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RANKING OF THE VIRTUAL MARKET GAME AND THE TRADITIONAL INDICATORS OF FINANCIAL PERFORMANCE

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ABSTRACT: This paper intends to compare the ranking of the business game Virtual Market with some financial performance indicators. The purpose is to verify if the game results – an enterprise environment computer simulation – in fact, is similar to a real situation in business in case it uses financial indicators as evaluation patterns. Therefore, first, it was made a short review about the importance of company's performance indicators showing the reasons that take his adoption as costs, competitiveness and so on. Afterwards, it was presented the performance indicators and its calculation formulae, as well as selected some according to a methodology described in this paper. After that, it was performed the calculation and then appraised the results making a comparison with the game ranking. At last, it was made some important considerations about the software.

Keywords: Business games, Engineering learning software, Performance indicator.

INTRODUCTION

The online business game Virtual Market (VM) is an instructional software program developed for use in graduate and post-graduate disciplines of the Department of Production Engineering of the São Paulo State University (Unesp), Bauru Campus. The purpose of the game is to facilitate the students' acquisition of competencies during the course of their studies through business games and simulations, in order to stimulate entrepreneurial learning and the integration of content during graduate and post-graduate studies.

The game is divided into two modules:

(1) Web module: where the players (students), individually or divided into teams, register and play using an internet browser, from any location where there is a computer connected to the internet.

(2) Local module: administration of the game including establishment of parameters, such as different configurations for each round, altering the degrees of difficulty of the game during its progress, and exchange of data among modules, among other management activities.

At the end of each round the VM generates accounting reports (balances, DRE, cash and stock) for financial analysis and, also ranking of players/teams.

The data used in Scarelli, Cavenaghi, Rodrigues (2007) are from a round of the game played by a class in the Industrial Engineering of the post-graduate program. The purpose of this article is to make a new comparison between traditional indicators of financial performance and the results of the VM business game generated from the grouping of games played by each player/team, from the third round

of the game of a class of graduate students. In the first comparison and analysis, several inconsistencies were observed between the results of the game and the values of the performance indicators (SCARELLI, CAVENAGHI, RODRIGUES, 2007). Some business rules used in classifying the players were modified. For this reason, it became necessary to test them again. Nonetheless, the objective of this article remains the same, that is, to verify whether the game faithfully approximates business reality when compared to these indicators.

PERFORMANCE INDICATORS

In the world of business administration, there is an axiom, which states, “without measurement there is no management.” In fact, a substantial part of the management process of an organization is based on quantification. The very word “calculation,” which also encompasses the meaning of “evaluation,” has its etymological origins in the ancient counting of cattle. For each animal, the herder dropped a stone, or *calculus* in Latin, in order to measure and verify the size of the herd.

With the evolution of society and its organizations throughout history, and as a function of the growing complexity of corporate operations, new methods of evaluation were developed. Today recognition is widespread of the importance of adoption of a complex of measures, called performance indicators, to evaluate the performance of businesses.

Several developments have aroused the business community’s interest in performance evaluation including (NEELY, 1999 *apud* CORRÊA, H. L.; CORRÊA, 2006):

- Until the 1960s and 1970s, the costs of direct labor generally were in excess of 50 or 60% of total business costs. In the 1980s and 1990s, it fell to 10 or 20% of the cost of product sales. In this manner, spreading indirect costs in proportion to the number of employees in a sector led to gross cost errors and to managers making erroneous decisions. Due to changes in the nature of business, the concept of performance evaluation had to be expanded beyond these simplistic methods of cost calculation.
- Increased competitiveness led businesses to seek to distinguish themselves in terms of technical quality, quality of service, personalization of products, innovation and flexibility in order to keep up with market changes. In the face of these non-financial factors, businesses came to require information about their performance in the context of various factors and not only in relation to cost.
- Increased competition and the resulting need to promote constant initiatives for improvement made apparent the necessity for businesses to base their strategies on measurement of their performance. Benchmarking, an approach to improvement, which is much used, is based on comparisons between businesses of their performance levels and practices in order to identify and adopt “best practices.”
- Today many corporations are subject to external controls. For example, with privatization of public services there were created government agencies to control and regulate the performance of the privatized businesses. It can also be cited the relationship between suppliers and vehicle assembly plants whose certification systems are based on measures, which seek to identify performances and behaviors considered important, comparing them with the desired levels.

