



**Manufacturing Flexibility and Advanced Human Resource  
Management in Latin America:  
The Case of Argentina and Uruguay**

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# **Manufacturing Flexibility and Advanced Human Resource Management in Latin America: The Case of Argentina and Uruguay**

## **Abstract**

In the continuous changing uncertainty global competitive environment, both the analysis of manufacturing flexibility and the adoption of human resource management (HRM) has spawned a number of theoretical and empirical research studies. However, insufficient attention has been paid to the connection between them and how the companies can adopt them appropriately. In the field of Latin America is even scant till date. Manufacturing flexibility and HRM have directly and indirectly to the operation performance, and impact the profit of the firms from Latin America. Using the data base from 301 manufacturing companies of Argentina and Uruguay, this paper tried to find out the relationship between mix, volume and new-product dimensions of manufacturing flexibility and nine HRM practices (individually and as a system) in the Latin American firms. The results show a positive relationship between the implementation of advanced HRM practices and manufacturing flexibility. The flexible firms have high level of implementation of HRM practices.

**Keywords:** HRM practices, manufacturing flexibility, Latin America, Argentina, Uruguay

## **1. Introduction**

In the recent years, as a consequence of globalization the issue of flexibility has been gaining increasing interest in the field of manufacturing operations. With the fast paced environment, there comes the ascendant product variety and shorter product life cycles, the managers notice that only the quality and cost cannot satisfy effectively in the market-place. In this sense, flexibility in manufacturing context has become a key component in the process of design, operation and management of manufacturing systems (Kraza *et al.*, 1990), and a critical variable for the achievement of a competitive advantage in the market-place (Sturim, 1999). Thus, many companies, managers and researchers begin to strive for a better understanding in the flexibility area, which then forms part of key weapons of the enterprises' competitiveness.

A company with flexibility is the one with not only the ability to respond to change their customers' need but also the capacity of facing the competitive pressures and uncertainty (Zhong *et al.*, 2002). In this sense, flexibility becomes one of the focus issues in the continuous improvement process strongly related with cost, quality and technology (Adam *et al.*, 1989; Bahjat, 2011), while Collins and Schemenner (1993) note that quality, cost and delivery dependability with flexibility are priorities mentioned. It is also a major tool when company faced direct challenges in uncertainty situation (Gerwin, 1993; Beach, 1998; Bahjat, 2011). From a performance perspective, it has been demonstrated that flexibility is a powerful system ingredient that enables stable performances under changing conditions (Becker B., 1996). Hence, in order to cope up with different unpredictable changes, the companies all need to possess some degrees of flexibility for staying competitive and gaining profit (Bengtsson *et al.*, 2002).

Manufacturing flexibility is a key strategic objective of many manufacturing companies. Nowadays, the companies with the capacity to develop and introduce new products quicker (Gaimon and Singhal, 1992), to make superior innovation than its competitors, to produce different types of products in the same time using existing facilities, etc., seem to have more competitiveness (Beach, *et al.*, 1998). Such considerations have been for the interest now being shown in manufacturing flexibility. Since the 80s, flexibility, particularly manufacturing flexibility has been well researched (Hayes, *et al.*, 1984; Krasa, 1990; Gerwin, 1993; Bengtsson,

*et al.*, 1996), in the twenty-one century, it continues being more and more important for the manufacturing companies to be outstanding. As many authors have described its features, “multi-dimension” has been paying attention (Gerwin, 1993; Swafford, *et al.*, 2006). The nature of multi-dimension implies that firms should adapt to changes in different ways and different types of flexibilities may be contain in a firm (Urtasun, *et al.*, 2012). The attributes of flexibility such as range, mobility, uniformity and the components of flexibility like machine flexibility and volume flexibility are often mingled (Barad, 1992; Gupta, 1993; Benjaafar, 1994). Therefore, the concept of manufacturing flexibility is polymorphous and confounded.

