IDENTIFYING THE INTER-RELATIONSHIPS BETWEEN THE COMPANY'S STRATEGIC SECTORS

Dragoş Bîlteanu[1*], Florentina Olivia Bălu[2], Irina Stancu[3]
[1)] *Bucharest University of Economic Studies, Bucharest, Romania*
[2), 3)] *University of Geneva, Geneva, Switzerland*

Abstract
To reveal the inter-relationships between the strategic axes of the analyzed company, we used the Balanced Scorecard Analysis (BSC) and the Partial Least Squares (PLS) technique. The PLS technique identifies strategic areas (or axes) by grouping performance indicators that have the highest percentage of explaining the variance within the indicator group. We linked the strategic axes with the company's performance sectors, while the PLS model illustrated the interaction between the company's strategic lines as well as the interaction between the company's performance indicators and their respective groups.
We started with principal component analysis (PCA) to identify the most important activity sectors for the company (for example, axis 1 = Profitability), to which we associated between 4 and 9 relevant performance indicators and selected those that were most correlated with their respective strategic sectors. We used the PLS technique for principal component analysis to show the correlations between the company's strategic sectors. The intensity of the relationships within the company allowed us to predict potential strategic lines for improving managerial performance.
The BSC enabled us to explain the relationship between corporate governance variables and company performance. Within the causal relationships, we provided a logical explanation of how the analyzed business sectors are interconnected.

Keywords
Strategic lines, Balanced Scorecard (BSC), Partial Least Squares (PLS), Principal Component Analysis (PCA), Corporate Governance.

JEL classification
C38, D22, E37, L25

* Corresponding author, **Dragoș-George Bîlteanu** – d.bilteanu@gmail.com

Introduction

In this article, the aim is to analyze the strategic aspects of Vrancart, one of the most important producers of corrugated cardboard, cardboard paper, and hygienic-sanitary papers in Romania. Vrancart currently recycles over 30% of the total collected waste paper nationwide, and aspiring to become a pioneer in cellulose-based waste recycling. The importance of analyzing the company's strategy and the interrelationships of its strategic sectors becomes of interest and important for the company's future. Furthermore, understanding these dynamics impact not only Vrancart's position in the industry but also holds broader implications for the waste recycling sector and environmental sustainability efforts in Romania. Taking into account the development prospects in this field of activity, it becomes opportune to analyze the company's strategy and the interrelationships of its strategic sectors.

Our research took into account the following objectives:

- Conducting a principal component analysis (PCA) to identify the most important strategic sectors for the company;
- Identifying the main groups of performance indicators that best explain the variance of the results of the strategic sectors highlighted by PCA;
- Using the partial least squares technique (PLS) to identify correlations between strategic sectors;
- Highlighting the intensity of company's interrelationships and potential predictions of strategic interaction lines.

By addressing these objectives, we are aspiring to provide insights into Vrancart's strategic background and offer useful suggestions for its future direction and performance optimization. Initially, we were preoccupied with giving the strategic sectors the most appropriate economic denomination (for example, Axis 1 = Profitability, Axis 2 = Productivity, etc.) while keeping a maximum of 9 indicators, those being the most relevant for each strategic sector, noting that we eliminated the irrelevant indicators. Furthermore, we applied the PLS regression which highlighted the correlations between business sectors, and revealed the intensity of the interrelationships, based on which we could predict possible lines of strategic interaction within the company.

Considering these research objectives, we structured the current article as follows: In the first section, we analyzed the BSC literature regarding its utility as a strategic management instrument. In the second section, we briefly presented the statistical methodology leading us to the optimal BSC model and commented on the results of the company's data analysis. Finally (in the third section), we presented the conclusions and possible future applications of this model.

Given the increased importance around waste recycling and environmental concerns, it is imperative to understand Vrancart's strategic sectors and their interrelationships. By understanding these interrelationships, we enhance our perception related to how Vrancart's strategic decisions impact not only its own performance but also the broader waste recycling industry and environmental sustainability efforts in Romania. This approach supports future strategic initiatives within Vrancart and offers informing policies aimed at promoting sustainable practices in the waste recycling sector.

Professor Bernard Morard, along with Dr. Alexandru Stancu and Dr. Christophe Jeannette from the University of Geneva in Switzerland, developed a software called „Optimal PLS software". This software enabled us to apply the PLS technique in order to analyze Vrancart's future strategic perspectives.

