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Article

From Solid Government to Self-Governance: Future Scenarios for Electricity Distribution in Iran

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Abstract

What alternatives can be imagined for the future of energy governance? The aim of this research is to foresight the main alternative scenarios for the future of the governance in electricity distribution in Iran. We used scenario planning methodology based on traditional model and a mixed method approach. So, quantitative tools such as "importance and uncertainty questionnaire", "cross impact analyze questionnaire" and "scenario wizard software" are combined with qualitative tools such as interview, expert panels, PESTEL analyze and narration. The results show that future governance can be described in five different scenarios including: big fat state, rentier government, individual market governance, collective market governance and smart social governance.

Keywords

Governance, Scenarios, Decentralization, Electricity Distribution

Introduction

Futures studies is an interdisciplinary knowledge which is a pro /pre active approach to deal with trans-disciplinary issues. In fact, many of the new theories in this field do not consider future s studies as a predictive knowledge, but believe that it is about learning and preparing for confrontation with the future (Gordon, 2008). Thus, the future is not readable because it does not exist yet; however, a futuristic study examines the views and opinions of individuals and groups about the future. These studies portray images of the future that can act as a basis for action in the present time (Son, 2012). On this basis, scenario thinking is one of the best-known and most effective methods for developing future images and alternatives. An approach based on scenario planning, is a conventional methodology about future s studies which goes beyond the limits of traditional thinking and through imagining possible or preferred future s (Bishop, Hines, & Collins, 2007).

On the other hand, the status and role of governance in the field of public utilities is an interdisciplinary issue and has been the subject of debate for decades in the economic, social, political and legal spheres. Public service organizations in the new environment with increasing uncertainties are supposed to provide solutions for public issues which can meet the diverse and sometimes conflicting expectations of policy makers and citizens at the same time. Similarly, along with growing changes in more turbulent environments, the complexity of energy systems has increased over decades and has become an important factor in many social, economic and political arrangements (Wilbanks, Bilello, Schmalzer, & Scott, 2012).

However, almost all reports from energy outlooks (including by the World Energy Agency, Shell, BP, etc.) are only about the future of fuels and technologies. These studies almost never refer to people and therefore technocratic decision-makings (with the help of experts in the energy industry) have happened without a public

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partnership in the energy sector. It is a widespread trend in the world and public energy choices are depicted in the form of simple choices between different types of fuels and technologies (Laird, 2013). This reductive view is exacerbated by regulatory and executive processes which merely emphasize on technological and economic dimensions of energy policy formulation and neglect other dimensions such as health, environment, partnership, security and justice in transformative energy systems (Graffy, 2011).

By the way, any comprehensive energy analysis and sustainable policy development in this area requires a holistic insight about the driving forces of change and the factors that influence the evolving of potential futures (Miller, O'Leary, Graffy, Stechel, & Dirks, 2015). On the one hand, we need a holistic and long-term view that takes into account the uncertainties caused by the process complexities, and on the other hand, such an approach can be effective when it comes from widespread and extensive social interactions between all players and actors in the energy field (including government, industries, private sector, markets, civilian organizations and especially citizens).

In this regard, the purpose of this paper is to explain the future of the governance in the field of energy distribution in Iran. So it is focused on identifying and determining the leading scenarios in the field of energy distribution and providing an overview of each alternative through the use of scenario planning approach. The main questions here include: "what alternatives future energy governance can be imagined in the next twenty years? Are there any new discourses in addition to dual government/market paradigm, going to be developed in this area? And whether it is possible that future developments will be influenced by emerging trends and new factors?"

The present paper seeks to find the groundwork for answering these questions by exploring and describing the alternative related scenarios. For this purpose, having short depicting the context of Iran in the field of electricity distribution, the function of energy scenario planning has been reviewed and methodological attempts have been made to use the scenario planning process to identify, explain and compare alternatives for the future of the energy distribution in Iran. Also, due to its futuristic perspective, this study attempted to deal with different dimensions of the energy governance issues through the interdisciplinary and multidisciplinary futures studies approach with a holistic and systematic view and without limiting to the disciplinary (technical/economic) constraints.

The Context of the Current System of Power Industry and Electricity Distribution in Iran

In the last two decades, the power industry in Iran, in line with the global restructuring of the world's electricity industry has made structural changes such as decentralization, deregulation and privatization. However, due to some economic and legal constraints, as well as the specific social, political and cultural conditions in the country, there is still much inefficiency in the performance of the industry (Vaziri, 2012).

The restructuring of the electricity industry, based on national energy policy and macroeconomic conditions, is a very complicated task, and it is not the same solution for all countries (Kirschen & Strbac, 2004). However, the following four agendas are proposed for the reform process in the Iranian electricity industry by the first consultant of the Iranian Electricity Restructuring Project: unbundling, deregulation, creating a competitive environment and privatization (SGGroup, 1997). Each, have been pursued in some way.

Traditionally, the government in Iran, like most developing countries, has had widespread involvement in economic affairs and has been involved in various fields, including the production and distribution of goods and services, pricing, industries, and the like and thus created a huge bureaucracy. In addition, a group of affiliated holding companies, as a large quasi- private sector, have taken a significant part of economic activities and operate in a variety of industries, including the electricity industry. Factors such as the security approach to energy supply, the resilience of government stakeholders, the weakness of the private sector, the lack of maturity of civil institutions, Inadequate legal frameworks and also cultural pressures and ideological concerns have created powerful intermediary institutions (Marzban & Mohammadi, 2016). These rentier institutions benefit from widespread political rents.

These quasi-private entities, cover the appearance of privatization policies. While, for the real private sector, which does not enjoy the benefits of the public sector and affiliated entities, the incentive to invest in the production and distribution of electricity is very limited. Management and ownership in the electricity industry

are virtually in the hands of the government and quasi-private sectors dependent on the government. In addition, subsidies are largely allocated to electricity and the prices are not real. actions such as the independence law of distribution companies, the launch of the wholesale electricity market and the transfer of power plants to the nongovernmental sector, have been evaluated by many, unsustainable (and even demonstration) measures that enhances the complexity of the state-owned enterprise structure.

The same conditions apply to the electricity distribution system in Iran. The government's concern about security of electricity supply - as a public good - has prevented the implementation of privatization policies in the distribution sector. The distribution system in Iran is currently operated by electricity distribution companies. According to the 2005 law, these companies should be independent companies, but 100% of the shares of these companies are available to state or semi-government companies; 40% of shares in distribution companies are state-owned preferred shares and 60% are in the form of non-state ordinary shares;

However, they are in fact state-owned companies, because first, the government holds the management of these companies through preferred shares; and secondly, 60% of its ordinary shares are also owned by a semi-governmental corporation whose shares and control are in the hands of the government too. Actually, the shells of these companies were privatized and their core (thinking, regulation, behavior and control) remained public.

