A DYNAMIC SIMULATION MODEL FOR BUDGETING AND FUNDS MANAGEMENT FOR SMALL SCALE FIRMS IN TURKEY

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1. INTRODUCTION:

Modern financial management is a complicated subject even for the experts. The entrepreneurs of small-scale firms in Turkey, having limited men-power and due to lack of budgeting or financial planning knowledge, have to rely on ad-hoc advice on their financial affairs from part-time financial advisers, or junior bankers and their life is full of unpleasant surprises. Consequently a simple budgeting and financial planning tool is a great contribution to their basic needs in strategical and operational management. A simple and demonstrative simulation model on budgeting and financial planning will be a highly desirable tool for the training of managers of small-scale firms. If such a tool had been available for them then they would practice with it to gain confidence to implement the methods set forth in the model in real life for better achievements. This is the idea behind the "Dynamic Simulation Model of Funds Management for Small Scale Firms" in Turkey presented in this paper.

The sections that follow will cover budgeting and funds management, application of system dynamic simulation models to budgeting, previous work in financial simulation, proposal for a simulation technique, findings and conclusions.

2. BUDGETING AND FUNDS MANAGEMENT

Anybody with some experience and knowledge on financial planning and model building realizes that each activity in the firm has an effect on the cost or benefit of the firm, which will be consequently reflected on the financial statements of the company. Each activity is result of action between several possible alternatives, which are in turn determined by several exogenous or indigenous factors. The multiplicity of alternatives and factors involved imply the complicated nature of the model. for example, in production planning process, we know that production capacity, type and composition of products, production technology, qualifications and number of workers, capital requirements for fixed assets, working capital and inventory, sales forecast and marketing, short and long term credit arrangements and costs, are interrelated factors and activities of a firm i.e. each is influenced by others: This is not an exhaustive list; there are several other factors or activities interrelated in the manufacturing industry that are subject of continuous research.

A simulation model should reflect but simplify this multiplicity of factors for different people with different priorities and judgments. Ideally the model should be flexible enough to produce the financial statements for any point of time on the time scale and for any span of time. These aspects of the simulation model necessitate some simplifying assumptions and restrict it for the small-scale firms. It is therefore characterized as a quasi-realistic simulation model.

3. SYSTEM DYNAMICS SIMULATION

The aim of System Dynamics and Simulation models is to identify the important relations among several factors without living through an expensive experience to discover the results of decision making. Some managers failing to realize pitfalls of interrelated factors may insist on wrong concepts and malpractices, which drag them to vicious circles and endanger the future of their companies. If they practice and contemplate on the impartially drawn Influence Diagrams of their activities, they may have a chance to discover the positive loops in their system. Ideally, managers would like to discover *an overall performance indicator* of the firm, which could be calculated and displayed immediately on the demand. Since such an indicator does not exist in practice the managers can discover *some of the important performance indicators* through simulation models using the method of system dynamics.

Therefore, to device a practical and quasi-realistic simulation model for funds management requires that it should be:

1. Simple and based on commonly available PC programs,
2. Restricted to requirements of small scale firms,
3. A budgetary tool and financial planning instrument,

4. Simple enough to be revised frequently by user to reflect changes in external conditions,

5. Have relatively small number of input parameters,
6. Flexible to cover short and long term periods,
7. Flexible for changing internal and external assumptions,
8. Produce reports in conventional financial statements.

4. PREVIOUS WORK IN FINANCIAL SIMULATION MODELS:

Several "**financial simulation models**" for computers have been developed by academia and software industry. A realistic and comprehensive simulation model for a relatively large-scale company requires quite a complicated, large and expensive program. Besides, such a program is to be revised frequently by specialists as and when the conditions or the priorities or the policies of the management change, making it impractical for applications in *small-scale* firms. Each case has its own particulars, which are to be incorporated in the model without discouraging the already shy user. In other words, customizing the model for each user is an important feature of the model. Generalized models tend to be complicated. Too simplified models produce unsatisfactory results. Therefore an optimum sophistication is targeted.

