# THE CONTENT OF MANUFACTURING STRATEGY: A CASE STUDY IN COLOMBIAN INDUSTRIES

# EL CONTENIDO DE LA ESTRATEGIA DE MANUFACTURA: UN ESTUDIO DE CASO EN LAS INDUSTRIAS COLOMBIANAS

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**ABSTRACT:** Manufacturing strategy (MS) is a long-term plan for production and operations system aimed to support the company's corporate strategy. The content of MS addresses the goals and strategic decisions to face competition. Despite the number of contributions on this subject, few studies have been conducted in the Colombian context. Therefore, this article shows the results of a study undertaken in 36 Colombian companies addressing the three main components of the MS content: competitive priorities, strategic decision areas and the management's approach to manufacturing. The results allow two groups of companies with different performance level to be identified, as well as the relationship of this performance with strategic decision areas and the management's approach to manufacturing.

**Key words:** Manufacturing strategy, competitive priorities, strategic decision areas, manufacturing management approaches, Colombian industry.

**RESUMEN:** La estrategia de manufactura (EM) consiste en un plan a largo plazo para el sistema de producción/operaciones diseñado para apoyar la estrategia corporativa de la compañía. El contenido de la EM aborda las metas y las decisiones estratégicas necesarias para enfrentar la competencia. A pesar del creciente número de publicaciones sobre este tema, pocas investigaciones han sido realizadas en el contexto colombiano. Por tanto, el presente artículo expone los resultados de un estudio realizado en 36 empresas colombianas que aborda los tres componentes principales del contenido de la EM: las prioridades competitivas, las áreas estratégicas de decisión y los enfoques de gestión para la manufactura. Los resultados permitieron detectar dos grupos de empresas que exponen diferentes niveles de desempeño así como las relaciones de dicho resultado con las áreas de decisión estratégicas y los enfoques de gestión de manufactura.

**Palabras clave:** Estrategia de manufactura, prioridades competitivas, áreas de decisión estratégica, enfoques de gestión para la manufactura, industria colombiana.

## 1. INTRODUCTION

Due to the growth of global competition and its effects on international operations, greater efforts in strategic planning have been undertaken in order to ensure the long-term survival of companies. From the strategic planning point of view, a topic of great interest in the last four decades has been the new role of the manufacturing system in the company's competitive strategy.

Traditionally, the manufacturing system has been treated as a part of the company whose role is limited merely to address technical issues of production. However, due to the current competitive context, many companies have understood that the manufacturing system can become a powerful competitive weapon to improve their performance in the market. In this way, Manufacturing Strategy (MS) can be defined as a long-term plan for the production and operations system aimed to support the company's corporate strategy. Despite the fact that this topic has been widely addressed in many scientific investigations, few studies on the subject have been conducted in the Colombian context.

Therefore, this article shows the results of a study undertaken in 36 companies located in the Colombian central-western region, aimed at analyzing the content of their manufacturing strategies. Specifically, the

study addressed three main aspects: a) the competitive priorities; b) the strategic decision areas and c) the management's approach to manufacturing. According to the findings, two clusters of companies were identified. The first cluster (leader group) showed significant strengths in his MS and better performance. The second cluster (lagging group) showed important weaknesses in many areas and lower performance. Likewise, the results revealed that 8 strategic decision areas were directly related with the companies' performance levels; however, the assessment of management's approach to manufacturing shows that none of them had positive impacts on the companies.

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## 2. LITERATURE REVIEW AND HYPOTHESIS

The formal study of MS comes from the original contributions of Wickham Skinner [1, 2] and, since then, it has become a topic of growing interest in the scientific community over the past 40 years. The MS seeks to assign a strategic role for manufacturing systems beyond the traditional technical role given in the past [3]. Therefore, MS can be understood as a long-term plan for manufacturing systems containing decisions and strategic actions aimed to support the whole company's strategy [4].

