SMALL BUSINESS MODELLING WITHIN THE FINANCIAL ACCOUNTING CONCEPTUAL FRAMEWORK

by
Winnie Fu

A thesis
presented to the University of Manitoba
in partial fulfillment of the
requirements for the degree of
Master of Science
in the
Department of Mechanical & Industrial Engineering

Winnipeg, Manitoba

THE UNIVERSITY OF MANITOBA

FACULTY OF GRADUATE STUDIES

*****

COPYRIGHT PERMISSION PAGE

SMALL BUSINESS MODELLING WITHIN THE FINANCIAL ACCOUNTING CONCEPTUAL FRAMEWORK

BY

WINNIE FU

A Thesis/Practicum submitted to the Faculty of Graduate Studies of The University of Manitoba in partial fulfillment of the requirements of the degree of MASTER OF SCIENCE

ABSTRACT

This study investigates the potential of structuring the Accounting Conceptual Framework, that is outlined in the CICA (Canadian Institute of Chartered Accountants) Handbook, within a continuous feedback simulation model in effort to study the behavioural aspects of the small business environment.

The study uses *pre-defined* relationships established in the framework to bind together parameters of importance. This provides a different dimension on an old concept that previously sought to define relationship through implied influences. Based on this new concept, the pre-definition establishes the relationship between parameters, the program links them, and the user defines the strength. How much do we invest in the business? What price should the product be sold at? Much would be the same in a real small business.

The result from the simulations of different business conditions provided much insight into the different aspects of operations. The type of information garnered was able to point to specific weaknesses, strengths, and possible strategies which would useful in making more effective business decisions. The research may assist many small business owners who wish to better understanding their specific business environment, positive or negative.

ACKNOWLEDGEMENTS

This thesis has been a long time in coming. The journey has taken me through numerous faculties, courses and jobs. Most of all, it has allowed me the honor of having Dr. Thornton-Trump as my advisor. Without his wisdom, guidance and boundless support, this thesis and degree would not come into realization. For that, I am deeply grateful.

I would also like to add special thanks to Professor O. Hawaleshka and Dr. H. Musaphir for being on my committee.

Luck has followed me through this thesis, particularly in the fortune of meeting Dr. C. Tax from the Department of Accounting and Finance for opening up my eyes to the intricacies of Accounting, which formed the basis of my ideas.

Finally, I wish to dedicate this thesis to my parents, whose constant drive for academic success has been a constant motivation in my journeys. Mostly, for their unwavering love, support. For always being there.

CONTENT

LIST OF FIGURES

CHAPTER 1: INTRODUCTION

1.1 Introduction

As the new millenium approaches, record numbers of entrepreneurs are starting and operating their own independent businesses. [9] They are doing so for the sole purpose of achieving profits and growth by identifying new opportunities. The challenge lines in assembling the necessary resources to capitalize on those opportunities in the face of great market uncertainty.

With such a dynamic economy, approximately half of all new firms cease operations within five years. [18] The most common reason for business failure is bankruptcies. [4] Bankruptcies usually result from a business's inability to determine weakness and vulnerabilities, evaluate them and to make adjustments or find solutions.

There is a need for new methodologies and tools to monitor, anticipate financial behaviour and needs of small businesses. Based on the review of recent literature, it was found that there is only a handful of simulations done on businesses. This is not enough when one considers the impact small businesses have on the economy and employment.

This thesis will attempt to introduce the conceptual idea of incorporating the accounting framework within a continuous feedback simulation model as a possible means of translating the small business environment. Hopefully, it will be able to identify vulnerabilities, possible business tactics, and utilization of such information in more effective small business practices.

1.2 Literature Review

It is important for the reader to realize that while much of the quoted literature is in U.S. terms, it was used only where applicable The thesis and the model was created using Canadian accounting practices and principles.

1.2.1 Defining Small Business

In order to model a generic small business environment, it is important to define what constitutes a small business. The U.S. Small Business Act of 1953 defines a small business one which *is independently owned and operated and not dominated in its field of operation.* The U.S. Small Business Administration takes it even one step further by establishing specific criteria:

- MANUFACTURING: 250 or fewer employees (If employment is between 250 and1,500, a size standard for the particular industry used.)
- WHOLESALING: $9.5 million to $22 million in the annual sales, depending on the line of wholesaling.
- RETALING: $2 million to $7.5 million in annual sales, depending on the line of retailing.
- SERVICE: Not exceeding $1.5 million to $10 million in annual sales, depending on the line of business. [17]

Outside of prescribed definitions and criteria, small businesses have also four (4) very well defined qualitative characteristics. These are:

1. Management is independent, since the manager usually owns the firm.
2. Capital is supplied and ownership is held by an individual or a few individuals.
3. The area of operations is primarily local, although the market isn't necessarily local.
4. The firm is small in comparison with the largest competitors in it's own industry. [5]

1.2.2 The Current Business Environment

The role of small business in North America is often understated. When you consider the types of numbers it generates for Gross Domestic Product (GDP) and employment, it is not difficult to realize that its importance and impact on every sector of the economy.

1.2.2.1 Business Starts

From 1970-1994, the non-farm self-employed increased by more than 72%, from 5.2 million to 9 million [18]. 1996 saw record levels of new business formation – the highest ever and a 2.8 percent increase over the record in 1995. [9]

Table 1.2 *Nonfarm Business Tax Returns, 1981–1995 (Thousands)*

Year	Corporations (Forms 1120 and 1120S)	Partnerships (Form1065)	Proprietorships (Schedule C)	Total	Annual Percentage Increase
1995	4,818	1,580	16,157	22,555	2.26
1994	4,667	1,558	15,831	22,056	2.22
1993	4,516	1,567	15,495	21,578	1.64
1992	4,518	1,609	15,066	21,230	2.79
1991	4,374	1,652	14,626	20,653	1.05
1990	4,320	1,751	14,149	20,439	4.78
1989	4,197	1,780	13,529	19,506	2.78
1988	4,027	1,826	13,126	18,979	3.79
1987	3,829	1,824	12,633	18,286	4.50
1986	3,577	1,807	12,115	17,499	3.18
1985	3,437	1,755	11,767	16,959	4.88
1984	3,167	1,676	11,327	16,170	6.40
1983	3,078	1,613	10,507	15,198	5.96
1982	2,913	1,553	9,877	14,343	5.38
1981	2,813	1,458	9,345	13,616	--
Average Annual Growth Rate (Percent)	3.8	0.5	4.2	3.8	

Source: U. S. Department of the Treasury, Internal Revenue Service, *Statistics of Income Bulletin* (Spring 1996), Table 21.

Factors contributing to the increase of self-employed are:

1. Growth in the labour supply that is not readily accommodated by wage-and-salary employment.
2. New unexploited opportunities.
3. The hopes of opportunities for greater financial returns.
4. Dissatisfaction with wage-and- salary jobs.
5. The need to supplement income.
6. Desire for independent work.
7. The rise in two-income earning family. [18]

Part-time entrepreneurs are also making dramatic contributions in all these categories, increasing five-fold in recent years. Approximately, ¾ of all new business owners are employed with a wage and salary job when they start a new business. [9] However, even with record new businesses, the net annual increase for total of small businesses averages just 2%. This is a result of an incredibly dynamic economy that sees rapid business formation and dissolution.

1.2.2.2 Employment

Small businesses (firms with fewer than 500 employees) employ 53% of the total private non-farm work force, contribute 47% of all sales in the country, and are responsible for 51% of the private GDP. [9] Of the approximately 9 million small businesses that filed tax returns in 1995, about half employ fewer than five people and 90% of that total employ less than 20. [8]

The rate of employment growth in small business-dominated industries has been quite dramatic. During the 1976-1990 period, small firms provided 53% of total employment and 65% of net new jobs. From 1991-1993, small firms with 0-4 employees created the most new jobs. [9] In 1995, it was higher than the U.S. nation average and 10 times the rate of large-business-dominated industries. (Table 1.11) [18] According to recent BLS projections, small-firm-dominated sectors will contribute about 60 percent of new jobs from 1994-2005. Large firms will contribute 15% and industries dominated by neither large or small firms will contribute the remainder. [9]

Table 1.11 *Employment Change by Industry Type, December 1994 to December 1995*

Type of Industry	Total Employment Beginning of Period (Millions)	Employment Change (Thousands)	Percent Change
Small-Business-Dominated	41.9	1,072.2	2.56
Indeterminate	17.2	352.4	2.05
Large-Business-Dominated	32.6	77.4	0.24
Total	91.8	1,499.3	1.63

However, the employment figures are probably understated. The Current Population Survey (CPS) permits a broader definition of business ownership that includes the incorporated self-employed (ISE) and wage-and-salary workers with a side business (WSSE or "moonlighters") along with the

unincorporated self-employed (USE). Under this definition, approximately 15.4 million people, in 1994, engaged in some form of entrepreneurial activity.

Table 3.3 *Distribution of Employment in Nonagricultural Industries by Class of Worker, March 1988 and March 1994*

Class of Worker	March 1988		March 1994	
	Number (Thousands)	Percent of Total Employment	Number (Thousands)	Percent of Total Employment
Total Nonagricultural Employment	**109,578**	**100.0**	**116,830**	**100.0**
Unincorporated Self-Employed (USE)	**8,112**	**7.4**	**8,856**	**7.6**
Self-Employed Only (SEO)	6,757	6.2	7,361	6.3
Self-Employed with Wage-and-Salary Employment (SEWS)	1,355	1.2	1,496	1.3
Wage-and-Salary Workers (WS)	**101,215**	**92.4**	**107,843**	**92.3**
Incorporated Self-Employed (ISE)	2,984	2.7	3,955	3.4
Wage-and-Salary Workers Only (WSO)	95,599	87.2	101,349	86.7
Wage-and-Salary Workers with Self-Employment (WSSE)	2,632	2.4	2,539	2.2
Unpaid Family Workers	**251**	**0.2**	**130**	**0.1**
Total Self-Employed (SE)	13,728	12.5	15,350	13.1
Unincorporated Self-Employed (USE)	8,112	7.4	8,856	7.6
Incorporated Self-Employed (ISE)	2,984	2.7	3,955	3.4
Wage-and-Salary Workers with Self-Employment (WSSE)	2,632	2.4	2,539	2.2

Source: Tabulation by Carolyn Looff & Associates of unpublished data from the U.S. Department of Commerce, Bureau[illegible]

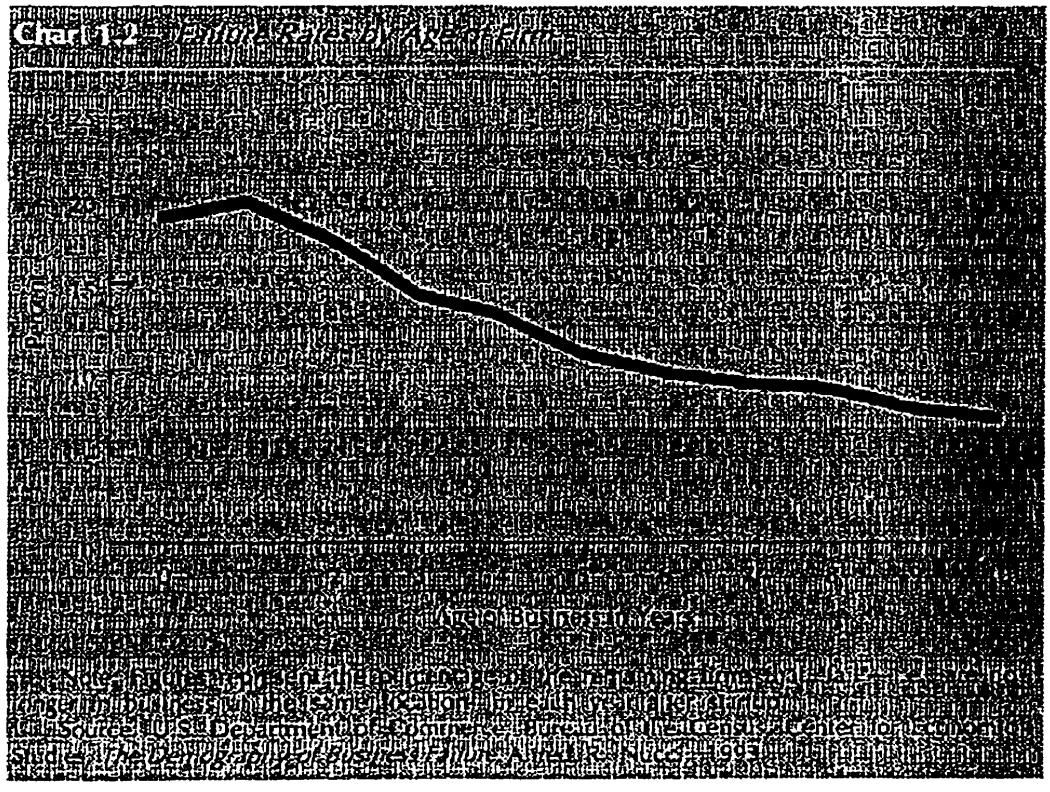
More and more people are considering self-employment or a combination with wage-and-salary as a serious alternative to just wage-and-salary.

Small businesses are becoming a major contributor to the economy, creating more flexibility, generating new services and products and helping to add to a nation's productive capacity. It is for this reason that greater attention should be paid to the financial and planning needs of small businesses.

1.2.2.3 Business Failures

As previously noted, even with record new business starts, the total of all small businesses is just averaging 2% annual increases. The dynamic economy cause businesses everywhere fail daily for numerous reasons. While levels for business failure have dropped moderately in the last three years, there are still wide variations from region to region.

One commonality amoung many small firms are their inability to survive the early years. Fewer than half of all new firms are in operation after 5 years. [18] For the given cohort, about 20% of new firms fail in each of the first and second years after startup. The failure rate decrease year by year; by the ninth or tenth year, only about 7-8% of the remaining firms fail, Chart 1.2.



Business failure is frequently used as an indicator on the health of American and Canadian businesses. According to statistical information published by Dun & Bradstreet, the number of businesses that failed in 1997 increase by 15.9%. Even with this modest increase, the failure rate (failures per 10,000 listed concerns) remained subdued at 88.

Bankruptcy is the most common reason for business failure. While the dollar amount of liabilities, haven shown a downward trend since 1991, increased by 26.6%, mid-range liability levels still account for the largest number of failures. More than half of businesses that failed in 1997 had liabilities between $25,000 and $1 million. The percentage of large failures (liabilities over $1 million) continued to decline, reaching its lowest point since 1996. [4]

1.3 Business Objective & Problem

The goal of any business, large or small, is to maximize the wealth of its owners. There are numerous ways a business can be created, operated and maintained. Whatever that might be there is always one constant truth: a business is a pool of funds fed by a variety of sources: investors and past earnings retained in the business. At any given moment, this pool of funds is static but changes continuously over time through the flow of funds. [14] The flow of funds through various sources can dictate an organization's destiny. In changing times, with increased competition, the allocation and raising of funds can affect overall growth and success of a business.

The efficient allocation and raising of funds has evolved into a discipline. The maintenance of an organization presents the biggest challenge. There is no direct methodology that applied will guarantee success. However, numerous models have been developed to analyze and assist in the matter.

Much of the current literature concentrates for evaluating business performance is limited to predictive multivariate models, financial ratios, and various valuation models.

1.4 The Proposed Study

The purpose of this thesis is to create a basic model of a generic small business within the financial accounting conceptual framework. This framework is pre-defined by the Canadian Institute of Chartered Accountants (CICA) Handbook. The model should mimic the environment, positive or negative, and conditions that are representative to such organizations.

As previously state, the ultimate goal of any business is to maximize wealth and avoid circumstances that would force business failure. Give the circumstances, no model would be considered appropriate if it was not built within the principles setout by the conceptual framework. This approach appears to be a promising tool for providing financial information on business performance. Past models that often failed to offer explicit financial justification [16].

There are a number of advantages for modelling the problem in this manner:

- The relationship between all parameters and the structure of the model is pre-defined by the framework.
- By using the Basic Principles in the framework, the model verification process is immediate and continuous.
- At any given time, the model can provide information regarding the behaviour of the business under certain conditions.
- The model is highly flexible. Due to the pre-defined parameters, adjustments to the model code can be easily made to suit different conditions. Parameters can be added or removed with minor modifications.

Powersim V1.1, a high level simulation language, was chosen as the means for creating the proposed model. Its code is highly visual and easy to understand by all.

Once a baseline reference model is constructed, it will be used to study various conditions experienced by small businesses. Conditions such as:

- Bankruptcies related to bank loans.
- The effect of cyclical/seasonal sales.

CHAPTER 2: SIMULATION PROCESS

2.1 Defining Simulation

Simulation is one of the most powerful analysis tools available for the design and operation of complex processes or systems. To simulate, according to the Webster's Collegiate Dictionary, is "to feign, to obtain the essence of, without reality". Here, simulation is defined as the process of designing a model as close as possible to the real system and conducting experiments with this model for the purpose of understanding the behaviour or evaluating various strategies for the operation of the system.

Basically, it is an experimental and applied methodology, which seeks to:

1. describe the behaviour of systems;
2. construct theories or hypotheses that account for the observed behaviour;
3. use these theories to predict future behaviour, that is, the effects that will be produced by changes in the system or in its method of operation. [12]

2.2 Methodology Framework

In any system simulation study, there are defined procedures to follow [19] [20] [12]. Figure 2.1, seen below, details the entire process.

