

Comparative analysis of enterprises of covering floors and walls by applying the radar charts methodology

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Abstract: The radial chart is a graphic that shows the financial situation of different management areas displayed on it. So we can take decisions in order to get company goals and to measure their effects through the obtained indicators from the application of sine and cosine theorem. The effects are multidirectional, so it is possible to see how the decision taken by a management area affects the display on the radial chart. At same time, the financial structure is linked to geometric figures obtained when the maturation average periods are measured on a radial axis.

Keywords: Radial Chart, Management Accounting, Decision Making, Economic Environment

1. Introduction

The radar charts are usually used to explain the behavior of an object of the study. Each variable is represented on one axis that has a common limit to all variables. This situation forces the variables to transform into the same measure and it allow us to do comparisons according to the object of study. We can find several examples of the application of the radar charts in economy. The Economic Bulletin of the Bank of Spain (BS) May 2010[1] use the radial chart to do annual comparisons of monetary variables under efficiency criteria, and Ortega and Alberola [2] use radial charts to cross analysis comparing economic magnitudes from different countries.

The radial charts have been used from 1801 [3] but they cannot be only used as a way to represent a reality under a study. German physicist Wilhelm Roöntgen Corant (1845-1923) discovered X-rays in 1895 and won the Nobel Prize in physics for his discovery in 1901. Currently, the medical diagnosis image is a specialty in medical science that is carried out by a doctor who has no knowledge of physical science. Similarly, an accountant can do the analysis of the company through a radial graph when on its radial axes, the average of the periods of maturation of a business year are displayed. According to Pérez's work [4] floor and wall covering companies will be compared, classified as 4333 in Statistical Classification of Economic Activities in the European Community (NACE).

A commercial operation is formed by a set of economic

and financial transactions recorded in the accounts. The time at which transactions take place is the implicit variable that is not presented in the financial statements.

This variable measures the period of time in which economic and financial transactions are involved in a commercial operation. The periods used to buy, sell, collect and pay indicate the economic or financial culture existing in a country.

The first part of this work will be dedicated to the Pérez's radial methodology. So the radial analysis will be developed in the second part. After obtaining the radial indicators of companies in each country, the strategic behavior will be defined and the differences in each country sector will be analyzed. Each radial chart presents a multidirectional vision of each displayed management area so we can know the characteristics of this market at each state or of the industrial sector.

2. Methodology

This methodology is based on the display of the average maturation periods (p_i) on each axis. The average of maturation periods is calculated through the used relations in table 1. This relation measures the flow rate of economic or financial accounting transactions. It is possible to obtain the dynamic behavior of a company through the economic or financial rotation (r_i) of the accounting transactions. The relation between the two indicators is as follows:

$$p_i * r_i = 365; I = s, c, p; \quad (1)$$

s= sales; c= collection; p = payment.

The previous expression is displayed on each radial axis and these indicators are obtained, as mentioned before, on

table 1, obtained from the annual balance information sheet and the profit and loss statement.

Table 1. Pperiod (pi) and rotations (ri) of each área.

Operation	average of maturation periods (pi)	economic or financial rotation (ri)
Sales	$\frac{COGS}{365} = \frac{AS}{ps} ; ps = AS * \frac{365}{COGS}$	$rs = \frac{COGS}{AS} = \frac{365}{ps}$
Collection	$\frac{S}{365} = \frac{AD}{pc} ; pc = AD * \frac{365}{S}$	$rc = \frac{S}{AD} = \frac{365}{pc}$
Payment	$\frac{POG}{365} = \frac{AC}{pp} ; pp = AC * \frac{365}{POG}$	$rp = \frac{POG}{AC} = \frac{365}{pp}$

