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THE INCIDENCE OF BANKRUPTCY'S SYNDROME ON FIRM'S CURRENT SITUATION AND FUTURE EVOLUTION

Abstract*: Many papers in the now-a-days literature regarding the evolution of a firm are focusing on the financial ratios that can predict quantitatively a possible failure to which the firm could confront. Also, a great number of papers are trying to identify the qualitative characteristics of the firm or of the firm's environment that can lead in the future to a failure or bankruptcy. Contrary, our paper tries, by making an analogy with the human body, to define a more complex situation that can occur at firm's level, namely: a syndrome, and to establish some of its characteristics. Through bankruptcy's syndrome we will define a state of complex associate symptoms, which, unsupervised, can evaluate and lead to firm's bankruptcy. Further, based on an empirical analysis conducted on 76 firms, several types of syndromes are identified and characterized, along with their influence on firm's actual and future state.*

Key words: *Bankruptcy's Syndrome, Symptoms, Grey systems theory, Firm's diseases, Performance.*

JEL Classification: C 02.

1. Introduction

Many of the researches conducted in the field related to the firm's analysis are focusing on the development of quantitative financial models, through which in some cases, firm's actual situation can be characterized and, in some others, future prediction about firm's evolution can be done. Another important part of the literature related to firm's analysis is stressing about on the identification of the possible connections and links between singular elements (such as: entrepreneurial orientation, market orientation, market subunit [13], HR configuration [11], learning capability [3], training [5], social responsibility [18] etc.), most of them qualitative by nature, and a certain level of firm's performance or even a possible firm's future failure.

The present paper tries to look over the changes that are taking place at firm's level as a cumulus of events, to which we will refer further on by the term "symptoms". The interconnection of the symptoms is the one that is responsible in

the future for the placement of a firm in a desirable or an undesirable situation.

Being aware that as long as the firm is situated in a "safe" zone, the elements that have contributed to the evolution of firm to that situation are looked from a position a little bit "contemplative" from which the managers are just interested in the identification of these elements on the purpose of continuing practicing them, in the other situation, in which the firm is in an undesirable situation, knowing these causes can became a capital problem.

Making an analogy with the human body, we shall refer in the following chapters of the present paper to the symptoms which are preceding the appearance of some "diseases" at firm's level, to the causes that generate these symptoms and to the way through which these symptoms can be interconnected and can lead to a much harder situation, namely the installation of a "bankruptcy's syndrome". All these elements are being defined and characterized on the next chapters.

2. Performance or failure in firm's activity

Even if we refer to the financial and non-financial performance or failure, the situation in which a firm can be found at a certain point becomes very important on one hand for its top management and on the other hand for the firm's environment, through the connections established over the time.

Firm's financial situation, the relations developed with the other firms, such as suppliers, clients or simple competitors, are influencing the environment in which the firm is conducting the business, and so, for this reason, the literature related to the study of the firm from different points of view continued over the years.

2.1. Financial performance

Even though, the financial performance has many definitions in the literature, we will consider in the following just some of the most import ones.

So, as Chen, Chen and Lee (2008) pointed out, if we consider firm as being a voluntary union of assets with the purpose of obtaining economic advantage, their performance can be defined as a difference between the value that managers expect to receive from the production and value created in their business.

Performance is highly linked to the economic growth and closely dependent on the existence of a competitive environment.

As Harris and Ogbonna (2001) believed that there are several explanations regarding the financial performance. One of these, the approach form the resources point of view, explains the financial performance as coming from inside and not as being given by the market power. According to this strategy, the role played by organizational learning and the rapid changes that took place at firm's level are underlined, those representing an advantage against their competitors, but, in the

same time, being a factor for obtaining the performance. This "simple" perspective over the performance represents even one of the explanations regarding the uniqueness of firm's on the market.

Moreover, the researches that addressed the financial performance have tried to capture the quantitative financial indicators.

