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Is worker commitment necessary for achieving competitive advantage and customer satisfaction when companies use HRM and TQM practices?

¿Es necesario el compromiso de los trabajadores para alcanzar ventajas competitivas y satisfacción del cliente cuando las compañías emplean prácticas de HRM y TQM?



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I. INTRODUCTION

The world of business is currently characterised by the greater competition brought about by fewer customers and social and economic globalisation. The environment is gaining in complexity and companies are trying to tackle this situation by using new forms of business management. Among these, Human Resource Management (HRM) and Total Quality Management (TQM), including customer and supplier integration to improve products and processes, are two of the bulwarks of improved competitiveness (Aragon-Sanchez and Esteban-Lloret, 2010; Huerta Arribas et al., 2005).

However, results have not always been conclusive (Boon et al., 2007) despite some earlier empirical research suggesting that HRM and TQM have a significant effect on an organisation's performance (Cua et al., 2001; Zacharatos et al., 2007; Bonavía Martín and Marín-García, 2006; Birdi et al., 2008). At the same time, a certain lack of



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EXECUTIVE SUMMARY

There is mounting interest in both theory and practice regarding the relationship between Human Resource Management (HRM) and Total Quality Management (TQM), as well as the relationship between HRM and TQM and organisational performance. This paper focuses on the empirical explanation of the role of commitment as a form of mediation between the HRM or TQM practices and company competitiveness (competitive advantage and customer satisfaction). Light is also shed on the interrelationship between HRM and TQM practices testing the scope of influence of each HRM practice on TQM implementation, including the effect of HRM on individual TQM practices.

RESUMEN DEL ARTÍCULO

Hay un creciente interés, tanto en los aspectos teóricos como en los prácticos, sobre la relación entre la gestión de los recursos humanos (HRM) y la gestión de la calidad total (TQM), así como sobre la relación entre HRM y TQM y los resultados empresariales. Este artículo realiza un estudio empírico que analiza el papel del compromiso de los trabajadores como variable mediadora entre las prácticas de HRM y TQM y la competitividad de la empresa (ventaja competitiva y satisfacción del cliente). También se analiza la relación entre las prácticas de HRM y TQM, determinando el efecto que cada práctica individual de HRM tiene sobre la implementación de TQM, así como el efecto en HRM de cada práctica de TQM.

knowledge can be seen on the part of top management as far as the HRM and TQM practices and their effects are concerned, as well as a certain inability or lack of belief in their ability to implement these systems in companies (Huerta Arribas et al., 2005).

In other respects, there is evidence for considering workers' affective commitment as a variable that might explain why employees decide to make an effort and display behaviours that favour the improvement of processes and help the company to achieve better results. Research has also been conducted into the relationship between affective commitment and HRM and TQM practices. Affective commitment therefore appears to be a major mediating variable for analysing how

and why certain HRM and TQM practices affect company results or not (Elorza et al., 2011; Paauwe and Boselie, 2005).

Research papers such as ours, which take these findings a step further by examining the specific influence of HRM and TQM subcomponents on the mediating mechanisms, would be of great benefit.

There is mounting interest in both theory and practice regarding the relationship between HRM and TQM and its effect on company results (Boon et al., 2007). In this line, the first aim of this research is to determine whether the implementation of TQM and HRM best practices affects the obtaining of competitive advantage and customer satisfaction directly or whether it does so due to the existence of workers' affective commitment (mediation effect). As the HRM and TQM best practices will foreseeably be related to each other, as a second objective of this research these relationships will be analysed in detail to clarify implementation synergies. The HRM best practices with the greatest influence on TQM and the TQM best practices with the greatest influence on HRM will be determined.

We will make use of a multiple-informant, international sample taken from the third round of the High Performance Manufacturing (HPM) project² (Schroeder and Flynn, 2001). With this research managers obtain evidence of whether HRM and TQM best practices need to be accompanied by measures to reinforce employees' commitment for their application to have a significant impact on company results (competitive advantage and customer satisfaction). Management will also be provided with evidence relating to the influence of each HRM best practice on TQM and of each TQM best practice on HRM.

There is evidence for considering workers' affective commitment as a variable that might explain why employees decide to make an effort and display behaviours that favour the improvement of processes and help the company to achieve better results

This enables businesses to focus on practices which generate greater synergies.

2. WHAT DO WE KNOW ABOUT HRM AND TQM BEST PRACTICES?

Some authors have considered HRM practices to be part of TQM. There is, in fact, a close relationship between HRM practices and TQM practices. Two dimensions are identified in TQM in some studies, sometimes referred to as “hard” and “soft”. The first of these is related to more technical aspects whilst the second is more intangible and emphasises human resource management. However, it is becoming more and more frequent for the two to be studied as separate categories so that an analysis can be conducted of whether the prerequisites for their implementation (which practices should be implemented first or at the same time as others) and the effects that they have on performance measures are the same or differ for each practice set.

TQM practices seek to systematically eliminate waste and improve product and service quality from the focus of continuous improvement. HRM practices aim to facilitate employee involvement and provide support for efforts for continuous company improvement and, specifically, efforts made in the area of TQM. Both technical aspects and the adequate management of human resources need to be considered for TQM to be implemented successfully. In this way it is possible to achieve worker commitment and engagement with continuous improvement and their willingness to assume and even encourage necessary changes to be made in the company. This could lead to increased competitiveness and improved company results. Both HRM and TQM are rational, consistent and strengthened systems of practices where the overall result is greater than the application of any one part.

HRM is a system of practices that provides employees with the skills, information and motivation to be involved in decision making and, when used as an integral part of business strategy, can consequently turn the workforce into a source of sustainable competitive advantage (Avella and Vazquez-Bustelo, 2005; Elorza et al., 2011; Gellatly et al., 2009; Marin-Garcia and Conci, 2009; Urbano et al., 2011). This research considers the six best practices habitually established by the prior literature. These are: recruiting and selection, supervisor support team, small group problem solving, task related training, multifunction employees, and rewards manufacturing coordination. Each of these is explained in **Figure 1**.

