TALLINN UNIVERSITY OF TECHNOLOGY
School of Information Technologies

Alireza Azari - 184574IVGM

CHALLENGES OF IMPLEMENTING IRANIAN EID IN THE PUBLIC SECTOR AND CITIZENS' AWARENESS OF IT.

Master's Thesis

Supervisor: Valentyna Tsap

M.Sc.Eng.

Tallinn 2018

TALLINNA TEHNIKAÜLIKOOL

Infotehnoloogia teaduskond

Alireza Azari - 184574IVGM

IRAANI VÄLJAKUTSED EID JUURUTAMISEL NING KODANIKE TEADLIKKUS ELEKTROONILISEST IDENTIFIKATSIOONIST

Magistritöö

Juhendaja: Valentyna Tsap

M.Sc.Eng.

Tallinn 2018

Author's declaration of originality

I hereby certify that I am the sole author of this thesis. All the used materials, references to the literature, and the work of others have been referred to. This thesis has not been presented for examination anywhere else.

Author: Alireza Azari

3/5/2020

Abstract

Nowadays, public expectations of the government have risen due to rapid advances in technology owing to the advent of the Internet, which has led to the emergence of electronic services. Governments are employing technology, mainly Web-based Internet applications, to enhance citizen access to government services and to enable citizens to use electronic services.

The following thesis seeks to identify the obstacles of implementing Iranian eID in the public sector, aiming to expedite the processes of this project and recommend viable solutions. In frames of the thesis, the positive experiences of several countries in eID management are reviewed to give a general description of the measures that have been taken as well as success factors by those countries that can be employed by the public sector in Iran. Besides, citizens' level of awareness regarding the eID in terms of applications and smart features will be measured utilizing surveying Iranian citizens.

As a final part of the thesis, based on the results of research and analysis of the experiences of different countries in the field of identity management, recommendations have been provided, as well as questions for future research on raising public awareness and reviewing the principles of a good government.

Keywords: e-Government, ID card, e-Identification, Citizens' awareness, Iran.

This thesis is written in English and is 83 pages long, including 6 chapters, 25 figures, and 2 tables.

Acknowledgment

I dedicate this thesis to my wife and my family. I would like to express my special gratitude to my dear wife for accompanying me during this period, for her love and constant support, for all the late nights and early mornings, and for keeping me sane over the past few months. I wish to acknowledge the support and great love of my family. They kept me going on, and this work would not have been possible without their input.

I wish to express my sincere appreciation to my supervisor, Valentyna Tsap, who has the substance of a genius: she convincingly guided and encouraged me to be professional and do the right thing even when the road got tough. Without her persistent help, the goal of this project would not have been realized.

I take this opportunity to express gratitude to all of the Department faculty members for their help and support.

Alireza Azari

2020

List of abbreviations and terms

CRO   Civil Registration Organization

eID   Electronic Identification

PKI   Public Key Infrastructure

NRIC   National Registration Identity Card

EGDI   E-Government Development Index

TAM   Technology Acceptance Model

2FA   Two Factor Authentication

IC   Integrated Circuit

GSB   Government Service Bus

TII   Telecommunication Infrastructure Index

HCI   Human Capital Index

ICT   Information Communication Technology

UIN   Unique Identification Number

PIC   Personal Identification Code

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1 Introduction

1.1 Overview of the research

The spread of information and communication technology has brought about widespread changes in economic, social, and government spheres, affecting different aspects of human life and triggering a worldwide transformation. Technology has deeply affected all areas such as business, health, education, business, and government. It has brought about new elements to them, such as e-government, e-health, e-learning, e-business, and more. (Wayne F. Cascio,Ramiro Montealegre, 2016) Providing online services to citizens is one of these elements, and electronic service is a new type of service to citizens in various fields in digital space.

Nowadays, policymakers in various governments are focusing on ICT as one of the most critical approaches, and e-government is considered as practical support for enhancing the efficiency and effectiveness of governments. (Silcock, 2001) The main goal of e-governance is to facilitate the existing processes in governance for all parties' governments, citizens, and businesses. (Saxena, 2005) One of the essential pillars of e-government is the eID system since it has a vital role in giving access to citizens to use public e-services.

EID or eID project in Iran launched in the early advent of smart government. Nevertheless, the majority of citizens in Iran are still encountering difficulties that are connected to bureaucratic burdens. Experiencing a wide variety of e-services and the multi-purpose use of eID in Estonia led me to offer practical suggestions to government officials to accelerate the process of the eID project in Iran. Besides, I intend to prove that raising awareness of citizens regarding the benefits that eID can offer is very crucial. Therefore, the current level of citizen's perception of eID is evaluated, and suggestions are provided accordingly. This research intends to aid the Iranian government in expediting the processes of the eID project and, most importantly, expanding citizens' knowledge on the use of eID.

1.2 Statement of the problem

The eID project has been carried out by the CRO in Iran. The e-ID scheme for the first time was launched for 10,000 employees in Qom (one of the small cities in Iran) in 2012, given that the province had the necessary infrastructure. (Shabani, 2017) Now, the Iranian government is already completing the e-ID implementation, and it is expected to be completed in 2020; however, due to mismanagement and improper planning, the project has not been as successful as expected. According to the statistics available at the CRO in Iran, 62 million people are the eligible target population for receiving eID. Thus far, 54 million people have completed registration for the eID; nevertheless, nearly 10% of citizens have not received their eID yet. (Hamshahri, 2019)

Although this project was launched in 2012, the government is still facing some challenges. Firstly, according to the recent statistics available at CRO, not all citizens have received their eIDs yet. (BornaNews, 2019) . Secondly, after the launch of the eID card issuance stage and providing the electronic cards to citizens, one of the most critical challenges is going to be the acceptance of the eID by citizens and their awareness level of smart features and benefits. Failure to achieve the acceptance and use of eID by citizens means that investment in this national project has been in vain.

1.3 Research objectives and questions

This thesis focuses on two areas in the framework of e-government. Firstly, as far as the eID project is concerned, it aims to identify main obstacles concerning project development in the executive stage in Iran and recommend solutions to remove them as much as possible. Secondly, regarding the citizens' awareness of the eID, the current level of citizens' awareness must be identified to offer concrete solutions on how to engage citizens in using eID to access electronic services. Hence, answering the following research questions would help the government accelerating the eID project in Iran and help to resolve issues concerning challenges and citizens' awareness.

> ➢ *What challenges of the eID project the public sector of Iran is currently facing?*

Answering the given question would help to identify the main obstacles and barriers that the public sector has faced so far. After identifying the obstacles, viable solutions can be suggested.

> ➢ *What international practices and lessons of e-identity management can be adopted and applied in Iran?*

Although establishing and developing e-governance elements as well as infrastructure and resources differ from country to country, useful practices and experiences in these projects can be employed.
Furthermore, it can be evaluated how different countries have faced similar obstacles in the project implementation phase, and the expected outcome can be taken into consideration as positive approaches and practices.

> ➢ *How to raise citizens' awareness to improve eID acceptance in Iran?*

Answering the given question would help to find strategies on how to raise citizens' awareness to provide them insights regarding the access and multiple benefits of using public electronic services. Citizens' perception of eID is a significant issue since lack of awareness regarding the benefits of the card and its new applications will cause citizens not to use the new national card.

1.4 Research design and methodology

To answer the posed research questions, a combination of the online survey and multiple case study approach as research methodologies have been employed in this thesis. In the following, the reason for using the mentioned methodologies is explained.

According to the findings of the research by Van Diel and her colleagues in a comparison between using quantitative and qualitative methods, it is concluded that the field of public administration is becoming quantitative, and the survey has been mostly used. (Groeneveld, S., Tummers, L., Bronkhorst, B., Ashikali, T.,Van Thiel, S., 2015) " We found that the use of quantitative methods is unequally distributed; some subfields (public management) use quantitative methods more often than others (policy and politics)". (Groeneveld, S., Tummers, L., Bronkhorst, B., Ashikali, T.,Van Thiel, S., 2015) Furthermore, in the research conducted by Anil Mathur, the findings indicate that online surveys have significant advantages over other formats, such as global reach, flexibility, low administration cost, convenience, and question diversity. (Evans, J.R. , Mathur, A. , 2005)

According to Stewart, as far as the case study approach is concerned, in governance-related research, the multi-case study method can be advantageous since it can identify patterns across organizational boundaries." The multi-case study is particularly valuable when relationships between organizational structures, management processes, and outcomes are under investigation." (Stewart, 2012)

First of all, the thesis will investigate the challenges in the electronic identification system in Iran. For this purpose, data will be collected in the form of an online survey that was distributed among 50 employees of CRO to identify the main obstacles of this project; the survey contains multiple questions as well as an open-ended question.

To answer the second research question, the multiple case study approach will be employed to gain in-depth insight into the research context. The primary purpose of the multi-case analysis is the comparison between cases. As a result, it will provide an overview of various e-identification management system practices and positive experiences in different countries, aiming to outline lessons that can be learned by Iranian e-government officials.

To answer the third research question, data will be collected using a survey as an instrument of data collection via social media to identify factors influencing citizens'

awareness of eID. The structure of the questions includes close-ended questions. Besides, Google Forms has been used as a tool for collecting information from citizens via a personalized survey.

1.5 Significance of the study

With the rapid growth of technological advancement, nowadays, most governments are moving towards e-government. This research can provide practical solutions for e-government in Iran as well as other countries in three areas.

In the first place, recommendations can be implemented in the Iranian government as well as in other developing countries, by examining the factors that have slowed down the process of eID project and investigating the challenges they are encountering and by reviewing the experiences of other countries at the executive levels.

Secondly, identifying the influential factors that lead to raising citizens' awareness towards eID can provide positive outcomes for the CRO that is responsible for the eID project in Iran, as well as the electronic government of Iran.

Last but not least, by enhancing the electronic identification system in Iran, citizens can benefit from a wide variety of public services electronically as well as digital signature technology that is paperless, cost-efficient, and time-saving. Besides, bureaucratic burdens will be reduced to a large extent, and as a result, citizens will no longer need to go to the administration offices to use public services.

2 Theoretical background

This chapter aims to demonstrate the theories and key concepts that are relevant to the subject of this thesis.

2.1 Identity theory

This subsection aims to present the importance of having an identity from the sociological and psychological point of view. Furthermore, it shows that electronic identification as a novel method of identification stems from identity theory.

Jan E. Stets and Richard T. Serpe have used a set of criteria to define identity within the context of social structure. They state that individuals' have responses when they reflect upon themselves in a role. " Generally, we consider identity to be a shared set of meanings that define individuals in particular roles in society (for example, parent, worker, spouse, or teacher role identity), as members of specific groups in society (for example, a church, book club, or softball group identity), and as persons having specific characteristics that make them unique from others (for example, an athletic or artistic person identity)." (Jan E. Stets , Peter J. Burke, 2013) Thus, it can be said that identity is defined as the set of attitudes and characteristics of individuals and what distinguishes them from others.