According to Neely, Gregory, Platts (1995), even though the theme of performance evaluation is a much-discussed topic, rarely is it defined. Literally, it is a process of quantification and of action oriented toward performance. From the perspective of the market, organizations attain their objectives by satisfying their customers with greater efficiency and efficacy than their competitors. The terms efficiency and efficacy are used with specificity in this context. Efficacy refers to the extent to which consumer demands are met, while efficiency is the measure of how economically the business’ resources are utilized to attain a set level of customer satisfaction. In this way, performance evaluation can be defined as a process of quantifying the efficiency and efficacy of actions.

This distinction is important because it not only allows identification of two important dimensions of performance but also calls attention to the fact that there are internal reasons (related to use of resources) and external ones (related to the level of service to clients and other interested groups) in order to pursue specified courses of action.

The importance of performance indicators becomes apparent to the extent that they represent a process of overseeing activities, actions and decision-making and thereby promote self-evaluation by the business. This process permits identification of strong and weak points and implementation of strategies for improvements in quality and productivity.

According to Najmi, Kehoe (2001) appropriate measurement of performance plays the following roles in relation to quality and productivity:

- It assures that consumer requirements are fulfilled;
- It provides standards for comparison;
- It provides visibility and indicators so that people can monitor their own levels of performance;
- It brings into relief problems of quality and determines which areas need priority attention;
- It provides an indication of the cost of low quality;
- It justifies the use of resources;
- It provides feedback in order to steer improvement efforts.

Henri (2006) calls attention to yet some other uses of performance indicators, attributing to them functions of:

- Monitoring expectations to establish communication with those involved;
- Facilitating the process of decision making;
- Helping to maintain focus in a way that calls the attention of everyone in the business to strategic subjects;
- Justifying and validating past, present and future decisions and actions.

The certainty of the importance of performance measurement for a competitive organization opens the way for questions such as: what to consider for adoption as an indicator of performance? How to evaluate whether a measure is in fact adequate?

Above all, it is important to emphasize that there are no good or bad performance indicators. There are indicators, which are more or less suited to the strategies adopted by an organization. There must be coherence and balance in the alignment of the types of indicators adopted and the strategic intentions of the organization.

Musa (2007) emphasizes that it is necessary to adopt performance indicators, but not indiscriminately. It is fundamental to know how to determine what to measure, which indicators are most relevant and, which bases will be used for measurement. An excess of measurements can cause gross errors due to the loss of management focus. Only that which is truly necessary should be measured.

METHODOLOGY FOR SELECTION OF PERFORMANCE INDICATORS

In order to be able to make a comparative analysis between the results generated from the complex of plays carried out by the participants in the VM business game and traditional performance indicators, first of all, it was necessary to select the indices to be used. The assumption underlying this paper is that only financial indicators should be used.

For this purpose, the first consideration is the different categories of indicators. According to Gitman (2002), as a matter of convenience, financial indices can be subdivided into four groups or basic categories:

- **Liquidity Ratios:** These have as their objective the evaluation of ability to pay obligations. These indices are valuable to creditors in evaluating risk in the extension of credit and in the analysis of prospects for collection on credit already extended. It is important to emphasize that not always does an elevated liquidity index translate into good financial management. In some cases, a high liquidity ratio can represent excess availability, with a consequent financial loss due to failure to invest resources, excessive inventory, excessively extended payment periods for accounts receivables, etc.
- **Operational ratios:** According to Gitman (2002) these indices measure the rapidity with which current accounts (inventory, notes receivable and payable, etc.) are converted into cash. In other words, they measure efficiency in the management of the company's assets.
- **Indebtedness Ratios:** Indebtedness ratios show the probability of the company not paying its obligations. The presence of third party capital, taken in with the purpose of generating profits, when excessive can lead a company to bankruptcy, since these loans commit the company to pay long term interest as well as to repay the principal.
- **Profitability Ratios:** Profitability ratios measure the extent to which a company is profitable or not. Its analytical premise is "the bigger the better," since without profits a business cannot attract third party capital and even risks attempts by its present creditors to reclaim their funds because they fear for the company's future.

For each category, the principal indices and their respective formulae are interconnected, as shown in Table 1.

