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Using System Dynamics to Model the Interaction Among the Factors of Good Governance, Satisfaction of Life and GINI Coefficient

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Abstract

Governments play a crucial role in well-being of people, the quality of life, reducing poverty, and increasing the social and economic capacities of society. Popular support is among the ways that can strengthen the political and economic bases of the country. Governments should provide and keep popular support. Since the level of life satisfaction is closely relevant to popular support, the degree of good governance, which is determined by the World Bank parameters, is considered the popular support parameter. In this research, a system dynamics model is developed to predict the behaviors of the satisfaction of life using suitable governance parameters. The results of causal relationships demonstrate that popular support requires a mutually supportive effort of the people, the legislature, the state, and the judiciary. Our results suggest that the interactions of the triple powers should consider more deeply in future studies so that people will be served more appropriately. In this study, due to the lack of information, it was not possible to investigate the consistency of the proposed model over time. Thus, it is suggested that under complete information, the consistency of the proposed model will be analyzed.

Keywords: Forecasting, Good governance, Policy making, Popular support, Satisfaction of life, System dynamics.

1 | Introduction



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There is a big gap between the performance of governance and what it expects to do in most countries all around the World. The performance of governance significantly impacts people's life and their well-being. Some studies considered a single goal variable for dealing with such a gap in a dynamic fashion using a system dynamics (SD) approach. For instance, [Rose-Ackerman and Program \(1997\)](#) and [Muhammad Aman Ullah and Tiru Arthanari \(2011\)](#) studied the issue of corruption in Pakistan. Moreover, [Torres et al. \(2007\)](#) investigated the bribery behavior of governance.

According to reviewing the related literature in the field of governance effectiveness on the satisfaction of people's life (studies published in 1990 to 2021), previous studies have explored the performance of governance using simple models. The philosophical definitions of governance, such as the rules of law, transparency, and public welfare, are widely available in the literature. However,



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operational purposes and methodologies for properly managing real systems are hard to determine. Hence, investigating dynamic systems through quantitative approaches is of great importance, as it brings people's life satisfaction.

The World Bank (1989) considered the lack of development in Africa a "Crisis of governance". It defined governance as "... the exercise of political power to manage a nation's affairs". Good governance includes some or all of the following features: an efficient public service; an independent judicial system and legal framework to enforce contracts; the accountable administration of public funds; an independent public auditor, responsible to a representative legislature; respect for the law and human rights at all levels of government; a pluralistic institutional structure, and a free press (Leftwich, 1993). Weiss and Thakur (2007) refer to Wikipedia to quote a definition for global governance. They stated that "the complex of formal and informal institutions, mechanisms, relationships, and processes between and among states, markets, citizens and organizations, both inter- and non-governmental, through which collective interests on the global plane are articulated, rights and obligations are established, and differences are mediated.

International agencies such as UNDP, the World Bank, the OECD Development Assistance Committee (DAC), and others define governance as the exercise of authority or power to manage a country's economic, political, and administrative affairs. The 2009 Global Monitoring Report sees governance as 'power relationships,' 'formal and informal processes of formulating policies and allocating resources', 'processes of decision-making', and 'mechanisms for holding governments accountable'.

The relationship between people and the government is a social contract under which government plays a crucial role in people's well-being and quality of life as well as in reducing poverty and increasing social and economic capacities. Thus, the performance of any government which declines these aspects will bring about political, economic, and social crises (Holmberg and Rothstein, 2012; La Porta, Lopez-de-Silanes, Shleifer, and Vishny, 1999; Rouhani, 2013).

Government and governance in today's meaning, have originated from the political idea that emerged after the sixteenth century. In that period, the governments were thought too weak to enter economic areas, and the thought of absolute freedom of business was promoted. The government was only allowed to perform critical functions. In this thought, the size of government should be aligned with the principle of business freedom. Since then to now, government theories has experienced many changes and had ups and downs, and the organizational structures of government have undergone remarkable changes to such an extent that the "good governance theory" of recent decade encompasses the set of economic, social, and governmental management thoughts (Holmberg and Rothstein, 2012; La Porta et al., 1999; Rouhani, 2013).

Taking all these into consideration, these authors were unable to find articles that proposed an integrating approach considering the impacts of governance factors on people's satisfaction of life in a manner that is important for this research. Hence, the main contribution of this research is adding governance strategies into the system of people's life using a system dynamics approach to examine people's behavior in contrast to what they may have expected of their government. There has been little quantitative research on this subject matter using the SD approach. In more detail, we emphasize (i) reviewing the literature on the subject matter taking system dynamics modeling into consideration, (ii) finding key factors affecting people's satisfaction of life, and (iii) identifying factors that can be used in determining government performance about peoples' well-being and satisfaction of life.

The rest of this article is organized as follows. Section 2 provides the research background. Section 3 reviews the related literature, and provides criteria extraction. In Section 4, the problem under study is described, and research contributions are discussed. In Section 6, the research methodology is explained. Section 7 provides model formulations. Model validation is discussed in Section 7. The scenario analysis

is discussed in Section 8. Managerial insights are presented in Section 9. Section 10 concludes the paper, and discusses future research paths.

2. Background

2.1. Good Governance

Governance has been defined to refer to the structures and processes that are designed to ensure accountability, transparency, responsiveness, rule of law, stability, equity and inclusiveness, empowerment, and broad-based participation. Governance also represents the norms, values, and rules of the game through which public affairs are managed in a manner that is transparent, participatory, inclusive, and responsive. Governance, therefore can be subtle and may not be readily observable. In a broad sense, governance is about the culture and institutional environment in which citizens and stakeholders interact and participate in public affairs. It is more than the organs of the government.

In recent years, extensive literature under the heading of good governance has been published by international institutions such as the United Nations Development Program, the World Bank, and the International Monetary Fund, where their central subject was good governance and how to achieve a government that can establish a democratic and justice-based development (Huther, Shah, and Division, 1998; Kaufmann et al., 2009; Kaufmann, Kraay, and Zoido-Lobaton, 1999).

Good governance, in a short and illustrative definition, is “the establishment of the acknowledged economy to upgrade the quality of a humanitarian life”. Of course, this will not be realized unless a fundamental change occurs in the thoughts and behavioral and natural features of governments. In other words, good governance is a conscious effort to make a shift in the economic and social foundations of society. All these efforts are made to improve the quality and humanitarian life and provide customers with more choices. In this governance, most people are considered the customers of the government, and the government has admitted the idea of customer orientation and believes that the customer is right (Holmberg and Rothstein, 2012; Kaufmann et al., 2009; La Porta et al., 1999; Rouhani, 2013).

2.2. System dynamics

System dynamics is a method of learning about a complex system and the development of management simulations that help to understand system complexities, sources of resistance against the policies, and designing effective policies (Otto, 2002). This methodology is used for discovering and presenting feedback processes and searching for the characteristics of the dynamics of complex systems using level and flow structure, delays, and nonlinear relationships (Mella, 2012; Tegegne, Moyle, and Becken, 2018). Here, the feedback structure, represented as positive and negative feedback loops, is the leading guide of system dynamics that help in interpreting the observed dynamic behavior and developing reasonable hypotheses about these behaviors and structural deficiencies of the model (Asere and Blumberga, 2015; Mella, 2012).