Social Identity Theory

Social identity theory is related to intergroup relations. According to this theory, identity has both individual and social dimensions. Personal identity is about the aspects of self that distinguish one from others and are specific to the individual. In contrast, social identity expresses only similarities. In this dimension, the individual defines himself/herself based on group or class affiliations. (Tajfel H. , 2010)

According to Tajfel's theory, social identity is conceptualized as the individual's awareness of belonging to a particular social group and the emotional value and importance of this membership for the individual. As a result, individuals residing in different groups can access social identities that represent their particular situation in

society. Nevertheless, belonging to a specific group only contributes to a positive social identity if the characteristics of that group can be compared favorably with other groups. In this comparison, individuals tend to judge in favor of their group.

Jan E. Stets and Peter J. Burke have explored the differences and similarities of identity theory and social identity theory, and they believe that combining identity theory with social identity theory will empower social psychology. " Such a theory would address agency and reflection, doing and being, behaviors and perceptions as central aspects of the self. It also would provide a stronger integration of the concepts of the group, the role, and the person " (Jan E. Stets, Peter J. Burke, 2000)

National Identity

National identity is the perpetual reproduction of the pattern of values, symbols, memories, myths, and traditions that make up the distinct heritage of nations. National identity is a concept that seeks to reduce conflicts in-group identities in a way that converges them into a higher identity, which is national identity. According to some scholars, national identity is ultimately dominant, and other sub-identities fall under it.

The vast majority sociologists emphasize the fact that interpersonal dialectics and society form a sense of identity. They rarely admit that identity is usually exposed to the attitudes and emotions of individuals, but the basis for its formation is social life. (Jenkins, 1996). Tajfel associates identity with group membership and considers it to consist of three elements as below : (Tajfel, 1978)

- The cognitive element (awareness that the individual belongs to a group).

- The value element (one's judgment of the positive and negative value consequences of group membership).

- The emotional element (feelings about the group and other people who have a special relationship with that group).

In fact, identity is a social construct which is socially consolidated and comes out of people's everyday social life. (Lawer, 2008)

According to the theorists, each individual needs to have an identity to interact with other individuals. Besides, having an identity can boost self-esteem, self-efficacy, and give authenticity to an individual.

The term identity in e-government will turn into e-identity; the governments now are providing services electronically to citizens. Having an electronic identity is one of the requirements for using these types of services. Electronic identification is rooted in identity theory except that all interpersonal interactions take place in the electronic space.

2.2 Good governance theory

The terms 'governance' and 'government' are vastly different, and these two concepts cannot be considered synonymous " Government occurs when those with legally and formally derived authority and policing power execute and implement activities; by contrast, governance refers to the creation, execution, and implementation of activities backed by the shared goals of citizens and organizations, who may or may not have formal authority or policing power " (Mohammed Asaduzzaman , Petri Virtanen, 2016)

Scholars have mentioned various definitions of governance from a variety of perspectives. However, the term governance is more defined in the context of politics and political activity. Although some articles also represent good governance as good government, they are two different concepts; since not all institutions of society are under the control of an executive body, and other institutions are equally involved in the process of governing a country. Nevertheless, there is a consensus among many scholars that a good government is a prerequisite for good governance.

It is noteworthy to know that how the scholars came up with the term good governance. Although Yu Keping considers two-state failure and market failure factors to be the reasons for the replacement of government by governance, he states that since state and market can fail in social resource allocation, governance cannot be an exception to this. Thus, the primary concern among scholars was how to tackle this problem, and they opted good governance concept to deal with this challenge (Keping, 2017)

The Asia-Pacific Economic and Social Commission (ESCAP) has outlined the fundamental principles of good governance and the factors that contribute to

strengthening these principles; ESCAP has good governance principles as follows: (Sheng, 2009)

➢ Participation

Public participation is one of the critical pillars of good governance. Partnerships can take place directly or indirectly (through legal entities). It is not to be expected that all existing ideas are taken into account in a country's decision-making system. However, the concept of participation here refers to the freedom of expression and diversity of views and the organization of civil society.

➢ Rule of Law

Good governance requires an ethical framework of laws that includes the full protection of the rights of individuals (especially minorities) in society and is properly implemented. It should be noted that fair implementation of laws requires an independent judiciary and an incompetent executive unit such as Police.

➢ Transparency

Transparency means providing a flow of information freely and easy access to it for everyone. Transparency can also be attributed to public awareness of how decisions are made and implemented. In such circumstances, the mass media will be able to quickly analyze and critique the policies adopted in the country's decision-making and executive system.

➢ Responsiveness

Accountability of institutions, as well as organizations within a specific legal and time frame to their members and clients, is one of the factors that lead to the establishment of good governance foundations in society.

➢ Forming general consensus

Providing the basis for the emergence of different views in different political, social and economic spheres, is one of the principles of good governance Playing this vital role

requires a thorough understanding of the long-term needs of the community on the path to sustainable development.

➢   Equal Rights (Justice)

Lasting prosperity in society will be possible by recognizing equal rights for all. In society, there must be an assurance that individuals will be commensurate with their activities in the interests of the community. In other words, in good governance, everyone should have equal opportunities.

➢   Effectiveness and Efficiency

Good governance is also a tool for regulating the activities of institutions for the efficient use of natural resources and environmental protection. Efficiency and effectiveness in governance are some of the issues that have become more important over time.

➢   Accountability

Accountability can be one of the critical components of good governance. Alongside government agencies, private organizations, and civic bodies active in the community must also be accountable for their policies and actions. It should be noted that the principles of good governance are interconnected and that each of them requires the implementation of the other tenets. Accountability, for example, cannot be expected to have much administrative effect in society without transparency and the rule of law.

In essence, it can be said that the main aim of good governance is performing public administration process to increase public interest as much as possible. (Keping, 2017) As mentioned above, to the principles and elements of good governance, it can be concluded that the willingness of governments to become electronic is also aligned with the principles of good government. Nowadays, governments are empowering their identity management systems to align with the concept of good governance. So far, a wide range of electronic services has been provided in this regard. Daniel Castro has made a report on eIDs which includes numerous social benefits for citizens as well as businesses which are summarized as below : (Castro, Explaining International IT Application Leadership: Electronic Identification Systems, 2011)

➢ Online transactions

Benefits :

- ❖ time-efficient

- ❖ eliminate various costs

- ❖ lowers the risk of fraud and identity theft

➢ Secure communication

Benefits :

- ❖ Helping to reduce errors and processing time.

- ❖ Eliminating duplicate data entry

- ❖ Very efficient in reducing the costs linked to unnecessary paperwork including printing costs, storage

- ❖ Transportation and disposal eliminate various costs

➢ E-democracy

Benefits :

- ❖ Online voting

- ❖ better inform citizens and facilitate improved participation

As the benefits above remarks, e-governance can enhance governmental transparency, accountability, and increase the responsiveness and efficiency that are the main principles of good governance.

2.3 Technology Acceptance Model

One of the concerns regarding the use of electronic services by citizens is the usefulness and ease of use of the service. E-service designers must consider these two factors; for example, e-tax service designers should incorporate tax-related information into the website so that citizens do not need a tax professional to use the website.

To this end, a model called the technology acceptance model (TAM) was introduced by Davis in 1989 (Davis, 1989). In this model, the two concepts of "perceived usefulness" and "perceived ease of use" are the basis of the end-user adoption of new technology. The purpose of this study was to develop a scale for predicting and explaining consumer behavior. (Davis, 1989)

Perceived usefulness

The extent to which a person believes that using a particular technology improves their job performance. The first thing that causes people to tend or not to use technology depends on their belief in the usefulness of that technology. If people believe technology improves their performance, they will tend to use it. This variable is called perceived usefulness. (Davis, 1989)

Ease of use perceived

Ease of use indicates that using a particular technology is simple and hassle-free. Ease of use is the second factor involved in technology adoption. Assuming that people may believe technology is beneficial, they may, at the same time, have the impression that it is so difficult to use that technology that it is difficult to use. This variable is called perceived ease of use. (Davis, 1989)

It is noteworthy to identify which factors affecting technology acceptance. Different variables would specify technology acceptance. Prodromos D Chatzoglou and his colleagues gathered data from a sample of 547 Greek citizens regarding factors affecting the intention to use e-government services. The findings reveal that among various factors such as perceived trust, internet experience, peer influence, computer self-efficacy, and perceived risk, perceived usefulness is the crucial determinant of the intention to use e-government services. (Chatzoglou et al., 2019) Park and his colleagues have also identified psychological traits like a strong determinant of acceptance of technology such

as personal innovativeness, technology readiness, and self-efficacy. (Park, S. et al., 2006) The study also disclosed that there is no relation between age and self-efficacy as findings revealed that elderly users with high self-efficacy tend to accept technology more than youngsters with low self-efficacy. Kumar et al. developed a model of e-government adoption and citizens' satisfaction, establishing that factors such as perceived risk, perceived control, website design (perceived usefulness and perceived ease of use) impact e-government adoption directly. At the same time, service quality increases citizens' satisfaction. (Kumar, V., Mukerji, B., Butt, I., 2007)

In addition, Viswanath Venkatesh and his colleagues have formulated the Unified Theory of Acceptance and Use of Technology (UTAUT) as an extended model of technology acceptance. They state that UTAUT as a handy tool aids the managers to evaluate the probability of success for brand new technology introductions as well as to perceive the acceptance criteria in order to design interventions proactively. (Venkatesh, V., Michael, M., Gordon, B., Fred, D., 2003) They hypothesize that four factors can have a great deal of importance as " direct determinants of user acceptance and usage behavior," namely performance expectancy, effort expectancy, social influence, and facilitating conditions. (Venkatesh, V., Michael, M., Gordon, B., Fred, D., 2003).

UTAUT model can be an excellent criterion for determining citizens' eID acceptance factors. Here's a brief explanation of direct determinant by Viswanath Venkatesh and his colleagues :

Performance Expectancy

The degree to which an individual believes that using the system will help him or her to attain gains in job performance.

Effort Expectancy

The degree of ease associated with the use of the system

Social Influence

It can be defined as to what extent an individual perceives that significant others believe he or she should use the new system.

Facilitating conditions

It can be described as the degree to which an individual believes that the use of the system can support an organizational and technical infrastructure.

