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# Comprehensive Management model for increasing the competitiveness of small and medium artisan jewelry enterprises in Peru

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**Abstract.** Today, many small and medium enterprises (SMEs) either go out of business or see their growth being stalled due to poor activity management and organization, which is why they are often unprepared to engage against large companies leading their competitive markets. This study aims to develop a comprehensive management model, exclusively designed for SMEs in the jewellery sector, which may encompass all areas that create value and make them competitive. The development of this comprehensive management model was deployed in 21 steps classified into three tiers based on three major philosophies. This study uses lean manufacturing to identify activities that add value and reduce waste, and lean green was used to provide the environmental care and culture approach required for a friendly and fair workplace environment. The selected scenario is a jewelry workshop, wherein techniques and tools were completely applied and yielded a 20% increase in operating performance and a 15% increase in annual return.

## 1. Introduction

According to the Jewelry and Goldsmith Analysis [1], the sector's exports experienced a 30% increase against the previous year, with a total revenue of US\$ 121.3 million. Although these numbers represent a great contribution to the Peruvian economy, they are considered as low yield as, according to the Institute of Mining Engineers of Peru [2], Peru contains 24% and 5% of the world's silver and gold reserves, respectively, but only less than 1% is used for manufacturing jewellery [3], while the foreign market generates US\$ 8,800 million per year. This situation has undoubtedly affected the growth of businesses within the sector.

The business landscape comprises 1,728,777 companies, with 99.5% corresponding to micro and small companies and 0.5% representing large companies [4]. According to the National Business Survey, only 20% of the micro businesses reported having a business plan in place when they began

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operating, while the remaining 80% usually disappear from the market within a year, as opposed to large companies that remain in business. Many SMEs decide against introducing management within their work guidelines, since these businesses are mostly unaware that applying knowledge in the management, organization, planning, and control of their operations can really create a difference in their results and make them more competitive in the national and international markets. This same scenario is experienced by many local organizations within the country.

All previous works describe comprehensive management models for large serial production line companies, a scenario that does not favour the Peruvian jewellery market. Moreover, no model or research study has even been validated in operating SMEs. Finally, none of the comprehensive management models developed has been applied in the jewellery industry.

Therefore, this study proposes a 3-tier model: business units, comprised by the different areas of the company; technological support, meaning the software used for supporting operations; and management, which is responsible for planning, organizing, directing, and monitoring each business unit based on the three fundamental model philosophies: lean manufacturing, lean green, and culture.

## 2. State of The Art

For the literature review, we focus on studies that might contribute to the development of different company areas. Starting with sales, and since businesses would not exist without sales, companies must plan, develop, and manage the various channels available to the customer for acquiring the product or service they offer. The multiple-equation model, as proposed by Isaac, Harald, and Scott [5], quantifies the impact and magnitude of the online and offline sales channels of the company, in terms of the expenses generated by both channels. Similarly, Abhishek, Jerath, and Zhang [6] propose a game theory model on reselling against the sales agency. This model also assesses which of the following channels offers the greatest benefits to companies: online sales, offline sales, direct sales, and agency resales.

On the other hand, like with any other jewellery manufacturing company, the production area, where the added value is created for the product, must also be considered. To control the production flow in craft workshops, we used the Cobacabana technique, developed by Matthias Thürer [7], as an alternative proposal to the Kanban technique. Unlike Kanban, Cobacabana adapts to variable workflows, where multiple activities must be performed at the same time, besides assessing delivery times by reducing production delays. Another proposal developed by Mhargareta Gansterer [8] studies aggregate planning impacts on a make-to-order (MTO) environment through a comprehensive hierarchical production planning (HPP) model, which combines the use of a linear mathematical model with a discrete event simulation model capable of generating a positive effect on saving money and resources, planning, and on-time deliveries. In the same manner, Randhawa and Ahuja [9] seek to improve quality, production, cost optimization, moral values, and work culture in general for the manufacturing industry through the successful implementation of the 5S tool.