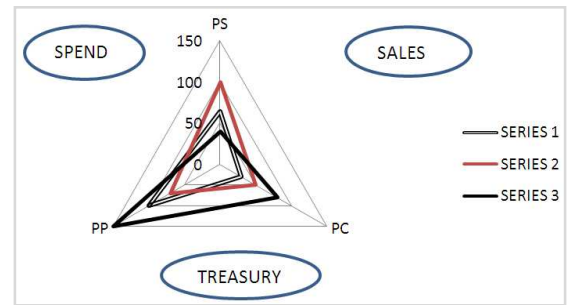
The variables from table 1 have to be explained carefully. There are two classes of transactions: economics and financial. When there is a sales operation, a relation is made with a financial transaction that performs as a financial compensation. This financial compensation implies a transformation of an economic value into a financial value. For this reason, when we compare the profit and loss accounting variables with the balance variables, the first must be multiplied by the tax effect of the value-added tax. This happens when we obtain the collection period (pc) and the payment period (pp), given that we use the credit position of clients and providers to get the periods mentioned previously. According to this, the variables that have been used in table 1 are valued in the table 2

Table 1. Name variables balance and profit and loss account.

Variables/ Operation	Balance sheet	Liabilities & Equity
Sales	Average Stocks (AS)	Cost of goods sold (COGS)
Collection	Average Debtors (AD)	Sales (1+VAT) (S)
Payment	Average Creditors (AC)	Purchases of goods (1+VAT) (POG)

Moreover, in this methodology the average period must be equal a 1 when there is an instant transaction. If this was not this way, expression 1 would never be fulfilled. The radial chart displayed on graphic 1 has three axes that represent the average of the maturation period and turnover or rotation ratios as an implicit variable. The limit of each axis is 365 according to expression 1.

The radial charts on graphic 1 represent different situations. When they are more concentrated there is a more dynamic commercial activity and moreover, the orientation of the triangle sides is significant to evaluate the management activity. This way, a specific geometric figure is associated to a financial structure that depends on the result obtained in the area. That is to say, it is necessary to measure whether the result of the area produces liquidity or not in the management activity. The issues identified are measured by applying the theorems of sine and cosine through the methodology of Pérez.



Graphic 1. The short-term management areas

The radial charts on graphic 1 represent three different strategic. Each position represents one different financial structure which depends on the financial sufficiency and of the liquidity of the results obtained in each area represented on graphic 1. This way, we avoid financial costs outside the commercial activity of the company. The necessary and sufficient conditions have been obtained through the cosine and sine theorems, according to expression 2 and 3.

$$PDk = pi^2 + pj^2 - 2 \cos \gamma * pi * pj \quad (2)$$

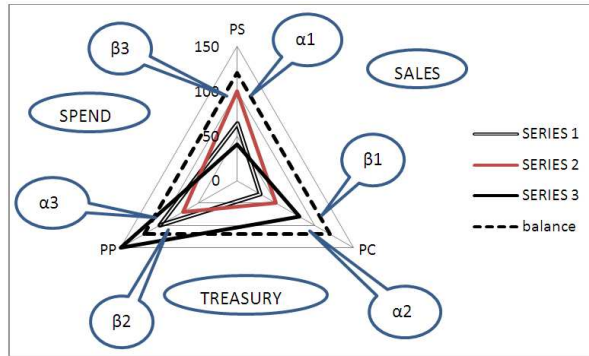
$$\frac{DPk}{\sin \gamma} = \frac{pi}{\sin \alpha} = \frac{pj}{\sin \beta} \quad (3)$$

$i \neq j ; i \square j$ are s (sales), c (collection), p (payment)
 $k = 1$ (sales), 2 (cash), 3 (spend)

The variable PDk is denominated 'perimeter distance' which is the distance between two periods of the same management area on graphic 2. So the angle γ is 120°, which is the result of dividing 360 degrees by the number of triangles in a radial graphic. The necessary and sufficient condition is obtained through the comparison of the perimeter distances (PDk), to obtain a positive financial clearance as shown on table 3.