Viswanath Venkatesh and his colleagues have presented a research model wherein the relation between crucial moderators(age, experience, gender, Voluntariness) and determinants have been examined, and findings are represented as below: (Venkatesh, V., Michael, M., Gordon, B., Fred, D., 2003)

- The impact of social influence on behavioral desire will be less extreme by gender, age, voluntariness, and experience

- The impact of effort expectancy on behavioral intention will be moderated by gender, age, and experience

- The impact of performance expectancy on behavioral intention will be moderated by gender and age

- Facilitating conditions will not have a significant influence on behavioral intention.
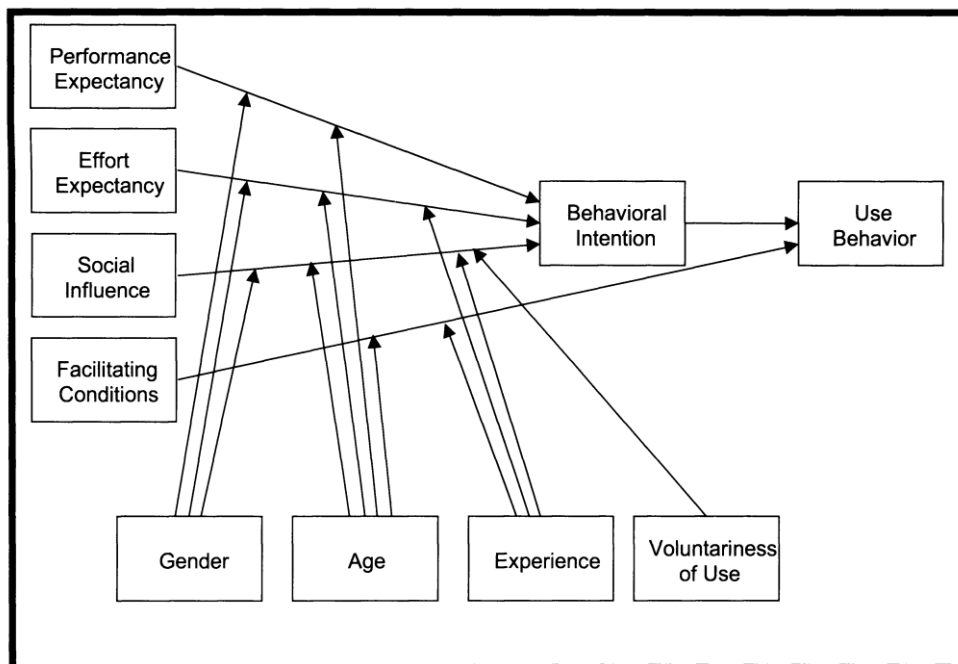
Figure 1. Research model by Viswanath Venkatesh and his colleagues

It is essential to know that what makes citizens accept or resist having eID as a tool for electronic identification and using electronic services. The TAM and it's extended models are useful models for measuring the factors that influence the acceptance of the eID as a brand new technology. In this regard, this thesis can yield promising results that may be used further to help increasing citizens' acceptance and awareness of eID.

3 State of the art

This section aims to give a short description of the national identification card history and its formation as well as the main components of the eID. Besides, experiences and lessons learned from several countries in the field of e-identity management will be reviewed, specifically Estonia as one of the pioneers and most prosperous countries in e-governance development. Estonia has been a positive role model for other governments in this domain.

3.1 National identity document

According to Clerk, Identification is defined as the act of identifying, the state of being identified, or something that distinguishes one; He states that the demand for identification was mainly related to societal rather than economic. " The social dimension of human culture is reflected by the idea of a person 'identifying' with a group. Indeed, group-membership ('one of us' or 'one of them') was probably a far more critical matter than individual identity ('I,' 'you' or 'he') throughout pre-historic times and most of the historical era." (Clarke, 1994) Historically, in the small communities in the past, individuals did not need to prove their identity since other individuals in those communities could recognize them, or they could find someone who could verify their identity. (Castro, Explaining International Leadership: Electronic Identification Systems, 2011) Nevertheless, nowadays, it is not possible since the communities are growing fast and becoming more significant. Currently, it is the government's responsibility of providing citizens proof of identity; the role of governments is the primary provider of identification. (Castro, Explaining International Leadership: Electronic Identification Systems, 2011)

(ITU, 2016) defines national identity programs as government-initiated programs that assign a UIN to each targeted participant, which is used for identification verification. Nowadays, modern bureaucracy requires identifying individuals in this way and states assign a unique "personal code" to each citizen. The structure of the ID number differs from country to country, and each country has its' own logic for generating this number.

The characteristics of a national card and its components will be presented in the next sections.

3.1.1 Characteristics of the identity document

Before the advent of the eID, citizens used to have the paper national card which included information such as personal details (name and family, date of birth, sex, citizenship and place of birth), unique ID-number (in most countries the personal ID code does not change during the cardholder's lifetime), photo of the individual as well as issuance and expiration date of the card. However, still in some countries, citizens are using paper cards. With the advancement of technology and the advent of e-states, the eID emerged. The eID has several features that enable citizens to use government-provided electronic services.

Using an eID will result in many costs being reduced at the government and community level, the most important of which are:

- Reduce costs associated with authentication in public and banking sectors

- Reduce the costs of frequent citizens visits by providing electronic services

- Reduce the cost of data storage, maintenance, and updating within ministries, organizations, and public and private sectors using smart card information and the country's population database.

Smart cards differ in material and size from paper cards and are more robust. Smart cards also have an electronic chip that carries embedded files. In addition to the features of paper cards, new features have been added to smart cards, as follows:

Information processing

Since the national smart ID card is a smart card, it can process information within itself. One of the potential features that can be put on an eID is "match on the card." This technology is one of the applications of smart card information processing. For example, the matching and authentication operations of a fingerprint are performed within the card itself. After receiving the fingerprint of a person using a sensor and sending it to the card,

received fingerprint with the one that stored on the card will be matched using a series of advanced mathematical operations.

Multi-purpose usage

The eID can be used for different purposes such as e-wallet, transport, ID card, access to e-government services, and many more.

Biometric feature

Another feature of the eID is the card's biometric features. The photo and fingerprint of the cardholder are stored electronically on the card, and thus; as a result, it increases the security of card usage. The cardholder must be present to use the card to digitally compare and match the fingerprint stored on the card and then be allowed to use the card's features (Balanoiu, 2009) The information is kept encrypted on the eID and prevents the card itself from unauthorized access. One of the main benefits of an eID, compared to the national paper card, is its high security, both visually and digitally. This way, it is possible to keep more confidential information with a higher confidence factor on your smart card. (Bolle, R. M., Connell, J. H., Pankanti, S. Ratha, N. K., Senior, A. W., 2003)

According to Clarke, "The term 'biometrics' is used to refer to any of a variety of identification techniques that are based on some physical and difficult-to-alienate characteristics. They are sometimes referred to as ' positive identification' because they are claimed to provide greater confidence that the identification is accurate." (Clarke, 1994)

Digital signature

Another essential feature of the eID is the use of a digital signature. "As an important safety technique, digital signature plays a significant role in guaranteeing the integrity, privacy, and non-repudiation of data." (Zhang, L., Shan, L., Wang J., 2012) Nowadays, it is vital to recognize the genuineness of texts and electronic documents in cyberspace, and therefore, digital signature and encryption techniques are used to achieve these goals. Thanks to the digital signature, individuals can sign documents, contracts, or agreements remotely via the internet; In the digital space, messages sent to the Internet are legalized

using an electronic certificate, and the recipient of a document can make sure that the document is not fake by signing the sender. The EID provides the platform for both the sender and the recipient of the document to sign and verify the documents. (Zhang, L., Shan, L., Wang J., 2012)"

Electronic services

The EID can be used to utilize the electronic services provided by the government to citizens in a variety of areas, including healthcare, finance, elections. Here are some of these services:

- eVoting

  The electronic voting systems include a process used to obtain and count votes from electronic devices. Electronic voting is a new method that has become more common in several developed countries over the last two decades. In electronic voting, votes are automatically recorded and counted by voting machines, which, while consuming less financial and human costs, also allows for the early announcement of the election result. Nonetheless, in many countries, the traditional way is not obsoleted yet. Traditionally people go to the polls at the ballot boxes, and it takes a lot of time and expense to transfer and count the ballots and delay the announcement of the result. (Taban, H., Konde, S., Sebwato, N., 2017)

  eVoting is divided into two categories: Internet voting and computer voting.

  1. Internet voting

  In this way, people get connected to the Internet through their computers at home and logged into the site. In this method, it is imperative to discuss security and prevent duplicate votes. Internet voting has various advantages; cost savings, the ability to get instant results, and the ability to reach voters around the world, are the benefits of this approach. "Remote Internet voting has become an increasingly popular alternative to on-paper voting." (Trechsel, 2016) Thanks to eID, citizens can vote at their convenience, remotely and securely.

  2. Computer voting

In this way, paper and boxes are no longer used traditionally. Instead, voters go to the polls, but they cast their ballots through a computer (special voting machines). So the names of the candidates are on the page, and the voter adds his / her vote to the relevant person by selecting the person's name. At the end of the voting process, the votes are counted by machines, and the report is transmitted to the central network. This method, which is used in most developed countries, still identifies voters with ID cards and is safe, but is relatively costly compared to other methods. (Stephen, M., Nichols, G.,Strizek, A., 1995)

- eHealth

E-Health is an emerging field of informatics, medical, public health, and commerce that evolves through the world wide web and related technologies. "The term e-health generally refers to incorporating information and communications technology (ICT) into healthcare products, services, and processes and into organizational and governmental infrastructures that can improve patient-citizens' health and well-being, increase efficiency and productivity in healthcare delivery, and enhance healthcare as an economic and social value." (Kovac, 2014)

One of the best innovations in the domain of e-Healthcare system is e-Prescription; it is a paperless system for issuing medical prescriptions. Doctors can prescribe medicine using the system electronically by an online form. At the drugstore, the patient presents an ID-card. The pharmacist then retrieves the patient's information from the system and issues the medicine.

- eTax

e-tax systems enable citizens to have cost-free preparation and lodgment of tax returns, high availability, and time-saving since most citizens can do their online tax return in a short time. Using eID, a taxpayer can log onto the system and approves the declaration form electronically.

3.1.2 Main components of electronic identification

The smart card is usually a plastic credit card-sized card with an embedded IC chip for storing and processing data. (ISO, 2007) In addition to having a durable cart's body with more security features than a national paper card, the EID has other benefits that paper cards cannot provide. A smart card is a small computer mounted on a plastic card; Placing a chip in the card instead of the magnetic strip makes it a smart card with a variety of uses. These cards are capable of controlling operations and process information, in addition to keeping the user's personal and business information.

Electronic Chip

The electronic chip embedded in the ID card is designed to perform cryptographic operations with keys stored on the chip. One key is used for authentication and the other for digital signatures. Terminals or card readers read the personal data that resides on the chip in order to identify the cardholder.

Public and private key infrastructure

PKI, as an encryption method, is used to secure the chip on the smart card. This is an asymmetric type of cryptography that has two keys, one for cryptography and the other for decryption. PKI is a set of technologies that allows us to use asymmetric or, in other words, public-key cryptography. In public-key cryptography, encryption and decryption operations are performed using public and private keys. (Balanoiu, 2009)

The most important pillar in digital signatures is the PKI structure. Digital Signatures secures online exchanges and provides citizens with a way to figure out who, what information, and what content is being transmitted and to ensure that information is not tampered with. Depending on the way the Certificate is issued, it is also possible to use digital signatures for non-repudiation, meaning that if someone does something, they can't deny it. In this case, if a person transmits information, he or she cannot deny it because only someone with the relevant Private Key is capable of transmitting such data. (Balanoiu, 2009)

3.2 Overview of the best practices of ID management in some countries

This chapter aims to review the best practices of some advanced countries in the E-governance domain, specifically in eID management. In this chapter, governmental approaches from differing perspectives that are relevant to the topic are evaluated. Identifying international practices and lessons learned can be fruitful and consequently would be adopted and applied.

3.2.1 Estonia

Undoubtedly, Estonia is one of the most advanced digital societies and global leaders in the context of e-government. National identity management in Estonia established in 1992 after full independence from the Soviet Union. (Martens, 2010) Currently, the Estonian Police and Border Guard Board is responsible for identity management and issuing personal identification documents.