Moreover, since this is a MTO environment, the activities of the workers must be effectively managed to provide quick response times. For these purposes, Nallusamy developed a comprehensive production management mode to address downtime in companies by applying single-minute exchange of die (SMED) and Kaizen, common lean manufacturing tools, at each workstation. Similarly, Saravanan's lean approach considers that a successful SMED implementation is able to increase productivity and reduce downtime for both machines and operators. On the other hand, author Suganthini Rekha argues that value-stream mapping (VSM) identifies manufacturing wastes to determine and eliminate actions that do not add value, which in turn improves company productivity. Finally, Bocken [10] developed a study that uses VSM to explore for a broader and more sustainable business thinking, which provides a conceptual link to the activities of the company, such as design, production, supply chains, relationships, and distribution channels.

In this light, supply chain management (SCM) has become a key strategic tool for improving performance and guaranteeing the competitiveness of companies in the market [11]. For this reason, Macchion and Fornasiero assessed different configurations based on a discrete event simulation by

emphasizing supply chain performance, in terms of delivery times and supply chain inventory volumes, when standard production becomes custom production. On the other hand, Antmann developed a mixed integer linear programming technique that proposes integrating environmental responsibility to the supply chain. Finally, Jukka Hemilä and Jyri Vilko [12] conducted a study based on qualitative interviews and expert group sessions, which provides a holistic perspective of the factors affecting new business development for the service supply chain.

Ultimately, all companies always strive to gear themselves toward continuous improvement in their operations and a constant renewal of goals and objectives to avoid lagging in the market. Continuous improvement is defined through multiple methodologies aimed at removing work module defects, adding value to services or products, and implementing a new work philosophy.

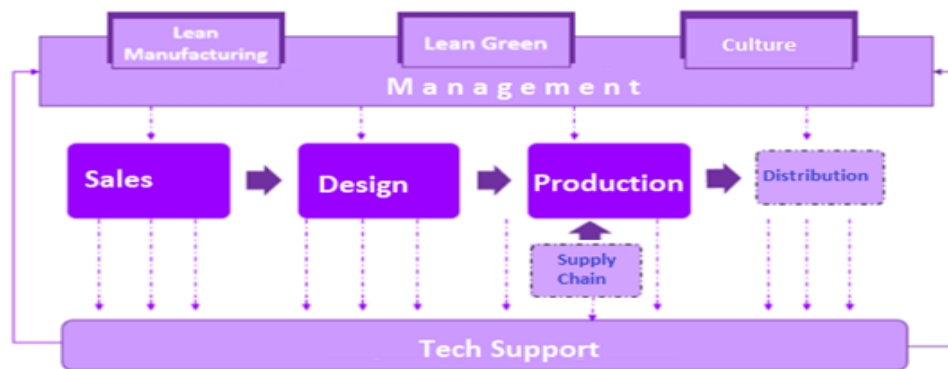
### 3. Research method

#### 3.1. Operations in Small and Medium Artisan Jewellery Enterprises

The business units of small and medium artisan jewellery enterprises are divided and developed as follows: sales are made from cash points and face to face. Preliminary jewellery designs are outsourced or drawn by hand, based on the item requested and the urgency. The manufacturing process includes the following operations: rolling, cutting, sanding, polishing, washing, and drying. The procurement process, as well as the delivery of the finished products, may be performed by staff members or, in some cases, outsourced. Here technological support is not usually a priority for SMEs because companies usually do not record the data generated by each business unit.

#### 3.2. Comprehensive Management Model for Small and Medium Artisan Jewel Enterprises

The proposed model divides comprehensive management for small and medium artisan jewellery enterprises into three tiers; the first layer is business units, such as sales, design, production, distribution, and supply chain areas, with the latter two usually being outsourced. The second layer is technological support and the third layer is management, which includes three philosophies: lean green, lean manufacturing, and culture. These philosophies serve as comprehensive management



**Figure 1.** Comprehensive management model

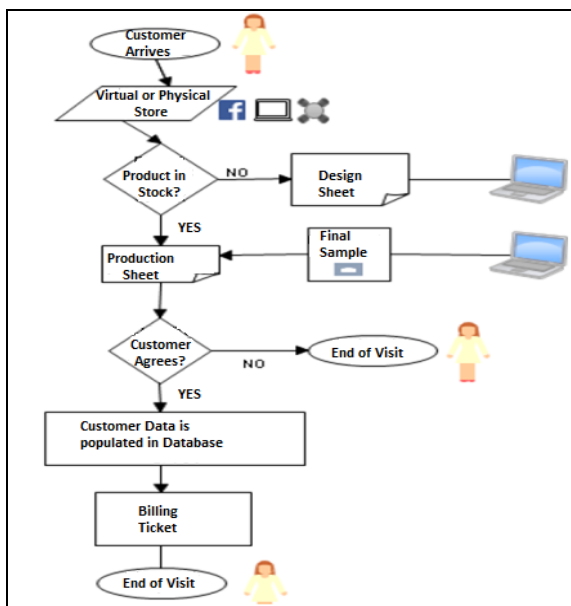
pillars for the business units of the proposed model. The model ultimately aims at streamlining SME management and increasing their competitiveness in the market.