Table 2. Perimeter differences in management areas

Management area	Perimeter difference	Result	Comparison
Sales	$d1 = DP3 - DP2$	$d1 \geq 0$	$DP3 > DP2$ (4)
Cash	$d2 = DP3 - DP1$	$d2 \geq 0$	$DP3 > DP1$ (5)
Spend	$d3 = DP2 - DP1$	$d1 \geq 0$	$DP2 > DP1$ (6)



Graphic 2. The angular coefficients of the management areas

The perimeter differences are related because d_2 is a lineal combination of the other two. That is to say, d_2 is the sum of the perimeter differences d_1 and d_3 and then, when the financial management area meets the necessary and sufficient conditions, the commercial activity provide liquidity and there is not a financial cost to maintain a financial position in short term, according to management activity. The lineal combination indicates that one of the perimeter difference, d_3 or d_1 , or both provide liquidity to reach the necessary and sufficient conditions on financial management area. Finally, table 4 contains the conditions indicated to each management area which are in graphic 2.

Table 3. The necessary and sufficient conditions of the angular coefficients

Management areas	Necessary condition angular coefficients		Sufficient condition	
			Financial sufficiency	liquidity of the result
Sales area	$\alpha_1 \leq 30$	$\beta_1 > 30$	$\alpha_2/\beta_3 > 1$	$CV/V < \beta_2/\alpha_3 < 1$
Cash area	$\alpha_2 \geq 30$	$\beta_2 < 30$	$\beta_1/\alpha_3 > 1$	$C/V < \alpha_1/\beta_3 < 1$
Spend area	$\alpha_3 \leq 30$	$\beta_3 > 30$	$\alpha_1/\beta_2 > 1$	$C/CV < \beta_1/\alpha_2 < 1$

Table 4. The search results in the Amadeus database

Product name		Amadeus	
Update number		219	
Software version		7.07	
Data update		14/12/2012 (n° 2191)	
Username		UNIVERSIDAD VALENCIA-415	
Export date		20/12/2012	
Castellón (Spain)		Step result	Search result
1.	All active companies and companies with unknown situation	17,577,614	17,577,614
2.	Region/Country/region in country: Castellon (Spain)	16,588	15,652
3.	Region/Country/region in country: Comunidad Valenciana (Spain), Castellon (Spain)	136,473	15,652
4.	NACE Rev. 2 (Primary codes only): 4333 - Floor and wall covering	77,508	41
European country		Step result	Search result
1.	All active companies and companies with unknown situation	17,577,614	17,577,614
2.	NACE Rev. 2 (Primary codes only): 4333 - Floor and wall covering	77,508	69,290
3.	Region/Country/region in country: France, Germany, Italy	5,261,634	22,667
4.	Number of employees: Last available year, min=50	450,200	43

Before applying the radial methodology, a date exploration was performed to obtain the maturation averages periods of regular economic activity, not considering those exceeding 365 days or when the accounts

Before proceeding, the dashed line shown in the graphic 2 represents a balanced position from which it is possible to measure the necessary conditions through visual observation, by comparing the amplitude of the angular coefficients of the other radial charts in relation to the dashed line.

In the radial methodology, decisions taken in an area affect the management results in other areas displayed in a radial chart. Thus, the necessary and sufficient conditions in the financial area determine that the company does not have to pay a financial cost given the position adopted in the market. Given that there is a lineal relation between the perimeter distances, the lack of liquidity that the result may offer is covered by the liquidity of the result obtained in the other two.

The financial clearance traditionally obtained by the difference between the payment period and collection period, we know now that it has consequences in the financial structure of the company, depending on the liquidity of the result obtained in each area. Given that each area is self-sufficient, the financial sufficiency and, at the same time, the liquidity of the result are reached.