PIC is a unique number assigned to every Estonian citizen and resident and consists of 11-digit pin including gender/century of the birth digit, date of birth digits, three random digits plus one checksum digit. (Martens, 2010)

- The national ID card

Estonia issued its first electronic ID cards in 2002. (IDABC, 2005) In Estonia, having an ID card for a citizen older than 15 years is mandatory. At the beginning , ID-cards were issued for a lifetime of 10 years with a certificate validity of 3 years. Since January 2006, both certificates and the card have a lifetime of 5 years. (Martens, 2010)

The new Estonian National ID card or eID contains the following information on the front:

❖ Surname

❖ First name

❖ Signature

❖ Document number

❖ Expiry date

❖ Place of birth

❖ Date of issuance

❖ Permit type

In addition, PIC, Date of birth, Nationality code, Sex plus machine-readable code can be seen on the back. Below the front and back of the card is shown : (IDABC, 2005)

Figure 2. Estonia eID -Back and Front

The Estonian eID operates based on PKI. The functionality of PKI is described in subsection 3.1.2. There are two associated private keys, protected by two separate PIN codes, on the card. The first PIN code, which is four digits, is used for authentication, and the second PIN code, which is eight digits, is used for digital signature. (Sertifitseerimiskeskus, 2003)

The chip embedded in the card has provided secure authentication and a legally-binding qualified electronic signature. Besides, the new ID cards posses contactless functionality built-in, and the new chip has a higher capacity to add new applications; For instance, an electronic public transport ticket or some other electronically issued certificate.

eID tokens in Estonia

Estonian eID is always issued together with the Estonian eID tokens.

- Digi-ID

  Digital identity card or Digi-ID is an ID-card like the smart card and can be used for authentication and giving digital signatures in an electronic environment.

- Mobiil-ID

  Thanks to Mobile-ID, citizens in Estonia can use a mobile phone as a form of a secure digital ID. By Mobile-ID, citizens can have reliable access to e-services and digitally sign documents without the presence of eID.

- e-Residency

  E-residency or 'virtual residency' is one of the best and unique achievements of the Estonian government launched in 2014. The main idea was recruiting 10 million e-Estonians by providing a gateway by which residents outside of Estonia can make investments in Estonia, run businesses and eventually, use the country as a bridge to commerce elsewhere in the European Union. (Taavi, K., Carlos, I., Vargas, A., Kaspar, A., 2016)

  The E-residency provides residents from other countries global access to Estonian e-services via state-issued digital identity. (Masso, 2018) Thanks to E-residency, E-residents can use the following services online: (Taavi, K., Carlos, I., Vargas, A., Kaspar, A., 2016)

  • Establish and administer a company;

  • Conduct all their banking;

  • Declare taxes;

  • Digitally sign contracts and other documents;

• Access international payment service providers

E-Residency provides the opportunity to international businesses to set up and develop their business from any location and consequently, it minimizes the administrative cost. Furthermore, E-residency helps the business owners of developing countries who are encountering problems concerning bureaucracy, travel restrictions, unstable political climates, and lack of standard digital services to establish and manage a trusted EU company online. (Taavi, K., Carlos, I., Vargas, A., Kaspar, A., 2016)

According to Taavi Kotka E-residents choose Estonia as a basis for residency in the first place because of the following factors:

❖ "Since Estonia ranks second in the world in terms of Internet freedom, it offers a strong social and infrastructural basis for aspiring entrepreneurs."

❖ "Estonia has a transparent flat-rate tax system with 0 % income tax on businesses for profits that are reinvested domestically."

It is noteworthy that e-Residency is different from citizenship, which means having an e-Residency card does not give the right to the cardholders to vote in the election or use it as a travel document.

"X-Road" the backbone of e-Estonia

There is no doubt that X-road is one of the best initiatives seized by the Estonian government. The X-road technology is a secure internet-based data exchange layer and as a backbone of electronic state in Estonia links all governmental and institutional databases by providing a secure connection between them so that the public and private sectors database can perform exchange data " X-Road offers a seamless point of interaction between those extending their services online and different state-managed datasets and services." (Mihkel Solvak, Kristjan Vassil, 2016) X-road has a decentralized nature which means there is no single point of failure, " X-Road is a platform, an environment, for efficient data exchange, but at the same time it has no monopoly over individual data repositories that belong to the institutions that join the X-Road." (Mihkel Solvak, Kristjan Vassil, 2016)

One of the benefits of the X-road system is the reuse of data " every joining institution and developed application can use the data stored in other institutions' repositories and is even legally encourage to do so in order to avoid the repetitive collection of client information." (Mihkel Solvak, Kristjan Vassil, 2016) Furthermore, X-Road is very useful for queries involving multiple agencies and information sources, in this way, the civil servant does not need to check data in different databases and revise mountains of documents, on the other hand, citizen needs to give data once only and not to every institution.

The novel initiative regarding X-road is creating a cross-border co-development of a national data exchange platform between two neighbors Estonia and Finland. "As a result, databases in both countries can interface, assist with cross-border services, and make e-services accessible to both Estonian and Finnish citizens." (Gailan, 2018) Although this initiative is very advantageous for both countries, governmental authorities are still encountering cooperation challenges. "It is even more challenging to deploy and use core platform components that have been developed by other countries." (Gailan, 2018)

The Estonian eID can be used for various applications, the type of applications and purposes for use are shown in table 1. (Martens, 2010)

Application	Purpose of use	Benefit
ID-ticketing	Traveling in public transportation	No need to carry different cards
Travel document	Crossing borders	More convenient
Partial replacement of driver's documents	Driver license	Allows checking the identity and retrieving all other relevant information

Citizen Portal	Use of different public services online.[1]	Connects most of the public services via a single point of entrance
Estonian Tax and Customs Board	Online tax declaration	❖ Time-efficient ❖ More transparent
Internet voting	Voting online in the election (Each citizen can vote as many times as he wants, but only the last vote will be counted)	Time-efficient
E-health/E-prescription	Access health records	❖ Paperless ❖ Time-saving for both patients and doctors
e-school	Students and teachers can join to an electronic platform via the Internet	❖ Students can access information from home ❖ The workload of teachers and school management would be diminished.
customer card	Becoming a customer of the company	❖ Time-saving ❖ magnetic cards are no longer needed

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[1] www.eest.ee

Internet banking	Bank authentication	Seamless and convenient
Digital signature	Digital signing of E-documents	❖ time-efficient ❖ paperless

Table 1. eID applications in Estonia

DigiDoc

In October 2002, the free of charge DigiDoc client-program was released. It is developed by the Certification Centre on the commission of the Look@World Foundation and paid for by Eesti Telefon, EMT, Hansapank, and Ühispank.

DigiDoc is a technical framework that enables citizens to create and verify digital signatures for electronic documents. DigiDoc provides an application for use on a PC, a web-based online application, and a portal to share documents with multiple signatures. (Castro, Explaining International Leadership: Electronic Identification Systems, 2011)

Lesson learned

This section aims to evaluate the success factors of the Estonian government as well as measures taken by the Estonian government to raise awareness of citizens towards eID.

- Executive approach

There is no doubt that one of the key factors in the success of eID management in Estonia has been the excellent cooperation among politicians, experts in the field, public and private sectors (e.g., Internet banking). As a result, it increased the speed of implementation and quality of the project." It is evident that without private sector involvement, there will be no incentive to make ID-cardholders overcome the barrier of smartcard reader acquirement and usage learning curve." (Martens, 2010)

Another success of the eID project in Estonia is the provision of necessary infrastructure and make the most of all available potentials. Some of the success factors are described as below: (Tsap, V., Pappel, I., Draheim, D., 2017)

- ✓ Building the interoperability between different systems based on X-road

- ✓ Creating software platforms such as central web portal [1]by the public sector

- ✓ The cooperation of the banking sector in the process.

- ✓ Public sector innovations

- ✓ Proper design and planning of the project

- ✓ Ease of registration and delivery

- Citizens' awareness of eID

In Estonia, due to the growing trend of e-services and convenience, eID usage has this ability to keep increasing. Moreover, the private and third sector has initiated several campaigns that support eID usage such as smart devices safety activity, EMT and Elisa's campaigns for Mobile-ID usage, etc.

3.2.2 Denmark

The e-ID in Denmark initially presented as a multi-purpose physical ID card, based on smart card technology within the national e-government plan in 1992. (Finance D. M., 1992) The national digital signature framework was established in 2000 by the government (Medaglia, R., Hedman, J., Eaton, B., 2017) In 2001, banks started developing their Net-ID, for access to online banking services. Due to a lack of technical difficulties, citizens did not use the digital signature as expected compared to the NET-ID. In 2008, NemID as a new solution emerged ("EasyID" in Danish), Nem-ID can be used as a signature for banking services and provides a two-factor identification technology, containing username and password and the possibility of logging from multiple devices. (Medaglia, R., Hedman, J., Eaton, B., 2017)

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[1] www.eest.ee

Nowadays, the NemID as an electronic identification card in Denmark is widely used by citizens, all public institutions and by private actors. The vast majority of Danish citizens today employ NemID to do online banking, to have interaction with public and private sector self-service, and the field is expanding."NemID has become a ubiquitous brand and is unique in its broad application across all of these sectors." (Finance M. o., The Next Generation of National Electronic Identity and Signing in Denmark, 2016)

NemLog-in

NemLog-in has a crucial role in Denmark's digital infrastructure by enabling Danish citizens and businesses to log into public self-service solutions. With NemLog-in, citizens can have access to many different service providers and public services. With NemLog-in citizens authenticate by NemID or digital signature.

More than 70 % of the Danish population, at the age of 15 and on, was using 'NemID' by 2015. (Commission, 2015) , however, the government aims to change NemID to a new digital identity solution (eID), MitID, which will be replaced in 2021. (Finance M. o., The Next Generation of National Electronic Identity and Signing in Denmark, 2016) MitID has some new features over NemID: (Finance M. o., Agency for Digitisation, 2020)

- MitID personal identities are no longer necessarily certificate-based (PKI)

- External partners, identity brokers, will be enabled to certify and provide their client solutions with end-user authentication.