KEY WORDS

TQM, HRM, Commitment, Competitive advantage, Customer satisfaction

PALABRAS CLAVE

Gestión de la calidad total, Gestión de los recursos humanos, Compromiso, Ventaja competitiva, Satisfacción del cliente

TQM is a manufacturing programme aimed at continuously improving and sustaining quality products and processes by capitalising on the involvement of management, the workforce, suppliers, and customers, in order to meet or exceed customer expectations (Avella and Vazquez-Bustelo, 2005). TQM has been defined according to the seven best practices that the prior literature has stated to be fundamental for the goals pursued by TQM to be achieved: top management leadership for quality, cleanliness and organisation, feedback, prevention, process control, customer involvement and supplier quality involvement. TQM best practices are explained in **Figure 2**.

Sufficient proof exists for the implementation of each of the TQM and HRM best practices to be stated to have shown its effectiveness and helped to achieve results, such as increased productivity, improved quality, reduced manufacturing times, reduced inventories and improved customer satisfaction. It also seems evident that the more tools that are implemented as an integrated set (rather than in isolation), the greater the effects will be, as a synergy effect would seem to exist between them.

Figure 1. HRM best practices

RECRUITING AND SELECTION [RS]	The company interviews a large number of people for openings in the plant and has developed an effective interview instrument for detecting specific criterion in employee selection, such as attitude/desire to work in a team, aptitudes for problem solving, ability to provide ideas and to improve the manufacturing process, work values and how well prospective employees will fit in with its culture.
SUPERVISOR SUPPORT TEAM [SST]	Supervisors frequently hold group meetings where employees can discuss things together in earnest, encourage people to work as a team and exchange opinions and ideas.
SMALL GROUP PROBLEM SOLVING [SGPS]	The organisation forms teams to help improve manufacturing processes. Groups are composed of workers who try to solve problems concerning their own areas. During problem solving sessions, all team members' opinions and ideas are heard before a decision is made.
TASK RELATED TRAINING [TRT]	Employees receive training and development in workplace skills on a regular basis. The organisation believes that ongoing training and upgrading employee skills is important. As a result, employees at the plant have skills that are above average in their industry.
MULTIFUNCTION EMPLOYEES [ME]	Employees receive training to perform multiple tasks so that they can fill in for others, if necessary. The longer employees have been at the plant, the more tasks they learn to perform.
REWARDS MANUFACTURING COORDINATION [RMC]	The incentive system at this plant is consistent with the plant goals and rewards/recognises people who pursue and contribute to accomplishing plant objectives fairly.

All functions across the organisation must be both consistent and integrated in order to meet individual and organisational objectives. TQM and HRM are no exception in this regard. It has been argued that TQM cannot be applied in isolation because, as the name suggests, it employs a total quality approach involving all organisational members and has high human resource content. It is holistic in nature and requires the motivation and commitment of all members of an organisation to seek customer satisfaction (Yang, 2006). Earlier studies assert that HRM can reinforce human relationships and group consciousness, raise employee competence, and achieve cultural change; it therefore acts as a catalyst for the implementation of TQM (Heras et al., 2009). HRM and TQM are strategically and tactically important for gaining competitive advantage. Earlier research has maintained that synergy and congruence between HRM practices have significant effects on the implementation of

Figure 2. **TQM best practices**

<p>TOP MANAGEMENT LEADERSHIP FOR QUALITY [TMLQ]</p>	<p>The top priority when evaluating plant management is quality performance. Therefore managers provide personal leadership for quality products and quality improvement, creating and communicating a vision focused on quality. Top management strongly encourages employee involvement in the production process and all major department heads within the plant accept their responsibility for quality.</p>
<p>CLEANLINESS AND ORGANISATION [5S]</p>	<p>The plant is kept neat and clean at all times. Emphasis is put on all tools and fixtures being put back in their places. As a result, employees can usually find the tools they need easily.</p>
<p>FEEDBACK [FEED]</p>	<p>Information on productivity is readily available to employees. Charts are posted on the shop floor showing defect rates, schedule compliance, the frequency of machine breakdowns, productivity and quality performance.</p>
<p>PREVENTION [PRE]</p>	<p>The organisation works to prevent problems, rather than fixing them after they occur. Therefore quality should be designed into a product, rather than defects inspected out after the fact.</p>
<p>PROCESS CONTROL [PC]</p>	<p>Processes in the plant are designed to be “foolproof”. Extensive use is made of statistical techniques to reduce variance in processes. Charts are used to determine whether manufacturing processes are in control and a large percent of the processes on the shop floor are currently under statistical quality control.</p>
<p>CUSTOMER INVOLVEMENT [CI]</p>	<p>There is frequent close contact with customers, and customers’ needs are regularly surveyed. Customers give feedback on quality and delivery performance and are actively involved in product design process.</p>
<p>SUPPLIER QUALITY INVOLVEMENT [SQI]</p>	<p>Quality is the number one criterion in selecting suppliers and most of the suppliers used have been certified. The plant strives to establish long-term relationships with suppliers who are actively involved in their new product development process or quality improvements.</p>

TQM (Boon et al., 2007; Lawler III et al., 2001; Yang, 2006). HRM topics should therefore be managed in accordance with TQM principles. Human resource participation in TQM practices is not optional, but an essential component if quality management is to reach its full potential. Yang (2006) for example, analyses the influence of HRM and TQM on four quality and performance measures on the one hand, and, on the other hand, the mediating effect of TQM practices on HRM practices and performance. Results confirm that HRM practices greatly influence the application of TQM practices and that both practices, when applied at the same time, greatly influence quality performance measures. Jiménez-Jiménez and Martínez-Costa (2009) analyse and then illustrate the positive effect that HRM and TQM have on organisational performance and how the existence of coherent HRM practices with TQM favour the results of TQM practices. These results are often measured by competitive advantage or customer satisfaction indicators (Aragon-Sanchez and Esteban-Lloret, 2010; Bonavia and Marin-Garcia, 2006; Marin-Garcia et al., 2008) (see **Figure 3**).