System dynamics methodology has fundamental differences from other modeling methods. Firstly, it highlights the feedback processes or causal relationships in which the variables affect each other. Secondly, behavioral decision-making is represented in the model, while the decision-makers are assumed to be individuals with limited rationality and incomplete information. Thirdly, it estimates processes with continuous time and consequently can be applied in discovering lag effects (Coyle, 1996; Kunc, 2017).

To build and simulate system dynamics models, some software has been developed, from which Vensim is one of the best ones. This software is an integrated framework for conceptualizing, building, simulating, analyzing, optimizing, and developing models for complex dynamic systems. Vensim has excellent speed and effectiveness (García, 2017).

3. Literature review and criteria extraction

Good governance means that all people behave fairly, and they have equal “legal rights” and “opportunities to access the governmental services”. The essential aspects of good governance include the rule of law, the control of corruption, the efficiency of the public sector, hearing the voice of citizens, and democracy (Kaufmann, Kraay, and Mastruzzi, 2009; Mardookhi, 2009).

Rodríguez-Pose Andrés and Tselios, Vassilis (2018) studied well-being, political decentralization, and governance quality in Europe. They concluded that because of governance problems, any potential well-being benefits related to the transfer of powers to subnational tiers of government and to providing public goods and services at the local level may not emerge. Previous studies have paid less attention to these aspects (e.g., Hessami, 2010; Kyriacou, Muínelo-Gallo, and Roca-Sagales, 2015).

Nikolaos Hlepas (2013) examined the relations between quality of life and local governance and especially the degree of social cohesion within the local community and the satisfaction with the institutions of national and regional government by collecting and comparing indicators. The findings of its research are: (1) countries with highly satisfied citizens have high social cohesion scores, and (2) such high social cohesion scores result in national institutional quality and trust in government institutions.

Nahavandi and Ajayebi (2021) conducted research on anti-poverty policies for rural households in Iran. Their results showed that supporting households in non-financial aid programs has a sustainable impact on their income, and eradicates poverty faster than financial aid programs.

Muhammad Aman Ullah and Tiru Arthanari developed a system dynamics model for studying corruption in Pakistan. They indicated that corruption is a hazardous social phenomenon in the world. In addition, its manifestation is a destructive agent against human development in developing countries. Torres et al. (2007) developed a system dynamics model to explore the effect of bribery on economic growth. In this model, the difference between the public and the private wage allows the model to introduce public corrupt activities in the economy.

DeHoog et al. (1990) have investigated the issue of citizen satisfaction with local governance. They have developed an economical account of happiness which indicates: (a) individual citizens' efficacy relative to the local government and their attachment to their community, and (b) the actual level and quality of services provided by local government.

The World Bank is one of the entities that has widely studied this subject. It has chosen government empowerment policies or governance improvement as a development policy-making, and defined indicators (criteria) to determine it. According to these criteria, the concept of good governance has been described by the World Bank, and its value is calculated for all countries, which is published annually (Kaufmann et al., 2009; Mungiu-Pippidi and Johnston, 2017; Sundaram and Chowdhury, 2012). These criteria are provided in Table 1.

Table 1. Criteria identification and description.

	Criteria	Descriptions
1	Voice and Accountability	Accountability indicates the responsibility of the public service providers for government's behaviors and requires them to respond to the needs of citizens. Accountability is the basis for an effective government and an entrepreneur governor. Adopting the accountability principle requires that the government shifts from an authoritative system to a more participatory one (Munshi & Abraham, 2004).
2	Political Stability and Absence of Violence/Terrorism	The stability in decision making (belief in procedural stability), being assured of the efforts toward the objectives (government efficiency in doing its functions), and the absence of violence against people and in international domains provide security for the people, and consequently, people can plan for their future more confidently and declare their critiques at different issues without any self-censoring. One important factor in ensuring political stability is the ability of the country to defend itself against the internal and external enemies, which should be noted (Akongdit, 2013).

3	Poverty	The struggle to reduce poverty is one of the most prominent roles of efficient governments and good governance. Poverty is a threat for the internal policy of countries because it ensures the advent of social damages such as corruption, drug abuse, divorce and family break up, emigration, and the breaking of regional balances, violence and criminals, social gap, and so forth. Thus, fighting poverty and improving the living conditions of poor groups, increasing their economic and social capacities, and detaching them from the poverty cycle and transform them into human capital are of the major concerns of governments (Sundaram and Chowdhury, 2012).
4	Public welfare	One of the main components of measuring good governance is the creation of public welfare and the improvement of life quality. This component is so critical that it has a special priority in the world system (and even from the foreign policy dimension) as national interest. In other words, this component is one of the governance measures in fulfilling demands, needs, and public rights of people. Good governance is sensitive to this point that any negligence to public welfare leads to economic challenge, reduction of the public trust, inefficiency, and motivation crisis (Huther et al., 1998).
5	Government effectiveness: being effective at the assigned tasks	A competent public sector collects its revenues efficiently and programs and budgets its costs correctly. The efficiency and effectiveness concepts include processes and entities whose results provide the needs and also give rise to the best use of the resources. In this context, two issues matter: the first is about the processes and institutes required by the society, and the second is about their organization such that public needs are satisfied with optimized use of resources (Munshi and Abraham, 2004) [23].
6	Regulatory Quality	Establishing judicial security, judicial justice, legal order, and finally, the rule of law in the economic, social, and civic relationships is one of the pillars and principles of good governance. For any country, the performance of the judiciary system is recognized as an indicator and symbol of its governance desirability. Surely, the performance of the judiciary system can distort the competent performance of good governance and make it fail (OECD Public Governance Reviews Colombia: Implementing Good Governance, 2013)
7	Rule of law	By the rule of law, we mean peace of mind and psychological security created in society. It is natural that if these measures are high for people and social entities, then the confidence in work and knowledge areas increase and risk is minimized. This is where good governance provides the community with the benefits of the rule of law establishment (in terms of justice, impartiality, and equality) (Saunders and Roy, 2003).
8	Control of corruption	Not abusing public power and control of corruption are indicators of good performance. Two major causes of corruption are lack of transparency. Good governance rests on the notion that in the process of human resource selection, competence and meritocracy is established. By the meritocracy, we mean a system that permanently seeks talents to bring up the most powerful and competent forces to tenure occupations especially the sensitive ones of management and leadership (Rose-Ackerman and Program, 1997).
9	Transparency	Transparency in good governance identifies the amount of information that is in access and how it is accessed. The lack of transparency in all its instances such as in the budget, bank, prices, financial markets, contracts, etc., is an anti-development factor (Godbole, 2004).

According to Table 1, under high values of factors with positive effects (e.g., the rule of law, accountability, and government effectiveness) and low values of factors with adverse consequences (e.g., corruption, excessive regulation, political instability, and violence), economic development can be appropriately reached. These factors are determined based on different surveys or gathering quantitative data. Currently, more than 20 international institutes are collecting related data. The World Bank publishes these factors for 177 countries (Rouhani, 2013; The Worldwide Governance Indicators (WGI) project, 2018).

