



The Application of Strategic Choice Approach (Case Study: Electricity Shortage Problem Caused by Cryptocurrency Mining in Iran)

Hasan Arabameri^{a*}, Mansour Momeni^b, Mahmoud Dehghan Nayeri^c

^a Department of Industrial Management, Faculty of Production and Operations, Alborz Campus, University of Tehran, Tehran, Iran.

^b Department of Industrial Management, Faculty of Management, University of Tehran, Tehran, Iran.

^c Department of Industrial Management, Faculty of Management and Economics, Tarbiat Modares University, Tehran, Iran.

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ABSTRACT

The continuous and round-the-clock operation of cryptocurrency mining devices generates significant heat that requires powerful cooling systems. Therefore, the main problem of mining is its high electricity consumption and energy usage. Unfortunately, due to the lack of planning by the country's officials, we are facing the problem of electricity shortage, which the growing digital currencies have exacerbated. Since decision-making in the real world (including the electricity shortage problem caused by mining) is complex and uncertain due to various influential factors, this research aims to apply a strategic selection approach to decision-making and provide solutions to solve the electricity shortage problem caused by cryptocurrency mining in Iran. In this study, the Strategic Choice Approach (SCA), one of the soft operational research methods, has been used for analysis, structuring, and decision tree development. For this purpose, four methods (styles) of SCA, which include ten steps, have been implemented. A working group consisting of twelve experts and stakeholders in digital currencies, facilitated by the researchers of this study, has been formed, and specific flowcharts and labels have been used. According to the SCA method, decision-making areas, decision options, areas of uncertainty, exploratory options, and decision trees have been designed. Finally, a "commitment package" ("improvement package") has been proposed to provide practical solutions. This article provides solutions for solving the electricity shortage problem caused by cryptocurrency mining through the SCA. For this purpose, specific tasks have been assigned to the Islamic Consultative Assembly, the Ministry of Economy, the Ministry of Energy and Foreign Affairs, and the government, excluding the mentioned ministries and some key players in digital currencies, which should be carried out in the present and future. By structuring the research problem through the SCA method as one of the soft operations research methods, the readers and users of this research will learn more details and dimensions of the mentioned method, contributing to expanding their knowledge of soft operations research. Although the SCA method has been implemented in Iran and other countries for a long time in various social and organizational issues, the diagrams, shapes, and tables used to implement SCA in this research contribute more to the readers' knowledge. It also helps to localize this method and other research done in the country.

Keywords

Keywords: Cryptocurrency mining, Strategic choice approach, Decision making, Uncertainties.

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1. Introduction

The introduction of cryptocurrencies as a new form of money has attracted tremendous attention in recent years. This new financial paradigm relies on miners to validate transactions by running their Cryptocurrency Mining Devices (CMDs). Nowadays, the mining business's significant profitability has tempted many private players in the electrical industry to employ their renewable energy resources to mine digital currency (Hajipour et al.,2022). Cryptocurrency miners consume much electrical energy to run their CMDs. These CMDs have a powerful computational capability to solve a complicated mathematical problem that validates the transactions between the digital currency's holders (Ghaebi Panah et al., 2022). In response, they are rewarded in digital currency to compensate for their expenditures. Therefore, one can simply deduce that cryptocurrency miners convert electrical energy to digital currency by running their CMDs (Hajipour et al.,2022). In other words, "miners" of cryptocurrencies are electromagnetic alchemists whose activity rapidly increases the consumption of each megawatthour of electricity.

The intensive calculations of their devices (miners) form the encrypted virtual currency and create new coins as payment. This work uses a staggering amount of electrical energy (Fairly, 2017). Along with the rapid growth of cryptocurrency mining worldwide, the number of digital currency miners in Iran is also increasing. Especially due to low electricity prices in Iran, the footprints of foreign miners can also be seen, in addition to the cheapness of electricity miners' feet on cattle ranches. Agricultural lands and fields have been opened, and underground home mining has caused growth. Electricity supply in Iran is faced with the problem of reducing the production of hydroelectric power plants due to the decrease in rainfall and the lack of planning for more electricity production. Electricity supply in Iran with the problem of reducing the production of power plants water has been faced due to the decrease in rainfall and lack of planning to generate more electricity.

Also, this rapid growth of cryptocurrency mining, which requires significant electricity generation, worsens the already bad electricity shortage. Lack of electricity and its frequent blackouts. It has become a disturbance in citizens' daily life processes, from home power outages to power cuts in the offices, the postponement of the client's work, and the closure of factories and companies that add to the country's problems. Then, the increase in electricity consumption due to the extraction of cryptocurrency, even in a situation where the country has limited direct electricity production, will put additional problems on the shoulders of the people and the country.

Now, the question arises: What is the solution? And how should this problem be solved? Answering these questions becomes more difficult when it is known that many stakeholders have faced problems, conflicts, and uncertainties. For example, some stakeholders are 100% in favor of cryptocurrency mining and say that the government should produce more electricity. But some ordinary people are seriously opposed because of the problems caused by blackouts. Also, questions such as: Why is the government's policy unclear about digital currencies? Why have the country's main custodians of digital currencies not been identified yet? There are some doubts and uncertainties about the issue. To better understand the many stakeholders of cryptocurrencies and analyze conflicts and uncertainties. It is necessary to know what factors have caused the rapid growth of cryptocurrency mining in Iran. The skyrocketing inflation rate in recent years has caused many people to maintain the value of their money. They engage in some speculative activities, which causes liquidity to wander occasionally in currency, coin, and car markets, and the stock market increases. They seek not to lose the value of their capital. There were other markets where they could make more profit. It was here that much from money; people moved towards digital currencies, of course, speed. The spread of digital currencies worldwide and its impact on the people of Iran should not be underestimated. Remember, maybe the low price of electricity in Iran sometimes causes the opening of rejection. The presence of foreigners was introduced in the country as another influencing factor.

Now, the main question of this research is, what is the solution? In a country facing a shortage of electricity and, on the other hand, people are involved in the emerging phenomenon of cryptocurrency mining (which consumes a lot of electricity), how can people address the problem and provide solutions to improve the situation? Should people legalize cryptocurrency mining like people in many other countries? Should people increase their electricity production capacity? and so on. Many people see the harsh confrontation of law enforcement and the judiciary as not a solution but also an additional cost on the shoulders of the courts and law enforcement. Some economists argue that cryptocurrency mining can be the best source of income for the government in the conditions of the country's sanctions. Several solutions are proposed, none of which can provide a comprehensive solution. Solving these problems and providing practical solutions have been the main reasons for the formation of this research. Therefore, considering the structure and position of the problem, it seems that the best option is to use the SCA as one of the research methods in soft operations.

Every science relies on philosophical foundations and has a special methodology based on the assumptions of ontology and epistemology. Based on different philosophical assumptions,

our attitude toward the world and reality, the problems in the real world, and the prescriptions prescribed to solve these problems are different (Hosseinzadeh and Mehrgan, 2012). Therefore, according to the situation of cryptocurrencies in Iran, to improve its situation, it is better to use the science of operations research because in operations research, by adopting a special attitude to organizational and social issues, the way to solve problems will be completely different. But which paradigm should authors use in operations research? Authors definitely cannot say that the life of classical operations research (hard operations research) has ended, and are these methods not capable of being used in complex problems involving people with different attitudes and interests, as soft and critical researchers claim (Hosseinzadeh and Mehrgan, 2012). However, nowadays, authors see much use of research techniques in classical operations, and according to its basics, authors may be able to use hard operations research to solve the research problem. But why do the researchers in this study use soft operations research to implement cryptocurrency mining? In order to answer this question, authors must express some concepts and basics of soft operations research in order to reveal their compatibility and validity to solve the research problem:

Soft operations research, or problem structuring methods, is a systematic approach to dealing with problematic situations. This approach provides a framework for managing and managing poorly structured issues or issues that cannot be easily quantified (Definition of the Operations Research Society of South Africa (ORSSA)).

Soft operations research methods mainly use qualitative, rational, objective, and structured methods to interpret, define, and discover different perspectives on an organization and its issues with a deeper look. This method leads to negotiation, learning, and ultimately more understanding and uses these perceptions to improve the conditions of complex issues (Hosseinzadeh et al., 2012).

Therefore, considering the many stakeholders of cryptocurrency miners, the emergence of many conflicts of interest between them, and the many uncertainties that exist in the issue of cryptocurrency mining in the condition of electricity shortage, we need to structure the research problem with soft operations research. In other words, since we need to identify the conflicts and uncertainties of the stakeholders in making better decisions with some research topics in soft operations, by examining and explaining them, the researchers will make a better implementation and, as a result, provide a more appropriate solution.

Among the various paradigms of soft operations, the SCA is due to the look and structure, qualities required for managing various uncertainties are selected for further study and

investigation (Ram et al., 2011). The SCA is chosen for further study and investigation due to its special view and structure for managing various types of uncertainty (Hosseinzadeh et al., 2012). SCA is used to tackle the decision problem in terms of structuring the problem and defining scenarios (Lami and Todella, 2023). The main goal of the SCA is to deal with complex decision issues and make decisions by considering different methods of uncertainty management and dealing with each type of uncertainty differently (Azar et al., 2016). The paper proposes using the SCA to structure the decisions and provide a solution to the lack of electricity caused by the cryptocurrency mining process, which is done by individuals and partly supported by meetings and interviews with DMs, experts, and stakeholders. The method is employed as a design tool to provide alternative transformation scenarios. It represents a way of approaching the challenge of planning in an uncertain world, eliciting guidelines and strategies.

Furthermore, it produces an actual project or transformation in a physical sense. By investigating what occurs during the different micro-processes with the interviewees, we focus on some behavioral issues and effects of the context, the models of the application, and the different entities involved in the interventions (Todella et al., 2018). The main objective of the SCA is to deal with complex decision-making issues and decision-making by considering different methods of managing uncertainty and dealing with different types of uncertainties differently. According to the stated contents, it seems that using the SCA is the best option for deciding on the current research problem. The present research is important and innovative due to its contribution to expanding the knowledge of soft operations research. In this way, it has been tried to describe the SCA as one of the soft research methods.

It should be noted that the current research has frequent validation due to the fact that it is evaluated and validated by the opinion of experts and stakeholders (Hosseinzadeh and Mehrgan, 2012). In this research, prominent books in this field, domestic and foreign articles, official statistics, magazines and reliable domestic and foreign websites have been used to collect data.