1. Review of the scientific literature

In the early 1990s, BSC analysis was developed by Robert Kaplan and David Norton, and emerged as an innovative concept in the world of strategic management. The BSC analysis provides companies' management with operational and financial measures regarding internal processes, customer satisfaction, as well as innovation and organizational improvement activities (Kaplan & Norton, 1992). Through the BSC analysis, managers can better identify their company's strategic objectives and measures to enhance their strategic performance. It was later recognized that the strengths of BSC are larger: it serves as a comprehensive management tool (Ahn, 2001), a strategic management and control tool (Hueng, 2000; Pforsich, 2005), and as a performance measurement instrument. "The concept of balanced scorecard has evolved beyond the simple use of perspectives and it is now a holistic system for managing strategy. A key benefit of using a disciplined framework is that it gives organizations a way to "connect the dots" between the various components of strategic planning and management, meaning that there will be a visible connection between the projects and programs that people are working on, the measurements being used to track success (KPIs), the strategic objectives the organization is trying to accomplish, and the mission, vision, and strategy of the organization." (Balanced Scorecard Institute, 2010).

As presented in their article (Stancu et al., 2017), "the strategic schema of the BCS (figure no. 1 below) exemplifies how value is created for the company, progressively presenting the logical connection between strategic objectives in the form of a cause-effect chain. Starting from "Organizational Capacity" (knowledge and skills, as well as managerial tools and procedural technology), performance improvement occurs through the enhancement of "Internal Processes" (increased efficiency and reduced processing time), which in turn enable the organization to enhance its relationship with "Customers" (reduced distribution time and customer loyalty), as well as improve the "Financial" sector's results (reduced costs, increased revenue, and profitability)."

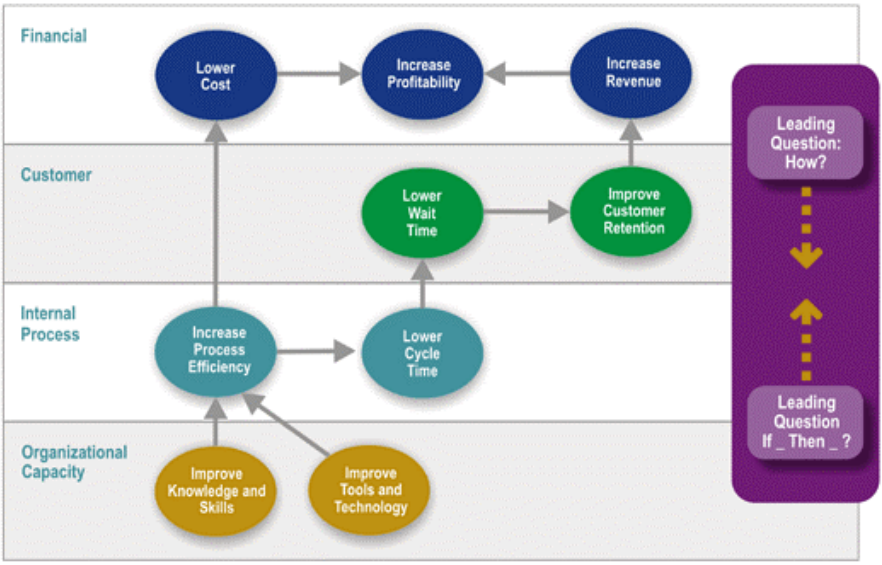

Figure no. 1: Balanced Scorecard strategic scheme
Source: The Institute Way: Simplify Strategic Planning & Management with the Balanced Scorecard, Balanced Scorecard Institute, (2010)