Table 1 Financial Indices And Their Respective Formulae

Liquidity Indices	Formula
CR = Current Ratio	$(\text{Current Assets} + \text{Long Term Receivables}) / (\text{Current Liabilities} + \text{Long-term Liabilities})$
CL = Current Liquidity	$(\text{Current Assets}) / \text{Current Liabilities}$
DL = Dry Liquidity	$(\text{Current Assets} - \text{Inventory}) / \text{Current Liabilities}$
Operating Ratios	Formula
IT = Inventory Turnover	$\text{Cost of Products Sold} / \text{Inventory}$
MPC = Median Period of Collection	$\text{Trade note Receivables} / \text{Average Sales per Day}$
MPP = Median Period of Payment	$\text{Trade note payable} / \text{Average Purchases per Day}$
PAT = Permanent Assets Turnover	$\text{Sales} / \text{Liquid Permanent Assets}$
TAT = Total Asset Turnover	$\text{Sales} / \text{Total Assets}$
Indebtedness Ratios	Formula
GIR = General Indebtedness Ratio	$\text{Current Liabilities} + \text{Long-term Liabilities} / \text{Total Assets}$
ICR = Interest Coverage Ratio	$\text{Profit before Interest and} / \text{Interest Expenses}$
LIR = Level of Indebtedness Ratio	$\text{Long-term Liabilities} / \text{Liquid Capital}$
Profitability Indices	Formula
GM = Gross Margin	$\text{Gross Profits} / \text{Sales}$
OM = Operating Margin	$\text{Operating Profit} / \text{Sales}$
LM = Liquid Margin	$\text{Net Profit after Income Tax} / \text{Sales}$
EPS = Earnings per Share	$\text{Income Available to Common Stockholders} / \text{Number of Common Shares Issued}$
ROTA = Return on Total Assets	$\text{Net Profit after Income Tax} / \text{Total Assets}$
RONA = Return on Net Assets	$\text{Net Profit after Income Tax} / \text{Net Asset}$

With the formulae established, all of their interconnected components can be divided into two groups: those components supplied by the VM business game, and those not so supplied. In this manner,

performance indices whose formulae contained at least one component not identified in the game were discarded, in what constituted the first stage of selection, as can be seen in Figure 1.

The indices discarded in this phase were:

- CR = Current Ratio
- ATC = Average Term of Collection
- ATP = Average Term of Payment
- ICI = Interest Coverage Index
- EPS = Earnings per Share

The second stage of selection of the performance indices to be applied to comparative analysis was the consideration of their relative importance within their categories.

By this criterion, the following were selected:

- Liquidity Ratios Category:

Current Liquidity (CL) is calculated with the equation 1. This index is the best indicator of a business' ability to pay (HOJI, 2003).

$$CR = \frac{\text{Current Assets}}{\text{Current Liabilities}} \quad (1)$$

Interpretation: The bigger the better.

- Operational Indices Category:

Total Asset Turnover (TAT) is calculated with the equation 2. If the business has high turnover, it signifies that it is managing well its sales. If turnover is low, it signifies that it is not utilizing its assets to capacity.

$$TAT = \frac{\text{Sales}}{\text{Total Assets}} \quad (2)$$

Interpretation: The bigger the better.

COMPONENTS OF FORMULAE OF PERFORMANCE INDICES		PERFORMANCE INDICES															
		LIQUIDITY			ACTIVITY				INDEBTEDNESS			PROFITABILITY					
		CR	CL	DL	IT	MPC	MPP	PAT	TAT	GIR	ICR	LIR	GM	OM	LM	EPS	ROTA
AVAILABLE IN GAME	SALES						X	X				X	X	X			
	AVERAGE SALES PER DAY					X											
	COST OF PRODUCTS SOLD				X												
	AVERAGE PURCHASES PER DAY						X										
	GROSS PROFIT											X					
	OPERATING PROFIT												X				
	NET ASSETS AFTER INCOME TAX													X		X	X
	INTEREST EXPENSE										X						
	INVENTORY			X	X												
	CURRENT ASSETS	X	X	X													
	PERMANENT ASSETS							X									
	TOTAL ASSETS								X	X							X
	CURRENT LIABILITIES	X	X	X							X		X				
	LONG-TERM LIABILITIES	X									X						
NET ASSET											X					X	
Not Available in Game	LONG-TERM RECEIVABLES	X															
	TRADE NOTE RECEIVABLES					X											
	TRADE NOTE PAYABLES						X										
	PROFIT BEFORE INTEREST AND INCOME TAX									X							
	INCOME AVAILABLE FOR COMMON STOCKHOLDERS													X			
	NUMBER OF COMMON SHARES ISSUED													X			

Figure 1. Discarded financial indices

- **Indebtedness Ratio Category:**

General Indebtedness Ratio (GIR) is calculated with the equation 3. This measure the proportion of assets acquired with borrowed money. The GIR is of the type “the bigger, the worse,” for it is related, in a directly proportional manner, to the business’ risk.

$$GIR = \frac{\text{Current Liabilities} + \text{Long-Term Liabilities}}{\text{Total Assets}} \quad (3)$$

Interpretation: The smaller the better.

