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## **FINANCIAL INDICATORS OF SIMULATED ENTERPRISES COMPARED TO REAL ENTERPRISES**

José de Souza Rodrigues, UNESP – Brazil, Av. Luis Edmundo Carrijo Coube, 14-01,  
Zip 17033-360 – Bauru – SP; [jsrod@feb.unesp.br](mailto:jsrod@feb.unesp.br) , 55-14-3103-6122  
Antonio Fernando Crepaldi, UNESP – Brazil, [crepaldi@feb.unesp.br](mailto:crepaldi@feb.unesp.br)  
Ariane Scarelli, UNESP – Brazil, [ariane@edata.com.br](mailto:ariane@edata.com.br)

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**Abstract:** This paper intends to analyze the data acquired from a business game played by 27 players. Each one of them simulates an enterprise and its data was used to calculate financial indices and they will be used to build individual ranking. After this, it will be discussed if it is possible to choose one of the groups to represent the real conditions of the enterprise. The first experiences showed that the ranking built for the game behave as expected. This attempt intends to analyze if it is possible to build a general indicator that could be used to analyze enterprises in the simulated environment.

**Keywords:** Business game, Virtual Market, Simulation, Teach-learning process, financial indicators

### **1. INTRODUCTION**

The Virtual Market was developed to assist students of engineering to learn and understand subjects related to management and production. Considering that today most Universities offer Internet access to their students the game was planned to Internet environment. It has three modules composed by “Internet Interface”, “Data Base” and “Data Processing System”.

In Internet Interface students make their decisions and receive information about inventory, cash, finance, accounting and decisions make. The subjects of production like capacity, prices, quantities of each product that should be done, forecasting, costs and inventory are others decisions students should make.

Using an amount of money received in the beginning of the game, the players should start their enterprises defining their capacity. In fact they are deciding about how much to produce of each product observing if their money is enough to buy the equipment and build the industrial plant necessary to produce them.

After defining the size of the industrial plant, the students should decide how much money to spend to provide a good enterprise policy of marketing, quality, advertising and research and development. Finally, the price of each product should be defined according to other decisions made.

These decisions plus the number of assembling workers and their salary compound the group of information that students should send to the system Data Base using the Internet Interface. These data are processed by the Data Processing System. The results are placed in the Data Base and can be accessed by students. Some indicators were developed to encourage students to think about each other’s strategies or, to use the market language, to know about their competitors.

The enterprises are classified by an indicator created specifically for this purpose and it will be used to compare with the data of real enterprises.

## 2. RANKING IN THE VIRTUAL MARKET

The ranking of the Virtual Market was created by combining financial indicators, market share of quantities sold of each product, revenues and total of money allocated to quality, research and development, marketing and advertising. To evaluate the virtual enterprises it was necessary to transform the original data using a scale from 1 to 2, because the data of some enterprises generate a division by zero when the indicator is calculated.

In this scale the worst value represents the number 1 (the minimum value) and the best, the number 2 (the maximum value) and the other enterprises are classified between these two points by equation 1.

$$Indicator = \frac{Value_{Original} - Value_{minimum}}{Value_{maximum} - Value_{minimum}} + 1 \quad (1)$$

Five individual indicators are calculated: yield, quantities, investment, sales and indebtedness.

This indicator is calculated for market share of sales and market share of quantities, for the sum of the investments in quality, R&D, advertising and publicity and for current ratio and quick ratio. In the cases of market share and current and quick ratios the indicator is calculated by using the geometric mean.

The indicator of market share is obtained by using the geometric mean of market share of sales (transformed in a scale from 1 to 2) and market share of quantities. This is because the enterprise that has the biggest amount of sales is not necessarily the same that has the biggest amount of quantities.

The same idea was used to build the indicator of indebtedness. In this case there are at least three important elements that should be considered. The first is current ratio, the second is quick ratio and the third is the relation between own capital and capital of third party.