3.2.3 Japan

Japan has a long history in the population registration system. Population registration systems introduced from China have existed in Japan since the early fifth century. (Chapman, 2008)" Both the jominhyo and the koseki are authoritative mechanisms that define, construct, and categorize the population according to normative expectations of family and identity in Japan." (Chapman, 2008) The following table represents information on population registration systems in Japan since 1872. (Chapman, 2008)

Population registration system	Introduced year	Description
Residency registration system (juminhyo)	1952	-Records the residential details of people in local municipalities -Used for managing the electoral register as well as being the basic administrative unifying system for recording, managing, and plotting accurate information on current residential addresses of all Japanese nationals living in Japan -Controlled by the central government and closely aligned with a family registration
Japanese family registration system (koseki)	1872	Contains details of gender, date, and place of birth, details of one's parents, siblings, and records of divorce and marriage.
alien registration system (gaikokujin tðroku)	1952	Used to record data concerning aliens resident in Japan.
Basic Resident Register Network System (Juki-net)	2002	The Joki-net system notarize living relationships to improve the convenience of residents and rationalize the administration of national and local governments

Table 2. Population registration systems in Japan (Chapman, 2008)

With the advent of Juki-net system for the first time in Japanese history, every Japanese was identified by a UIN, from birth to old age. Despite strong public opposition to this system, Juki-net enabled the government and municipalities to have the personal information of all citizens assigned to a unique number. It also provides optional ID cards that embedded a chip that can hold various types of data and communicate with the card

reader at a distance from the card and connect to a personal database using the master key. (Chapman, 2008)

After the Juki-net implementation, some municipalities refused to connect to the Juki-net database for security reasons. Moreover, the risk of data leakage and privacy violations, as well as a lack of trust towards the government, were fears amongst the population. By March 2006 an only a very small number of the community had received the card. Therefore, the project was not as successful as expected. (David, .W, Paul, D., 2016)

My number card

MyNumber, as a National ID system, was launched in January 2016. My Number (kojin bangō) known as an 'Individual Number', is a 12-digit ID number issued to all citizens and residents of Japan as well as resident foreigners. My number card can be utilized for social security, taxation, and disaster response purposes. Citizens do not need to have My number card in Japan; however, the government is encouraging citizens to apply for it, and currently, only 13% of eligible citizens have applied for it. (Nikkei, 2019)

Given the low popularity of My number card in Japan, the Japanese government decided to take measures to persuade citizens to apply for it. The reason why Japan is selected in this chapter is the initiatives and measures the government plans to implement shortly concerning the My Number card, which can be very useful to adopt for the Iranian government. Here are some of the major plans of the Japanese government in the future: (Nikkei, 2019)

- Using My Number card in place of a health insurance card

  Japanese citizens can use My Number card to access to the government's Myna Portal platform[1] to check their medical information from 2021. Citizens will be able to obtain information regarding the result of medical checkups, prescription drug history, as well as past medication history. Besides, It would be possible for citizens to claim deductions for medical expenses by declaring all eligible costs online.

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[1] https://www.cao.go.jp/

- Storing e-money on My Number card

  The government has a prospective plan to provide a point system for citizens who shop with their My Number cards, and it will enable them to use My Number card to buy at retails stores and websites designated by the local government.

- Using My Number card for various financial / banking services

  The government aims to enable citizens to request official government documents, such as proof of registered seal.

- Issuance

  In order to avoid potential bottlenecks with the distribution of the cards in 2022, each municipality will operate its plan for issuing them.

3.2.4 Singapore

There is no doubt that Singapore has been one of the Pioneers in digitalization " the Republic of Singapore is one of the first countries in the world to develop an integrated and coherent approach to computerizing the government." (Weiling Ke, Kwok Kee Wei, 2004) The one-stop E-citizen portal was launched in April 1999 provided a single point of access and organized services based on citizen life events rather than departments and agencies. (Weiling Ke, Kwok Kee Wei, 2004) E-government developed rapidly in Singapore since 2000, although several obstacles found during the initial phase, such as unclear vision and e-government goals to agencies, a lack of technical capabilities and financial resources, and the problem of the digital divide. (Weiling Ke, Kwok Kee Wei, 2004) Singapore decided to take some measures to overcome these obstacles, as a first step the government employed strong leadership by formulating a strategic plan in June 2000 aiming to improve the infrastructure and bridge the divide by following a guideline: " every service that can be delivered electronically shall be electronically available, and that all services shall be designed on a "customer-centric" and not an "agency centric" basis ". (Weiling Ke, Kwok Kee Wei, 2004)

NRIC

The National Registration Identity Card first issued in 1965; it is compulsory for Singaporean citizens older than 15 years old and foreign citizens who are permanent residents of Singapore. (NationalRegistrationAct, 2020)

The NRIC is identified by an NRIC number ("Identity Card Number"), which is a unique set of nine alpha-numerics given to each.

On the front side of the card, are the holder's personal information and a non-color photograph. On the other side of the card are the NRIC number, issue date of the card, and the holder's residential address. The nationality of permanent residents is on the card as well.

In addition, the Singaporean government has provided a web portal[1] which enables citizens to register for various certificate and submit their documents through the electronic service such as ID card, birth certificate, passport, etc., as a result, it would be time-saving and convenient from a citizen perspective. The video tutorials for submitting the documents are also available for each specific case.

SingPass

Singapore Personal Access (SingPass) launched in 2003 and has been the biggest achievement of e-government in Singapore.SingPass is a unique digital identity that, as an instrument of identification of the citizen digitally, serves as a gateway to «hundreds of e-services provided by more than 60 government agencies» in Singapore, and it is managed by the Government Technology Agency (GovTech). Thus far, 84% of the Singaporean population has a SingPass in their private possession. (SingaporePersonalAccess, 2020) SingPass plays a vital role in the e-government implementation in Singapore, and the way it is proposed to the citizen makes a difference for the success of such a procedure.

The government enhanced the security of SingPass by implementing 2FA feature, by 2FA citizens will need to enter their SingPass ID and password, plus a one-time password (OTP) sent via SMS or generated through a one-key token.

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[1] https://www.ica.gov.sg/documents

It is noteworthy that the use of SingPass for citizens is very beneficial since the cost of getting SingPass on the surface is much lower than the cost of losing the comfortable and way of paying taxes, getting medical reports, and registering personal commodities. In addition, Citizens can register for SingPass on the web portal[1] provided by the government so that they do not need to go to the office for registration, and individuals who have already SingPass can update their profile, set up 2FA, etc.

According to Anton Minardi, the success story of Singapore in e-government is based on several factors: (Minardi, 2017)

- Widespread internet use.

- Use of the Internet by citizens as a daily need

- Cooperation of all kinds of public groups involved educational institutions, businesses, and citizens.

- The strong leadership to enforce the e-government system for the government to government, to citizens, and businesses.

It can be stated that Singapore has been successful in e-government initiatives. Below several success factors of the Singaporean government in the domain of electronic government have been mentioned.

- Role of Singapore companies as a contributor to e-government.

- Clear vision and long-term goals

- Proper budgeting utilization and implementation at high levels of government

- Various organizations dedicated to e-government solutions

- Movement of the entire government in the direction of focusing on the user-orientation

- Cooperation between private and public sectors, each with clear and defined tasks.

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[1] https://www.singpass.gov.sg/

- Providing users with the capabilities and abilities to use e-government services. These activities include school-based training to familiarize students with IT and to conduct learning and computer courses.

Singapore companies have also implemented e-government solutions in other countries such as Brunei, Thailand, Sri Lanka, Hong Kong, China, Mexico, and Saudi Arabia.

In essence, although Singapore and Denmark were among the prosperous countries in implementing e-government when it comes to electronic identification management, these countries are still following Estonian initiatives and using their experiences. Therefore, it can be said that Estonia is by far the most advanced e-government in the world.

4 Iranian eID system

This section aims to provide a general overview of e-government in Iran as well as initiatives that the government has employed thus far in shaping e-government, along with the relation of e-ID with the key components of e-government.

4.1 Introduction

Almost all developed countries are now focusing on the development of e-government as a key strategy that can help them succeed in the 21st century. While different technologies in the public sector are being employed, the need for e-government arises from the integration of services and the provision of information to citizens. According to the 2018 UN E-Government Survey, currently, Iran's ranking in the United Nations EGDI 2018 [1] was 86. In comparison with previous years, Iran moves 20 notches up to rank 86 among 193 countries in the EGDI 2018. In this 20-fold increase, the status of e-government in Iran has moved from the middle class (MEGDI) to the upper level (HEGDI), and the E-Participation Index has climbed 38 steps. As it is mentioned on the UN website, the EDGI value is between 0 and 1, and Iran's EGDI value was 0.6083 this year. Regarding the sub-items, Iran got 0.6319 scores in the online service index (OSI), 0.4566 in the TII, and 0.7364 in the HCI this year. (UN, 2018) Meanwhile, the ICT Minister Mohammad Javad Azari Jahromi announced that a total of 67 percent of state-run organizations in Iran are currently offering e-services, the information and communication technology.

Iran - All Rank

Indicator	Measure	2003	2004	2005	2008	2010	2012	2014	2016	2018
E-Government Index	Rank	107.00	115.00	98.00	108.00	102.00	100.00	105.00	106.00	86.00

Figure 3. E-government index from 2003 to 2018 in Iran

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[1] EGDI evaluates the scope and quality of online services, status of telecommunication infrastructure and existing human capacity.

Recent statistics show the rapid development of e-government in Iran. In the last year, the number of visits to the national website of smart government services[1] has seen a steady increase, reflecting a decline in in-person visits and progress towards achieving e-government. The following are some of the actions of e-government in Iran.

e-government portal

The Government Service Portal[2] has been operating for a long time now, providing a variety of electronic services so that Iran can move towards achieving e-government more quickly. One of the initiatives about setting up this site is the ability to communicate with the president. Accordingly, people can submit their complaints and express their ideas through this site to the President. Various electronic services such as electronic payment of taxes are provided through this portal, certificate services such as ID change, renaming, and are other services that this portal offers. Among other services, this portal provides weather forecasting and public meteorological services, post office e-service, rural and urban services, Medical System Organization, Drug Price Query, etc.

Mobile app

A mobile app provided by the government is another recent Iranian initiative to move toward e-government. In this app, 16 leading governmental organizations offer more than 50 types of services to citizens. This app provides a variety of services to the user and facilitates many tasks in the areas of social security (latest payroll of insured persons, etc.), Ministry of Industry (activation of Mobile phones, device authentication queries, etc.), Welfare Organization (latest pension deposit, medical commission, etc.), registration, meteorology, stock exchange and more. In this application, services such as online payment of bills, tracking of postal items, and other services of various organs are available. For example, it is possible to pay bills online through a billing ID or to use a scanner barcode. Part of the application is dedicated to notification that the user can be informed about the thematic list of services in different areas. Knowing the rules and regulations of using the services in order to clarify and manage the correspondence and interactions of the executive bodies with the people and businesses is another part of this

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[1] https://www.mob.gov.ir/

[2] https://www.mob.gov.ir/

application. In fact, with the launch of the mobile app, the government has taken an important step forward in the field of e-government. This way, people don't have to go to the offices in person and such an application can help to tackle challenges such as air pollution and unemployment while making institutions more transparent. (Zade, 2018)

It is noteworthy to mention that authentication in this application and portal discussed above is performed only by entering the national code and phone number, unfortunately, the smart card authentication system has not yet been implemented.

Government Service Bus (GSB)

Today, data exchange and tracking how information is handled correctly in heterogeneous information systems with different constraints is one of the needs of the public sector. Organizations provide services independently or minimally electronically, and services that require communication between multiple executive organizations are either not offered or are provided through various ports (multiple counters).

According to the above mentioned, in the Fifth Plan Development Act of the National Information Network in Iran, the purpose of developing e-government services has been accompanied by the introduction of the Ministry of Communication and Information Technology (ICT) as the executor of the project. Integration of information and services in order to realize e-government requires a framework for the exchange and sharing of data, information, and services. This is done in different layers and the process of service delivery. Implementation of e-government requires that all government agencies make data available to others in order to provide their services and facilitate the business by providing information technology and delivering services as quickly as possible, only through connection to the GSB platform.