Despite the fact that electricity distribution companies are supposed to act as a corporation and comply with economic relations, due to their managerial and financial dependence on the governing bodies of the industry, they are practically dependent in deciding and organizing their relationships and do act as a government agency. Also, due to continued financial dependence on the government, they find no reason to insist on corporate activities (based on income and expenditure). In such a situation with a lot of complexity and lack of certainty, scenario thinking is an essential requirement for understanding future alternatives.

Scenario Planning in the Field of Energy Governance

Rapid technological developments, better understanding about economic risks and recognition of more comprehensive environmental benefits have affected all aspects of social life (IRENA, 2014). These changes not only change the way of production and consumption of energy, but also affect the experiences and lifestyle of individuals' living in future communities (Miller et al., 2015).

The concept of "decentralization" is usually signified in governance reforms and considered as a potential tool for increasing learning, accountability, efficiency and effectiveness of governance, conflict resolving and collaborative action (Faguet, 2014). This tendency was first developed through the concept of "privatization". However, following shortcomings and limitations of market experience (concluding that the mere market solution always and everywhere does not provide the best answer to public problems), ultimately reinforced democratic discourses and reformed the concept of governance as a triangle shaped by public sector, the private sector, and civilian organizations (Donahue, 2004). Integrating these three parts forces together and creating a new sector can lead to the emergence of a new approach that fosters innovation through co-operation and leads to more favorable social and economic outcomes (European Commission, 2013). From this perspective, the concept of governance is beyond the hierarchy regulatory or energy policy, and it involves collective decision-making processes, network relations, and institutional settings. It seems that these are the same challenges for improving the governance system in the area of energy distribution in Iran.

Due to these governance changes, it seems that the electricity system is at the beginning of the path of great transition (Hojckova, Sanden, & Ahlborg, 2018). The emergence of new technologies as well as new emerging trends in market and policy making, such as renewable energies, power generation in consumption site, s mart regulation and more participating customers, are some evidences for this transformation (Brown, 2014; Fratzscher, 2015).

By the way, in today's world, some factors such as increasing number of actors, growing competition, developing technology, disruptive innovation and also the emergence of new knowledge patterns and new ways of thinking that traverse disciplinary boundaries through transdisciplinary approaches, caused uncertainty to grow

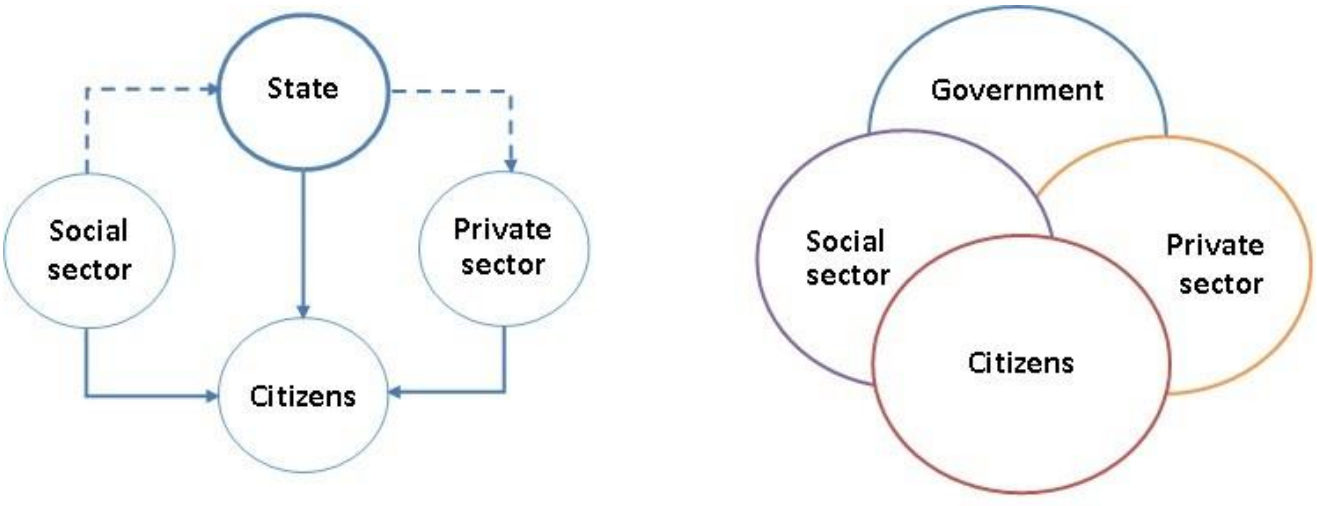

Fig. 1: The changing relationships of governance in delivering public outcomes (Christiansen & Bunt, 2012)

increasingly (Gidley, 2010). So, facing up to the future and the uncertainty that surrounds it, in an intelligent and pragmatic way, is a critical necessity (Glenn & Gordon, 2009). However, these complex environments are fertilized contexts for scenario thinking. By explaining the evolution path of the drivers, trends, events, backgrounds and casual forces, the scenarios expand structural thinking about the future (Borjeson, Höjer, Dreborg, Ekvall, & Finnveden, 2006). In addition, scenario based planning can be used to simulate and inform policy discussions through revealing critical uncertainties and reflecting radical and possible alternatives (Misuraca, Broster, & Centeno, 2012). Indeed, scenario based approach can help us to create images and stories about the future by recognizing some of the important elements and factors that will probably affect future structures (Bostrom, 2009).

Hickford et al. (2014) have argued that demographic changes, economic growth, technological innovation and behavioral changes in communities are among the driving forces effective on future energy scenarios. Also, Höjer, Gullberg and Pettersson (2011) have emphasized that finding ways to organize a social life style that does not exacerbate the environmental crisis is a key challenge in the field of energy. In this regard, scenario analysis in futures studies is a way of inclusive describing of the future, accessing different perspectives in the field of study, creating alternative futures, identifying drivers and risks in different scenarios, and reducing the risks by using alternatives (Inayatullah & Song, 2014).

For example, Gollwitzera, Ockwell, Muok, Ely and Ahlborg (2018) have shown how electricity in mini-grids might be understood as a Common Pool Resource (CPR) and how this human-made product - due to its network nature and institutional characteristics - can be managed based on a sustainable model of Natural Resource Management. Based on Agrawal's (2001) research on shared ownership, they have explored how the electric energy in a mini grid, has the characteristics of a shared resource. These facts describe why community based governance models (McGranahan, Songsore, Kjellen, Jacobi, & Surjadi, 2001) can be useful for resource management approach in the field of electricity distribution. In the same way, Weinrub and Giancatarino (2015) claim that decentralized renewable energy systems can provide greater economic benefits for the local community, greater local entrepreneurship, more sustainability and more empowerment for local communities to control energy resources.

These series of studies have revealed the fact that electricity energy systems are in transition to a new state in which the centralized and large-scale energy distribution networks face new challenges, and local smart grids and self-sufficient disconnected off grid networks (both based on prosumers) are expanding rapidly. But despite the fact that numerous studies have previously dealt with the future of electricity systems, there are still significant gaps in the holistic evaluation of more complete set of sociotechnical system elements that can create and support alternatives futures (Hojckova et al., 2018). In this context, scenarios can show that how the

emergence of different futures can be possible from the present time (Vriens, 2004). This paper, clarifies the issue.