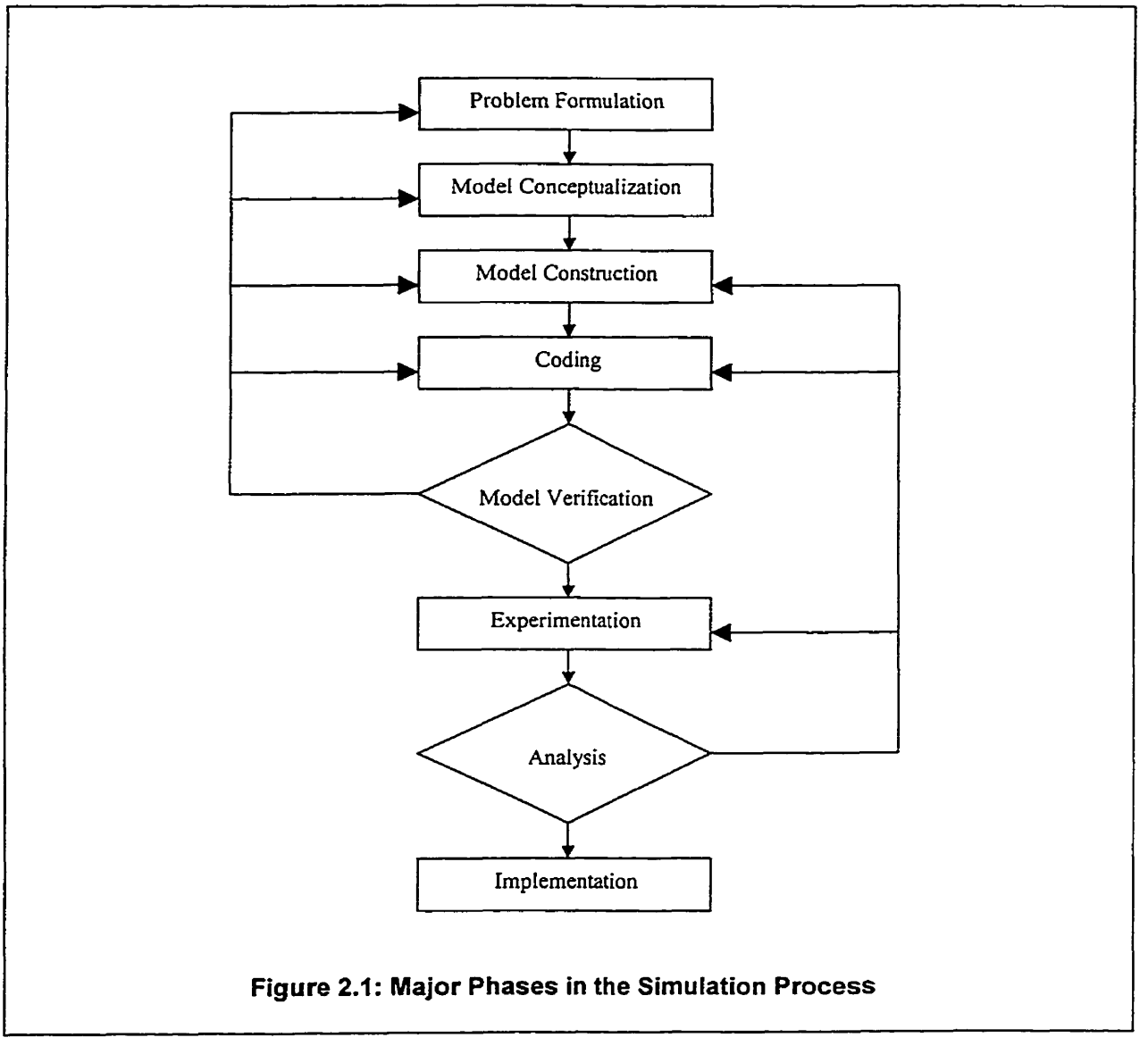


Figure 2.1: Major Phases in the Simulation Process

CHAPTER 3: SMALL BUSINESS MODEL

3.1 Overview

In the last twenty years, small business has become a major force in most economies around the world. Entrepreneurs are starting small businesses in droves and this trend is likely to continue into the next millenium. However, while record numbers enter into such arrangements, a great proportion of these new entrants also cease to exist after 5 years due to business failure. By trying to model a small business, maybe certain information could be discerned about behaviour that would assist in more effective business practices and decisions.

Depending on the problem being studied, a simulation model can be classified in many ways. This model was determined to be of three things:

- Dynamic
- Stochastic
- Continuous.

To integrate all three classifications, there must be an understanding of small business and its numerous variable relationships. By using the parameter relationships already pre-defined in the financial accounting conceptual framework, the mathematical model can be constructed using the simulation programming language Powersim V1.1. Powersim V1.1 was chosen for its ease of use and its highly visual aspect, which would be beneficial for others who wish to grasp the model's concept without much effort.

Due to the unique nature of the model, the conceptual framework should provide continuous verification during the current coding process, experimentation and future modifications.

Experimentation done on the model will test its viability as a methodology and tool for discerning the behaviour patterns of small business under various conditions.

3.2 Problem Formation

When formulating a problem, it is prudent to ask and answer the basic 5 W's: **what**, **why**, **where**, **when**, and **who**, along with **how**. These questions are dealt with on at a time in the following paragraphs.

So what is the problem? Throughout the recorded history of time, there have existed small businesses, while not necessarily in the form that we recognize today. Since its existence, owners have been attempting to capitalize on opportunities. However, many have also failed. The reasons for small business failures are numerous. Some are the result of unavoidable circumstances but most failures are due to a combination of variables well within the owner's control.

Poor business practices that lead to failures, know no boundaries, of race, age, education, nations, time, etc. They have the ability to affect all. So the question is how can we create better business practices?

As already stated in the introduction, this thesis will introduce the concept of incorporating the accounting conceptual framework within a continuous feedback model in hopes of discerning small business behavioural patterns.

3.3 Model Conceptualization

In the construction of this model, certain boundaries were set for the scope and depth of study. Due to the model's generic tendencies, not everything may reflect reality. The boundaries include:

1) The model will not exceed the boundaries defined for small businesses in Chapter 1.2.1, in a Canadian context.
2) The small business model must be contained within the Canadian general financial accounting conceptual framework.

3.3.1 Financial Accounting Conceptual Framework

Accounting can be defined as a "descriptive/analytical discipline that identifies a great mass of events and transactions that characterize economic activity." [6] This information is communicated primarily

through financial statements. Financial statements include (1) a balance sheet, (2) an income statement, (3) a statement of cash flow, and (4) a statement of retained earnings.

All financial statements are prepared within a conceptual framework, Generally Accepted Accounting Principles (GAAP), so as to eliminate potential dangers of bias, misinterpretations, inexactness and ambiguity. This framework, illustrated in Figure 3.2.1.1, sets forth general guidelines in determining procedures, practices and rules that are stipulated by a standard setting body.

It is this framework which investors, creditors and managers depend on for providing accurate information. As noted there are many levels to this framework, however, only the Basic Principles of the third level is of particular concern. This levels describes how to recognize and measure each event/transaction.

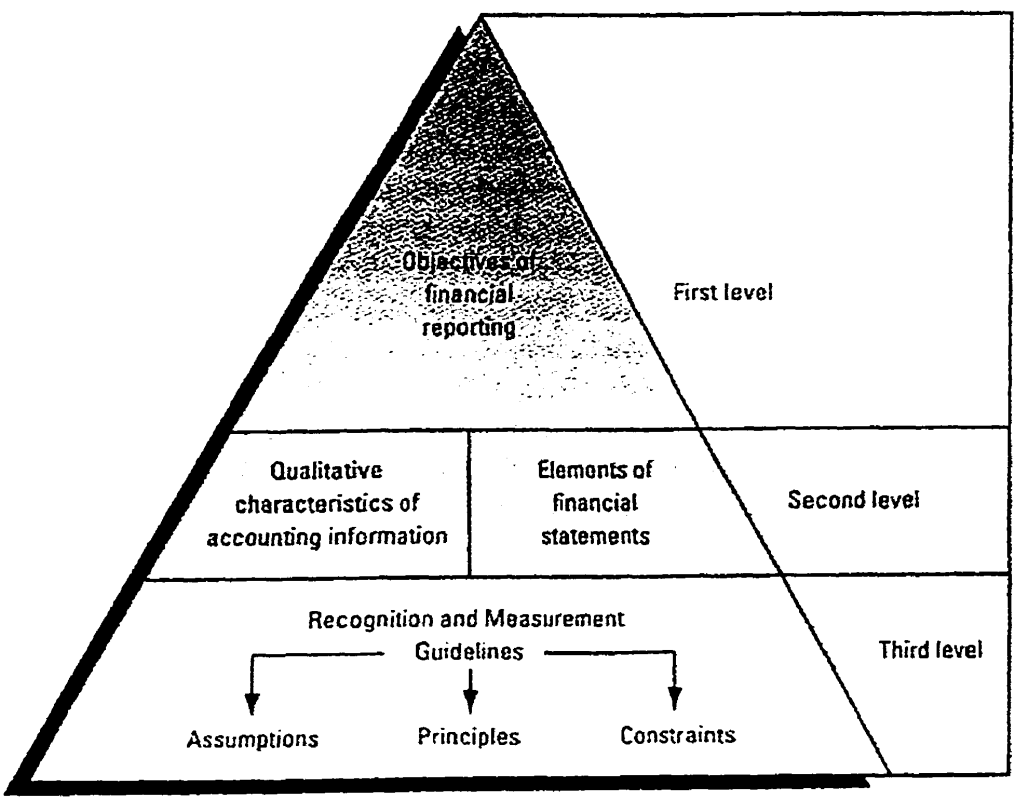


Figure 3.1 Financial Accounting Conceptual Framework

Basic Principles: There are four basic principles used when deciding when and how to measure, record, and report assets, liabilities, revenues and expenses:

1. Historical Cost Principle: transactions and events are recognized in financial statements at the amount of cash or cash equivalents paid or received or the fair value ascribed to them when they took place.
2. Revenue Realization Principle: provides guidance in answering the question of when revenue should be recognized (recorded in accounts). Revenue is generally recognized when (1) performance is achieved and (2) reasonable assurance regarding the measurability and collectibility of the consideration exists.
3. Matching Principle: Expense recognition is tied to revenue recognition. This principle dictates that expenses that are linked to revenue in a cause and effect relationship are normally matched with revenue in the accounting period in which revenue is recognized.
4. Full Disclosure Principle: It recognizes the practice that providing information is of sufficient importance to influence the judgement and decisions of an informed user.

All businesses can be identified as a series of events and transactions. By following the framework and basic principles, these events are described by a series of double-entry transactions. Transactions are external event involving the exchange of something between two or more entities which are systematically shown in "account" arrangements.

The double-entry system is essentially a balance- *for every debit there must be a credit or vice versa* [6]. This results in the basic accounting equation:

$$\text{Assets} = \text{Liabilities} + \text{Owner's Equity}$$

From these transactions in various accounts, Financial Statements can be generated.

3.3.2 Parameters

In defining the parameters that are to be used in the model, it is necessary to understand its relationship to the conceptual framework.

The framework sets out pre-defined guidelines for each specific type of parameters and its established relationship with others. By following it, the parameters will then generate Financial Statements used to provide an accurate reflection of current business conditions.

The structure of business, large or small, is essentially the same since the conceptual framework is applicable to all. Therefore, it was necessary to choose parameters based on their relational importance to small businesses. Specific parameters could be incorporated to restrict the model and certain types of behaviour. However, the model is flexible and is able to add, delete, modify or extend to include other parameters if necessary.

Listed in Table 3.2.2.1 is the different parameters chosen to reflect a generic small business.

TABLE 3.1 Small Business Parameters

Accounts Receivable	Common Share Issue
Purchase of raw material	Accounts Payable
Production of finished goods	Sales & Revenue
Cost of goods sold	Insurance Expense
Bank loans	Patent Expense
Capital Assets	Rent Expense
Warranty Expense	Administration Expense
Income Tax	

To make it easier for the reader to understand the established relationships amoung parameters, Powersim V1.1 had visual capabilities that allows the programmer to produce the code in a user friendly visual format which is much like an influence diagram, see Appendix A.

To assist some users in the understanding how the different parameters interact with each other, two influence diagrams (Balance Sheet and Income Statement) were created, Appendix B. Note: there are no assumptions outside the established relationship of the CICA Handbook. Also, not all parameters are shown in the diagram. It is only meant to be used as a general reference for understanding. It is more prudent for the reader to use the visual Powersim code for a more accurate understanding.

3.4 Model Construction

3.4.1 Simulation Languages

Once the conceptualization of the system is completed, the next step is to construct the model using a suitable simulation building language. These languages can be classified into four separate groups [24]:

1. Spreadsheets
2. Simulators or Simulation Software Packages
3. Simulation languages
4. General purpose languages

Out of the four, Simulators or Simulation Software Packages was the most suitable. Spreadsheets, such as Excel, can only be used in limited static or stochastic simulations and simulation and general-purpose languages are often too difficult for non-programmers to understand.

Simulators or simulation software packages allow one to simulate a system contained in a specific class of systems with little or no programming experience. Available software include: Arena, ProModel, SimEngine , PowerSim, and Stella.

Powersim V1.1 was chosen for being highly visual. Both the programmer and users would find it easy to use. It is a dynamic modeling simulation that is available to users in a wide variety of areas, particularly management, corporate and public planning, industrial simulations, environmental issues, the experimental sciences, education and training. It is designed to support quantitative and experimental approach to management. [25]

3.4.2 Powersim V1.1

POWERSIM – *The Compelete Software Tool for Dynamic Simulation* is a Microsoft Windows based software package that is used to facilitate the study of dynamic systems. The formulations of such systems is done through graphical notation, by drawing your ideas on the computer application screen (Figure 3.2) using symbols and arrows. (Figure 3.4)

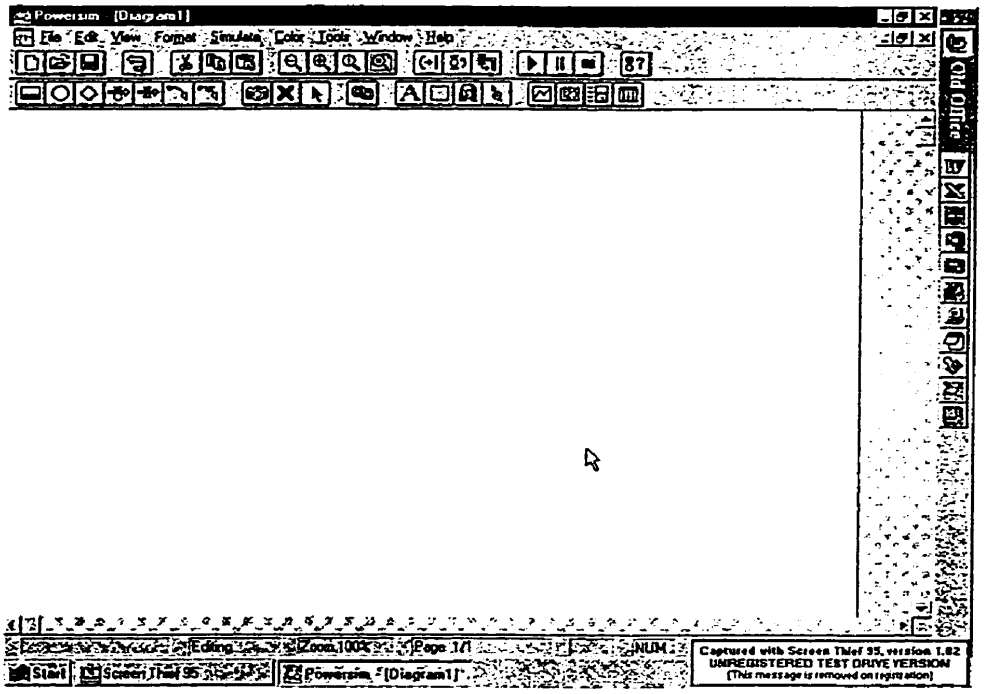


Figure 3.2: Powersim V1.1 Application Window

Commandbar

The commandbar is located below the menubar, and contains a set of buttons for performing the most frequently used commands in POWERSIM.

New	Paste	Rotate Name
Open	"Zoom out"	Move Valve
Save	"Zoom in"	Options
Undo	"Zoom to 100%"	Run
Cut	"Zoom to fit in window"	Pause on/off
Copy	Straighten	Stop

Table 1: Commandbar buttons

Toolbar

The toolbar is located below the commandbar and contains a set of buttons for creating and editing objects.

Level	Camera	Line
Auxiliary	Eraser	Time Graph
Constant	Pointer	Time Table
Flow-with-rate	Chain	Number
Flow	Text	Slider/Bar
Link	Frame	
Delayed Link	Picture	

Table 2: Toolbar buttons

Figure 3.3 Powersim V1.1 Menu and Toolbar Icons

Using the tools from menus & toolbar, seen above in Figure 3.3, Powersim can model all different sorts of processes, including large, complex, multiple feedback systems. [25] As already seen in the toolbar, there are numerous symbols used as variable building blocks, each having its own unique function. (Figure 3.4)

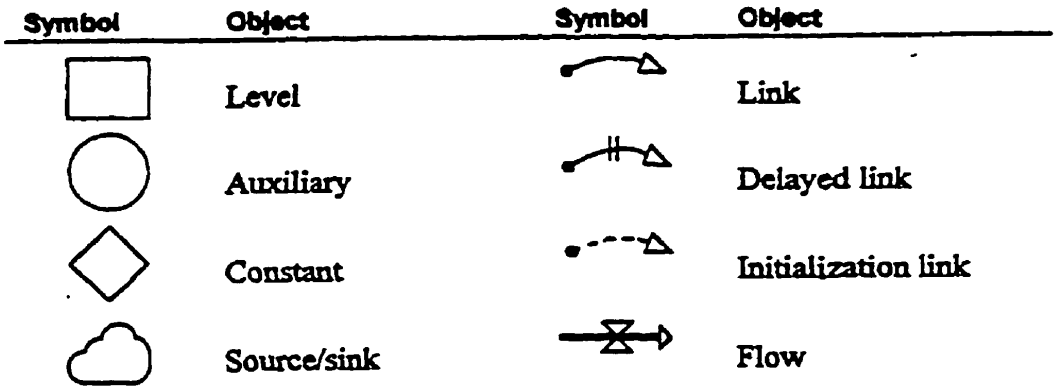
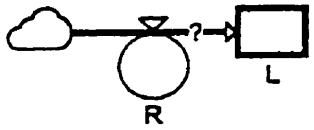


Figure 3.4 Flow diagram editor building blocks

When a variable symbol has a "?" in it, it means that the variable is either not defined or has an error.

When a flow has a "?", it means that the flow is improperly defined.



A unique feature of this simulation program is its ability to take "snaphots" of original variables and use them for linking purposes elsewhere in the program model.

When a double frame is used on a variable, it means to indicate that the variable is an array.

3.4.3 Coding

Coding of this conceptual idea was tricky but fortunately, the framework provided the necessary guidelines.

Coding began much the same way that most individuals start a new business. Usually, the very first action/transaction is the issuing of shares to generate capital. This particular parameter transaction

was translated into code. The code was required to mimic the transaction exactly. Flowing the funds into their proper "accounts" by linking.

Slowly, step by step, each parameter that was relevant to a small business was translated into code in the same manner. There were some non-financial parameters incorporate to assist in the generation of others. All parameters do require initialization values.

What resulted was a set of "accounts". However, "accounts", individually, do not have much relevance. In the end, code was generated to *group* the "accounts" together and create financial statements such as the Balance Sheet and Income Statement.

Hence, a reference model of a generic small business was created that would react similarly to regular accounting software. See Appendix B for the complete code.

3.4.3.1 Transaction/Event Coding

To assist the reader, an example of a parameter, bank loans, will be detailed in the following section.

Quite often, most new small business do not collect assemble enough capital to begin operations and turn to banks to supply them with the difference. This comes in the form of "Bank Loans".

Such a loan would create the accounting journal transactions seen below:

Jan 1, 19A
Dr. Cash
  Cr. Loan Payable

Dec. 31, 19A
Dr. Interest Payable
  Cr. Interest Expense

Jan 1, 19B
Dr. Loan Payable (amortized payment)
Dr. Interest Payable
  Cr. Cash

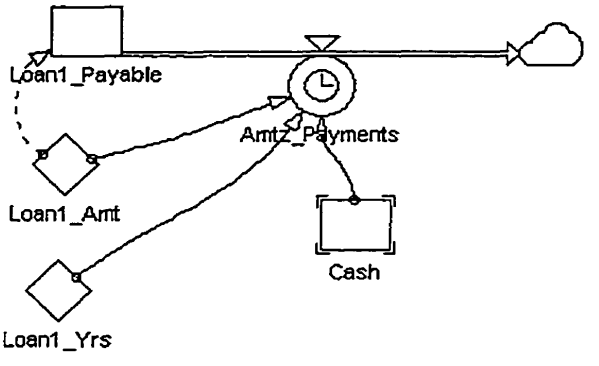


Figure 3.5 Initialization of Bank Loan & Amortization Payments

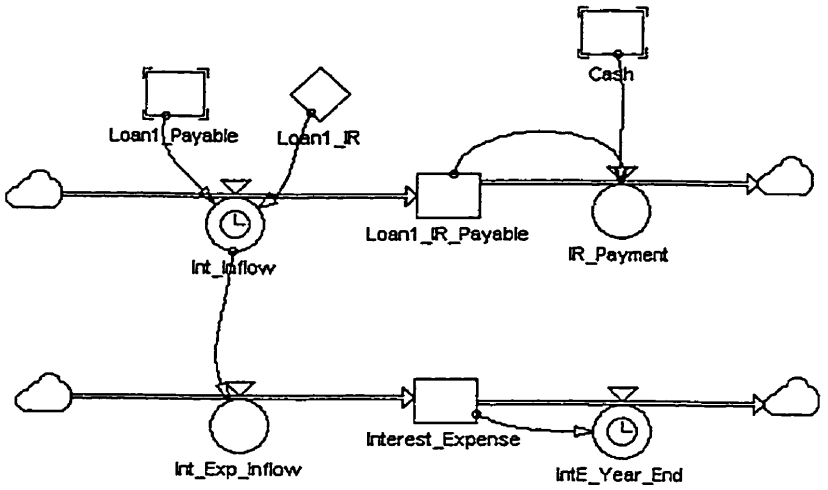


Figure 3.6 Interest Liability and Expense

It is these double-transactions that the code must mimic.