3. Management Data bases

The information used to perform a comparative analysis of economic activity classified as 433, corresponds to the activity floor and wall covering in NACE that has been obtained from Amadeus Data Base. The criteria of accounting information selections are presented on table 5 and table 6 to Castellón and European enterprises, respectively.

of profit and loss account and balance sheet did not have a value to obtain the maturation average periods and so, seven companies of Castellón with a sales volume lower than 40.000€ have been eliminated, as well as thirteen of

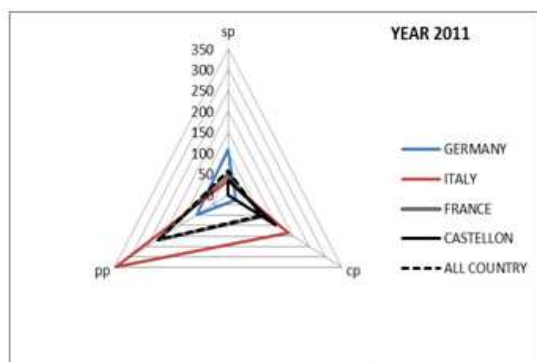
European companies with a sales volume lower than 3.410€.

To obtain the average maturation periods of companies, the average maturation period of each company has been calculated, as well as the average of the results of the management areas of each company. The radial charts are shown in graphics 3, 4, 5 and 6. They represent the transversal situation of year 2011, 2008, 2005 and 2006. The three radial charts show some characteristics of economic activity listed above. First, the activity in Castellón is the most dynamic because your radial chart is the more concentrated. Second, the financial area perimeter distances (PD2) are parallel at years 2006 and 2011; this indicates that there is a similar financial position in all European sector companies and, at the same time, there is a different management on companies in Castellón.

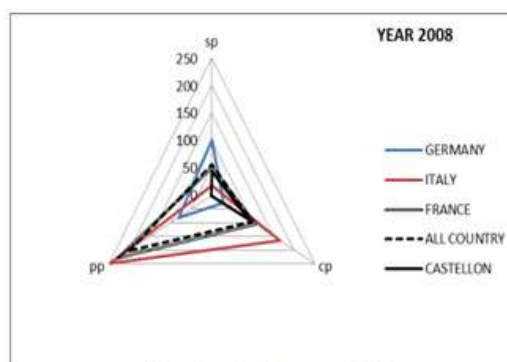
The years 2006 and 2011 present a change of tendency. At the year 2011 there is a reduction of all maturation average period, but in these years the payment period is increased respect of previous year. This situation allow

more financial sufficiency on spend and financial areas but not in the area of sales management, where the financial sufficiency decreases. This strategy to obtain more financial sufficiency in spend area provide liquidity of result to financial area.

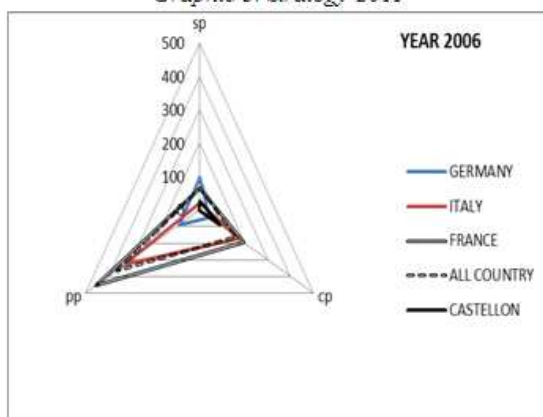
The activity of French companies conditions the analysis of this sector in Europe where the activity of Castellón has not been considered. The sector activity in Europe is determined by the French companies because the radial charts' dashed lines representing the whole industry in Europe coincide with the lines of radial charts representing the strategies of French companies. So we can see how the placement of the product in the market remains because the sales period remains constant but the liquidity of the result cannot be measured. This can be seen by comparing the financial area of the years 2011 and 2005. In 2011, a greater liquidity of transactions is produced than the one in 2005, but the financial sufficiency does not change due to parallelism of the perimeter distances, and thus the year 2008 will be a year of transition.