For this reason, over time, diverse accounting ratios indicators have been used to measure firm's performance:

- ROA and ROE [6];
- Net sales per employee [10];
- Return on sales [8];
- Average sales growth or profit margin [11];
- Earnings before interest, taxes, depreciation and amortization (EBITDA) per number of employees [5];
- Change in sales and market share expansion [2].

2.2. Non-financial performance

Even though the non-financial performance has no intrinsic value for companies' managers, it can be used as a leading indicator for the financial performance [15], and it can offer an additional quantity of information which is not incorporated in the financial performance nor contained by the accounting measures.

Through the indicators that are measuring the non-financial performance we can firstly identify enterprise's reputation. Having a high reputation, an enterprise can easily introduce new products and services, by reducing the buyer's risk of trial. [1] Also, a good reputation can lead to a good maintenance of the relationships with key suppliers, distributors and potential allies. [1]

Another performance indicator, non-financial by its nature, can be customers' satisfaction, expressed qualitatively by the degree of satisfaction felt by customers or numerically by the average number of satisfied customers or by the number of customers whose level of satisfaction exceeds a certain level.

Because the satisfied customers are more likely to buy a greater volume of enterprise's products or services, or even to recommend those products/services to other potentially customers, the cost of attracting new customers is lower, the failure costs are reduced and the financial performance can reach higher levels.

Other variables that can be used for measuring non-financial performance are: quality of products and services, growth of number of customers, on-time delivery, employee satisfaction or morale, employee efficiency, long term relation with suppliers and customers' response time.

Even though, in most of the cases, the enterprise's management is giving a higher importance to the financial performance, the non-financial performance is also extremely important by the fact that it leads to the achievement of a better

financial performance, through a higher reduction of production costs, an increasing in productivity, an improving the yield or reducing the material consumption and nevertheless a higher level of sales growth over time.

Knowing that both types of performance are highly important to the firm, we are suggesting that as much as it will be possible, the two components of firm's performances should be incorporated in the analysis conducted as firm's level.

2.3. Failure

The financial failure lasts since the first firms were born and continue to affect a great number of firms. The forms of failure are many any diverse and it can affect all kind of companies from a little retail shop to the great corporations.

Even though, all the businesses start from the wish of being successful, many of them fail before reaching this point. The annual number of bankruptcies is the witness of such of failures.

Commonly, a business is said to have failed if it is no longer able to fulfil the legal constraints of its creditors.

3. Bankruptcy's syndrome

In practice, the term of "syndrome" is used mainly in the medical field and it reflects o specific pathological situation in which the human body can be at a certain moment in time.

Making a parallel between the human body and the firm, both seen as complex adaptive systems, we found and defined the equivalent of the human syndrome of disease, namely the bankruptcy's syndrome.

Figure 1 is designed to graphically model the analogy between the two complex systems considered.

Yoshida (2010) consider that in the human body case, where slight sickness caused by a little slump of any organ may be cured by correcting the function of the organ. Starting from this observation, we can move further in the economic field and state that, in the same way as in the human body, in firm's case, once with the identification of the non-functionality of a certain subsystem which can generate abnormal situations, the manager, having all the necessary means, could act upon the sources of anomalies and can "cure" the firm [16].

Certain diseases can occur as a result of a chain reaction determined by some serious problems that started in a small part of the company, but, which, unhealed at the right moment, extended and caused a more complicated and viral situation. In this case, firm's recovery becomes more and more difficult as the time is passing and the means that are used are not the most proper ones.