The BSC strategic scheme (Figure no. 1) offers a logical chain of cause-and-effect relationships (organizational capacity, internal processes, etc.) and their effects (increased efficiency, customer loyalty, increased profitability, etc.).
However, subsequent critical analysis has revealed limitations in the Balanced Scorecard method due to its main hypothesis concerning the distinction between relevant and irrelevant relationships. Nørreklit (2000) emphasizes that BSC identifies a logical relationship between the analyzed strategic perspectives rather than causality between them. Because it fails to consider any connection between the organization and its competitors, the Balanced Scorecard (BSC) cannot be considered a comprehensive strategic management tool. Therefore, a discrepancy between the company's current strategy and its assumed strategy should be permissible. Kanji (2002) argues that the model is overly abstract and challenging to use as a measurement tool. Furthermore, he notes that the connections between strategic perspectives lack clear explanation, and the causal relationships are not adequately relevant, as they are interdependent rather than genuine correlations. Finally, Malina & Selto (2003) found that the performance indicators identified in the BSC model are biased and not objective.
Furthermore, subsequent analysis identified constraints in the BSC method, mainly regarding its failure to consider connections between the organization and its competitors and the abstract nature of its strategic perspectives. Even with these constraints, the BSC had notable influences and has been used extensively across industries and organizations all around the globe, highlighting notable impacts in numerous fields such as marketing, management, accounting etc. (Albertsen & Lueg,

2014; Amer et al., 2022). Authors Malagueño et al. (2018) identified extensive fiscal and intangible performance enhancements in middle sized enterprises, such as the one in our study, which translated into increased organizational capacity, innovation and efficiency.

Antmen and Yilmaz (2020) demonstrate the significance of knowledge transfer and project selection in organizational health. They use the Balanced Scorecard (BSC) to develop a model guiding critical decision-making in project selection, ensuring alignment with strategic goals while considering resource constraints. Additionally, their review of literature identifies diverse successful BSC applications, impacting supplier performance evaluation, research and development management, technology assessment, and sustainability analysis.

The PLS method, is still a useful statistical modeling tool in general and financial management, management control, etc, even though it also has its limitations, and significant results can be obtained with small data samples. Due to the less rigorous hypotheses underlying the statistical technique, PLS also has the ability to work with non-normal data (Chenhall & Langfield-Smith, 2007).

However, these technical advantages also encompass the challenges commonly encountered by management and control scientists: the endeavor to maximize predictive accuracy despite having limited information. Creamer and Freund (2010) have overcome these limitations of PLS by using the AdaBoost technique. Alternative decision trees were generated to explain the relationship between corporate governance variables and business performance. The AdaBoost technique selects the most important indicators of the BSC board for the company's strategic planning (Creamer and Freund, 2010). Structural equation models (SEM), introduced by Joreskog (1973), and models based on manifest and latent variables, such as LISREL developed by Haenlein and Kaplan (2004), have been developed to create scenarios where company's performance is assessed using numerous indicators. Therefore, the Partial Least Squares (PLS) method materialized as a useful statistical modeling tool, offering advantages in handling large datasets and non-normal data.

In the last few years, the economic background has suffered unprecedented challenges, such as COVID-19 pandemic, the energy crisis, and geopolitical tensions (such as the war in Ukraine or the Israel-Palestine conflict), all of which have reformed the interrelationships between companies' strategic sectors. These challenges highlighted the need for applying strategic management tools like the BSC and the PLS so that the organization is in a better position to adapt to ever-changing market environment and circumstances.

2. Research methodology

PLS generalizes and combines characteristics of PCA and multiple regression method. PLS operates with large (sometimes very large) samples of independent variables to predict dependent variables regarding the strategic lines of the company.

Within a large dataset comprising economic, financial, social data etc., PCA selects a small number of uncorrelated variables, known as principal components, which capture the majority of the variability present in the original variables. Additionally, PLS

regression selects latent factors that cannot be directly and precisely measured by indicators that can be directly observed and measured through PCA.

To highlight the relevance of available variables, Principal Component Analysis (PCA) grouped the company's economic, financial, personnel, etc., variables within specific activity sectors. For each sector, relevant indicators were selected, in a way that justified these choices from an economic perspective. Finally, through PLS regression, the cause-and-effect chain between activity sectors was generated, while identifying the intensity of these interrelationships.

The process of identifying interrelationships between strategic sectors allows the company's management to effectively prioritize its activities. These interrelationships, along with their coefficients of intensity, enabled us to study the impact of changing various variables on the company's performance. As a methodology for identifying the relationships and interactions of the analyzed variables, we used a software developed by Prof. Bernard Morard together with Dr. Alexandru Stancu and Dr. Christophe Jeannette from the University of Geneva.

