts.
- Elements of the procurement model.

For the realization of the present project the hypothetical-deductive method has been followed Baconiano, under the following stages and considerations:

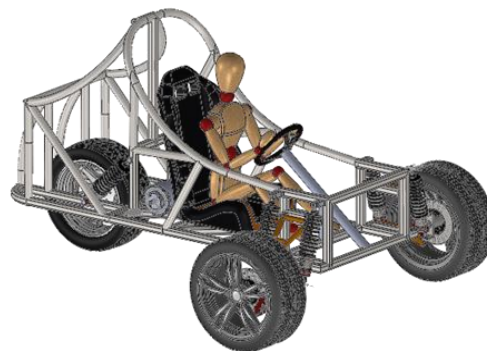
Observation: The need to integrate a procurement system to ensure the continuous flow of materials for the manufacture of a recently created (prototype) electric vehicle model (e-trike) considering the new dimensions and different material requirements with respect to existing vehicles.

Induction: Since the vehicle is a newly created model (in prototype version), the supply chain is not established for each of the parts that compose it. There may be some elements that are required of special manufacture and / or providers that have not been identified as possible restrictions.

Hypothesis: Mentioned earlier.

Experimentation: Firstly, the final and released version of the prototype product was established and on the basis of that, the assembly tree at the engineering level and the list of materials or parts were established. With these elements it was feasible to assign identification numbers to the parties and generate a list of feasible suppliers for their construction.

Figure 1. Engineering design released for electric vehicle construction type e-trike zero emissions.



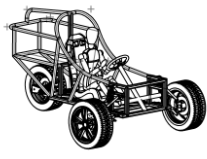
Scientific thesis or theory: The correct interaction of the variables observed in the project can be constituted in a procurement model that identifies the complete chain that provides the necessary materials for the construction of e-trike vehicles under the released engineering version.

In order to identify the parts that make up the material requirements in the present case study, the engineered design of the vehicle to be built was determined, the design being released (Figure 1). Said model refers to an electric vehicle type e-trike zero emissions.

Once the prototype version of engineering has been released and through the analysis developed with the use of electronic technology (SolidWorks), a list of the materials composing said design was obtained (Table 1) and the assembly shown in figure 2.

Table 1. Bill of materials using SolidWorks.

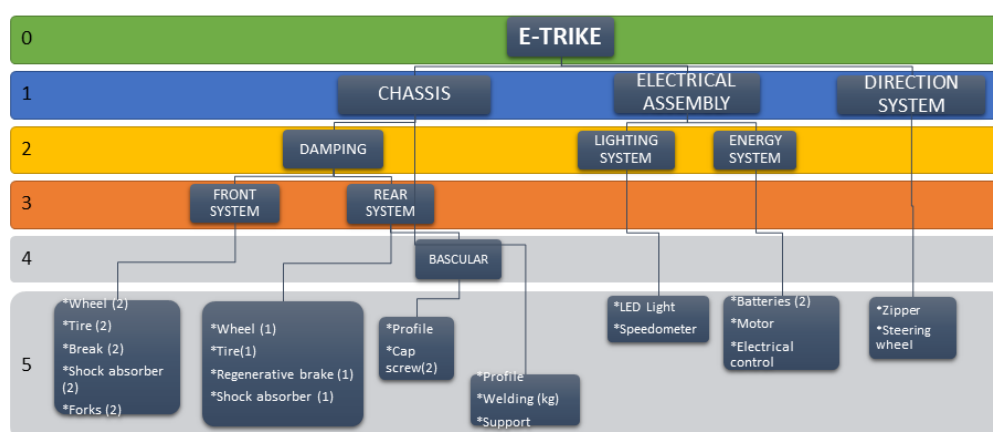
	4	3	2	1	
	N.º DE ELEMENTO	N.º DE PIEZA	DESCRIPCIÓN	CANTIDAD	
F	1	chasis		1	F
	2	asiento		1	
	3	sus20mm		8	
	4	Wishbone Upper Front		2	
	5	Wishbone Lower Front		2	
	6	Hub Carrier		2	
	7	Disk (brake)		2	
E	8	BMW M6 Coupe Wheel/Tyre		2	E
	9	Shock Absorber Front		3	
	10	19 Inch Wheel Assembly		1	
	11	eje trasero		1	
	12	perno sus trasera		2	
	13	soporte llanta trasera		1	
D	14	susdoble17mm		2	D
	15	Disk (brake) Assembly		1	
	17	direccion		2	
	18	Kormány assembly		1	
	19	volante		1	



SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOURBONICAL: UNIBELL: ANGULAR:	ACABADO:	REBARBAR Y DOVIER ARISTAS VIVAS	NO CAMBIE LA ESCALA	REVISION
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Based on the elements found in the antecedents of the logistic models and after identifying that there is no provisioning model as such that defines the parts that must be integrated into the logistics of entry for products of recent creation.

Figure 2. E-trike type vehicle zero emission assembly tree.