Table 2. Different criteria extracted from previous studies.

No.	Criteria	Author's name	Solution approach
1	Voice and Accountability	Munshi & Abraham (2004)	
2	Transparency	Godbole (2004), Hans J. (Jochen) Scholl & Luis F. Luna-Reyes (2011)	System dynamics
3	Government effectiveness	Saeed Abedi et al. (2021)	System dynamics
4	Public welfare	Huther et al. (1998), Tiep Nguyen, Stephen Cook and Vernon Ireland, (2017)	System dynamics

5	Poverty and antipoverty	Zhang, Zhang, and Lei, Saeed (2020), Nahavandi and Ajayebi (2021).	System dynamics
6	Political stability and absence of violence	Akongdit (2013)	Data analysis
7	GINI factors	Maria Letizia Bertotti, Amit Chattopadhyay, Giovanni Modanese (2017), Niazi, Ganji, & Namvar Moghaddam, (2017), Komejani and Mohammadzadeh (2014)	Statistical data analysis,
8	Community well-being	Sibel Eker, Nici Zimmermann, Shane Carnohan & Mike Davies (2018)	System dynamics
9	Public service and policy analysis	Li and Ding (2020), Agostino, Arnaboldi (2018), Xuesong Li and Yunlong Ding (2020)	Holistic approach
10	Controlling corruption	Rose-Ackerman, & Program, (1997). Muhammad Aman Ullah, Tiru Arthanari (2011), Torres et al. (2007)	System dynamics
11	Total productivity	Saeed Abedi et al. (2021)	System dynamics
12	Life satisfaction	Niazi, Ganji, & Namvar Moghaddam, (2017) DeHoog et al. (1990)	Statistical data analysis
13	Bribe	Soto-Torres, Fernandez-Lechon, Fernandez-Soto (2007)	System dynamics
14	Integration of eight criteria of 1, 2, 3, 6, 7, 9, 10, and 12.	Current research	System dynamics

With governance's criteria identified and presented in Table 2, it can be noticed that usually, researchers have concentrated on one subject matter while relaxing other essential factors or ignoring the rest. However, many studies overlooked the governance factor in the creation and shaping of social problems by ignoring the full consideration of critical factors into one integrated model. As the literature review shows, a quantitative model considering all key factors of governance under one umbrella showing their impacts on the satisfaction of life and the GINI coefficient is rare to find. However, this complicated problem gets even more complex as governance factors and their related activities are considered simultaneously in model development.

4. Contributions and research questions

This study investigates the dynamic impacts of governance effectiveness on the satisfaction of people's life in society. This research aims to: (i) review the literature on system dynamics modeling, (ii) find key factors affecting the satisfaction of people's life, and (iii) identify factors that can be used in determining government performance regarding people's well-being and their satisfaction of life. The contribution of this study is to consider all criteria using an integrated model to study critical governance criteria for a multi-criteria structure with stock and flow diagrams. The research questions of this study are as follows:

- (1) How do endogenous and exogenous factors affect each other in a cause-and-effect manner through feedback loops?
- (2) How do dynamic governance factors influence society?
- (3) Which factors affect the satisfaction of people's life?
- (4) Which factors influence the GINI coefficient?

The prior literature has ignored investigating various factors in system dynamic modeling. However, analyzing the effects of several factors on the satisfaction of people's life. Table 2 provides some research conducted on the extracted categorized subject matter, as was discussed before.

5. Research methodology

Phase I: The extraction of factors

1. Key factors are extracted from a comprehensive review of the previous studies.
2. A group of experts were consulted to list the most significant factors affecting people's satisfaction with life about government performance. Then, our finding from the literature, as discussed in 1, was shared with the experts to finalize their decisions.
3. They are consulted with the same group of experts on determining how they may ascertain the positive and negative impacts of one factor on another.
4. By giving and getting appropriate feedback to/from the team of experts, we were able to make the study process smooth and manageable.

Phase II: Data Preparation

1. A questionnaire was given among the experts, and they were asked to indicate how much, from a scale of 0 to 1, one factor may affect another.
2. This phase was completed in two rounds to make sure that the provided data were satisfying for the experts.

6. Model development steps

The steps to develop this model are as follows:

- (1) Defining dynamic hypotheses,
- (2) Extracting key factors from the related literature and experts' opinion,
- (3) Classifying factors into endogenous and exogenous to determine the boundary of the system,
- (4) Developing a cause-and-effect diagram and a stock-and-flow diagram,
- (5) Formulating a model,
- (6) Carrying out a numerical simulation of the stock-and-flow diagram,
- (7) Validating results, developing scenarios, and providing analyses.

6.1. Dynamic hypothesis

In general, a hypothesis expresses the relationship between two or more variables that a researcher expects to prove through their study. The hypothesis is critical because it is a starting point and a foundation of any scientific research. One of the most essential benefits of drawing a primary hypothesis is that it gives readers to have a proper and more accurate understanding of the model's complexity. A simplified hypothesis can be considered as a conceptual model of the problem. In the following, the dynamic hypothesis of the problem is described using H1 through H3 signals.

H1: Political stability (PSA) has positive impacts on the control of corruption (COC) and the satisfaction of life (SOL).

H2: Governance effectiveness (GOE) has positive impacts on the satisfaction of life and corruption control (COC).

H3: Governance effectiveness hurts the GINI factor.

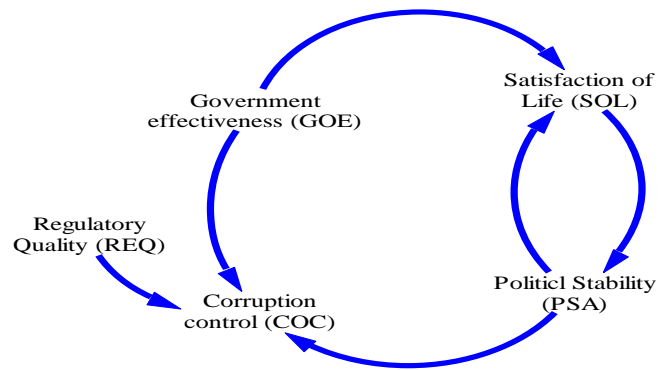


Figure 1. The dynamic hypothesis of the problem.

6.2. Factors identification and system's boundary

As future policies are made regarding the influence of independent factors on the dependent ones, it is necessary to consider factors affecting the government's popular support. A list of factors affecting popular support of governance was extracted from the previous studies and the questionnaire given to the experts. In this questionnaire, the following criteria were considered in terms of being affecting or not affecting the popular support of the government. The conceptual relationships among these factors were extracted from the experts' opinions (including social and economic specialists). The mathematical relationships also were formulated using a multivariate regression performed in SPSS software considering the affecting sub-criteria on some factors. In addition, a system dynamics model for governance was created in Vensim 6.4.