Academics studies analyzing the relationships between flexibility and performance measures such as sales revenue or profitability indicates a positive and strong relationship between them (Upton's, 1994; Bahjat, 2011). Nayak, *et al.* (2010) found a significant positive relationship between flexibility and performance where the majority of dimensions of flexibility found to be significant factors affecting production system performance. Manufacturing flexibility contribute directly and indirectly to firm performance (Bahjat, 2011). Many researchers have paid attention to the manufacturing flexibility's multi-dimensional approach and what determines the firm's capacity to deal with uncertainties arising from the demand side, as Koste and Malhotra (1999) defined several dimensions of manufacturing flexibility that includes machine, labor, material handling, routing, operations, expansion, volume, mix new product and modification. Suarez, *et al* (1996) proposed an integrative framework to analyze manufacturing flexibility from a strategic perspective, focusing on the first-order flexibility like mix, volume, and new-product flexibility.

Besides, many researchers have demonstrated the positive relationship between HRM and firm performance (Huselid, 1995; Youndt, *et al.*, 1996; Guest, 2001). HRM practices are of paramount importance in the development, utilization and behavior of firm's human capital. Hence, both manufacturing flexibility and HRM practices have positive impact to the operation performance. Here we try to confirm which performances impact the flexibility in the manufacturing area and which are more important. How the firms manage their employees (e.g. HRM practices) is a key factor. As the articles relating the manufacturing flexibility and the advanced HRM practices are still limited (Kathuria, *et al.*, 1999; Das, *et al.*, 2003; Ahmad, *et al.*, 2003; Urtasun, *et al.*, 2012), fewer studies have attempted to do the empirically-tested in Latin America (Elvira, *et al.*, 2005; Vassolo, *et al.*, 2012), the ones of Argentina and Uruguay are even rare, another significant study of this paper is to find out their relationship and how to manage them mutually to make a plant or a firm more competitive.

With the rapid industrialization and globalization, not only the US, Japanese, Korean, European manufacturers are facing the competition with challenge and chance, but also the developing economies like in Asia, China, India and Turkey, in Latin America like Brazil, Mexico, Argentina, Uruguay etc., are capable of providing low-cost and good-quality standardized items (Kathuria, 1999). The managers begun to find out that only the cost and quality cannot satisfy the market-place. Flexibility has become one key point for the competition and facing uncertainties. However, the empirical researches in this field are often from plants in Europe, Japan and the United States, so few have touched the third world (Nayak *et al.*, 2010). In Latin America especially Argentina and Uruguay are even scant.

This paper contributes to the current literature on manufacturing flexibility and HRM practices in Latin America context: Firstly, advancing in the field analyzing the relationship between manufacturing flexibility and HRM practices, both individually and as a group; secondly, using the database from 301 manufacturing companies in Argentina and Uruguay, to offer new evidence about the achievement of manufacturing and the adoption of HRM practices in Latin America; thirdly, proposing a research framework, including hypotheses, that relates

competence to capability and capability to customer satisfaction; fourthly, providing management suggestions for plants managers of manufacturing firms in Latin America, especially the ones that are planning to promote the flexibility of manufacturing.

The paper is organized as follows: in the Section 2, we will present a necessarily literature review of manufacturing flexibility background. Section 3 will be focus on the presentation and explanation of the hypothesis. Next section contains the data analysis and the result. Finally in Section 5, we will go to the discussion and conclusion.

## **2. Manufacturing Flexibility**

With the market-globalization and uncertain-environment, flexibility has been considered as an absorber of the uncertainty and variability (Bahjat, 2011) because of its ability to change or react with efficiency on effort, time, cost or performance (Upton, 1995). Manufacturing flexibility forms part of the literature since the eighties. Mascarenhas, (1981) is one of the earliest researcher that defined manufacturing flexibility, then Gupta, *et al.* (1989) edited his definition to “the ability of a manufacturing system to cope with changing environment or variability”; Cox (1989) called manufacturing flexibility “the rapidity and relief for firms to change their market situation”; Nagarur, (1992) defines it as “the ability of the system to quickly adjust to any change in its internal factors”.

