



Regional Finance Resource Distribution Simulation by Dynamic Systems Approach

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Abstract. Sustainable development means improving the lives of people with the aim of optimizing the distribution of resources to meet their needs, the Bnhvkh future contributions are taken into consideration. From the perspective of developing countries synonymous with effective distribution of funds and resources between regions, Bnhvkh enable them to priorities determined, according to the opportunities and threats ahead to achieve. Every year in the budget as part of the acquisition of capital assets provincial budget, the province placed the country in its sole discretion to advance the development objectives of the various activities of the distribution. This process causes problems in the areas of development, the gap of inequality between regions and expectations Mtfvat stakeholders (including public and city officials) is. The natures of these problems are complex because of the multiplicity of actors and agents, and because of changes in political, economic, regional and trans-regional strategies, of dynamic problems. Efforts to achieve optimal distribution in satisfaction of stakeholders have been done. But the lack of systematic and comprehensive approach to this problem was felt. This study offers a model system for the issue of the status of variables and actors with ties factual account. As well as the implementation of different scenarios and sensitivity analysis model was evaluated against possible changes.

Keywords: provincial fund distribution, performance-based budgeting, regional development, system dynamics

1. INTRODUCTION

Many scientific models have been presented concerning the distribution of funds and each model has addressed one or more important dimensions in this regard (Ziyari 2009). The main policy of these programs is the balanced and comprehensive development of the regions so that to improve the living conditions of the people and thereby to attain the country's macro-objectives. Accordingly, the road to sustainable development at the national level is through smoothing the regional development and this would not be possible provided that the features and capabilities are accurately realized, the prosperity gap between them is considered, and efficient and operational programs in the distribution of funds at the regional level are provided. In recent decades, nations have implemented a variety of regional development programs and they have gone through successes and failures along the way. However, despite the scientific and practical efforts in the field of development planning; the main objectives of combating poverty and improving the social and economic living conditions of citizens have not been achieved. The increasingly widening gap between the rich and the poor, environmental crises, depletion of

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underground resources and competition to exploit new energy resources, imbalance in the development of different regions, among others, are all the evidence to complete failure of these mentioned programs (Hosseini, 2007).

The objective of all governments in this era is to achieve sustainable development which poses many challenges despite all its utilities. Sustainable development is considered as a growth model that makes use of resources to meet human needs, of course in a way that the environment is not hurt and the rights of the future generations to use the limited resources are not ignored (Harris, et al. 2001). Since this objective is not attainable but through planning, the most important issue is how to distribute limited resources and funds to maximize the effectiveness in removing development gaps and increase the level of the socioeconomic prosperity of the regions.

With the above explanation, the main problem in the distribution of regional funds is the presence of many variables and parameters in this process with mutual effects on each other. The extent of these factors contributes to the complexity of the process of distribution of funds and even the impacts that the factors have on each other over time gives it also a dynamic quality. Therefore, the appropriate model for equitable distribution of funds in the regions should be able to consider the complexity of the factors as well as the dynamic nature of the issue. This research study aims to design a system model with respect to the cause of equality and balanced development of regions (considering their prosperity conditions and capabilities) to measure the effectiveness of the regional distribution of funds according to performance indicators, the system actors, and macro-variables. To this end, the dynamic system model is simulated during the time period from 2005 to 2025.

2. METHOD

A system dynamic approach is used to model. It will contribute to the analysis which takes into account the complex relationships of cause and effect between the factors and variables that influence the distribution system of regional funds. In order so, according to the experts' and budgeting professionals' comments at the national and regional levels and the previous research, the key variables are identified and based on their behavior patterns in the last ten years; causal account and causal loops for designing the model are determined. The effects of the fund distribution, the potential overlapping, and the impact of possible time delays are used for the analysis of the effects of the fund distribution method. The constant and iterative process of modeling and analysis in this study is as follows. The present study is basic and applied in terms of its objective. It is also descriptive and explanatory considering the available conditions. The methodology and the data collection procedure were survey-based, as well. Soft system methods and system dynamics are the techniques employed in this study. The main issue to address in the study is presenting a framework for the effectiveness of regional distribution of funds with a performance-based budgeting approach, so the results would lead to a cause-effect manifestation of different factors and variables in the allocation of funds

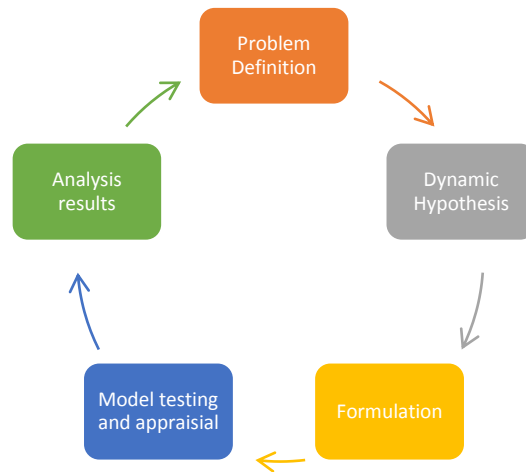


Figure 1. The iterative modeling process.

Since the data collected are used to simulate the behavior of the system in the real world, the present study is considered as a quasi-experimental research study. The structure of the model is secondary data-based, which will be generally divided into two kinds of actual data and survey data. Thereby, the extraction method of the model will be based on inductive inference that is one of the strongest methods employed to design the models and theories.

2.1. Funds to Provincial Assets Acquisition

The successful experience of decentralization policies in some countries has led to other countries' gradual attention to this issue. They have also considered granting more powers to the provincial units in development planning. In our country, with the initiation of the implementation of the Third Development Plan (2000 to 2010); this issue was considered, and to this end, the formation of a council called the Council of Provincial Planning and Development was expected in the Act. The duties of the council were generally to check and verify the long-term and short-term programs as well as the provincial annual budget within the framework of the country's planning system (Keshvar, 1999). According to the results obtained during the implementation of the Third Development Plan in terms of enhancing the powers of the provinces; these policies were also followed in the Fourth Development Plan (2005 to 2010).

In the Fifth Development Plan (2011 to 2015), a chapter was added entitled regional development for the implementation of the decentralization policies in a better way. Keeping on the implementation of these policies was also emphasized during the Fifth program through making changes in the composition of the provincial Councils of Planning and Development and giving more powers to the cities. (Iran, Yusuf et al. 2012).

Due to the complex and dynamic nature of the issue of the funds distribution to the acquisition of capital assets among regions (31 provinces of the country), a number of strategies was employed to determine the contribution of each region. Using factor analysis methods, multi-criteria decision-making, game theory and the like for optimal distribution of funds is due to the involvement of many actors in this issue wherein their conflicting interests can show the superior efficiency of a method. Therefore, the present study aims to use the system approach and the related tools to dominate on the issue in order to reckon that in addition to achieving equitable distribution of funds among the regions; the highest satisfaction is also obtained for stakeholders.