The MS addresses two main elements: the formulation process and the content. The formulation process establishes how to proceed in order to strengthen and deploy the capabilities of manufacturing systems according to the company´s long-term strategy [5]. The content addresses the goals and strategic decisions to face the competition. Traditionally the content encompasses two main aspects: competitive priorities and strategic decision areas [3]. However, we consider that it is necessary to take into account a third aspect: the management's approach to manufacturing. These three topics, given the purpose of this article, are discussed in greater detail below.

### 2.1. Competitive priorities

The competitive priorities are the goals for manufacturing systems in order to increase the company's competitive advantage [6]. Competitive priorities have been named in different ways such as manufacturing goals, manufacturing tasks and manufacturing outputs, among others [7].

In the 80's, Miller [8], proposed a group of seven competitive priorities to guide the manufacturing system toward a better performance in the market: low cost, high quality, high service level, broad product portfolio, service attitude, product innovation and reaction to change. Due to the growth of international trade and the consequent increase of competitors, during the decade of the 90s new competitive priorities such as delivery, flexibility, and environmental responsibility became more relevant [9]. At present, there is a certain level of agreement on six main competitive priorities: cost, quality, flexibility, delivery, service and environmental responsibility [3,10-12].

In the Colombian context, few studies have been conducted regarding competitive priorities. According to the literature review, only one contribution in the metalworking sector [7,] and two in the apparel sector [13,14] were found. In the contribution of Sarache et al. [13] the so-called effectiveness indicator (*EI*) was developed. This indicator allows the performance assessment of manufacturing systems, based on their outcomes in competitive priorities. Because *EI* was applied in the present study, the mathematical expression is shown in equation 1.

$$EI_i = \sum_{j=1}^{n} W_{ij} C_{ij} \quad (1)$$

Where:

$EI_i$: Effectiveness of manufacturing system at Company *i*.

$W_{ij}$: Weight of competitive priority *j* at company *i*.

$C_{ij}$: Rating of competitive priority *j* at company *i*.

### 2.2. Strategic decision areas

The strategic decision areas for manufacturing systems greatly affect the company's survival. These are divided in structural and infrastructural decisions [3, 15, 16]. Structural decisions are characterized by their long-term impact not only because they require high investment but also because they significantly affect the manufacturing system's capabilities. In turn, infrastructural decisions address the management processes in diverse company areas in order to support

the manufacturing system [17]. Table 1 shows the structural and infrastructural decisions according to various contributions.

Based on the above, the performance and orientation of MS depends on two main aspects: the performance in competitive priorities and the way companies adopt to focus their strategic decision areas.

**Table 1.** Strategic decision areas in manufacturing

| Structural decisions | Infrastructural decisions |
|---|---|
| Processes | Human resources |
| Capacity | Products |
| Facility location | Planning and control |
| Facility layout | Organization |
| Supply/distribution | Work study |
| | Quality management |

Source: Author´s elaboration based on contributions of [3],[5],[16] and [17].

In this sense, the hypothesis 1 and 2 are as follows:

**Hypothesis 1.** There are different profiles of companies according to their EI and the orientation of to their strategic decision areas.

**Hypothesis 2.** There is a relationship between the performance in the strategic decision areas and the EI achieved by companies.

### 2.3. Management's approach to manufacturing

Companies have adopted various management approaches that must be taken into consideration as a part of the content of manufacturing strategy. From a broad perspective, these approaches are based on management philosophies aimed to improve effectiveness and performance of production systems. The most recurrent management's approach to manufacturing have been Just in Time (JIT) and Total Quality Management (TQM) [18,19], Total Productive Maintenance (TPM) [20], Theory of Constraints (TOC) [21,22], 5s and Kaizen [23,24]. Such approaches are not applied in an isolated way, but rather they act in an interconnected manner which commonly occurs between TPM, TQM and JIT or between TQM and Kaizen [25]. These considerations support the hypotheses 3 and 4.

**Hypothesis 3.** There is a relationship between the implementation level of management's approach to manufacturing and the EI achieved by companies.

**Hypothesis 4.** The management's approach to manufacturing adopted by companies are applied in a complementary way.

## 3. METHODOLOGY

### 3.1. Population and sample

The study was conducted in large and medium-sized industrial enterprises located in the Colombian central-western region. According to the government statistical reports, the population was composed of 48 companies. The survey was sent to production managers achieving a response rate of 75% (36 companies). Based on the contribution of [26], 11 semi-structured interviews were conducted in order to collect qualitative data to enrich the study outcomes.