This research uses the SCA of four methods (style) that includes ten steps. It can be implemented. Also, a working group consisting of twelve experts and the beneficiaries of digital currencies has been formed with the facilitation of the researcher of this research. The end of the "commitment package" (improvement) is proposed in order to provide a practical solution.

2. A review of literature and research background

Problem Structuring Methods (PSMs) belong to the family of facilitated modeling approaches, a term that some soft OR scholars and consultants use to define approaches that combine group

dialogue, facilitation, and participatory modeling (e.g., [Franco and Montibeller, 2010](#); [Franco and Rouwette, 2011](#)). The application of PSMs involves a group of stakeholders who seek to address a complex and uncertain problem situation of common ([Lami and Tavella, 2019](#)). The SCA is one of the types of problem structuring methods that we will explain:

The origin of the SCA can be found in the experience gained from two research projects in the 1960s. These are two projects, and several researchers have many records. They cooperated differently to understand the behavior of strategic decision-makers while making decisions and studied and talked with them about the dilemmas they constantly face. SCAs were discussed. One of these projects related to communication in the industry ([Crichton, 1966](#)), and another related to the policy of city administration ([Friend and Jessop, 1977](#)). Both projects were carried out by research teams from the Operational Research and Sociotechnical Institute that was named "Tavistak". The perspective gained during the implementation of these two projects later became the foundation for developing operational methods used in decision-making processes. One of the scientists involved in these research projects is "John Friend". He researched policy-making in municipal governments and was one of the pioneers of the SCA in planning under uncertainty. Friend, with the collaboration of "Allan Hickling", published his experiences with the workshops of the SCA in his book "Planning Under Pressure" ([Friend and Hickling, 2005](#)). Gradually, these methods became widespread, and today, they are used to solve decision-making problems in many parts of the world and various organizational and inter-organizational environments. However, this approach is very effective and can be implemented quickly and informally, even at lower decision-making levels.

In SCA, to manage the complexities, contradictions, and uncertainties of the decision-making process, the four complementary states of "shaping", "design", "comparison", and "choosing" are definitions. It has been shown that they are connected in dynamic ways (Figure 1). The inputs to this process are multiple problems, and the outputs are multiple decisions. The formulation (shaping) of the structuring of the fields of authority and relationships between them is done, and in the state of design of possible solutions according to the compatibility between the options of the fields, different options are designed in the situation of comparing these solutions in terms of consequences. Their predictability is compared by considering the range of related uncertainty. In the state of discretion about conscious management and uncertainty over time, how moving forward by balancing flexibility against commitment in a closed format progress is determined in the first two situations, the field of discretion is open to decision-makers, and in the two final situations of this field in order to reach an action

agreement is limited. Formulation situations, political authority over design situations, and technical comparison are considered during decision-making. Through circulation or changing the state, decision-makers can move from one state to another.

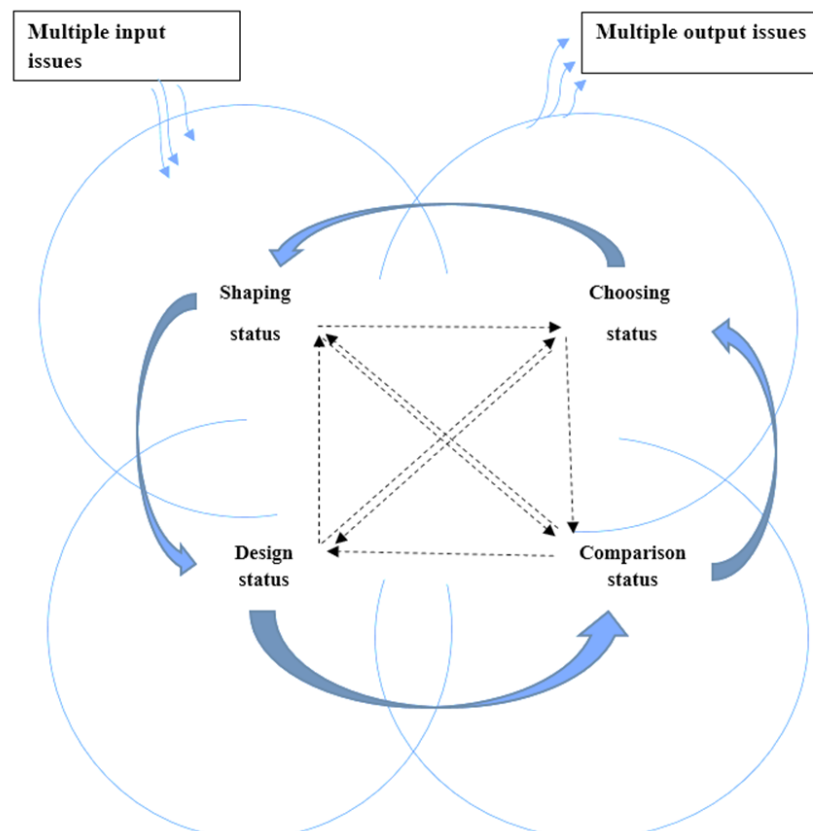


Figure 1. Input and output status SCA

Decisions are always faced with different. According to the strategic approach, different uncertainties should be dealt with differently. There are three general categories of uncertainties:

A. Uncertainties about our working environment(UE): This type of uncertainty can be managed through relatively technical responses, such as exploration, scientific research, and cost prediction.

B. Uncertainties about our Guiding values (UV): This type of uncertainty requires a political response. Such a response can take the form of a request from a higher authority for policy guidance, a structured exercise to clarify stated goals, or a program of consultation.

C. Uncertainties about choices on related agendas (UR): This type of uncertainty arises from the consequences of a decision.

Figure 2 summarizes the three initial types of uncertainties, each requiring a different kind of response. This image represents a snapshot of the overall view at any given moment when

one or more decision-makers or a level of difficulty in decision-making are present. Therefore, the image may appear static, but it actually has a significant impact on the dynamic movement of any complex decision-making process.

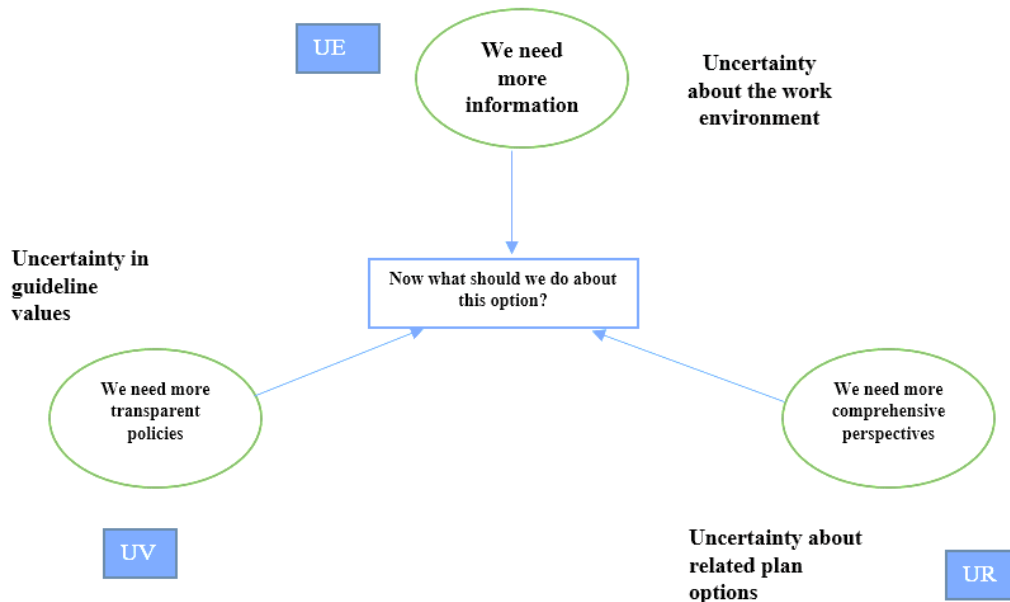


Figure 2. Three types of uncertainty in decision-making

Based on studies conducted, the strategic decision-making approach has been used in various researches, such as decision-making in economic issues (Collins and Zhu, 2005), public projects (Rolando, 2015), design and architecture (Todella et al., 2018), a multi-methodological combination of the SCA and the analytic network process (Lami and Todella, 2023), and so on.

3. Stages of implementing the SCA

3.1. Methods of shaping

Step 1: Determining decision-making areas

SCA allows actions of detection through the shaping mode (Friend and Hickling, 2005; Gomes Júnior and Schramm, 2021; Smith and Shaw, 2019). The set of decision areas enables consideration of the main concerns that the irruption of a new problem implies and makes them visible: through the shaping mode, it is possible to have a clearer representation of the problematic situation. The shaping mode in SCA relates to the “perplexity” phase, where the problem comes to the fore. This first mode of SCA aims to support detecting all the issues related to the problem (Lami and Todella, 2023).

In a conventional strategic decision-making workshop, the facilitator begins the program by creating a common understanding of the main decision-making areas. This process can lead to extensive discussions, enabling participants to learn from other perspectives. This study chose a group of 12 stakeholders and digital asset experts for the workshop. In this workshop, participants were arranged in a semi-circle facing the facilitators. The researchers of this article were introduced as the facilitators of the workshop. The session starts with the facilitators establishing a baseline concept of "decision areas" regarding cryptocurrencies. During the sessions, some issues lightly influenced by participants' input are better recorded in a separate list called "Uncertainty Areas." It is necessary to identify different types of uncertainties. To better identify decision-making areas and understand the issues, their root causes were explored and presented in Table 1. It should be noted that in all SCA stages, shortened titles of decision areas are used instead of using abbreviations for each decision area. Additionally, a question mark (?) is placed before each decision area's title for identification purposes.