Figure 3. Mediation and results variables

<p>AFFECTIVE COMMITMENT</p>	<p>The workers' values and the organisation's values are very similar and workers tell their friends what a great organisation it is to work for. They are proud to tell others that they are part of this organisation. Workers are extremely glad that they chose this organisation to work for and would accept almost any type of job assignment in order to continue working for their organisation.</p>
<p>COMPETITIVE ADVANTAGE</p>	<p><i>Delivery:</i> Better on time delivery performance and faster delivery than the competition in the industry. <i>Flexibility:</i> Greater flexibility for changing the product mix or volume. <i>Inventory:</i> Less inventory and shorter cycle time (from raw materials to delivery) than the competition in the industry. <i>Innovation:</i> Speedier introduction of new products in the plant and new products launched on time. <i>Quality Performance:</i> Better product capability, performance and conformance to product specifications than competitors.</p>
<p>CUSTOMER SATISFACTION</p>	<p>Customers are pleased with the products and services provided to them and seem to be happy with the company responsiveness to their problems. Customer standards are always met and they are satisfied with the quality of products or services.</p>

Despite the publishing of a considerable body of HRM and TQM literature that examines the relationship between HRM and TQM and organisational performance across a number of countries and

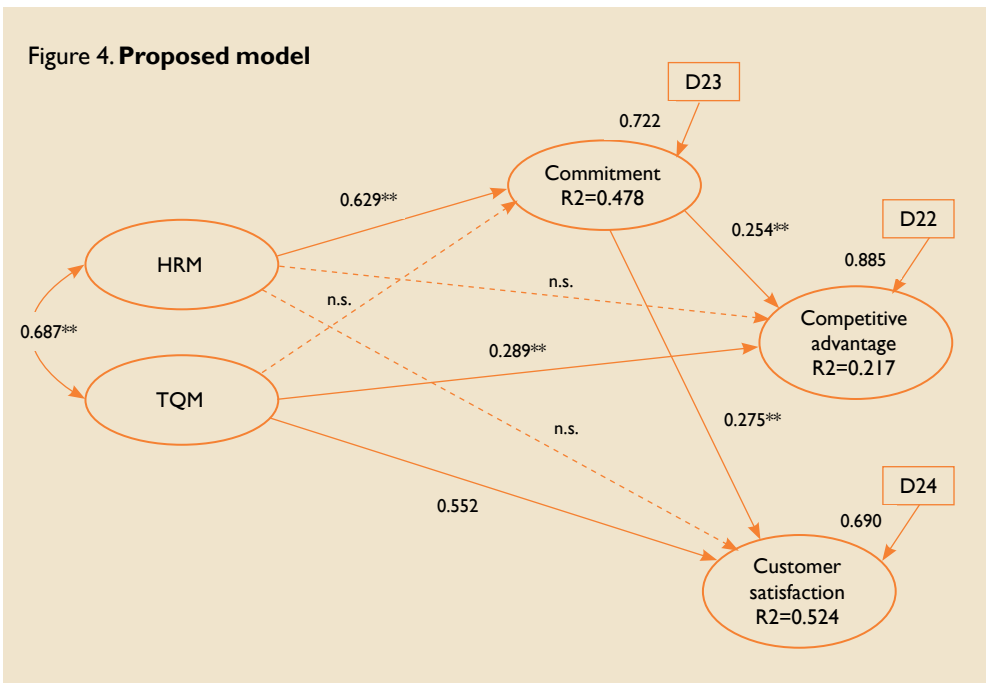
industries, there is very little empirical literature available that deals with mediation variables like social exchange or commitment (Boon et al., 2007). Affective commitment is defined as emotional attachment to, identification with, and involvement in the organisation (see Figure 3). Recent research would seem to indicate that certain organisational practices put in place by the company could affect employees' affective commitment (Elorza et al., 2011; Guerrero and Herrbach, 2009; Lapointe et al., 2011). In short, the implementation of the HRM and TQM best practices help to transmit the message throughout the company that employees are a key part of the system. Objective-aligned remuneration practices, for example, create a context where employees can feel safe and secure within certain bounds and trust in the company. If there is also an effective feedback system and a context where processes work in a stable way, they feel that the outcome of their work depends on their effort and not external causes, such as machines being wrongly set up, for example. Similarly, practices that favour training, autonomy and group decision-making help employees to better understand processes and identify with, and engage emotionally with, the work that they do in the organisation. The bottom line of all this is that employees who feel attached to their organisations work harder and this impacts positively on company performance (Elorza et al., 2011; Gellatly et al., 2009; Lapointe et al., 2011).

Bearing in mind the objectives of this study as stated in the introduction section, this article seeks to respond to these main questions:

- Does the implementation of TQM best practices have a direct effect on gaining a competitive advantage and customer satisfaction or does it do so due to the existence of the commitment of employees (mediation effect)?
- Does the implementation of HRM best practices have a direct effect on gaining competitive advantage and customer satisfaction or does it do so due to the existence of the commitment of employees (mediation effect)?
- Is there an internal relationship between HRM practices and TQM practices? If so:
 - Which HRM best practices have the greatest influence on TQM?
 - Which TQM best practices have the greatest influence on HRM?