### 3.2. Variables and measures

In this research, three groups of variables were addressed: competitive priorities, strategic decision areas and implementation of manufacturing management approaches. Table 2 summarizes the operationalization of variables.

**Table 2.** Variables, dimensions and measures used in the study

| Variables | Dimensions | Measurement |
|---|---|---|
| Competitive priorities | Cost, quality, flexibility, delivery, service and environmental responsibility. | Performance assessment for each competitive priority regarding to the company's main competitor (Likert scale 1-5). |
| | Effectiveness indicator (EI) | Application of equation 1 |
| Strategic decision areas | Processes, capacity, facility location, facility layout, supply/distribution, human resources, products, planning and control, organization, work study and quality management. | Level of performance in every decisión areas according to the context, business requirements and market expectations (Likert scale 1-5). |
| Manufacturing management approaches | JIT, TQM, TPM, TOC, 5s and Kaizen | 0: not used.<br>1-5: according to the level of implementation/functionality. |

### 3.3. Tests of validity and reliability

The survey content was structured according to contributions obtained from the literature review; also, two experts evaluated it. The internal consistency, tested by Cronbach's alpha coefficient, was 0.943, showing a high level of reliability [27]. By applying an analysis of variance among companies that responded to the survey and those that did not, the sample consistency was tested ($F = 0.004$, P-value $\geq 0.05$ (0.950)). These results also were verified by the Mann-Whitney U test, repeating the process for subsets of medium and large enterprises ($U = 100$; P-value $\geq 0.05$ (0.094); $F = 0.653$ for medium enterprises; $F=1.681$ for large enterprises; P-value = 0.429 for medium enterprises and 0,209 for medium enterprises).

Likewise, in order to improve the survey content, a pilot test in three companies was carried out. Finally, convergent validity was assessed by the principal component analysis factor with varimax rotation. The obtained solutions were suitable for all dimensions (KMO> 0.5; p-value <0.001 in all cases).

## 4. RESULTS AND DISCUSION

### 4.1. General description.

According to the results shown in Table 3, quality is the most important competitive priority, followed by service and deliveries. While cost was considered as the last, both flexibility and environmental responsibility were rated as satisfactory.

**Table 3.** Performance in competitive priorities

| Competitive priority | Statistic | | Percentage of companies by level of performance | | | |
|---|---|---|---|---|---|---|
| | **Mean** | **S** | **1-2** | **3** | **4-5** | **Total** |
| Quality | 4.50 | 0.78 | 2.8% | 8.3% | 88.9% | 100% |
| Service | 4.14 | 0.80 | 2.8% | 8.3% | 88.9% | 100% |
| Deliveries | 3.97 | 0.74 | 2.8% | 19.4% | 77.8% | 100% |
| Flexibility | 3.83 | 0.94 | 8.3% | 27.8% | 63.9% | 100% |
| Environmental Responsibility | 3.81 | 0.98 | 8.3% | 25.0% | 66.7% | 100% |
| Cost | 3.58 | 1.03 | 13.9% | 30.6% | 55.5% | 100% |

Table 4 shows the results regarding strategic manufacturing decision areas. As is shown, 80.5% of companies consider that quality management is the best performing decision area. Although none of the analyzed decision areas showed a critical situation, a significant gap was detected in processes decisions, facility layout, work study and supply/distribution. This outcome clearly suggests the need of improvement programs in these decision areas to achieve a better performance in the manufacturing system.