Table 1. Problem, root causes, and decision areas (Nejati et al.,2018)

Problem	The root causes of the problem	Decision-making areas	The title of the areas - decision-making
The need for fundamental transformation in the field of digital currencies	<ul style="list-style-type: none"> -In recent years, with the increase in popularity and public interest in digital currencies, the speed of approval and implementation of regulatory laws has not increased -The government and parliament have not looked at it as a new industry -In recent years, the lack of electricity caused by the growth of cryptocurrency mining has created problems close to a crisis for the country 	What are the most important transformative measures in the country's field of cryptocurrencies?	Transformational actions?
So far, the government has focused more on mining and has not paid attention to other aspects of blockchain.	<ul style="list-style-type: none"> -The problem of lack of electricity caused by the growth of underground mining -He does not consider blockchain as a transformative technology that pays attention to its other dimensions -The abandonment and uncertainty of cryptocurrency exchange and payment platforms inside the country 	What solutions exist for the government to comprehensively focus on all aspects of the blockchain, not just mining?	The government's focus on all aspects of the blockchain?
Unreasonable growth of illegal (underground) mining	<ul style="list-style-type: none"> -Increasing home extraction -Prohibition of legal mining and reduction of issuing mining licenses by the government increases illegal mining -Low electricity prices in Iran -Absence of an intelligent, online, and real-time monitoring system of electricity consumption at all levels of production, transmission, and distribution 	What are the optimal and basic solutions to prevent illegal extraction?	What are the basic and optimal ways to prevent illegal mining?
	<ul style="list-style-type: none"> - Subsidies paid by the government 		

Problem	The root causes of the problem	Decision-making areas	The title of the areas - decision-making
There is not enough electricity to mine cryptocurrencies, and the low electricity tariff encourages people, including foreigners, to mine in Iran.	<ul style="list-style-type: none"> - So far, no proper planning has been done to provide electricity through renewable sources such as solar, wind, and nuclear. - The electricity tariff is not different for mining in the cold and hot seasons - The power of the private sector has not been used to produce electricity 	What work method should we use to supply the required electricity and create a suitable and optimal tariff system?	Appropriate and optimal electricity supply and price solutions?
The threat-oriented, passive, mandated, negative, and permission-oriented view of the field of cryptocurrencies by the government	<ul style="list-style-type: none"> -So far, the government has not reached a consensus on cryptocurrencies -Lack of appropriate and codified laws -Failure to pay attention to the concerns of the private sector in the field of digital currencies 	How will the threat-oriented, passive, mandated cryptocurrency change to an opportunity-oriented, active governance system and new regulatory methods?	Changing the government's view of the state of cryptocurrencies?
Weakness in macro-management of crypto-currencies, the existence of disturbances in the field of the mining industry	<ul style="list-style-type: none"> -Failure to estimate the positive effects of the digital currency industry, especially from the aspects of macroeconomics, energy, and environment -Lack of preparation of legal, software, and hardware infrastructures for the implementation of macro policies regarding cryptocurrencies. -Illegal entry of mining equipment and devices, or counterfeit, scrapped devices and equipment -Absence of appropriate and codified laws in the field of extraction, which is a sign of the government's lack of planning 	What solutions can people use to address the weaknesses in the macro management of cryptocurrencies and solve the country's problems?	Appropriate solutions to cover the weakness in the macro management of crypto-currencies and solve the mining problems ?
The inappropriateness of the government's regulatory policies in asset management and asset maintenance has created risks for people's activities in the cryptocurrency market.	<ul style="list-style-type: none"> -Service infrastructures, relevant technologies, investment funds, and supporting institutions have not been established in this case -There is no proper insurance and tax mechanism in this case -It is not clear whether cryptocurrencies are currency or assets (if it is a currency, it is related to the central bank, and if it is an asset, it is related to the stock exchange) -Lack of development of institutional capacities and capital market tools 	What solution is suggested for improper regulation of asset management policies and the keeping of cryptocurrencies, which currently creates risks for people's activities in this field?	Appropriate regulation in the field of cryptocurrency management policies?
The government has not taken valuable measures in the fields of consensus algorithms, blockchain, functional tokens, personal wallets, and the conversion of metal assets into digital assets	<ul style="list-style-type: none"> -Lack of awareness of their benefits, which can improve the economic and political situation of the country -Academic research has not been optimally used either in software or hardware -Considering the scope of the issue, and the large volume of transactions, and its users, people need advanced and expensive technologies 	What measures should the government take regarding consensus algorithms, blockchain, utility tokens, personal wallets, and converting metal	Necessary measures in the field of cryptocurrencies?

Problem	The root causes of the problem	Decision-making areas	The title of the areas - decision-making
(necessities of cryptocurrencies).		assets into digital assets?	
The need for quality and suitable devices and equipment for extraction	<p>-Prohibiting or reducing the issuance of mining licenses and the growth of illegal mining causes smuggled, scrapped, counterfeit, and low-quality devices and equipment to enter the country.</p> <p>-Blockchain, creation of functional tokens, cryptocurrency, etc., due to the large volume of users and their transactions, in order to verify the identity and the possibility of public participation, needs new technologies to build devices and equipment, which currently these technologies are There is no complete in the country - lack of attention to the features of each device according to the type of extraction</p>	What is the solution in manufacturing or buying suitable and high-quality extraction devices and equipment?	Making or buying suitable and quality devices and equipment?
Missed opportunities in exploiting the strategic capacities of cryptocurrencies in the field of payment and exchange	<p>-The necessary standards for exchanging cryptocurrencies have not been developed with an emphasis on customer recognition, maintenance rules, and validation.</p> <p>-Prohibition of direct exchange of cryptocurrencies with goods and services inside the country and lack of monitoring, supervision, and control of payment and settlement tools in goods and services transactions by creating an integrated technical infrastructure</p> <p>-Failure to create or strengthen internal cryptocurrency exchanges.</p>	How can people compensate for the lost opportunities by exploiting cryptocurrencies' strategic capacities in payment and exchange?	Compensation for lost opportunities in using the capacities of payment and exchange?
Lack of serious involvement of the executive branch and the legislative branch regarding cryptocurrency mining	-Maybe they are unaware of the problem, which is that the problems caused by blackouts affected by cryptocurrency mining may cause the country to have a crisis.	How can the government and parliament help to organize the cryptocurrency mining situation?	Organization of the mining situation by the government and parliament?
Failure to determine the duties of businesses in the field of digital currencies	<p>-Ignorance that it can generate income for the people and the country</p> <p>-Due to the sanctions, Iranians cannot operate in all foreign exchanges, or the capital of Iranian users may be blocked due to the sanctions.</p>	What are the suggestions for digital currency businesses to help improve the power shortage situation?	What is the status of businesses in the field of digital currencies?
Development or non-development and participation or non-participation with foreigners in the creation and development of mining fields in the country	<p>-Although the development of mining farms can be a source of income for the country, industries and factories, manufacturing and service companies and organizations, and ordinary people suffer due to blackouts caused by mining.</p> <p>-Unfortunately, no effective action has been taken by the government in this case</p>	Should mining farms be developed or banned, given the country's current situation? Moreover, should we cooperate with	Development or non-development, participation or non-participation with foreigners in establishing mining fields?

Problem	The root causes of the problem	Decision-making areas	The title of the areas - decision-making
		foreigners in this field?	
Using cryptocurrency mining (digital currencies in general) to earn income for the country	-Cryptocurrency mining is a major source of income that has not been used in Iran - Cryptocurrencies can be used instead of dollars in business transactions	How can cryptocurrency mining (digital currencies in general) be used to earn income for the country?	Earning income from cryptocurrency mining (digital currencies)?
Non-cooperation of the general public regarding rational extraction and helping to solve the problem of electricity shortage	-Lack of education and awareness of the issue -Some unpleasant characteristics of Iranians, such as personal profiteering, make them not accept that the profit or loss resulting from the extraction goes to themselves in the first stage.	How can people promote rational extraction to the country's public and help solve the electricity shortage problem?	Promoting ordinary people to avoid illegal mining?

Second and third steps: relationship between decision areas and determining the center of focus

In the next stage, the "decision-making" diagram is created, in which certain decision areas are connected by straight lines, usually referred to as "decision relationships." It is worth mentioning that, unlike other methods, the strategic option approach does not use arrows to indicate causal or sequential relationships between decision areas. A decision diagram or graph provides a broader view of the problem structure. A decision graph is a two-dimensional map that shows a collection of decision areas, connections, and disconnections between decision areas. Figure 3 illustrates the type of decision-making diagram in this workshop, which has been approved after some discussion and conversation among the participants. Some conventions used in this stage to construct Figure 3 are described as follows:

- Different line drawing styles (dashed line and dotted line) are used to record the relationships between elements where there is disagreement or uncertainty.
- Decision areas with high importance or urgency are indicated by a circle with a solid line around them.
- The group must choose a center of focus after examining.