III. Results

Through observation and consultation it was identified that the systems approach posed by Ludwin Von Bertalanffy (1920) constitutes an optimal model within which the phases or stages of the input supply or logistics model can be identified. This model is described in figure 3. Next, the elements proposed to constitute the procurement model are defined. Elements of "entrance" in the raised model:

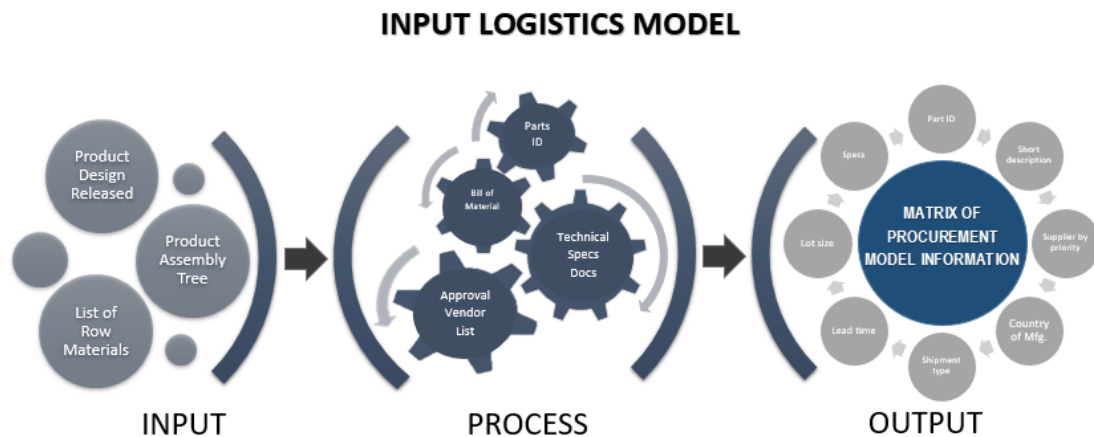
Design freed from the product. The latest revision of the product to be manufactured (e-trike) is considered. If for any reason some change in any of the parts of the design is made, it is suggested that the entire design be analyzed since there may be an impact on size, functions or characteristics in any part that is not considered as a direct

relation. The provisioning model will then be valid only for the version of the product that has been released or for which it has been made.

Material's list. It is a detailed list of the parts that will constitute each of the assemblies and subassemblies that constitute the final model. In this list the common parts that are part of more than one subassembly must be identified and in the same way the parts of special manufacture.

Assembly tree. It refers to the graphic description of the level of assembly of each element constituting the final product. This element in the logistics of entry allows to graphically identify the number of manufacturing stages that will be followed to arrive at the final manufacture of the product and in the same way, the purchased pieces that integrate each level will be reflected in the list of materials.

Figure 3. Input logistics model for E-trike type vehicle zero emission assembly.



Elements of "process" in the model:

Assignment of identification to each part. As identified in the theoretical basis of this article, the assignment of an identification code for each raw material is a fundamental part that results in the technification and automation of control systems with the use of information technology that favor efficiency of the chain in its entirety. In the same way, at the data logging level, the ID or identification of the parts is the additional element that converts a BOM defined in the entry section into a material bill which is described below.

Bill of Materials (BOM). It originates based on the assembly tree and the material list by adding it already the identification code that has been defined and identifying the number of repetitions that a part is included within each one of the assemblies and / or subassemblies to determine its use and identify the total amount in the construction of a product. The material bill is constituted as a key product for the process logistics in the manufacturing since it is the fundamental reference for the planning of the material requirements and the master plan of production in a manufacturing company.

Definition of fiches or technical assignments. The existence of technical data sheets facilitates the development of suppliers for both special manufacturing parts and common assembly parts. It must contain the technical specifications of dimensions, materials, colors, uses, resistance, presentation, special environmental conditions, handling, etc. which must be considered for a single part or for a subassembly consisting of several parts. The data sheet ensures reliability and repeatability even when using different suppliers and must exist for each of the elements described in the assembly tree.

Construction of list of approved suppliers. It is the result of a scheme of evaluation and development of suppliers conforming a documentary reference that facilitates the work of provisioning, promotes the continuous improvement and the quality of the acquired parts. A supplier that is part of the list of approved suppliers has been verified as to who knows the parts needed, knows its technical specifications and has the necessary control systems installed to ensure the technical and assembly requirements of the product.

IV. Conclusion

With regard to the hypothesis raised, we can conclude that if it was possible to identify the elements that should constitute a supply model that indicates the logistics products that must be taken into account to promote the relevant supply of materials in their production, however the model itself it does not ensure the constant flow of material or its existence, but only points out the elements that provide a reliable control scheme for whoever manages the logistic supply system.

It is considered that the present case study could be extrapolated to the different turns of the small and medium enterprises that contemplate some system of production of tangible goods since its elements, still in simple

processes, contemplate are preventive fires that help to assure a logistics of manufacturing or internal with reliable supplies.

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