Powersim V1.1 has a number of limitations, unfortunately, initiating actions is one of them. The programmer him or herself must initiate certain operational decisions that are not periodic, such as a bank loan.

On Jan. 1, 19A, a bank loan was created (Loan1_Amt), Figure 3.5. As a liability, it was immediately intialized into an "account" or level variable (Loan1_Payable). In turn, cash was received and initialized in the cash "account", seen in Figure 3.7. Thereby completing the journal transactions.

As with every loan, there are certain conditions attached: 1) number of years the loan is outstanding (Loan1_Yrs) and 2) interest rate (Loan1_IR). These conditions are used to calculate the annual amortization payments and interest owed.

In order to provide the users with complete financial statements, it is sometime necessary for bookkeepers to make "adjusting entries". Adjusting entries are journal transactions, made to properly reflect the reality of current business conditions. The journal transaction made for Dec. 31, 19A are "adjusting entries". These entries were made to reflect the liability the business owes for interest. Figure 3.6 details how interest is incurred (Int_Inflow), expensed (Int._Exp_Inflow) and paid annually (IR_Payment).

On Jan. 1, 19B, a journal transaction is entered into the books to show the annual amortization payments. These payments reduce the Loans1_Payable liability account, reducing it year after year until the liability is paid up. This is seen in Figure 3.5 as an outflow (Amtz_Payments). As the liability is reduced, the program code also outflows that amount out of the "cash" account. Thereby completing the transaction see in Figure 3.7.

Technically, two journal entries can be made on Jan. 1, 19B.. One for the repayment of the loan portion and the other for the payment of interest owed. However, it was rolled into one for more

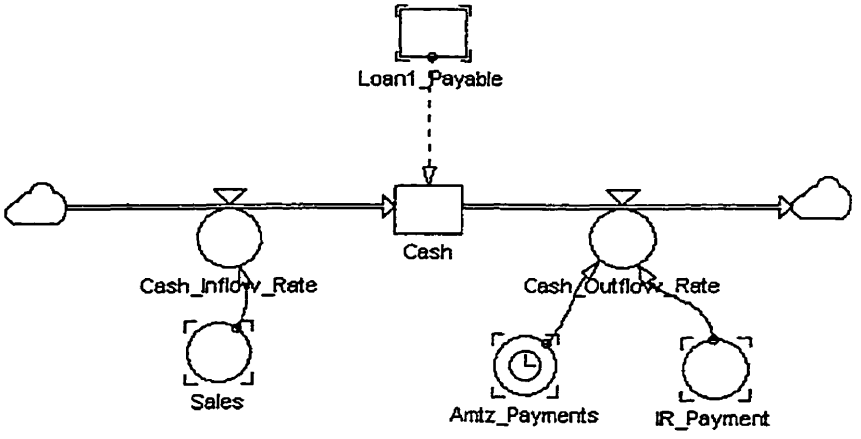


Figure 3.7 Repayment of loan and interest

efficient bookkeeping.

Note: to better reflect reality, an IF statement was added to each of the outflows of these accounts. The outflow transactions would only occur IF there is enough in the "Cash" account to repay the liability.

All other parameters had their code built up in a similar manner. The key was the ensure that the "double-entry" accounting was simulated accurately.

3.4.3.2 Financial Statements

By coding all the different parameters, the accounts generated were used to create financial statements that report on current business conditions. There is both a Balance Sheet and Income Statement.

The Balance Sheet provides information about the nature and amounts of investments in resources, obligations to creditors, and the owners' equity in net resources. It provides a basis for (1) computing rates of return; (2) evaluating the capital structure, and (3) assessing the liquidity and financial flexibility of the enterprise.

There are three classes of items included on the Balance Sheet: assets, liabilities, and owners' equity. Through these three classes, it is a reflection of the general accounting equation:

Assets = Liabilities + Owners' Equity

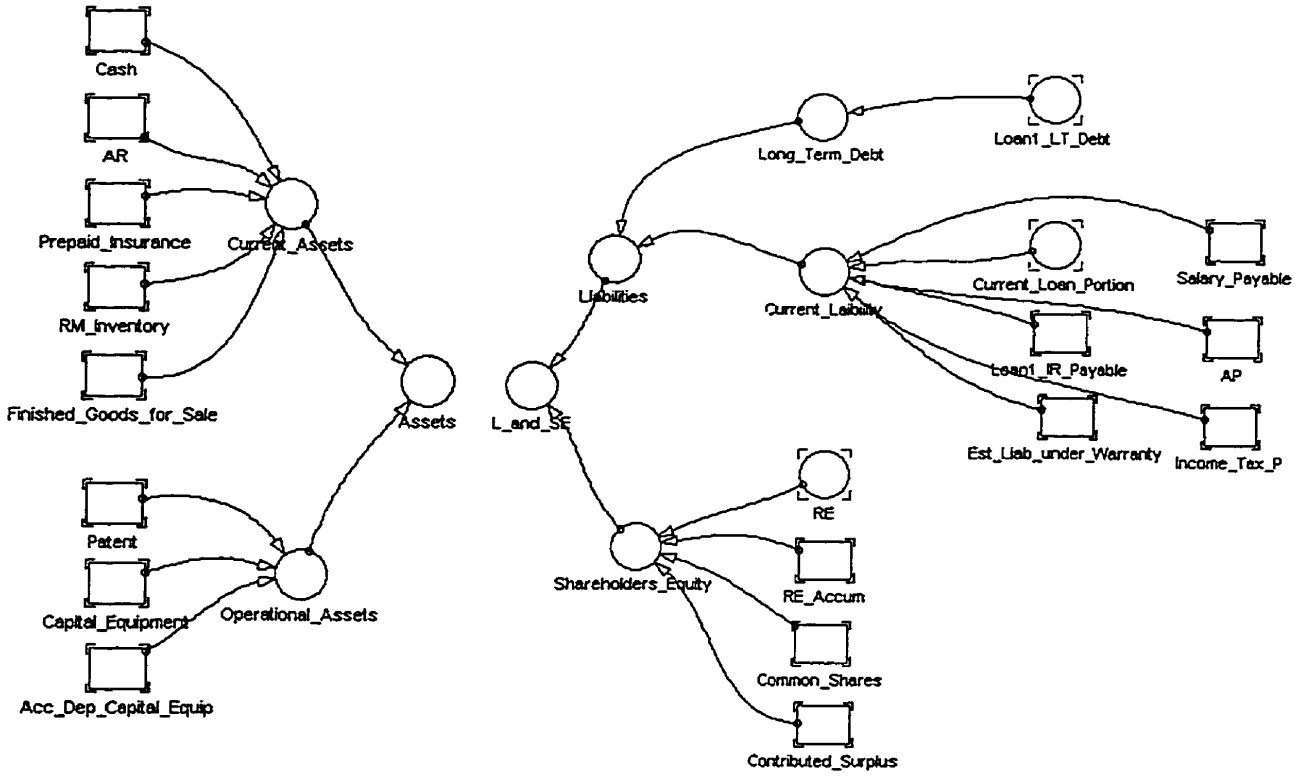


Figure 3.8 Program Representation of the Balance Sheet

Powersim V1.1 is also capable of generating tables that list the values going through particular variables during each cycle, Figure 3.9.

By having the code generate a Balance Sheet, the model verification step in the simulation process became on-going throughout the entire project. Because a balance sheet is suppose to be "balanced", any time a new "event" was

BALANCE SHEET

TIME	Assets	L and SE
248	133,763.84	133,763.84
249	134,122.13	134,122.13
250	134,480.43	134,480.43
251	134,838.74	134,838.74
252	135,197.07	135,197.07
253	135,555.41	135,555.41
254	135,913.76	135,913.76
255	136,272.12	136,272.12
256	136,630.50	136,630.50
257	136,988.89	136,988.89
258	137,347.29	137,347.29
259	137,705.70	137,705.70

Figure 3.9: Balance Sheet Results

added to the model, verification for accurate double-entry is instantaneous and continuous.

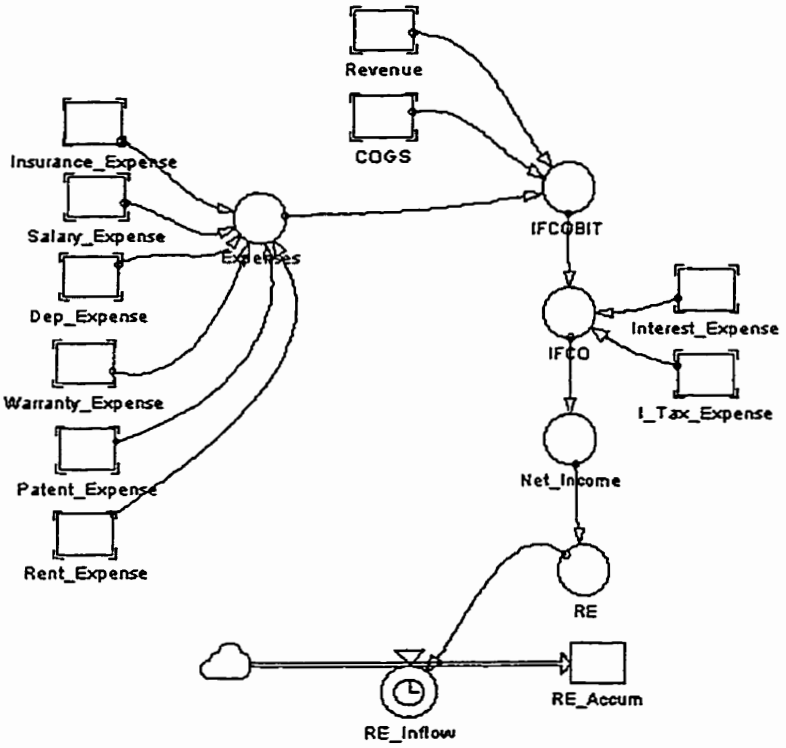


Figure 3.10 Program Representation of the Income Statement

the Income Statement was also generated, Figure 3.10. It is a report that measures the success of business operations for a given period. It provides information that helps in predicting the amounts, timing, and uncertainty of future cash flows.

The transactional approached to accounting requires the use of revenue, expense, loss, and gain accounts. These make up the major elements of an Income Statement.

There are three things of note about the generated code and values. First, Retained Earning is equal to Net Income. This is because no divided were issued. If dividends were issued, the two values would not equate.

TIME	Revenue	COGS	Expenses	IFCOBIT	Interest_Expense	I_Tax_Expense	Net_Income	RE
255	88,651.80	13,291.8	60,789.47	14,570.6	0.00	0.00	14,570.56	14,570.56
256	89,251.80	13,343.7	60,979.14	14,928.9	0.00	0.00	14,928.93	14,928.93
257	89,851.80	13,395.7	61,168.79	15,287.3	0.00	0.00	15,287.32	15,287.32
258	90,451.80	13,447.7	61,358.43	15,645.7	0.00	0.00	15,645.72	15,645.72
259	91,051.80	13,499.6	61,548.06	16,004.1	0.00	0.00	16,004.13	16,004.13
260	91,651.80	13,551.6	61,837.67	16,262.6	1,000.00	6,081.57	9,180.98	9,180.98
261	600.00	51.96	189.60	358.44	0.00	0.00	358.44	358.44
262	1,200.00	103.92	379.19	716.88	0.00	0.00	716.88	716.88
263	1,800.00	155.88	568.77	1,075.34	0.00	0.00	1,075.34	1,075.34
264	2,400.00	207.84	758.34	1,433.82	0.00	0.00	1,433.82	1,433.82
265	3,000.00	259.80	947.90	1,792.30	0.00	0.00	1,792.30	1,792.30
266	3,600.00	311.76	2,137.44	1,150.80	0.00	0.00	1,150.80	1,150.80
267	4,200.00	363.73	2,326.97	1,509.31	0.00	0.00	1,509.31	1,509.31
268	4,800.00	415.69	2,516.49	1,867.83	0.00	0.00	1,867.83	1,867.83
269	5,400.00	467.65	2,705.99	2,226.36	0.00	0.00	2,226.36	2,226.36
270	6,000.00	519.61	2,895.49	2,584.90	0.00	0.00	2,584.90	2,584.90
271	6,600.00	571.57	3,084.97	2,943.46	0.00	0.00	2,943.46	2,943.46
272	7,200.00	623.53	3,274.44	3,302.03	0.00	0.00	3,302.03	3,302.03

Figure 3.11 Income Statement Results

Second, both interested and income tax is expensed in the appropriate year. If table values were to be generated for the interest payable and income tax payable accounts, the reader would see these

liabilities paid in the next yearly cycle. Third, a yearly cycle is 260 time cycles in the model. This is number of calculated work days in a year.

Currently, both the Statement of Retained Earnings and Changes in Cash Flow Position have not been generated.

3.5 Experimentation & Analysis

Upon completion of the reference model, two particular situations were reviewed:

1. Bank Loan
2. Cyclical Sales

Three separate experiments were run for each situation. In each experiment, certain conditions were altered and result garnered. The reader should note that only six experiments were attempted due to a shortage in time, not because of model limitations. These experiments are meant to show the potential of the concept, not specifics.

The code for each Experiment has been attached to Appendix C.

3.5.1 No Bank Loan with Prepaid Insurance

The reference model had very specific elements in place for possible experimentation. Such elements included a bank loan, steady state sales, the purchase of prepaid insurance and capital equipment. A basic assumption about financing was made. It assumed that there was enough financing, through share issue and bank loans, to cover start-up expenses.

Note: All profits made are assumed to re-invested into the business.

In this first experiment, the bank loan was eliminated. However, by eliminating this loan, there is not enough capital to start-up.

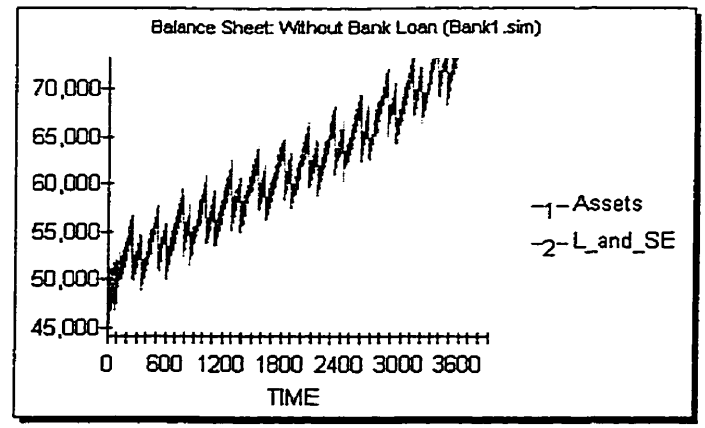


Figure 3.12: Balance Sheet Trend without a Bank Loan

Therefore, the number of common shares issued rose from 25-50 in order to provide needed capital. All other variables remained fixed.

The simulation runs for 15 years. All graphs are time index on a per day basis. The model assumes that there are 260 working days in a year.

With no loans outstanding, steady sales, and reinvested earning, it appears that the business has no problem sustaining its slow but steady growth from year to year.

For most small businesses, this is not normally the situation. Most lack the necessary capital to begin operations and must seek either loans or other investors to compensate. The following two experiments will review the effects of a loan.

3.5.2 Bank Loan Financing

In Experiment 2, a bank loan for $20,000 with a 5-year amortization plan at a 10% interest rate was initialized. The loan is employed instead of issuing more shares to finance start-up operations. Note that the organization is required to purchase this prepaid insurance every 5 years for $25,000. Without it, the business cannot operate due to government regulations. All other variables remain steady.

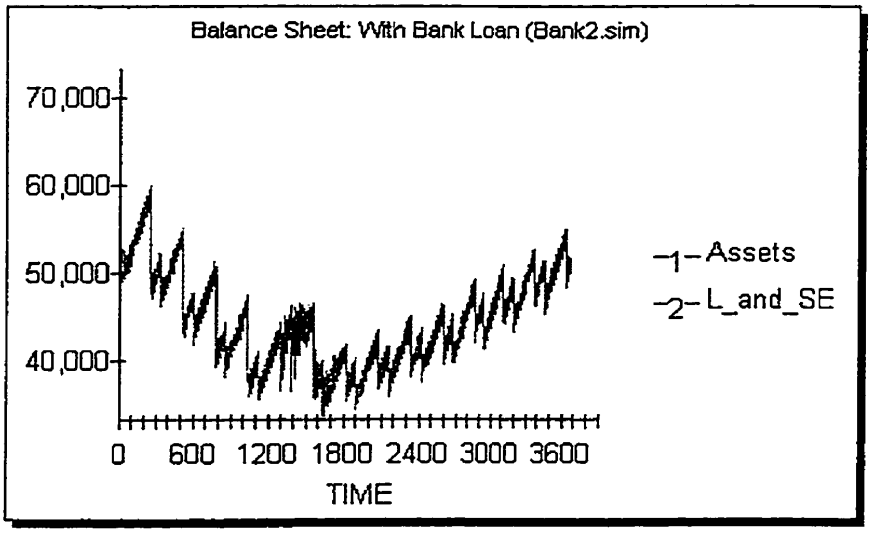


Figure 3.13: Balance Sheet Trend with a 5-year Bank Loan

Figure 3.13 show a generated balance sheet. During the first five years, the net worth of the organization showed a dramatic reduction and the end of each year due to the repayment of the loan.

The downward trend is an indication that the sales generated is not enough to counterbalance, hence, the drop in net worth.

At the end of 5 years, the debt is completely paid off but at the same time, the organization is required to purchase another $25,000 worth of prepaid insurance. Fortunately, enough cash was generated through sales to also make this purchase but it left the organization "struggling".

Struggling is defined as organizational difficulties that are reflected in the graph as violent oscillations. In these experiments, it is due to cash flow problems. When cash is too low (less than $10,000), workers are asking to take delayed wage payments until cash levels are higher, lowering bankruptcy risks. These delayed wage liabilities accumulate until there is enough money to pay off all outstanding wages. Hence the oscillations in the balance sheet trends.

This struggling is observed starting in Year 6 and continues until near the end of Year 7, when the business finally excavates itself out. Once recovery was underway, there were no significant problems and the net worth of the organization grew uniformly under steady sales.

This demonstrates how an organization can use financial leveraging as a means to start a business and generate revenue.