The historical data was gathered from available records of the analyzed company. We consider the collected data to be reliable and valid for our proposed analysis. As the initial data varied across different measurement scales, we standardized them by calculating deviations from the mean and normalizing them according to the standard deviation. We selected 31 economic and financial indicators with annual frequency from 2010 to 2018, and identified four strategic sectors (axes):

- Profitability (PROFITAB);
- Productivity and research (PROD&RES);
- Capital and results (CAP&RES);
- Personnel (PERSONNEL).

We then, attributed to each sector between 4 and 9 explanatory variables, with had the most intense connections (or the best value) for the respective axis. The majority of explanatory variables (nine) were grouped in the "Capital and Results" axes, showing strong correlation intensities (over 0.9) but also intense negative correlation (- 0.978) from the share of sales of hygienic paper in total turnover.

3. Results and discussions

The strategic sectors are presented as activities amongst the most relevant for the company. In order to issue a proper definition, it is essential to eliminate variables that would not adequately explain the definition given to the axis, variables with approximate values, as well as those that would not fit well within the axis definition. As mentioned earlier, each strategic sector comprises between 4 and 9 explanatory variables, with the most intense connections (or the highest relevance) to that sector. For example, the "Capital and results" sector has a very good representation (coefficients between 0.9 and 0.7) of the variability of the 6 explanatory indicators (Figure no. 2).

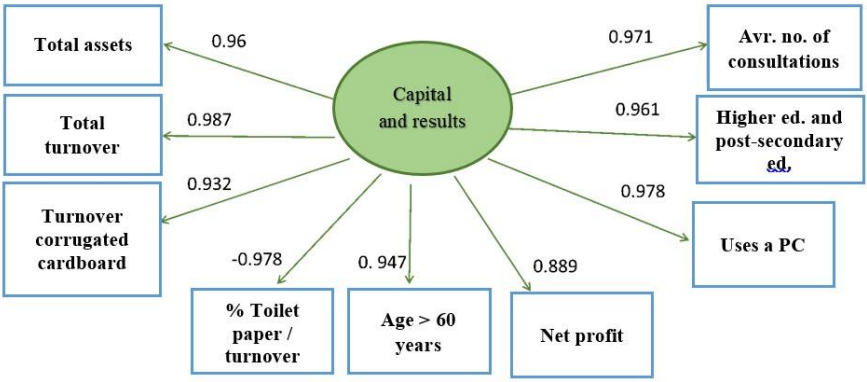

Figure no. 2: The coefficients of variation of the 9 explanatory indicators for the "Capital and results" sector.

Source: Author's processing of statistical data using the "Optimal PLS" software from the University of Geneva

In our judgment (Figure no. 2) we identify the performance of the "Capital and results" sector mainly explained by "Turnover", "Total Assets", as well as the quality of professional training (professional experience, higher education, computer usage, etc.). The outcome of these close interrelationships is reflected in the net profit. Consequently, significant changes in these variables will strongly influence the "Capital and results" sector. The cause-and-effect relationships between these indicators and the analyzed sector underscore that an increase in fixed and current assets, and implicitly in sales, will positively impact the entire "Capital and results" sector. Similar considerations can be made regarding the interrelationships in the other sectors: "Profitability", "Productivity and research", and "Personnel".

The cause-and-effect relationship between "Total assets" and "Capital and results" aligns with the industry's capital intense nature. Successful companies prioritize investments in high-performing assets, leading to enhanced efficiency, shorter process durations, and ultimately lower investment costs (per ton of product) and reduced fixed costs (per ton).

The noticeable negative correlation of -0.978 between the proportion of toilet paper sales and total turnover is supported by the company's current efforts to explore optimal alternatives (such as disinvestment, reinvestment, or retention) for this particular production line, which is experiencing substantial depreciation.

The cause-and-effect interrelationships are identified and defined through PLS regression but they are not predetermined. The model of the PLS regression has the advantage of being statistically stable, the most stable among all interaction models (validated by the Bootstrap technique). The most relevant results of the PLS model are the interrelationships between sectors, and the possible cause-and-effect connections between them (Figure no. 3).