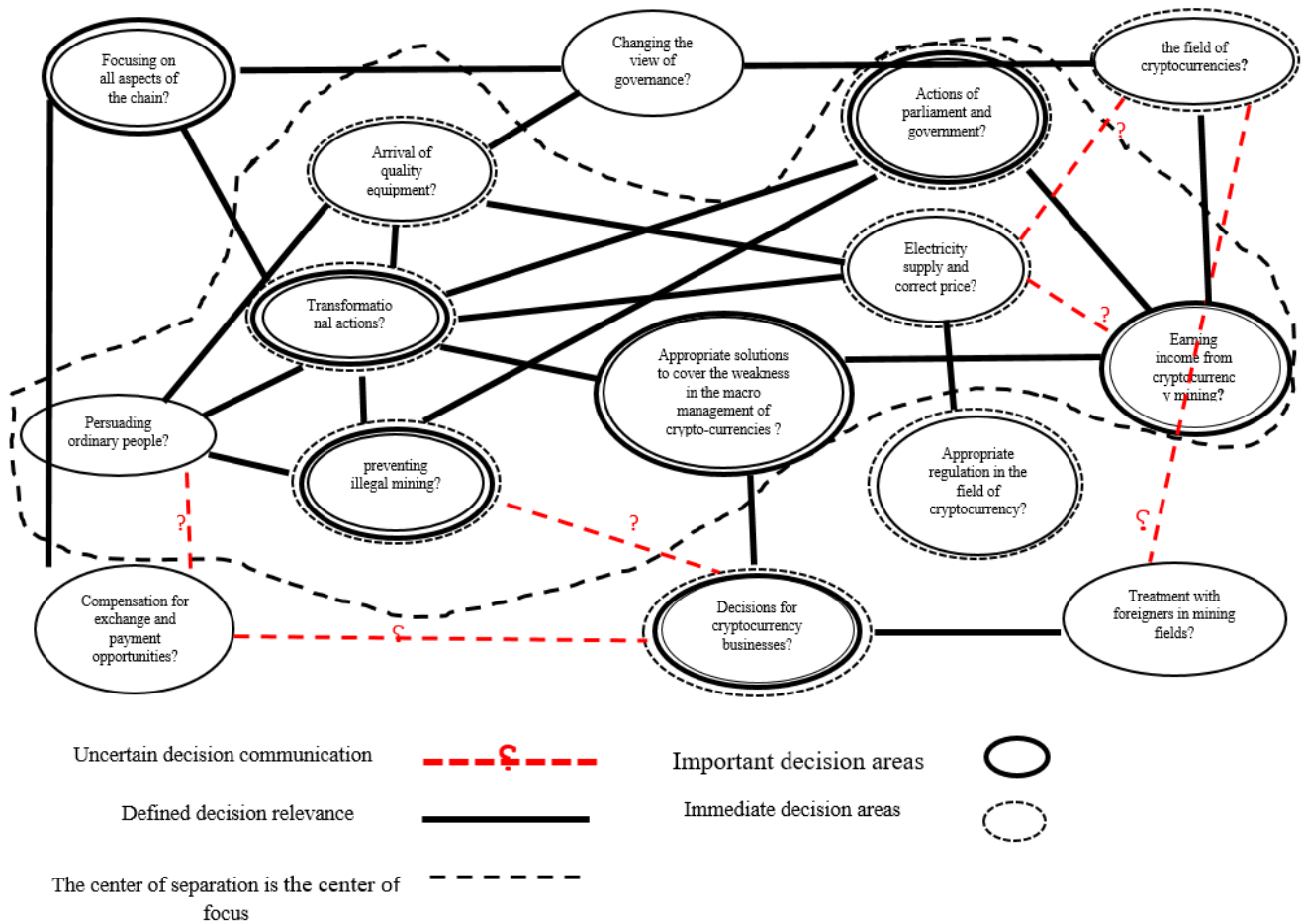


Figure 3. Decision-making diagram and Focus Center

Since the number of areas present in the decision-making diagram and the complex relationships between them seem difficult, in this step, a subset of these decision areas is selected based on "importance and significance," "need for immediate action," and the decision relationship "defined" and "uncertain" with other decision areas, as the focal point of the issue. Regarding the decision areas that are set aside, it does not mean that they do not require immediate and significant action, but rather that decision-making about these decision areas can be done almost independently and does not require additional resources in the decision-making process due to the complexity of the process. However, as a principle, it should be known that the final choice of the focus center lies with the users (facilitators) because the choice of the focus center is not a technical issue but a matter that should be entrusted to the judgments of the participants' values.

3.2. Design methods

Fourth step: determining decision options

The designing mode in SCA can be likened to the “consultation” phase, in which each aspect of a defined problem is articulated. This second mode of SCA aims to develop several alternatives and scenarios, which include the whole range of entities and aspects involved in the process (Lami and Todella,2023). When a problem focus center is selected with a reasonable number of decision areas and is approved, the next step is to agree on the options within each decision area. Table 2 - The options identified within each decision area are displayed.

Table 2. Creating options for decision areas within the focus center

Row	The title of decision-making areas	Decision making options
1	Persuading ordinary people? (Advocating the general public of the country to avoid illegal mining?)	-Cultivation and education -The electricity tariff should be different in the electricity consumption time. It should be divided into three parts: critical, limited, and normal, for which extraction should be prohibited entirely in critical conditions.
2	Transformational actions?	-From the threat-oriented, passive, directive, negative, and license-oriented governance system of cryptocurrencies to the opportunity-oriented, active, and positive governance system with a risk management approach and modern regulatory methods; -From focusing only on the cryptocurrency mining industry to the comprehensive attention of all dimensions of blockchain technology and from services based on centralized reference bases to distributed services based on distributed ledger (strengthening all three fields of extraction (mining), maintenance (holding) and transaction (trading)) and, as a result, creating functional tokens, national cryptocurrencies, and converting and exchanging physical assets into digital currencies -Both methods
3	Preventing illegal mining? (Prohibition of unauthorized extraction (underground?))	-Creating a smart and online monitoring system for electricity consumption at all levels of production, transmission, and distribution, using the capacity of public reports, reforming the energy subsidy system and currency policies and increasing the popularity and public interest in cryptocurrencies, the speed of legislation, and monitoring of laws should also be increased, and it is necessary for governing institutions to look at it as a new industry -In the field of cryptocurrency mining, it has been emphasized the development of the production of products with optimal efficiency and increasing the export of electricity along with consumption management and promoting the consumption of domestic goods along with planning to improve quality and competitiveness in production
4	The arrival of quality equipment? (Making and buying quality equipment?)	-Manufacturing or importing quality devices and equipment, depending on the type of cryptocurrency and the more profitable the device, the higher its price, and also legalizing the import of devices and equipment in order to prevent the entry of smuggled and counterfeit devices -Using academic and academic capacity to build devices and equipment -Allocating part of the income of cryptocurrency producers to the import of mining devices and equipment
5	What are the solutions to compensate for the weakness in the macro management of cryptocurrencies and solve the existing problems?	-Creating cryptocurrency-tradable investment funds in the stock market requires the development of institutional capacity and capital market tools to manage investment risks in the cryptocurrency market. -Formation of digital assets depository institution and cryptocurrency deposit company

		-Developing the infrastructure of cryptocurrency custody services of the stock exchange and cryptocurrency investment advisory services with an emphasis on increasing the production capacity of cryptocurrencies in the country and adopting appropriate tax and insurance measures
6	Electricity supply and correct price?	-Using the power of the private sector to produce electricity and to supply cryptocurrency miners with the electricity they need, as well as connecting cryptocurrency miners to the power grid and purchasing the required electricity -The Ministry of Energy should use renewable sources, including solar, water, geothermal, and especially nuclear, to supply electricity to mining farms and home miners and supply energy from the place of increasing productivity, such as generating electricity from flare gas and reducing electricity losses. Production in the transmission network
7	Actions of parliament and government?	-To resolve the uncertainty in the field of blockchain in the field of exchange, tariffs, and the activity of foreign platforms and, in general, the uncertain situation, to introduce cryptocurrencies as assets and be included in the field of capital market supervision (not that they are presented as currencies and in the field of be supervised by the central bank) -Creation and strengthening of cryptocurrency exchanges with Iranian platforms in the country and in the short term by forming the National Headquarters of Cryptocurrencies with the mission of recognition, explanation, policy-making, division of duties between the ministries and related institutions, and supervision of the proper implementation of assigned duties and activation of all capacities of this To improve the current situation.
8	Earning income from cryptocurrency mining (digital currencies)?	-Big investment in constructing and purchasing devices and equipment needed for digital currencies and forming support and investment funds. - to expand trade exchanges with other countries, new policies on digital currencies and the development of international discourse are needed. -Development of technological infrastructures and websters and use of appropriate and efficient tax and insurance system

Step 5: Examining compatibility between options and creating compatible plans

When a set of two or more options is agreed upon in each decision-making area, the next step is to examine the compatibility of these options between different decision-making areas within the problem's focus. The selected options from different decision-making areas, which are within a focal point, are examined and judged in pairs to what extent they can be combined.

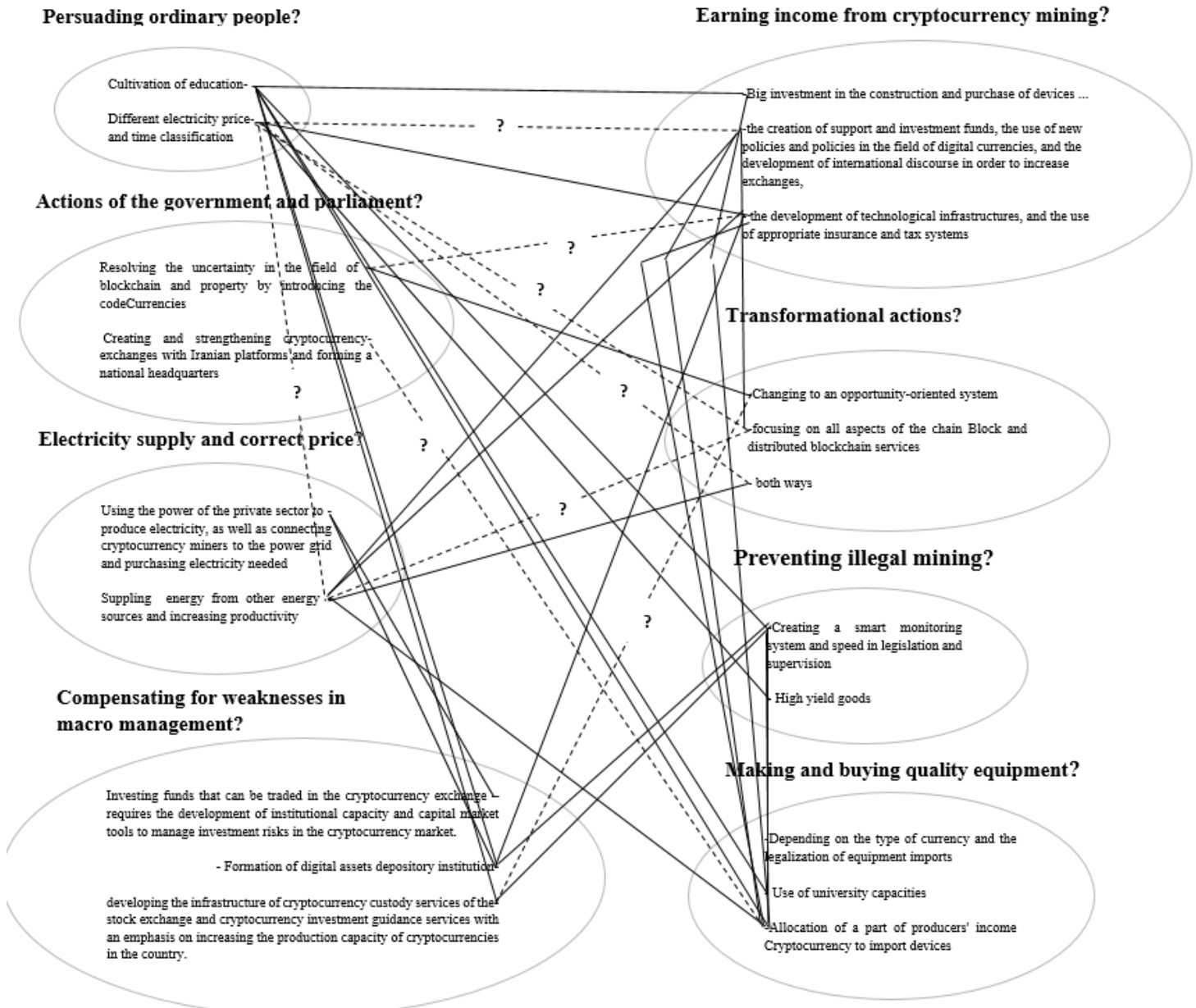


Figure 4. Represents a graphical view of the compatibility between options (Nejati et al.,2018)

It may seem strange that the lines connecting the options in the graph, instead of showing the compatibility relationship between the two options, actually show their incompatibility. In any case, experience shows that the number of incompatible relationships is often less than that of compatible relationships, and a simpler graph is always drawn by using this. By expanding each part of the decision diagram and turning it into an option diagram, the decision relationship is replaced by a binary options pair. Binary option pairs are formed when two combined options are incompatible and present a conflicting situation when combined. Incompatibility can arise due to logical inconsistency or judgmental inconsistency (such as the high cost of option combination or unacceptable consequences). This process is done by drawing a compatibility

network or a compatibility matrix. In Figure 4, the decision areas within the focus are shown in the compatibility network. For the sake of simplicity and ease of concept transfer, the following symbols are used:

- (x) denotes an incompatible, conflicting combination (binary option pair).
- (?) denotes questionable compatibility.
- (*) indicates a compatible combination.