Table 3. Endogenous and exogenous factors for identifying system's boundary.

	Endogenous factors	Abbreviation for endogenous	Exogenous factors	Abbreviation for exogenous factors	Other factors
1	Satisfaction of life	SOL	General government final consumption expenditure (% of GDP)	GOVEXP	Being located in an unstable region of the world
2	Control of Corruption	COC	The income share of 4 lower tenths	S40	Sanction
3	Gross National Income Per Capita	PGNI	Unemployment Rate	UER	War history
4	Political Stability and the absence of Violence/Terrorism	PSA	The income share of 1 upper tenth to the income share of 1 lower tenth	S1010	Natural disaster
5	Regulatory Quality	REQ	per capita gross national income (PGNI)	PGNI	Under developing country
6	Rule of Law	ROL	per capita expenditure/gross domestic production	PEXP/GDP	
7	Voice and Accountability	VAA	Government Effectiveness	GOE	
8	GINI	GINI			
9	Inflation	INF			
10	Globalization	KOF			

6.3. Cause and effect diagram

As noted by Peter Senge (2016), "There is no one-sided action". A systematic thinking approach considers actions with both cause and effect phenomena. By definition, when the impact of Variable A on Variable B is in the same direction (increasing both or decreasing both), then a positive sign (+) is used. On the other hand, when the impact of Variable A on Variable B is in the opposite direction (one increasing and the additional decreasing), then a negative sign (-) is used. These rules are used for drawing a cause-and-effect diagram, which is presented in Figure 2.

6.3.1. The overall model

Figure 2 demonstrates the general model of the problem, considering the impacts of governance effectiveness (GOE) on the system under study. In this study, input variables are government effectiveness (GOE), regulatory quality (REQ), globalization index (KOF), the ratio of per capita expenditure to per capita gross domestic production (GDP), per capita gross national income (PGNI), the ratio of general government consumption expenditure to (GOVEXP), the income share of 4 lower tenths (S4), the ratio of the income share of the one upper tenth to that of the one lower tenth (S1010), and unemployment rate (UER). GOE is an outer variable impacting the system under study in different ways. The impacts of that can be seen in the inflation rate (INF), corruption control (COC), rules of law (ROL), and Political Stability and Absence of Violence/Terrorism (PSA). The impacts of this outer variable on the mentioned variables are demonstrated by the formulas in Table 6. In this model, the only created loop is between two criteria of “political stability and absence of violence/terrorism” and “satisfaction of life”, where the political stability and absence of violence factor affects satisfaction life with a lag of 1 year.

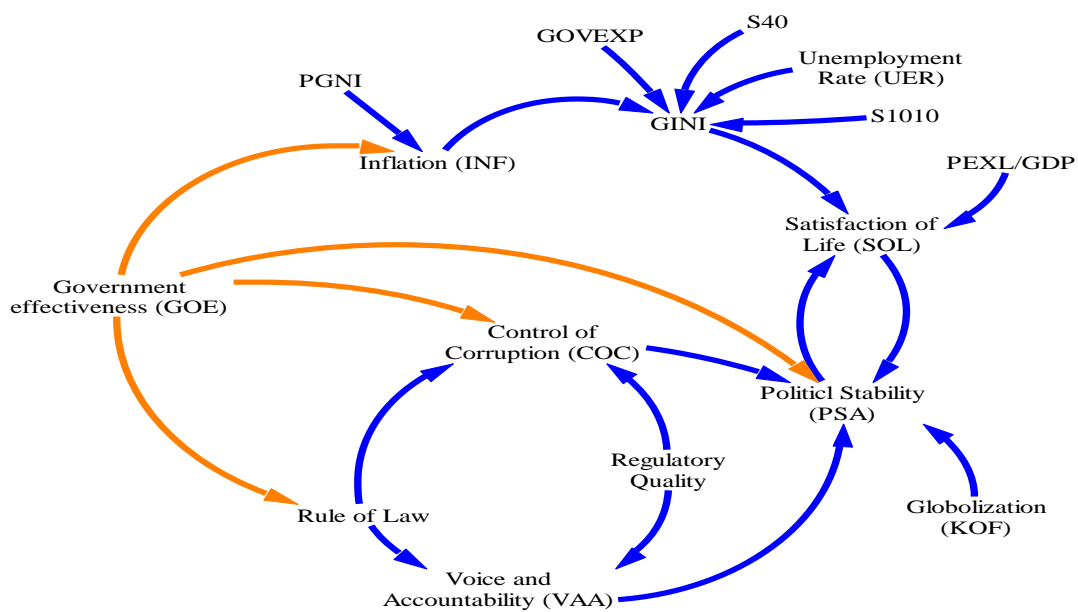


Figure 2. A cause-and-effect diagram of governance impacts on systems under study.

6.3.2. GINI coefficient

The Gini index is a widespread measure of income inequality in a society expressed as a non-dimensional ratio of the relative mean absolute difference of income between two income classes to double their mean (Maria Letizia Bertotti a, Amit K. Chattopadhyay b, Giovanni Modanese, 2017). Developed by Italian statistician Corrado Gini in 1912, the Gini coefficient ranges from 0 to 1, but is often written as a percentage. Mathematically, the Gini coefficient is defined based on the Lorenz curve. The Lorenz curve plots the percentiles of the population on the graph's horizontal axis according to income or wealth, whichever is being measured. The cumulative income or wealth of the population is plotted on the vertical axis. (<https://worldpopulationreview.com/country-rankings/gini-coefficient-by-country>). There are many factors that can influence the GINI coefficient. Our investigation of the literature points to the variables such as inflation rate, per capita expenditure/gross domestic production, the income shares of 4 lower tenths (S40), Unemployment rate (UER), the income share of 1 upper tenths to income share of 1 lower tenth (S1010) (Abedi et al., 2021).

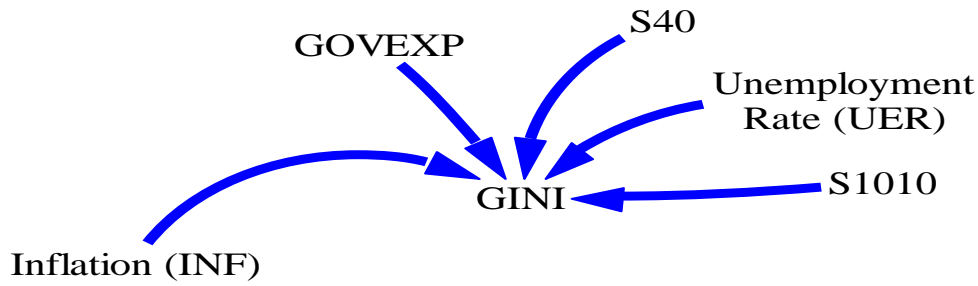


Figure 3. The GINI factor and its influencing factors.