3.5.3Bank Loan with Shorten Amortization

Experiment 3 replicates Experiment 2, except the number of amortization years for repayment is shortened to 2 years.

With a shorter amortization period, you see an earlier and longer struggle. In Figure 3.14, net worth drops dramatically each time the amortized amount

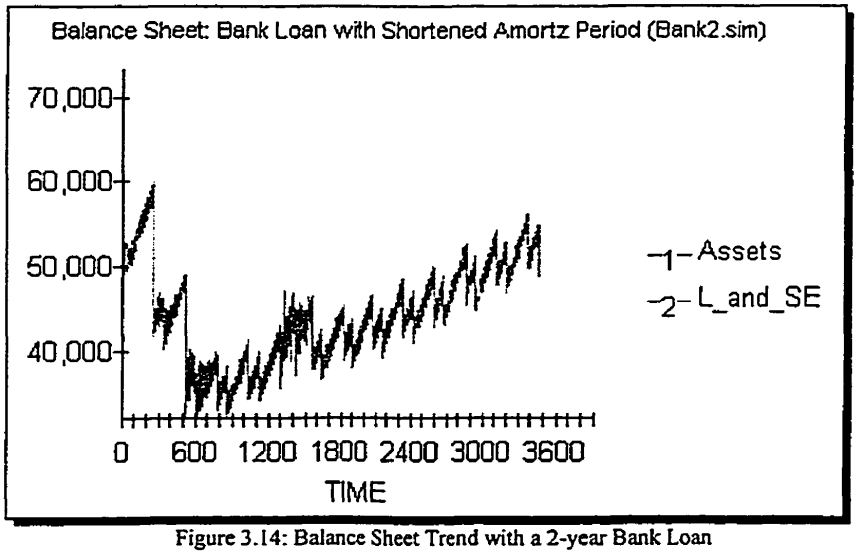


Figure 3.14: Balance Sheet Trend with a 2-year Bank Loan

need to be repaid. At the end of Year 2, the repayment drops cash very low levels and the company is forced to struggle for a period. The organization spent Year 3,4 & 5 trying to recover from the loan.

The business barely generates enough revenue before being hit by the prepaid insurance cost. This action again reduces company cash levels and leaves it struggling to recover for another year. Should the company been unable to generate enough cash from sales, it would have collapsed.

As previously stated half of all new small business is no longer in operation after five years and fail due to bankruptcies brought on by laibilities.

3.5.4 Cyclical Sales

Some small businesses experience seasonal sale. In the three following experiments, the model attempts to replicate some of the behaviour and conditions experienced by cyclicality.

Sales were modified from a steady state to produce a sinwave with amplitude of 10 over the year. Sale would range from 0 to 20 units order per day. The sinwave would have the organization begin production at mid-season and going upward.

All other variables were held constant. Including the number of workers at 2 people who work for 8 hours a day. No overtime is considered. Each worker is capable of producing 5 finished units per day and raw material is purchased on a JIT system. Therefore, minimal inventory is held.

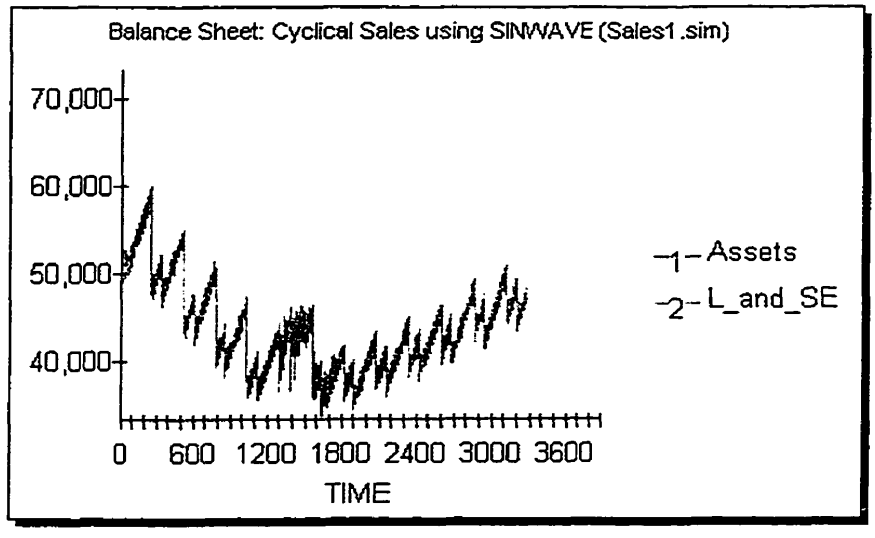


Figure 3.15: Balance Sheet Trend for Cyclical Sales

The effect was similar to sales with a steady state. No matter what, two workers can only make 10 units a day if there is no overtime. What resulted was an order backlog that was slowly worked off during low season. The workload was spread out and deliveries were made based on the worker's production rate. So, the revenue generated remained steady over time.

As usual, the company was forced to "struggle" in Year 6 because it was not able to generate enough revenue to cover the loan and the prepaid insurance without creating a cash flow problem.

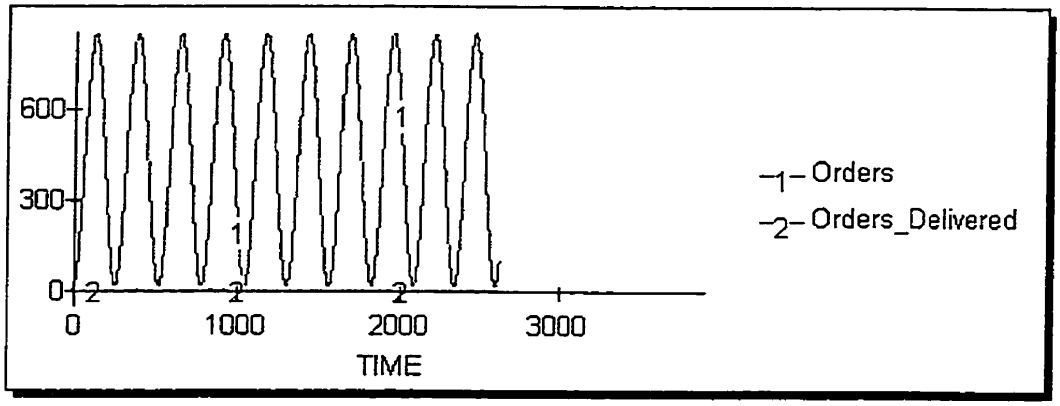


Figure 3.16: Backlog Order Trend in Relation to Delivered Goods

While the results were similar to steady state growth, the backlog was very large. It is highly doubtful that most customers would wish to wait a half of year for delivery of their goods.

3.5.5 Cyclical Sales with Additional Staff

Experiment 5 had the same conditions as Experiment 4 but an extra person was added at half-time to compensate for the backlog.

The availability of half a person made a huge impact. While backlogs still occurred, they were immediately dissipated. This

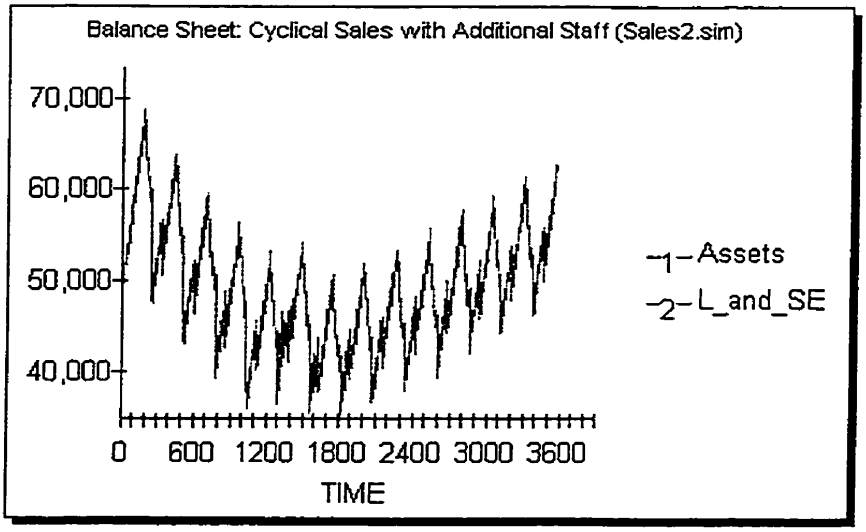


Figure 3.17: Balance Sheet Trend with Cyclical Sales and Additional Staff

is reflected in the balance sheet graph that now resembles a sinwave (Figure 3.17). Revenue is generated at the appropriate periods, showing the quick turnaround of orders to the delivered product.

The extra person didn't seem to hurt the organization at all. In fact, it was of tremendous benefit. With overhead expenses remaining the stable, the only extra cost was for wages. On top of that, with more units produced, it increased overall revenue. In turn, this allowed the company to purchase prepaid insurance in Year 6 without much impact on the business.

3.5.6 Cyclical Sale with Cancellations

At any time there is a backlog, there is an unhappy customer who ends up canceling his or her order because of the wait. Experiment 6, with the same conditions as Experiment 4, only adds some code for a cancellation policy under certain conditions:

IF(Orders>500,Orders-500,0)

When there was a backlog of more than 500 order, the excess amount was terminated. This trail run collapsed the business. With cancellations, it was unable to generate enough cash to purchase prepaid insurance at the beginning of Year 6.

When cancellation were made, it seemed to leave workers with a bit more time later on. When low season came around, there was less work that anticipated due to cancellations and during low season, workers were often not needed.

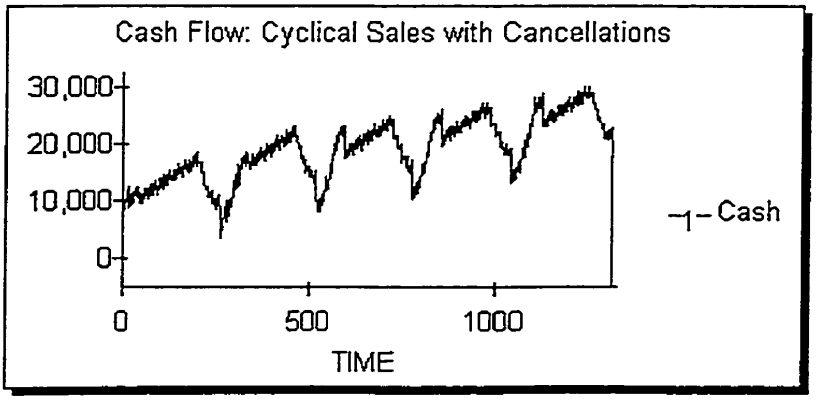


Figure 3.18: Cash Flow Trend with Cancellations during Cyclical Sales

In review of the collapse, it was visible that the business came just short of having generated enough revenue to purchase the insurance. In cases like this, there are numerous tactics that can be taken before or after that would provide enough financial leverage to keep the business afloat.

CHAPTER 4: CONCLUSION

While numerous efforts have been made to find ways to valuate small businesses, the approach from an accounting conceptual framework and engineering simulation programs make for a unique combination.

Accounting should be an integral part of any organization. Information generated from it can be used to assist in making financial decisions. By using the framework's pre-defined relationships within a simulation structure, there is the potential to create a behavioural modeling program that will assist managers and owners in making more effective financial decisions.

A generic continuous feedback baseline model was created using Powersim V1.1 that details the many relationships found within small businesses. By using this reference model with, various conditions such as bank loans and sales, were tested and reactions analyzed.

From the results of the experiments, a number of conclusions could be drawn:

1. The model placed under certain conditions seemed to correctly mimic the behavioural patterns known to occur. For example, the use of loans for financial lever and cash flow problems.

2. When testing certain conditions, possible tactics or solutions to problem areas became fairly apparent. In turn, these tactics could be tested on the problem to see if the problem can be dispersed.

3. Incorporating the accounting conceptual framework within a simulation model shows initial indications that it will provide business owners and investors with the needed information for more effective business practices.

4. It would be advisable to run further experiments with other parameters to test the full range of the program.

CHAPTER 5: RECOMMNDATIONS

The purpose of this thesis was to investigate the conceptual idea of integrating the accounting conceptual framework with a simulation model program. The study lead to some interesting conclusions. However, there are still more opportunities that should be explored:

1. Further Experiments

Only six trail experiments were run on the reference model. However, a complete model was created with multitudes of variable. Each that can be used in other experiments. For example: accounts receivable and bad debt expense, warranty liabilities and expense, capital equipment and it's affect on production, etc. These are other possibilities that should be explored.

2. Further Program Modifications

While the current program structure is solidly intact, the peripheral variable which generate the numerous accounting transactions can be refined to allow for more. This would eliminate the number of overall alterations required to when experimenting different business conditions.

3. Recoding

Powersim V1.1 was created in 1991. It has some definite limitations due to its creation age. As a result, the program lacks certain types of flexibility that would make for a smoother program. For example, this program is unable to stop itself when certain variable conditions are met. Only the programmer is able to physically stop the program when he or she wishes.

If further studies are to be done in this area, it might be prudent to recode the program in a lower level language, possibly Visual Basic. Lower level code would create flexibility that the current language cannot provide. However, there are some distinct disadvantages.

Powersim is a high level visual simulation language. It provides highly visual program/user friendly interface. By recoding at a lower level, the simplicity of the interface would be lost along with the visualness. This problem would also wreak havoc on any alterations the programmer may wish to make.

4. Truthing & Expansion

The accounting conceptual framework covers a wide range of areas with different business conditions requiring specific treatments so to generate the maximum amount of information. Further studies should include further truthing and the expansion into other areas, including Finance. The model should be able to generate the maximum amount of information to better analyze the possible behaviours.

REFERENCES

[1] Awadh, B., (1994) A Manufacturing Process Planning Model Using Genetic Algorithms

[2] A. Aziz and G.H. Lawson, Cash Flow Reporting and Financial Distress Models: Testing of Hypothesis, *Financial Management,* 18(1), Spring 1989

[3] Paul Barnes, The Analysis and Use of Financial Ratios: A Review Article, *Journal of Business Finance & Accounting,* 14(4) Winter 1987

[4] Dun & Bradstreet Inc., (1997) Business Failure Record: A comparative statistical analysis of geographic and industry trends in business failures in the United States

[5] R.M. Hodgetts and D.F. Huratko, Effective Small Business Management, Fifth Edition, The Dryden Press, New York, 1995

[6] D.E. Kieso, J.J. Weygandt, V.B. Irvine, W.H. Silvester, and N.M. Young, Intermediate Accounting, Fifth Canadian Edition, Volume 1, John Wiley & Sons Canada Ltd., Toronto ON, 1998

[7] D.E. Kieso, J.J. Weygandt, V.B. Irvine, W.H. Silvester, and N.M. Young, Intermediate Accounting, Fifth Canadian Edition, Volume 2, John Wiley & Sons Canada Ltd., Toronto ON, 1998

[8] National Federation of Independent Business, (1996) Small Business Facts, http://www.nfibonline.com/politics/issue-archive/NFIB-small-biz-info/fact.html

[9] Office of Advocacy (U.S. Small Business Administration), The Facts About Small Business, 1997, September 1997

[10] Office of Advocacy (U.S. Small Business Administration), The State of Small Business, May 1996

[11] Office of Advocacy (U.S. Small Business Administration), The State of Small Business: A Report of the President, 1996

[12] R.E. Shannon, Systems Simulation: The art and science, Prentice Hall Inc., Englewood Cliffs NJ, 1975

[13] N.C. Suresh and J.R. Meredith, A Generic Approach to Justifying Flexible Manufacturing Systems, FMS Proceedings 1984, pp 36-42

[14] J.C. Van Horne, C.R. Dipchand, and J.R. Hanrahan, Fundamentals of Financial Management, Canadian Sixth Edition, Prentice-Hall Canada Inc., Scarborough ON, 1989

[15] Yu, E. C., (1987) The Use of Zeta "Bankruptcy" Analysis in a Simulation Model to Study the Economic Benefits of CIM

[16] G.J. Michael and A.D. Little, Economic Justification of Modern Computer-Based Factory Automation Equipment; A Status Report, FMS Proceedings 1984

[17] Office of Advocacy (U.S. Small Business Administration), Facts About Small Business and the U.S. Business Administration, 1985, 7

[18] Office of Advocacy (U.S. Small Business Administration), The Annual Report on Small Business and Competition, *Self-employment and Small Business*, 1996

[19] R.I. Hall, Simple Techniques for Constructing Explanatory Models of Complex Systems for Policy Analysis, Dynamics, 4(3), 1987

[20] R.B. Chase and N.J. Aquilano, Production and Operations Management, Illinois: Richard D, Erwin Inc., 1985

[21] T. J. Gogg and J.R.A. Mott, Introduction to Simulation, Proceedings of the 1993 Winter Simulation Conference, Los Angles, CA., pp. 9-17, The Society for Computer Simulation

[22] E. Altman, B.G. Haldeman, and P. Narayanan, Zeta Analysis: A New Model to Identify Bankruptcy Risk to Corporations, Journal of Banking and Finance, 1, June 1997

[23] E. Bringham, A. Hahl, and W. Rentz, Canadian Financial Management Theory and Practice, Holt, Rinehart and Winston of Canada, Ltd., 1993

[24] A. L. Law, and D. W. Kenton, Simulation Modeling and Analysis. 2nd Edition, McGraw-Hill Inc., New York, 1991

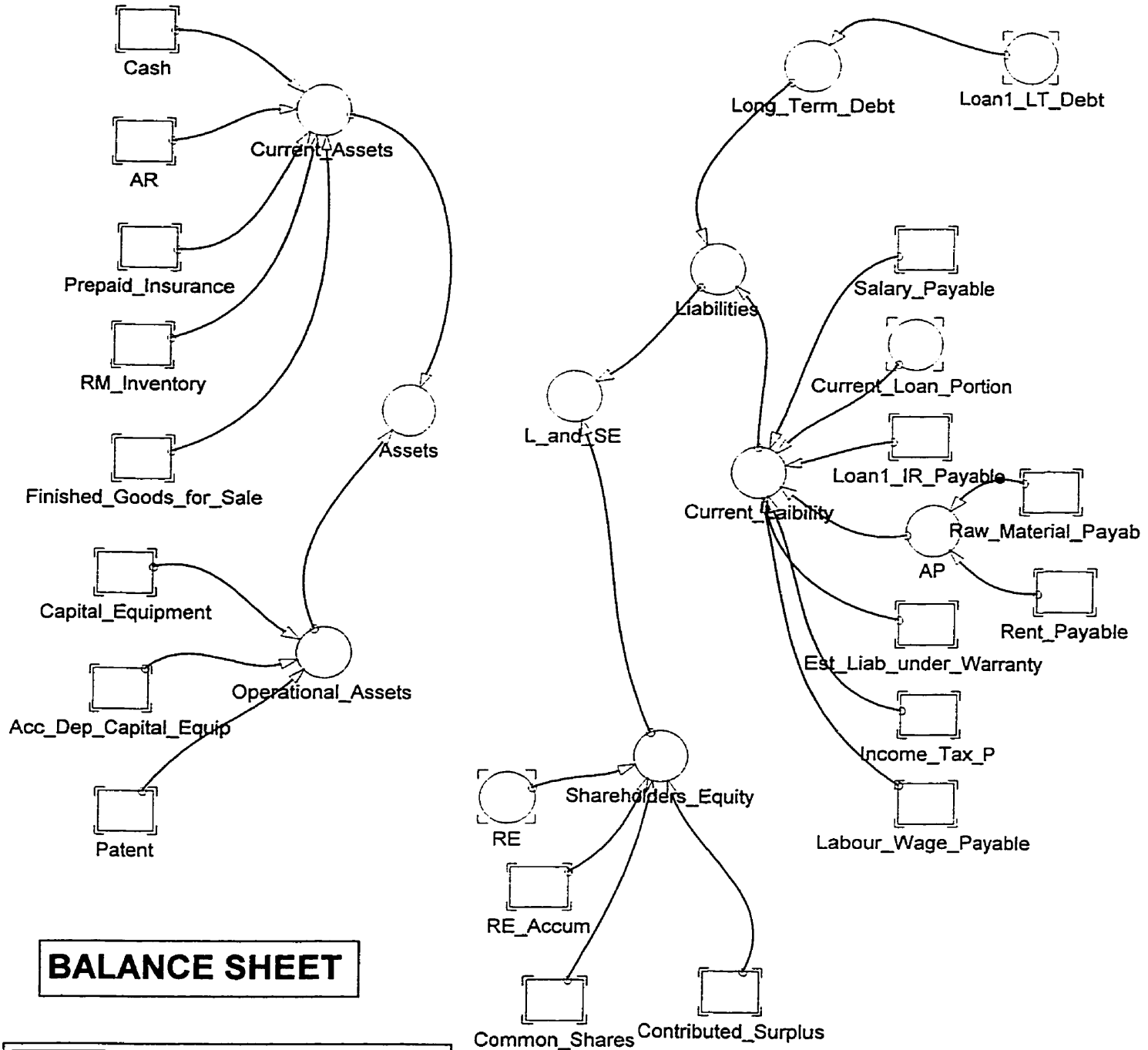
[25] ModelIData, Powersim V1.1: User's Guide and Reference, 1991