#### 3.3. Operation of the Proposed Model

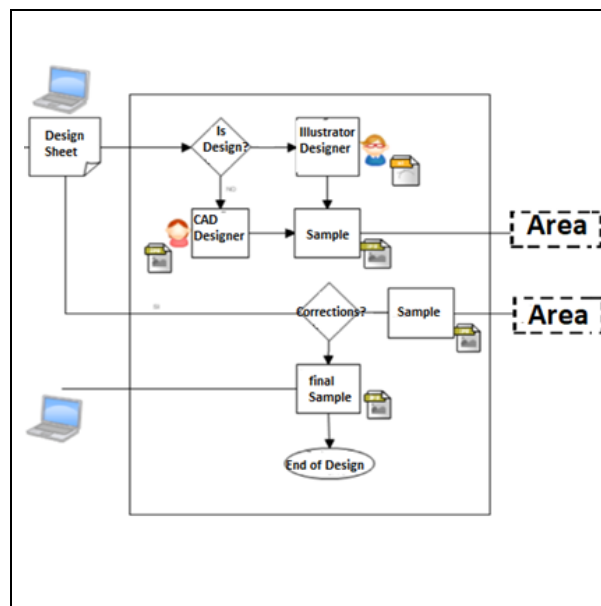
**3.3.1. Comprehensive Sales Area Management.** For the management of the sales area, a flowchart reveals the travel path for staff members, customers, and information. On this basis, help tools were designed for the online and physical store salespersons, such as sales speech and the design *sheets*, job profiles, and sales procedure manuals, which facilitate sales closings, increase sales, and proper storage of daily information. Daily information is mainly comprised of daily reports, including daily

sales, sales by products, sales by seller type, sales margin, and access to customer information. Based on the results from these reports, the company will be able to set new objectives, follow-up on indicators, and assess its continuous improvement. (Figure 2).

**3.3.2. Comprehensive Design Area Management.** For the management of the design area, a flowchart reveals the travel path of customer designs from one area to the next, up to proper information storage. Based on this, the following help tools were created for designers: design sheets and job profiles to facilitate design control, staff member results, and proper storage of daily information. Here, daily information is mostly comprised of daily reports, including number of designs, number of modifications per order, appointed designer, costs, and design database. Based on the results from these reports, the company will be able to set new objectives, follow-up on indicators, and assess its continuous improvement (see Figure 3).