**Table 4.** Performance in strategic decision areas

| **Strategic decision areas** | **Statistic** | | **Percentage of companies by score range** | | | |
|---|---|---|---|---|---|---|
| | **Mean** | **S** | **1-2** | **3** | **4-5** | **Total** |
| Quality management | 4.08 | 0.84 | 5.6% | 13.9% | 80.5% | 100% |
| Capacity | 3.97 | 0.74 | 0.0% | 27.8% | 72.2% | 100% |
| Products | 3.97 | 0.85 | 5.6% | 19.4% | 75.0% | 100% |
| Organization | 3.97 | 0.77 | 5.6% | 13.9% | 80.5% | 100% |
| Planning and control | 3.86 | 0,72 | 5.6% | 19.4% | 75.0% | 100% |
| Human resources | 3.83 | 1.03 | 11.1% | 19.4% | 69.5% | 100% |
| Facility location | 3.64 | 1.02 | 11.1% | 25.0% | 63.9% | 100% |
| Processes | 3.64 | 1.07 | 13.9% | 30.6% | 55.5% | 100% |
| Facility layout | 3.64 | 1.05 | 13.9% | 27.8% | 58.3% | 100% |
| Supply/distribution | 3.58 | 0.77 | 8.3% | 33.3% | 58.4% | 100% |
| Work study | 3.42 | 1.05 | 16.7% | 33.3% | 50.0% | 100% |

**Table 5.** Effectiveness index (EI)

| Statistic | Company size | | Global |
|---|---|---|---|
| | Medium | Large | |
| *EI* | 3.84 | 4.09 | 4.00 |
| Maximum | 4.66 | 4.75 | 4.75 |
| Minimum | 2.69 | 2.75 | 2.69 |
| Median | 3.84 | 4.10 | 4.07 |
| Standard deviation | 0.55 | 0.48 | 0.51 |
| Coeff. of variation | 14.2% | 11.6% | 12.7% |

*U de Mann-Whitney* (99.500), *p-value* (0.100) > 0.05

By applying equation 1, the average *EI* for the group of surveyed companies was 4,0 ranging from 2.7 to 4.8 (See table 5). According to the scale proposed by Sarache [13], this result can be considered as satisfactory. On the other hand, no significant differences were found between medium and large enterprises. In general, the findings suggest that companies have a good level of performance in their competitive priorities that enable them to meet market needs adequately.

### 4.2. Hypothesis testing

By applying K-means cluster analysis with Ward's method, the hypothesis 1 was tested. Two groups of companies with significant differences in all variables were identified (see Table 6). The first cluster (named leader group), made up of 58% of the companies, showed better results not only in *EI* but also in the strategic decision areas compared with the second cluster (named lagging group).

**Table 6.** ANOVA results for cluster analysis

| Variable | Cluster 1 Mean (S.D) | Cluster 2 Mean (S.D) | P-value |
|---|---|---|---|
| EI | 4.21 (0.41) | 3.71 (0.50) | 0.002** |
| Capacity | 4.38 (0.59) | 3.40 (0.51) | 0.000*** |
| Facility location | 4.05 (0.67) | 3.07 (1.16) | 0.003** |
| Processes | 4.33 (0.66) | 2.67 (0.72) | 0.000*** |
| Facility layout | 4.33 (0.58) | 2.67 (0.72) | 0,000*** |
| Supply/distribution | 4.10 (0.44) | 2.87 (0.52) | 0.000*** |
| Human resources | 4.38 (0.67) | 3.07 (0.96) | 0.000*** |
| Products | 4.24 (0.77) | 3.60 (0.83) | 0.023* |
| Planning and control | 4.14 (0.57) | 3.47 (0.74) | 0.004** |
| Organization | 4.33 (0.58) | 3,47 (0,74) | 0.000*** |
| Work study | 3.86 (0.66) | 2.80 (1.21) | 0.002** |
| Quality management | 4.48 (0.60) | 3.53 (0.83) | 0.000*** |

* Significant differences at 0.05; ** Significant differences at 0.01 *** Significant differences at 0.001.

Although the study did not address the management's approach to manufacturing to avoid missing data because some companies do not apply them, an additional assessment showed that companies in cluster 1 has a greater inclination towards implementing such approaches in their manufacturing systems (See Table 7).