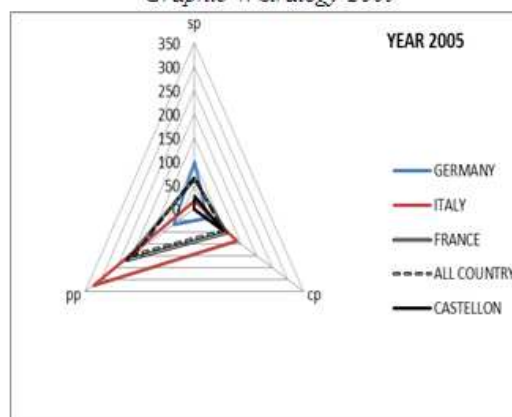
Graphic 3. Strategy 2011



Graphic 4. Strategy 2009



Graphic 5. Strategy 2006

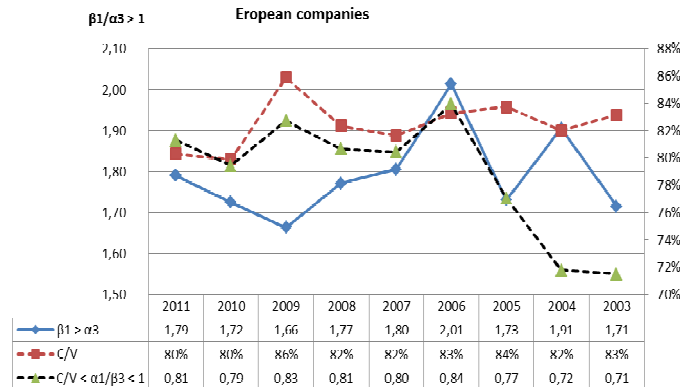


Graphic 6. Strategy 2005

The evolution of the sector's economy can be seen in graphic 7, where the angular indicator of the financial management area is represented. The sufficiency conditions are represented on its main ordinate axis. Liquidity conditions are represented in the secondary axis and the management result through the sales and purchases ratio. In

order to get an optimal financial position, the dashed line of the condition of the liquidity of the result, must pass the sales and purchases ratio dashed line.

We must remark that the financial sufficiency is produced during the whole period.



Graphic 3. Sufficient conditions in the area of treasury.

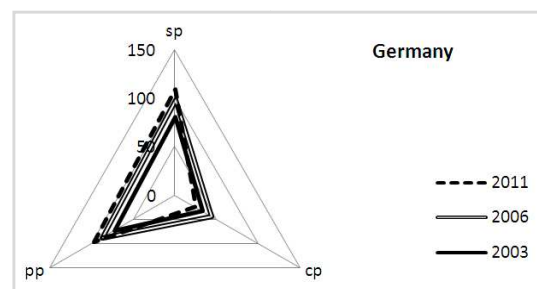
In the graphic 6, the year 2006 is the best of which are represented because the sufficient conditions reach the highest level and the result of the financial area meets the liquidity conditions also in this year. As noted above, financial sufficiency conditions are fulfilled in 2011 and 2005, but the difference remains in the liquidity of the financial area result of 2011 as it happens in 2006. The line of α_1/β_3 indicator is higher than line C/V and this indicator does not exceed the value of the unit in two years, but this situation doesn't happen in 2005. The year 2008 is a transition year and meets the sufficiency condition as year 2011, but the liquidity conditions of the result are not produced, so there is an outside financing to commercial activity. Moreover, 2009 presents a worst case scenario which is corrected by increasing the payment period at 2011. These changes in the conditions of economic activity have their effect on the financial structure of the company, and in the following sections we will be compared two kinds of companies.

It's necessary to indicate that the whole financial structure of European companies is not shown because the radial chart of each country indicates that there are different contractual terms in each one. It is therefore not possible to use an equal approach to add balance accounts when economic cultures are different. Hence, the following sections present the heritage structures of the balance of Castellón and German companies, according to the economic environment in which economic and financial transactions are carried out, represented in their respective radial charts.