2.2. System Dynamics Method

In the early 1960s, Forrester (1965) presented dynamics system as a simulation and modeling methodology for the analysis and long-term decision-makings on the issues of dynamic industrial management. Forrester (1965) and his research group at the Massachusetts Institute of Technology proposed a plan on the basis of a system approach that depicted the people's mental models of the loop of cause and effect relationships between the phenomenon. The images show the relationships among a number of variables associated with each other to form a whole and a certain form of behavior. Presenting dynamic analyses on a different set of variables over time using computer simulation models became richer and causal feedback loops were also added to them. The models elevated in what Forrester called dynamic systems (Aracil 1981, 1989; Forrester, 1965; Goodman, 1988; Martinez et al. 1996; Martinez and Requena, 1986; Richardson and Pugh III, 1981; Roberts, 1978; Roberts et al., 1983; Senge, 1991; Senge et al., 1995, 2000; Sterman, 2000).

Cause and effect profiles and flow models of the main parts of the modeling are based on the system dynamics method. Cause and effect profiles indicate the variable affecting the model and the type of relationship among them, and the main constituent parts of the flow diagram are the status and flow variables which along with feedbacks are considered as two basic concepts in the theory of dynamics systems. State variables are the integrations which specify the system status and provide information for making decisions. State variables are not necessarily tangible. Flows are the change rate of available conditions in the systems. The value of a state variable is composed of the total integrated amount of input and output streams. If inputs are more than outputs, then the net value of a state variable increases and if the output flow is greater; the value will decrease (Sterman, 2004).

There are other types of variables in the process of dynamic systems modeling, all trying to provide a better description of the real world; including covariates, tables, rates (parameters) and exogenous variables (the same).

The methodology of dynamic systems has been employed in various areas of production-distribution systems management to biological systems (Milling and Snabe, 2007). Sterman argues that if the system should be optimized which is not static and , has no feedback the best and the most usable technique is optimization, in which such conditions are not taken into account in the area of management decisions (Sterman 2004). In short, he considers the system dynamics modeling approach as follows: (1) modeling process, (2) definition of the problem, (3) setting the dynamic hypothesis, (4) providing a causal and flow model, (5) validity testing of the model, (6) assessment of scenarios, and (7) implementation of scenarios.

The dynamic system models are extensively used in the form of study and analysis of social systems as well as progress and development programs. The top feature of these models is their ability to adopt proper management strategies (Morecroft 2007). In addition, models of dynamic systems are potentially capable to provide a framework for interactions among various stakeholders such as policy-makers, developers, and planners (Vennix, 1996; Stave, 2003). Such models allow for proposed assumptions and various test scenarios to be tested (Sterman, 2004).

The preparation for dynamic system model begins with a list of all the variables that play a potential role in creating a dynamic model. The next stage is composed of the specification of the major causal effects and feedback loops among identified variables (Sterman 2004). Therefore, the potential factors are selected from multiple linear regression models to create dynamic system model. In addition, experts in the field of research are consulted to confirm and expand the model. Figure 2 illustrates conceptually the processing of dynamic system model.

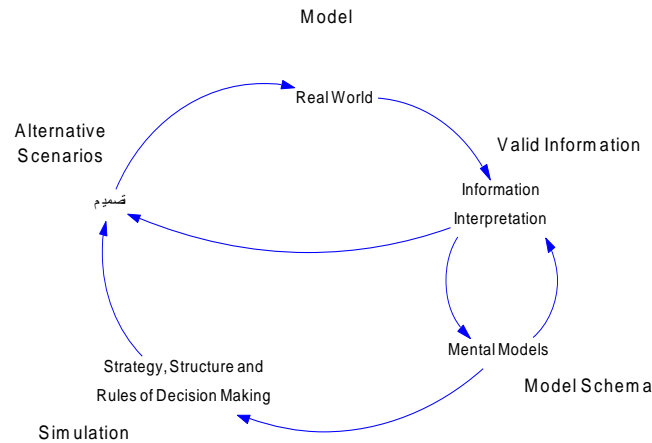


Figure 2. The schematic process of preparing dynamic system model

2.3. Experiences Using System Dynamics in the Distribution of Resources and Funds

Since World War II, the systematic approach has been used to solve the budgeting problems (Coyle, 1996). Urban planners, industrial engineers and many scientific fields have extensively employed dynamic systems modeling tools during the past decades (Stephanou and Bourke, 1982; Forrester, 2002). Dynamic systems as a way to study organizational behavior and management have attracted many researchers' and authors' attention in the past three decades (Senge, 2010).

Field studies on the behavioral process of the budget process are often based on econometric techniques and regression analysis. These procedures are to draw linear relationships among variables. In these models, a set of independent variables have effects on one or more dependent variables (High Performance Systems, 1994).

Despite the capability of cause and effect models to explain the budgeting process in the public sector, there are a few studies using the dynamic approach in the context of the budget and the budgeting system in organizations and at the governmental level (the researcher's findings). The main reason for this can be difficulty in measuring and establishing the relationships between macroeconomic variables in a simulated model. Efforts by Forrester and his colleagues to show the global economic growth is among the first studies in this field using dynamic approach to identify the systems. The model of "industrial dynamics" by Forrester displays in a macro-form the business economic cycle by means of cause and effect profiles (Forrester, 2013).

Grizzle and Pettijohn (2002) in an article entitled "implementation of the performance-based budgeting of dynamic systems approach" tried to identify the variables that influence the success of performance-based budget process. Based on Edwards' (1980) model of public policies, they attempted to identify the key variables in the organizational budgeting system and to outline the cause and effect models. Since the simulation and the scenario analysis were not parts of their research, they were only limited to design the cause and effect model and examine its validity (Grizzle and Pettijohn, 2002).

The doctoral dissertation by Tayebeh Amirkhni in 2010 entitled "a model for the implementation of the performance-based budgeting in Iran" was one of the most important studies in the field of the development of performance-based budgeting techniques into the environment of dynamic systems. To this end, the fundamental data theorization method and models of dynamic systems were used to design and implement the model, respectively. The results suggests that the laws and regulations of the supporter, stakeholders, structure, culture, leadership style, performance management systems, activity-based costing, strategic planning,

information technology and change management are of utmost importance in the implementation of performance-based budgeting (Azar et al. 2010).

In another study by Azar and his colleagues (2013), the presented model by Azar (1998) was used to reveal a model which is in harmony with the costing structure of the university and determines not only the budget required for each program and the cost list; but it can also specify the amount of funds allocated to each school and department tailored to the specific standards of the Ministry of Science, Research, and Technology based on per capita student. Of the significant points in this model is the communication between the lowest level of each branch (activities and level of education) (Azar and Amini, 2013).

The doctoral dissertation by Mohammad Walipour (2013) entitled as “performance-based budget approach to business excellence model (the case study: hospitals of Tehran University of Medical Sciences)” is a simulated budget model in which the budget has been addressed as the concept of excellence and efficiency. Since the budgeting is designed using the literature review and interviews with experts, in the form of two scenarios by using the fuzzy and constancy approaches; the model is studied in order to respond better in the face of uncertain conditions (Khatir and Azar, 2013).

Simulating the budgeting model with a fuzzy-constancy approach was the topic for another study as a master’s thesis by Mohammadreza Amini. He used the technique of data envelopment analysis to design a constant fuzzy model which considers the importance of the objectives of each program and its budgetary constraints (Amini and Azar, 2012).