If the normal rules of calculation of these indicators have been taken, in some cases it will appear division by zero and this condition will make the software fail. The problem can not be solved by using a specific number for these occurrences. Although in the real market enterprises that use only own capital are uncommon in the game these situations are possible. The subtraction of the capital of third party from the own capital was used instead of calculating the indicators by division. The same rule is applied to the other two indicators. Equations 2, 3 and 4 show how the calculus is made.

$$Capital_{indicator} = Capital_{own} - Capital_{third\_party} \quad (2)$$

$$Ratio_{current} = Cash + Inventories + receivable - exigible \quad (3)$$

$$Ratio_{quick} = Cash + receivable - exigible \quad (4)$$

After this calculus the indebtedness is calculated using equation 5.

$$Indebtedness = \sqrt[3]{(Capital_{indicator})(Ratio_{current})(Ratio_{quick})} \quad (5)$$

The yield indicator is calculated by equation 6.

$$Yield = \sqrt{(net\ profit)(accumulated\ profit)} \quad (6)$$

Here the problem is that net profit and accumulated profit can be positive or negative. If one of them is positive and the other is negative equation 6 does not make sense because the result will be a square root of negative number. So, after the calculus of equation 6 the values of net profit and accumulated profit are transformed by using equation 1.

Finally the ranking is formed by the calculation of the general indicator for each player as in equation 7.

$$Ranking = \sqrt[5]{(yield)(quantities)(investment)(sales)(indebtedness)} \quad (7)$$

### 3. Indicators in real enterprises

The evaluation of enterprises is a specific area of knowledge and some one of the indicators that are used in it will be used here to compare the rank of the game Virtual Market with them. Why to do this? Because the effort of building methods of evaluation of real enterprises should be considered in building games if they intend to simulate market and problems related to management and production of goods and services.

Although the most used method to evaluate enterprises is the return on investment (ROI), it has been criticized because it considers prices and cash flows constant all the time (FIGUEIREDO NETO, 2003). As the objective of the game is to help students and teachers in the teach-learning process, this method is presented as a resource to be used to plan the investment in capacity and to determine the prices of the products, because it is simple to explain how the method works and normally this subject is in disciplines as Financial Math and Economic Engineering. So, if students do not know this method, it is easy to teach them how to use it in the game and probably they will see it in details during the course.

In fact, the return on investment depends on the capacity of the managers to convert sales in profit. This ability depends on a balanced decisions involving prices, costs (material, salary, energy, taxes, depreciation and so on), investments in product development (R&D, quality, advertising, publicity), industrial plant capacity (equipment and number of workers, big or small industrial plant, invest all in the beginning of the game or during the game), human resources policy (salary) and policy of capital (own or third party, invest or take an owe, sell in cash or finance the client, buy material in cash or installment).

### 4. 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.

Some development has arisen 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. Appropriate measurement of performance plays the following roles in relation to quality and productivity (NAJMI, KEHOE; 2001):

- 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 (FIGUEIREDO NETO, 2003).

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 (MUSA, 2007).

## **5. METHODOLOGY FOR SELECTION OF PERFORMANCE INDICATORS**

It was selected only financial indicators to compare the results generated from the complex of plays carried out by the participants in the VM business game to traditional performance indicators. Financial indices can be subdivided into four groups or basic categories (GITMAN, 2002):

- 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: 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 Figure 1.

Liquidity Indices	Formula
GL = General Liquidity	$(\text{Current Assets} + \text{Long Term Receivables}) / (\text{Current Liabilities} + \text{Long-term Liabilities})$
CR = Current Ratio	$(\text{Current Assets}) / \text{Current Liabilities}$
QR = Quick Ratio	$(\text{Current Assets} - \text{Inventory}) / \text{Current Liabilities}$
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	$\text{Operating Profit} / \text{Sales}$
NPM = Net Profit 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	$\text{Net Profit after Income Tax} / \text{Net Asset}$

Figure 1. Financial Indices And Their Respective Formulae

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 and 2.