Then in the nineties many researchers began to focus not only on its concept or definition but also its measurement. Koste, *et al* (1999) defined several dimensions of manufacturing flexibility including machine, labor, material handling, routing, operations, expansion, volume, mix, new product and modification and all these dimensions are defined by range and adaptability. D’Souza, *et al.* (2000) said that the externally driven manufacturing flexibility dimensions are variety and volume flexibility, internally driven manufacturing flexibility dimensions are material handling flexibility. Benjaafar, (1994) argued that the concept of manufacturing flexibility is confounded because the elements that the attributes of it such as range, mobility and the components of it like machine flexibility and volume flexibility are often mingled. Suarez, (1996) defined four basic type of flexibility: mix, volume, new-product and delivery-time flexibility, saying that the non-technology factors have close relationship with them and six factors will affect the implementation of flexibility (production technology, production management techniques, relationships with subcontractors, suppliers, and distributors, human resources, product design, accounting and information systems). Actually from all this we can go to the conclusion, that manufacturing flexibility is a plant or a system’s ability to manage their resources and to make appropriate and rapid change in uncertain-environment, besides, it is a concept of multi-dimensions. Companies with flexibility can own different dimensions. In this paper, we will apply the three output-type dimensions of Suarez, (1996) -- mix dimension, new-product dimension and volume dimension –in our research.

The manufacturing flexibility system has confirmed its importance respond to the changing circumstances caused by the environment (Gupta, *et al.*, 1989). Generally, output flexibility and production technology have been paid most attention. The suppliers and clients also have close connection with manufacturing flexibility (Das, *et al.*, 2003). Other factors that have impact to the manufacturing are related to the management of employee, the HRM practices like human capital investment, new technology, etc. The researches of the connection between manufacturing flexibility and HRM practices are really limited (Kathuria, *et al.*, 1999; Das, *et al.*, 2003; Ahmad, *et al.*, 2003), which is not matching up with the need of this study. Their relationship is a key point that in this paper we are going to find out.

## **3. Hypotheses for Empirical Analyses**

In recent years, HRM practices have been repeatedly justified that they have the potential to improve and sustain organizational performance. All kinds of practices that help to manage the employees are included. Not only to select and to promote the employees, but also let them fit with the company and its culture. Therefore, it is said to have a positive impact on the firm's capacity to adapt to changes and for their competitive advantage (Coff, 1997; Schuler, *et al.*, 1987). Also, it respects local environment, which is a key component in Latin America (Elvira, *et al.*, 1995).

Bailey, (1993) suggested that an effective HRM strategy needs three components: abilities, motivation and opportunities. One of the most well-known definitions is from Pfeffer in 1998, he concluded the Human Resources Management practices in seven parts, which are: (i) Employment security; (ii) Selective hiring of new personnel; (iii) Self-managed teams and decentralization of decision making as the basic principles of organizational design; (iv) Comparatively high compensation contingent on organizational performance; (v) Extensive training; (vi) Reduced status distinctions and barriers, including dress, language, office arrangements, and wage differences across levels; (vii) Extensive sharing of financial and performance information throughout the organization. Although there is no absolute definition of the HRM practices, most researchers have reached an agreement that the practices related to the organization of work (e.g. flexible job assignments, self-directed work teams and a high level of communication), the practices used to manage the employment relationship (e.g. selective and exhaustive staffing procedures, extensive training and fair treatment through all organizational levels), compensation practices (e.g. above-average wages and compensation schemes linked to group performance introduce novel ways of motivating, compensating and coordinating employees) etc., are called as advanced HRM practices.