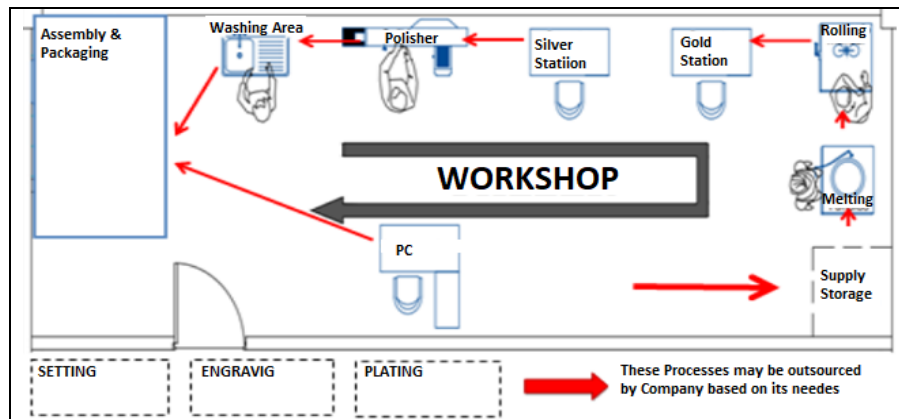


**Figure 2.** Sales unit flowchart



**Figure 3.** Design unit flowchart

**3.3.3. Comprehensive Production Area Management.** For the management of the production area, a layout denotes the jewelry manufacturing travel path, from the moment it arrives at the workshop to its final packaging. Based on this, the following help tools were created for artisans: production sheet, Kardex, aggregated plan, and job profiles, which facilitate managing orders, staff member results, and proper storage of daily information. Here, daily information is mostly comprised of daily reports, including daily production, type of jewels produced, weight per jewel, time per jewel, appointed staff member, costs, and manufactured product database. Based on the results from these reports, the company will be able to set new objectives, follow-up on indicators, and assess its continuous improvement (Figure 4).



**Figure 4.** Proposed layout

**3.3.4. Model Implementation.** An implementation guide was developed to facilitate model execution. Model implementation consists of four stages:

**First stage: Plan:** Step 1: Company Diagnosis, Step 2: Define objectives and goals, Step 3: Create the work plan, Step 4: Submit work forms to the Board, Step 5: Perform integration and company commitment activities.

**Second stage: Organize:** Step 6: Work group organization and leader selection by area, Step 7: Perform toolbox talks on new tools, Step 8: Assign tools for working, Step 9: Establish a Company support system, Step 10: Transformation of information.

**Third stage: Lead:** Step 11: Sales area management, Step 12: Apply designated tools, Step 13: Design area management, Step 14: Apply designated tools, Step 15: Production area management, Step 16: Apply designated tools.

**Fourth Stage: Control:** Step 17: Reporting by area, Step 18: Continuous improvement.

#### 4. Case Studies

This section uses a case study to discuss the role of the MGI model in SMEs. The case study was conducted with the specialized staff members from an artisan jewelry shop. The objective of this case study is to validate the model presented in the research method section for a successful MGI model implementation in a small company, as previously discussed in Section D. Model.

##### 4.1. Artisan Jewellery Company

To study the application of the model presented in Section 3, we selected the Expresat Artisan Jewelry (JAE) company, established in mid-2013 in downtown Lima, Peru. JAE is a small custom gold and silver jewelry manufacturing company with 12 workers and annual revenue of 80 thousand soles. Besides their MTO shop, the company also runs physical and online stores, where they exhibit their products, such as rings, bracelets, earrings, and necklaces. Further company details are provided in the following section.

##### 4.2. Analysis: The JAE Case

In this section, the company is further characterized through interviews and analysis. The model presented in Section 3 has been used to assess JAE's status in terms of the MGI application. This research study is based on the company data collected through the application of the MGI model supported by interviews with the general manager and assistant manager of the company. These interviews have focused on the company's processes, management support, strategy development, and the integration of areas with supporting technology for the application of the MGI model in a SME.

#### 4.2.1. Management by JAE Business Unit

##### Comprehensive sales area management

JAE serves more than 100 customers, with ages ranging between 18 and 45. Customer satisfaction means that the company has successfully met the requirements of its customers with quality products, competitive prices, and on-time deliveries. For the sales area, training was performed on virtual reports and tools such as the sales speech and the procedure manual and the design sheets. The company was asked to describe area progress in a virtual report containing information on the number of sales, number of abandoned sales, costs per product, and the types of products sold. At the same time, indicators were improved with support from the comprehensive sales management tools. In general, the company managed to increase its sales and reduce its percentage of abandoned sales and goals. Moreover, the sales force received support through the management tools while the MGI model was being executed.

**Table 1.** Sales area results table.

<b>RESULTS AND BEHAVIORS CONTROL</b>	<b>Before</b>	<b>After</b>
<i>NO. UNSATISFIED CUSTOMERS</i>	<b>91</b>	<b>2</b>
<i>% ABANDONED SALES</i>	<b>15%</b>	<b>1%</b>
<i>% GOALS ACHIEVED</i>	<b>50%</b>	<b>107%</b>
<i>SALESPERSONS PER STORE</i>		
<i>% COMPLAINTS PER SALESPERSON</i>	<b>27%</b>	<b>2%</b>

4.2.2. *Comprehensive JAE Design Area Management.* For the design area, new designers received training on tools such as the design sheet, the procedure manual, and the design storage. The company was asked to describe area progress in a virtual report containing information on the number of designs, number of reprocesses, costs per design, times, and staff members in charge. In general, the company managed to implement the area and its tools, supported by teamwork. These cultural factors contributed to eliminate obstacles and reduce previously calculated implementation times.