The indices discarded in this phase were:

- GL = General Liquidity

- 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 Ratio (CR) is calculated with equation 8. This index is the best indicator of a business' ability to pay (HOJI, 2003).

$$CR = \frac{\text{Current Assets}}{\text{Current Liabilities}} \quad (8)$$

Interpretation: The bigger the better.

- Operational Indices Category:

Total Asset Turnover (TAT) is calculated with equation 9. 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.

$$TAT = \frac{\text{Sales}}{\text{Total Assets}} \quad (9)$$

Interpretation: The bigger the better.

Components of Formulae of Performance Indices		PERFORMANCE INDICES																	
		LIQUIDITY				ACTIVITY				INDEBTEDNESS				Profitability					
		NWC	GL	CR	QR	IT	MPC	MPPI	PAT	TAT	GIR	ICR	LIR	GM	OM	NPM	EPS	ROTA	RONA
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	X														
	PERMANENT ASSETS								X										
	TOTAL ASSETS									X	X							X	
	CURRENT LIABILITIES	X	X	X	X							X	X						
	LONG-TERM LIABILITIES		X								X								
	NET ASSET												X						X

Figure 1. Discarded financial indices

Components of Formulae of Performance Indices		PERFORMANCE INDICES																
		LIQUIDITY		ACTIVITY				INDEBTEDNESS				PROFITABILITY						
		GL	CR	QR	IT	MPC	MPPP	PAT	TAT	GIR	ICR	LIR	GM	OM	NPM	EPS	ROT	RONA
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 2. Discarded financial indices

- Indebtedness Ratio Category:

General Indebtedness Ratio (GIR) is calculated with equation 10. 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.

$$GIR = \frac{\text{Current Liabilities} + \text{Long-Term Liabilities}}{\text{Total Assets}} \quad (10)$$

Interpretation: The smaller the better.

Net Working Capital (NWC) is calculated with equation 11, that represent the difference between Current Assets and Current Liabilities. It is a measure of liquidity of an enterprise and it is useful to compare temporal series (GITMAN, 2002).

$$NWC = \text{Current Assets} - \text{Current Liabilities} \quad (11)$$

Interpretation: The bigger the better.

- Profitability Ratio Category:

Net Profit Margin (NPM) is calculated with equation 12. This index is often cited to indicate a business’ success in terms of profitability over sales. The Net Profit Margin represents the extent to which the business achieved profitability for each monetary unit sold; the bigger it is, the better.

$$NPM = \frac{\text{Net Incomet after Income Tax}}{\text{Sales}} \quad (12)$$

Interpretation: The bigger the better.

## 6. THE ENTERPRISES SIMULATED

Twenty seven enterprises were in the challenge presented here. Five of them were taken to be analyzed using the indicators showed above, the three firsts, the fourteenth and the twenty seventh enterprises.

The first analysis compares the results of the first and the last ranked in the Virtual Market game (Table 2).

Table 2 – Comparison between the first and the twentieth seventh ranked

<b>Performance Indices</b>	<b>1<sup>st</sup> Place</b>	<b>27<sup>th</sup> Place</b>	<b>Interpretation</b>
Current Ratio (CR)	30,62	2,66	Amount>better
Total Asset Turnover (TAT)	0,06	0,24	Amount>better
General Indebtedness Ratio (GIR)	0,56	0,78	Amount<better
Net Profit Margin(NPM)	-0,04	0,09	Amount>better
Net Working Capital (NWC)	R\$ 78.241.027,26	R\$ 26.815.489,41	Amount>better