Jay W. Forrester introduced techniques for system dynamics in 1977 (2) that have been applied on several areas including financial planning. Yetiş, in 1982 applied system dynamics and Simulation Models for a Cost-Volume-Profit analysis using DYNAMO Compiler. İnelmen (3) applied the same techniques in 1992 to problem of balancing cash flow of a company. R. C. Coyle (4) published a new book in 1996 covering the subject comprehensively. In that book he discusses the theoretical background, giving several samples in several areas including Financial Planning and discussing the new developments and available Computer Package Programs such as DYSMAP, COSMIC and COSMOS, VENSYM, STELLA, POWERSIM, etc. which are developed after DYNAMO. His emphasis is also on specialized package programs designed for simulation and system dynamics. In the book he used COSMIC which is DYNAMO related program. He mentions that he has seen programs written in FORTRAN but does not comment on **spread sheet** applications.

5. PROPOSAL FOR A NEW SIMULATION TECHNIQUE

Spread sheet programs today are equipped with number of built in functions, goal seek and scenario solvers including linear programming, etc. These packages are widely available. The users of PC are becoming familiar with spread sheet programs and PC packages of the spread sheet programs are relatively cheap. The programs are equipped with graphic modules which produce varieties of graphics suitable for many cases. The spread sheet programs are also equipped with development languages, such as Visual Basic which can be used to develop DYNAMO type applications and Macros to facilitate development of user defined functions and customising facilities. We are not in a position to comment on their assistance features for developing **influence diagrams**, though a simple and easy-to-use manual drawing facilities exist which can be used as an alternative to hand drawing of influence diagrams in a much elegant way.

A sample output of a sub model for recruitment and training of workers of the firm is attached herewith as **Annex 1.** *Influence Diagram for Recruitment and Training of Workers* is given as **Annex: 2 (a)** and *Cost-Volume-Profit Model* of Yetiş as **Annex: 2 (b).** All features of system dynamics is easily applied and demonstrated that simple models are easy to develop and apply with the help of spreadsheet program. Graphic facilities and *what-if scenarios* are easily applied. Linear Programming and Goal Seek facilities are not utilized in the sample but could be used in optimization of production and cost of capital. Expansion of the model for various levels of management is easy. The results are obtained in few seconds and can be printed. Graphics immediately reflect changes in the model as soon as any variable or assumption is recorded on the spreadsheet.

Computer presentation of the results is attractive since displaying the results of revisions on the screen instantly without boring the audience is possible. The facility called *Auditing* in recent versions of some of the spread sheet programs which display interrelated cells in the spreadsheet can be used to draw influence diagrams. Elaboration of this aspect is left to computer wizards.

The proposed model is a prototype of dynamic simulation model of funds management for small scale firms in Turkey. This is a narrowed version of the "Simultaneous Cost-Volume-Profit Planning and Control" thesis of Yetiş (1).

Yetiş's thesis was very comprehensive covering several modules and sub-modules **Annex :2 (b)** and designed and run on mainframe computers with Dynamo Compiler. In this paper a much simpler simulation model is prepared for a spreadsheet package program and applied to a simple case just to demonstrate advantages and disadvantages of spreadsheet method vis a vis DYNAMO and other simulation packages.

6. CONCLUSIONS

The purpose of this study is to demonstrate the scope of application of spreadsheet programs to **Dynamic Simulation Models on Financial Budgeting and Funds Management** of a small-scale manufacturing firm. Advantages and disadvantages of spreadsheet analyses against Simulation Packages available in the market are discussed briefly in the paper. On the basis of the foregoing discussions it can be concluded that relatively simple system dynamic problems can be analysed using spread sheet applications. The computer wizards can develop user oriented programs and develop techniques for easy drawing of influence diagrams and improve and extend the model to cover more cases and make it easily applicable to the needs of a small scale industrialist.

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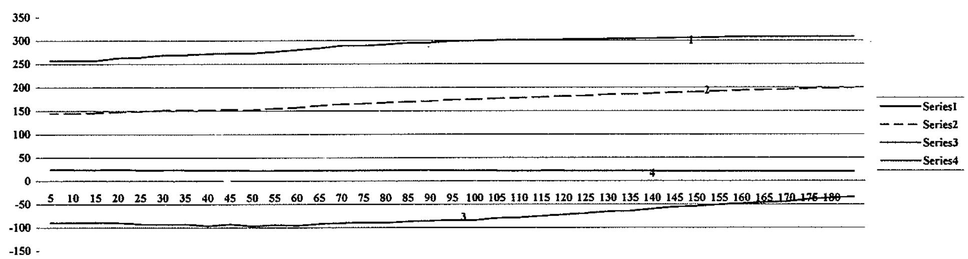
Recruitment and Training of Workers