- **Profitability Ratio Category:**

Liquid Margin (LM) is calculated with the equation 4. This index is often cited to indicate a business’ success in terms of profitability over sales. The liquid margin represents the extent to which the business achieved profitability for each monetary unit sold; the bigger it is, the better.

$$LM = \frac{\text{Net Income after Income Tax}}{\text{Sales}} \quad (4)$$

Interpretation: The bigger the better.

CALCULATION OF PERFORMANCE INDICATORS OVER GAME RESULTS

Of the total of thirty-six participating teams, there were strategically selected five results for which performance indicators were calculated for comparative analysis. Since the purpose was to compare the results of the game with a ranking constructed from the performance indicators, data were taken from the first three places, from eighteenth place (intermediate classification) and from last place. The indices were calculated as shown in Table 2.

Table 2. Results and performance indices

		Place		
		1 st	2 nd	3 rd
Component	Sales	R\$ 2.379.000,00	R\$10.137.500,00	R\$ 2.197.800,00
	Net profit after Income Tax	R\$ 389.412,60	(R\$ 48.813,35)	(R\$ 65.618,43)
	Current Assets	R\$ 41.836.397,34	R\$ 21.952.664,90	R\$ 37.572.318,19
	Total Assets	R\$ 51.486.556,64	R\$ 51.021.488,39	R\$ 59.299.593,67
	Current Liabilities	R\$ 748.800,20	R\$ 3.316.695,70	R\$ 9.224.408,61
	Long-term Liabilities	R\$ 270.000,00	R\$ 85.850,00	R\$ 80.000,00
Performance Indicator	Current Liquidity (CL)	55,87	6,62	4,07
	Total Asset Turnover (TAT)	0,05	0,20	0,04
	General Indebtedness Ratio (GIR)	0,02	0,07	0,16
	Liquid Margin (LM)	0,16	0,00	-0,03

		18th	36th
Component	Sales	R\$ 4,00	R\$ 0,00
	Net profit after Income Tax	(R\$ 288.874,81)	(R\$ 17.025.412,45)
	Current Assets	R\$ 42.183.301,51	R\$ 23.762.075,03
	Total Assets	R\$ 49.412.221,41	R\$ 581.221.096,13
	Current Liabilities	R\$ 242.504,79	R\$ 57.426.512,03
	Long-term Liabilities	R\$ 0,00	R\$ 548.660.543,57
Performance Indicator	Current Liquidity (CL)	173,95	0,41
	Total Asset Turnover (TAT)	0,00	0,00
	General Indebtedness Ratio (GIR)	0,00	1,04
	Liquid Margin (LM)	-72.218,70	-

COMPARISON OF GAME RESULTS WITH FINANCIAL PERFORMANCE INDICATORS

The first analysis undertaken was the intersection of the performance indicators from first and last places in the business game. It was verified that all of the indices of first place pointed to a better entrepreneurial situation than did those of last place, suggesting compatibility among the game's results criteria and the indicators, as shown by Table 3.

Table 3. Comparison between 1st and 36th (last) places

Performance Indices	1 st Place	36 th Place	Interpretation
Current Liquidity (CL)	55,87	0,41	Amount>better
Total Asset Turnover (TAT)	0,05	0,00	Amount>better
General Indebtedness Ratio (GIR)	0,02	1,04	Amount<better
Liquid Margin (LM)	0,16	-	Amount>better

The second comparison was between the indicators for first and second places (Table 4).

Table 4. Comparison between 1st and 2nd places

Performance Indices	1st Place	2nd Place	Interpretation
Current Liquidity (CL)	55,87	6,62	Amount>better
Total Asset Turnover (TAT)	0,05	0,20	Amount>better
General Indebtedness Ratio (GIR)	0,02	0,07	Amount<better
Liquid Margin (LM)	0,16	0,00	Amount>better

In this analysis it is noted that first place had a better score than second place with respect to ability to pay Current Liabilities (CL); first place's GIR was lower, demonstrating that he financed his assets less with third party capital, and his Liquid Margin (LM), which represents a business' profitability, was also much better. Second place stands out when sales management (TA) is considered, although the TA of first place was also good.