It may seem strange that the connecting lines between options in the graph represent their incompatibility instead of showing the relationship between the two options. However, experience shows that the number of incompatible relationships is usually smaller than the number of compatible relationships, and following this rule, a simpler graph can always be drawn. The best way to obtain an accurate count of combinations is to consider decision areas in agreement and sequentially, then systematically assess the probability of each relationship occurring until all possible combinations are reached. Moreover, the feasibility of each combination should be controlled at each stage. The logic of this method is explained in Figure 5.

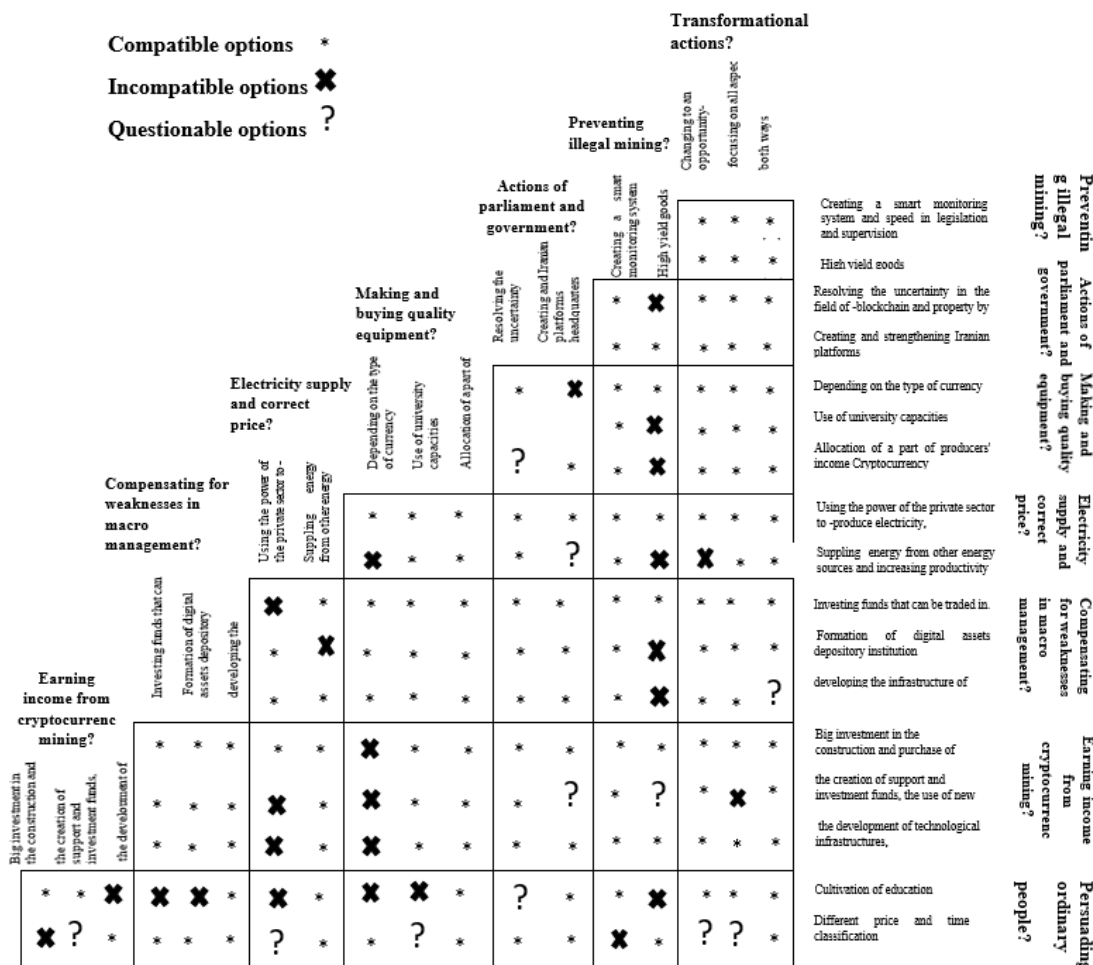


Figure 5. Compatibility and incompatibility network of decision areas in the center of focus (Adaptability Matrix) (Nejati et al.,2018)

According to Figure 5, the decision areas in the center of focus are listed in a specific order from left to right; in this case, the order of Table 2 (Figure 3) is used. Then, the option is individually analyzed so that the last option's compatibility with the previous options in the chain is examined at each point. The result of implementing this procedure reduces the number of possible combinations to 10 cases (Figure 6). To explain the method in detail, all possible branches are individually examined. In this chart, referred to as the "decision tree", whenever we reach a binary options pair, we draw a multiplication sign at the end of the branch. Any combination that does not result in a binary option pair is considered a possible decision pattern. The branches with a multiplication sign are eliminated as closed or dead branches.

Persuading ordinary people?	Transformational actions?	Preventing illegal mining?	Making and buying quality equipment?	Compensating for weaknesses in macro management?	Electricity supply and correct price?	Actions of parliament and government?	Earning income from cryptocurrency mining?	Selected Plan number	
Cultivation and education Different electricity price- and time classification	Changing to an opportunity-oriented system focusing on all aspects of the chain Block and distributed blockchain services both ways	Creating a smart monitoring system and speed in legislation and supervision High yield goods	Depending on the type of currency Use of university capacities Allocation of a part of producers' incomes	Investing funds that can be traded in the Formation of digital assets depository institution- developing the infrastructure of	Using the power of the private sector Supplying energy from other energy	Resolving the uncertainty in the field of- Creating and strengthening exchanges with Iranian platforms	Big investment in the construction and	✗	
							the creation of support and investment funds	✓	1
							the development of technological	✓	2
							Big investment in the construction and	✗	3
							the creation of support and investment funds	✗	
							the development of technological	✓	
							Big investment in the construction and	✗	4
							the creation of support and investment funds	✓	
							the development of technological	✓	
							Big investment in the construction and	✓	6
the creation of support and investment funds	✓								
the development of technological	✗								
Big investment in the construction and	✓	8							
the creation of support and investment funds	✗								
the development of technological	✗								
Big investment in the construction and	✓	9							
the creation of support and investment funds	✓								
the development of technological	✗	10							

Figure 6. Production of practical decision-making Plans through selection trees (Nejati et al.,2018)

As discussed in the identification of options within a decision area, it is natural for different participants to have different perspectives on combining options, considering some as possible and others as impossible. Such differences can be a starting point for working towards clearer shared perspectives on the structure of the decision problem for the decision-maker. In this section, after eliminating plans that have resulted in dead ends, ten potential plans are shown in Figure 7. It should be noted that according to the consensus in this study, even disputed combinations have been considered as compatible combinations.

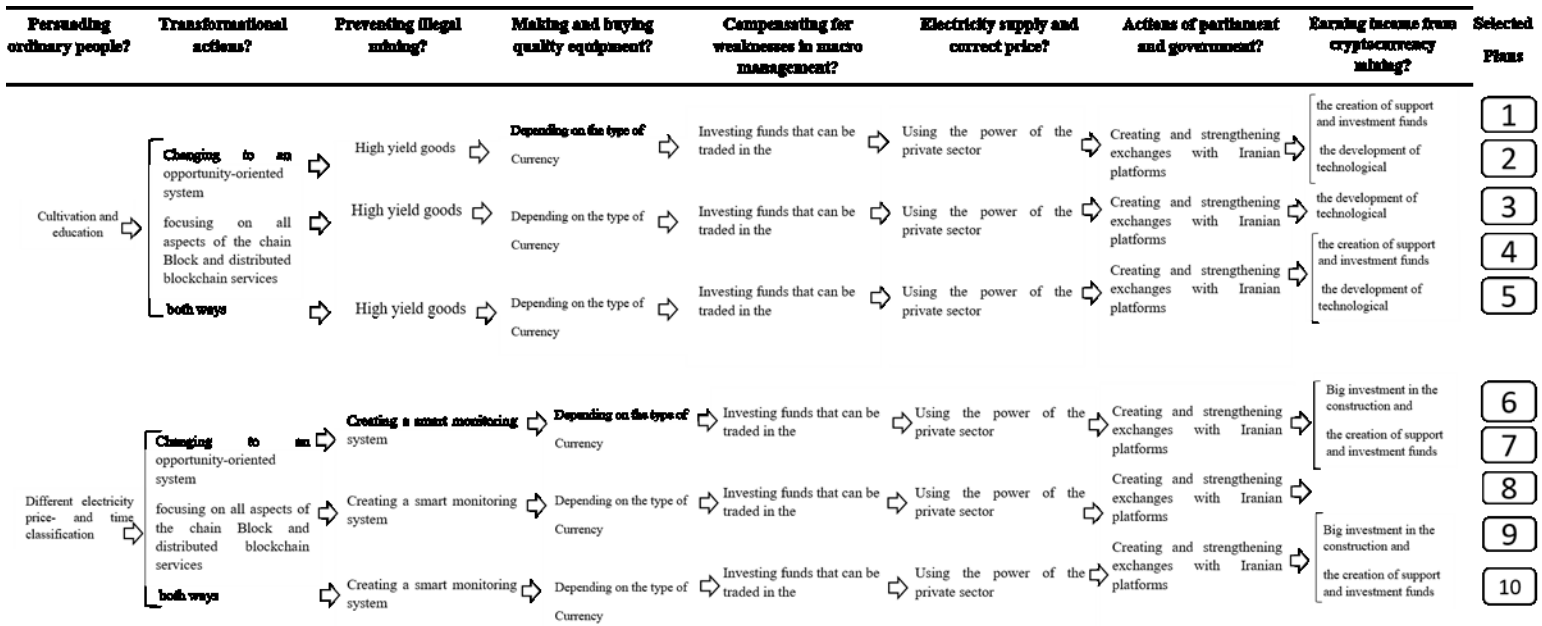


Figure 7. Selected plans (Nejati et al.,2018)

3.3. Methods used in comparative style

Step 6: Identifying the areas of comparison

Only one dimension is rarely considered in a decision. In addition, in a decision problem, many individuals usually participate, each having their criteria. Essentially, a comparison area can be considered as several important areas in terms of participants' involvement in the decision-making process, in which participants are interested in knowing the consequences of alternative paths and options. Table 3 shows an example of four comparison areas agreed upon by the members in this section. This list has been obtained through discussion and exchange of views among participants.