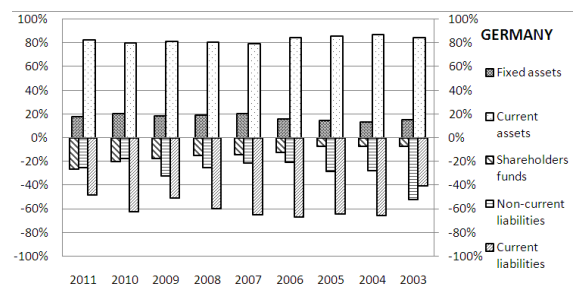
4. The German Companies

German companies not only have a large period of sales but also present a more dynamic commercial activity. Graphic 8 shows three years that present how constant characteristic have parallel their perimeter distances of spend management area. That is to say, the German companies have maintained the same management in this area, therefore management changes have occurred in the area of sales. In 2011, compared to previous years, there is a reduction of collection period and this increases the

financial sufficiency on the sales and financial areas, but the result of the sales management area does not provide liquidity and the sufficiency in the area of sales is also supported by the decisions taken in the spend area. Moreover, the result of cost and sales activities does not generate liquidity, indicating that financial decisions in these areas are not associated to managing their economic results, and costs of economic activity do not lead to financial sufficiency entity.



Graphic 4. Strategy of companies of Germany



Graphic 9. The structure of the assets and liabilities of German companies.

The situation described indicates that decisions taken in one area affects the overall management of the areas represented in a radial chart, and simultaneously there are changes in the financial structure of the company. Graphic 9 shows the balance sheet aggregates from 2003 to 2011. Within the period specified, short-term financing is replaced by long-term financing and shareholders' funds. That is, this change in strategy aims to raise financial sufficiency in the area of sales, but not in the liquidity of the result. As noted, the decisions taken in one area affect

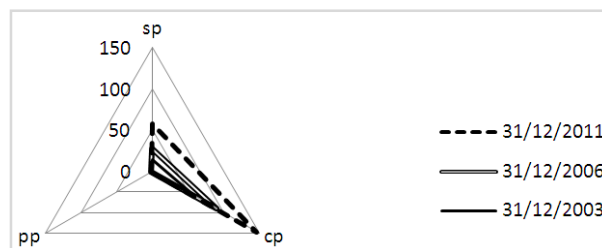
all those areas that are represented in a radial chart. Thus, it is necessary to consider the liquidity conditions on table 4 as elements of the results of each management area.

5. The Castellón Companies

The Castellón companies have not financial sufficiency on treasury area as it can be seen on graphic 9, where the angle β_2 of spend area is wider than angle α_2 . This company never reaches the financial sufficiency in sales and in spends areas, and therefore they have a financial cost to cover this situation of insufficiency. The strategy is centralized on the sales area and the profit is not liquid so the benefit remains constant. We can see how the perimeter distances of the sales (PD1) are parallel, that is to say, financial insufficiency is maintained over time, and shows that there are a continued management that is based on a cultural environment more different than in European companies.

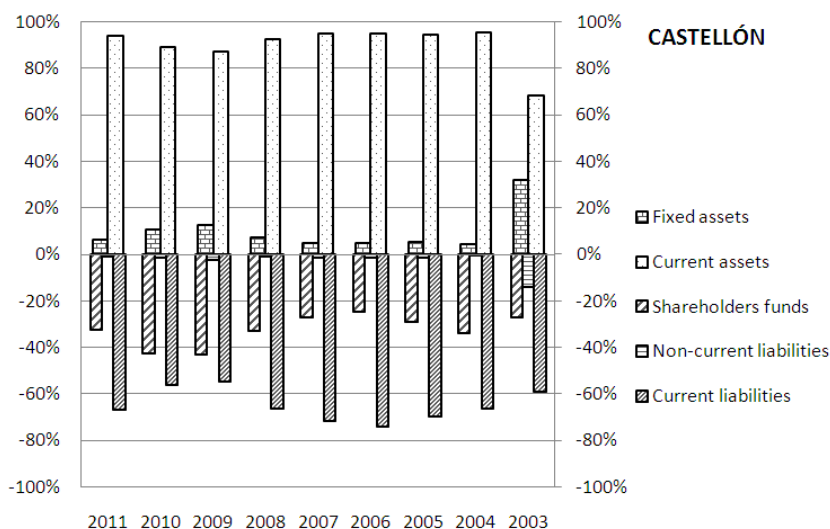
The strategy of Castellón companies is based on lending credit to market so they need to get liquidity through long-