[26] G. Welsch, D.G. Short, & G.R. Chesley, Fundamentals of Financial Accounting, Irwin, Homewood IL., 1987

[27] Stikeman, Income Tax Act, Annotated, 26th Edition, 1997, Carswell Thomson Professional Publishing

APPENDIX A:

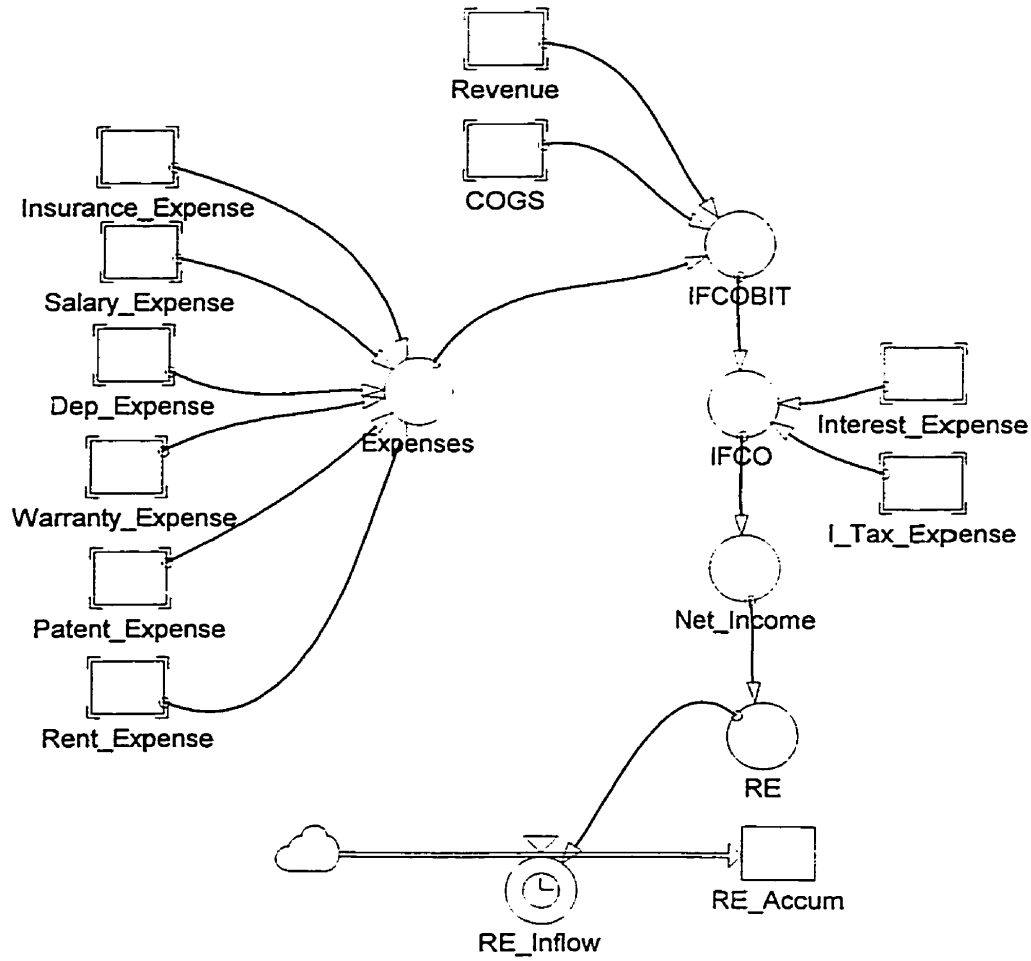
SMALL BUSINESS
VISUAL PROGRAM CODE



BALANCE SHEET

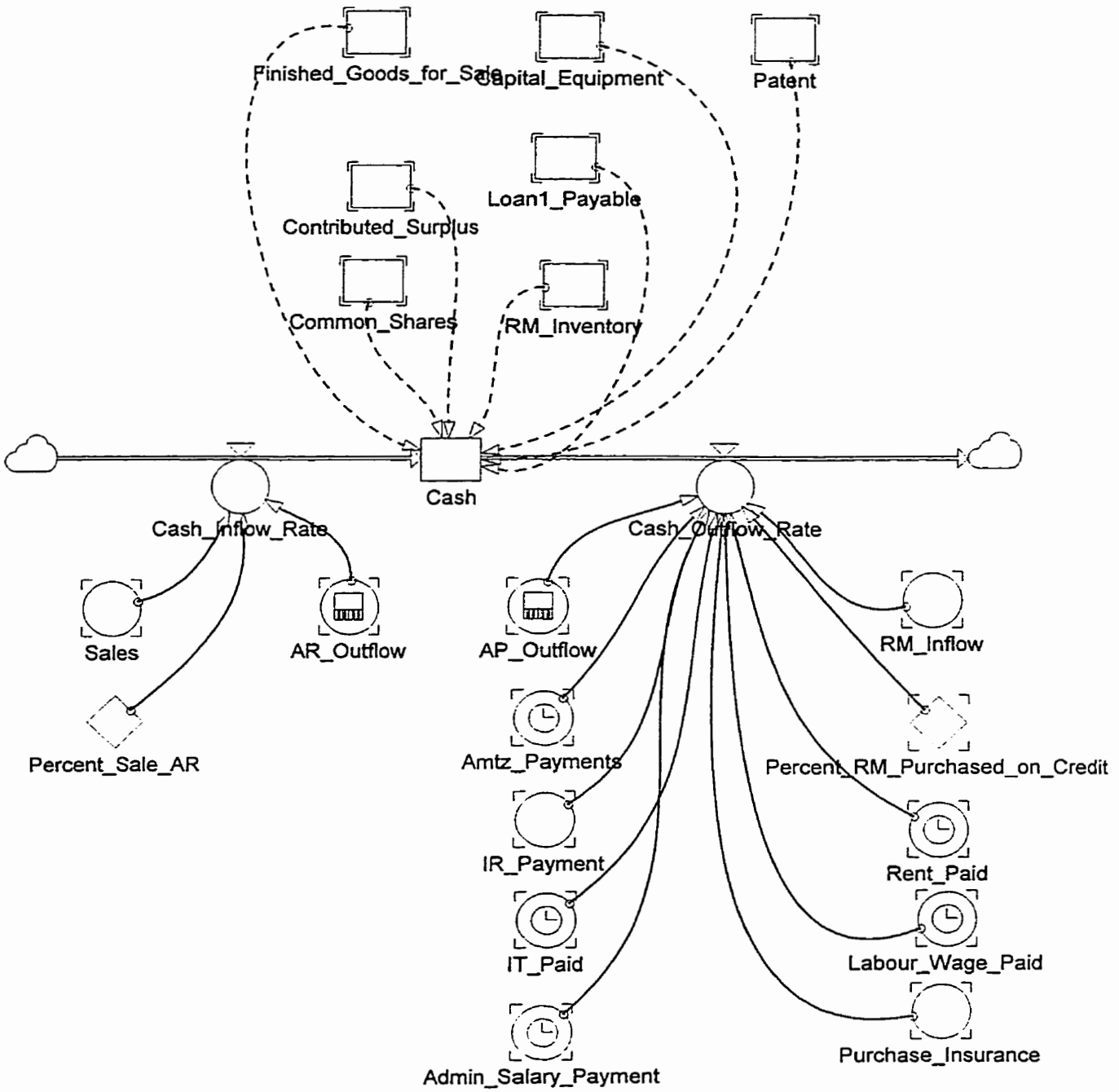
TIME	Assets	L_and_SE
0		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		

INCOME STATEMENT

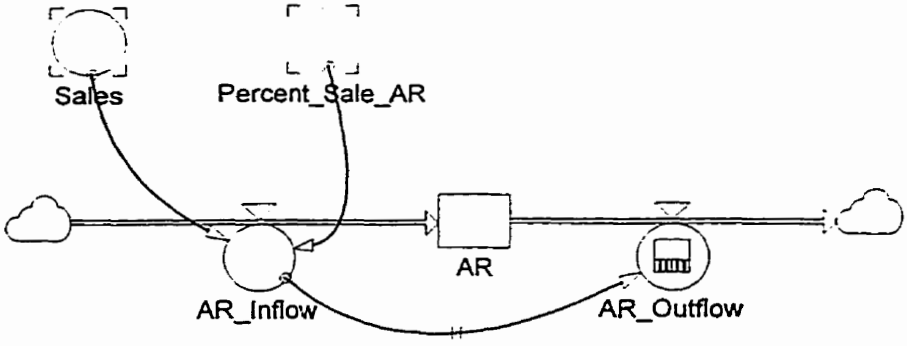


TIME	Revenue	COGS	Expenses	IFCOBIT	Interest_Expense	I_Tax_Expense	Net_Income
0							
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							