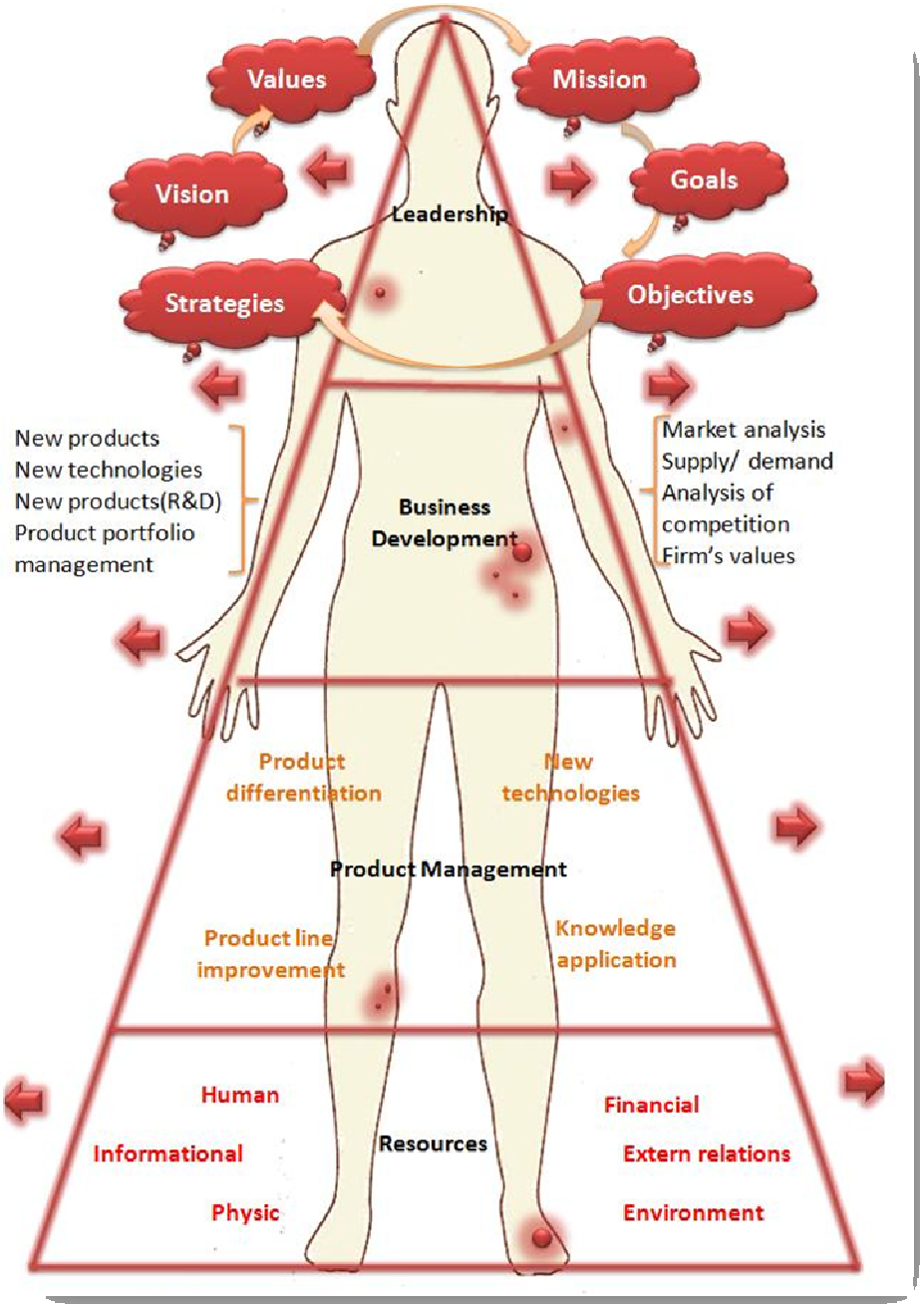

Figure 1: The analogy between the human body and the firm

In this point, as in the human body case, we can surely speak about a phenomenon more dangerous, namely the syndrome, referred in the company's case through the term "bankruptcy's syndrome".

In economics, this term will be translated through a complex of associated symptoms which characterizes a certain situation (system control loss and unpredictable behaviour), a certain disease, which, left untreated, can lead to the onset of bankruptcy. [16]

Considering these reasons, elements such as symptoms, causes, financial or non-financial performance, the ways through these are linked are becoming more and more important. Along with them, the different ways of modelling that can be used for an early identification of a certain abnormal behaviour at firm's level and of treating from incipient stages the corresponding syndrome of bankruptcy are considered to be necessaries in order to save the firm from a great loss, such as ending bankrupt.