Table 3. Comparison areas

Comparison title	The field of comparison
Implementation costs and resources	The cost, financial, human and technological resources of project implementation
Execution time	Project implementation time
Possible result	The possibility of achieving the plan
Income (output)	Income (output) of the plan

Step 7: Comparing different plans

When many decision plans are created, especially if the goal is to extract important information about areas of process uncertainty, comparing all of these plans simultaneously based on all agreed-upon criteria is difficult. A set of ten decision plans has been created and presented in Figure 7, and to be simultaneously assessed based on the four comparison areas, it will be a

large set. In practical workshops, a rotational approach is often used when comparing decision plans to deal with the diversity problem. For example, comparing plans three and six (pairwise comparisons and elimination to reduce the number of feasible plans) is shown in Figure 8.

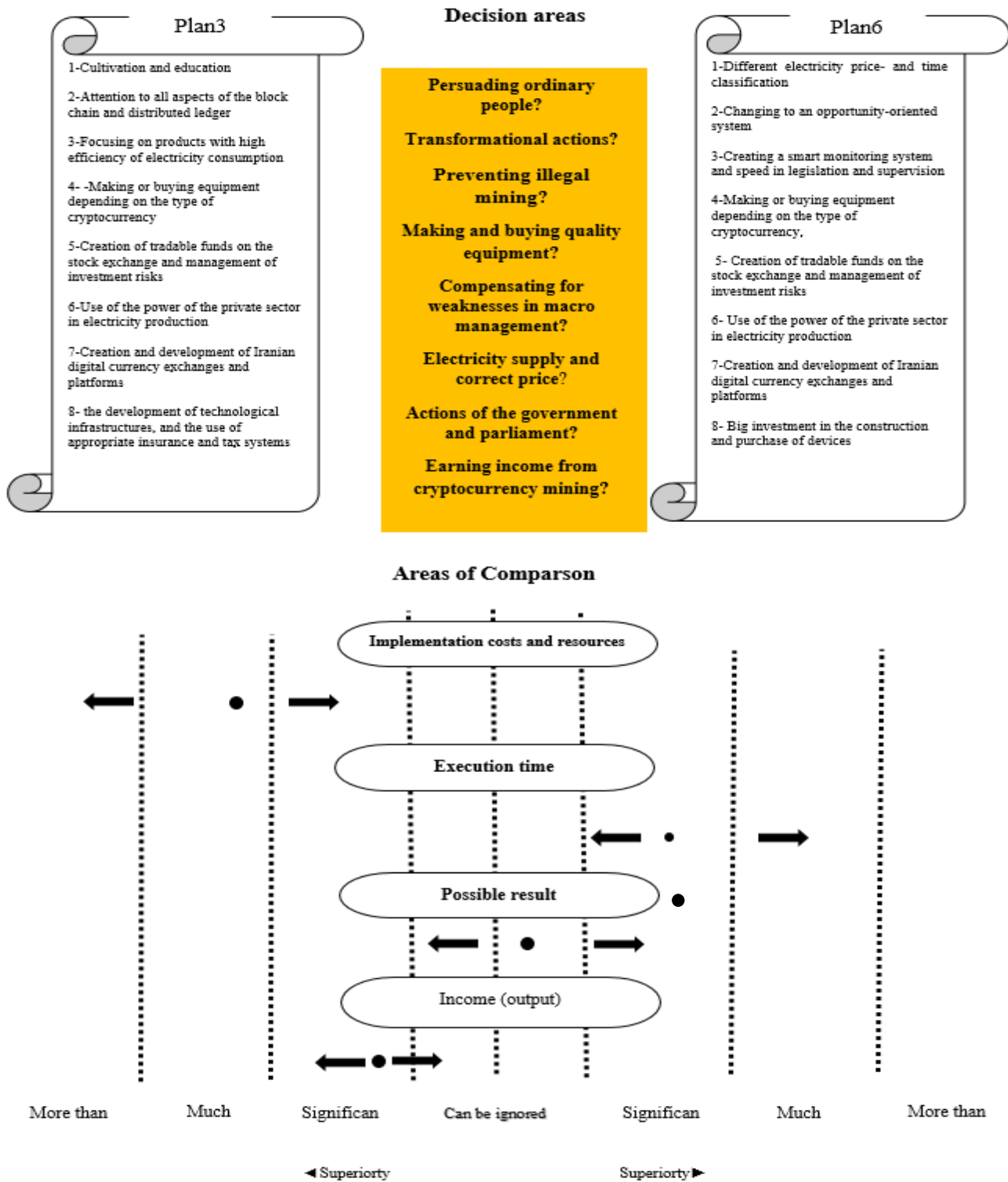


Figure 8. A network comparison chart between plan 3 and 6 (Nejati et al., 2018)

In Figure 8, the network diagram is divided by vertical lines, which represent the superiority of the "More than," "Much," "Significant," and "Can be ignored" options attached to the right or left. The vertical line in the center of the diagram indicates the superiority (Can be ignored) of one option over the other. Therefore, judgments can be made regarding the superiority level of one option on the right or left side of this diagram, such as judging comparison areas. Figure 8 shows that judgments can be made based on each comparison area regarding the superiority level of each option compared to another option, as well as judgments about the range of uncertainty surrounding this point. Since flip charts are used in this study, small labels are used to place a dot indicator (●) to show the level of superiority and two range indicators (◀or▶) to represent the spectrum on the row of each comparison area. These indicators can be easily changed during discussions among participants.

3.4. Methods used in the selection style

Step 8: Identifying approaches for dealing with uncertainties

When transitioning from the comparison style to the selection style, the issue of managing uncertainties arises. All three uncertainties (Figure 2) can hinder the agreement on priority options for key decision areas. The unique characteristic of the strategic option approach is that it provides a framework for managing various uncertainties in the selection style. After presenting the list of uncertainties, the type of uncertainty must be determined. Sometimes, the type is ambiguous, and a combination of classifications needs to be used. As shown in Table 4, decision areas are listed, and each uncertainty area is given a specific title. In the next step, the relative importance of uncertainties is determined. To prevent confusion between the decision areas and the uncertainty areas, a question mark (?) is placed before the label of the uncertainty areas. Table 4 presents a four-point scale for grading uncertainty areas based on their relative importance or superiority compared to the focal point of the comparison process.

Table 4. A set of uncertainty areas

Score	Type	The title of the field	Areas of uncertainty
**	UE	?Definition and recognition of the customer and expert	?Accurate definition and recognition of customers or beneficiaries and specialists or experts
***	UV/UR	?The value of the mental image	?The value of the mental image created after solving the problem, for each of the stakeholders
**	UV	?Development of nuclear energy	?Development of peaceful nuclear activities for electricity production according to the conditions of the country
****	UE/UV	?The nature of cryptocurrencies	?Today's nature of digital currencies that are under the supervision of the central bank as a currency or an asset under the supervision of the stock exchange
*	UE	?Islamic and customary jurisprudential limitations	?The limitations of mining and digital currencies in general from the point of view of jurisprudence (Islamic discussions of halal and haram) and custom
****	UV	?Agreement on the JCPOA	?Agreeing with 5+1 and reaching the conclusion of JCPOA
****	UR	?The growth of the gold and stock market and...	?Potential growth of gold, coin, dollar and stock markets
***	UV	? Iran's Sanctioners strategies	?Iran's Sanctioners strategies to Earning income through cryptocurrencies or digital currencies
***	UE/UR	?The level of environmental destruction	?The amount of destruction and cost that mining can have on the environment or the planet

The next issue is what actions can reduce uncertainty in key areas. Any action taken to address doubts and uncertainties within an area of uncertainty is called an "exploratory option". Identifying each exploratory option can be in response to a specific area of uncertainty. Table 5 provides a framework for encouraging discussion and exchange of ideas on this issue. One option for dealing with uncertainty is always "Failure to take action" (meaning it is a neutral option but visually emphasized since reducing uncertainty can sometimes be so difficult that taking no action may be the best choice). It should also be noted that every exploratory effort in investment leads to a reduction in uncertainties within each area of uncertainty, or not (at what cost and when?).

Table 5. Compares options for further research and investigation in areas of uncertainty

Profit	Delay	Cost	Options for further research (exploratory)	Areas of uncertainty
... ++	... **	... #	Failure to take action Negotiating and consulting with the government for the rapid implementation of the digital transformation document, as well as preparing a comprehensive plan to be submitted to the parliament for approval	?Today's nature of digital currencies that are under the supervision of the central bank as a currency or an asset under the supervision of the stock exchange
++ ...	** ...	## ...	Negotiating with relevant government officials and managers Failure to take action	?Agreeing with 5+1 and reaching the conclusion of JCPOA
++ ... +	* ... ***	# ... ###	Consultation for the formation of an economic expert team in the Ministry of Economy, specializing in cryptocurrencies Failure to take action Putting the issue on the agenda of the government	?Potential growth of gold, coin, dollar and stock markets
++ ++ ...	** * ...	### # ...	Negotiation with key and effective managers Simulation of the problem with software Failure to take action	?The value of the mental image created after solving the problem for each of the stakeholders
... + ++	... *** **	... ## #	Failure to take action Open negotiations Consultation and clarification meeting with the country's ambassadors	?Iran's Sanctions strategies for Earning income through cryptocurrencies or digital currencies
... ++ +	... * ***	... # ###	Failure to take action Negotiation to be included in the agenda of the government board Consultation with miners	?The amount of destruction and cost that mining can have on the environment or the planet

In Table 5, different symbols have been used in the left column for each criterion to evaluate the options under consideration relative to the reference point (non-action). The cost of an option is measured by its component or opportunity cost. The delay caused by an option may lead to immediate decision-making, and the benefit obtained due to increased certainty and reduced uncertainty in a particular area.

Step 9: Prioritizing decision areas and presenting confidence-building plans

The author has now reached a point where the author can express the relative advantage of options in decision areas with a higher priority based on their relative flexibility in determining the future of other decision areas. It is done by retrieving the decision plan layout based on the priority level, as shown in Figure 9. Decision areas with higher priority are moved to the beginning of the list. Here, the option tree's structure is the same as presented in Figure 7, with the difference that the areas with high priority have been moved to the beginning of the decision areas list of the center of focus. Here, the option decision area "Transformational actions?" has the highest priority compared to other areas.