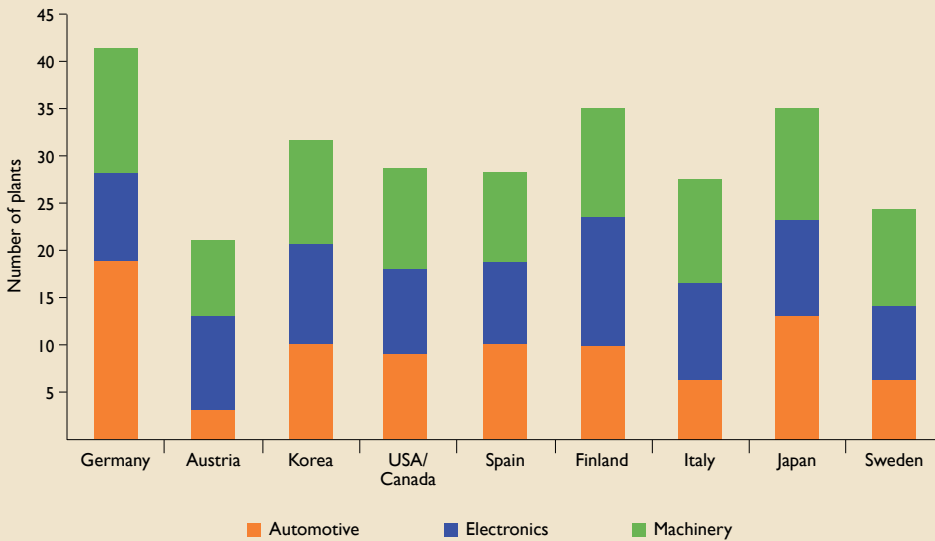
The model presented in **Figure 4** is tested to answer the three lead questions³. This model shows the results of the analysis which is detailed below. The lines between variables indicate the relationships tested. The influence of one group of practices on the other and vice versa is tested using correlation analysis (Yang, 2006).



3. ANALYSIS OF A MULTIPLE INFORMANT INTERNATIONAL SAMPLE

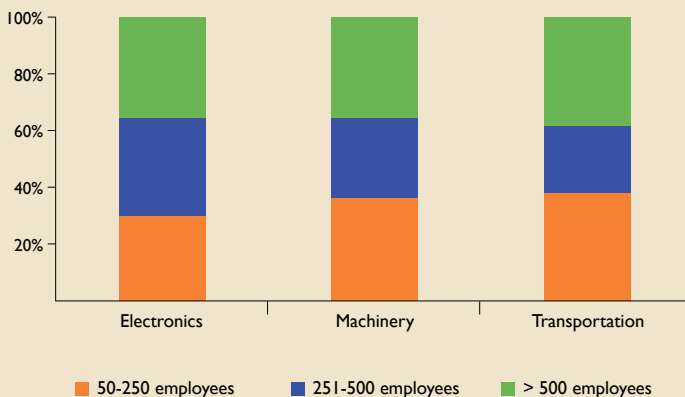
The analysis is based on the HPM project database, the data for which was collected during the third round of the project (2005-2007 time-frame) by an international team of researchers. As a whole, the international sample is made up of 266 mid-to-large-sized manufacturing plants across ten countries: Austria, the USA and Canada, Finland, Germany, Italy, Japan, Korea, Spain and Sweden (**Figure 5**). The unit of observation is the manufacturing plant. In each country, the plants were randomly selected from three industries: automotive components (SIC code: 37), electronics (SIC code: 36) and machinery (SIC code: 35). Stratified sampling was used to obtain a similar number of plants for each combination of industry and country.

Figura 5. Sample distribution by country and industry



With respect to the size of the plants analysed, 35.6% have between 50 and 250 employees, 28.3% between 250 and 500 employees and 36.1% more than 500. A by-sector analysis shows that there is a similar distribution of plant size in all three sectors, as can be seen in Figure 6.

Figura 6. Sample distribution by company size (number of employees) and industry



The items were targeted at plant accounting managers, direct labour, human resource managers, inventory managers, process engineers, plant managers, quality managers, supervisors and plant workers. The HRM and TQM scales (from 1 (Strongly Disagree) to 7 (Strongly Agree)) are responded to by at least two different managers/workers at the plant so that information can be triangulated.

In this multiple informant international sample HRM and TQM best practices have been analysed to test the model shown in Figure 4⁴. The factors and items used in the analyses are detailed in the Appendix.

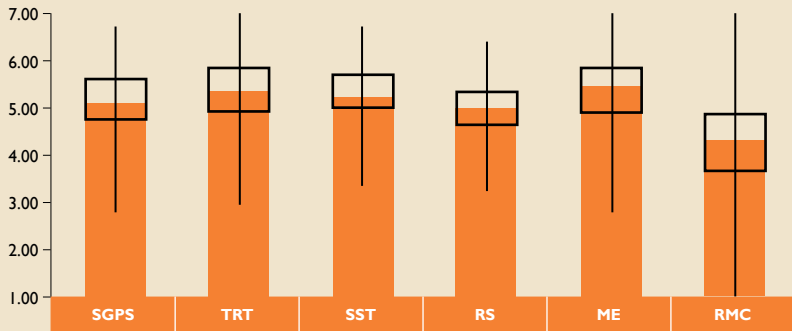
4. THE EFFECT OF COMMITMENT ON HRM OR TQM PRACTICES AND COMPANY COMPETITIVENESS

The companies analysed show a medium to high intensive use of both HRM and TQM best practices (**Figures 7 and 8**). On a scale of 1 to 7 the average is 5. The most frequent practice in HRM is Task Related Training (with an average of 5.26) and the least frequent practice is Rewards Manufacturing Coordination (with an average of 4.3). In TQM programmes the most frequent practice is Prevention (with an average of 5.93) and the least frequent practice is Process Control (with an average of 4.7). The distribution of the average scores points to the HRM and TQM practices possibly being implemented as a system and not isolated practices. This was confirmed by the model's fit statistics (see note 4), which show that HRM and TQM practices form an integrated system which can be measured with a single score to represent all the practices in each block.