The efficiency of the use of assets (TAT) of the first ranked is inferior than the last, as well as the NPM. It shows that the ranking of the game was working against the indicators. But there is something important to be considered in this case, the Current Ratio. It shows that the enterprise ranked as the first is bigger than the 27<sup>th</sup> and it is operating with less indebtedness. As in the real market it is possible for a big enterprise to have a margin inferior than the margin of a small competitor. This situation could be represented by the information of Toyota and General Motors. In 2006 (for the fiscal year ended in March 31<sup>th</sup>), GM's sales were bigger than Toyota's, but its income was smaller than Toyota's. In fact, the first position in the ranking only indicates that this enterprise is important in the sector in which it competes, even if its rent is not so good at the moment. While GM sold 207.3 billion dollars and Toyota sold 202.8 billion dollars, they had a loss of 1.9 billion dollars and a yield of 13.9 billion dollars respectively.

The next comparison was between the indicators of the first and the second in the ranking of the game as showed in Table 3.

Table 3. Comparison between indicators of the first and the second enterprises in the ranking

<b>Performance Indices</b>	<b>1<sup>st</sup> Place</b>	<b>2<sup>nd</sup> Place</b>	<b>Interpretation</b>
Current Ratio (CR)	30,62	∞	Amount>better
Total Asset Turnover (TAT)	0,06	0,05	Amount>better
General Indebtedness Ratio (GIR)	0,56	0,24	Amount<better
Net Profit Margin(NPM)	-0,04	-0,25	Amount>better
Net Working Capital (NWC)	R\$ 78.241.027,26	R\$ (2.252.950,97)	Amount>better

The second enterprise in the ranking presents better indicators for Current Ratio and General Indebtedness Ratio. These differences with the indicators of the game refer to the worst situation of the second enterprise in the Net Working Capital.

The third analysis compares the indicators of the first enterprise with the third (table 4).

Table 4. Indicators of the first and the second enterprises in the ranking

<b>Performance Indices</b>	<b>1<sup>st</sup> Place</b>	<b>3<sup>rd</sup> Place</b>	<b>Interpretation</b>
Current Ratio (CR)	30,62	86,64	Amount>better
Total Asset Turnover (TAT)	0,06	0,02	Amount>better
General Indebtedness Ratio (GIR)	0,56	0,01	Amount<better
Net Profit Margin(NPM)	-0,04	-1,28	Amount>better
Net Working Capital (NWC)	R\$ 78.241.027,26	R\$ 39.159.505,78	Amount>better

CR and GIR of the second enterprise placed in the ranking are bigger than the first, while they should be smaller. In this situation half of the indicators agree with the ranking position of the enterprises and the other half disagree. As presented in tables 2, 3 and 4, the indicators only show specific conditions of the enterprises. So, their evaluation should use a lot of indicators combined to give the best idea of the real situation of the enterprise.

## 7. REAL ENTERPRISES

Fourteen enterprises were taken from the real market, classified as auto-industry by the Brazilian magazine Exame in its edition Melhores e Maiores (2007). This magazine intends to present news of corporative market in Brazil. As Forbes magazine, Exame presents the 500 biggest enterprises per year and analyzes them and their economic sectors. The same indicators presented for the game Virtual Market were analyzed too, as presented in table 5.

Table 1 – Comparison of the first and the fourteenth ranked in the sector Auto-Industry

<b>Performance Indices</b>	<b>1<sup>st</sup> Place</b>	<b>14<sup>th</sup> Place</b>	<b>Interpretation</b>
Current Ratio (CR)	1.10	1.90	Amount>better
Total Asset Turnover (TAT)	3.10	3.50	Amount>better
General Indebtedness Ratio (GIR)	0.68	0.47	Amount<better
Net Profit Margin(NPM)	0.05	0.06	Amount>better
Net Working Capital (NWC-Million) US\$	128.50 US\$	23.10	Amount>better

As in the game, the first placed industry does not present the best result in all indicators. Only the indicator NWC of the first enterprise behaves as it should. Table 6 shows the data of the first and the second enterprises (MELHORES e MAIORES, 2007).