6.3.3. The impact process of government effectiveness on the satisfaction of life

As stated by Komeijani and Mohammadzadeh (2014), this chain displays the impact of governance along with the gross national income per capita on the tax rate, and consequently, on class inequality (poverty intensity), which is eventually an affecting factor on the people’s satisfaction from governance. In this subsystem, the government effectiveness affects tax rate, and thus GINI coefficient, which indicates class inequality, is affected by inflation, the ratio of consumption expenditure per capita to per capita GDP, government total consumption expenditures to GDP, the income share of 4 lower tenths, the ratio of the income share of the one upper tenth to that of the one lower tenth, and unemployment rate.

Inflation is affected by two variables of government effectiveness and PGNI. The existence of a direct relationship between inflation and the GINI coefficient (the distribution of income among people) has been verified in several references. The relationship between these two criteria is not as simple as a regression relationship. Due to the causative relationships (interactions), the relationship between these two variables is complex and is not as simple as the mathematical relationship given in Table 6 (Asgari, 1991; Komeijani and Mohammadzadeh, 2014; Nolan, 1988). On the other hand, class inequality along with consumption expenditure per capita to GDP brings about the change with people’s satisfaction of life, and this, in turn, affects political stability and the absence of violence. This variable interacts with people’s satisfaction with life.

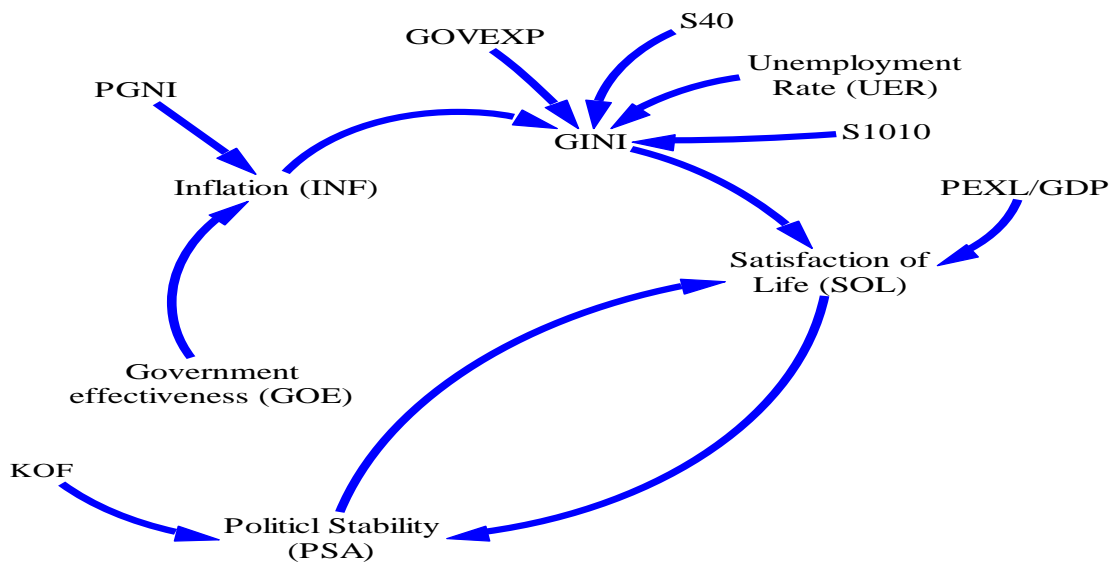


Figure 4. The government effectiveness on the satisfaction of life using the GINI coefficient.

6.3.4. Impacts of governance on the rule of law

This chain represents the impacts of governance on the rule of law and control of corruption. The control of corruption (COC) and regulatory quality (REQ) result in changes in voice and responsibility

measures (freedom of speech). The freedom of speech, control of corruption, government effectiveness, and globalization bring political stability, the absence of violence/terrorism, and people's satisfaction with the governance.

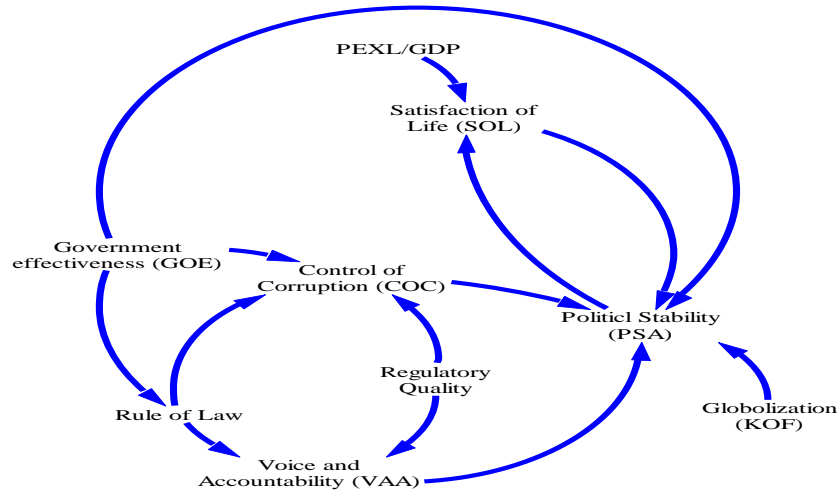


Figure 5. The impact of government effectiveness on the satisfaction of life using the rule of law.

6.3.5. The impact of regulatory quality on the satisfaction of life

The regulatory quality of both the “voice and responsibility (freedom of speech)” and the “control of corruption” affects the political stability and the absence of violence/terrorism. Therefore, it brings people's satisfaction with life. Other input parameters relate to the economic factors, which are extracted from experts and scientific references.

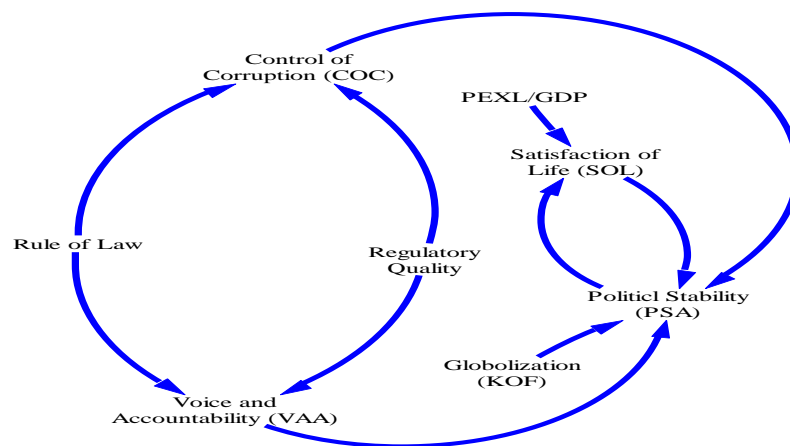


Figure 6. The impact of regulatory quality on the satisfaction of life.

6.3.6. Political stability and the absence of violence/terrorism

The political stability and the absence of violence/ terrorism are factors indicating the level of governance stability in a society and how the government manages the system by implementing its policy and making decisions. The PSA factor is influenced by five factors, including: (i) corruption control, (ii) governance effectiveness, (iii) globalization (KOF), (iv) the satisfaction of life, and (v) voice and accountability (VAA).