Empirical papers of HRM practices on performance are extensive (Delaney, *et al.*, 1996; Becker, *et al.*, 1996; Collins, *et al.*, 2003). But the research about the relationship between HRM practices and manufacturing flexibility are limited. Kathuria, *et al.* (1999) tested their relationship 483 individuals in 99 manufacturing plants of USA. Das, *et al.* (2003) modeled their relationship in the supply chains. Ahmad, *et al.* (2002) discussed the impact of HRM practices across countries. However, the research in Latin America and especially, Argentina and Uruguay, is rarely exist. In this article, we expect to use the database from Argentina and Uruguay, to prove that the impact of HRM practices on organizational performance that proposed by Pfeffer (1998) and others can be generalized across manufacturing plants and be positive. Hence, we make two hypotheses as below:

*Hypothesis 1: There is a positive relationship between the use of advanced HRM practices and manufacturing flexibility.*

The HRM practices literature's have discussed that the effect of a combination practice is stronger than the individual ones (Huselid, 1995; Macduffie, 1995; Lepak, *et al.*, 1999). Previous research are largely concentrated on a single HR practice, such as compensation, selection, etc. (Gerhart, *et al.*, 1990). This systemic approach therefore recommends applying the whole package of advanced HRM practices instead of a selection of its constituent parts. In this sense, we are wondering if the manufacturing flexibility will have a positive connection with not only an individual HRM practices but also a group or a system of it. The hypothesis 2 showed our expectation.

*Hypothesis 2: There is a positive relationship between the use of advanced HR practices as a system and manufacturing flexibility.*

### **3. Empirical Approach**

### 3.1. The situation of Latin America, especially Argentina and Uruguay

The companies and industries of Latin America are going ahead with the global economic trend and have occupied an important situation in the competition. The biggest country Brazil is one of the BRIC (Brazil, Russia, India and China) countries when the whole world was facing the sub-prime crisis. Other countries like Mexico, Argentina, Colombia and Uruguay, etc., are playing an important and active role in the world trade. However, with the development of the economy and companies, the flexibility and human resource management practices of this area have been ignored by the management literature (Elvira et al., 2005). Especially the south countries Argentina and Uruguay, has nearly no previous study until now.



(photo from Wikipedia.org)

Argentina has a population of 41 million and a labor force of 18 million. The GDP/capita is 10.6 thousand dollars (2011). Uruguay has a population of 3.3 million, with labor force 1.5 million and the GDP/capita is 14.2 thousand dollars (2011). Uruguay ranked the 89 in the Doing Business ranking (World Bank, 2011) while Argentina ranked the 124 out of 185 countries and regions.

The firms in these two countries and the other countries of Latin America are at large small and medium-sized enterprises, that unlike the formalized, specialized and decentralized large companies (Germain, *et al.*, 1999), they are more flexible at production and surviving for this. Besides, the human resources management is a key component for these countries, as has been investing in programs, the SME (Small and Medium-Enterprise) can increase their productivity by promoting innovation, training while the multinational companies can be more efficient and advanced (Ibarraran, *et al.*, 2009).

### 3.2 Sample and variable measurement

This analysis is based on a single questionnaire for the plant managers of 301 diverse manufacturing firms from Argentina and Uruguay in the year of 2009. The answers are from phone call, email and interview; the major part is from a 60-minute face-to-face interview. The interviewees are plant managers (70%), general managers or operations managers from the manufacturing companies, if they are blue-collar, the answer is useless. These 301 firms have an average company history of 30 years, with about 88 workers. It should be notice that the company with the least number of workers—19. It has also been concluded, because it's a character of the companies in this field, and the small-medium size companies have higher flexibility (McAdam, *et al.*, 1999) because they perform oriented by the customers and the practices impact more obviously in them (Walley, 2000). The survey contains questions relating to production, technology, quality, human resources policy, internal organization,

relationships with suppliers and customers, as well as a series of questions on general information about the plant. The section of human resources policies provides extensive information about all the aspects that have a direct impact on labor relations: personnel selection and promotion criteria, existence and types of incentives, salaries, type of contract, workers' educational level and the training, absenteeism, staff restructuring and actions that are carried out in the company to inform and engage the workers. The same questionnaire has been used in the Spanish companies from 1998 to 2007 (Urtasun, *et al.*, 2012). Last but not least, the analysis is based on a plant-level; firms with multiple plants will need to calculate the average implementation of both technologies and practices.