3. CAUSE AND EFFECT MODELING

3.1. Cause and Effect Model at Zero level

The primary process of modeling the dynamic systems reveals the cause and effect relationships among the variables of the problem. For this purpose, it is necessary to set the scope of the problem to be able to identify the variables and their impact extent. According to the components of each of the radical definitions (CATWOE), the variables and their relationships will be determined. To identify the main factors of the problem and to explain the causal relationships of these variables (dynamic hypothesis); the review of literature, the pattern of behavior of variables over time, as well as experts’ comments can be used.

The key variables affecting the regional budget system are identified through the examination of the country’s five-year development plans, annual budget laws, and opinions among the experts and officials involved in the process. Looking at the behavior of variables over time, the causal profile at the zero level is designed in Figure 3 which illustrates the causal relationships of key variables. These relationships are based on four main subsystems which are specified separately.

(1) Actors’ expectations and willingness

- Regional authorities’ satisfaction (governors, parliamentarians, officials of executive agencies)
- People’s consent
- Legislators’ satisfaction and willingness
- Administrators’ willingness to implement

(2) The quality of funds distribution system and performance appraisal

- Effective distribution of provincial funds
- Success in achieving performance-based budget
- Increased interest in the outcomes
- Feeling of inequality among regions
- Wealth level and development of the regions
- Quality of activity-based costing system
- Quality of performance indicators
- Quality of regional development documents (assessment of opportunities and capabilities)

(3) Legal requirements

- Quantity of guidelines and the requirements of the budget law
- Quantity of protective rules and regulations

The cause and effect profile at the zero level of funds to provincial distribution assets acquisition is designed in Figure 3.

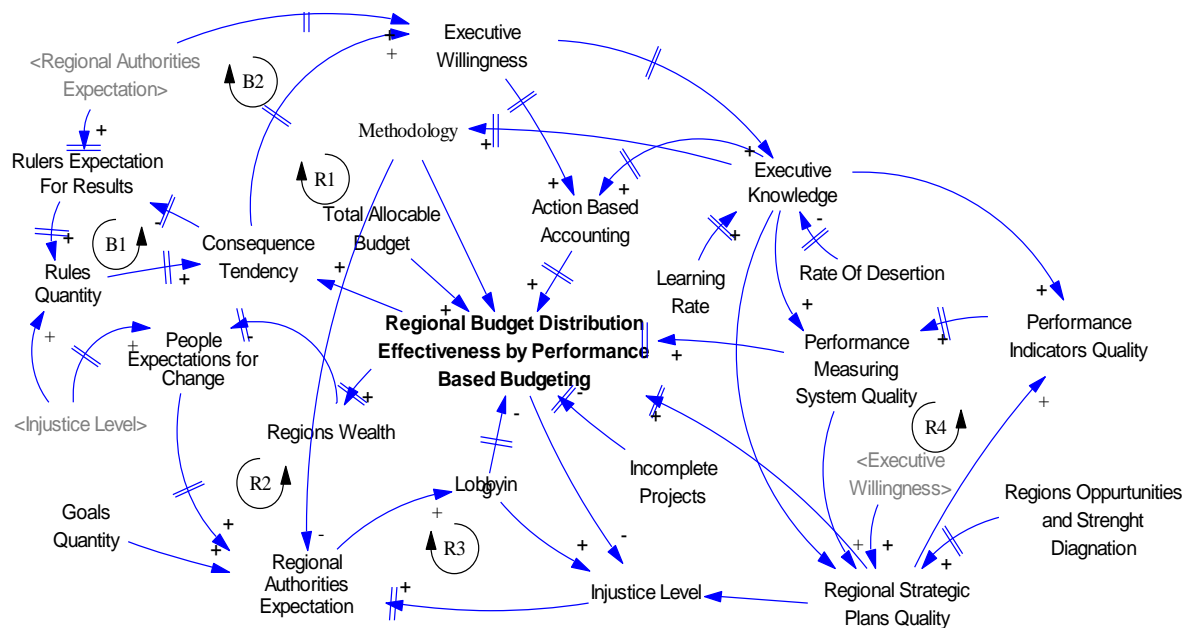


Figure 3. Cause and effect model of regional funds distribution process with performance-based budget approach (zero level)

The figure above shows the five main loops and the two deflator loops explaining the relationships between variables.

3.2. Level-One Cause and Effect Model

In many studies on dynamic systems, the original model is broken and the provision of the sub-models of the system behavior is addressed. The aim is to create an entrance capability of the main variables of the problem, the excess complexity is prevented and its study is made easier. In this research study, the model is broken up into three sub-systems as follows.

3.2.1. Actors' Expectations and Willingness

In the first reinforcer loop (R1); as the effectiveness of funds distribution approach increases, willingness to the consequences increases among the actors. Willingness to the outcomes means the acceptance of the allocable periods after the current operation. Presence of and increase in this attitude among regional authorities will particularly enhance the performance indicators which are an index for administrators' decision-making to determine the regions' share.

Willingness to outcomes increases the administrators' motivation to involve performance indicators more than before, and makes the cause and effect relationships clear. Efforts to increase the knowledge level and strengthening the structure of the action-based costing system by the administrators, ultimately leads to effective decision-making in the distribution of funds. Obviously, in this increasing loop; a delay is observed between the increased effectiveness of the distribution of funds and increase in willingness to consequences in which at least a three-year delay to gain the city authorities' trust to the efficiency of the distribution of funds is considered.

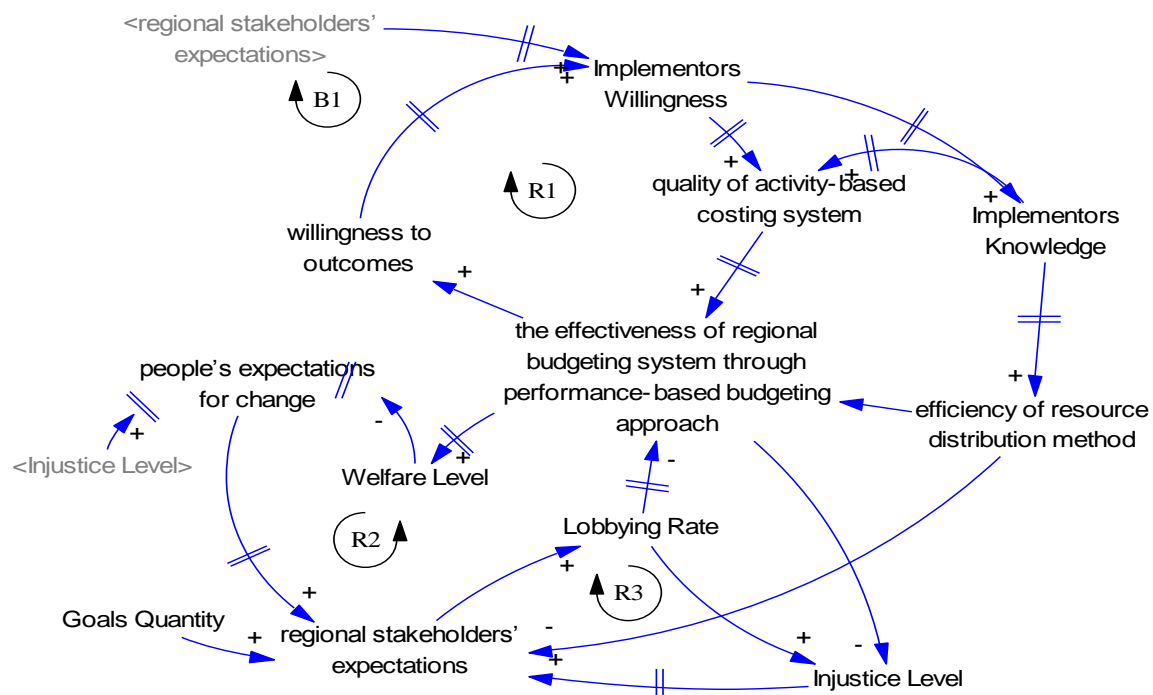


Figure 4. The cause and effect profile of system actors' expectations (the public, officials and administrators) at level one.