In the next section, the main characteristics of a complex adaptive system are shortly presented and, based on them, further on the characterization of the bankruptcy's syndrome is conducted, taking into account in the same time its symptomatic behaviour.

3.1. Firm – a complex adaptive system

Formally, the term of "complex adaptive systems" refers to a collaborative system made of several nonlinear interconnected principal components.

Firm is one of the best examples of complex adaptive system. Inside it, its agents can be seen as functional collaborative components or entities of firm's systems.

Complex adaptive systems, and by this we refer even to the firms, have different characteristics such as [9]:

- Emergence;
- Co-evolution;
- Sub optimal;
- Requisite variety;
- Connectivity;
- Simple rules;
- Iteration;
- Self-organizing;
- Edge of chaos;
- Nested systems.

These properties of complex adaptive systems are acting together for creating a new order and coherence, which conduct to the creation of a solid base which sustains the firm and insures it's surviving, especially in the conditions in which its environment is continually, rapidly and unpredictably changing.

3.2. Firm's genetics and the bankruptcy's syndrome

Firm can be seen as a "recombination crossover, a kind of holistic strategic alignment between business, technology, information and management that causes the enterprise mutation and evolution as a complex adaptive system". [19]

Continuous transcription of the DNA takes place at firm's level between the elements such as: strengths, weakness, opportunity and threat, which are, in fact, the principal components of a SWOT analysis.

Along with the identification by the firm of these elements, firm's life cycle, history, type, applied methodologies, vision, concepts used in every day activity represent crucial components which are directly influencing the items of the SWOT analysis.

As a complex adaptive system, the firm, together with the all the fluxes that are taking place within its framework, vertical, horizontal or of any other nature, are leading to the identification of two main processes that are constituting the base of firm's success and long life existence, namely:

- Strategic processes;
- Informational system processes.

Digging further, these processes are based on the existence and well integration on other four fundamental elements such as the one presented in Figure 1 and listed below:

- Leadership;
- Business development;
- Product management;
- Resources.

Each of these elements has a very specific and well defined purpose and corresponds to a distinct component of the firm or to a group of such components. [14]

As it is represented in Figure 1, the brain of the firm is represented by the leadership, which, through the vision, the values by which the firm is guiding, the mission and the purposes of the firm, succeeds to create the organizational culture and to guide all the other components through the accomplishment of its goals and to correlate firm's activity in such a manner that, seen from outside, firm can be perceived as a whole, as a single "organism".

On the well functionality of this segment depends, in the future, firm's evolution. Because at this level the direction that firm should follow is established along with the processes regarding the sustaining and achieving a competitive position, the continuous improvement and the passing over the obstacles that can appear in every day activity, we can say that the "thinking" process is attribute to this segment.

Some questions regarding the identification and adoption of the best market strategies, consumer based strategies or product strategies, or about the determination of the possible ways in which the competitive advantage can be

achieved and maintained, or about the modalities in which a success team can be gathered and stimulate, or about how the firm succeeds to respond to stockholders expectations, appear at this level. Business development segment is highly linked to this segment as well.

Moving further to the next system represented by the product management, it can be added that here is the place where took place all the activities realized by the components involved in the development and the maintaining of a large variety of products, goods and services, on the market.

Through the specific elements of this segment we can underline the product teams, with role in the identification of the key competences which make a product more valuable for the customer and which determine this one to continue choosing it in the detriment of other complementary products from the same category or of other complementary products.

All the systems presented above depend on the existence of a system of "resources", very stabile, which can sustain and activate the development of the necessary capabilities in each company. From this point of view, the "feet" of the firm are:

- Human resources;
- Informational resources;
- Physical and financial resources;
- Environmental policies;
- Extern relations.

A break down at any of the above level, correlated with one or more failings at other levels, inferior or superior, or with a chain reaction made by the initial break down, can lead to the instauration of disequilibrium, of a bankruptcy syndrome, which should be treated as soon as possible.