### 3.2.1. Manufacturing flexibility

Manufacturing flexibility is multi-dimensional; here we only use the three first-order dimensions defined by Suarez, (1996): mix flexibility, new-product flexibility and volume flexibility. In our questionnaire, there is a part especially for these three dimensions. We provide a 5-point scale questionnaire, where 1-Totally disagree, 2-Disagree, 3-Neither agree nor disagree, 4-Agree and 5-Totally agree. Every dimension is in a "composite" way, combining by different items, which represent in different important way for the flexibility construct. In Table 2, it shows that after varimax rotation, the relation to the three principal components with the highest percentage of total variation explained. From the Table 2, we can see different items are connected with different flexibility. Following we will explain separately each of the three flexibility dimensions:

*Volume flexibility* is the extent of change and the degree of fluctuation in aggregate output level which the system can accommodate without incurring high transition penalties or large changes in performance outcomes (Koste, *et al.*, 1999), in the table there are two items that are combined with: (1) we can relatively easy adapt to constant changes in the quantities to produce; (2) the cost to increase or decrease the quantity of output is low.

*Mix flexibility* is defined as the number and variety of products which can be produced without incurring high transition penalties or large changes in performance outcomes (Koste, *et al.*, 1999), which here is combined with three items: (3) a high number of product references manufactured in the plant; (4) the products manufactured in the plant are very different from each other; (5) the mix of products manufactured in the plan can be easily changed.

*New-product flexibility* is as technology advances rapidly and customers become more sophisticated, rapid product introduction can give firms a real competitive advantage (Suarez, 1996). Here it is also combined with three parts: (6) each year, many new products are introduces; (7) the new products are very different from the existing ones; (8) we take very little time to develop or introduce new product.

Table 2. Principal component analysis.

survey items	Volume flexibility	Mix flexibility	New-product flexibility
(1). We can relatively easy adapt to constant changes in the quantities to produce	<b>0.783</b>	0.141	-0.09
(2). The cost to increase or decrease the quantity of output is low	<b>0.539</b>	-0.148	0.491
(3). A high number of product references are manufactured in the plant	0.299	<b>0.74</b>	0.062
(4). The products manufactured in the plant are very different from each other	-0.005	<b>0.81</b>	0.184

(5). The mix of products manufactured in the plant can be easily changed	0.503	0.365	0.207
(6). Each year, many new products are introduced	-0.042	0.475	<b>0.649</b>
(7). The new products are very different from the existing ones	-0.081	0.226	<b>0.781</b>
(8). We take very little time to develop or introduce new product	0.351	0.027	<b>0.664</b>
Cumulative % of total variation	22.54	43.217	60.436

Notes: Number of observations = 398. Loadings after varimax rotation.  
The parts related to each dimension are in bold type.

From the “bold type” part we can see the items are connected with each type of flexibility, the result occupied 60.436% of the total answers. The result will be analyze in the Section 4.

### 3.2.2. Advanced HRM practices

In this paper we followed the HRM practices literature (Huselid, 1995; Pfeffer, 1998; Urtasun, *et al.*, 2012), using nine advanced HRM practices to see the impact on operational performance: (1) middle-manager level; (2) salary level comparing to the competitors; (3) selection tools; (4) extensive training; (5) high performance compensation; (6) formal performance evaluation; (7) incentives program; (8) information share; (9) employee participation.

Table 3. Statistic Descriptive and Exploratory Factor Analysis for HRM practices.