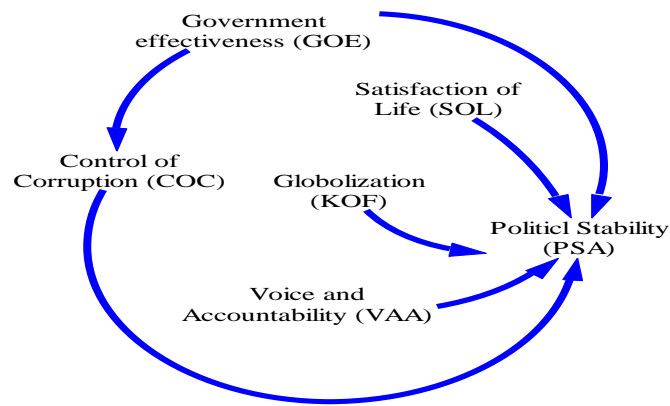


Figure 7. The impacts of some factors on the political stability and the absence of violence/terrorism.

6.4. Data description and results

The selected criteria, which are provided in Table 2, were published by the World Bank. As a remark, the globalization criterion was published on the globalization website. In addition, the parameters affecting the GINI index, as shown in Table 4, were extracted from the study by [Komeijani and Mohammadzadeh \(2014\)](#). Also, the parameters affecting the satisfaction of life index (e.g., general government final consumption expenditure, social security, political stability, the absence of violence/terrorism, distributive justice, and GINI coefficient) were extracted from the study of [Niazi et al. \(2017\)](#).

Table 4. The parameters affecting the GINI coefficient.

Criteria	Abbreviation
General government final consumption expenditure (% of GDP)	GOVEXP
The income shares of 4 lower tenth	S40
Unemployment rate	UER
The income shares of 1 upper tenth to income share of 1 lower tenth	S1010

The values of variables are considered based on the data of 11 years from 2005 to 2015, and are shown in Table 5.

Table 5. The values of variables.

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Control of Corruption	0.3951	0.3805	0.3495	0.2427	0.2057	0.1762	0.2038	0.2322	0.2796	0.3125	0.3173
GINI	0.436	0.448	0.3893	0.3841	0.421	0.3542	0.3512	0.3609	0.374	0.388	0.395
Government Effectiveness	0.3333	0.3512	0.301	0.3058	0.3684	0.3923	0.4123	0.3555	0.2891	0.3798	0.4663
General government final consumption expenditure (% of GDP)	0.1208	0.1247	0.0948	0.1005	0.1118	0.1081	0.0962	0.0946	0.0924	0.1028	0.127

KOF	Voice and Accountability	Unemployment Rate	Satisfaction of life	The income shares of 4 lower tenth	The income shares of 1 upper tenth to lower tenth	Rule of Law	Regulatory Quality	Political Stability and Absence of Violence/Terrorism	Increase of GNI/ per Capita	Personal final consumption (% of GDP)	Inflation
0.484	0.1058	0.103	0.5308	0.1487	16.46	0.2344	0.1176	0.2427	0.1765	0.5328	0.1343
0.5076	0.0817	0.121	0.5322	0.1409	17.4	0.1914	0.0588	0.1739	0.1763	0.539	0.1001
0.5094	0.0769	0.112	0.5336	0.1433	17.59	0.1579	0.034	0.1787	0.2263	0.509	0.1734
0.5204	0.0721	0.106	0.5129	0.152	15.79	0.2067	0.0291	0.1635	0.157	0.5171	0.2541
0.5213	0.0664	0.1048	0.5008	0.1516	15.97	0.1754	0.0287	0.0806	0.1157	0.5568	0.1355
0.5336	0.0664	0.1197	0.4888	0.1555	14.71	0.1564	0.0287	0.0616	0.1231	0.5373	0.1009
0.5347	0.0704	0.1352	0.4768	0.1761	11.09	0.1737	0.0569	0.0758	0.106	0.5301	0.2087
0.5303	0.0563	0.1245	0.4609	0.1778	10.79	0.1972	0.0711	0.0995	-0.1181	0.5713	0.2574
0.5365	0.0516	0.1263	0.514	0.1793	10.68	0.1643	0.0569	0.1137	0.1615	0.5481	0.3927
0.5295	0.0591	0.1044	0.4682	0.1718	12.33	0.125	0.0481	0.1714	-0.0697	0.5659	0.1722
0.5363	0.0788	0.1057	0.475	0.1696	12.65	0.1731	0.0673	0.1762	-0.1736	0.6299	0.137

6.5. Input data description and their insert

The data of variables was collected from Iran's Amar Center and the World Bank sites. The data was available for 2005-2015 years. The relationships among variables were identified according to the experts' opinions and calculated by using a multivariate regression performed in SPSS software. As a remark, the applicability of the regression method for identifying the criteria relationships was verified in previous studies, such as [Feng, Chen, and Zhang \(2013\)](#), [Fontoura, Chaves, and Ribeiro \(2019\)](#), [Hekimoglu and Barlas \(2010\)](#), [Houghton et al. \(2015\)](#), [Kazemi and Hoseinzadeh \(2016\)](#), [Rajabi \(2017\)](#), [Srijariya, Riewpaiboon, and Chaikledkaew \(2008\)](#). In Table 6, formulations for criteria changes (rows 1, 3, 5, and 7) and also formulations for criteria values (rows 2, 4, and 6) are provided.

Table 6. Criteria formulations.

	The criterion	Formula
1	INF	$0.631-0.38*PGNI-1.165*GOE$
2	GINI	$-1.63+1.939*GOVEXP +0.591*UER +6.723*S40+0.045*S1010+0.168*INF$
3	SOL	$0.03+0.007*"PEXP/GDP"-0.134*GINI+0.087*PSA(t-1)$
4	VAA	$0.006+0.321*ROL+0.161*REQ$
5	PSA	$0.333+0.466*COC+0.187*KOF+ 0.244*GOE-1.07*VAA-1.157*SOL$
6	COC	$0.326+0.639*GOE -1.654*REQ+0.588*ROL$
7	ROL	$-0.179+GOE*0.473$

7. Model validation

[Maani and Cavana \(2007\)](#) argued that the ultimate aim of the system dynamics model and its validation is establishing the validity of the structure of the model. [Sushil \(2003\)](#) stressed that "the structure of the system is what produces the behavior of that system". In this regard, the economy system will produce fragile results and hence unacceptable behaviors for goal variables. The governance model of this study has been subjected to a series of tests discussed briefly below. These tests are: (i) structure test, (ii) dimension consistency test, (3) border adequacy test, (4) mathematical formulation accuracy test, and (5) reproduction behavior test. As experts pointed out in their research ([Sushil, 2003](#); [Maani and Cavana, 2007](#); [Muhammad Aman Ullah and Tiru Arthanari, 2011](#)), "an exact matching between real data and model data points is not required for model validity". This is because a system dynamics model is not designed to include the internal and external details, however.

7.1. Testing the model structure

This test is performed to answer the following two questions:

1. Is the model structure under the existing knowledge about the design of the real system?
2. Does the model represent the structure of real systems ([Sushil, 1993](#))?