**Table 7.** Management's approach to manufacturing applied for each cluster

| Management approaches | Cluster 1 | | | | Cluster 2 | | | |
|---|---|---|---|---|---|---|---|---|
| | Not used | Low | Medium | Good | Not used | Low | Medium | Good |
| JIT | 10% | 19% | 19% | 52% | 40% | 27% | 26% | 7% |
| TQM | 5% | 10% | 18% | 67% | 40% | 27% | 26% | 7% |
| TPM | 10% | 14% | 33% | 43% | 47% | 20% | 33% | 0% |
| TOC | 29% | 14% | 19% | 38% | 47% | 20% | 20% | 13% |
| 5s | 5% | 10% | 28% | 57% | 13% | 53% | 27% | 7% |
| Kaizen | 24% | 10% | 14% | 52% | 47% | 27% | 19% | 7% |

The results in Table 8 partially support the hypothesis 2. Among the eleven decision areas evaluated, only eight of them showed significant regression models that proved their direct relationship with *EI*. In the remaining decision areas (facility location, human resources and quality management) enough evidence was not found to establish some relationship with this indicator.

**Table 8.** Relationship between strategic decisions areas and EI

| Variable | Spearman's rho | | Regression | | | |
|---|---|---|---|---|---|---|
| | Coefficient | P-value | $\hat{\beta}_0$ | $\hat{\beta}_1$ | F-Test (p-value) | $R^2$ |
| EI (dependent variable) | 1.000 | . | | | | |
| Capacity | 0.612*** | 0.000 | 2.244*** | 0.442*** | 0.000*** | 0.409 |
| Facility location | 0.305 | 0.070 | 3.440 | 0.154 | 0.068 | 0.095 |
| Processes | 0.592*** | 0.000 | 2.971*** | 0.282*** | 0.000*** | 0.355 |
| Facility layout | 0.510** | 0.001 | 3.202*** | 0.217** | 0.006** | 0.200 |
| Supply/distribution | 0.600*** | 0.000 | 2.658*** | 0.374*** | 0.000*** | 0.321 |
| Human resources | 0.232 | 0.173 | 3.615*** | 0.100 | 0.236 | 0.041 |
| Products | 0.471** | 0.004 | 3.045*** | 0.240* | 0.016* | 0.159 |
| Planning and control | 0.329* | 0.050 | 0.315*** | 0.232* | 0.050* | 0.108 |
| Organization | 0.407* | 0.014 | 2.772*** | 0.309** | 0.004** | 0.221 |
| Work study | 0.418* | 0.011 | 3.143*** | 0.251** | 0.001** | 0.269 |
| Quality management | 0.285 | 0.092 | 3.317*** | 0.167 | 0.103 | 0.076 |

* Significant at 0.05. ** Significant at 0.01. *** Significant at 0.001.

On the other hand, the regression analysis exposed in Table 9, indicates that implementation of management's approach to manufacturing does not affect the *EI*. None of the analyzed management approaches showed significant results. Even more, the coefficient of determination ($R^2$) was very low in most cases; therefore, it was not possible to find statistical support for hypothesis 3.

**Table 9.** Relationship between EI and management's approach to manufacturing

| Variable | Spearman's rho | | Regression | | | |
|---|---|---|---|---|---|---|
| | Coefficient | P-value | $\hat{\beta}_0$ | $\hat{\beta}_1$ | F-Test (p-value) | $R^2$ |
| EI (dependent variable) | 1.000 | . | | | | |
| JIT | 0.338 | 0.079 | 0.3869*** | 0.063 | 0.305 | 0.040 |
| TQM | 0.032 | 0.869 | 4.040*** | 0.010 | 0.900 | 0.001 |
| TPM | 0.074 | 0.715 | 3.986*** | 0.025 | 0.787 | 0.003 |
| TOC | 0.127 | 0.564 | 3.975*** | 0.033 | 0.692 | 0.008 |
| 5s | 0.257 | 0.149 | 3.698*** | 0.103 | 0.172 | 0.059 |
| Kaizen | 0.208 | 0.330 | 3.939*** | 0.049 | 0.509 | 0.020 |

*** Significant at 0.001.

Regarding hypothesis 4, a factor analysis with varimax rotation that showed adequate results at 0.001 was carried out (KMO = 0.783 Test, P-value <0.001; communalities greater than 0.5). Through this analysis, two factors were extracted with a total explained variance of 85.13%. That is, the management's approach to manufacturing can be grouped in two factors: the first one made up of JIT, TQM, TPM and TOC; the second one made up of 5S and Kaizen (see Table 10). However, because both factors are located over one of the quadrants of the Figure 1, it is possible to conclude that all management's approach to manufacturing are closely related, complementing each other, whereby the hypothesis 4 is validated.

