

## Design of Family-Owned Business Simulation Game Using System Dynamics Approach To Facilitate Practices of Interpreting and Analyzing Financial Reports

Akhmad Hidayatno<sup>1</sup> and Iko Putera<sup>2</sup>

Industrial Engineering Department, Faculty of Engineering, University of Indonesia  
E-mail: <sup>1</sup> akhmad@eng.ui.ac.id, <sup>2</sup> iko\_ti02@yahoo.com

### Abstract

*The focus of this research is to design business simulation game with financial report as its output which is able to provide an real-time interactive, motivating, risk-free environment to improve the knowledge and skill in interpreting and analyzing financial report produced by a business entity. The game simulates a family-owned business to provide a simple kind of financial report that can ease understanding and support the learning process. System dynamics approach was used to model the complexity of the business system and ease the identification of the relationships between variables in the system. The simulation game was built using Powersim Studio 2005 and Microsoft Excel software and tested in the classroom. Results of learning points identification of the game show that the game is able to support the process of learning in understanding financial report, analysing the effect of decisions made, and as a reference in decision making.*

**Keywords:** *system dynamics, simulation, game, financial report dan experiential learning.*

### Abstrak

*Penekanan penelitian ini adalah untuk mendesain sebuah permainan simulasi bisnis untuk membantu pemahaman pemain dalam menginterpretasikan dan menganalisa laporan keuangan yang disimulasikan. Permainan simulasi ini dapat memberikan suatu lingkungan yang interaktif, bebas resiko dalam menguji coba alternatif-alternatif pengambilan keputusan yang tentunya akan berdampak terhadap laporan keuangan. Permainan mensimulasikan sebuah entitas bisnis keluarga dan disusun dengan aplikasi Powersim 2005 dan Excel. Ujicoba pelaksanaan telah dilakukan di kelas Akuntansi dan Biaya. Hasil ujicoba menunjukkan bahwa pokok-pokok pembelajaran yang ditargetkan untuk ditingkatkan dapat dicapai.*

**Kata Kunci:** *Sistem dinamis, Simulasi, Permainan Simulasi, Laporan Keuangan dan Pembelajaran Eksperiential*

### 1. Introduction

Financial report is a very important source of information which able to tell how good is the overall condition of a company. It can show profitability, composition of liabilities and equity, solvability, and other financial parameters of a company which can be used to monitor company performance and as reference for business strategy evaluation. The inability in understanding the information showed by financial report can cause failure to the company [1].

The simulation game which is designed in this paper uses financial report as its output or feedback. Using that feedback, then the players can learn and practice to interpret and analyze financial reports produced by their game decisions. Simulation gaming as one of the forms of experiential learning is able to provide a motivating, interactive, and risk-free environment.

System dynamics approach was used in designing the simulation model due to the capability of system dynamics approach to model complexity of a system such as a

business system. The approach also could ease the identification of relationships between variables in the system., which would be feedback to the students.

The simulation game was designed for teaching and learning purpose. To support and ease the learning process, the business simulated by the game is a family-owned business which produced a relatively simple financial reports. In short, the objective of this research is to develop family-owned business simulation game and its manual which can facilitate practices of interpreting and analyzing financial reports.

## 2. Methodology

This research was completed through several steps. The data used as reference in designing the game were collected through analyzing existing game that has similar characteristics. User interview was also conducted to explore user requirements which can also be used as reference in developing basic concept of the game. After the data were completely collected, the next step was developing the basic concept of the simulation game. This step includes developing the story and assumptions underlying the game. In this step, the variables involved in the game and how they related to each other were presented using causal loop diagram.

After the game conceptualization was done, the next step is constructing the model using stock and flow diagram on Powersim Studio 2005. Subsequently, the model should be verified and validated to ensure the model can run correctly without any error and run according the concept designed [2,3]. After the model validation step, the next step is to identify the learning points which can be achieved through using the simulation game. Ideally, the simulation game should be able to facilitate 3 main aspects in analyzing financial report, which are: profitability analysis, liquidity analysis, and management performance analysis [4]. After the learning points have been identified, the next step is developing game manual to support its implementation in teaching and learning activities.

## 3. Results and Discussion

The existing simulation game used as reference for developing the basic concept of the game is the Small Business Growth Management Flight Simulator (SBGMFS) created by Carmine Bianchi and Enzo Bivona of University of Palermo, Italy. The objective of this game is to teach how to manage business, especially small-business. This game simulates how business decisions and family-related decisions have impacts on the condition of the company not just in the short run but also in the long run [5]. Although this game also uses financial report as its output, but the form of the financial report has been modified so it is not in standard form anymore. But the dynamics of the simulation quite represent the dynamics of business. Those dynamics were then analyzed using causal loop diagram and used as reference for developing the new simulation game.