In general terms, bankruptcy's syndrome is a complex of associated symptoms which characterizes a certain state in firm's existence and which, unsupervised, can evaluate and lead, in the end, to the bankruptcy.

3.3. Types of syndromes

Different categories of bankruptcy's syndromes can be determined for a certain economy, based on a representative sample extracted from the whole population and by applying a genetic algorithm.

Genetic algorithms are easy to used and very useful in this situation due to their properties that permit the extraction of certain rules, which are easy understandable to the expert systems.

Following the work conducted by Shin and Lee (2002) which applied a genetic algorithm for establishing some cut-off points for a series of financial indicators on the purpose of determining if a company can be considerate bankrupt or not, we extended the research and we tried to apply these algorithms for determining the cut-off points for the presence of a bankruptcy's syndrome.

The general form of such a rule which wants to be extracted based on genetic algorithms, for the case in which we are considering a fixed number of five symptoms, is the next one:

if [S1 is greater or equal (less then) CPT1,
and S2 is greater or equal (less then) CPT2,
and S3 is greater or equal (less then) CPT3,
and S4 is greater or equal (less then) CPT4
and S5 is greater or equal (less then) CPT5]
then Firm presents a bankruptcy syndrome.

where:

- S1, S2, ..., S5 represent a selection of some economic-financial indicators, namely the symptoms of a possible failure that can be identified and measured at firm's level;
- CPT1, CPT2... CPT5 are the cut-off points which are going to be determined by applying the genetic algorithm.

Based on the industry in which the firm is activating and the type of the company, the values that results by applying the rule presented above can vary.

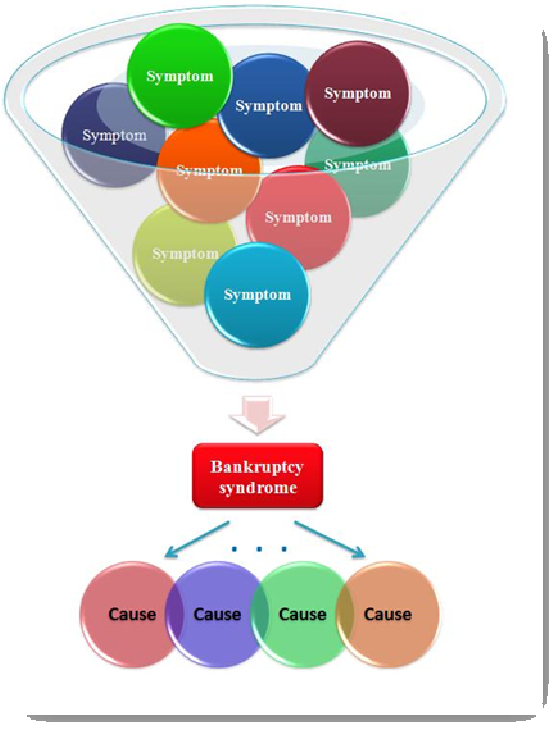

Figure 2: The relation between symptoms-syndrome-causes

Once with the identification of the different categories of syndromes, it can pass to the determination of the causes that first lead to the appearance of the symptoms (one of the possible ways of doing it can be by using the grey matrix of economic-financial knowledge, constructed in [4]).

4. Grey incidence

For determining the grey degree of incidence of a certain syndrome that occur at firm's level on the present state or future evolution of that firm (by state we refer to the financial or/and non-financial performance or even a possible failure), we will use the elements taken from grey systems theory.