Table 2 – Comparison of the first and the second ranked in the sector Auto-Industry

<b>Performance Indices</b>	<b>1<sup>st</sup> Place</b>	<b>2<sup>nd</sup> Place</b>	<b>Interpretation</b>
Current Ratio (CR)	1.10	2.60	Amount>better
Total Asset Turnover (TAT)	3.10	2.40	Amount>better
General Indebtedness Ratio (GIR)	0.68	0.75	Amount<better
Net Profit Margin(NPM)	0.05	0.04	Amount>better
Net Working Capital (NWC-Million) US\$	128.50 US\$	45.80	Amount>better

When the first and the second enterprises are compared, only the indicator CR of the second is bigger than the first when it should be smaller.

The last analysis compares the first and the third placed enterprises in the ranking of the Exame Maganize (2007), as showed in table 7.

Table 3 – Comparison of the first and the third ranked in the sector Auto-Industry

<b>Performance Indices</b>	<b>1<sup>st</sup> Place</b>	<b>3<sup>rd</sup> Place</b>	<b>Interpretation</b>
Current Ratio (CR)	1.10	2.40	Amount>better
Total Asset Turnover (TAT)	3.10	1.40	Amount>better
General Indebtedness Ratio (GIR)	0.68	0.41	Amount<better
Net Profit Margin(NPM)	0.05	0.08	Amount>better
Net Working Capital (NWC-Million) US\$	128.50 US\$	130.20	Amount>better

## 8. CONCLUSION

The real market and simulated environment are both similar because they are difficult to be analyzed. The short term and the long term changed the meaning of the indicators as well as the way that managers decide to invest and to allocate the money available. As in GM and Toyota cases, although the present scenario indicates that probably Toyota will overcome GM in sales and rentability, their history probably says more about what is happening now than their indicators. In fact, some decisions taken in the past in circumstances which were different from today are changing the operational conditions of the enterprises. So, past actions reflect on the present.

All the effort made to evaluate the results of enterprises and to know their prices face the difficulties. Sometimes the sector presents especial characteristics and in its conditions indicators and methods should be adapted or changed to give satisfactory answers.

In the game as in the real market the indicators are only information that can be used to make the managers' decisions better and to improve their strategies. It means that the game can help future engineers and managers to improve their knowledge and abilities to make decisions under risk as the purpose of the game.

## 9. REFERENCES

- FIGUEIREDO NETO, L.F. **Análise e Gestão de Projetos: proposta de aplicação da teoria das opções reais na produção agropecuária**, 2003, doctoral thesis, Escola Politécnica da Universidade de São Paulo, 2003.
- GITMAN, L. **Princípios de administração financeira**. 7<sup>th</sup>. ed. São Paulo: Harbra, 2002.
- HOJI, M. **Administração Financeira – uma abordagem prática**. 4. ed. São Paulo: Atlas, 2003.
- REVISTA EXAME, **Melhores e Maiores**, edition 0899A, São Paulo: April, August 2007.
- SCARELLI, A. ; CAVENAGHI, V. ; RODRIGUES, J. S. Ranking do jogo Mercado Virtual comparado com os indicadores de desempenho financeiros tradicionais. In: Proceedings of the **INTERTECH - Internacional Conference on Engineering and Technology Education**, Guarujá-SP, 2008.
- 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, Bauru-SP: Unesp, Proceedings of the **XIV SIMPEP-Simpósio de Engenharia de Produção**, 5 a 7/ nov/2007.
- SCARPEL, R. A.; MILIONI, A. Z., Utilização conjunta de modelagem econométrica e otimização em decisões de concessão de crédito. **Pesquisa Operacional**, Rio de Janeiro, v. 22, n. 1, p.61-72, 2002. Available in: <[http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S0101-74382002000100004&lng=es&nrm=iso](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0101-74382002000100004&lng=es&nrm=iso)>. Access in: 05 Feb 2008.