**Table 10.** Rotated Component Matrix

| Management approaches | Component | |
|---|---|---|
| | 1 | 2 |
| JIT | 0.240 | 0,858 |
| TQM | 0.635 | 0,664 |
| TPM | 0.652 | 0,664 |
| TOC | 0.128 | 0,893 |
| 5S | 0.949 | 0,095 |
| Kaizen | 0.879 | 0,328 |

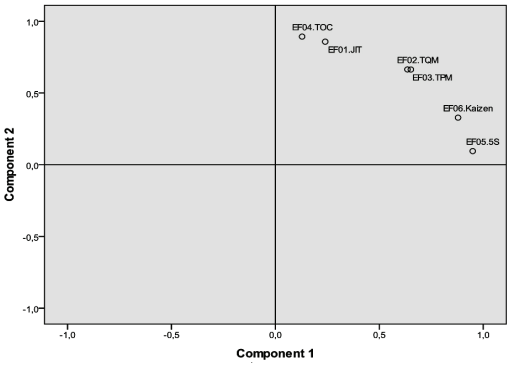


**Figure 1.** Rotated Component graphic

## 5. CONCLUSIONS

According to their competitive results, companies can be classified into a leader group or into a lagging group. Compared with the lagging group, the leader group showed better performance in its competitive priorities (average *EI* = 4.21) and a higher level of development in both strategic decisions areas and management's approach to manufacturing. Regarding the size, there was no significant difference between medium and large companies.

Also, the surveyed companies consider that the two of the most important competitive priorities are quality and cost. However, when the performance level was assessed, the cost showed the lowest rating. This finding indicates that companies must review their strategic decision areas and their management's approach to manufacturing in order to achieve a better performance level.

In addition, the study showed that a proper development of strategic decision areas positively affects the performance of competitive priorities. According to the results, capacity, processes, facility layout, supply/distribution, products, planning and control, organization and work-study are the decision areas that generate a greater effect on a firm's performance.

Furthermore, although the quality was the most prominent competitive priority, efforts regarding quality management are not generating the expected positive effects. Based on this result it is possible to infer that the quality management systems adopted by enterprises should be reviewed and improved.

Regarding management's approach to manufacturing two findings were significant. First, its level of implementation is still not adequate in most companies and many of them do not have a clear idea about its proper application. Second, there was no statistical evidence to establish that such approaches positively affect the firm's performance in their competitive priorities.

## 6. REFERENCES

[1] Skinner, W., Manufacturing Missing Link in Corporate Strategy, Harvard Business Review, 47 (july-August), pp. 136-145, 1969.

[2] Skinner, W., The focused factory. Harvard Business Review, May-June, pp. 113-121, 1974.

[3] Martín, M. Y Díaz, E., Posicionamiento estratégico de las empresas industriales en las prioridades competitivas de operaciones: desarrollo y aplicación de un indicador de medida. Cuadernos de Economía y Dirección de la Empresa, 39, pp. 59-94, 2009.

[4] Domínguez-Machuca, J.A., Álvarez-Gil, M., Domínguez-Machuca, M.A., García-González, S. Y Ruiz-Jiménez, A., Dirección de Operaciones: aspectos estratégicos en la producción y los servicios, McGraw-Hill, Madrid, 1995.

[5] Boyer, K., Swink, M. and Rosenzweig, E., Operations strategy research in the POMS journal. Production and Operations Management,14(4), pp. 442-449, 2005.

[6] Li, S. and Scullion, H., Developing the local competence of expatriate managers for emerging markets: A knowledge-based approach. Journal of World Business, 45 (2), pp. 190-196, 2010.