##### Comprehensive JAE design area management

For the design area, new designers received training on the selected tools, AutoCAD and Adobe Illustrator, in addition to training on tools such as the design sheet, the procedure manual, and the design storage. The company was asked to describe area progress in a virtual report containing information on the number of designs, number of reprocesses, costs per design, times, and staff members in charge. In general, the company managed to implement the area and its tools, supported by teamwork. These cultural factors contributed to eliminate obstacles and reduce previously calculated implementation times. The reasons for introducing technological support to management were to improve efficiency, reduce costs, improve design and sales times, and improve company efficiency to become competitive at local and international level.

##### Comprehensive JAE production area management

Before starting with the production changes, the aggregate production plan was developed. This tool helped us determine the type of company production, forecast future demands, and define production strategies to meet demands.

It must be considered that during the production area implementation, the company moved its workshop to the downtown area of the city, thus enabling us to apply the SMED tool for reducing workstation changeover times. Our layout follows the same jewelry manufacturing scheme: the first machine placed was the laminator, where the manufacturing process starts. Next, two folders—gold and one silver—were settled and a tool rack was placed between them. Then, the polishing machine

was placed, followed by a washing and a jewelry assembly table. During the machine layout distribution, there were many changes to test how comfortable it was for operators to move around and procure the required tools. Once the final workshop layout was defined, we proceeded to organize the materials, supplies, products, and tools used in the production processes. For these purposes, we used the 5S System, a lean manufacturing tool. This tool has the following steps: sort and eliminate, straighten and set, shine, standardize for visual control, and sustain discipline and habits. Below, the activities developed for each variable are detailed.

**Sort:** There was a sorting process for all tools and materials based on their lifespan. Moreover, waste was eliminated from the surrounding areas to the work folder since they only filled the space and obstructed the production process.

**Straighten:** New racks were acquired for the production instruments. Furthermore, compartments were added to the production table for storing the basic materials used throughout the day. The work folder was also conditioned to keep the melting and acid hoses in order.

**Shine:** Use protocols were established to maintain the polishing machine in proper operation. This machine should be cleaned before use and after use.

**Visual Control:** Colored labels were placed to divide workshop components: blue for the tools, red for the three raw materials, and green for materials in general. On the other hand, purple was used for finished products ready for delivery.

**Discipline and Habits:** Rules were created, and notices were placed in work areas to ask employees to preserve the changes implemented and for creating the habit of maintaining the workshop organized. All employees were also asked to leave their workstations in order, clean all machines, store waste in the designated containers, and dispose the garbage accumulated during the day. For better control purposes, a checklist detailing the spaces that must be cleared at the end of the shift was developed.

The critical production process tool is Cobacabana, which, as per the state of the art, indicates order reception and delivery dates, and their corresponding priority. At the same time, we proposed a special production sheet for the products offered by the company, wherein jewel designs, and details such as weight, chain type, setting, engravings, and business hours, are specified.

## 5. Results

Next, the main results of the comprehensive management model are reported based on the selected metrics and data extracted from area reports (Table 2).

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**Table 2.** Implementation results for company “X”

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MANUFACTURING TIMES & COSTS FOR A NECKLACE WITH NAME							
No.	Description	Time 2017	Time 2018	Optimization In Minutes	Cost in Soles 2017	Cost in Soles 2018	Savings in Soles
1	Supplies	1440	0	1440	20	0	20
2	Transport Supplies to Manufacturing Area	60	0	60	20	0	20
3	Design	1440	5	1395	1	3	-2
4	Rolling	10	0	25	6	0.06	6
5	Cutting	30	15	10	3.9	1.95	1.95
6	Sanding	10	3	7	1.3	0.39	0.91
7	Polishing	15	3	7	1.95	0.39	1.56
8	Washing & Drying	15	3	7	1.95	0.39	1.56
9	Assembly	3	1	2	0.39	0.13	0.26
10	Finishing	5	3	2	0.65	0.39	0.26
11	Supervision	0	3	-3	0	0.39	-0.39
12	Labeling Packaging	10	3	7	1.3	0.39	0.91
TOTAL		3038	39	2959	58.44	7.48	51.02

## 6. Conclusions

In summary, this study evidences the effectiveness of the comprehensive management model applied in a jewelry manufacturing company, not only increasing sales but also productivity and quality assurance in strategic and operational works. On the other hand, the following conclusions were reached based on the tools and programs implemented.