HRM Practices	Statistic Descriptive		Factor Loadings		
	Mean	St. Deviation	F1	F2	F3
Selection Tools	2.93	0.794	<b>0.65</b>	0.217	0.045
Extensive Training	2.9	0.897	<b>0.682</b>	0.324	0.054
High Performance Compensation	2.68	0.928	<b>0.75</b>	0.114	-0.169
Formal Performance Evaluation	3.65	0.873	<b>0.714</b>	-0.038	0.058
Incentives Program	3.23	1.017	<b>0.707</b>	0.067	0.074
Information Share	2.14	1.019	0.128	<b>0.843</b>	-0.049
Employee Participation	2.89	1.076	0.201	<b>0.787</b>	0.15
Middle-manager Level	1.87	1.116	-0.067	0.255	<b>0.683</b>
Salary Level	3.38	0.659	0.111	-0.142	<b>0.824</b>
			28.155%	45.782%	59.247%

In the questionnaire there is also a part especially about the advanced HRM practices. In order to detect the different combinations of advanced HRM practices, we carry out an Exploratory Factor Analysis (MacDuffie, 1995). Three factors contributed 59.247% of the information (Table 3). Also from the Table 3 we can see that the selection tools, extensive training, high performance compensation, formal performance evaluation and incentives program are connected in Argentine and Uruguay companies. We named them as the company or plant's ABILITY. The information share and employee participation form the second part, we named it the RIGHT of employees. And the middle-manager level and salary level formed the third



part, which is named LEVEL of the company or plant. From the Mean result we can see that the evaluation incentives is in the highest level among the plants. Salary level is also a little bit higher than the intermediate-value. Information share is at a low level while the middle-manager level is the lowest, that the major part of middle-managers is not the blue-collar workers.

Depending on the Table 3, we make a Table 4 to see the relationship more clearly. In the Table 4, we can see specifically all the survey items that are used to measure the advanced HRM practices together with their variable names for subsequent analyses, type of response and percentage of plants in each response category.

Table 3. Advanced human resource management practices.

Var.Name	Survey Items	type of response	% of plants
LEVEL1	The middle management positions are covered by plant operators.	5-point scale	
		1. 'Never'	49.3
		2. 'a few times'	31.4
		3. 'half of the times approximately'	6.6
		4. 'major times'	9
		5. 'always'	3.8
LEVEL2	Compared to our direct competitors, the salaries paid to employees in this plant are	5-point scale	
		1. 'extremely lower'	0.4
		2. 'lower'	3.8
		3. 'similar'	58.6
		4. 'higher'	32.3
		5. 'extremely higher'	4.9
ABILI1	The Variety of selection techniques during the staffing procedure (interviews, personality and ability tests, simulations, etc.)	5-point scale	
		1. 'null' or 'very low'	4.1
		2. 'low'	19.4
		3. 'normal'	59.2
		4. 'high'	13.9
		5. 'very high'	3.4
ABILI2	Investment in training, both in hours and money spent	5-point scale	
		1. 'null or very low'	6
		2. 'low'	24.5
		3. 'normal'	46
		4. 'high'	20.5
		5. 'very high'	3
ABILI3	The percentage of employee's salary which is tied to firm or plant performance	5-point scale	
		1. 'null or very low'	15.2
		2. 'low'	17.2

		3. 'normal'	52.7
		4. 'high'	13.9
		5. 'very high'	1
ABILI4	Plant employees' performance is formally evaluated	5-point scale	
		1. 'totally disagree'	1
		2. 'disagree'	14.5
		3. 'neither agree nor disagree'	12.1
		4. 'agree'	63.3
		5. 'totally agree'	9.1
ABILI5	The results from formal performance evaluations are tied to incentives or are used to make decisions about salaries.	5-point scale	
		1. 'totally disagree'	5.2
		2. 'disagree'	24.1
		3. 'neither agree nor disagree'	16.2
		4. 'agree'	51.5
		5. 'totally agree'	3.1
RIGHT1	Employees regularly receive formal communication regarding financial information and firm's performance.	5-point scale	
		1. 'totally disagree'	27.7
		2. 'disagree'	46.6
		3. 'neither agree nor disagree'	11.1
		4. 'agree'	12.8
		5. 'totally agree'	1.7
RIGHT2	The employees are involved in regularly scheduled meetings to identify, select, analyze, discuss and propose solutions to work related issues.	5-point scale	
		1. 'totally disagree'	7.8
		2. 'disagree'	37.2
		3. 'neither agree nor disagree'	16.9
		4. 'agree'	34.8
		5. 'totally agree'	3.4

Notes: Number of observations = 301. Some variables have missing observations.