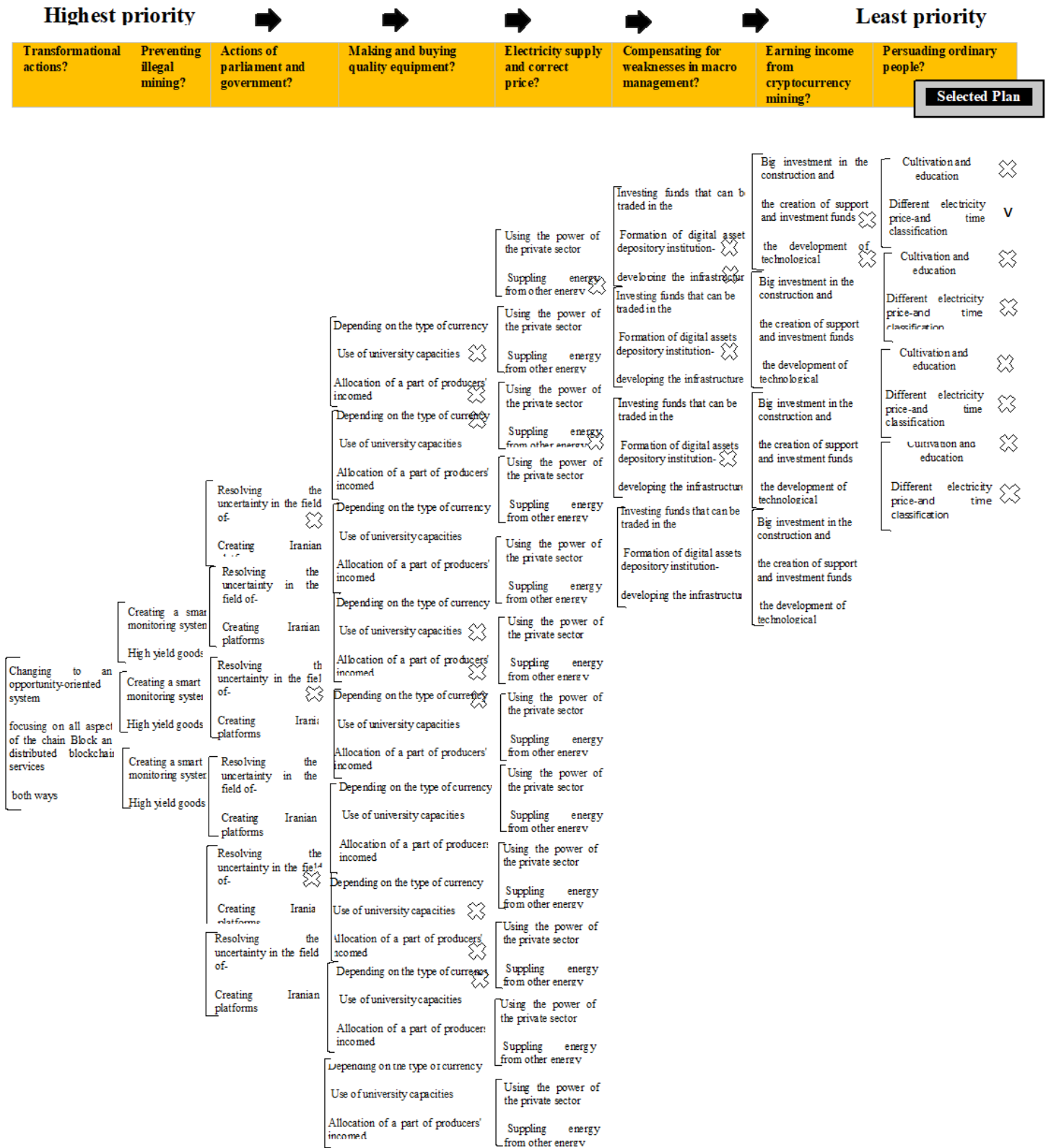


Figure 9. Comparison of options in terms of priority for determining flexibility in future choices (Nejati et al., 2018)

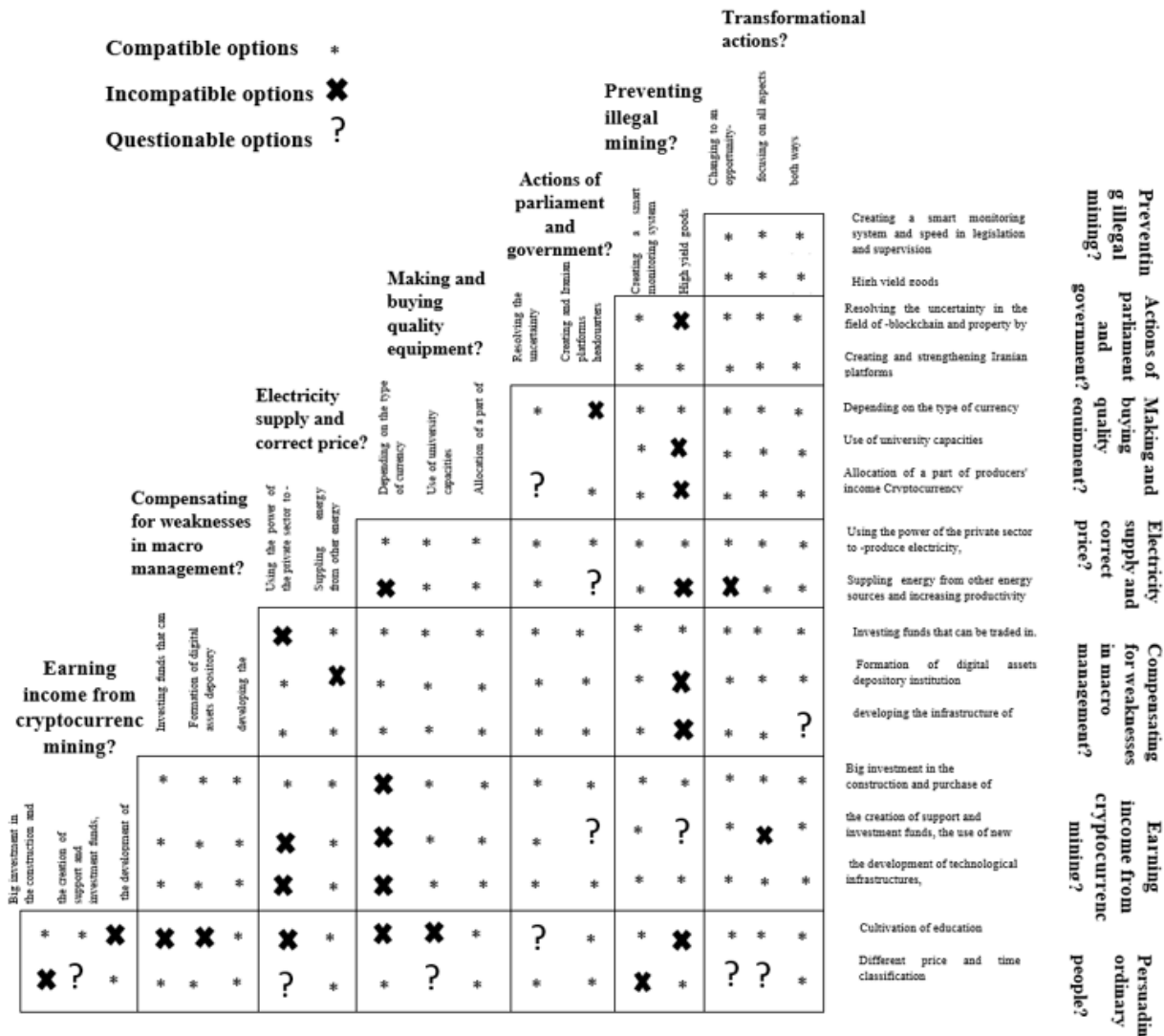


Figure 10. Adaptability matrix in new form (Nejati et al., 2018)

Among the 13 proposed plans listed in Figure 11, seven more probable and superior decision plans have been extracted. These plans have been selected based on several more important comparative areas. If the number of superior and more reliable decision plans has already been prepared from all or some of the decision areas that are easily selected, but in cases where analysis and investigation are required, the problem differs. At this stage, participants focused on analyzing new aspects of the problem situation to select more reliable plans; ultimately, these seven plans were chosen. However, as mentioned before, this study also considers questionable plans compatible.