[7] Sarache, W., Cárdenas, D. Y Giraldo, J., Procedimiento para la definición y jerarquización de prioridades competitivas de fabricación. Aplicaciones en las pymes de la industria metalmecánica. Ingeniería y Competitividad, 7(2), pp. 84-91, 2005.

[8] Miller, S., Make Your Plant Manager's Job Manageable. Harvard Business Review, 1 (1), pp. 69-74, 1983.

[9] Olhager, J. and West, B.M., The House of Flexibility. Using the QFD approach to Deploy Manufacturing Flexibility. International Journal of Operations & Production Management, 22 (4), pp. 50-79, 2002.

[10] Ahmad, S. and Schroeder, R.G., The impact of human resource management practices on operational performance: recognizing country and industry differences. Journal of Operations Management, 21, pp. 19-43, 2003.

[11] Boyer, K.K. and Lewis, M.W., Competitive priorities: investigating the need for trade-offs in operations strategy. Journal of Production and Operations Management, 11 (1), pp. 1-13, 2002.

[12] Askar, M. and Mortagy, A.K., Assessing the relative importance of competitive priorities in Egyptian Companies. Advanced Management Journal, 72 (3), pp. 35-46, 2007.

[13] Sarache, W., Modelo con enfoque estratégico y procedimientos para contribuir al incremento del nivel de desempeño de las PyMEs de confección desde la función de producción. Tesis doctoral, Universidad Central de Las Villas, Santa Clara, Cuba, 2003.

[14] Sarache, W., Castrillón, O. and Giraldo, J., Prioridades competitivas para la industria de la confección: estudio de caso. Cuadernos de Administración, 24(43), pp. 89-110, 2011.

[15] Krajewski, L.J., Ritzman, L.P. and Malhotra, M.K., Administración de operaciones. Procesos y cadenas de valor. Octava edición, Pearson Educación, México, 2008.

[16] Ibarra, S. and Sarache, W., Dirección de la producción: su papel estratégico en la productividad. En: Colectivo de autores (Ed.). Gestión de la producción: una aproximación conceptual, Unibiblos. Bogotá, 2008.

[17] Miltenburg, J., Manufacturing strategy. How to formulate and implement a winning plan. Second edition, Productivity Press, New York, 2005.

[18] Zapata, A. and Sarache, W., Calidad y responsabilidad social empresarial: un modelo de causalidad. Dyna, No. 177, pp.31-39, 2013.

[19] Escanciano, C. and Iglesias-Rodriguez, F. Quality management and integrated total quality in Spanish mining: results of an empirical study. Dyna, No. 171, pp. 167-174, 2012.

[20] Kumar, R., Kumar, D. and KUMAR, P. Manufacturing excellence through TPM implementation: a practical analysis. Industrial Management & Data Systems, 106(2), 256-280, 2006.

[21] Inman, R., Lair, M. and Green JR, K., Analysis of the relationships among TOC use, TOC outcomes, and organizational performance. International Journal of Operations & Production Management, 29(4), pp. 341-356, 2009.

[22] Goldratt, E. Y Cox, J., La Meta. Un proceso de mejora continua, Ediciones Castillo, México, D.F., 1995.

[23] Bayo, A., Bello, A. and Merino, J., 5S use in manufacturing plants: contextual factors and impact on operating performance. International Journal of Quality & Reliability Management, 27(2), pp. 217-230, 2010.

[24] Magnier, R., Getting ready for kaizen: organizational and knowledge management enablers. The Journal of Information and Knowledge Management Systems, 41(4), pp. 428-448, 2011.

[25] Kaur, M., Singh, K. and Singh, I., An evaluation of the synergic implementation of TQM and TPM paradigms on business performance. International Journal of Productivity and Performance Management, 62(1), pp. 66-84, 2013.

[26] Valles, M.S., Técnicas cualitativas de investigación social. Reflexión metodológica y práctica profesional, Editorial Síntesis, Madrid, 1997.

[27] Hernández, R. Y Fernández, C., Baptista, P., Metodología de la investigación. 4ª edición, McGraw-Hill, México, D.F., 2006.