The second reinforcer loop (R2) primarily shows the association between the level of effectiveness of the regional distribution of funds and the wealth level of the region. The wealth level of the region in the regional budgeting process is often measured by a set of indicators of the development which encompasses economic, social, and cultural and infrastructure areas. Thus, by increasing the regional wealth level in these indicators, the public level of expectations as the main development sensors will be reduced. People are of paramount importance in the budget process, since with delays about 1 to 3 years, using the power of their influence can increase the expectations of regional authorities (including governors, heads of agencies, provincial counselors and budget deputies). Increasing the expectations of regional authorities

will influence the effectiveness of the distribution of funds in two ways. First, as the destructive side through strengthening their efforts to lobbying for more contributions to the regions, and then putting pressure on administrators to improve the distribution of funds, as another aspect.

Lobbying is conducted through making efforts to create non-administrative relations as well as putting some capabilities as excuses to do so. In political sciences, lobbying is a specific act and career by which there are efforts to extend the influence of an attitude or a particular viewpoint in the governing system of a nation or in the public opinion (Luneburg and Susman, 2005). Thus, in the mentioned loop, increasing lobbying power has a negative impact on the effectiveness of this process and leads to the reduction of effectiveness level and thereby previous gains (with a delay) will be lost.

The third reinforcer loop (R3) exclusively shows the impact of regional inequality on regional authorities' malicious behavior. Regional disparities are inevitable between the bordering regions and the central areas in most of third world countries which comes from the centralized structures of a planning system in the historical process (Eesa Mirnajjaf et al., 2012). Given the increase in the gaps for the wealth level in terms of development indicators and ignoring their real capabilities, the authorities will primarily recognize the issue and this will lead to higher level of expectations among them. Increasing the level of expectations among them has a direct impact on the index of lobbying for changing the results in their favor; thereby it will reduce the effectiveness of the funds distribution process. Therefore, enhancing the officials' level of expectations is one of the key factors driving changes in the process of distribution of resources and movement towards performance-based budgeting.

In the first balancing loop (B2), the influence of the willingness to outcomes on legislators' level of expectations as well as the passing rate of laws are taken into account. The willingness to outcomes reduces the legislators' level of tendency to improve the rules quantitatively and qualitatively. Clearly, given the broad scope of the legislation and other issues, legislators tend to pass the minimum number of required laws and resolve the legal issues. Thereby reducing the level of their expectations and attending other issues will reduce the quantity and quality of the region's budget rules. Again, decreasing the amount of rules and regulations that is the result of the need to the issue of budgeting, a reduction in the level of interest in the outcomes with a delay of 3 years will result. Therefore, the balancing loop will lead to maintaining a desirable level of legislators' expectations to achieve results in the form of the key variable of willingness to outcomes.

3.2.2. The Quality of the Distribution System of Funds and Performance Appraisal

Decision-making process to determine the share of each of the regions will be effective provided that it is based on realistic measures of performance. Several fundamental factors are related to the quality of the fund distribution system; (1) information on performance, (2) recognizing the capabilities and opportunities for regional growth based on field studies, (3) objective distribution of funds to achieve growth, benefit and equality among the regions; and (4) increasing all system actors' willingness to the outcomes.

Regional Finance Resource Distribution Simulation by Dynamic Systems Approach

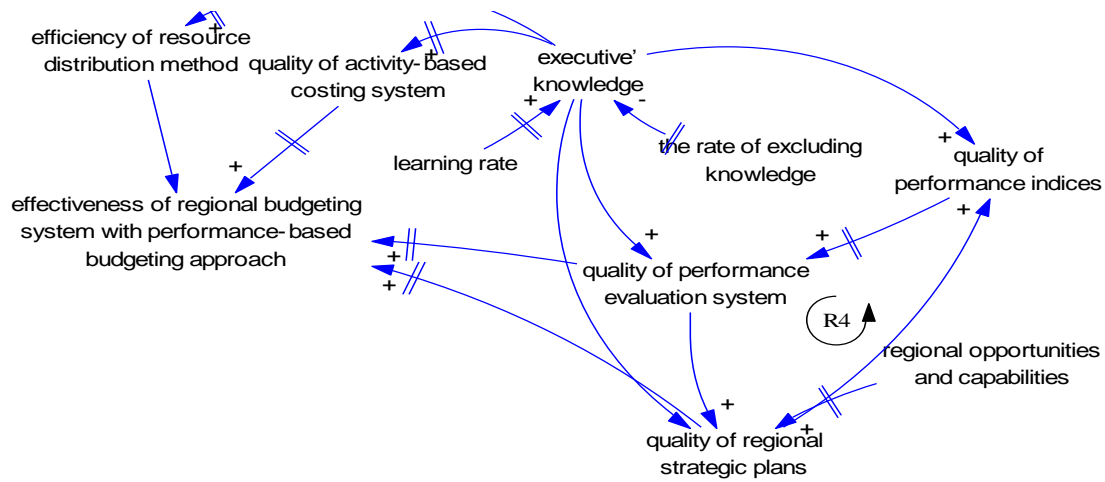


Figure 5. Cause and effect profile of sub-system quality of distribution of funds and performance evaluation at level one

The ability of each region in achieving indicators of economic growth in the past will be the criterion for determining their performance and their ability in future periods. Performance information should be explained in the form of appropriate and highly powerful measures. Given the lack of statistical data; the definition of these indicators is very important because they are the main criterion of funds distribution. Figure 5 show that administrators' knowledge plays a central role in the efficiency of the performance evaluation of the regions.

The fourth reinforcer loop (R4) is placed in this sub-system and affects the quality of the performance appraisal system. Evaluating the performance is an underlying part for the performance-based budgeting system, which, if measured correctly, the distribution process will be increasingly positive and the efficiency constantly improves. Performance evaluation system as well influences the quality of strategic plans for regions. These programs which are formulated based on the identification of opportunities and capabilities are the road map of the region for periods up to 5 years which only consider goals that can be achieved based on the available conditions. This is regarded as one of the strengths of this model because goals are determined comparatively and there are efforts to avail the regions equally with the resources. Determining goals separately in the strategic programs can improve performance indicators and in addition to increasing reliability in the performance evaluation, it leads to improving and speeding up the procedures for statistical activities.