The conclusion is that first place is in a better position than second place in the results, confirming the compatibility of the business rules with the performance indices.

The third analysis was the intersection of the performance indicators for first and third places in the VM business game (Table 5). As in the first analysis, all the indicators point to the better position of first place, verifying, once again, the compatibility among the evaluation criteria.

Table 5. Comparison between 1st and 3rd places

Performance Indices	1st Place	3rd Place	Interpretation
Current Liquidity (CL)	55,87	4,07	Amount>better
Total Asset Turnover (TAT)	0,05	0,04	Amount>better
General Indebtedness Ratio (GIR)	0,02	0,16	Amount<better
Liquid Margin (LM)	0,16	-0,03	Amount>better

The next comparison was between the indicators for first and eighteenth places (intermediate position) in the game's results (Table 6).

Table 6 Comparison Between 1st And 18th Places

Performance Indices	1st Place	18th Place	Interpretation
Current Liquidity (CL)	55,87	173,95	Amount>better
Total Asset Turnover (TAT)	0,05	0,00	Amount>better
General Indebtedness Ratio (GIR)	0,02	0,00	Amount<better
Liquid Margin (LM)	0,16	-72.218,70	Amount>better

In this comparison it is notable that eighteenth place obtained better results in relation to first place concerning capacity for payment of current liabilities (CL) and also that his GIR is lower, demonstrating that he financed his operations less with third party capital. However, first place stands out when sales management (TAT) and especially Liquid Margin (LM), which represents a business' profitability, are considered.

Taking efficiency of sales and profitability of the business as more expressive indicators in terms of results than current liquidity and the indebtedness ratio, it can be concluded that first place in the game is compatible with the performance indices.

CONCLUSION

The results of the comparative analysis between the results of the VM game and the financial performance indicators calculated for the data from play suggest that the game presents good consistency, approximating business reality, when compared to the indices.

In the first article (SCARELLI, CAVENAGHI, RODRIGUES, 2007) the suggestion was made for undertaking more detailed studies, as well as a comparative revision between the business rules employed in the results of the players and the determinant principles of the financial performance indicators.

In this article, after study and modifications implemented in the business rules of the game, coherence can be verified between the scores presented in the results and the financial performance indices used in the analysis. The results until this point are, therefore, considered satisfactory.

This does not mean that study and evaluation of the game should be interrupted or ended; on the contrary, the results reinforce the thesis that more study should be undertaken in order to continuously refine the Virtual Market business game so it can be an effective instrument in the teaching-learning process.

REFERENCES

- SCARELLI, A.; CAVENAGHI, V.; RODRIGUES, J. S., Análise comparativa entre alguns indicadores de desempenho financeiros tradicionais e o ranking do jogo de empresas para ensino de engenharia Mercado Virtual, *In: SIMPEP*, XIV, 2007, **Anais XIV SIMPEP**, 5 a 7/ nov/2007.
- NEELY, 1999 *apud* CORRÊA, H. L.; CORRÊA, C. A., **Administração de produção e operações: manufatura e serviços – uma abordagem estratégica**, 2 Ed, São Paulo: Atlas, 2006.
- NEELY, A.; GREGORY, M.; PLATTS, K., Performance measurement system design, **International Journal of Operations Management**, Vol. 14, No 4, 1995.
- NAJMI, M.; KEHOE, D., F., “The role of performance measurement systems in promoting quality development beyond ISO 9000”, **International Journal of Operations & Production Management**, Vol. 21, No 1/2, 2001.
- HENRI, J., Are your performance measurement systems truly performing?, **CMA Management. ABI/INFORM Global**, Vol. 80, No 7, p. 31-35, nov 2006.
- MUSA, E. V., **Gestão baseada em fatos – não se pode gerenciar o que não se sabe medir e explicar**, *Artigo*, maio/2006. Disponível em <<http://www.fpnq.org.br>>. Acesso em 21/04/2007.
- GITMAN, L., **Princípios de Administração Financeira**, 7 Ed, São Paulo: Harbra, 2002.
- HOJI, M., **Administração Financeira – uma abordagem prática**, 4 Ed, São Paulo: Atlas, 2003.