It should be noted that scenario based planning, requires the participation of all players. Indeed, co-construction of scenarios between different players and experts, allows for the explicit negotiation within and among interest groups and enables them to collaborate and agree on priorities (Withycombe, 2014). It has been shown that collaborative governance and co-operative methods are significantly effective in understanding the economic and political conditions of energy supply regimes and organizing related activities (Foran, Fleming, Spandonide, Williams, & Race, 2016). Consequently, the resulting scenarios can help stakeholders and decision makers to assess common understanding of the issue and evaluating policy options (Reed & Kasprzyk, 2009). All of these are also important for the distribution system in Iran.

Research Methodology

The present paper used an applied method in terms of the type of research objectives, and in terms of data collection method, a mixed method (quantitative and qualitative) with exploratory and descriptive future oriented approach has been used. Accordingly, it sought to diagnose and describe the most probable scenarios in the field of future electricity distribution.

The present study, based on a traditional scenario planning approach, was organized according to the steps of the Schwartz methodology to identify and rank the key factors and also the main drivers and uncertainties. Based on these findings, the scenario logic has been designed as a scenario wizard software output and then, expert-based explanations have been developed. In the end, using the findings recorded in the panels and interviews, five main scenarios were written and narrated (See Table 1).

Table 1: The process of developing scenarios matched and based on the Schwartz model (1992)

Step 1: Identifying focal issue or decision (explanation of the research problem)
Step 2: Identifying the key factors in the environment (reviewing literature and interviewing experts).
Step 3: Ranking the key factors based on their importance and uncertainty (questionnaire)
Step 4: Determining the driving forces and major uncertainties (Panel of Experts)
Step 5: Selecting the scenarios logic (CIB matrix inventory and scenario wizard software)
Step 6: Fleshing out the scenarios (panel of experts)[1]

In this research, a panel consisting of eight experts familiar with the Iranian electricity industry (specialized at least in one of the predetermined related fields including economics, power engineering, management, futures studies, sociology and law) was held in four meetings during two months. Each one of the expert was a professor or manager or a specialist in the field of public utilities in Iran and familiar with the Iranian electricity industry. Due to the very limited and yet uncertain statistical society, in the interview phase, a Snowball sampling method was used to find the experts.

In determining the time horizon, it has been attempted that this horizon, firstly, is not so close that the expectation of significant changes seems unlikely and at the same time, is not so far as to make it hard to imagine. Accordingly, the twenty-year vision defined for the scope and horizon of the research. It's expected that this horizon provides the results more practical for stakeholders and more effective for strategists and policy-makers.

Findings

Over the coming decades, different communities across the globe, will face diverse uncertainties and choices about how to produce, convert and use energy by new ways (Miller et al., 2015). Therefore, any analysis related to the future of energy should be done through the evaluation of its constructive elements and its formation process (Grunwald, 2011). In this part of the paper, after clarifying the questions (the first step of the Schwarz model), the actions and findings are presented in the five sub-sections as follows:

- Identifying the key factors and determining of driving forces and key uncertainties.
- Selecting the Scenario Logic.
- Developing future governance scenarios in the field of electricity distribution.
- presenting a conceptual model and Comparison of scenarios.

Identifying the key factors and determination of driving forces (and key uncertainties)

Key factors are important variables in the environment that can play a significant role in shaping future options. In this regard, through the study of related literature and interviews with a number of experts, a comprehensive assessment of variables, trends and events related to the case of the study was carried out and the initially list of 92 factors influencing the future of governance in the field of public utility in general (and electricity distribution in particular) was collected. Then, a questionnaire was designed and used to assess and rank the "importance" and "uncertainty" of the factors (and determine the key factors).

Sampling was based on qualitative method among professors, managers or specialists who are well known in the industry or scientific community and are known as an expert in the research issue. Accordingly, the questionnaire was sent to 62 experts and finally, 34 responses received from target community. The number of contributors, by the distinction of expertise, is shown in Fig. 2:

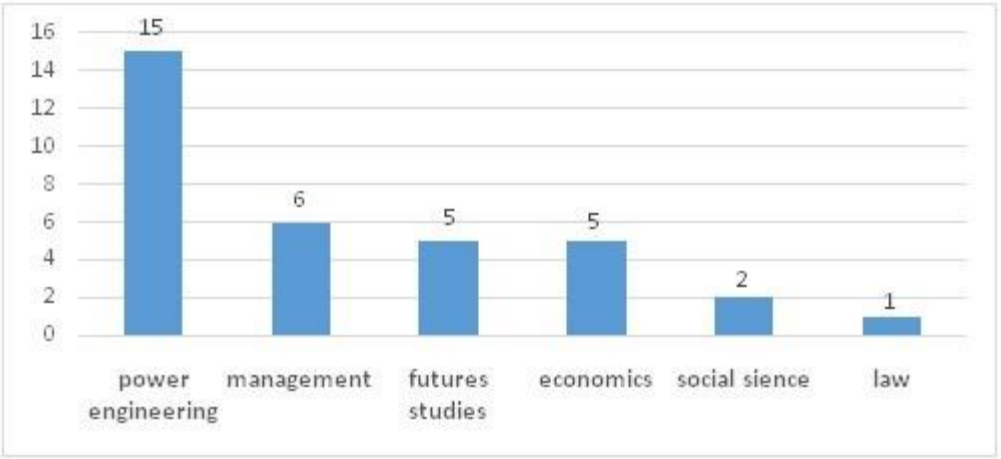

Fig. 2: Demographic analysis of respondents to the first questionnaire

Based on the analysis of the responses received from the experts, the matrix of the key factors affecting the future of governance in the distribution of electricity was formulated in the panel of experts.

According to the experts' views, all 20 variables with an estimated significance and uncertainty of over 4.5, were considered as key factors. Additionally, three other critical variables whose significance was above 5.5 but their uncertainty was less than 4.5, were also selected as key factors by the experts in the panel. As a result, 23 variables from the 92 primary variables were identified as the key factors in shaping the future of electricity distribution (See Fig. 3&4):

In the scenario analysis, the uncertainties arise from the driving forces. Therefore, systematic identification of drivers, were realized through the analysis and clustering of the key factors. Based on this, 23 key factors were discussed and analyzed at the expert panel; it was tried to set factors with common and closely relationship with one category. Finally, these key factors are classified into five driving forces based on their joint implications, as described below (See Table 2,3,4,5 & 6).

The outputs of the expert panel at this stage are the five main drivers (and uncertainties of each one). As a result, the most important driving forces of the future of power distribution in Iran, has been summarized and depicted in Fig. 5.