The GSB stands for Government Service Bus as an integrated information exchange platform and one of the critical pillars of e-government infrastructure development. The GSB is a collaborative platform designed to facilitate the exchange of heterogeneous government information, integrated software and hardware intermediate systems to allow information exchange between government agencies to be conducted safely and in the least possible time. According to the Secretary of the Electronic Services Commission, currently, 114 executive organizations in Iran are connected to GSB. (Aliaghaee, 2020)

Launching the National Information Exchange Platform (GSB) is distinguished from two aspects:

- Integrating government agencies as service providers and information for use in other sectors in a standardized and uniform format

- Any government agency as a service recipient can connect to this integrated platform and use the services of other departments

Iranian E-Box

The electronic dashboard (E-box) has been designed and implemented by the Iranian National Carrier System to provide direct and indirect government communication with people in a secure and accessible environment at any time and place.

This system is one of the projects in the field of e-government of the Iranian Information Technology Organization. It is currently operational and available to all people in the country. This system is known as the most comprehensive communication system between the government and the public, which can support not only the sending of official and public announcements and letters from all government agencies to the public but also reducing the physical presence of people in different governmental organizations. Other features, such as requesting the forms to be completed by the organizations, also allow people to submit replies and more. Among the essential elements of this system can be mentioned in the following:

- Integrated and comprehensive gateway to government communication with people;

- Paperless;

- Ensure the validity of the documents sent to the Iran folder.

4.2 The National Identity Card

The CRO is one of the essential pillars of the government due to possessing identity and citizenship documents as well as vital statistics of citizens in Iran. Providing public services to the people and specific demographic information to the authorities is the primary responsibility of this organization. Under the new rules, one of the tasks of the

CRO is to record vital events such as birth registration, issuing the birth certificate, and death registration. Tasks such as setting up a mechanized database of the country's population data and issuing a national ID card to collect and produce human statistics across the country and publish it are among the critical tasks of the CRO.

The Iranian National Identity Card or ID card is an identity card issued to all Iranians over the age of 15. Domestic registration offices in Iran and embassies abroad issue national cards to Iranian nationals. Every permanent citizen residing in Iran or residing outside of Iran who is an Iranian citizen and is over 15 years old must have a national ID card or obtain his / her national number from organizations and institutions affiliated with the Ministry of Interior. The National ID card is required for many citizen business tasks such as obtaining a passport, driver's license, banking, registration, etc. The national code is a 10-digit number; on the left are the first three digits of the city code where the birth certificate is issued, the next six digits are the unique code for the person holding the birth certificate, and the last digit is a control digit, obtained from the nine digits on the left. (Sabteahval, 2020)

Starting 2015 National Organization For Civil Registration started issuing Smart National ID Card for all the new applicants. The eID posses new features such as Biometric, smart chip, laser hologram, and three sets of the public key and private key. Currently, the e-ID card is not only compulsory for many tasks in Iran and Iranian Missions abroad but also, and they are the only form of ID acceptable by banks for any transaction. (Sabteahval, 2020)

4.3 Current state of identity management in Iran

According to the report given by the CRO in Iran, from 2019, the old national cards will not be valid, and citizens must register for eIDs. Besides, according to the statistics available on CROs' portal, on the process of issuing an eID, 55 million people have already completed the registration process, of which 46 million cards have been released and submitted to Offices across the country, including counters and post offices, and so far citizens have received 45 million eIDs from offices around the country. (Sabteahval, 2020)

Unfortunately, after nearly a decade of the eID project, the infrastructure required to use the smart features has not been created yet. This section intends to address the steps taken

by the Iranian government so far to use the eID optimally. As explained earlier, the smart card has new features, and the use of these new features requires the creation of appropriate platforms and infrastructure.

Digital signature

The digital signature is undoubtedly the biggest goal of creating an eID so that every citizen can digitally sign documents and contracts.

Initial moves to create a PKI began in the Ministry of Commerce around 2003, and then started with legal approvals and now serve as an e-commerce development center. Other institutions have also created this infrastructure in terms of applications, such as national civil organization for the EID, the Central Bank under "named" system, and "Naja[1]" for Electronic Passports, the Judiciary, the National Register of Property and Documents and the Ministry of Health. Currently, there is no systematic link between the aforementioned infrastructures, and each of them has its roots; however, the new initiative has occurred in the health care system. Currently, physicians willing to digitize their services can visit IMC's website[2] and apply for a digital signature. To do this, they are required to enter their national ID and medical identification code in the application form, digital signatures will authenticate the digitized prescriptions and patient records. The initiative is complementary to Iran's Social Security Organization project of replacing paper insurance booklets with electronic cards. Unfortunately, the software and hardware infrastructure needed for the public to use digital signature by smart card has yet to be addressed, and the government has faced challenges that are mentioned in subsequent sections.

Removing insurance booklets

In Iran, the Social Security Organization supports 42 million insured and pensions as well as providing 18 types of medical services to insured persons. This organization has various insurance and health centers, including 356 hospitals and clinics. The Social Security Insurance Division also has 480 branches throughout the country, and its

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[1] Law Enforcement Force of the Islamic Republic of Iran

[2] www.Irimc.org

insurance services are provided to the covered community through these units. (Tamin, 2019)

New initiatives

- The newest initiative concerning the use of the eID is replacing insurance booklets with e-ID. This has been crucial in the field of information technology in social security organization, and all social security centers now offer the necessary health services to the insured by means of eID without receiving an insurance booklet. As in other advanced countries, the medical record of the insured person is stored and protected on a chip embedded in the smart card, and the physician can access that insured person's medical records. (Tamin, 2019)
- CRO, as an executive institution, is launching a new platform for citizens to provide electronic services related to identity activities such as registration for birth certificate and eID. Hence, citizens do not need to attend offices to receive services. (Sabteahval, 2020)

4.4 Overview of eID system components

Iranian eID provides three primary uses of identification, authentication, and digital identity, allowing different applications to be deployed on a single card to be used as a multifunctional tool. The smart card is usable in a variety of banking and financial support and is manufactured using the highest technology that has a high-security level and can record the electronic fingerprint. In addition, this card, unlike the birth certificate, is a document and is the key to entering e-government. Iranian eID is both card-centric and network-based. This card can be used instead of all identification cards such as military cards, certificates, insurance, and other cards. Like other national e-IDs, this card also has personal information such as a unique national code, name, date of birth, and expiration date of the card. An electronic chip is also provided on the back of the card.

Figure 4. Front of the card

Figure 5. Back of the card

In general, high-level services provided through the National eID have been put into two general categories: physical (visual) services, and electronic services. Physical or visual services are services provided to the holder of the card. The cardholder, due to having this card, can access to some services that can only be provided by identification. The electronic service category that can be provided by the card is divided into two groups of cards inside and outside the card. Electronic services inside the card are services provided to the cardholder due to the structure and software embedded in the card. These services are also divided into two types of identity services and citizen services within the card. Citizenship services within the card include voting, subsidies, health, and payment. As one of the essential aims of the eID project was the creation of a gateway to e-government services, the architecture of the eID project was based on the feasibility of providing the

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maximum number of applications. Accordingly, two models of service provided at the time of the operation of the EID were presented: Providing On Card Services and Off Card Services. (Amidian, 2015)

On card services

Services are provided based on "card applications" of the eID. In this model, the relevant software, with the necessary permissions, provided by the registrar to the serving organizations, requests specific operations from the card, or they read or write data from the relevant section. Data for any On-Card service stored and restored in its dedicated space. To store these data, the file and directory structure is intended to be on the card, so that the provider of each service will only access its part. (Amidian, 2015)

Off card services

Electronic services are available to e-ID holders, all of which use two Identification and Authentication services that are on the EID, to identify the recipient (citizen) and authenticate it, respectively. Digital Signature is also available for this service. All data and processes required for service provision are in the system provided by the provider, and there is no dedicated space for this type of service on the card. In this case, special data and transaction logs are stored in the data bank designed by the server. Thus, there is no limitation on the number of items of information as well as the amount of data. The National SmartCard data center is one of the essential parts of providing service to citizens. (Amidian, 2015)

Although the data center of the EID is important in terms of its information and its processing, one of the most important reasons is the provision of uninterrupted service to citizens, a service which is unique according to the number of subsystems involved in providing the service. In general, the following criteria are considered for the Data Center: (Amidian, 2015)

- High Availability
- Scalability
- Security
- Manageability

5 Analysis and Findings

This section will provide information regarding the findings and analysis in the frame of this thesis.

5.1 Citizens' awareness

The primary purpose of e-government is to provide e-services to citizens. Therefore, the eID is the key to accessing and using these services. Since the primary beneficiaries of e-government are people, the transfer of knowledge of technology application to use e-services is crucial. Undoubtedly, a person who is not informed and does not have awareness on how to access and use e-services will not be able to receive the offered benefits, which will later most likely, result in dissatisfaction.

In this section, it is intended to examine what challenges there are for the implementation of the eID from the citizens' perspective. In another research, Aparajita Pandey and his colleague have identified various problems regarding this issue as below : (Aparajita Singh Pandey , Jatinderkumar R. Saini, 2013)

- Trust

- Resistance to Change

- Digital Divide

- Privacy & Security

- Cost

Providing practical solutions would ameliorate the situation and tackle the issues mentioned above.

The purpose of this survey is expressed through the following important goals:

1. Examining the level of awareness of citizens about the electronic services and services that the eID offers them.

2. Examining people's knowledge to use technology such as IT literacy (Digital divide).

3. The level of satisfaction of the individuals from the changes that have occurred, such as the electronic nature of the services and the replacement of the old national card (Resistance to Change).

4. Evaluating the level of trust among citizens to use electronic services and provide their personal information to government agencies (Trust and privacy).

In order to appraise the level of citizens' awareness in Iran regarding the eID, the survey has been distributed via the Internet using social networks. This survey helped to collect 211 number of responses from citizens, and it consisted of 14 multiple-choice questions that were designed to analyze the level of citizens' awareness and use of eIDs as well as electronic services. The survey also aimed to measure the level of knowledge of citizens and their interest in using electronic services and new applications of the new national card, such as digital signatures.

Details of findings that are collected , analyzed and presented below.

Q1) The age of responders was requested to be specified.

The results illustrate that the age groups 31-40 with 21.8% of the respondents and 41-50 with 21.3% have the least difference. Besides, the age group of 18-30 with 23.7% had a larger number of respondents, and the minority of responders were aged 60 and more, which is 12.8 % of the total number of people who submitted their reply. The number of responders among the rest of the age groups was almost close to each other. The age groups 31-40, with 21.8% of the respondents and 41-50 with 21.3%, have the least difference. Also, the age group of 18-30, with 23.7%, had a more significant number of respondents. (see Figure 6) It can be seen from the numbers that the age group of 18-30 is interacting with government agencies more than other age groups and more interested in giving feedback.