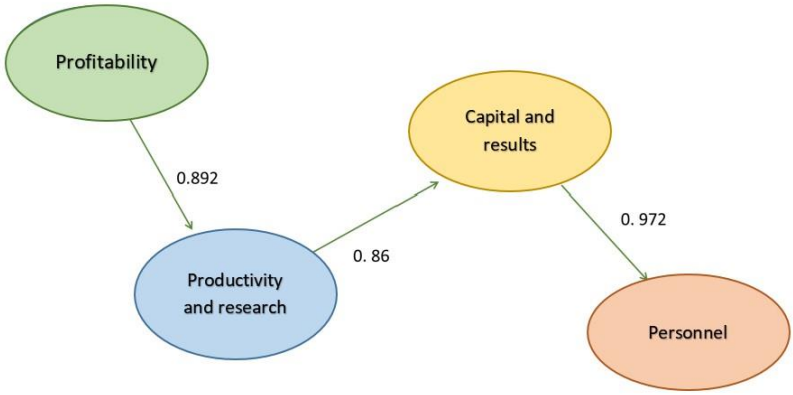

Figure no. 3: Possible causal connections between the company's sectors
Source: Author's processing of statistical data using the "Optimal PLS" software from the University of Geneva

These results align with the intuitive management approach exercised by the company until the end of our selected time frame (2018). "Profitability" has a significant impact (0.892) on "Productivity and research" with a disseminating effect (0.86), further affecting "Capital and results", which in turn have a strong effect (0.972) on "Personnel". Our research highlights relevant strategic indicators and the logic behind the company's management strategy, namely investing the company's capital in high-performing assets and in employee training, which in turn influenced the turnover indicator as well as company's profitability.

The intensity of the cause-and-effect connections in the model allows for a better understanding of the company's trends. It also suggests measures that management should take to update, correct, and anticipate the company's strategy using selected sector indicators.

In detailed form, the diagram of the interrelationships between axes, as well as the explanatory power of each sector with significant variables, can be seen below (Figure no. 4).

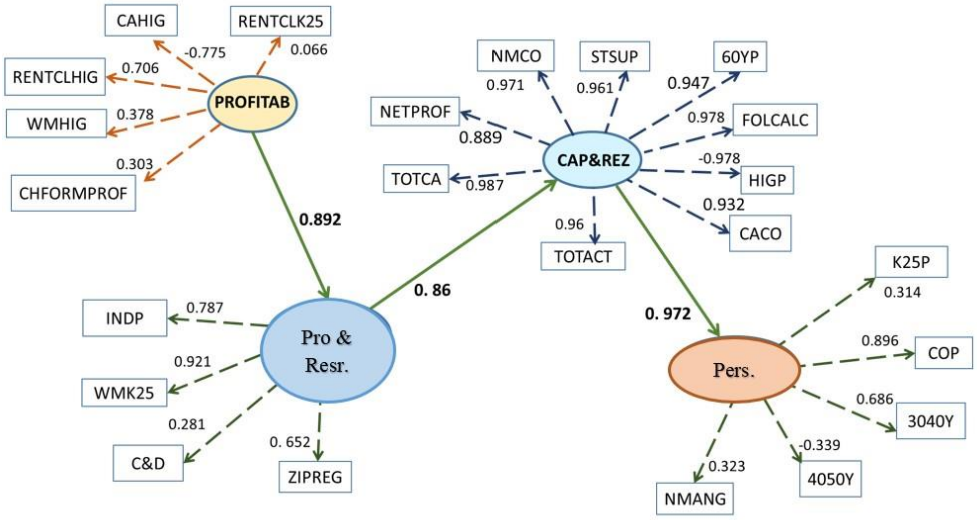

Figure no. 4: The explanatory capability of each sector with the relevant variables
Source: Author's processing of statistical data using the "Optimal PLS" software from the University of Geneva

Legend for Figure 4:

1 = Profitability (PROFITAB)	***2 = Productivity & research (Pro&Resr.)***	***3 = Capital & Results (CAP&REZ)***	***4 = Personnel (Pers.)***
Client/Rentability K25 (RENTCLK25)	*Productivity Index (INDP)*	*Total assets (TOTACT)*	*Avr. No. Of employees (NMANG)*
Client/Rentability HIG (RENTCLHIG)	*W K25 (t/h) (WMK25)*	*Total Turnover (TOTCA)*	
CA HIG (CAHIG)	*C&D (C&D)*	*Turnover CO (CACO)*	*30-40 y old (3040Y)*
Ch form prof. (CHFORMPROF)	*Days of training (ZIPREG)*	*% HIG (HIGP)*	*40-50y old (4050Y)*
W MHIG (t/h) (WMHIG)		*Net profit (NETPROF)*	*% CO (COP)*
		Average number consultations (NMCO)	*% K25 (K25P)*
		Higher ed. & post secondary ed.. ((STSUP)	
		Using a PC (FOLCALC)	
		> 60 y old (60YP)	