The analysis of the relationships in the model set out in Figure 4 provides answers to the three lead questions set for the study. The dotted lines in Figure 4 represent non-significant paths that have been eliminated from the final model⁵. This implies that there are no significant relationships between these variables, as explained in the following.

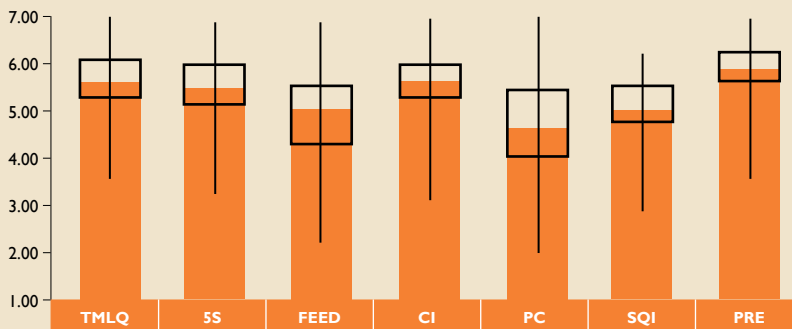
Upon reviewing the results, it can be seen that the proposed model (Figure 4) enables 52.4% of the variation in customer satisfaction and 21% of the competitive advantage to be explained. Both figures are especially high and provide the model with the capacity to explain a significant part of the causes that affect competitive advantage (in terms of quality, innovation, inventory, flexibility and delivery) and customer satisfaction. This means that a major part of the analysed companies' customer satisfaction and competitive advantage comes

Figure 7. Degree of use of HRM practices



Mean	5.10	5.26	5.22	4.97	5.33	4.32
Q1 (25%)	4.66	4.75	4.80	4.61	4.88	3.63
Maximum	6.85	7.00	6.75	6.33	7.00	7.00
Minimum	2.76	2.83	3.30	3.30	2.69	1.13
Q3 (75%)	5.65	5.78	5.67	5.38	5.77	5.00

Figure 8. Degree of use of TQM practices



Mean	5.65	5.54	4.91	5.59	4.70	5.00	5.93
Q1 (25%)	5.27	5.12	4.33	5.25	4.07	4.67	5.62
Maximum	7.00	6.86	6.83	6.90	6.93	6.39	7.00
Minimum	3.70	3.23	2.24	3.17	2.00	2.79	3.57
Q3 (75%)	6.07	6.01	5.59	5.97	5.42	5.44	6.34

from implementing HRM and TQM best practices, and also from their employees' commitment. The joint use of these tools therefore has a synergy effect on performance measures.

A strong relationship can be seen between TQM and HRM practices, confirming prior studies. In other words, they are two practice sets that mutually support and need each other. The direct relationship between the TQM practices and the results is also positive and significant. Consequently, companies that use TQM to a greater extent obtain better results for competitive advantage and achieve greater customer satisfaction. However, the results show that there is no significant direct relationship between the HRM practices and the performance measures analysed. Does this therefore mean that there is no relationship between HRM and company results? To answer this question the mediating effect of worker commitment needs to be analysed.

It can be seen that the HRM practices are closely related to employees' commitment and that, the greater the commitment, the greater the competitive advantage and customer satisfaction. It would therefore appear that the effect of HRM on competitive advantage and customer satisfaction is completely mediated by commitment. In other words, worker commitment is necessary for HRM best practices to have a significant impact on performance measures.

However worker commitment does not mediate significantly between TQM and the performance measures; instead the effects of TQM on competitive advantage and customer satisfaction are direct. Does this imply that worker commitment is not necessary for TQM practices to improve performance measures? We would like to make two remarks in this respect. Firstly, the strong relationship between HRM and TQM helps justify this result, as the mediating relationship between TQM and worker commitment is channelled via HRM. Consequently, part of the improvement in results that is achieved by implementing TQM is achieved through the implementation of HRM best practices and the existence of worker commitment. Secondly, TQM practices advocate the standardisation and improvement of processes which represents an improvement in company results on its own, irrespective of worker commitment (whereby the direct effect of TQM on performance measures). We again stress the synergy that exists between practices, which are strengthened by their being implemented as a set. In other words, in order for TQM to be implemented fully and effectively, it is necessary to use HRM practices which, in turn, require worker commitment if they are to have a significant effect on performance measures.



5. ARE THERE CERTAIN HRM PRACTICES THAT HAVE A GREATER INFLUENCE ON TQM PRACTICES, AND VICE VERSA?

Now that the strong relationship between HRM and TQM practices has been demonstrated, it is interesting to determine which HRM best practices have a greater influence on TQM and vice versa. This will enable managers to gauge which practices to implement for the greatest possible synergy between these programmes to be achieved.

The relationship between HRM and TQM practices has been analysed based on the correlations table (Table 4 in the Annex). The sum of each row divided by the total of the whole correlation table provides an insight into the weighted value of importance of the HRM practice for the whole of the TQM practices. It is therefore possible to see which practices are implemented to more or less the same extent (correlations) and the influence that an HRM practice might have on the set of TQM practices as a whole can be calculated and compared to the other HRM practices (row analysis). An analogous analysis can also be done comparing the TQM practices (column analysis).

The HRM practice with the greatest influence on TQM is Small Group Problem Solving (Table 1). The forming of groups that can take action if any incidents occur enables improvements that have a clear effect on TQM practices. Below is a group of two practices, each with a similar degree of importance: Task-Related Training and Supervisor Support Team. Recruiting and Selection, Multifunctional Training, and Rewards Manufacturing Coordination, although they are important, have less of a relationship with the deployment of TQM than the first three mentioned.