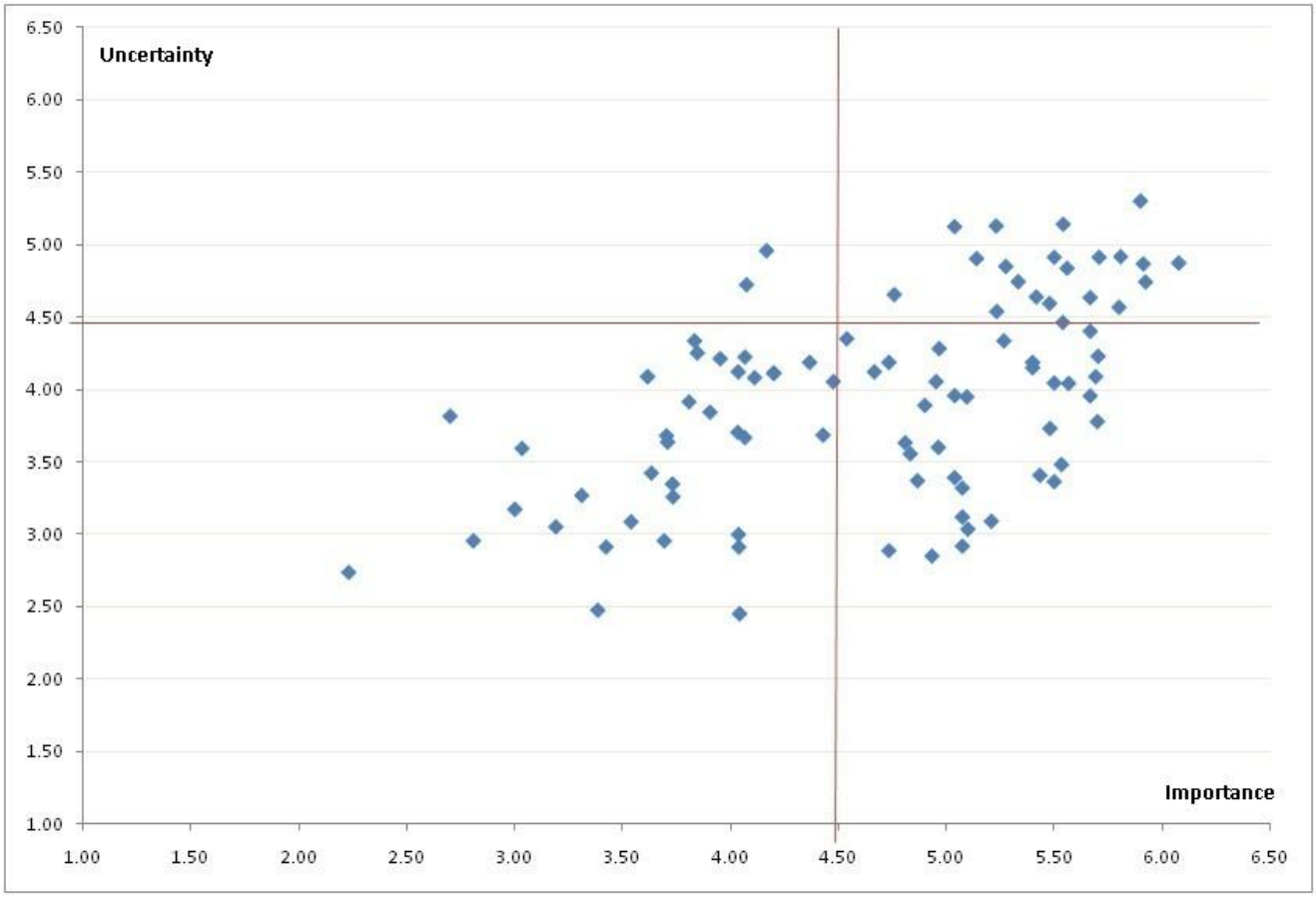

Fig. 3: The matrix of factors affecting the future of governance in the distribution of electricity

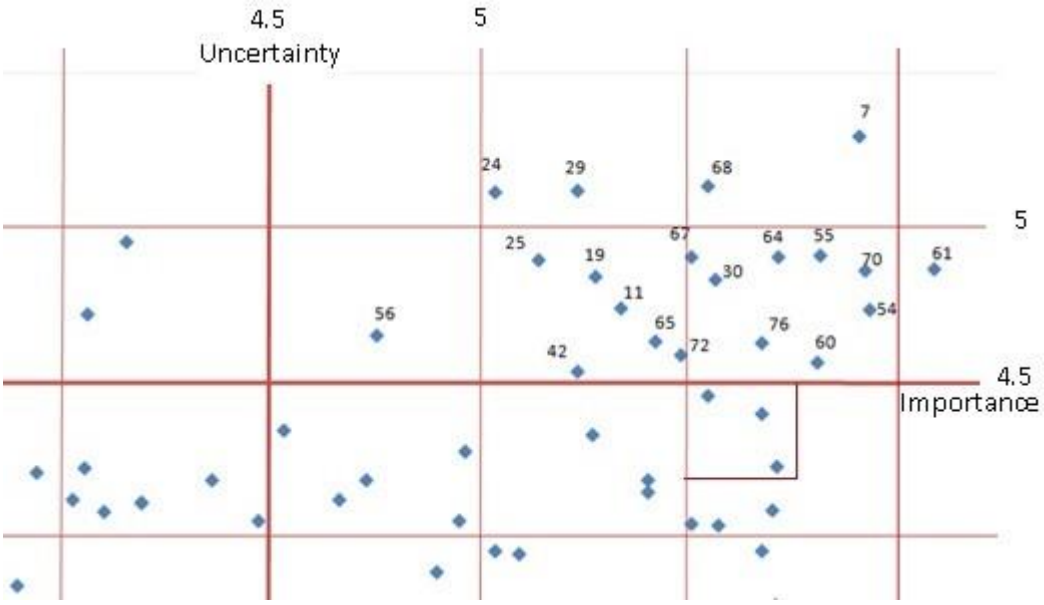

Fig. 4: Matrix of key factors affecting the future of governance in the distribution of electricity

Table 2: Determination of the first driver (and its uncertainties)

Key factors (and ranks)	Monopolies due to the influence of quasi-private institutions	2
	Political rents versus accountability	3
	Political approaches in the process of privatization	5
	Disagreement over macro levels of the government over governance practices	6
	Adherence to democratic rules in decision makings	7
	The commitment of senior managers to national policies and development plans	9
The main themes	Monopolization, eliminating rent, development, democracy, accountability	
Driver 1	**The political approach of the political system**	
Uncertainties	Totalitarian	
	Combined (rentier)	
	Democratic	

Table 3: Determination of the second driver (and its uncertainties)

Key factors (and ranks)	Transparency of economic interactions and non-discriminatory inform of economic opportunities	4
	Governance Approach to Business and Innovation Model in the Public sphere	8
	Collaborative and decentralized approaches in providing local services	18
	Attracting international partnership and cooperation in the energy sector	20
The main themes	Decentralization, non-discrimination, transparency, liberalization, good governance	
Driver 2	**Economic governance model (how to provide public services)**	
Uncertainties	Government (centralized)	
	Competitive (market oriented)	
	Collective (community-based)	

Table 4: determination of the third driver (and its uncertainties)