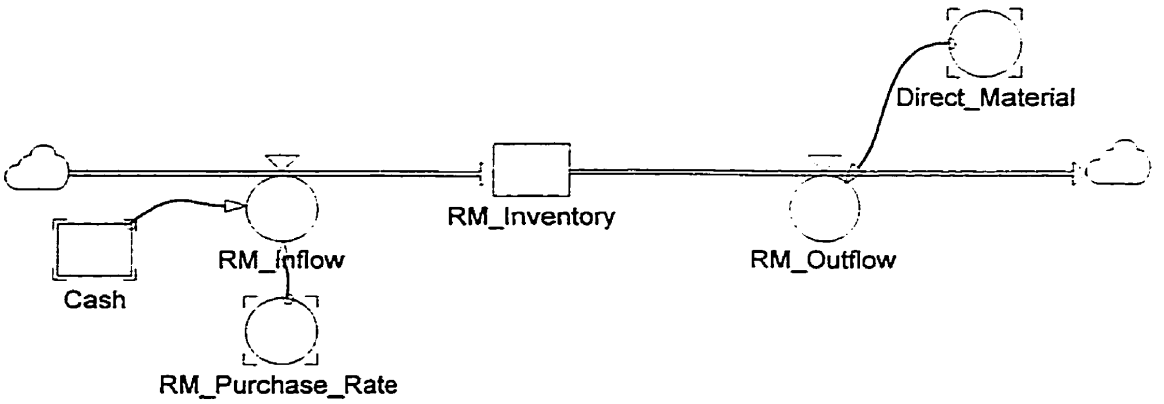
CASH ACCOUNT

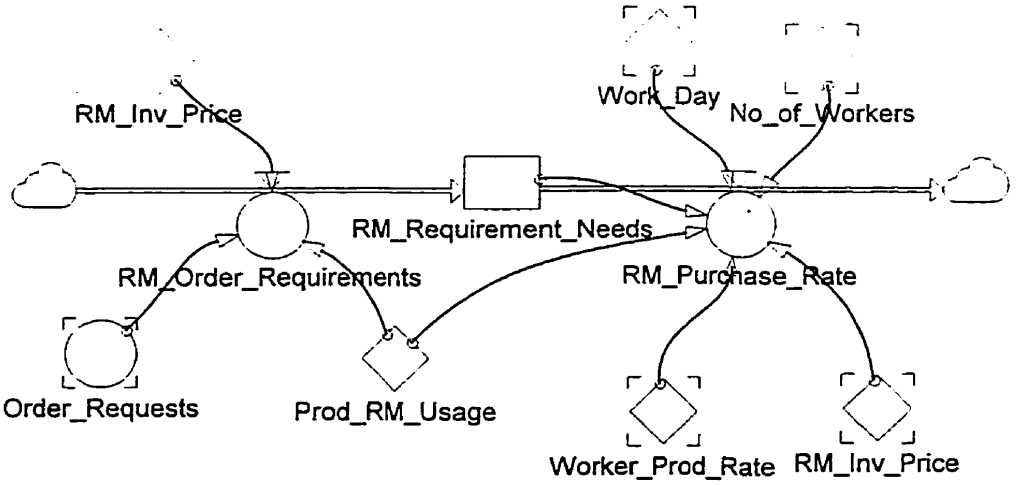


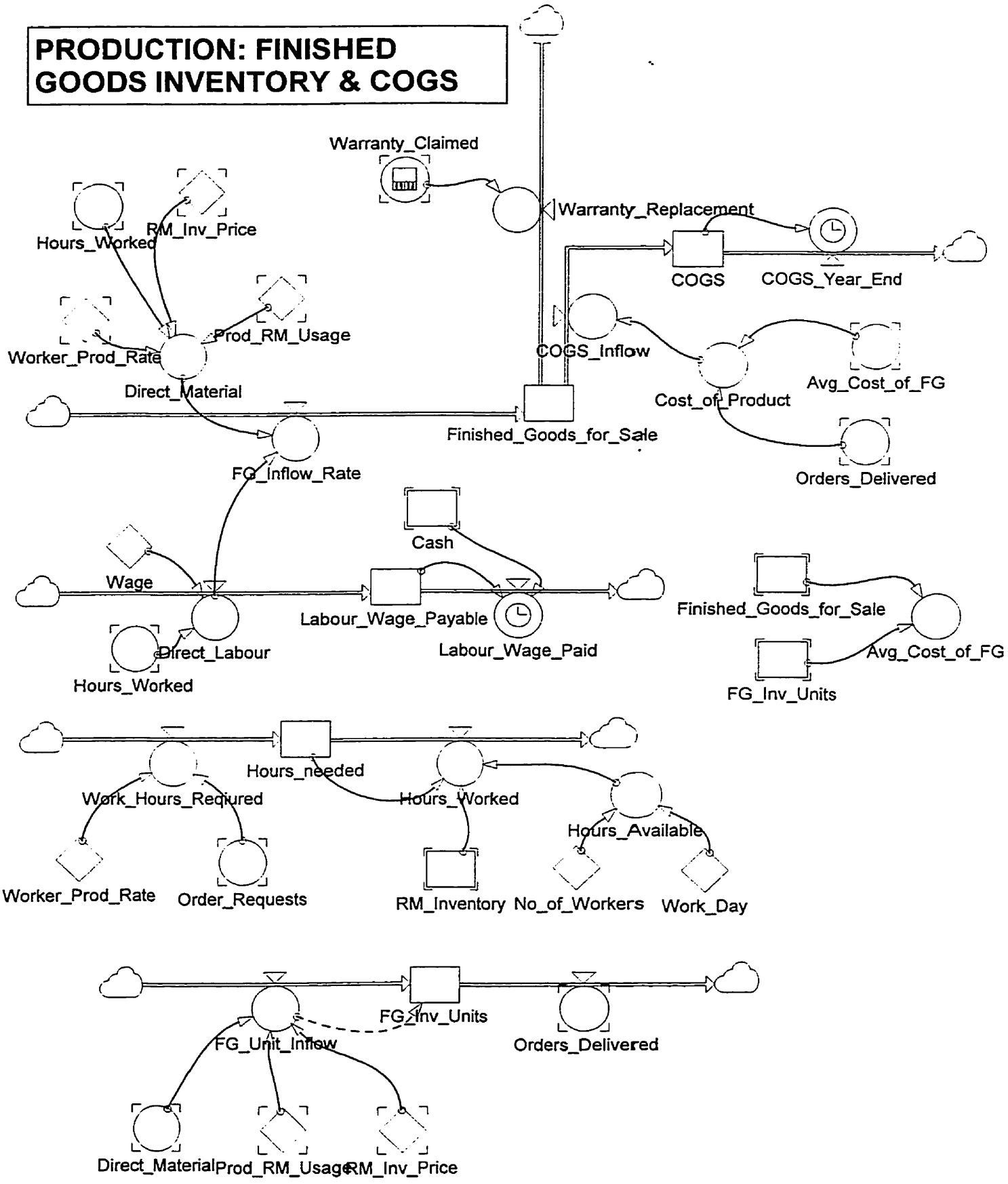
Accounts Receivable



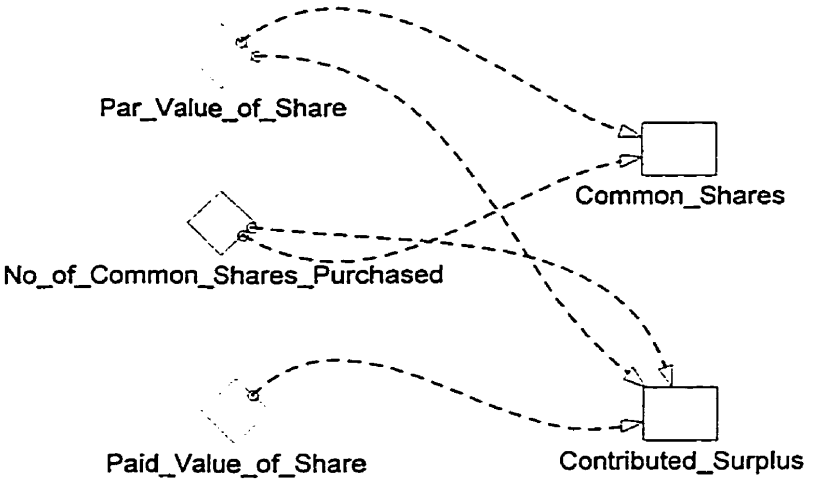
RAW MATERIAL INVENTORY



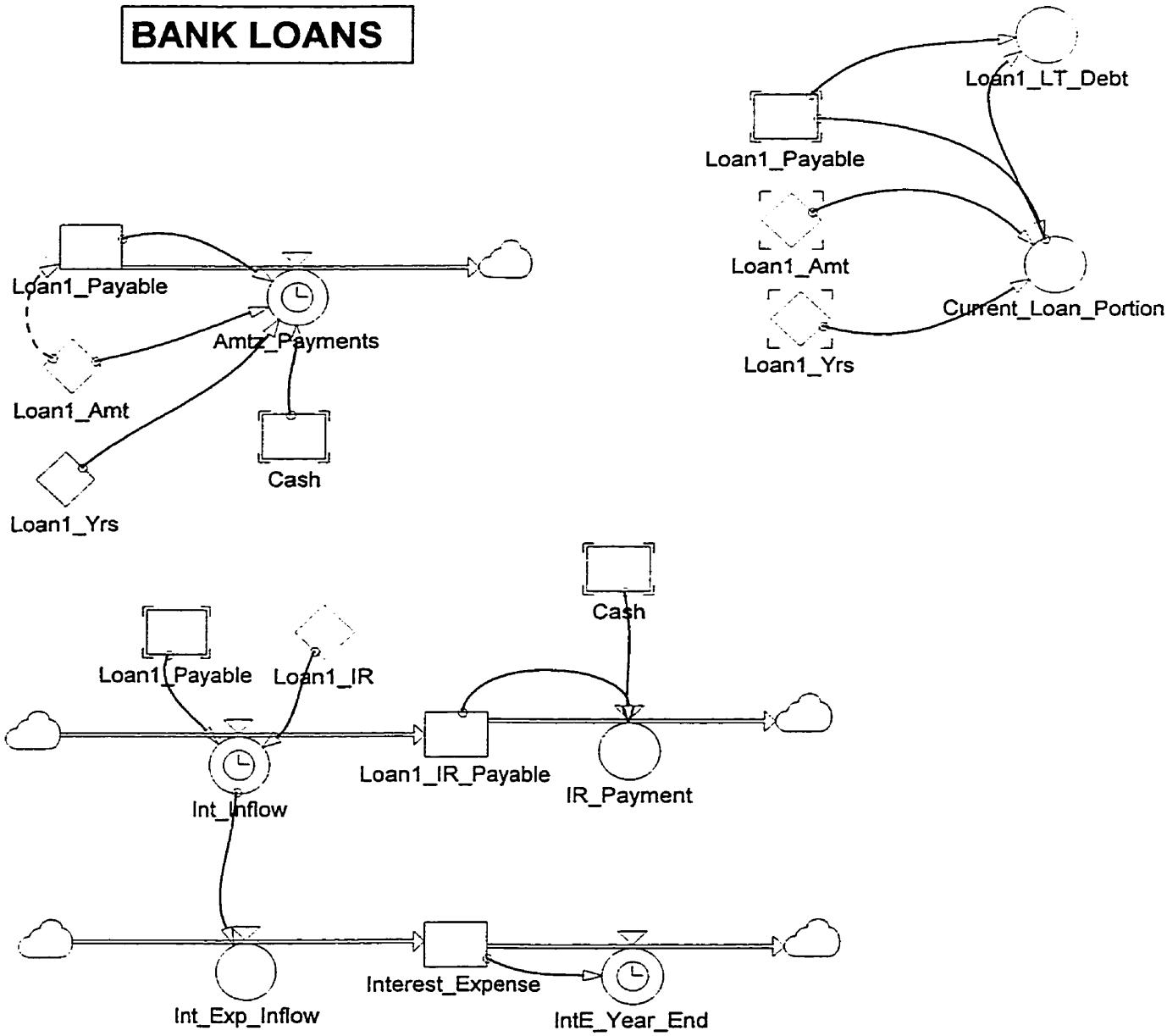



PRODUCTION: FINISHED GOODS INVENTORY & COGS
Warranty_Claimed
Warranty_Replacement
Hours_Worked
RM_Inv_Price
COGS
COGS_Year_End
Worker_Prod_Rate
Prod_RM_Usage
COGS_Inflow
Direct_Material
Cost_of_Product
Avg_Cost_of_FG
Finished_Goods_for_Sale
FG_Inflow_Rate
Orders_Delivered
Cash
Wage
Labour_Wage_Payable
Finished_Goods_for_Sale
Direct_Labour
Labour_Wage_Paid
Avg_Cost_of_FG
Hours_Worked
FG_Inv_Units
Hours_needed
Work_Hours_Required
Hours_Worked
Hours_Available
Worker_Prod_Rate
Order_Requests
RM_Inventory
No_of_Workers
Work_Day
FG_Inv_Units
FG_Unit_Inflow
Orders_Delivered
Direct_Material
Prod_RM_Usage
RM_Inv_Price

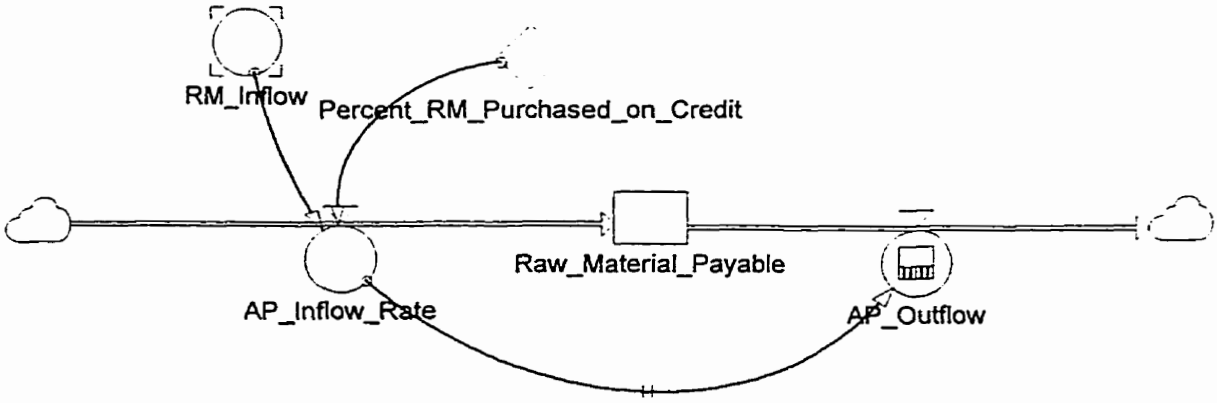
COMMON SHARES



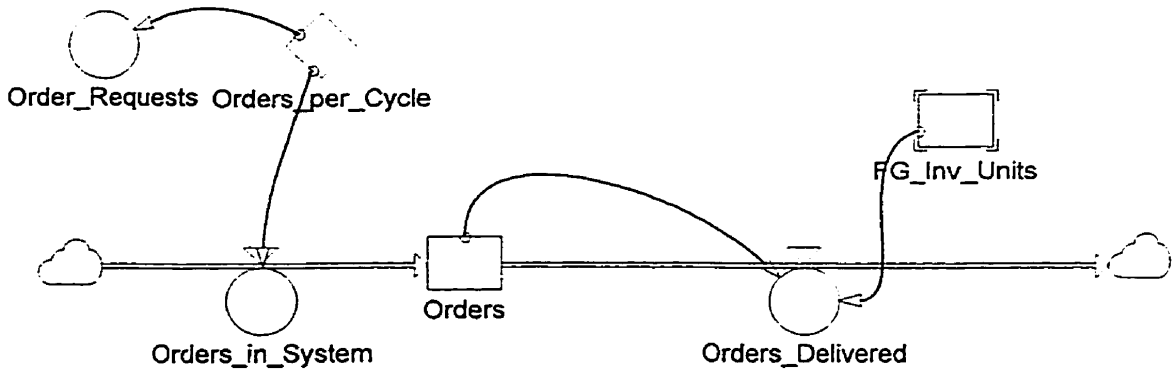
BANK LOANS

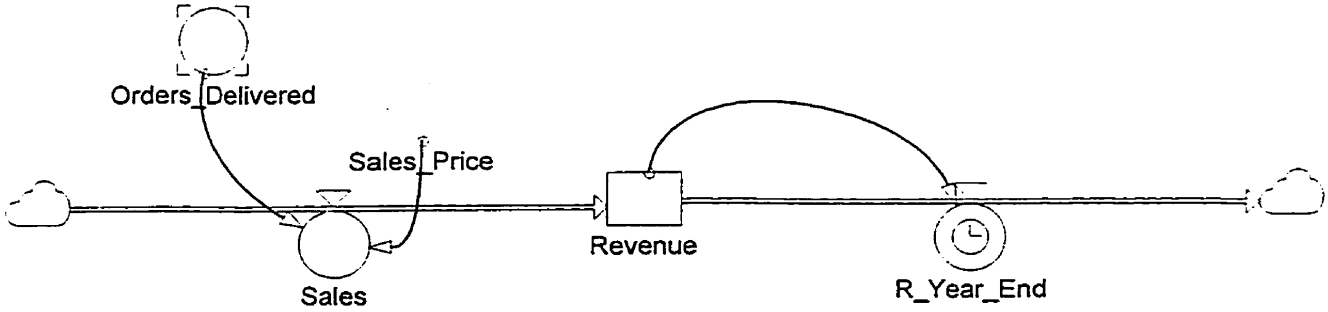

Loan1_LT_Debt
Loan1_Payable
Loan1_Amt
Current_Loan_Portion
Loan1_Yrs
Loan1_Payable
Amtz_Payments
Loan1_Amt
Cash
Loan1_Yrs
Cash
Loan1_Payable
Loan1_IR
Loan1_IR_Payable
IR_Payment
Int_Inflow
Interest_Expense
Int_Exp_Inflow
IntE_Year_End

ACCOUNTS PAYABLE

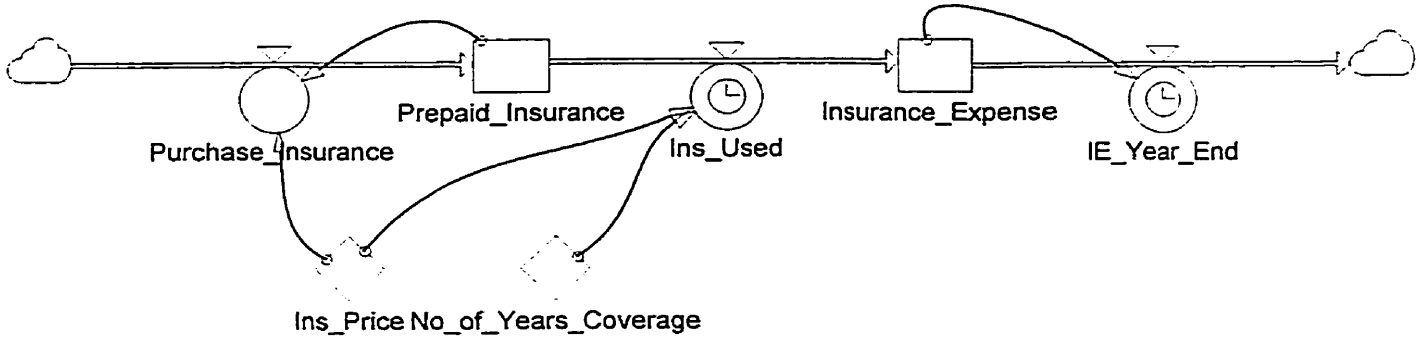


REVENUE

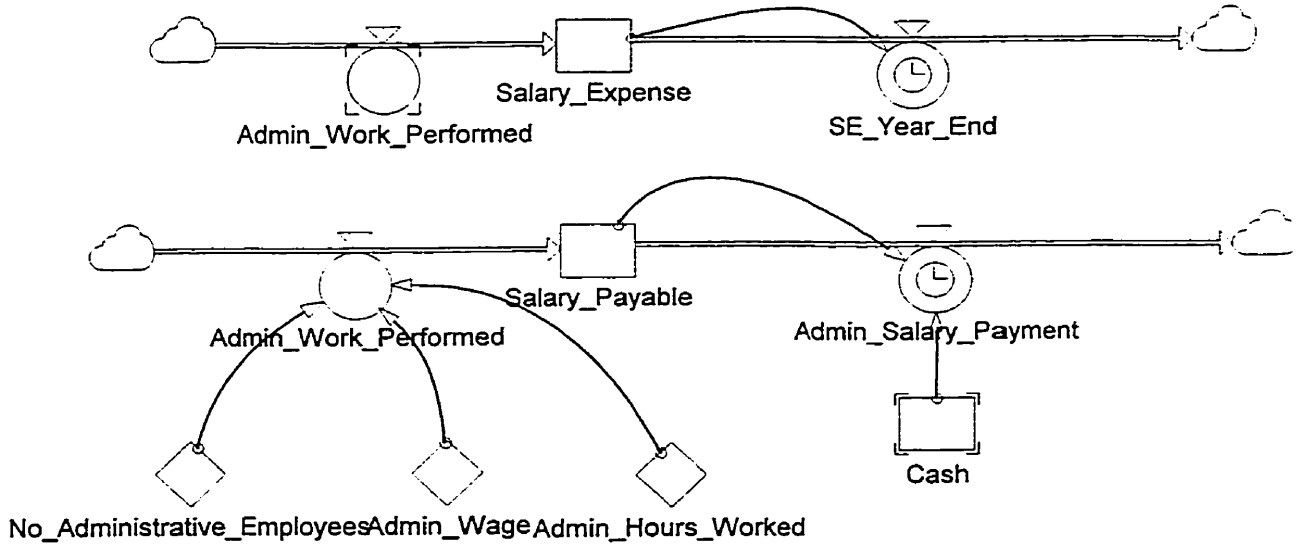

Order_Requests
Orders_per_Cycle
FG_Inv_Units
Orders
Orders_in_System
Orders_Delivered