Q2) Respondents were asked if they used the Internet

This question aims to assess how many people use the Internet regularly and also examines the lack of access due to insufficient IT literacy and a lack of access facilities. According to the responses, 93.4% of respondents use the Internet in their daily life,

although the sample has been small, it indicates that the vast majority of people use the internet daily. On the other hand, 2.8% of respondents rarely use the internet, and 2.4% of respondents tend to connect to the Internet occasionally, rather than all of the time. Besides, 0.9% of respondents claimed that they do not have access to the internet in their region. Finally, only one responder (0.5%) stated that they can use the internet to a limited extent due to the lack of IT literacy. (see Figure 7)

Q3) Respondents were asked for what purpose they use the Internet

As responses show a large number of respondents (184 respondents; 87.2%) use the Internet for amusements as well as using social networks, hence, it can be concluded that people have more tendency to use the Internet for entertainment rather than research or business. It is noteworthy that 45 of the respondents employ the Internet for accessing public services (see Figure 8). Having said that, the small scale has been used for this purpose, the outcome of this part of the survey cannot fully reflect the real situation.

Q4) Respondents were asked about the existence of public e-services

This question aims to measure the level of citizen's awareness regarding the existence of public e-services. As can be seen from the chart, almost half of the respondents (50.2%) are not aware of the existence of electronic services (see Figure 9). Although it has been nearly several years since the project began, almost half of citizens are unaware of the existence of e-services, so it can be concluded that the government has not been very successful in informing citizens about e-services.

Q5) Respondents were asked if they were experiencing a long queue when visiting public sector offices.

Various responses have been given to this question, and as it is clear from the chart, only 25% of the respondents have rarely experienced long queues (see Figure 10). However, it can be said that the experience of long lines also depends on the number of visits of citizens. Undoubtedly, people who have very few visits to offices may not experience long queues. Nevertheless, it can be concluded from the obtained statistics that citizens have to wait in line for a while when visiting government offices.

Q6) Respondents were asked about the different types of gateway they use to access public e-services.

As is evident from the chart, comparing web portals and mobile apps, 36% of citizens use web portals to access e-services, while 22.3% use mobile app for this purpose. Moreover, it is noteworthy to mention that 29.4% of respondents are not aware of the existence of e-service portals (see Figure 11), so that it can be concluded that the government should inform citizens in this regard.

Q7) Respondents were asked about the type of public e-services they have used

The vast majority of citizens (45% of respondents) have used the electronic services concerning to CRO, these e-services include EID Registration, observing eID issuance status, announcing a change of address, requesting for name selection, requesting for the death certificate, requesting for a given name/surname change. On the contrary, 29.9% of respondents have not used any kind of e-services at all (see Figure 12).

Q8) Respondents were asked whether they have received their eID card or not.

Almost one-third of respondents (28.9 %) claimed that they had not received their EID yet (see Figure 13), it can be concluded that almost ten years after the project began, many citizens have not yet received a new national card.

Q9) Respondents were asked for what reason they were going to change the old national card to a new one.

Since last year the government announced that the citizens who have not received the eID are not allowed to do any identity activities such as banking transactions. Citizens were obliged to register for a new national card. As can be seen from the chart, the vast majority of respondents (60.7%) claimed that they registered for an eID card due to government coercion. Some of the respondents (23.2%) stated that they intend to change their old cards owing to the new and digital applications that eID provides. (see Figure 14) It can be concluded that the reason that respondents are resistant to change seems to be a bureaucratic burden or time-consuming procedure (see Q5).

Q10) Respondents were asked if they are aware of any application of eID.

This question aims to evaluate the extent to which the citizens are familiar with eID's applications. It can be seen from the bar chart that almost half of the respondents (40.3 %) have no information about the mentioned applications (see Figure 15). As mentioned

in the previous questions, it seems that half of the respondents (from the selected scale) do not have information about the applications of the eID.

Q11) Respondents were asked about the use of a digital signature.

In general, digital signature in Iran has been provided to employees by some organizations, so that employees of that organization can digitally sign documents. This question aims to assess the extent to which citizens have used digital signatures in general and regardless of the use of digital signature on the eID. According to the chart, more than half of the respondents (51.2%) have never used digital signature, and 24.6 % of them have no information about it (see Figure 16).

Q12) Respondents who received their eID were asked if they used it for any purpose.

This question aims to examine if citizens, despite having eID can use new applications of it, such as a digital signature or Internet voting, etc.. As is clear from the chart, nearly half of the respondents used the new national card only for physical authentication. Besides, 78 respondents (38.8 %) claimed that they did not use any of the new applications (see Figure 17). Therefore, it seems reasonable to assume that the necessary infrastructure for the latest applications of the eID has either not been provided yet, or people still do not have information about the new applications.

Q13) Respondents were asked if they prefer to use e-services to visiting government offices in person.

As the chart shows, the vast majority of citizens (82 %) have more tendency to use public e-services rather than visiting administrative centers and offices in person. It is noteworthy to mention that 10.4 % of citizens are not able to use e-services due to a lack of IT literacy (see Figure 18).

Q14) Respondents were asked if they agree to provide their personal information to government agencies.

Since every citizen must be comfortable and trust the technology with which she or he will interact, this question aims to examine the level of trust among citizens regarding providing their personal information located in the smart card to government agencies.

As can be seen from the chart that 63.5 % of citizens do not trust government agencies to access their personal information (see Figure 19).

5.1.1 Summary

This section intends to provide an overview of the results of the survey.

- Almost half of the respondents are not aware of the existence of public e-services as well as the new applications that eID can provide for them. In addition, some people lack IT literacy.

- Almost half of the respondents do not trust the government to share their personal information with them. The trust can be a problematic issue forasmuch as if citizens distrust government, they will not accept to use any tool or new technology introduced by the state.

- Almost half of the respondents are resistant to change the old national card with the new one. The reason may be due to the time-consuming process of registration and receiving the new card.

As the result shows, citizens' awareness of eID is one of the key elements that have to be considered by officials before implementing e-governance and its components. Recommendations, as well as possible future research, will be outlined in the next chapter to tackle these issues.

5.2 eID implementation challenges in Iranian public sector

This section aims to evaluate the issues regarding the implementation of eID from the project executors' perspective. To this end, an online survey was distributed via social media to employees of one of the branches of the CRO in Tehran. 45 out of 50 responses were collected by this online survey. The survey aimed to examine the following factors:

- Obstacles and challenges of implementing Iranian eID in the public sector

- Accessibility of citizens to public services in comparison to the past.

- Accessibility of citizens to public services online

- Current bureaucratic delays in comparison to the past.

- The preference of employees to access public services (online or traditional)

Below the details of findings that are collected are presented.

Q1) The employees were asked if they believe that the eID project has facilitated the way citizens access to public services.

As can be seen from the pie chart, slightly more than half of the responders (51.1%) disagree that existing eID has provided easier access to public services for citizens (see Figure 20). This result indicates that some citizens still are struggling to access public services.

Q2) The employees were asked if the citizens can access public services online these days.

As the result shows, the majority of employees (68.9%) do not agree that this possibility has been provided for citizens to access public services online, while 20% of responders can confirm that citizens can access services online(see Figure 21). It can be concluded that according to the majority of employees' responses, most public services are not established online.

Q3) The employees were asked if there has been any reduction in bureaucratic delays after the emergence of eID.

According to the responses, 62.2% of employees believe that the use of the eID in Iran has not reduced the current bureaucratic delays while 31.1% agree that eID has been efficient in this regard (see Figure 22). As the majority of responses represents, it can be concluded that thus far, the eID has not had a profound impact on reducing bureaucratic delays.

Q4) The employees were asked if they prefer to use eID to access public services or would rather access them offline.

As a result, indicates that 53.3% of employees prefer to access public services traditionally (see Figure 23). It can be concluded that these services are not fully provided

that surprisingly, even more than half of the employees who are working in this domain also would rather access public services offline.

Q4) The employees were asked about challenges, barriers, and limitations that the public sector has faced regarding the eID project.

As the chart shows, approximately half of the responders (24 employees, 53.3%) believe that lack of infrastructure can be one of the main barberries of eID implementation. Besides, 23 of responders (51.1%) agree that the lack of coordination and interaction among the organizations can be one of the challenges. However, some employees (35.6%) found government bureaucracy as a challenge (see Figure 24).

In addition to this, employees were asked to express their opinion regarding this question (see Figure 25).

The comments were collected from employees are presented below :

- "In my opinion, the biggest issue regarding the delay of eID card issuance was stopping the production of the card body because of the inability to build the card body in Iran due to sanctions imposed by the US. Thus this project was supposed to be done in a year or less but took five years, and twenty percent of citizens still have not received the eID, and about fifty percent are waiting to receive it."

- "This card still does not support the minimum facilities in the country, so that in many centers it must be provided with a birth certificate to be certified, and this shows the inefficiency and inability of this card in the country, while in developing countries. It turns out that this card alone is the identity of the citizens, and with a similar card, they benefit from all citizenship services without pain."

- "One of the major concerns can be the lack of culture-building about eID and new technology as well as lack of proper timing and implementation of delivery to the people."

In conclusion, according to the responses and comments by the employee regarding this question, the following challenges and barriers are seemed to be the major ones:

- Lack of infrastructure that led to the inefficiency of the smart card in the country;

- Lack of coordination and interaction among different authorities;

- Lack of proper timing and implementation of the project;

- Inability of the CRO to produce the body of the card domestically due to sanctions that led to belated issuance and delay of delivery.

5.2.1 Summary

To sum up, it can be said that, employees as individuals who are providing public services to citizens, believe that the eID project has not been successful as expected due to the mentioned barriers and challenges. Some believe that the challenges can be stem from mismanagement of the project; on the other hand, some believe that it could be the cultural issue. This survey helped to collect information from the executive body of the project in order to identify the main challenges in this domain.

5.3 Discussion

The surveys employed in this thesis helped to measure the level of citizens' awareness of eID and to identify the challenges in the implementation of the eID project in the public sector. In addition, the study of identity management systems in different countries and their experiences provided us with useful information that can be applied to the Iranian case.

The results indicate that the main challenges in the implementation of the project are the lack of necessary infrastructure and cooperation between authorities, as mentioned by employees in the previous section. Furthermore, the unexpected result in Q4 from the second survey shows that even though a decade has passed since the start of the project, yet almost half of the CRO's employees, who are also citizens of the community, are reluctant to use online services. Besides, half of the respondents of the first survey are resistant to change to a new national ID card, and they have to make this change since it is mandatory.

The experiment provides new insight into the relationship between the imposed sanctions on Iran and the delay of the issuance of the cards. On the one hand, it could be the barrier,

however, on the other hand, this delay in the project process due to producing the cards led the CRO to decide to produce cards domestically and no longer depend on other countries. As a result, this weakness created an opportunity for self-sufficiency in the project in the public sector.

The findings of the surveys can provide useful information for the CRO and give them new insight and would help to enhance the electronic identification system in Iran to have a better public e-service provision. As a result, it is expected that citizens can benefit from a wide variety of public services electronically as well as digital signature technology.

6 Recommendations and Conclusion

This section aims to provide recommendations and an overall conclusion.

6.1 Recommendations

As mentioned earlier, a significant percentage of citizens have not yet received their national ID cards, and as the results of the surveys indicate, the necessary infrastructure to use the features of the smart card has not been provided yet. This section intends to provide recommendations based on findings, measures, and best practices taken by evaluated countries in order to expedite the project process and alleviate its problems as well as raising citizens' awareness of the eID.