Key factors (and ranks)	Citizenship rights and the right to choose	10
	Decentralization of public policy making processes	11
	The role and participation of civil society organizations and NGOs	13
	Empowering local and network governance	16
	Open participation of elites and experts in socio-political decision-making	17
The main themes	Participation, empowerment, diversity, citizen rights, civil society	
Driver 3	**Social partnership capacity**	
Uncertainties	Limited participation	
	Individualized participation (private)	
	Collective participation (civil)	

Table 5: Determination of the fourth driver (and its uncertainties)

Key factors (and ranks)	Managerial approach to competitiveness and participation in the industry	1
	Independence of the regulatory (from the state authority)	12
	Assigning ownership and management of electricity distribution companies to the non - governmental sector	14
	Financial/managerial independence of electricity distribution companies from governmental holding company	15
The main themes	Regulatory, non-governmental actors, real prices, independency and ownership	
Driver 3	**Relationships inside the industry (between distribution companies with the government)**	
Uncertainties	Affiliation	
	Ownership independency	
	Ownership and management independency	

Table 6: Determination of the fifth driver (and its uncertainties)

Key factors (and ranks)	Technological innovations in the field of information technology (block chains, big data and ...)	19
	Smart control and operation technologies in power distribution network	21
	Optimization efficiency and storage technologies (energy saving)	22
	Distributed generation technologies in place of consumption (from renewables)	23
The main themes	Innovation, smartness, renewable energy, energy efficiency, storage, distributed generation	
Driver 3	**Development of new technologies**	
Uncertainties	Decreasing growth	
	Constant growth	
	Increasing growth	

Fig. 5: The main drivers developing the future governance scenarios in electricity distribution system

Selection of Scenario Logic (cross-impact analysis and scenario wizard software)

The logic of the scenario planning in this research (according to the Schwartz model) is to identify the main alternatives for the future of governance in the field of electricity distribution in Iran. The logic of shaping scenarios comes from the connection and compatibility between descriptors (the uncertainties). As mentioned in section 5.1 (by presenting the results of the experts panel), the future of governance in distribution of electricity, depends on five key drivers, and for each of the drivers, three different uncertainties are determined.

According to this, potentially 243 scenarios (i.e. 3 x 3 x 3 x 3 x 3 scenarios) from different combinations of uncertainties are theoretically possible. However, only a few of these theoretical situations can be relatively consistent in the real world, and fewer of them can be combined with strong consistency.

An efficient and complete calculation of all consistent scenarios requires an evaluation software which applies the CIB^2 algorithm to the cross-impact data. The input data of this software is based on cross-impact matrix. This matrix is used to derive expert opinions about the effect s of the descriptor s in different situations. Ultimately, by

computing direct and indirect effects of the states on each other, consistent scenarios are preceded by the software.

At the end of this phase, 18 of the 34 selected experts, completed the cross impact analyze questionnaire (Fig. 6).

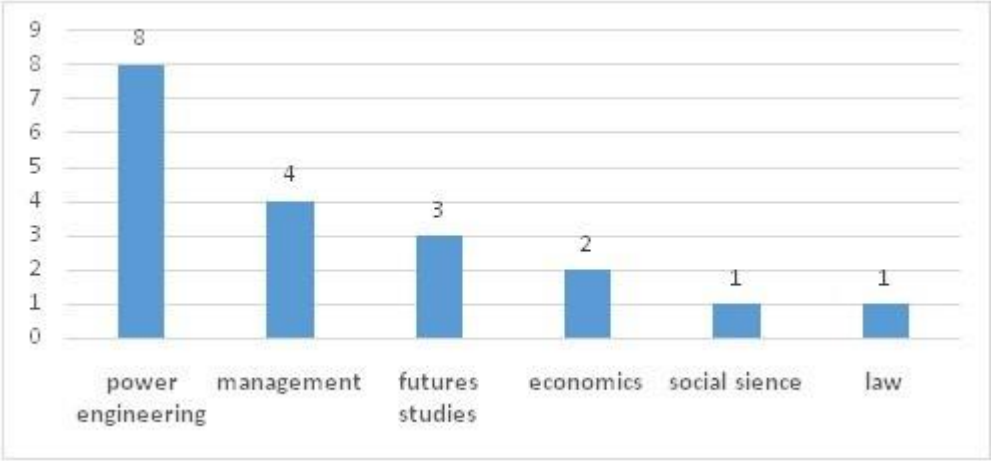

Fig. 6: Demographic analysis of respondents to the second questionnaire

The results were discussed in the panel. The interactions between the existing uncertainties were defined in a range of 3 to -3. The resulting matrix was recorded as input data in the software.

Table 7: The cross-impact analyzes matrix based on different uncertainties of driving forces

Government Political Approach												
Totalitarism				3	-1	-1	3	-1	-2	2	-1	-2	2	1	-1
mixed (rentier)				2	1	1	1	1	0	2	1	-1	0	2	0
Democratic				-1	2	2	-2	2	3	-1	1	2	-1	-1	2
Economic Business Model															
Governmental (centralized	3	2	-1				2	0	0	3	-1	-2	1	1	-1
Competitive (Market oreinted)	-1	1	2				-1	3	2	-1	1	2	-1	0	3
Collective (Cummunity oriented)	-1	1	2				-2	1	3	-1	2	2	-1	-1	2
Social Engagement Capacity															
Non (less) Participation	2	1	-2	2	-1	-2				1	0	-1	1	0	-1
Individual Participation (Privative)	-1	1	2	0	3	1				0	1	2	-1	0	2
Collective Participation (Civil)	-2	0	3	0	2	3				-1	1	2	-1	0	2
Relations Whitin The Industry															
Dependency	2	2	-1	3	-1	-1	1	0	-1				1	0	-1
Ownership Independency	-1	1	1	-1	1	2	0	1	1				0	0	1
Ownership and mgm Independency	-2	-1	2	-2	2	2	-1	2	2				-1	1	2
New Technology Development															
lowering (steady) Growth	2	0	-1	1	-1	-1	1	-1	-1	1	0	-1			
stable Growth	0	2	0	1	0	0	0	1	0	0	0	1			
Increasing Growth	-1	0	2	-1	3	2	-1	2	2	-1	1	2			

Each scenario is a combination of uncertainties (descriptors), and the software will recognize a number of scenarios as scenarios with high consistency among all possible scenarios. The metrics for determining more consistent scenarios are two scenario indicators: "total impact score" (a positive point) and "consistency value" (a non-negative point). Accordingly, the software output, consisting of five different scenarios with the strongest internal consistency among the main uncertainties, as follows:

Table 8: Final description of the final five scenarios in terms of key uncertainties and driving forces

Scenarios	**Scenario 1**	**Scenario 2**	**Scenario 3**	**Scenario 4**	**Scenario 5**
Uncertainties	**Big Fat State**	**Rentier Government**	**Individual Market Governance**	**Collective Market Governance**	**Smart Social Governance**
The political approach of the political system	Totalitarianism	Mixed (rentier)	Democratic	Democratic	Democratic
Economic governance model	Centralized	Centralized	Market oriented	Market Oriented	Community oriented
Social Partnership Capacity	limited Participation	limited Participation	Individual Participation	Collective Participation	Collective Participation
Relationships inside the industry	Dependency	Dependency	Ownership and management Independency	Ownership and management Independency	Ownership and management Independency
Development of new technologies	Decreasing Growth	Stable Growth	Increasing Growth	Increasing Growth	Increasing Growth
Total Impact Score	37	28	44	44	44
Consistency Value	3	0	0	0	0
Fundamental values	Authority and concentration	Security and stability	Development and competitiveness	Independence and participation	Cooperation and intelligence

Developing future governance scenarios in the field of electricity distribution

Based on the findings of the previous steps, probable scenarios about the future of governance in the field of electricity distribution can be summarized in five main scenarios as bellow. The narration of each scenario is retrieved from the expert descriptions in the panels and interviews.