Two data sequences are considered [12] X_0 and X_j, j=1...n, with initial values that differ from zero and having the same length, with t = the time period and n = the number of variables. For these we will have:

$$X_0 = (x_{1,0}, x_{2,0}, x_{3,0}, x_{4,0}, \ldots, x_{t,0}), \tag{1}$$

$$X_j = (x_{1,j}, x_{2,j}, x_{3,j}, x_{4,j}, \ldots, x_{t,j}), \tag{2}$$

The images of the initial values of the two sequences X_0 and X_j are:

$$X_0' = (x_{1,0}', x_{2,0}', \ldots, x_{t,0}') = \left(\frac{x_{1,0}}{x_{1,0}}, \frac{x_{2,0}}{x_{1,0}}, \ldots, \frac{x_{t,0}}{x_{1,0}}\right) \tag{3}$$

$$X_j' = (x_{1,j}', x_{2,j}', \ldots, x_{t,j}') = \left(\frac{x_{1,j}}{x_{1,j}}, \frac{x_{2,j}}{x_{1,j}}, \ldots, \frac{x_{t,j}}{x_{1,j}}\right) \tag{4}$$

The start-up points determined based on the previous formulas for X_0 and X_j are:

$$X_0^{0'} = (x'_{1,0} - x'_{1,0}, x'_{2,0} - x'_{1,0}, \ldots, x'_{t,0} - x'_{1,0}) = (x_{1,0}^{'0}, x_{2,0}^{'0}, \ldots, x_{t,0}^{'0}) \tag{5}$$

$$X_j^{0'} = (x'_{1,j} - x'_{1,j}, x'_{2,j} - x'_{1,j}, \ldots, x'_{t,j} - x'_{1,j}) = (x_{1,j}^{'0}, x_{2,j}^{'0}, \ldots, x_{t,j}^{'0}) \tag{6}$$

Grey degree of incidence is computed as::

$$r_{0j} = \frac{1 + \left|s'_0\right| + \left|s'_j\right|}{1 + \left|s'_0\right| + \left|s'_j\right| + \left|s'_0 - s'_j\right|} \tag{7}$$

where $\left|s^{'}0\right|$ and $\left|s^{'}_{j}\right|$ are determined in the following way:

$$\left|s^{'}0\right| = \left|\sum_{k=2}^{t-1} x^{'0}_{k,0} + \frac{1}{2} x^{'0}_{t,0}\right| \tag{8}$$

$$\left|s^{'}_{j}\right| = \left|\sum_{k=2}^{t-1} x^{'0}_{k,j} + \frac{1}{2} x^{'0}_{t,j}\right| \tag{9}$$

The degree of grey incidence represents a numeric characteristic for the closeness relation between two data sequences.

5. The incidence of bankruptcy's syndrome on the firm

Having the financial data for three years period with regard to a number of 76 Italian firms from the Campania region ([21][22]), and by applying a genetic algorithm of the type presented above, some rules regarding the presence of a syndrome were identified.

Based on these rules, three types of syndromes were depicted:

- Syndrome 1:
  - Liquidity ratio < 0.557 (and);
  - Retained earnings to total assets ≥ 0.079 (and);
  - Capital to total assets < 0.586 (and);
  - Financial expenses to sales < 0.571(and);
  - Quick ratio < 0. 662.
- Syndrome 2:
  - Liquidity ratio < 0.692 (and);
  - Retained earnings to total assets ≥ 0.130 (and);
  - Capital to total assets < 0.572 (and);
  - Financial expenses to sales < 0.523 (and);
  - Quick ratio < 0.671.
- Syndrome3:
  - Liquidity ratio < 0.692 (and);
  - Retained earnings to total assets ≥ 0.081 (and);
  - Capital to total assets < 0.586 (and);
  - Financial expenses to sales < 0.523 (and);
  - Quick ratio < 0.662.