User requirements are identified to explore how the simulation game should be designed so it is suitable to be used in teaching and learning activities. Identification of user requirements were done by conducting interview to Mrs. Betrianis Bachtaruddin, Ir., Msi, the lecturer of Cost Accounting class of Industrial Engineering Department University of Indonesia. From the interview, there are several learning points which should be facilitated by the simulation game which are:

- Practicing interpretation and analysis of financial report.
- Monitoring company's performance.
- Developing and evaluating business strategy.
- Practicing the implementation of account receivable policies.

Those learning points are actually similar to the 3 important aspects in analyzing financial report mentioned on previous section.

The simulation game was designed to facilitate the practice of interpreting and analyzing financial reports. So it is clear that the main output of this game is financial



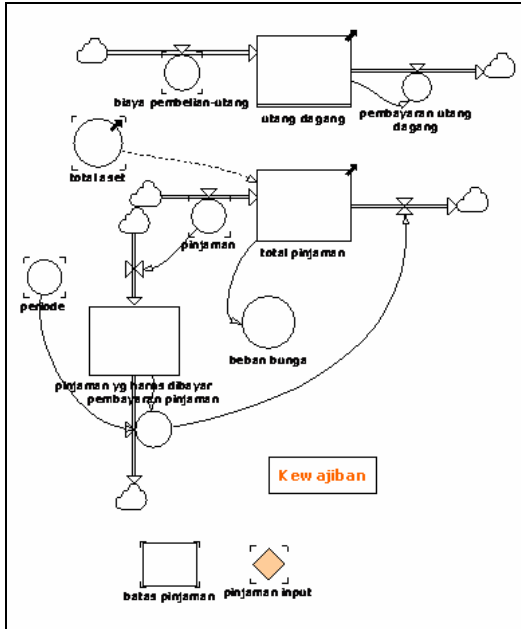


Figure 2. Liabilities Sub-Model

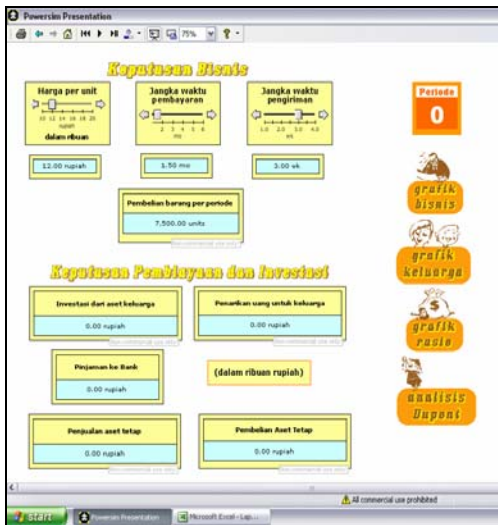


Figure 3. Game Interface (Input Page)

Model validation was done to check whether the model already fits the concept designed in the conceptualization phase. The aspects which were validated in this model are: Demand behavior, liquidity, and financial report validity. The behavior of the demand was tested using two different combinations of input. The first one consists

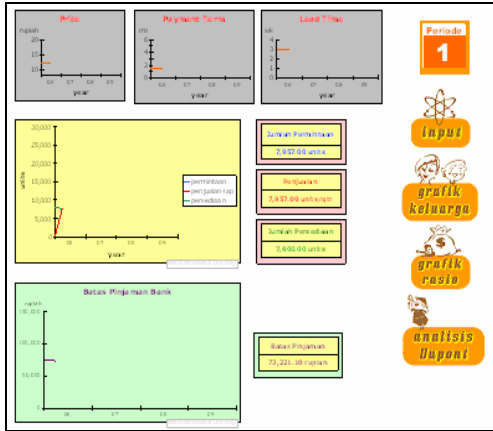
of input values which are logically will generate low demand level. The second combination consists of input values which are logically will generate high demand level. The results are shown on Figure 6 and 7, the generate demand level generated for each combination of input fits the concept and the logic. So it can be stated the demand behavior of the model is valid.

Liquidity validity test was conducted using the similar method used in demand behavior validity test. Two combinations of input values were compared. The first one used 1 month terms of payment, while the second one used 4 months terms of payment. Logically, the first combination will produce more liquid financial condition than the second one. Using account receivables turnover ratio, the results of both combinations were compared. Table 1 shows account receivables turnover ratio for each combinations and it can be seen that 1 month of terms of payment generated higher ratio which means it has better liquidity than 4 months of terms of payment.