First scenario: Big fat state

The government strives to sit on top and expand its authority and scope. According to this scenario, ownership and management are fully controlled by the powerful great government. So, this situation decreases economic efficiency and undermines other potential actors in the realm of governance (market and civil society). The government is very tight in terms of financing and investing in the energy infrastructure. The competitiveness of industries in the international arena has been greatly weakened. Citizenship rights and participation do not play an important role in the mind of government executives, while public service (including electricity distribution) is the duty and responsibility of the state.

By increasing the inability and inefficiency of state in generating and supplying electric energy, there will be large blackouts in different regions of the country. Citizens, who have recognized the government as responsible for the electricity supply, would protest against rising prices. The distribution and transmission network is worn out and the government does not have the necessary financial support to maintain and develop the network.

In this scenario, state-owned energy distribution companies are responsible for providing electricity to consumers and the private sector is very weak, fragmented and do not actually have a macroeconomic role. Therefore, the government finds the only way to delay the collapse of the industry in the unprofitable injection of funds and subsidies.

Second scenario: Rentier government

In this case, market orientation and economic liberalization, are partially implemented, but as the first scenario, this process is planned in such a way as to preserve the authority and dominance of the state (to control and manage of relations in the field of public utilities); so there is still a significant gap in order to reach the real concept of governance. The shares of electricity distribution companies are transferred to semi-private Government-controlled institutions. Thus these companies still have the nature of the administration, rather than complying with corporate rules.

Indeed, economic, social, financial, legal, and international pressures have forced the government and state to delegate part of its ownership and management of public services to the nongovernmental sector. But some circumstances such as the security attitudes in the energy sector and political interests of the government power owners, create powerful intermediary institutions that use their widespread influence in the government and their financial resources to benefit from extensive political rents; consequently, instead of real competition, multilateral monopolies are formed between limited actors and under conditions of lack of transparency.

Therefore, despite the relative and formative privatization, the expected economic benefits and social participation are not accrued; instead, a new class of dominant intermediary institutions is formed (these new institutions - which benefit from rentier situation - are themselves a more serious obstacle to private sector development and overcome government monopoly). These semi-government institutions have the same function and effectiveness as previous state institutions, but they have new financial resources and cover the appearances of implementing privatization policies. However, energy prices are not yet modified and the consumption pattern has not changed. Finally, security of supply in the long run will be at risk due to inefficiencies and inadequacies of the system and this causes public dissatisfaction with the government, in the absence of accountable civil institutions.

Third scenario: Individual market governance

The government has committed to privatization and transferring of property ownership rights in the field of public utilities. Investors and independent private enterprises are interacting in a free, competitive and non-discriminatory environment. As the gradual formation of necessary institutional and leg al foundations, needed willingness in the pillars of governance for transferring ownership and management of affairs to the private

sector is created. Simultaneously, actors and private investors become more powerful and they are voluntarily entering the supply chain of energy, initially with the government's supportive policies, and then by ensuring the establishment of a competitive market (Which reduces the risk of competing with the government).

Electricity distribution companies are divided into two sections: Commerce and Wire. The wire management section in distribution companies (which are generally private, unless the private sector is reluctant to participate) is solely responsible for the transmission and maintenance of the network. The provision of services and electricity to consumers is fulfilled only through electricity retailers (which are necessarily private and independent commercial companies).

The electricity retail market and the electricity exchange is activated and more energy exchanges in the electricity markets take s place through bilateral contracts between independent private actors (including suppliers and consumers of electricity). According to this scenario investment security and incentives for private investors are growing. At the same time, technological solutions such as distributed generation, simultaneous generation of electricity and heat and the production of electricity from renewable energy sources are increasing eventually. Energy prices are shifted to a real level and subsidies gradually go down. However, the dominant culture in the society knows the government responsible about any disruptions to electricity supply. Even the public may evaluate the entire privatization process as a government trick to monetize and mitigate the burden of responsibility.

Fourth scenario: Collective market governance

The development of social participation (compared with the third scenario) from individualism to collectivism has made it possible to make better use of social and urban capacities for excellence in governance. It can eliminate some challenges of the market governance scenario. In fact, the full manifestation of governance in this scenario has been achieved by optimizing the cooperation and synergy between the three parts of governance (including state, market and civil society).

In this scenario, numerous single private actors in the free market are not the only determinant of economic relations; rather, the associations and non-governmental organizations are important actors in the economic interactions and play a significant participatory and monitoring role in the public domain. Thus, the government has recognized the sovereignty of citizens and the institutions such as NGOs and corporations have an active presence in the social and economic spheres. Social capital has grown dramatically in the community and the government, without direct intervention, merely directs the macroeconomic environment.

A number of energy distribution companies have private ownership and management (in the form of corporate property or investment consortiums). Some others have a cooperative ownership and management (with involvement of civil society) and a number also are owned and managed by the urban management (municipalities). Along with the competition rules, growing social demands and stakeholders expectations also play a major role in forming partnerships and directing interactions.

Thus, 39 state-owned electricity distribution companies are divided and minified to many small and non-governmental distributive companies, each one work in a small geographic area with local management, providing local services and having a local governance. Actually, through the transformation of distribution companies to some small and defused companies (having private or cooperative ownership), the distribution grid is split into very small mini-grids. This makes it possible for getting access to connected smart grids. It is also provided an appropriate field for off grid growth in rural areas. Furthermore, the network security is increased dramatically.

Fifth scenario: Smart social governance

Public institutions and associations are the most important actors in the economic arena. Formal and voluntary collective organizations (such as think tanks, NGOs and local organizations), along with government and private enterprises, play a significant role in monitoring and policy making. In this regard, social and political decentralization leads to the empowerment of citizens and as a result, increases the participation of citizenship groups.

In addition to markets, local utility organizations such as consumer associations and consumer service communities are formed to manage collective actions. They can lead to appropriate form of resource allocation.

Accordingly, by decentralizing and distributing the power of the state, the institutions rises from a community-based approach, such as NGOs or urban and rural associations, can be able to have active participation in governance affairs.