The statistical validation of the model reveals high values of model reliability and consistency (exception, axis 2), extracted variance (exception, axis 4), and the coefficient of determination R2 (with values of 0.889, 0.611, and, respectively, 0.503). The explanation of the cause-effect relationship between axes 1, 5, and 2 is presented in the table below (Table no. 1).

Table no. 1. Statistical validation of the implementation of the PLS model

Sectors	*Composite reliability* [2] *>0.6*	*Average variance extracted* [3] *>0.5*	*R-squared* [4] *>0.67 strong >0.33 moderate >0.19 weak*	*Redundancy Index* [5]
PROFITAB	0.111	0.268	-	0.343
Pro&Resr.	0.775	0.493	0.796	0.600
CAP&REZ	0.983	0.915	0.740	0.897
Pers.	0.509	0.318	0.945	0.454

Source: Author's processing of statistical data using the "Optimal PLS" software from the University of Geneva

However, while our research offers useful insights related for the strategic sectors and interrelationships within Vrancart, it is also important to highlight the limitations of this research. Firstly, the data used for our studies reflects only the time span 2010-2018, which might miss to capture recent development and progress in the waste recycling industry, predominantly external factors such as COVID-19 pandemic, energy crisis or the geopolitical tensions, and serious impacts on macroeconomic dynamics. Secondly, our selection of performance indicators and strategic sectors might have involved a degree of subjectivity which could have influenced the sturdiness of our findings. Lastly, while our PLS regression model offers insights into cause-and-effect relationships between variables and sectors, it is manly based on internal factors within Vrancart and did not consider external market dynamics or competitive stressors, which could provide with further context for strategic decision-making.

Even with these limitations, our research offers a good foundation for further exploration into the strategic management practices of Vrancart and proposes helpful insights for both academia and industry practitioners.

[2] Composite reliability is a metric that assesses the internal consistency of a set of variables, indicating how well they align with the intended measurement objectives.

[3] Average Variance Extracted quantifies the proportion of variance explained by the model compared to the variance caused by measurement error.

[4] R-squared is a statistical measure that indicates how close the data points are to the regression line. It's also referred to as the coefficient of determination or multiple determination coefficient in the context of multiple regression.

[5] The redundancy index quantifies the extent to which relevance is duplicated within a system, aiming to improve its reliability.

Conclusions

Identifying the relevant strategic sectors is essential for enhancing value, optimizing managing resources, controlling risks, and succeeding in competition. If the study's aim is performance strategy, it's essential for the variables to adequately explain the sector. The accurate identification of sectors is influenced by numerous factors such as collecting performance indicators, resource management, risk control, competition success, and more. The increased relevance of performance indicators enhances the efficacy of the optimal BSC model.

The intensity of cause-and-effect interrelationships within the model offers a better understanding of the company's trends. We have identified the extent to which each indicator's variability is influenced by the strategic sector it belongs to. Additionally, it suggests measures that need to be revised, rectified, and anticipate the company's strategy using sector-selected indicators.

PLS addresses strategic performance synthesis by pinpointing cause-and-effect interrelationships between variables and sectors, as well as between sectors (their hierarchy). This approach enables understanding the causal sequence behind strategic performance. Adopting the PLS approach could give the company a real advantage in economic competition.

As final conclusion remarks, we have the following future research directions to consider:

- Running a longitudinal research that traces the changes in strategic sectors and their interrelationships over time, might offer extra understanding over useful future changes to Vrancart's strategies that can provide positive impact on performance;
- Comparing Vrancart's strategic sectors and their interrelationships with those of other companies from the same industry, could offer further knowledge of the industry specific dynamics and business environment;
- Using scenario planning technique to simulate numerous future scenarios and assessing their impact on Vrancart's strategic sectors could assist in developing more comprehensive strategic plans and risk mitigation strategies.

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