As the relationships were formed based on the experts' opinions, the model structure is verified in this way.

7.2. Dimension consistency test

Are all variables in all equations in balance at both sides? [42]. This test also was performed for the model, and because all variables are ratios and are unitless, we can conclude that the equations are balanced.

7.3. Border adequacy test

First, key variables are extracted by reviewing the literature and consultation with experts in the field. Second, variables were categorized into indigenous and exogenous factors, and compared with the extent of the problem statements it was determined whether the importance of the border is sufficient. All criteria to be studied as problems' goal variables (i.e., corruption control, GINI factor, inflation rate, the satisfaction of life, accountability, transparency, responsiveness, the rule of law, stability, equity and inclusiveness, empowerment, and broad-based participation) were considered in the model structure. Hence, the design of the problem using such variables was built and then simulated.

7.4. Mathematical formulation test

This test was noted by the study of [Muhammad Aman Ullah and Tiru Arthanari \(2011\)](#). Under this test, the equations relating to the causal loop diagram should be checked. Specifically, in the equations, the '+' and '-' signs must match the signs in the causal loop diagram. We do this test for the mathematical formulation of the problem.

7.5. Reproduction behavior test

One of the most critical tests available to analysts for model validation is reproducing the behavior of goal variables. Such results are usually compared with the historical data of related goal variables. With this test, it is determined which model variables can rebuild the amounts of historical data. Figure 8 compares model outputs with the actual data obtained from the past. When such a match occurs, the modeling results can ensure that validity for future predictions may be warranted ([Sushil, 1993](#)). The graph of each parameter, along with the statistical analysis for verifying their accordance through the years of 2006 to 2016, is as follows (fundamental values are represented in red color with points of triangular shape, and predicted values are represented in blue color with issues of the cross mark).

The proposed model, with the mathematical formulation used, generated behaviors of three key goal variables, as reported in Figures 8, 9, and 10. As Figure 8 shows, the proposed model develops a satisfying trend for the satisfaction of life, which is very closely related to the actual system behavior. Please notice that fundamental values are represented in red color, and predicted values are represented in blue color. The accuracy of forecasting using the proposed approach and mean square error for SOL is 95.43 percent.

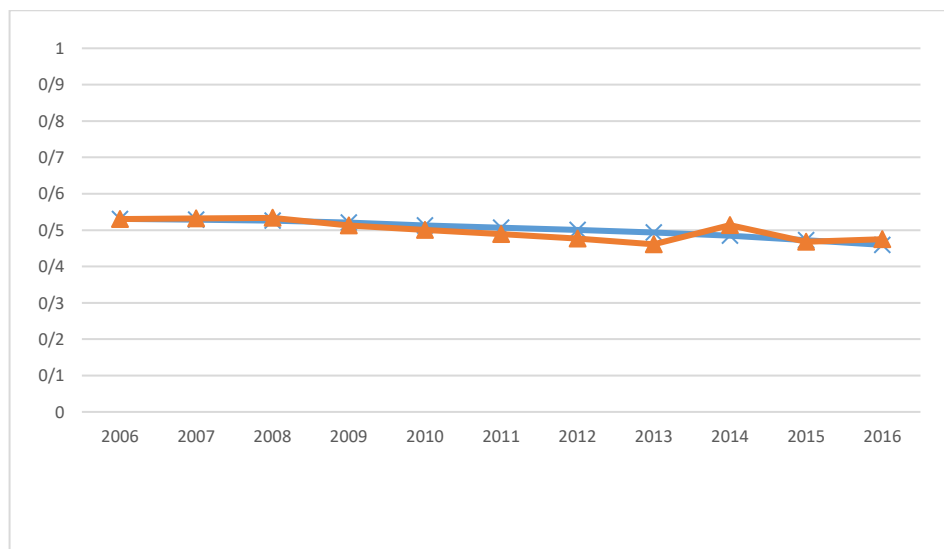


Figure 8. The reproduction behavior test of satisfaction of life measure during 11 years.

Figure 9 reports the behavior of the corruption control factor for 11 years of data. The predicted values, which are represented in blue color, with points of the cross marks, are compared with the original corruption control shown in red. However, there are some discrepancies between these two trends. The main reason is that in society, corruption is not easily controllable by the government. It may be forced to be controlled and weakened for a while, but then, in other forms and shapes, it will reappear. Since this behavior is more of the oscillating type, the pattern between 2006 to 2010 performed fine, and after that, some discrepancies appeared. The accuracy of forecasting using the proposed approach and mean square error for COC is 81.82 percent.

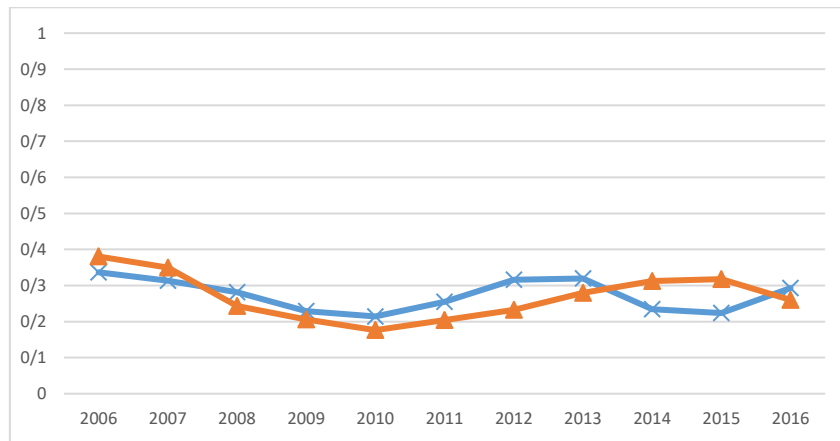


Figure 9. The reproduction behavior test of control of corruption measure during 11 years.

Figure 10 shows the behavior of the GINI factor for 11 years. The predicted values (represented in the blue line) are compared with the original corruption control (shown in red). Predicted values are highly close to the actual ones. In Figure 10, actual and expected values follow oscillating patterns. Based on the proposed approach and the mean square error method, the accuracy of GINI factor forecasting is 95.42%.

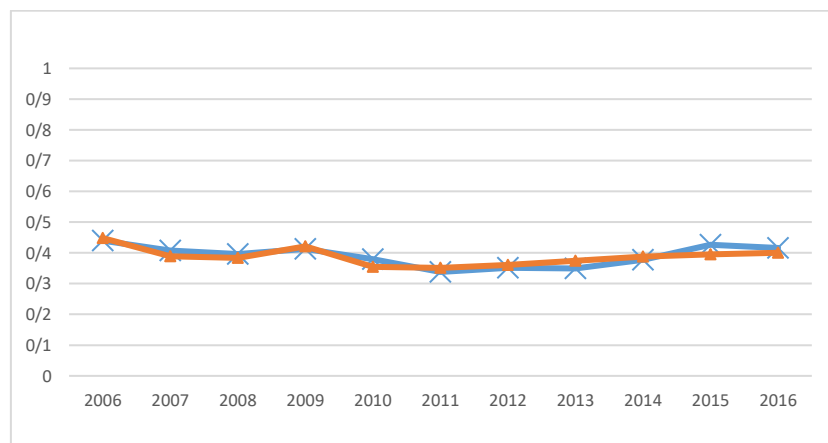


Figure 10. The reproduction behavior test of GINI coefficient measure during 11 years.