Selected Plans

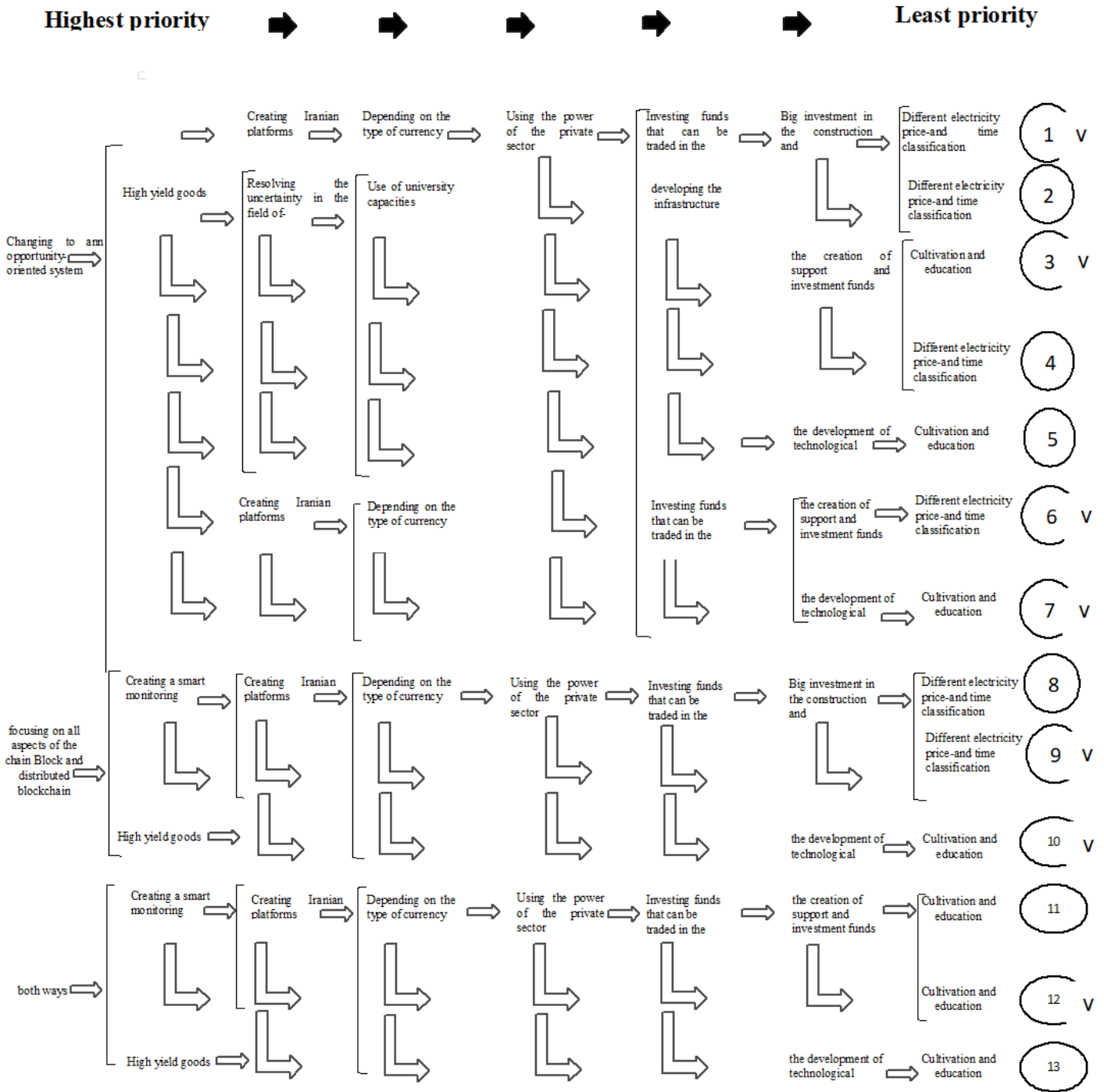


Figure 11. Selected plans (Nejati et al., 2018)

Step 10: Providing commitment package(improvement package)

Now, attention must be paid simultaneously to making initial decisions and managing uncertainty. Usually, a network diagram is used as a framework and infrastructure for the integration process, which has gained popularity as a commitment package or abbreviated as an improvement package. As shown in Tables 6 and 7, each commitment package includes a set of proposals for how to move towards a commitment over time. In the "Present" column, immediate decisions or actions and an exploratory option are considered for each decision area. In the "Future" column, decisions that need to be made in the future for exploratory options and necessary contingency planning for decisions that have immediate action for them are specified for each decision area. Finally, after examining and analyzing the problem, facilitators presented the commitment package with the help of the commitment package working group in Tables 6 and 7.

Table 6. Commitment package in the present time

	Actions to be taken in the present	
	Decision areas- Actions	Areas of uncertainty -further research and investigation
Some of the main players in the field of digital currency include basic companies such as banks, accounting and legal companies, technology companies, and startups.	Deciding on businesses in the field of cryptocurrencies? (setting up a two-year plan)	?The value of mental image (Problem simulation with software)
Parliament and the government, except the Ministry of Economy, Ministry of Energy, and Ministry of Foreign Affairs	Transformational actions? (Change to an opportunity-based system)	?Potential growth of gold, coin, dollar, stock markets, and so on (Consultation for the formation of an economic expert team in the Ministry of Economy, specializing in cryptocurrencies)
Ministry of Economy, Central Bank and Stock Exchange	Making appropriate decisions about cryptocurrency policies? (providing infrastructure and funds)	?The nature of cryptocurrencies (negotiations and consultations with the government for the rapid implementation of the digital transformation document and also the preparation of a comprehensive plan to be submitted to the parliament for approval)
Ministry of Power	Preventing illegal mining? (Creating a smart monitoring system and High-yield Goods)	?The amount of environmental destruction (negotiation to be included in the agenda of the government board)
Ministry of Foreign Affairs		?Iran's Sanctions strategies for Earning income through cryptocurrencies or digital currencies (consultation and explanation meetings with the country's ambassadors)

Table 7. Commitment package in the future

	Actions that have been postponed until some time in the future	
	decision areas	Areas of uncertainty
Some of the main players in the field of digital currency include basic companies such as banks, accounting and legal companies, technology companies, and startups.	Compensating the weakness in macro management of cryptocurrencies? Compensation for lost opportunities in exploiting the capacities of exchange and payment?	
Parliament and the government, except the Ministry of Economy, Ministry of Energy, and Ministry of Foreign Affairs	Actions of parliament and government? Cooperation or noncooperation with foreigners in creating and developing mining fields?	?Legal, Islamic and customary restrictions
Ministry of Economy, Central Bank and Stock Exchange	Making and Buying quality mining equipment and devices? Necessary actions in the field of requirements and requirements of cryptocurrencies?	?Definition and recognition of customers and experts
Ministry of Power	Persuading ordinary people not to extract illegally/Supply? Supply of electricity required for extraction and proper electricity tariff?	?Development of nuclear energy for electricity generation
Ministry of Foreign Affairs	Earning income through cryptocurrencies?	?Agreement on the JCPOA

4. Research findings

The blockchain, a part of digitalization, can promote competition and provide transparency between power companies and their customers. Iran is known as a country with excessive electricity consumption and an undeniable share of total energy consumption. According to the Iranian Ministry of Energy report, Iran's most significant electricity consumption sectors are industrial, residential, agriculture, and public (Esmaeili and Rafei , 2021). Statistical information published by Tavanir Co. shows that electricity consumption for these sectors in 2019 was 97,081 million kWh, 88.500 million kWh, 38,764 million kWh, and 25,589 million kWh. The general results of this research show that cryptocurrency mining does not greatly impact Iran's electricity shortage (about ten percent). The benefits of the cryptocurrency mining industry should not be ignored due to the lack of electricity. However, one should consider providing more energy through renewable energies, such as nuclear energy.

According to the above tables, the proposed solutions for solving the problem of electricity shortage caused by mining are shown in two decision areas and areas of uncertainty in present and future times. In the decision areas, according to Figure 9, the decision area "Transformational actions?" with the decision option "Change to an opportunity-based system" and the decision area "Preventing illegal mining?" with the options "Creating a smart monitoring system and speed in legislation and supervision" and "High-yield Goods" have the highest priority that should be pursued and implemented by the Parliament, the government,

and the Ministry of Energy. Regarding the six decision areas in the center of focus, in the future, delayed and fundamental actions should be taken through the relevant ministries or organizations. These decision areas are displayed in red and bold font. Among the decision areas that were not in the center of focus, the two decision areas, "Deciding on businesses in the field of cryptocurrencies?" and "Making appropriate decisions about cryptocurrency policies?" have considerable priority according to Figure 3, and three decision areas "Compensation for lost opportunities in exploiting the capacities of exchange and payment?", "Cooperation or noncooperation with foreigners in the creation and development of mining fields?", and "Necessary actions in the field of requirements and requirements of cryptocurrencies?" have been selected by the working group members without official analysis and agreement. They should be pursued and implemented in the future.

According to Table 5, five areas of uncertainty along with the option for further research and investigation are: "?Value of mental imagery" (simulating the problem with software), "?Potential growth of gold, coin, dollar, and stock market" (Consultation for forming an economic expert team in the Ministry of Economy, specialized in cryptocurrencies), "?The nature of cryptocurrencies" (negotiating and consulting with the government for the rapid implementation of the digital document transformation and preparing a comprehensive plan for approval by the Parliament), "?The amount of environmental destruction" (negotiation to be included in the agenda of the government board), and "?Strategies of sanctions to earning income through digital currencies" (consultation and explanation meetings with the country's ambassadors). The relevant ministries and organizations should pursue and act upon these areas to help solve the electricity shortage problem. These areas are displayed in green font and bold. One area of uncertainty, "?Agreement on the JCPOA", that is not mentioned in the mentioned table requires action, along with three areas of uncertainty "?Legal, Islamic and customary restrictions", "?Definition and recognition of customers and experts?", and "?Development of nuclear energy for electricity generation", should also be followed up and acted upon in the future.

It should be noted that constructing a commitment package does not necessarily mean the end point of the SCA process, as all delayed options must be examined according to predetermined procedures and specific orders. Additionally, new decision areas may unexpectedly emerge, new areas of uncertainty may arise, and new participants may enter the process. These factors contribute to the continuation of the SCA process and the cycle of

lightweight shaping, design, and comparison. The more complex the subject under investigation, the more illogical it is to assume that the process of SCA reaches its endpoint .

5. Conclusion

The SCA is one of the problem structuring methods to deal with complex and not properly structured problems, which is rooted in the experience of observing and supporting the groups involved in the developing decision-making processes, and its development has been related to the philosophy of practical research (Nejati et al., 2018). In this research, using the SCA to improve the situation of the problem (problems of lack of electricity due to the mining of cryptocurrencies), decision-making and solutions have been presented in such a way that the measures taken by Iran's government organizations and institutions to reduce uncertainties and improve the fields the decisions of cryptocurrencies, have to do, has predicted. But the most important result of this research, which results during the implementation of SCA, is that:

The cryptocurrency industry and digital currencies have many advantages and should not be ignored due to the lack of electricity. However, government institutions should take measures to supply the required electricity and organize the status of digital currencies.

The use of the SCA method for structuring and deciding many social and organizational issues has become common in Iran, and its further implementation helps to localize this knowledge in the country, so it is suggested to use this method in other issues that are important for the country in future research. It is very important to use. Of course, SCA is one of the soft operations research methods, and researchers can implement the same issue of digital currencies with other soft methods such as SSM and SODA.

Ethical Approval

All surveys, interviews or focus groups, etc. conducted in this research according to Ethics approval is by the Human Research Ethics Committee (HREC), duly constituted All subjects gave their informed consent before participating in the study..and Important ethical concerns were considered. During the manuscript, the ethical principles of writing, including ethics, fraudulent publication, plagiarism, duplicate publication, authorship and possible conflict of interest, have been observed. All experts and interviewees have participated in this research with their consent and all scientific principles and rules have been correctly implemented in these interviews. Also, all the authors are fully satisfied with the publication of the information of this article

Availability of data and materials

The main data of this research was obtained through interviews with twelve experts who have complete knowledge of digital currencies and cryptocurrency mining. This data is freely available to the public. The authors provide a data availability statement indicating that the data, the methods used in the analysis, the code and the materials used to conduct the research can be made available to any researcher for the purposes of reproducing the results or replicating the method.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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