The middle management positions are 49.3% 'Never' covered by plan operators while 'a few times' has 31.4%; compared to our direct competitors, the salaries paid to employees in the plan is 58.6% similar to the others, while 32.3% consider that their salary paying to employees are 'higher' than their competitors; 59.2% of the managers considered their selection tools are similar to their competitors; the extensive training has been considered 46% as normal as the others. 52.6% of the salary are indifferent from the others. 63.3% 'agree' that their plant employees' performance is formally evaluated while 51.5% confirmed that the results from formal performance evaluations are tied to incentives or are used to make decisions about salaries. 46.6% are 'disagreed' that the employees receive formal communication regarding financial information and performance. There are 37.2% and 34.8% of 'disagree' and 'agree'

that the employees are involved in regularly scheduled meetings to identify, select, analyze, discuss and propose solutions to work related issues.

To conclude, the characteristics of Argentina and Uruguay are that the salary, the selection tools, the extensive training and the high performance salary are at an indifferent level, while the middle management positions, and the information sharing are at a low level, performance evaluation and performance evaluation are considered a high level.

#### 4. Result and discussion

To due with the three flexibility dimensions-*volume flexibility*, *mix flexibility* and *new-product flexibility*, we make a cluster analysis (Table 4). Cluster 1 is made of 47 plants that are below the average in all the three dimensions. Cluster 2, of 98 plants, has the below-average levels of Volume Flexibility and New-product Flexibility, but is the highest in Mix Flexibility. Therefore, the plants in Cluster 2 have a limited range of productivity and new product, but are capable to adjust their production to changes in the volume of products demanded. Cluster 3 is consist of 99 plans, which have above average of all the three dimensions, but has more advantage in the new-product dimension while Cluster 4's Volume Flexibility is higher than others. It is interesting to see that there is cluster with all the dimensions below average (Cluster 1), in this case the Volume Flexibility and Mix Flexibility are very close and could be alternative; also a Cluster with all the dimensions above (Cluster 3), here the ability of Volume Flexibility and Mix Flexibility are also similar. And also Clusters with one of the dimensions very above the average, one near the average and one below, like Cluster 2's advantage in Mix Flexibility and Cluster 4's Volume Flexibility.

To draw the conclusion, we can define the four clusters of plants as: non-flexible plants (i.e. Cluster 1), plants show the Mix Flexibility (i.e. Cluster 2); well-flexible plants (i.e.) and plants show the Volume Flexibility (i.e. Cluster 4). These four clusters results have been elaborated, we identified associations, chi-square test and ANOVA were applied to mean values by cluster of the HRM practice items. With results in the Table 6, we need to go to the conclusion that why manufacturing flexibility is related to the advanced HRM practices. As results show, there are several significant differences in the average values of advanced HRM practices across flexibility cluster. For *Plants' Abilities*, there are four out of five variables that capture the breath of recruitment sources employed in the Plants' Abilities, which means these practices are closely linked with the extent flexibility (variable ABILI1, ABILI2, ABILI3, ABILI5). In situation of *Employees' Right*, RIGHT1 is at a two stars level significant difference. In case of *Plants' Social Levels*, there is no significantly mean difference across clusters for the percentage of the employee's middle position level. Additionally, the difference of Cluster3 is bigger than the others and the one of Cluster1 is the smallest. All these results and differences have improved our Hypothesis 1, that there is a positive association between the use of advanced HRM practices and manufacturing flexibility. Therefore, the selection tools, the extensive training, the performance salary, the high performance compensation and the information sharing have a positive relationship with manufacturing flexibility. The middle management position, the salary compare to other plants and the participation are not significantly related.