3.2.3. Legal Requirements

Quantity and quality of laws passed by the parliament and the government heavily influence the distribution of funds. Based on the statistical results and the reports by the statistical population, the low or the high level of the laws can reduce the efficiency of the funds distribution process. The presence of excess laws will decrease effectiveness since it limits administrators in determining the optimal share of the region and distribution will be highly determined on the basis of the requirements of the budget.

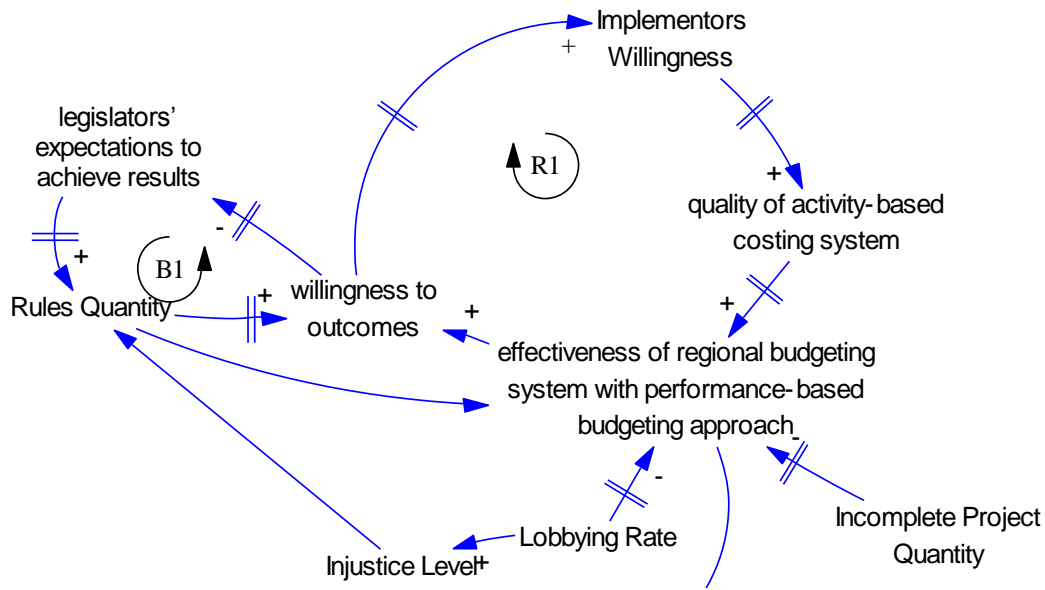


Figure 6. The sub-system of legal requirements at level one.

On the other hand, the multiplicity of laws and their contents can strengthen the willingness to outcomes among the administrators and the legislators which will continuously increase the tendency of executives and will enhance and improve the effectiveness.

Budget requirements, circulars and governmental rules based on the fulfillment of incomplete civil projects in each period reduces the effectiveness of the process of funds distribution, all of which are because of granting limited powers of enforcement to administrators to determine the proportionate share for each region.

At the second balancing loop (B2); other methods are gradually rejected as the result of increasing interest in the outcomes by officials, legislators and administrators of the process of funds distribution. As well, there are efforts to improve performance indicators by the regions, increase the effective ways of measuring, and enhance the effectiveness of the distribution. In the meantime, the rulers are faced with numerous issues. There are increased tendencies to outcomes and reduced level of expectations, and over time with the abolition of some laws and paying attention to other issues; the ineffective rules in the process of distribution gradually decrease. This issue will lead to an increase in the interest in outcomes. This balancing loop will prevent from the excess increase of the laws and will retain them at the desirable level. According to the reviews by the researcher, the extra number of the rules or their paucity can reduce the effectiveness.

3.2.4. Flow Modeling

The figure for the flow model is used to simulate the dynamic system procedure whose main components are state and flow variables. States and flows along with the feedbacks are considered as two main concepts in the theory of dynamic systems. State variables are integrations that identify the status of the system and provide information to make decisions and act as follows. Flows are the rate of change of available conditions in the systems. In addition to the state and flow variables; covariates are also of significance in the model of dynamic system. Covariates are functions of state variables and constant or exogenous variables (Sterman, 2004).

At this point, the flow profile is drawn based on the determined cause and effect diagram, the conducted studies, and feedbacks from experts. In this figure, some of the factors affecting the

implementation of the performance-based budget are considered as exogenous, such as the number of the developmental goals of the regions, incomplete projects, multiplicity of rules and the assessment quality of the capabilities and opportunities of the regions. Other factors are lodged in the model and the system and their levels are determined as endogenous; therefore, most of the key variables of the issue are endogenous and their value is determined in the model.

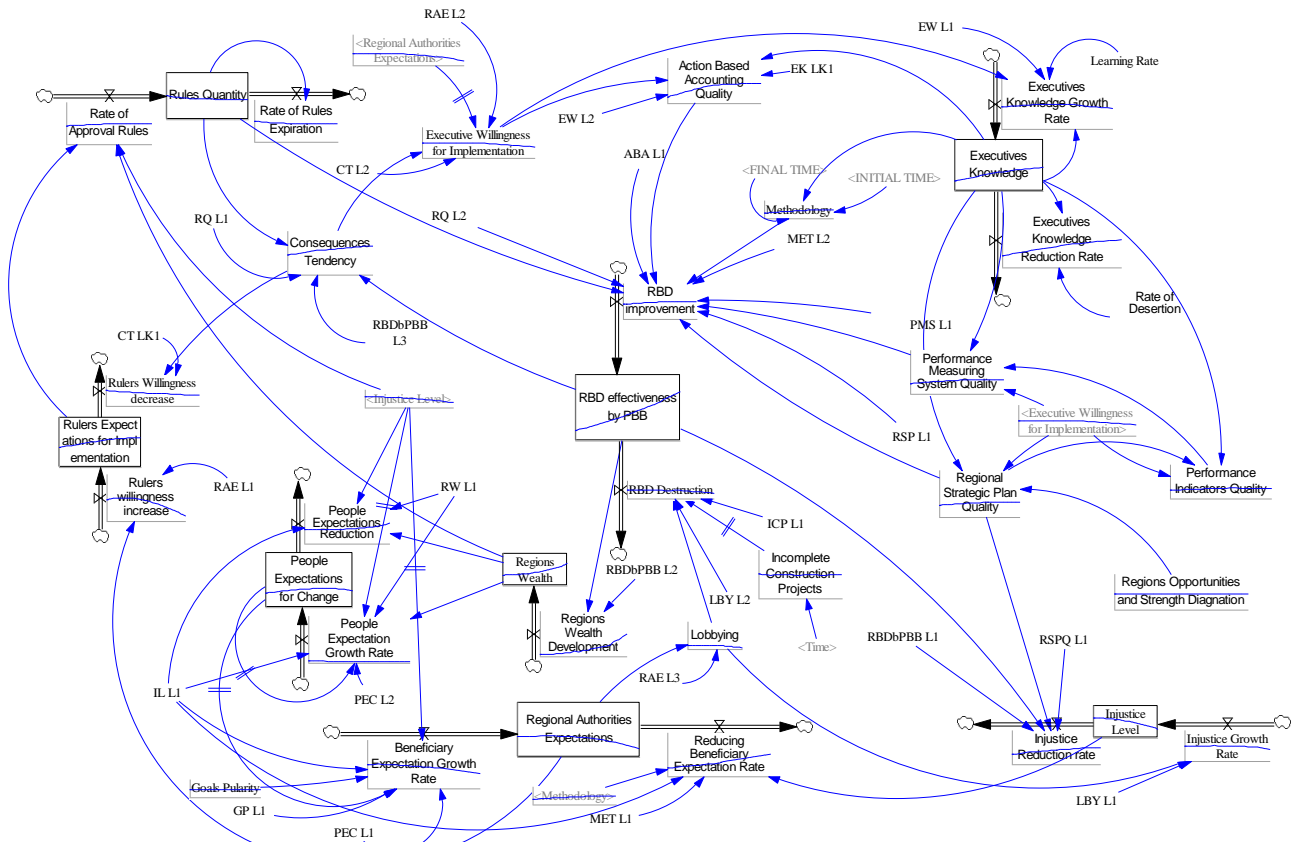


Figure 7. The flow profile of the process of regional distribution of funds using the performance-based approach