Orders_Delivered
Sales_Price
Revenue
Sales
R_Year_End

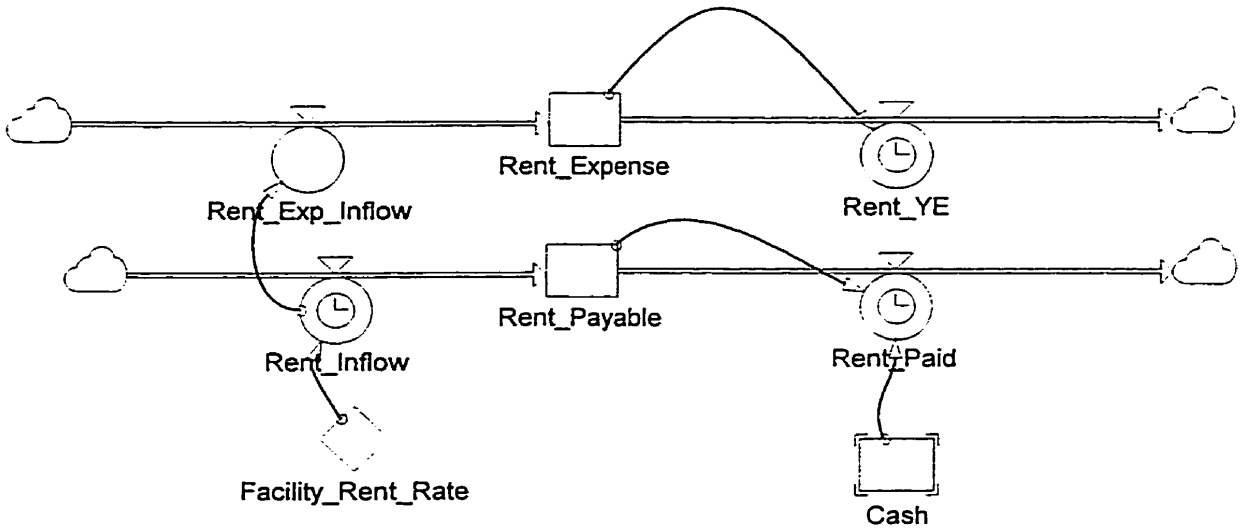
INSURANCE EXPENSES



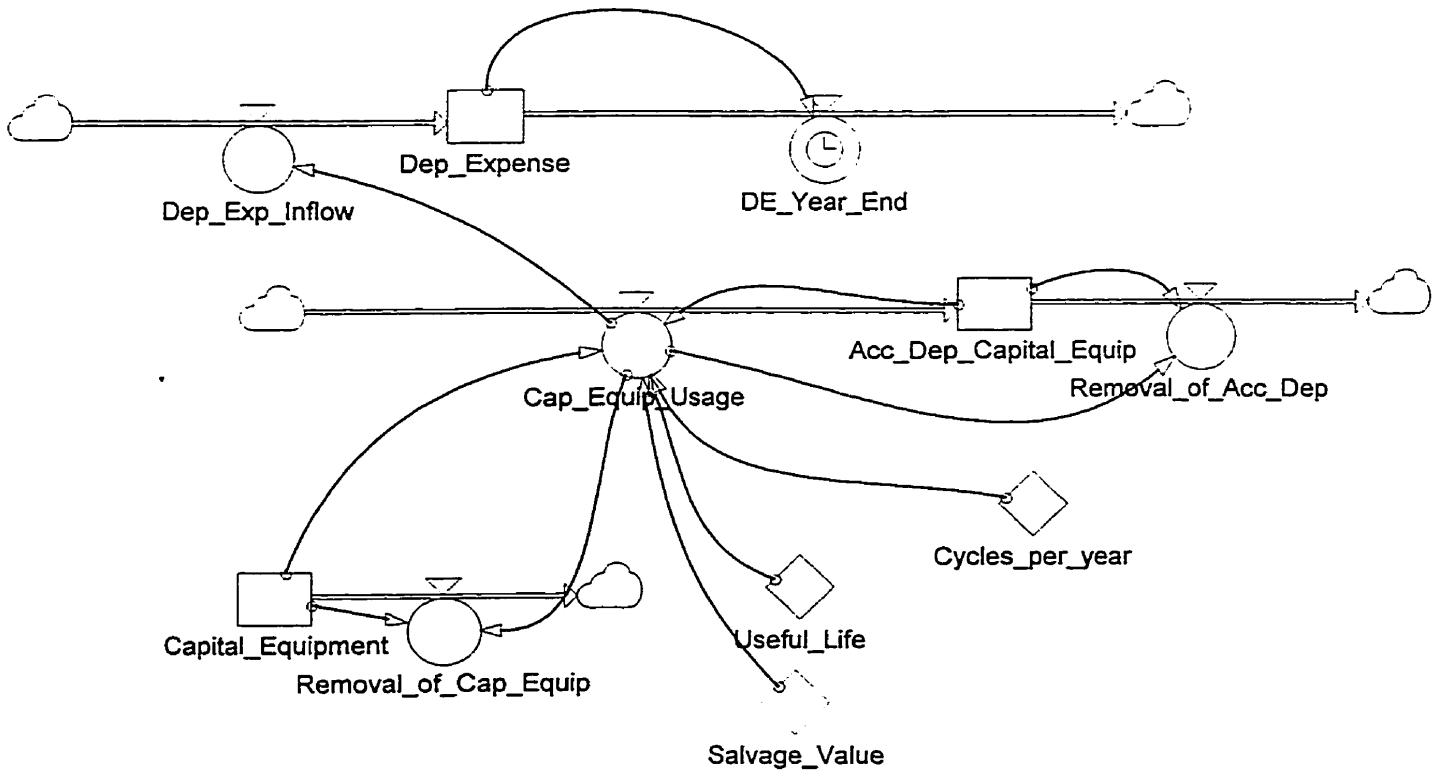
SALARY EXPENSE



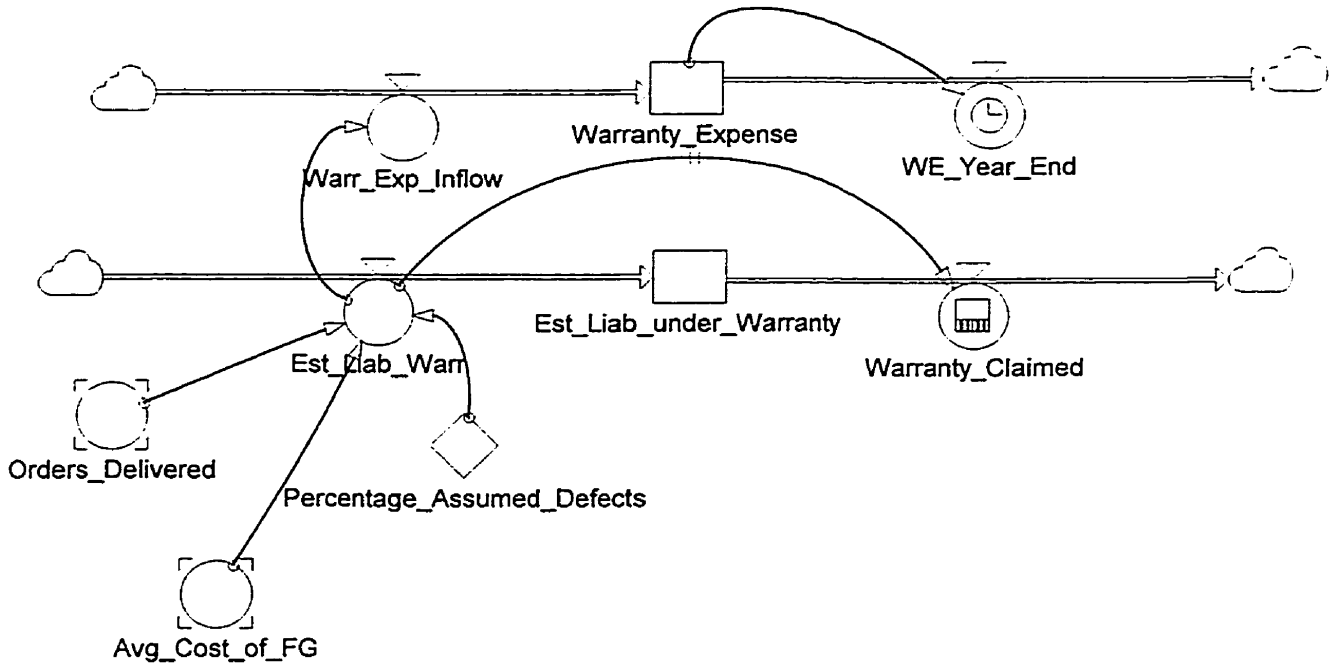
RENT EXPENSE



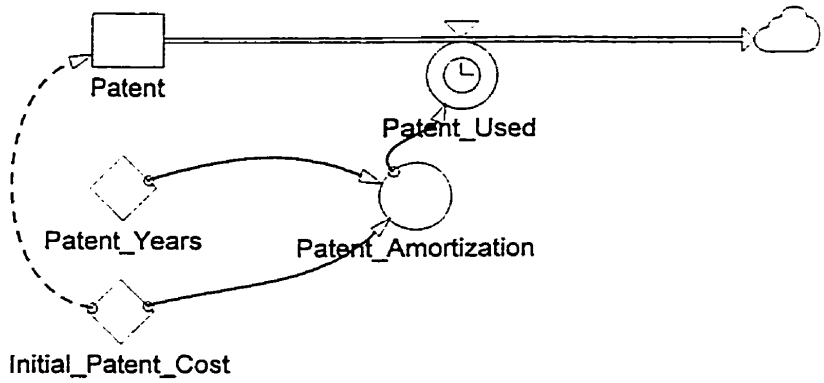
CAPITAL EQUIPMENT

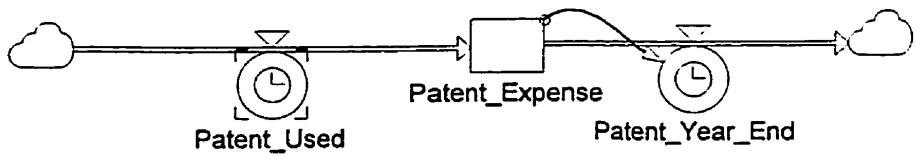


WARRANTY EXPENSE

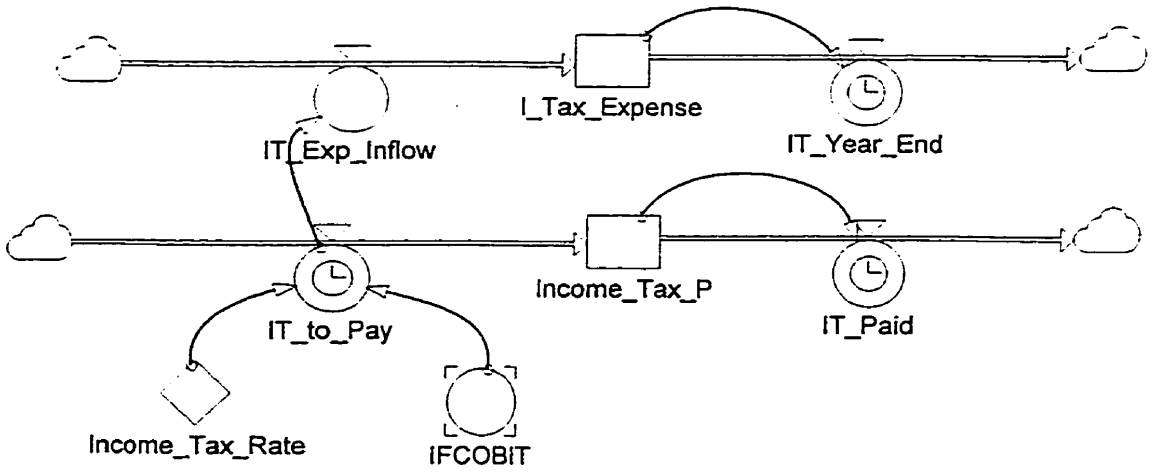


PATENT EXPENSE





INCOME TAX EXPENSE



APPENDIX B:

SMALL BUSINESS MODEL CODE

- Acc_Dep_Capital_Equip
  - INIT 0
  - -dt*(Removal_of_Acc_Dep)
    +dt*(Cap_Equip_Usage)
  - Dollar
  - The accumulated amount of capital asset used.
- AR
  - INIT 0
  - -dt*(AR_Outflow)
    +dt*(AR_Inflow)
  - Dollar
  - Account Receivable account
- Capital_Equipment
  - INIT 10000
  - -dt*(Removal_of_Cap_Equip)
  - Dollar
  - The fair value of purchase capital equipment
- Cash
  - INIT Common_Shares-RM_Inventory-Finished_Goods_for_Sale-Capital_Equipment+Loan1_Payable-Patent+ Contributed_Surplus
  - -dt*(Cash_Outflow_Rate)
    +dt*(Cash_Inflow_Rate)
  - Dollar
  - Cash Account
- COGS
  - INIT 0
  - -dt*(COGS_Year_End)
    +dt*(COGS_Inflow)
  - Dollar
  - The accumulated amount of cost of goods sold each year.
- Common_Shares
  - INIT No_of_Common_Shares_Purchased*Par_Value_of_Share
  - Dollar
  - The dollar value of shares issued.
- Contributed_Surplus
  - INIT No_of_Common_Shares_Purchased*(Paid_Value_of_Share-Par_Value_of_Share)
  - Dollar
  - The excess amount paid for common shares issued.
- Dep_Expense
  - INIT 0
  - -dt*(DE_Year_End)
    +dt*(Dep_Exp_Inflow)
  - Dollar
  - Accumulated deprecation expense for each year.
- Est_Liab_under_Warranty
  - INIT 0
  - -dt*(Warranty_Claimed)
    +dt*(Est_Liab_Warr)
  - Dollar
  - Warranty liability
- FG_Inv_Units
  - INIT FG_Unit_Inflow
  - -dt*(Orders_Delivered)
    +dt*(FG_Unit_Inflow)
  - A count of the stock on hand. This is done because the cost of wages and RM may change over time.
- Finished_Goods_for_Sale
  - INIT 0
  - -dt*(COGS_Inflow)
    -dt*(Warranty_Replacement)
    +dt*(FG_Inflow_Rate)
  - Dollar
  - This includes: 1) Direct material, 2) direct labour, 3) factory overhead

Hours_needed
INIT 0
-dt*(Hours_Worked)
+dt*(Work_Hours_Reqiured)
How many production hours are needed to fill orders.

I_Tax_Expense
INIT 0
-dt*(IT_Year_End)
+dt*(IT_Exp_Inflow)
Dollar
Accumulated income tax expense each year.

Income_Tax_P
INIT 0
-dt*(IT_Paid)
+dt*(IT_to_Pay)
Dollar
Income tax owed.

Insurance_Expense
INIT 0
-dt*(IE_Year_End)
+dt*(Ins_Used)
Dollar
The accumulation of insurance expense.

Interest_Expense
INIT 0
-dt*(IntE_Year_End)
+dt*(Int_Exp_Inflow)
Dollar
The accumulated interest expense each year in the nominal account.

Labour_Wage_Payable
INIT 0
-dt*(Labour_Wage_Paid)
+dt*(Direct_Labour)
Dollar
Wages owed to employees

Loan1_IR_Payable
INIT 0
-dt*(IR_Payment)
+dt*(Int_Inflow)
Dollar
The amount of interest owed to the bank.

Loan1_Payable
INIT Loan1_Amt
-dt*(Amtz_Payments)
Dollar
Amount of money borrowed from the bank.

Orders
INIT 0
+dt*(Orders_in_System)
-dt*(Orders_Delivered)
Unit
Orders waiting to be fulfilled.

Patent
INIT Initial_Patent_Cost
-dt*(Patent_Used)
Dollar
patent value

Patent_Expense
INIT 0
-dt*(Patent_Year_End)
+dt*(Patent_Used)
Dollar
Accumulated patent expense each year.

Prepaid_Insurance
INIT 0
+dt*(Purchase_Insurance)
-dt*(Ins_Used)
Dollar
The amount of prepaid insurance asset yet to be used and expensed.

Raw_Material_Payable
INIT 0
-dt*(AP_Outflow)
+dt*(AP_Inflow_Rate)
Dollar
Current liability that is owed to creditors

RE_Accum
INIT 0
+dt*(RE_Inflow)
Dollar
Accumulated retained earnings.

Rent_Expense
INIT 0
+dt*(Rent_Exp_Inflow)
-dt*(Rent_YE)
Dollar
The accumulation of rent expensed each year.

Rent_Payable
INIT 0
-dt*(Rent_Paid)
+dt*(Rent_Inflow)
Dollar
Rent owed.

Revenue
INIT 0
-dt*(R_Year_End)
+dt*(Sales)
Dollar
Accumulation of revenue generated each year.

RM_Inventory
INIT 50
-dt*(RM_Outflow)
+dt*(RM_Inflow)
Dollar
Stock used to manufacture products

RM_Requirement_Needs
INIT 0
-dt*(RM_Purchase_Rate)
+dt*(RM_Order_Requirements)
Dollar
The dollar amount of raw material needed to satisfy orders.

Salary_Expense
INIT 0
-dt*(SE_Year_End)
+dt*(Admin_Work_Performed)
Dollar
The accumulation of salary expenses.

Salary_Payable
INIT 0
-dt*(Admin_Salary_Payment)
+dt*(Admin_Work_Performed)
Dollar
Wages owed to administrative employees

Warranty_Expense
INIT 0
-dt*(WE_Year_End)
+dt*(Warr_Exp_Inflow)
Dollar
Accumulated warranty expense each year.

Admin_Salary_Payment
= IF(Cash<10000,0,PULSE(Salary_Payable,10,10))
Dollar
The bi-weekly payment of wages.

Admin_Work_Performed
= Admin_Hours_Worked*Admin_Wage*No_Administrative_Employees
Dollar
The amount of salaries that were paid and expensed each cycle.

Amtz_Payments
= IF(Loan1_Payable<=0,0,IF(Cash>(Loan1_Amt/Loan1_Yrs),PULSE(Loan1_Amt/Loan1_Yrs,261,260),0))
Dollar
Annual cash repayment of bank loan.

AP_Inflow_Rate
= RM_Inflow*Percent_RM_Purchased_on_Credit
Dollar
The amount of raw material purchased on credit.

AP_Outflow
= DELAYPPL(AP_Inflow_Rate,30,0)
Dollar
The payment of account payable liability.

AR_Inflow
= Sales*Percent_Sale_AR
Dollar
The amount of sales sold on credit.

AR_Outflow
= DELAYPPL(AR_Inflow,40,0)
Dollar
The cash inflow from paid up account receivables.

Cap_Equip_Usage
= IF(Acc_Dep_Capital_Equip<=Capital_Equipment,((Capital_Equipment-Salvage_Value)/Useful_Life)/
Cycles_per_year,0)
Dollar
The use of the capital asset.

Cash_Inflow_Rate
= (Sales*(1-Percent_Sale_AR))+AR_Outflow
Dollar
The amount of cash inflowing into the cash account.

Cash_Outflow_Rate
= (RM_Inflow*(1-Percent_RM_Purchased_on_Credit))+AP_Outflow+Admin_Salary_Payment+Amtz_Payments+
IR_Payment+IT_Paid+Rent_Paid+Labour_Wage_Paid+Purchase_Insurance
Dollar
The outflow of cash from the account.

COGS_Inflow
= Cost_of_Product
Dollar
The cost of goods sold sold each cycle.

COGS_Year_End
= PULSE(COGS,260,260)
Dollar
Clearing the nominal account at the end of the year.

DE_Year_End
= PULSE(Dep_Expense,260,260)
Dollar
Clearance of nominal account at the end of each year.

Dep_Exp_Inflow
= Cap_Equip_Usage
Dollar
The amount of deprecation per cycle.
Direct_Labour
= Hours_Worked*Wage
Dollar
How much wages were earned by employee for production.
Est_Liab_Warr
= Percentage_Assumed_Defects*(Avg_Cost_of_FG*Orders_Delivered)
Dollar
Assumed warranty liability owed per order.
FG_Inflow_Rate
= Direct_Labour+Direct_Material
Dollar
The dollar amount of units finished that are for sale.
FG_Unit_Inflow
= Direct_Material/(Prod_RM_Usage*RM_Inv_Price)
Unit
Units made.
Hours_Worked
= IF(RM_Inventory<=0,0,IF(Hours_needed>Hours_Available,Hours_Available,Hours_needed))
Hour
Hours worked in production per cycle.
IE_Year_End
= PULSE(Insurance_Expense,260,260)
Dollar
Clearance of nominal account at the end of each year.
Ins_Used
= PULSE(Ins_Price/No_of_Years_Coverage,259,260)
Dollar
The amount of prepaid insurance asset that has been used and is now being expensed.
Int_Exp_Inflow
= Int_Inflow
Dollar
The interested is expensed in the appropriate year.
Int_Inflow
= PULSE(Loan1_Payable*Loan1_IR,259,260)
IntE_Year_End
= PULSE(Interest_Expense,260,260)
Dollar
The clearance of the nominal account at the end of each year.
IR_Payment
= PULSEIF(Cash>Loan1_IR_Payable,Loan1_IR_Payable)
Dollar
Interest payment on bank loan.
IT_Exp_Inflow
= IT_to_Pay
Dollar
Expense of income tax.
IT_Paid
= PULSE(Income_Tax_P,340,260)
Dollar
Yearly tax payment.
IT_to_Pay
= PULSE(IFCOBIT*Income_Tax_Rate,259,260)
Dollar
Income tax to pay.
IT_Year_End
= PULSE(I_Tax_Expense,260,260)
Dollar
Clearance of nominal account at the end of each year.

Labour_Wage_Paid
= IF(Cash<10000,0,PULSE(Labour_Wage_Payable,10,10))
Dollar
Bi-weekly payment of production wages. However, should cash levels fall below $10,000, wage payments will be delay until this condition is met.

Orders_Delivered
= IF(FG_Inv_Units>1,IF(FG_Inv_Units>Orders,Orders,FG_Inv_Units),0)
Unit
Finished good units delivered.

Orders_in_System
= Orders_per_Cycle
Unit
Orders that are logged into the system.

Patent_Used
= PULSE(Patent_Amortization,259,259)
Dollar
Amortization of over time.

Patent_Year_End
= PULSE(Patent_Expense,260,260)
Dollar
Clearance of nominal account at the end of each year.

Purchase_Insurance
= PULSEIF(Prepaid_Insurance=0,Ins_Price)
Dollar
Purchase of prepaid insurance.

R_Year_End
= PULSE(Revenue,260,260)
Dollar
Clearance of nominal account at the end of each year.

RE_Inflow
= PULSE(RE,260,260)

Removal_of_Acc_Dep
= IF(Cap_Equip_Usage=0,Acc_Dep_Capital_Equip,0)
Dollar
Removal of the captial asset and accumulated deprecation off the balance sheet when the useful life has passed.

Removal_of_Cap_Equip
= IF(Cap_Equip_Usage=0,Capital_Equipment,0)
Dollar
Removing the capital asset and accumulated depreciation at the end of its useful life.

Rent_Exp_Inflow
= Rent_Inflow
Dollar
Expensing of rent each month.

Rent_Inflow
= PULSE(Facility_Rent_Rate,22,22)
Dollar
Rental rate

Rent_Paid
= IF(Cash<10000,0,PULSE(Rent_Payable,23,22))
Dollar
Monthly payment of rent.

Rent_YE
= PULSE(Rent_Expense,260,260)
Dollar
Clearance of nominal account at the end of each year.

RM_Inflow
= IF(Cash<1000,0,RM_Purchase_Rate)
Dollar
Purchase of raw material for production.

RM_Order_Requirements
= Order_Requests*Prod_RM_Usage*RM_Inv_Price
Dollar
The dollar amount of raw material that needs to be purchased to satisfy order.

RM_Outflow
= Direct_Material
Dollar
The dollar amound of raw material taken from inventory for production.

RM_Purchase_Rate
= IF(RM_Requirement_Needs<=0,0,No_of_Workers*Work_Day*Worker_Prod_Rate*Prod_RM_Usage*
RM_Inv_Price)
Dollar
Raw material actually purchased for production.

Sales
= (Orders_Delivered*Sales_Price)
Dollar
Dollar value of generated revenue

SE_Year_End
= PULSE(Salary_Expense,260,260)
Clearance of nominal account at the end of each year.

Warr_Exp_Inflow
= Est_Liab_Warr
Dollar
Expensing the liability in the appropriate year.

Warranty_Claimed
= DELAYPPL(Est_Liab_Warr,40,(0))
Dollar
Warranties that were claimed.

Warranty_Replacement
= Warranty_Claimed

WE_Year_End
= PULSE(Warranty_Expense,260,260)
Dollar
Clearance of nominal account at the end of each year.

Work_Hours_Reqiured
= Order_Requests/Worker_Prod_Rate
Hour
How many production hours will be needed to fill orders.

AP
= Raw_Material_Payable+Rent_Payable

Assets
= Current_Assets+Operational_Assets
Dollar

Avg_Cost_of_FG
= IF(FG_Inv_Units=0,0,Finished_Goods_for_Sale/FG_Inv_Units)
Dollar/Unit
The cost per unit.

Cost_of_Product
= Orders_Delivered*Avg_Cost_of_FG
Dollar
The actual cost of the unit.

Current_Assets
= AR+Cash+Finished_Goods_for_Sale+Prepaid_Insurance+RM_Inventory
Dollar

Current_Laibility
= Loan1_IR_Payable+Salary_Payable+Current_Loan_Portion+Est_Liab_under_Warranty+Income_Tax_P+AP+
Labour_Wage_Payable
Dollar

Current_Loan_Portion
= IF(Loan1_Payable>0,Loan1_Amt/Loan1_Yrs,0)
Dollar
The current portion of the loan that will be paid in the next year.