In the electricity distribution sector, institutions such as local management associations and local service companies are formed and manage the local distribution of energy (in partnership with citizens and other stakeholders). With the prevalence of these community-based institutions, the classical logic of governance evolves to self-governing approach.

In the new space, consumer associations or local service companies replace public or private companies by providing the part or the whole of the utility services, such as electricity. They are responsible for the local supply and management of common energy infrastructure. Those who use the services of these companies are themselves shareholders and stakeholders of these companies; thus, in a natural way, they try to provide the highest performance and highest service to the company. Local companies are agile and low-cost; so their supervision is provided in the best form and the security of supply is guaranteed.

In this scenario, the state can monitor competition; but only the general principles of competition. From the local point of view, it is the duty of everyone to maintain the network (tailored to everyone's profit). The mechanism of punishing the perpetrators (including the saboteurs), the rules and conditions of using network and also the terms of participation in decision making are completely transparent.

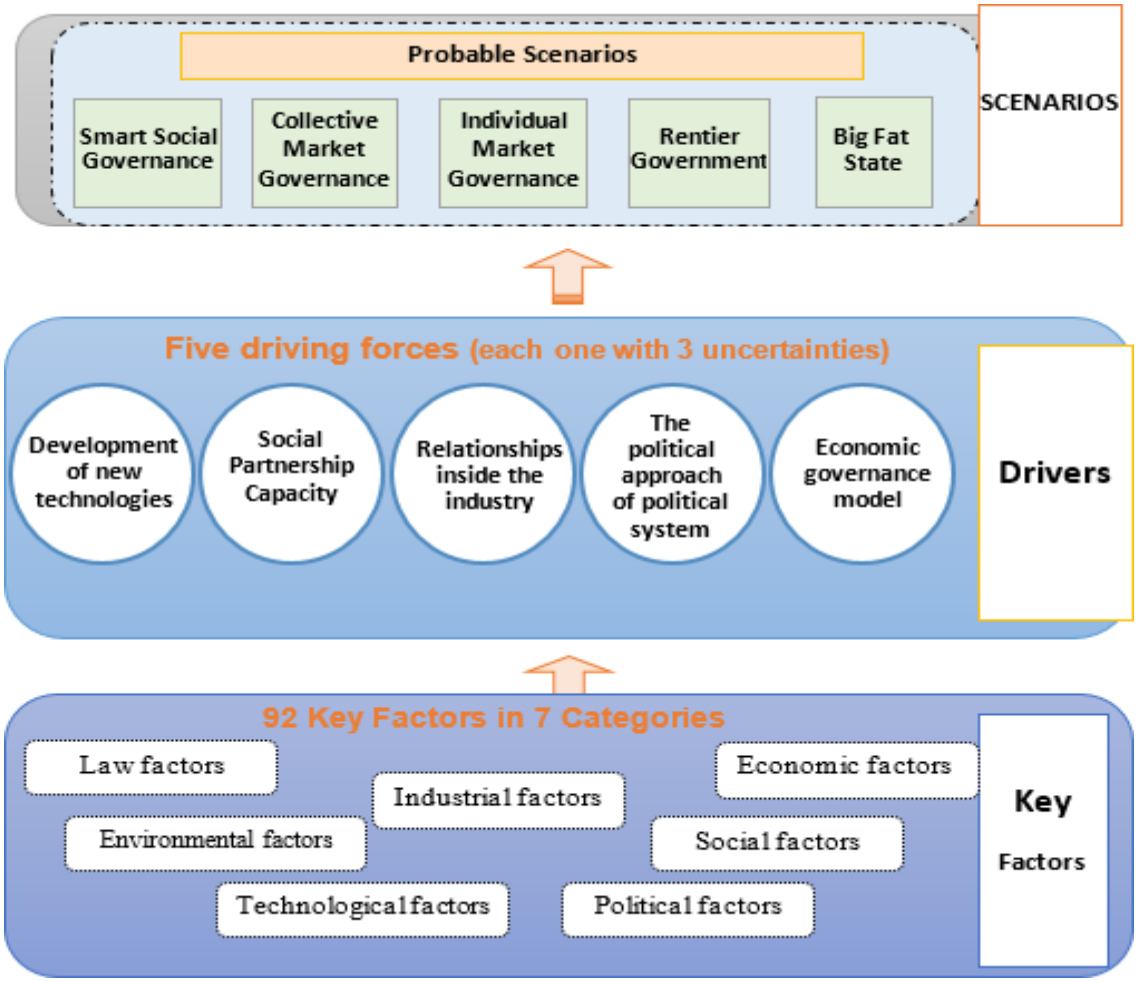

Fig. 7: The final conceptual model based on research findings

Presenting a conceptual model

In this section, after identifying key influential factors, environmental drivers and uncertainties, probable alterna-

tives for the future of governance in the field of electricity distribution has been compiled and presented in the form of a conceptual model of research.

According to the methodology of the research, in the scenario method, each of the resulting scenarios must have certain differences with other scenarios. The comparison of five output scenarios based on some of important criteria, reveals the overall path of this evolution.

Table 9: Comparison of scenarios based on key governance criteria (The contents of this table are based on the views of the research experts)

Smart social governance	**Collective market governance**	**Individual market governance**	**Rentier government**	**Big fat state**	Scenario name
					criteria
Network governance and local governance (citizenship governance)	Cooperative and public governance	Good governance and corporate governance	Government	State	**The nature of the governance system**
Public participation of the stakeholders & beneficiaries of the facility	Participation of economic stakeholders and social institutions	Participation of market actors	Controlled participation of selected individuals and institutions	Lack of partnership	**Level of partnership**
Civic priorities (consumers priorities)	Economic and social priorities (responsibilities)	Priorities of competition and free economy	Combining political and economic priorities	Political priorities	**The basis for decision making**
Council (local decision making)	Consensus (representatives of the private and public sectors)	Based on market rules and competition rules	Expert evaluation and political decision making	Based on the views, relationships and interests of politicians	**Decision making style**
Cooperative economy (shared economy)	Regulated free (institutional) economy	Free market economy	Decentralized state economy	Centralized state economy	**Type of economic governance**
Federal regulatory and local self-regulatory	Inclusive regulatory (with the participation of civil society organizations and professional associations)	Independent regulator (appointing members and budgets by the Independent Council of Competition)	dependent regulator (members and budget by the government)	Political directors in governmental structure	**Regulatory**
Ownership & management of municipalities, cooperatives and consumer associations	Distributed property and management (private and cooperative companies)	Ownership and management of the private sector	Semi-private ownership and government management	Governmental ownership and management	**Network control (ownership and management)**
Establishment and general facilitation	Fitting and facilitation	Policies and guidance	Planning and control	Planning and enterprise	**Government role**

Discussion and Conclusions

It is not strange today to say that Modern decentralized models of electricity generation from renewable energy can be powerful alternatives for current centralized model. (Weinrub & Giancatarino, 2015). In this study, we find that five different scenarios for the future of energy distribution can be imagined. The first and the second, are roughly indicative of the past and present situation of energy distribution in Iran. The third scenario shows what is expected to be achieved based on current targets and approved policies. And finally, scenarios four and five are alternatives to the future of energy governance over the next 20 years that can be realized, and as a contribution of this study, special attention has been paid.