The related formulas were defined through the flow profile for each variable. At this stage, via the top-grade documents and the statistical data available, as well as experts' opinions (in qualitative variables); mathematical formulas were identified and appropriate values for each variable were determined. Because of the qualitative nature of variables, relations between them are indicated as functions of Lookup, Smooth, If Then Else and relative mathematic relations.

To write the equations in the software Vensim, all variables are scaled and the scales of qualitative variables are between 1 and 100 according to the experts' comments. Therefore, the ideal state is 100 and the undesirable one is 1. To implement the model, the values of the state variables and their rates were determined according to the experts' opinions as well as the former and current conditions of regional distribution of funds (since 2005); the given amounts are mentioned in Table 1 as follows.

Table 1. Considered conditions for implementing the performance-based budget in the regional distribution of funds in Yazd province.

Variable	Considered numerical values based on top-grade documents, statistical references, and experts' opinions
current state of performance-based budget in the regional distribution of funds	15%
willingness of administrators to implement level of public expectations	26.5%
authorities' expectations in the region	26%
legislators' expectations	37%
number of laws related to the distribution of funds	30 related laws
administrators' knowledge level	19%
level of inequality between regions	62
average wealth of the regions	32%
rate of increase in the staff's level of knowledge	35%
rate of decrease in the knowledge level (due to the departure of former employees)	5%
number of goals	18%

Considering the values, the parameters of the model were implemented and the following results were obtained.

3.2.5. The Success of the Distribution System of Funds Using the Performance-Based Budgeting Approach

The administrators' tendency to implement the budgeting process on the basis of performance in the distribution of funds in the regions could be among the most important factors in the success of the process outlined; because this group is considered as the front-line in this process. Their level of knowledge, methodology employed for decision-making, quality of activity-based costing systems, performance evaluation and the referred indicators all are effective on being successful. Each of these factors on the basis of standardized coefficients extracted from statistical sources and experts' opinions influence the model that has been considered in terms of the prediction time period.

Examining the behavior of this variable in the 20-year period shows that it is continually rising in a way that it is simulated from the primary value of 15% in 2005, with an average increase of 20 % annually, to 77.6% in the final year. Thus, it demonstrates an increase of more than four times during this period that is the resultant effect of all these factors.

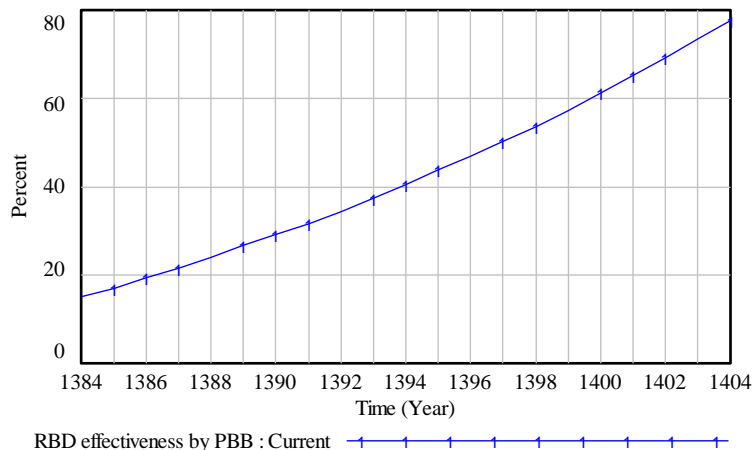


Figure 8. The success with funds distribution system using performance-based budgeting approach.

3.2.6. Level of Wealth and Equality among the Regions

The level of utilization of the facilities by the regions and the level of inequality to attend the regions are two key variables that are the main stimuli to changing the level of expectations among authorities, legislators, and administrators to implement performance-based budgeting system in the regional distribution of funds. These two variables are highly affected by the key variable of the system that is the rate of success in the implementation of performance-based budgeting system.

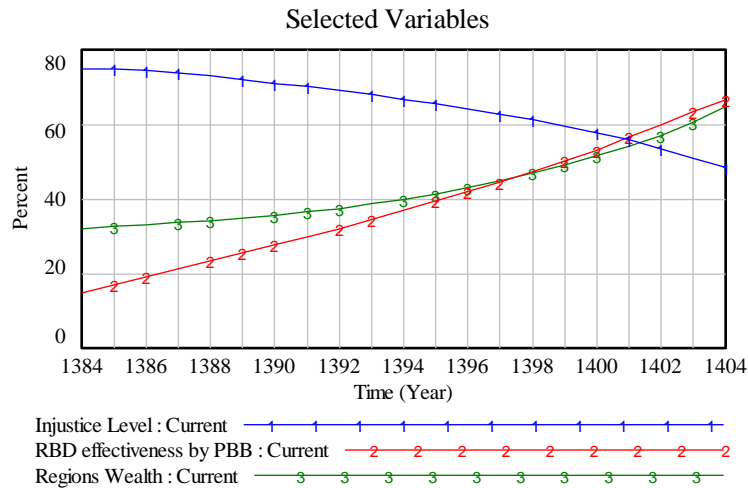


Figure 9. Level of wealth and equality among the regions.

Figure 9 shows the rate of the changes in these variables during the simulation process. The statistical analyses and reference to the experts’ opinions revealed that the level of wealth and inequality among the regions at the start of the simulation process are 32% and 73%, respectively. The level of wealth in the regions over time has grown to some extent in line with the increasing success of the operational budgeting process and on the other hand there is a reduction in the amount of inequality. The amount predicted at the end of the simulation process is 64.8% and 48.4%, respectively.

3.2.7. The Expectations of the Public, Officials and Rulers

Changes in the level of development and equality among the regions will primarily strengthen the level of expectations among the public as well as regional authorities. Since people compare the level of wealth in the region they live in with other regions, they understand the wealth gaps better and make an effort to attract more funds to improve their level of benefit through increasing and imposing social and political pressures on officials. Figure 10 illustrates the changes in the level of expectations among people, officials and rulers during the simulation process. In 2005, these values were respectively 26%, 37% and 40% which reached respectively to 75%, 30% and 74% at the end of the period. It is obvious that the level of people’s expectations have increased during this model; however, at the final 5 years, the simulation has had a fixed process down the slope.