Table 1. **Relative importance HRM practices over TQM**

HRM BEST PRACTICES	IMPORTANCE OVER TQM PROGRAMMES (%)
[SGPS] Small Group Problem Solving	22.8
[TRT] Task Related Training	17.9
[SST] Supervisor Support Team	17.4
[RS] Recruiting and Selection	15.8
[ME] Multifunction Training	13.6
[RMC] Rewards Manufacturing Coordination	12.4
Total	100

Similarly, the relative importance of TQM practices over HRM practices can be estimated by taking the sum of the columns divided by the sum of the correlations table as a whole (Table 2). In this case, the TQM practices that are most related to the HRM practices are Top Management Leadership for Quality, followed by Cleanliness and Organisation, Feedback, and Customer Involvement. The other three TQM practices appear to have less of a relationship with the deployment of HRM practices.

Table 2. Relative importance of HRM practices over TQM

TQM BEST PRACTICES	IMPORTANCE OVER HRM PROGRAMMES (%)
[TMLQ] Top Management Leadership for Quality	18.1
[5s] Cleanliness and Organisation	16.8
[Feed] Feedback	16.4
[CI] Customer Involvement	15.6
[PC] Process Control	13.0
[SQI] Supplier Quality Involvement	11.7
[Pre] Prevention	8.4
Total	100

6. CONCLUSIONS AND MANAGERIAL IMPLICATIONS

The findings provide new empirical evidence regarding the relationship between HRM, TQM and worker commitment. To be precise, the questions set have been answered. The first two questions focus on the first of the objectives that was set in the introductory section of this article. The remainder corresponds to the second objective that was set. To summarise the main conclusions:

- *Does the implementation of TQM best practices have a direct effect on gaining competitive advantage and customer satisfaction or does it do so due to the existence of the commitment of employees (mediation effect)?*

This research shows that a significant direct relationship exists between the implementation of TQM best practices and the gaining of a competitive advantage and customer satisfaction. As these are practices that standardise and improve the process, they achieve improvements in performance measures on their own. The more they are

implemented, the better the results for competitive advantage and customer satisfaction that the company obtains.

In other respects, worker commitment does not mediate significantly between TQM and performance measures. The high correlation between TQM and HRM means that the mediating effect that worker commitment could have is diluted, as in order to be fully implemented TQM needs HRM, and HRM, in turn, needs worker commitment in order for its implementation to have an effect on competitive advantage and customer satisfaction.

TQM therefore improves performance measures by two distinct routes, one direct and the other indirect via HRM and worker commitment. If these tools are implemented as a set there will be a greater impact on company results.

• Does the implementation of HRM best practices have a direct effect on gaining competitive advantage and customer satisfaction or does it do so due to the existence of the commitment of employees (mediation effect)?

The findings have not shown a significant direct relationship between HRM best practices and the gaining of competitive advantage and customer satisfaction. Implementing HRM best practices is seen to be a prerequisite for TQM to reach its full potential, but worker commitment seems to be necessary for it to have a significant effect on performance measures. Worker involvement therefore seems to be a key element.

• Is there an internal relationship between HRM practices and TQM practices?

In the international sample analysed the implementation of the two sets of practices (TQM and HRM) was done in integration with each other and not as isolated and independent practices. The research reveals a strong relationship between HRM practices and TQM practices. These are mutually-supporting programmes whose joint implementation boosts their impact on performance measures. Without forgetting the importance that the commitment of the employees has for this relationship, naturally.

• Which HRM practices have the greatest influence on TQM?

The HRM practice that is most related to TQM is Small Group Problem Solving, followed by two groups of practices. The first group comprises two practices with a similar degree of importance: Task-Related Training and Supervisor Support Team. The second group is made up of practices which, although they are important, have less

of a relationship with the deployment of TQM than the three mentioned above: Recruiting and Selection, Multifunctional Training, and Rewards Manufacturing Coordination.

• *Which TQM practices have the greatest influence on HRM?*

The TQM practices with the greatest influence on HRM are Top Management Leadership for Quality, followed by Cleanliness and Organisation, Feedback, and Customer Involvement. The other three TQM practices (Process Control, Supplier Quality Involvement, and Prevention) appear to have less of a relationship with the deployment of HRM practices.

With regard to the first of the objectives set in the introductory section, on the basis of these findings, top management should bear a number of factors in mind for HRM and TQM practices to be implemented and developed successfully. In this respect it is shown that the involvement of Human Resources in TQM programmes is not something that is optional, but rather a core component if we want quality management to reach its full potential. In other regards, affective commitment is seen to play a decisive role in channelling the potentialities of the HRM practices and their effect on performance measures. This is why company managers who decide to implement HRM programmes should pay special attention to measuring and driving up the commitment of their workers, as this is the key on which results hinge. If worker commitment is not achieved, the investment in HRM practices will have a lesser effect on performance measures or will even be non-existent.

Implementing HRM and TQM best practices in companies should have a knock-on effect on business performance. It is, however, a process that is neither easy nor fast. On the one hand, the implementation of the practices requires a certain amount of time for them to be taken on board and become routine and work without getting in the way of the processes. On the other hand, the close relationships between the various practices, not only the relationships among the HRM practices themselves, or the TQM practices themselves, but the cross-relationships between the two, make implementation hugely complex. Yet, as has been demonstrated in this study, management should pay special attention to the effect of commitment as a mediator of the results that come from implementing HRM practices. It takes a little longer to squeeze all the performance potential out of the HRM practices as worker commitment is a social process that is slow to build. However, the potential reward for companies can coun-

terbalance the effort put in to implementing HRM and TQM practices. As the findings of this research show, companies that put HRM and TQM best practices into effect present greater customer satisfaction and greater competitive advantage when the latter is measured in terms of quality, innovation, inventory, flexibility and delivery.