We propose that there is a way of relating the five scenarios whereby they are arranged as a sequence of increasing governance decentralization from lowest to highest. By crossing from each one to another (figure 8), the level of decentralization and participation between stakeholders improves. In higher levels of decentralization, the concepts of cooperation and local / collective action may provide the basis for creating value in the future mechanisms of public utilities (including electricity distribution).

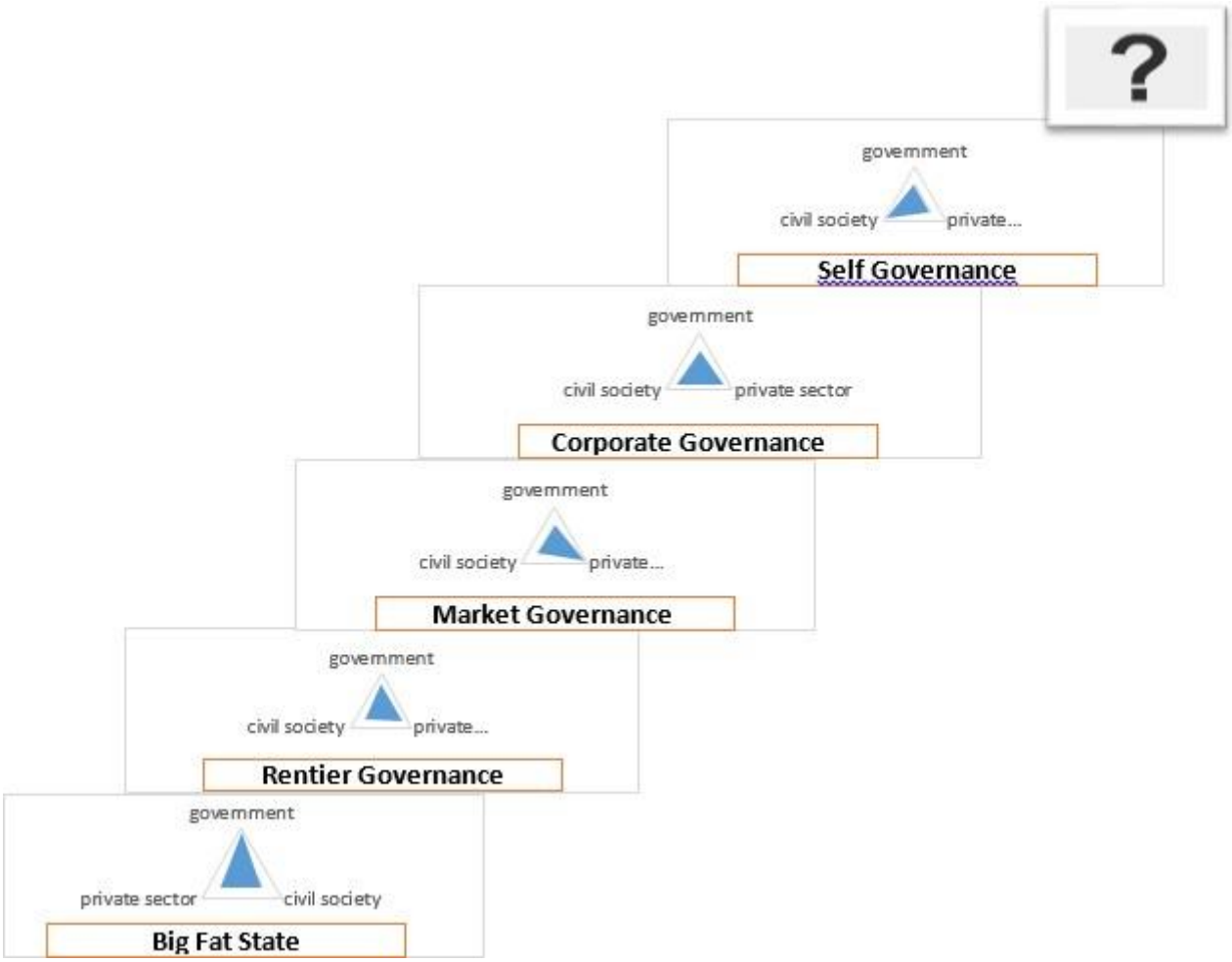

Fig. 8: Interaction between various dimensions of governance in the evolution of scenarios

Therefore, Stakeholder' s engagement, public space discussions, participatory management, co-policymaking and other forms of consultation, cooperation and interaction between civil society, interest groups or citizens with the state are the main pillars of the evolution of governance. The findings show that the perspective of distributed and participatory governance of electricity supply may be a preferred image for most actors and experts, but it

must be considered that the best governance model in any situation is likely to be highly context specific and may diverge from this ideal.

It seems that the concept of governance in the new era, is based on network relationships or governance through networks, where "cooperation" is considered to be the dominant organizational culture, and policies are only conducted through consensus. (OFlynn & Wanna, 2008). If such a situation is realized, as it is described in self- governance approaches (Ostrom, 2005), ordinary citizens have a very high capacity for making effective public activities through collective action outside of the market (Boyte & Kari, 1996).

Consequently, integrating the power of the public, private and social sectors together can lead to the formation of a new approach that generates innovation through cooperation and improves the intelligence of planning and policy making systems. This new approach, by increasing the voluntary participation of the social sector s (such as NGOs, social enterprises, etc.) can lead to more favorable social and economic outcomes. In such a space, national electricity network is divided into a diverse set of local grids and micro grids, in which the common good of electricity is managed through institutional mechanisms such as local service companies or users associations. As a result, in scenarios 4 and 5, the consumers of energy as real interest groups are also the main actors and they are not captured anymore.

Thus, in alternative scenarios of electricity distribution governance (based on self-governance), collective action is realized through user associations, as well as monitoring the performance of the service provider's (rather than by the third party). Consumers (costumers), retailers and local service providers in new condition, can find network-based solutions (such as associations, cooperatives, and civic communities) to collaborate and improve their quality and effectiveness. In addition, by adopting institutional arrangements such as trusting and empowering local institutions in small groups, while overcoming the "free ride tragedy", it' s expected a more successful management of decentralized electricity supply for local communities (Ahlbor & Boran, 2018).

Finally, the well-connected distribution grid of the future of electricity, based on distributed and small-scale production at the place of consumption, provides a platform for increasing the choice s for customers/consumers. A super grid with centralized, inclusive, and large-scale governance will not be relevant. In the future energy grid, energy consumers are energy producers (prosumers) and we will face "a large numbers of self-governing consumers without the reliance (or with minimum reliance) on the network" or "many small self-regulating mini-grids". At the same time, they are integrated into a complex energy system.

Notes

1- Steps 7&8 of the model are out of scope of this research

2- Cross impact balance analyzes

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