The development and implementation of the online sales and physical store channels facilitated the work for sellers, offering greater sales opportunities, and strengthening customer relationships. Similarly, the positive use of sales force incentive strategies stimulated area staff members, increasing up to 80% over the sale obtained against the pre-implementation scenario.

The use of lean tools progressively increased productivity and labor efficiency, fully complying with the implementation program within the times allocated in the production area. Moreover, the organization and layout changes applied to the production workshop were critical to strategically connect workstations among themselves and prevent delays from unnecessary movements. Finally, the Cobacabana tool provided greater control of completed orders, eliminated downtimes due to lack of information, and installed quality assurance through a product seal of conformity before shipment.

The internationalization of the design area greatly reduced the time spent in the design in more than 90%, going from a 24-hour waiting time to just 30–60 minutes, thus adding value to the product in terms of customer service and response times.

Further, a relationship was created between the three management philosophies and company staff members. Lean manufacturing was deployed as an inclusive methodology, which encourages all participants to generate value for the company. Similarly, its inclusive nature also creates culture, which leads us to the second philosophy, wherein the organizational climate and behaviors were fostered. This prompted all staff members to work together, provide mutual support, and identify themselves with the values and missions of the company, which was evidenced as profitability levels increased. Finally, the green philosophy generated operator awareness in terms of their work and the possible effects caused by their operations.

## 7. References

- [1] ADEX 2018 Análisis del Sector Joyería y Orfebrería. Obtenido de Retrieved from: [http://contenido.adexperu.org.pe/descargas/estadisticas\\_sector\\_joyeria.pdf](http://contenido.adexperu.org.pe/descargas/estadisticas_sector_joyeria.pdf)

- [2] IIMP 2018 Instituto de Ingenieros de minas del Peru. Obtenido de Retrieved from: <http://www.iimp.org.pe/actualidad/peru-cuenta-con-el-5-delas-reservas-mundiales-de-oro-y-24-de-plata>
- [3] ADEX, A D 2018 ADEX. Recuperado el 6 de 09 de 2018, de Retrieved from: <http://www.adexperu.org.pe/notadeprensa/en-peru-se-destina-menos-del-1-de-oro-y-plata-a-la-elaboracion-de-joyas/>
- [4] PRODUCE 2015 Anuario Estadístico Industrial, MYPE y Comercio Interno. Recuperado el 30 de abril de 2018, de Retrieved from: <https://www.produce.gob.pe/documentos/estadisticas/anuarios/anuarioestadistico-mype-2015.pdf>
- [5] Dinner I M, Van Heerde H J and Neslin S A 2013 Driving Online and Offline Sales: The Cross-Channel Effects of Traditional, Online Display, and Paid Search Advertising *J Mark Res* **50** 527-545.
- [6] Abhishek V, Jerath K and Zhang Z J 2016 Agency Selling or Reselling? Channel Structures in Electronic Retailing *Manag Sci* **62** 2259- 2280
- [7] Thürer M, Land M J and Stevenson M 2014 Card-based workload control for job shops: Improving COBACABANA *Int. J. Prod Econ* **147** 180- 188.
- [8] Gansterer M 2015 Aggregate planning and forecasting in make-to-order production systems *J Prod Econ* **170** 521-528
- [9] Randhawa J A 2017 An investigation into manufacturing performance achievements accrued by Indian manufacturing organization through strategic 5S practices *Int J Prod Perform Manag* 754 - 787.
- [10] Bocken N M P, Rana P and Short S W 2015 Value mapping for sustainable business thinking *Int J Prod Res* **32** 67-81.
- [11] Zare R, Chavez P, Raymundo C, Rojas J 2018 Collaborative Culture Management Model to Improve the Performance in the Inventory Management of a Supply Chain *Congreso Internacional de Innovacion y Tendencias en Ingenieria, CONIITI 2018 – Proceedings*, 8587073.
- [12] Hemilä J and Vilko J 2015 The development of a service supply chain model for a manufacturing SME *Int J Logist Manag* 517-542.