In the meantime, we can observe a reduction in the officials’ level of expectations due to their direct communications with the administrators of funds distribution as well as complete awareness of the funds distribution method. This issue also leads to their awareness of the faster

effectiveness process and having lower expectation level since they are ensured with realistic distribution procedures and expected to achieve development and equality among the regions.

Rulers who initially have higher expectations from the public are satisfied due to the development of the system and increase in the tendency to outcomes. Their expectations are also converged with the publics in the final years. The increase steep of their level of expectations has been reduced at the final 5 years, and almost at the end of the year 2025; it is constant. This is due to a delay in the impact of factors on increasing incentives among rulers.

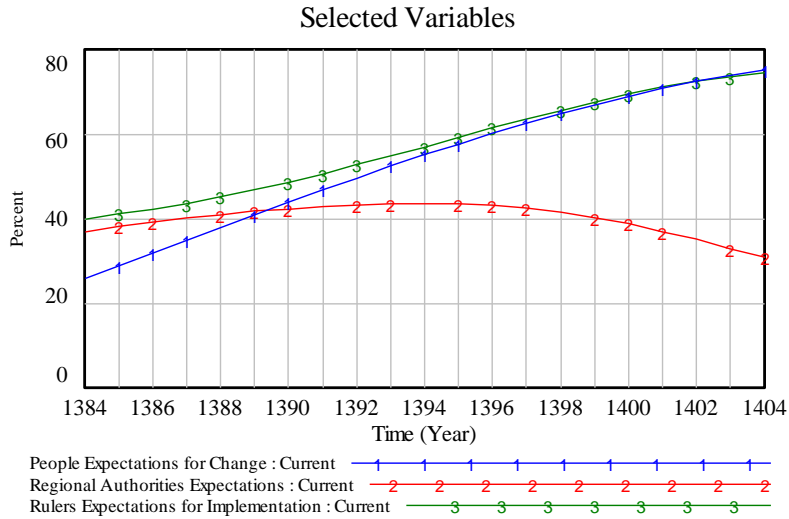


Figure 10. The sub-system of expectations among people, officials and rulers

3.2.8. Multiplicity of Laws

Laws are a necessity to the successful implementation of each activity especially when the distribution of resources is raised, since they will increase the efficiency of legislators’ enforcement and prevent disputes among authorities. Examining the experts’ opinions suggests that the presence of laws at a moderate level can have effects and their paucity or excess can reduce effectiveness.

Surveys by the researcher on the top-grade documents (annual budget laws and five-year development plans) demonstrate that in 2005 there have been about 30 laws associated with the available regional distribution of funds which have increased to 73 laws during the simulation period according to Figure 11. The reason for this increase can be found in the analysis of the previous data. Increased legislation is always a quick strategy and sometimes the only way to reduce conflicts and a remedy to distribute funds without adverse consequences. Therefore, it is natural that the attempts to increase the laws in order to enhance the effectiveness of distribution procedure and ultimately improve development indices. But, since the number of laws itself obstructs the development, it is clear that in the final years of simulation, the increase steep will reduce and the growth is blocked.

At the time of implementing the project in 2004, there were 28 laws in this field that obviously show that the model is able to reveal the available state in terms of validity.

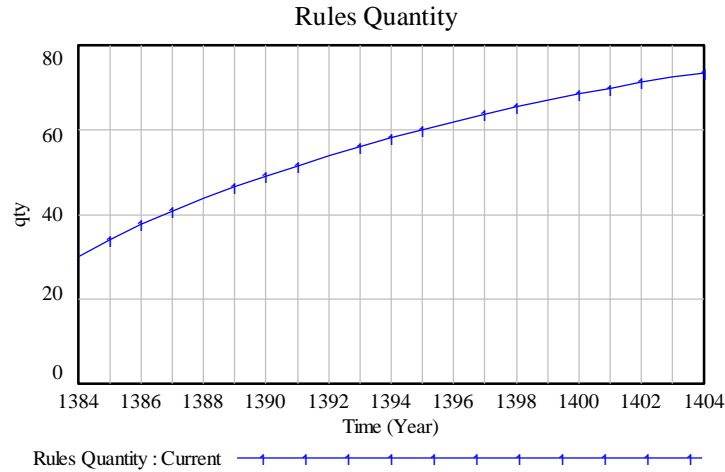


Figure 11. The multiplicity of laws passed each year.

3.2.9. The Quality of Performance Evaluation System

The Performance evaluation system is among the systems whose absence will lead to impossible implementation of performance-based budgeting, and it is taken into account as one of the required condition to successful implementation of performance-based budgeting. So, in this study, its quantity is considered as one of the main factors affecting the performance-based budgeting which is itself influenced positively by the capacity of scientific and technical personnel, information technology, quality of performance standards and the willingness of staffs to implement performance-based budgets. Studying the behavior of this variable showed its close and direct correlation with the indices of performance appraisal. The value of this variable at the beginning of the simulation period was 24% which will be about 56% during the country’s 20-year outlook.

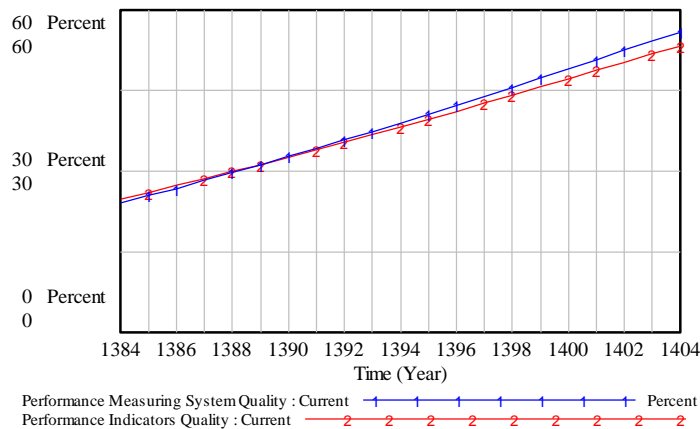


Figure 12. The quality of performance evaluation system

3.2.10. Rulers’ Knowledge Level

Knowledge level among rulers is of the main variables of this study which does not directly influence the success of the implementation of the performance-based budget, but its indirect effect will be significant on others.

Examining the structure of the model shows that growth in the knowledge level among the rulers will be respectively influential on the funds distribution method, the quality of activity-based accounting system, the quality of performance evaluation system and the employed

indicators for it. The growth of the personnel's level of knowledge mainly emerges from their willingness to implement performance-based budget. Accordingly, with the discovery of new knowledge, it is expected to escape of the effective ways of decision-making, to provide efficient measures and to formulate regional strategic plans. On the other hand, increasing the knowledge will contribute to the desire to increasingly expand its quantity and quality.

The qualitative nature of the employees' knowledge level at the beginning of the simulation period was 19% (compared with developed countries) which reaches to 65% at the end of the period over time and through the rulers' willingness as well as the effect of increasing the level of knowledge.