As noted by [Sushil \(1993\)](#), the system dynamics model is not used for point prediction. This model can be used only for pattern prediction. In Figure 10, the behaviors of the entire system through the model simulation approach are depicted.

8. Scenarios analysis

In this section, we introduce three new scenarios and discuss about the results of scenarios. In this study, we consider scenarios, which are most beneficial to policymakers in terms of examination and implementation.

8.1. Scenario 1: Basic scenario

In this scenario, the impacts of governance effectiveness (GOE) on inflation (INF), the control of corruption (COC), political stability (PSA), and the rule of law (ROL) are considered similar to the basic model. The results of this scenario are shown in Table 7. Other scenarios are explained in the following sub-sections. The computational results of different scenarios are shown in Table 7.

8.2. Scenario 2: (10 percent improvement in GOE performance)

With this scenario, we show the impacts of a 10 percent increase in GOE on factors of inflation, political stability, corruption control, and rule of law. Table 7 demonstrates results obtained from the calculations using the regression formula for Table 6 and data of the year 2015 from Table 5.

An increase of 10 percent in governance effectiveness brings a 3.3 percent decrease in inflation in the next year. In addition to that, this 10 percent increase in GOE has an impact of 0.2 percent improvement in people's satisfaction with life in comparison with the base value. PAS and ROL have also improved compared with their base value of -1.1% and 4.2% to -0.7% and 6.4%, respectively. We also noticed that INF has decreased by 3.3% and the GINI coefficient from a base value of 39.2 to 38.3, which is in the right direction as expected. Further analysis of Table 7 indicates that VAA and COC have also been improved. The results of this scenario show the importance of executive agencies and law enforcement and how their activities can lead to better outcomes for controlling corruption, enhancing people's satisfaction with life, improving the GINI coefficient, and so on. This is why people should vote and send the right persons to the executive offices to get effective results.

Table 7. The calculation results of proposed scenarios.

		Basic Scenario results: Percent changes	10% increase in GOE	10% decrease in GOE	50% increase in GOE
1	Inflation (INF): percent change	2.2%	-3.3%	7.6%	-25%
2	GINI coefficient	39.2	38.3	40.1	34.6
3	People satisfaction of life (SOL): percent change	-0.7%	-0.5%	-0.8%	-0.1%
4	Voice and Accountability (VAA)	3.02	3.7	2.3	6.6
5	Political stability (PSA): percent change	-1.1%	-0.7%	-1.4%	0.7%
6	Control of corruption (COC)	54	58	49.4	75.1
7	Rule of law enforcement (ROL): percent change	4.2%	6.4%	2%	15.2%

8.3. Scenario 3: (10 percent decline in GOE performance)

With this scenario, we show the impacts of a 10 percent decline in GOE on inflation, political stability, corruption control, and the rule of law. These results are shown in Table 7. Under this scenario, changes in INF, SOL, PSA, and ROL are about 7.6%, -0.8%, -1.4%, and 2%, respectively. This scenario hints that governance effectiveness plays a significant role in inflation and satisfaction of life management. The political stability of the system and rule of enforcement is also impacted by the governance effectiveness, as is expected in real-life situations. Under this scenario, the control of corruption declines from 54 (base study) to 49.4 while the GINI coefficient increases from 39.2 (base value) to 40.1, which is in the right direction as expected. The results of this scenario indicate how much government can have an influence on corruption control and GINI factors. Citizens of the countries are aware of their duties and responsibilities at the time of governmental office election would get relevant results as they expect.

8.4. Scenario 4: (50 percent increase in GOE performance)

With this scenario, we show the impacts of a 50 percent improvement in GOE on inflation, political stability, corruption control, and rule of law factors. The results obtained in critical factors are shown in Table 7. This type of scenario analysis is known as shock therapy to see how the model will react to significant changes as may be necessary for policy analysis. This study also points to the reality that people's satisfaction with life is not significantly impacted by the changes made in governance effectiveness. Perhaps, people's satisfaction with life is deeply injured by poverty and inflation that cannot be improved under high governance effectiveness very quickly. Knowing that the values shown in Table 7 are the results of one-year improvement of the GOE factor, we can conclude that it needs years of progress in governance effectiveness to get into a good value for SOL.

9. Managerial insights

This paper analyzes the interrelationships among the governance factors and satisfaction of life and GINI factors. The outcome of this study can act as a comprehensive guideline for managers in government administrations for policy implementation as well as policymakers and law institutions and enforcement. The extracted managerial insights of this study are suitable for managers and decision-makers in local government agencies, municipalities, and private and non-private organizations, as listed below.

1. Regarding this study and its related scenarios, we can suggest that an improvement of 20 to 25 percent per year in governance effectiveness is essential to bring significant changes in the values of SOL, COC, ROL, ING, GINI coefficient, and VAA.
2. An organization may use this study to research the interaction between the quality of products and customers' loyalty to their organization.
3. Measures similar to the criteria employed in this study are expected to be used by organizations to trace their internal and external customer satisfaction in contrast to the organization's performance.
4. Governance accountability and transparency, can lead to some behavior standards and benchmarks for managers of organizations.
5. Knowing that any misled information from the accounting system or vagueness of information on a company's financial situation or internal corruption can lead to a catastrophic situation for any organization, then conducting a similar study for clients' behavior tracking is highly recommended for entities.

10. Conclusion

Considering the designed model and discussions given above, it is concluded that the establishment of good governance, and consequently, popular support requires the change in significant input variables, government effectiveness, and regulatory quality, concurrently. These two variables are not obtained unless the society is meticulous in selecting the legislature and state powers and other institutes. On the other hand, the judiciary must be in line with the two abilities to reduce corruption and improve judicial justice and security, which have a considerable effect on the satisfaction of life. In other words, if these triple powers are not coordinated, people's satisfaction and thus their support for governance reduces, and this created negative loop causes all powers to become weaken gradually. As a result, the society and its indices decline.

It is suggested that the interactions of the triple powers are considered more deeply in future studies so that people can be served more appropriately. In this study, due to the lack of information, it was not possible to investigate the consistency of the model over time. Thus, it is suggested that whenever complete information is available, the proposed model is run with it, and its results are evaluated. Our observation by executing the extended model of this problem (beyond what is reported in this article) indicates that low changes in GOE (such as plus or minus 10 percent) would not generate significant changes to the governance criteria and the satisfaction of life. We also observed that only a shock of above 50 percent could make significantly impact on some key factors. Hence, as another future research extension of this article, one may consider shock therapy as a part of the model's sensitivity analysis. Research conducted here using a system dynamics approach for integrating governance criteria and factors impacting people's satisfaction with life, is functional, practical, informative, and valuable to any human-based organization. This research can be used as a guide in both product and service industries to make better manage situations.

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