			1	2	3	4	5	6	7	8	9	10	11	12
Base for Variable Demand	10	Rondom Numbers (Demand Forecast)	12	12	14	16	10	12	9	8	11	7	11	11
Base for fixed Demand	10	**Periods**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Incriment of fixed Demand	-0.3	**CNT + z** copies Random Numbers to the line "Demand available for the												
Results	**nnn**													
Parameters	**mm**	Work Load, beginning period	0	0	0	0	10	19	27	24	30	30	33	28
Total No.of Jobs available	323	Demand available for the firm	12	10	9	11	11	9	17	16	8	10	15	7
		Potential work load	12	10	9	11	21	28	44	40	38	40	48	35
Number of Workers/Job	4	Work Force Needed for Potential Work Load	48	40	36	44	84	112	176	160	152	160	192	140
Total No.of Jobs Undertaken	272	Jobs Undertaken (-Dropped)	0	0	0	10	9	8	7	15	8	10	10	7
Job Duration, Periods	4	Work Load, end of period	0	0	0	10	19	27	34	39	38	40	43	35
Total No.of Finished Jobs	257	Jobs Finished, at the end of period				0	0	0	10	9	8	7	15	8
		Work Load, end of period	0	0	0	10	19	27	24	30	30	33	28	27
		Work Force Needed for Work Load	0	0	0	40	76	108	136	156	152	160	172	140
		Trained (new) Workers Joined	0	0	0	39	0	0	0	37	0	0	0	78
		Total Work Force, after trainees Joined	0	0	0	79	76	108	136	193	152	160	172	218
		Tranees being trained, beginning period	0	43	43	43	0	41	41	41	0	87	87	87
Aver. No.of New Recruits	367	New Recruits	43	0	0	0	41	0	0	0	87	0	0	0
Duration of Training, Periods	4	Tranees being trained, end period	43	43	43	43	41	41	41	41	87	87	87	87
Drop Out Rate, Ratio	0.1	Trainees Dropped Out	0	0	0	4	0	0	0	4	0	0	0	9
		Tranees Joined the Work Force	0	0	0	39	0	0	0	37	0	0	0	78
		Number of trainees on hand, end period	43	43	43	0	41	41	41	0	87	87	87	0
No of Tranees/Trainers	10	Trainer Workers Needed	4	4	4	4	4	4	4	4	9	9	9	9
		Total Workers Needed (Trainers + Workers)	4	4	4	44	80	112	140	160	161	169	181	149
		Total Work Force, beginning period	5	4	4	4	43	39	35	31	65	58	52	47
Workers Quitting Rate, Ratio	0.1	Workers quitted, end period	1	0	0	0	4	4	4	3	7	6	5	5
Aver. No.of Workers Avail.	72.5	Total Work Force, end period	4	4	4	43	39	35	31	65	58	52	47	120
		Workers Available for work force	0	0	0	39	35	31	27	61	49	43	38	111
		Work Load that can be handled by Work Force	0	0	0	10	9	8	7	15	12	11	10	28
		Work Load, beginning Period	0	0	0	10	19	27	24	30	30	33	28	27
Average Jobs Discrepancy	-4.5	Job Discrepency; (-) Extra Jobs, (+) Less Jobs	0	0	0	0	-10	-19	-17	-15	-18	-22	-18	1
Average Workers Discrepancy	4.92	Workers Discrepancy (-) Needed, (+) Extra Wo.	-4	-4	-4	35	-4	-4	-4	33	-9	-9	-9	69

What-if Scenarios on Recruitment and Training of Workers:

Number of Workers at the start	5	5	10	15	20	25	30	35	40	45	50	55
1. Total No.of Finished Jobs	257	257	258	263	265	269	270	272	273	273	276	280
2. Average No. of Workers available X 2	145	145	146	148	149	152	152	152	154	152	155	157
3. Average Job Discripancy X 20	-90	-90	-89	-90	-92	-93	-92	-96	-92	-97	-94	-96
4. Average Workers Discripancy X 5	24.6	24.6	24.2	25	23.5	24.1	24.1	23.6	24.1	22.7	23.1	23.1