With respect to the second of the objectives set, the present research provides a weighted classification of the influence of HRM practices on TQM implementation, as well as the effect of HRM on individual TQM practices. This is an essential piece of information for businesses as it allows them to focus on practices which generate greater synergies.

The present paper confirms the positive effect that the implementation of HRM and TQM best practices has on performance measures and the influence of worker commitment. Notwithstanding, there are still some issues pending that it would be interesting to address in future research. By way of example, these include: what problems arise when best practices are implemented and how are they overcome? Does it matter which practices are implemented first or are the results always the same? How do you achieve the commitment of the employees during times of crisis when there is a downsizing of the workforce? How are the practices sustained so that there is no decline in their effect sometime after they have been implemented?

This research is not without its limitations. The sample is broad and international, but it focuses on mid-to-large-sized companies. Data-gathering needs to be extended to small companies in order to analyse whether the findings can also be extended to companies of this type. In other respects, other variables have not been included in the model that could also provide competitive advantages and affect customer satisfaction and which would probably be co-related with the TQM and HRM programmes (TPM, one-piece flow tools and information technologies, for example,). It would be interesting to analyse a more complex model in the future so that the interrelationships between a broader set of practices can be evaluated. Having said this, this research is based on a stronger data set than previously used in other studies, and this allows some limitations of previous studies to be overcome, including those linked to multiple-informant data gathering, the breadth of the set of variables, the use of reliable multi-item scales and a sampling design that guarantees representation by both industry and country. The HPM project data overcomes these shortcomings and also has the advantage of enabling a broad



sample to use SEM. The questionnaires include a substantial number of endogenous variables, objective and subjective data related to performance and plant characteristics, and a range of exogenous variables. The HRM and TQM scales are responded to by at least two different managers/workers in the plant so that information can be triangulated. Taken together, this data is probably unique given the wealth and depth of the variables studied, as it includes practically all facets of Operations Management (Marin-Garcia and Carneiro, 2010).

ANNEX

Table 3. Confirmatory Factor Analysis of second-order factor scales. Standardised factor-loading solution

CODE	SCALE	HRM	TQM	COMPETITIVE ADVANTAGE
SGPS	Small Group Problem Solving	0.269**	0.631**	-
TRT	Task Related Training	0.874**	-	-
SST	Supervisor Support Team	0.711**	-	-
RS	Recruiting and Selection	0.803**	-	-
ME	Multifunction Employees	0.810**	-	-
RMC	Rewards Manufacturing Coordination	0.591**	-	-
TMLQ	Top Management Leadership for Quality	-	0.639**	-
5s	Cleanliness and Organisation	-	0.658**	-
Feed	Feedback	-	0.781**	-
CI	Customer Involvement	-	0.697**	-
PC	Process Control	-	0.647**	-
SQI	Supplier Quality Involvement	-	0.635**	-
Pre	Prevention	-	0.446**	-
Del	Delivery	-	-	0.709**
Flex	Flexibility	-	-	0.771*
Inv	Inventory	-	-	0.641**
Inno	Innovation	-	-	0.700**
QPerf	Quality Performance	-	-	0.733**
Goodness of Fit summary		Chi2 sig. 0.000 Chi2 / d.f.: 1.997 CFI 0.939 IFI 0.940 MFI 0.733 GFI 0.882 RMSEA 0.061	Chi2 sig. 0.000 Chi2 / d.f.: 1.796 CFI 0.943 IFI 0.944 MFI 0.761 GFI 0.889 RMSEA 0.054	Chi2 sig. 0.002 Chi2 / d.f.: 1.930 CFI 0.955 IFI 0.956 MFI 0.941 GFI 0.948 RMSEA 0.064

* Statistics significant at 5%; ** 1%.

Table 4. Correlations between HRM and TQM scales.
All correlations are significant

	5S	CI	FEED	PRE	PC	SQI	TMLQ	ROW SUM	% ROW
SGPS	0.539	0.486	0.565	0.203	0.504	0.362	0.531	3.19	22.82%
ME	0.332	0.321	0.261	0.177	0.231	0.192	0.387	1.901	13.60%
RS	0.355	0.435	0.309	0.232	0.232	0.276	0.375	2.214	15.84%
RMC	0.29	0.159	0.308	0.171	0.268	0.19	0.354	1.74	12.45%
SST	0.434	0.418	0.402	0.157	0.263	0.338	0.42	2.432	17.40%
TRT	0.404	0.368	0.441	0.232	0.323	0.277	0.458	2.503	17.90%
Column sum	2.354	2.187	2.286	1.172	1.821	1.635	2.525	13.98	100.00%
% Column	16.84%	15.64%	16.35%	8.38%	13.03%	11.70%	18.06%	100.00%	

APPENDIX: FACTORS AND ITEMS USED IN THE ANALYSES

TQM (second order factor)

Cleanliness and Organisation [5S]

- We take pride in keeping our plant neat and clean.
- Our plant is kept clean at all times.
- Our plant is disorganized and dirty.

Customer Involvement [CI]

- We frequently are in close contact with our customers.
- Our customers give us feedback on our quality and delivery performance.
- We strive to be highly responsive to our customers' needs.

Feedback [Feed]

- Charts showing defect rates are posted on the shop floor.
- Charts showing schedule compliance are posted on the shop floor.
- Information on quality performance is readily available to employees.

Prevention [Pre]

- We believe that prevention is preferable to inspection for quality improvement.
- In our view, quality should be designed into a product, rather than defects inspected out after the fact.
- We believe that prevention is more effective and economic than repairing undesirable problems.