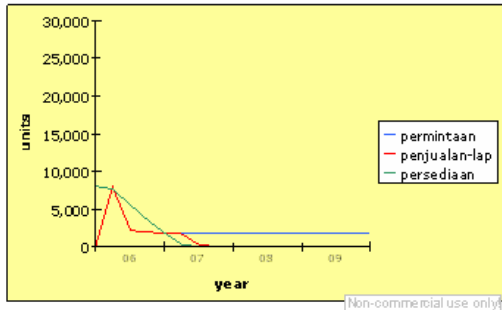
Periode	0	1	2	3	4	5
	Jan 2006	Apr 2006	Jul 2006	Oct 2006	Jan 2007	Apr 2007
Pendapatan	0	95484	97313.89	97313.89	104324	104324
biaya	0	58677.5	52057.5	52057.5	58807.5	58807.5
<b>Laba kotor</b>	0	36806.5	45256.39	45256.39	40516.47	40516.47
<b>Biaya Operasional</b>	0	21483.9	18749.47	18758.28	20119.06	24882.04
biaya pengiriman	0	7771.5	7822.5	8381.5	8690.5	8749.5
biaya persediaan	0	13000	13000	13000	13000	13000
biaya umum & adm	0	100	100	100	100	100
depresiasi	0	100	100	100	100	100
<b>Total Biaya Operasional</b>	0	41355.4	38671.97	39239.78	40909.56	45531.54
<b>Laba operasional</b>	0	5548.9	6684.429	6016.611	7806.912	2984.927
<b>Pendapatan dan biaya lain-lain</b>	0	472.5	110.5311	90.65473	33.57034	173.3095
pendapatan bunga	0	4000	4000	4000	4000	4000
beban bunga	0	-3527.5	-3893.47	-3903.35	-3966.43	-3826.77
<b>Total pendapatan dan beban lain-lain</b>	0	9076.4	2694.96	2107.256	3640.482	841.77
<b>Laba sebelum pajak</b>	0	538.9919	421.4532	728.0965	0	0
<b>Laba bersih</b>	0	-5076.4	2155.968	1685.813	2912.386	-841.77

Figure 4. Game Output (Income Statement)

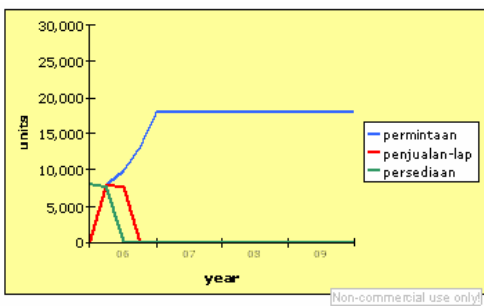
The financial report validity test was conducted by checking the balance sheet whether it is already balance or not, and then the whole components of financial report were checked to see the synchronicity between the components. The results showed that the components are synchronous to each other so it can be stated that the model is valid. Figure 8 shows the synchronicity between the components of financial report.



**Figure 5.**  
Game Output (Business Graphs)



**Figure 6.**  
Low Demand Input



**Figure 7.**  
High Demand Input

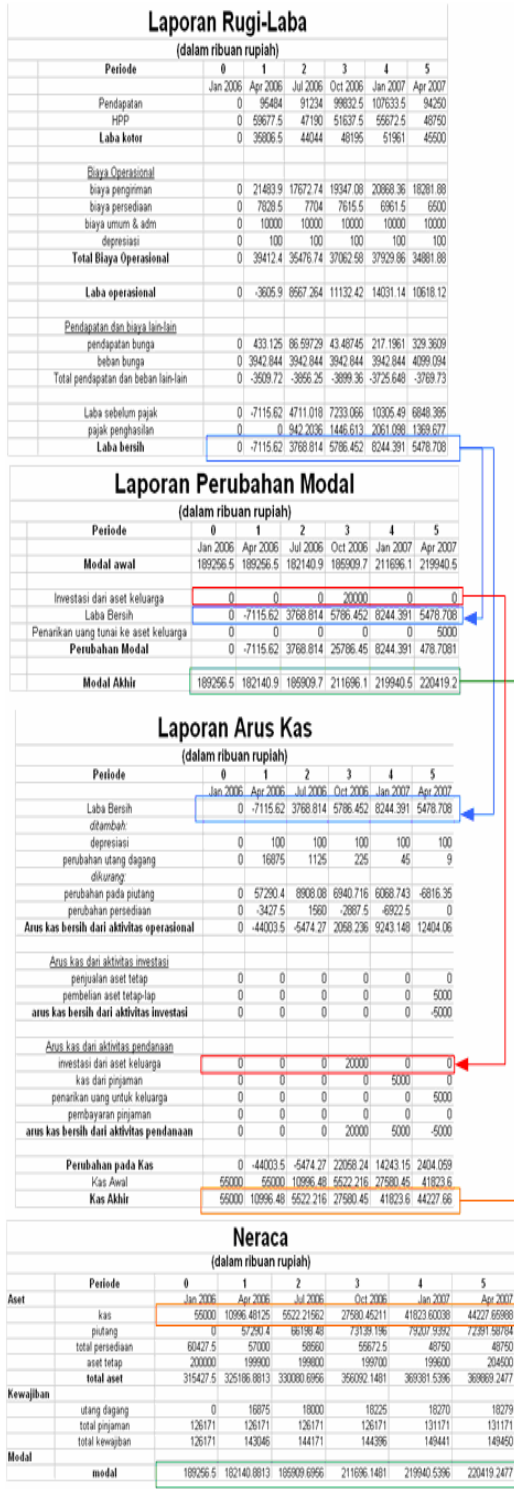
To identify learning points that can be achieved through the implementation of this simulation game, the game was tested to the students of Cost Accounting class, Industrial Engineering Department, University Of Indonesia. Two days before the participants play the game, general briefing was