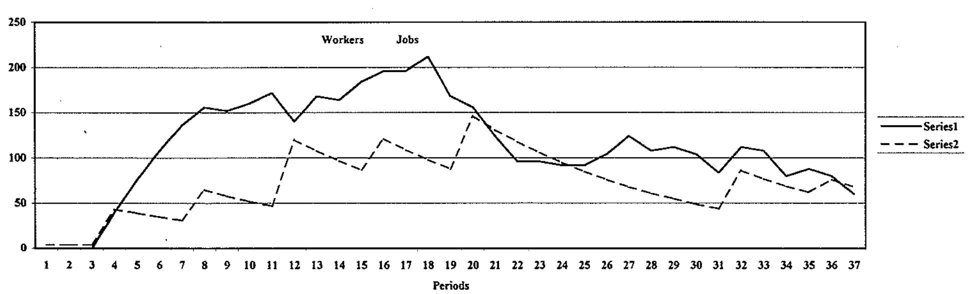
Effect of Number of Workers at Start



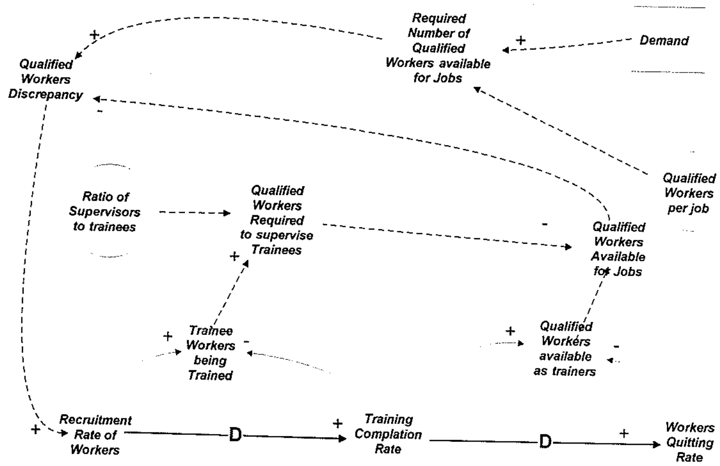
No of Workers at start

Periods	1	2	3	4	5	6	7	8	9	10	11	12
1. Jobs on hand (Work Load) x 4	0	0	0	40	76	108	136	156	152	160	172	140
2. Total Number of Workers (Work Force)	4	4	4	43	39	35	31	65	58	52	47	120

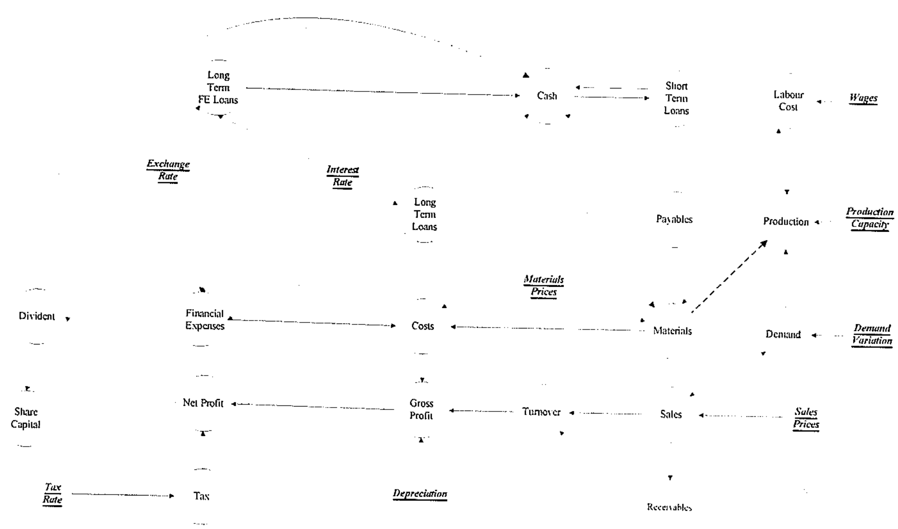
Number of Workers and Jobs



Periods



a) Influence Diagram for Recruitment and Training of workers



b) Cost-Volume-Profit Model after Yetiş (1982)