Table 5. Cluster Analysis

	FV	FM	FNP
<b>cluster 1</b>			
n	47	47	47
mean	2.5319	2.5426	2.2837
sd	0.51504	0.54003	0.54719

<b>cluster 2</b>				
n	98	98	98	
mean	3.2959	4.1071	2.5646	
sd	0.66129	0.44403	0.46011	
<b>cluster 3</b>				
n	99	99	99	
mean	3.9293	3.9091	3.7172	
sd	0.47921	0.4538	0.48179	
<b>cluster 4</b>				
n	55	55	55	
mean	3.8909	2.4273	2.2273	
sd	0.4377	0.64849	0.60804	
<b>Total</b>				
n	299	299	299	
mean	3.495	3.4866	2.84	
sd	0.73786	0.88698	0.81063	

Besides, in the advanced HRM system, the result comes out that the Plants' Abilities exhibits higher average level in flexible clusters. The Cluster 3 is the largest, followed by Cluster 4 and Cluster 2. Mean value is significantly lower in cluster 1. The conclusion drawn from here can support our Hypothesis 2: There is a positive relationship between the use of advanced HR practices as a system and manufacturing flexibility. The system of ability is significant, so the companies with the five abilities have better performance and better flexibility.

## 6. Discussion and conclusions

With the analysis of the data base of Argentina and Uruguay, we have explored the relationship between Human Resources Management practice and manufacturing flexibility. Especially the companies with advanced HRM practices seem to have more manufacturing flexibility not only individually and also as a system. Both of our hypotheses have been proved that the companies more flexible have better advanced HRM practices in a great extent than the less flexible ones.

Table 6. Advanced HRM practices by clusters.

Variable	Test <sup>a</sup>	Cluster 1	Cluster 2	Cluster 3	Cluster 4
<b>Advanced HRM practices</b>					
Plants' Abilities					
ABILI1	15.078***	2.77	2.74	3.24	2.83
ABILI2	14.458***	2.66	2.78	3.2	2.74
ABILI3	24.515***	2.48	2.42	3.08	2.59
ABILI4	4.892				
ABILI5	24.921***	2.87	3.08	3.63	3.06
Employees' Rights					
RIGHT1	14.901**	2.15	1.85	2.41	2.15
RIGHT2	2.285				
Plants' Social Levels					
LEVEL1	3.477				
LEVEL2	2.213				
Advanced HRM sys.					
<i>Plants' Abilities</i>	15.056***	2.8383	2.9345	3.3903	2.9574

*Employees' Rights* 1.262

Plants' Social Levels 4.239

Notes: Chi-square test is used for categorical variables and ANOVA (F statistic) for interval variables and for categorical variables with more than 10 categories.

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

Our hypotheses have been proved and therefore, our paper has contributed to the manufacturing literature by: Firstly, we have confirmed the positive relationship between manufacturing flexibility and HRM practices. The selection tools, the extensive training, the performance salary, the high performance compensation and the information sharing have a individually positive relationship with manufacturing flexibility. The middle management position, the salary compare to other plants and the participation are not significantly related. If the selection tools, the extensive training, the performance salary, the high performance compensation and the information sharing stay in a group, they also get a positive relationship; secondly, using data-base from 301 manufacturing organizations of Argentina and Uruguay, we find out the character of this field which will fill in the blanks, some positive variables are different from European, Japanese and US manufacturing companies; thirdly, focusing on the first-order manufacturing flexibility and analyzing individually and as a combination, systematically tested the impact of manufacturing flexibility; fourthly, proposing a research framework, including hypotheses, that relates competence to capability and capability to customer satisfaction; fifthly, our research will contribute to the owners or managers of multinational organizations that are planning to promote the flexibility of manufacturing; last but not least, it provides new evidence about the adoption of HRM practices in Latin America.

However, our study is not free of limitations that need to be investigated by the future researchers. In the research we have only used three most common flexibility dimensions. The other dimensions have been ignored. Our research area is only the south-American countries; we have not compared it with the research of the other areas of the world.

Finally, with the market-globalization and the each day more extensive competition in the manufacturing industry, the plants managers need to understand the importance of manufacturing flexibility and the advanced HRM practices in their company, and update their knowledge to make future strategies. This paper has provided some new empirical evidence in this field.

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