Process Control [PC]

- A large percent of the processes on the shop floor are currently under statistical quality control.
- We make extensive use of statistical techniques to reduce variance in processes.
- We monitor our processes using statistical process control.

Supplier Quality Involvement [SQI]

- Our suppliers are actively involved in our new product development process.
- We maintain close communication with suppliers about quality considerations and design changes.
- We actively engage suppliers in our quality improvement efforts.

Top Management Leadership for Quality [TMLQ]

- Plant management provides personal leadership for quality products and quality improvement.
- Our plant management creates and communicates a vision focused on quality improvement.
- Our plant management is personally involved in quality improvement projects.

HRM (second order factor)

Small Group Problem Solving [SGPS]

- Our plant forms teams to solve problems.
- In the past three years, many problems have been solved through small group sessions.
- Problem solving teams have helped improve manufacturing processes at this plant.

Multifunction Employees [ME]

- Our employees receive training to perform multiple tasks.
- Employees at this plant learn how to perform a variety of tasks.
- Employees are cross-trained at this plant, so that they can fill in for others, if necessary.

Recruiting and Selection [RS]

- We use attitude/desire to work in a team as a criterion in employee selection.
- We use work values and attitudes as a criterion in employee selection.
- In hiring, we select employees who can provide ideas to improve the manufacturing process.

- In addition to job skills, we look closely at how well prospective employees will fit in our culture.

Rewards Manufacturing Coordination [RMC]

- Our incentive system encourages us to vigorously pursue plant objectives.
- The incentive system at this plant is fair at rewarding people who accomplish plant objectives.
- Our reward system really recognises the people who contribute the most to our plant.
- The incentive system at this plant encourages us to reach plant goals.

Supervisor Support Team [SST]

- Our supervisors encourage the people who work for them to work as a team.
- Our supervisors encourage the people who work for them to exchange opinions and ideas.
- Our supervisors frequently hold group meetings where the people who work for them can really discuss things together.

Task Related Training [TRT]

- Our plant employees receive training and development in workplace skills, on a regular basis.
- Management at this plant believes that continual training and upgrading of employee skills is important.
- Our employees regularly receive training to improve their skills.

Commitment (first order factor) [COMIT]

- I talk up this organisation to my friends as a great organisation to work for.
- I am proud to tell others that I am part of this organisation.
- This organisation really inspires the best in me in the way of job performance.
- I am extremely glad that I chose this organisation to work for, over others I was considering at the time I joined.
- For me, this is the best of all organisations for which to work.

Competitive Advantage (second order factor)

Delivery [Del]

- On time delivery performance.
- Fast delivery.

Flexibility [Flex]

- Flexibility to change product mix.
- Flexibility to change volume.

Inventory [Inv]

- Inventory turnover.
- Cycle time (from raw materials to delivery).

Innovation [Inno]

- Speed of new product introduction into the plant (development lead time).
- On time new product launch.

Quality Performance [QPerf]

- Conformance to product specifications.
- Product capability and performance.

Customer Satisfaction (first order factor) [CS]

- Our customers are pleased with the products and services we provide for them.
- Our customers seem happy with our responsiveness to their problems.
- Customer standards are always met by our plant.
- Our customers have been well satisfied with the quality of our products, over the past three years.

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NOTES

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2. The HPM project seeks to analyse best practices in the production area in different countries and industries with a view to determining their influence on performance and achieving competitive advantages. It aims to establish an integrated set of processes that enable a sustainable worldwide competitive advantage to be obtained by means of the continuous improvement of manufacturing capabilities. It began with studies conducted by Schroeder and Flynn (2001) in 45 US plants (distinguishing between those that were U.S. and Japanese owned) from three sectors (electronics, machinery and automotive components). The second round (1994-1997) examined 164 plants in Asia (Japan), Europe (UK, Germany and Italy) and the USA. This study focuses on the third round (2005-2007), which analysed 266 plants across ten countries in Europe, the USA and Asia (see section three).
3. HRM, TQM and competitive advantage are second-order constructs (with 6, 7 and 5 factors, respectively), whereas commitment and customer satisfaction have been modelled as first-order constructs (see Appendix). An analysis has been carried out on the psychometric properties of the measurement models in every case.
4. The analyses will be performed using the EQS programme and the maximum-likelihood parameter estimation method. Structural equations will be used to check the full latent structural model and to analyse which relationships are validated in the data sample. The weighted value of importance of each of the planned HRM and TQM practices will also be identified using Yang (2006) methodology. The starting point for this will be the HRM and TQM scale correlation table. The weighted value of importance is calculated by taking the sum of the absolute value of the correlations in the row (or column) divided by the sum of the absolute value of all correlations (Yang, 2006).
5. The measurement model of all the constructs has adequate goodness-of-fit indices (Normed Chi-squared <5; CFI>0.90; IFI >0.90; GFI>0.85; RMSEA<0.08). Additionally, all the factor loads of both the item scales and the second-order factor scales are significant with values, for the most part, of over 0.6 (Table 3 in the Annex shows the values for the second-order scales). The other two scales are equally valid from the psychometric point-of-view (Customer satisfaction: Chi2 sig.=0.386, Chi2/d.f.=0.952, CFI=0.999, IFI=0.999, MFI=0.999, GFI=0.952, RMSEA=0.000; Commitment: Chi2 sig.=0.464, Chi2/d.f.=0.922, CFI=0.999, IFI=0.999, MFI=0.999, GFI=0.950, RMSEA 0.000). For greater visibility, the factor loads of the measurement models are not included, although these are available from the paper's corresponding author upon request. The model's lack of goodness-of-fit is not excessive, but it is, on the whole, adequate (Chi2 sig.=0.000, Chi2/ d.f.=0.153, CFI=0.883, IFI=0.884, MFI=0.141, GFI=0.722, RMSEA=0.048). In addition, all the estimated factor loads were significant.