- Direct_Material
  - = Hours_Worked*Worker_Prod_Rate*Prod_RM_Usage*RM_Inv_Price
  - Dollar
  - The amount of raw material used in production.
- Expenses
  - = Dep_Expense+Insurance_Expense+Patent_Expense+Rent_Expense+Salary_Expense+Warranty_Expense
- Hours_Available
  - = No_of_Workers*Work_Day
  - Hour
  - Number of hours that are available by workers for production each cycle.
- IFCO
  - = IFCOBIT-Interest_Expense-I_Tax_Expense
  - Dollar
  - Income from continuing operations.
- IFCOBIT
  - = Revenue-COGS-Expenses
  - Dollar
  - Income from continuing operation before interest and tax.
- L_and_SE
  - = Liabilities+Shareholders_Equity
  - Dollar
- Liabilities
  - = Current_Laibility+Long_Term_Debt
  - Dollar
- Loan1_LT_Debt
  - = Loan1_Payable-Current_Loan_Portion
  - Dollar
  - The long term portion of debt.
- Long_Term_Debt
  - = Loan1_LT_Debt
  - Dollar
- Net_Income
  - = IFCO
- Operational_Assets
  - = (Capital_Equipment-Acc_Dep_Capital_Equip)+Patent
  - Dollar
- Order_Requests
  - = Orders_per_Cycle
  - Unit
  - Number of units ordered.
- Patent_Amortization
  - = Initial_Patent_Cost/Patent_Years
- RE
  - = Net_Income
  - Dollar
  - Change in retained earnings per cycle.
- Shareholders_Equity
  - = Common_Shares+RE+RE_Accum+Contributed_Surplus
  - Dollar
- ◇ Admin_Hours_Worked
  - = 8
  - Hour
  - Hours worked per day.
- ◇ Admin_Wage
  - = 10
  - Dollar/Hour
  - Administrative employee wage per hour.
- ◇ Cycles_per_year
  - = 260
  - Day
  - Number of working days in a year.

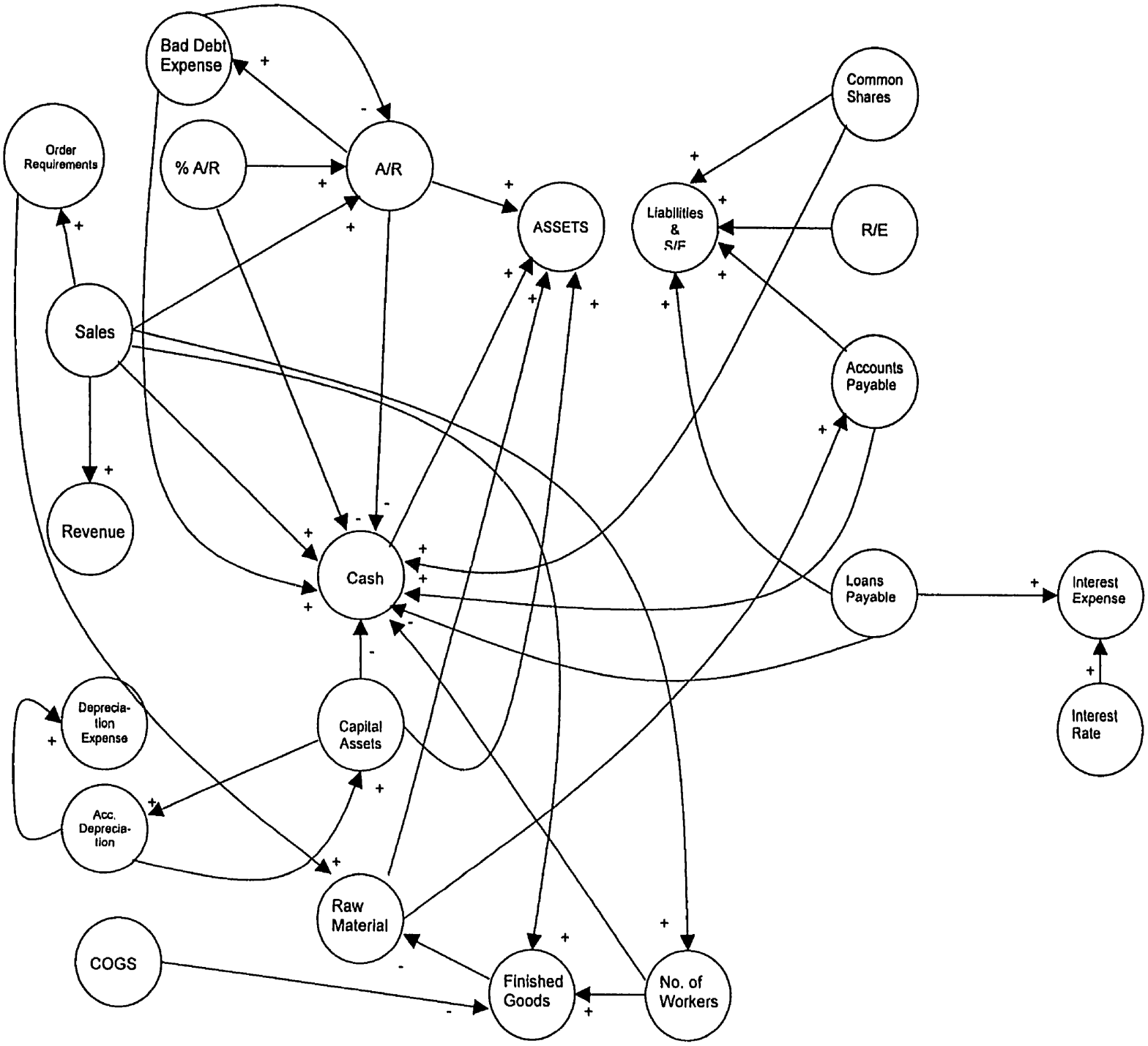
- Facility_Rent_Rate
  - = 1000
  - Dollar/Month
  - Rent per month
- Income_Tax_Rate
  - = 0.38
  - Percent
  - Tax rate
- Initial_Patent_Cost
  - = 5000
  - Dollar
  - Fair value of patent
- Ins_Price
  - = 25000
  - Dollar
  - The price of insurance for 5 years.
- Loan1_Amt
  - = 20000
  - Dollar
  - The amount of the loan.
- Loan1_IR
  - = .1
  - Percent
  - Loan interest rate.
- Loan1_Yrs
  - = 5
  - Year
  - The number of amortization years for loan.
- No_Administrative_Employees
  - = 2
  - People
  - Number of administrative employees.
- No_of_Common_Shares_Purchased
  - = 25
  - Share
  - The # of shares issued by the organization
- No_of_Workers
  - = 2
  - People
  - # of Workers on the production line
- No_of_Years_Coverage
  - = 5
  - Year
  - No. of years for coverage.
- Orders_per_Cycle
  - = 10
  - Unit
- Paid_Value_of_Share
  - = 1100
  - Dollar/Share
  - The actual amount paid per share.
- Par_Value_of_Share
  - = 1000
  - Dollar/Share
  - The par value of each common share
- Patent_Years
  - = 50
  - Year
  - Number of years the patent is usable.

- Percent_RM_Purchased_on_Credit
  - = 0
  - Dollar
  - Payment of raw material purchased on credit.
- Percent_Sale_AR
  - = 0
  - Percent
  - Percentage amount of sales that is on credit.
- Percentage_Assumed_Defects
  - = 0
  - Percent
  - % of defective units.
- Prod_RM_Usage
  - = 5
  - RM
  - The number of raw material units required to make one unit of finished goods.
- RM_Inv_Price
  - = 0.1
  - Dollar
  - Price for the stock that is used to manufacture parts
- Sales_Price
  - = 30.25
  - Dollar
  - Sale price of finished product.
- Salvage_Value
  - = 0
  - Dollar
  - How much the capital asset is worth at the end of its useful life.
- Useful_Life
  - = 10
  - Year
  - How long the asset can be useful.
- Wage
  - = 3
  - Dollar/Hour
  - An assumed wage that is paid to workers who are creating the parts to later be sold for revenue.
- Work_Day
  - = 8
  - Hour
  - How many hours a production employee works.
- Worker_Prod_Rate
  - = .625
  - Unit/Hour
  - How quickly an employee can build one unit of finished goods.

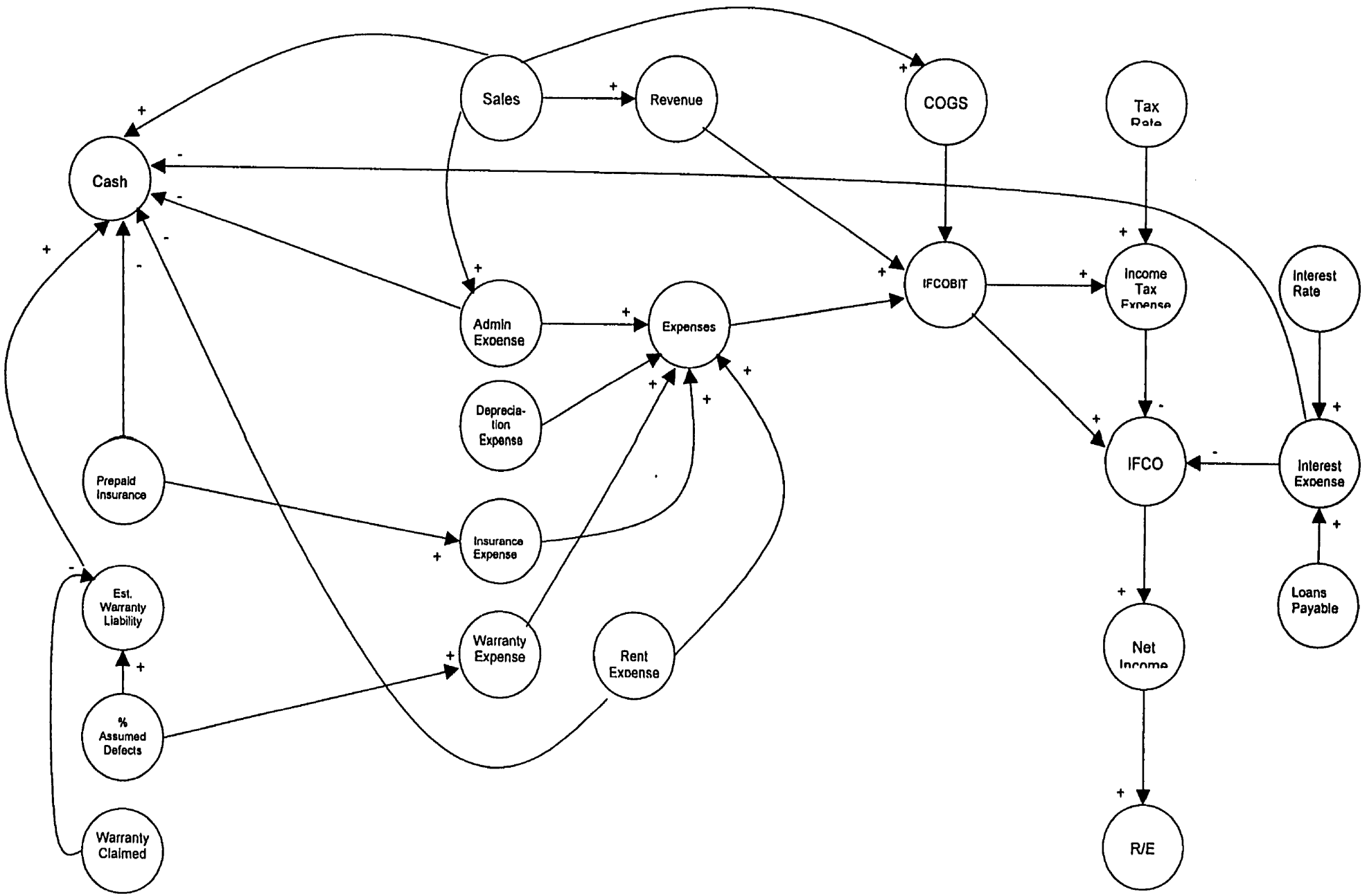
APPENDIX C:

INFLUENCE DIAGRAMS

INFLUENCE DIAGRAMS: Balance Sheet



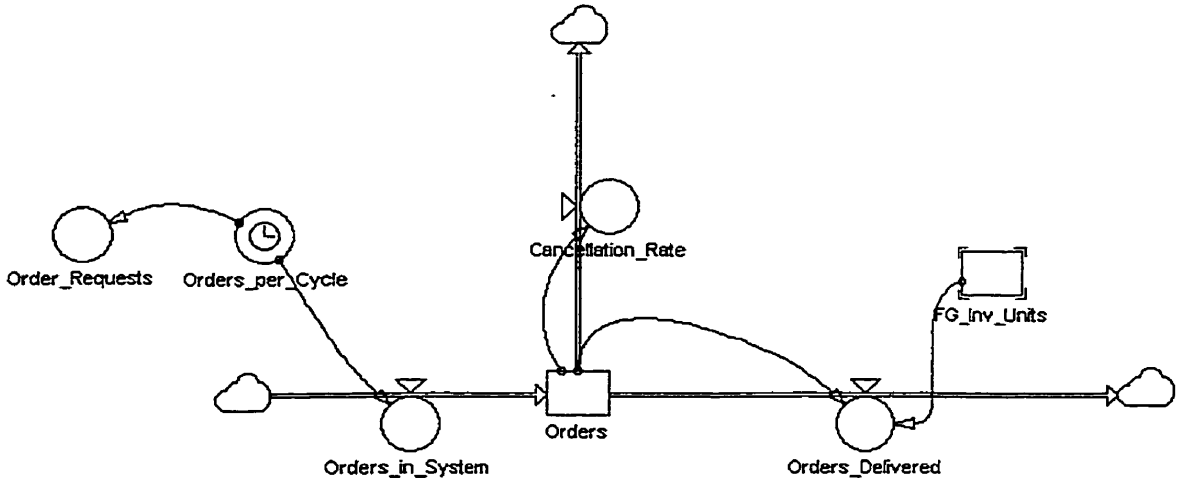
INFLUENCE DIAGRAMS: INCOME STATEMENT

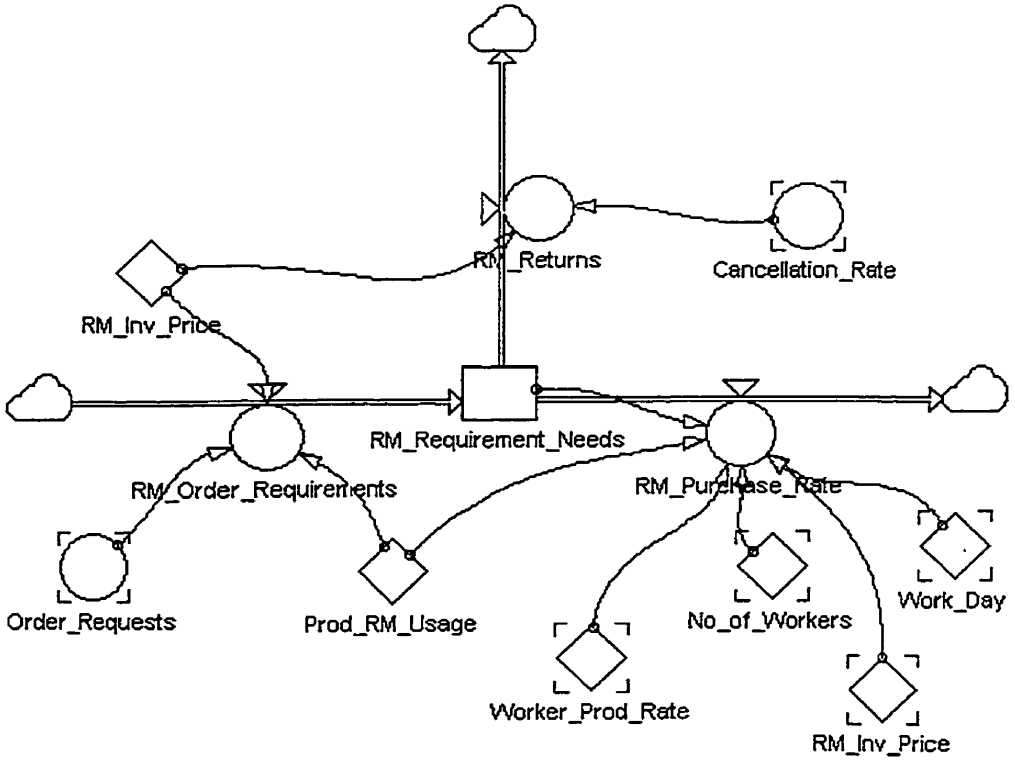


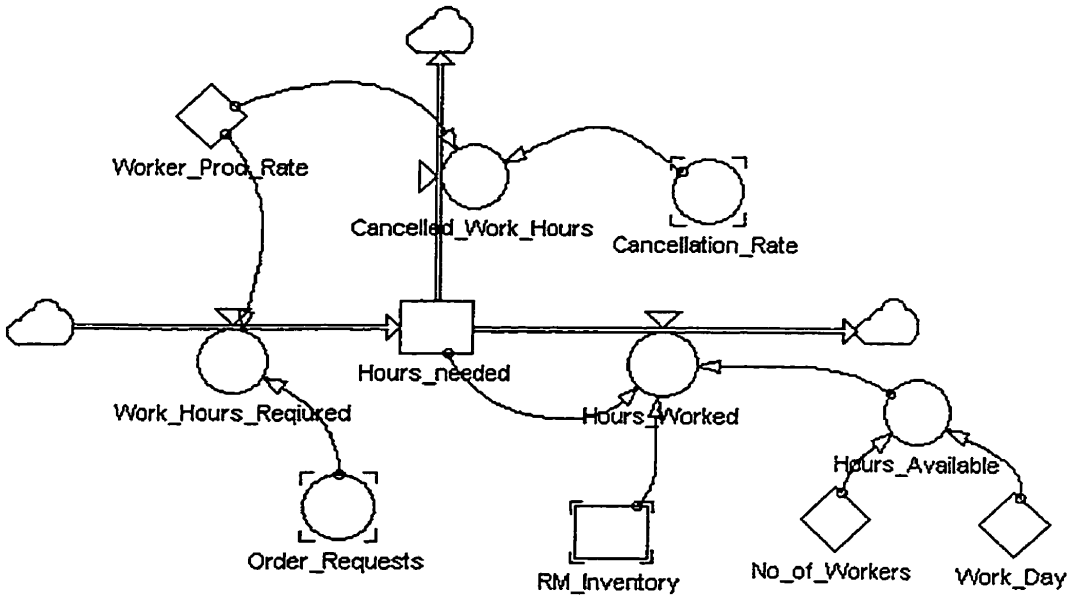
APPENDIX D:

EXPERIMENT VISUAL CODE

Only Experiment 6 had code additions. This comes as a number of cancellation variables on the backlog of order, raw material purchase requirements, and production hour requirements. Each of these code modifications are shown in figures below.






Worker_Prod_Rate
Cancelled_Work_Hours
Cancellation_Rate
Hours_needed
Work_Hours_Required
Hours_Worked
Hours_Available
Order_Requests
RM_Inventory
No_of_Workers
Work_Day