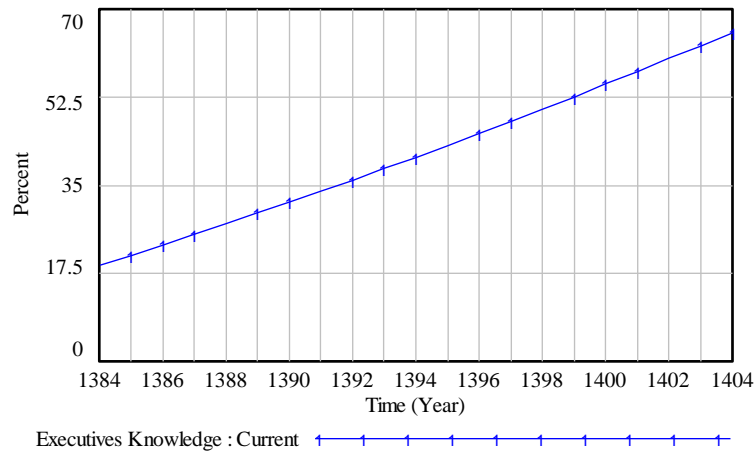


Figure 13. Executives' level of knowledge during the simulation periods

4. DISCUSSION AND CONCLUSIONS

The present study has three main achievements as follows:

- Specifying the requirements for the implementation of the performance-based budget in the regional distribution of funds,
- Determining the impact and the mutual effect of these factors on each other,
- Identifying the functions and mathematical relationships among these factors.

Therefore, this study will help local governments and the responsible executives to examine the mentioned relationships and distribute of funds based on regional performance in the previous periods. Given that most of the methods used so far have been different based on the level of wealth and its difference among the regions, the true potential of the regions in different areas have been always overlooked. In general, the results from the separate examination of the behavior of each variable reveal the fact that all the effective factors on the implementation of performance-based budgeting have at the beginning a faster developmental process than the development process of performance-based budgeting. The estimation of their behavior over time will result in an increase in the level of effectiveness of the funds distribution process.

This research, based on the country's 20-year prospect document, tries to simulate for the last two 10-year period (2005 to 2014) with the aim of testing the efficiency of the model (2005 to 2015) with the aim of simulating and predicting the main variables affecting the success of performance-based budgeting system in the level of the regions.

The importance of designing a dynamic model in this study is due to considering two factors, the level of wealth and the level of equality among the regions. The main objective of the distribution of funds is almost achieving these two factors and the requirements for implementation of such programs are determined by the same factors. Since the level of expectations among the public and the regional authorities is a major stimulus to reform the regional budget system, these two factors will change accordingly. Implementation of the mentioned model shows that at the start of the simulation model, the level of expectations among people and authorities increases since the performance appraisal process is fully-fledged and there is a lack of reliable data as well as strong indices.

Given the growing methods of physical and virtual communication as well as awareness of other regions, these groups try to compare their level of wealth with others and put pressures on decision-makers to amend the system as they understand the available gap. The first effect factor is the legislators with reforming the influential laws on decision-making and the second factor is the process rulers. Pressure on the rulers increase the level of knowledge and reforms the performance evaluation system as well as its indices. The results showed that the average delays of two years will lead to an increase in the executives' willingness to increase the effectiveness of the funds distribution process.

The manner in which the system is remarkable is its positive sustainability. Thus, the behavior of the system over time is always positive. Therefore the factors taken into account in the system dynamic model can be sufficient for the successful implementation of performance-based budgeting in the regional funds distribution. Of course, this does not mean that all factors have been considered; however, positive stability shows that the most important factors whose impact or their mutual interactions can bring about effective implementation have been taken into account.

REFERENCES

- [1] Amini, M.R., Azar, A. (2011). Designing the performance-based budgeting model with a constant-fuzzy approach, Tarbiat Modarres University. Master's Degree.
- [2] Azar, A. (1996). "Designing the mathematical model of cost planning in the country's governmental agencies - deterministic and fuzzy approach." *Journal of Management* (35 Knowledge (35-36).
- [3] Azar, A. et al. (2010). "Designing the implementation model of performance-based budget with system dynamics approach". *Journal of Iran's Management Sciences*, the fifth year, (18).
- [4] Azar, A. et al. (2013). "Designing the Performance-based Budgeting Model (Case Study: Tarbiat Modarres University)" (*Vision for Public Administration*) (15).
- [5] Bakhtiari, S. et al. (2011). "Examining the development status of Yazd province using multiple criteria decision-making methods and factor analysis." *Journal of Planning and Budget* 7 (2).
- [6] Coyle, R. G. (1996). *System Dynamics Modeling: A PRACTICAL APPROACH*, Taylor & Francis.
- [7] Eesa, A.Z. et al. (1391). "Spatial analysis of regional disparities between the border regions and central Iran." *Geopolitics of Iran*. 25.
- [8] Forrester, J. W. (2002). *Urban Dynamics*, Pegasus Communications.
- [9] Forrester, J. W. (2013). *Industrial Dynamics*, Martino Publishing.
- [10] Grizzle, G. A. and C. D. Pettijohn (2002). "Implementing Performance-Based Program Budgeting: A System-Dynamics Perspective." *Public Administration Review* 62(1): 51-62.
- [11] Harris, J., et al. (2001). *A Survey of Sustainable Development: Social and Economic Dimensions*, Island Press.

- [12] Hossein A. M. (1998). "The prioritization of the villagers in the process of rural development" Village and Development, the first year.
- [13] Iran, et al. (2012). The Fifth Five-Year Development Plan Law and objectivity of the subsidies.
- [14] Keshvar. S.M.V.B.R. (2009). The Third Planning Law for Economic, Social and Cultural Development in Islamic Republic of Iran. Tehran, Management and Planning Organization of Iran.
- [15] Keshvar. S.M.V.B.R. (2004). The Fourth Planning Law for Economic, Social and Cultural Development in Islamic Republic of Iran. Tehran, Management and Planning Organization of Iran.
- [16] Khatir, A.M.P. et al. (2013). Designing performance-based budget approach with organizational excellence model (case study: hospitals of Tehran University of Medical Sciences), Tarbiat Modarres University. PhD.
- [17] Luneburg, W. V. and T. M. Susman (2005). The Lobbying Manual: A Complete Guide to Federal Law Governing Lawyers and Lobbyists, American Bar Association.
- [18] Milling, P. D. P. and B. Snabe (2007). The Usage of System Dynamics in Organizational Interventions: A Participative Modeling Approach Supporting Change Management Efforts, Dt. Univ.-Verlag.
- [19] Morecroft, J. (2007). Strategic modeling and business dynamics: A feedback systems approach, John Wiley & Sons.
- [20] Senge, P. M. (2010). The Fifth Discipline: The Art & Practice of The Learning Organization, Crown Publishing Group.
- [21] Stave, K. A. (2003). "A system dynamics model to facilitate public understanding of water management options in Las Vegas, Nevada." Journal of Environmental Management 67(4): 303-313.
- [22] Stephanou, S. E. and R. D. Bourke (1982). The systems approach to societal problems, D. Spencer Publishers.
- [23] Sterman, J. (2004). Business Dynamics: Systems Thinking and Modeling for a Complex World, McGraw-Hill.
- [24] Vennix, J. A. M. (1996). Group model building: facilitating team learning using system dynamics, J. Wiley.
- [25] Ziyari, K. A. (2009). Principles and methods of regional planning, Tehran University.