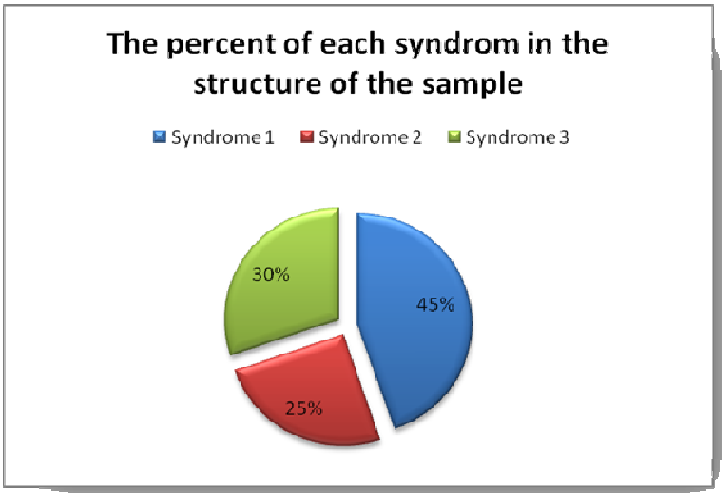

Figure 3: The percent of each type of syndrome in the structure of the sample

From the total number of considered firms, 34 presented the type one of syndrome, 19 the second type and the rest of 23 firms the type three, as it is showed in the Figure 3.

Taking into account these three types of syndromes and a performance indicator (in this case we have considered an indicator of the financial performance, namely the earnings from sales) and using the elements presented above regarding the determination of the grey degree of incidence, the results presented in the Table 1 were achieved.

	V1	V2	V3	V4	V5
Syndrome 1	0.734	0.546	0.734	0.854	0.568
Syndrome 2	0.431	0.762	0.573	0.874	0.911
Syndrome 3	0.821	0.649	0.716	0.707	0.652

Table 1: The mean degree of grey incidence of each syndrome based on the identified symptoms

Due to the fact that the number of firms from each category was unequal, for each of the three categories, we computed a mean degree of grey incidence, function on the five symptoms: liquidity ratio (V1), retained earnings to total assets (V2), capital to total assets (V3), financial expenses to sales (V4) and quick ratio (V5). Table 1 and Figure 4 present the results.

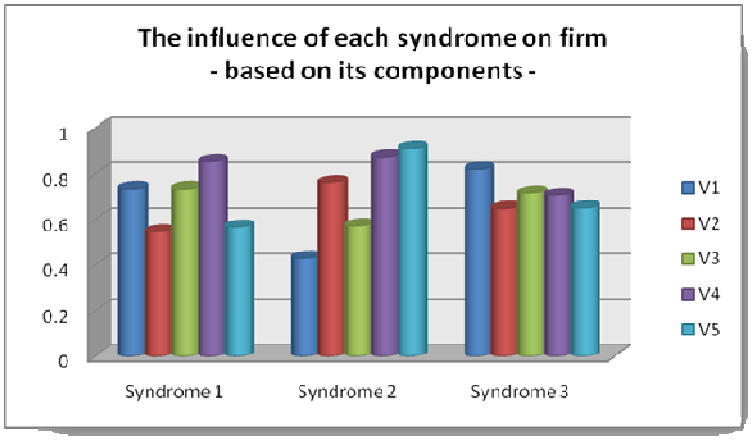

Figure 4: The incidence of each syndrome on firm

By calculating the cumulative influence of the three types of syndromes on firms' financial performance, the values obtained are almost the same: 0.687 in the case of the first syndrome, 0.710 in the second syndrome case and 0.709 for the third syndrome. Even thou, these values are falling in the same range, this meaning that no matter the type of the syndrome that appear at firm's level, the influence of them is almost the same, the more powerful conclusion, that comes from analysing the degree of these syndromes (almost 0.7) shows a high incidence of the syndrome of firm's performance.

6. Concluding remarks and future ways of continuing the research

As it was mentioned above, taking into account the level determined for each of the degrees of incidence, the incidence of a bankruptcy syndrome of firm's performance can no longer be neglected and for this reason, we consider that continuing and extending the research in this field as being necessary.

In future researches, the authors propose the study on the incidence of the bankruptcy's syndrome on the non-financial performance and to determine how, further on, this can affect the financial performance, and at which point and level of incidence the firms are declared bankrupt.

Also, once with the identification and extrapolation and generalization of the main types of syndrome that can occur in economy, a matrix of grey knowledge can be used for determining a set of conditions, causes, that lead to the occurrence of some anomalies at firm's level.

Knowing these sets of cause, the top level management can act upon them through specific instruments on the purpose of decreasing the effect of these influences on firm's actual situation and future evolution.

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