term financing, which means that there are not profits to distribute between the shareholders and thus, it increases the companies' equity to reduce the financial cost.

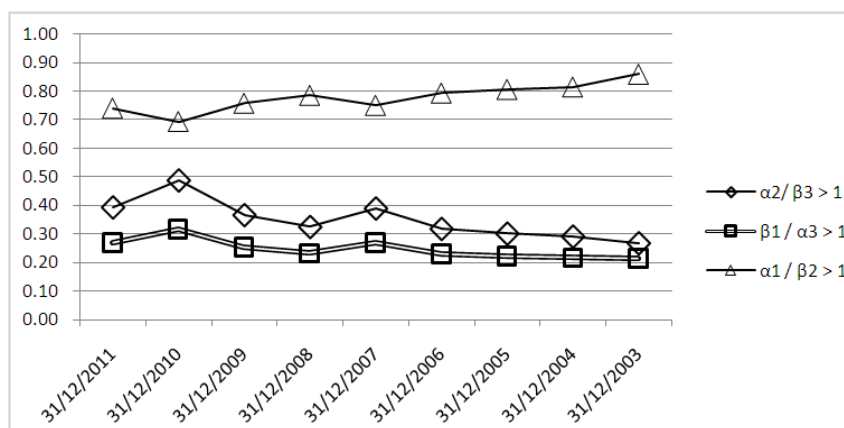


Graphic 10. Strategy of companies of Castellón

According to graphic 11 shown below, the current liabilities increase until 2006, they decrease from 2006 until 2010, and increase again from 2010 to 2011. The financial sufficiency of treasury ($\beta_1/\alpha_3 > 1$) increases in the same way as shown in graphic 12.



Graphic 11. The structure of the assets and liabilities of Castellón companies



Graphic 12. The financial sufficiency of management areas

As indicated in previous paragraphs, illiquidity in business is covered with non-commercial funding. This

situation is represented on graphics 11 and 12. On graphic 12, financial sufficiency of treasury is determined by the

behavior of financial sufficiency of the purchases area, but the behavior of financial sufficiency of the sales area also affects its level. When the level of financial sufficiency in the treasury area decreases and in the purchasing area increases from 2007 to 2010 the kind of long-term financing changes. In this period the financing grows because the result of that area doesn't provide liquidity, as indicated in annex Castellón. The liquidity of the result condition ($CV/V < \beta_2/\alpha_3 < 1$) is not met in any year in the sales area, however it is this area which provides greater liquidity to the sector since the ($\beta_2/\alpha_3 < 1$) is the smallest of them all. Namely, in that area, the liquidity of the result condition is tighter. At the same time is this area the one that provides greater financial sufficiency in the sector as shown in graphic 12.

6. Conclusion

The radial charts represent not only the dynamics of the business, they also represent the management by companies in different economic environments. So, they represent an economic culture where firms make decisions that can be measured through angular indicators.

In the radial charts, the orientation of the sides of one of them allows us to measure the result of the management carried out in each of the areas represented in it, and as a consequence, we know how the activity has been carried out on it. That is to say, we can know if it is due to the result of the activity or to the financing obtained outside it. This last question justifies the companies' financial structure. In this way, decisions taken in one area affect the whole company, and through radial charts, the analyst can measure its effects.

Finally, the radial methodology opens the door to a new form of measuring the business activity through objective independent and normalized indicators and allows us to assess the economic content of accounting information.

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