conducted to explain how the simulation game will run. Game manual was also handed out to the participants to ensure their understanding about the rules and the basic concept of the game.

**Table 1.**  
Results of Liquidity Test

Account Receivable Turnover Ratio				
Period	2	3	4	5
Terms of Payment 1 Month	1.628731	1.599857	1.764722	1.666667
Terms of Payment 4 Month	1.412095	1.349152	1.068106	1.13524

The simulation game ran for 16 periods. In every 4 or 8 periods, the participants were asked several questions that motivated them to analyze the condition of the company in several periods. In the last period, the participants were also asked to analyze their overall performance in doing the simulation. They were also asked about what they had learned from the simulation game. From the exploration of the participants answers and analysis, there are several learning points that can be achieved through this simulation game. Table 2 shows the learning points which are also cross-checked with ideal points of financial report analysis according to the theory. From those learning points, it can be concluded that the game has fulfilled the ideal points in analyzing financial reports. So it can be stated that the game has achieved the objective of the design of this simulation game which is to facilitate practices of interpreting and analyzing financial reports.



**Figure 8.**  
Financial Report Synchronicity Test

Game manual was designed to support Financial Game implementation in teaching,

learning or training process. The manual will help the players to understand the simulation game so they can use the game correctly. The manual consists of explanations about the story or assumptions used in the game, the variables involved in the game, game output, rules of the game, interface of the game, how to operate the game, formulas of financial ratios used in the game, and references the players can use to increase their understanding about financial reports.

**Table 2.**  
Learning Points

	Profitability Analysis	Liquidity Analysis	Management Performance Analysis
Practicing the skill to judge the profitability of a company using income statement and financial ratios	●		
Understand that different level of terms of payment will affect the amount of cash-on-hand.		●	●
Practicing the right calculation of inventory level to fulfill demand but also to keep the inventory cost as low as possible	●		●
understand that bank loan can increase the amount of the cash but in the other hand the interest will increase the amount of total cost	●		●
analyze the impacts of the decisions to the condition of financial report	●	●	●
Plan business strategy			●
Understand that the price level has to be balanced with the service level given to the customer	●		
Predicting the response of the market to business decisions	●		●
Understand that company has to be able to give value to the stakeholders			●

The application of this simulation game surely can be implemented not just in academic institution such as university or

business school. Companies can use this game to train their employees not only in terms of interpreting and analyzing financial reports but also to shape their mental model about business. For further research, this simulation game is able to be developed by simulating more complex business dynamics and using more complex and detailed financial reports and other outputs. One example is to change the scope of the business modeled in the game. Go-public businesses can be modeled, thus resulting in more complex dynamics involving more variables affecting financial condition of the company.

#### **4. Conclusion**

The result of this research is a simulation game called Financial Game which simulates a family-owned business (limited company) in running its business activities. The decisions which should be made by the players include business decisions, financing decisions and investing decisions. The main output of the game is financial report which shows the impacts of the decisions made by the players to the financial condition and performance of the company.

The game was designed to be played directly by the players without any role of administrator. The game was also equipped with game manual to support the implementation of the game in teaching or learning activities. The game was tested and the results have proven that the game is able to support the learning process in interpreting and analyzing financial reports as describe in the learning points target designed in the game.

#### **References**

- [1]. Keown, Arthur J. et al. *Financial Management*, Pearson Prentice Hall, USA, 2005.
- [2]. Harrell, Charles. 2000, *Simulation Using Pro Model*, Mc Graw Hill, USA.
- [3]. Sterman, John D. 2000, *Business Dynamics*, McGraw Hill, USA.
- [4]. Courties. J, citated on Harahap, Sofyan Syafri. 2004, *Analisis Kritis atas*

- Laporan Keuangan*, PT RajaGrafindo Persada, Jakarta.
- [5]. Bianchi, Carmine dan Bivona, Enzo. 1999, "Commercial & Financial In Small and Micro Family Firms: The Small Business Growth Management Flight Simulator", Sage Publications.