Recommendations for raising Citizens' awareness

- Establishing several campaigns that support eID usage.

- Inform citizens through the national media about the benefits of the new ID card to encourage them to use it.

- Providing catalog including useful information about the benefits of the eID and how to use the new components such as a digital signature. This catalog can be uploaded online on the CRO's website and can be handed over to citizens who visit the office to get the new national ID card.

- Creating educational projects for different age groups to raise the level of digital literacy, such as school-based training to familiarize students with IT and to conduct learning and computer courses, especially in rural areas.

- Creating campaigns to help citizens who are suffering from technophobia and are reluctant to use new technology.

- In the public sector, gaining the trust of citizens is one of the most critical points. Lack of trust causes the service not to be used. In the private sector, we see that there is a very close relationship between customers and

companies, which raises the level of trust between them. The government should also gain the trust of the citizens by establishing close ties with the citizens. Moreover, The government must apply security measures to ensure citizens that their privacy matters and personal data on eID will not be invaded.

- Establishing an integrated web portal where all e-services will be accessible and functional.

<u>Recommendations for expediting the process of eID project</u>

- Cooperation and coordination between different authorities, public and private sectors.

- Defining new goals, modifying unsuccessful plans, and allocating more budget for this project.

- Equip all administrative centers with the necessary infrastructure for better service delivery.

- Creating the necessary platform and infrastructure for each member of the community to use a digital signature.

- Putting the central focus on the citizen-centric approach.

- CRO, as an executive body of the project, needs to employ more workforce and develop the required infrastructure to achieve the main goals of this project.

There is no doubt that these measures cannot be applied instantly, and it requires time, enormous resources, and budget. However, learning from the best practices of other countries can provide new insight into the Iranian government.

6.2 Future work

Although the issue of e-identity management is very crucial to examine, and Iran has faced a significant challenge in terms of implementation, there has not been any research focusing on this issue so far. In this thesis, the main aim was to identify the major

problems and dilemmas. However, this research has also faced limitations that have raised several questions and can be addressed in the future.

- What influential factors can raise citizen's awareness of using eID?

- How can the Technology Acceptance Model be applied in Iran in order to raise the citizens' awareness?

- How can Iranian governance turn into good governance based on good governance concepts mentioned in the frame of this thesis?

- What is the main weak point of the Iranian government in implementing the digital signature?

6.3 Conclusion

Iran is one of the most civilized countries with 83 million inhabitants and the second-largest country in the middle east. The Iranian people are genuine and cultured, and they always deserve the best. After the Islamic revolution, the Iranian people have always been under economic pressure from so-called superpowers, such as the US economic sanctions on the Iranian people, which have been a significant obstacle to Iran's progress. However, there is no doubt that the government's misguided policies have not been ineffective in this regard.

When it comes to technological advancement, Iran has always tried to approach the best, and several measures have been taken in this regard. In the discussion of e-government, Iran has ever attempted to make significant progress, the e-government project has been going on for almost ten years, but unfortunately, it is facing problems. Since eID is one of the most important pillars of e-government and as the results of this thesis show that the government has acted poorly in this field, in this thesis, it was tried to examine the obstacles and problems and provide solutions to aid the government.

In this thesis, an attempt was made to examine the problem of eID in two ways. A quantitative research method was used to design an online survey and share it among citizens on social media. As expected in this thesis hypothesis, given the selected scale,

citizens have a very relative awareness of the applications of e-ID and its benefits, and unexpectedly almost half of the citizens were reluctant to change their old national card.

Secondly, using the quantitative research method and designing another survey, this time, it aimed to find the root causes from the perspective of CRO's staff in one of the branches in Tehran that are delivering this service to citizens. As the results showed, more than half of the employees acknowledged that some e-services are still not available and that due to lack of infrastructure, a percentage of citizens have not yet received a new national ID card. Besides, the unexpected result indicated that even half of the employees prefer to access services offline.

Moreover, the experiences of different countries as prosperous and advanced countries in this field, such as Estonia, Denmark, Singapore, and Japan, were also examined in order to provide the Iranian government with the latest initiatives, remarkable lessons and ways to progress. As a leader of the digital government, the focus was on the case of Estonia, which is by far one of the best e-states in the field of electronic identity management.

Lastly, in frames of the research, findings of the surveys aided to outline the personal vision, provide recommendations, and raise important questions for future research.

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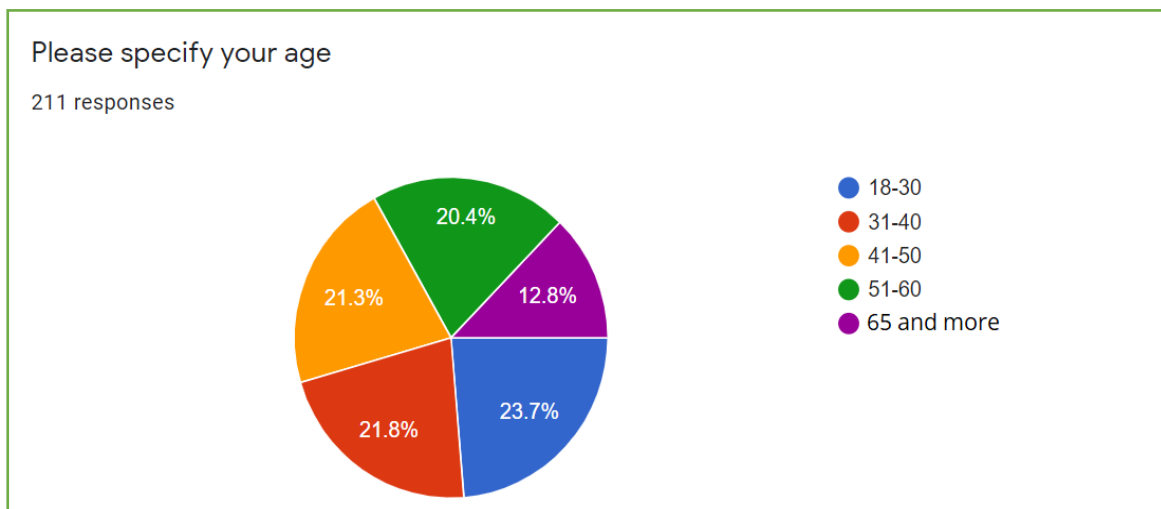
Appendix 1 –Survey NO1 results
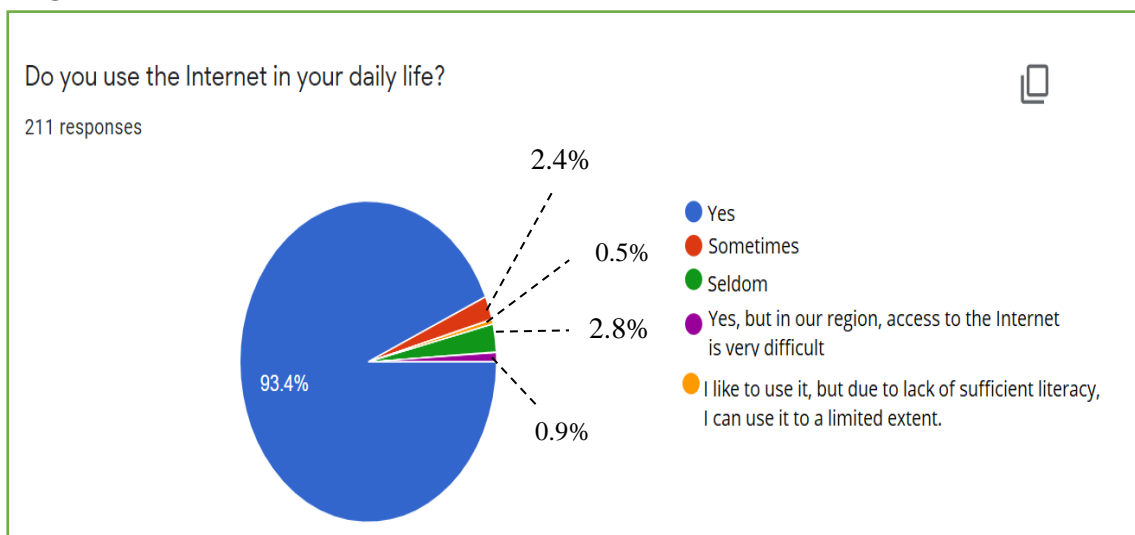
Q1

Figure 6. Answer to question 1

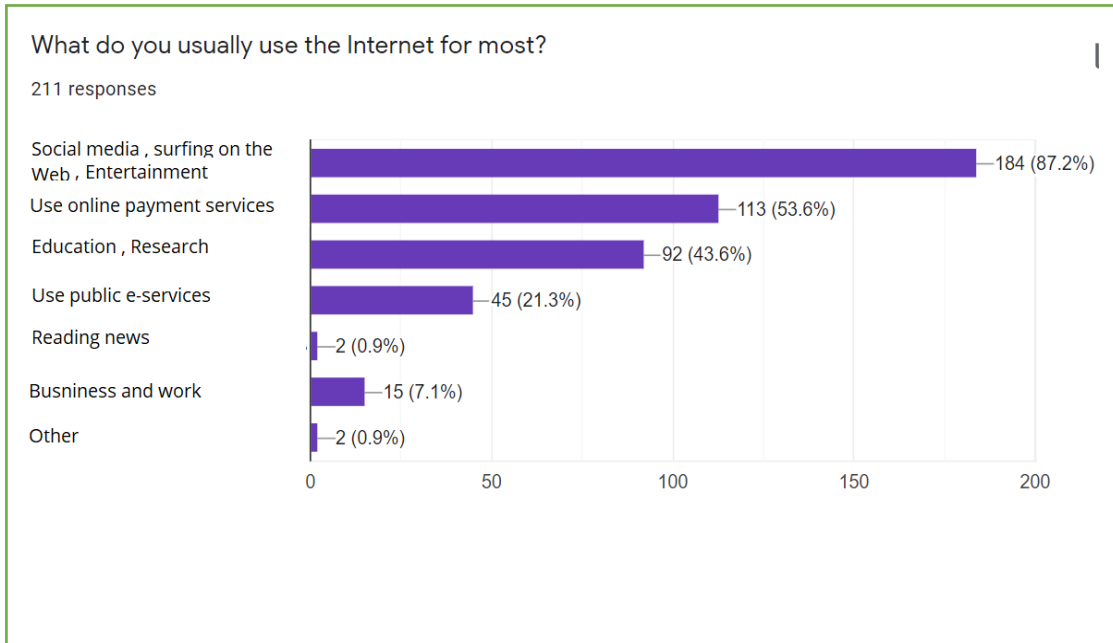## Q2

Figure 7.Answer to question 2

Q3

What do you usually use the Internet for most?

211 responses

Social media , surfing on the Web , Entertainment	184 (87.2%)
Use online payment services	113 (53.6%)
Education , Research	92 (43.6%)
Use public e-services	45 (21.3%)
Reading news	2 (0.9%)
Busniness and work	15 (7.1%)
Other	2 (0.9%)

Figure 8.Answer to question 3

Q4

Are you aware of the electronic services provided to citizens by the government?

211 responses

- Yes 49.8%
- No 50.2%
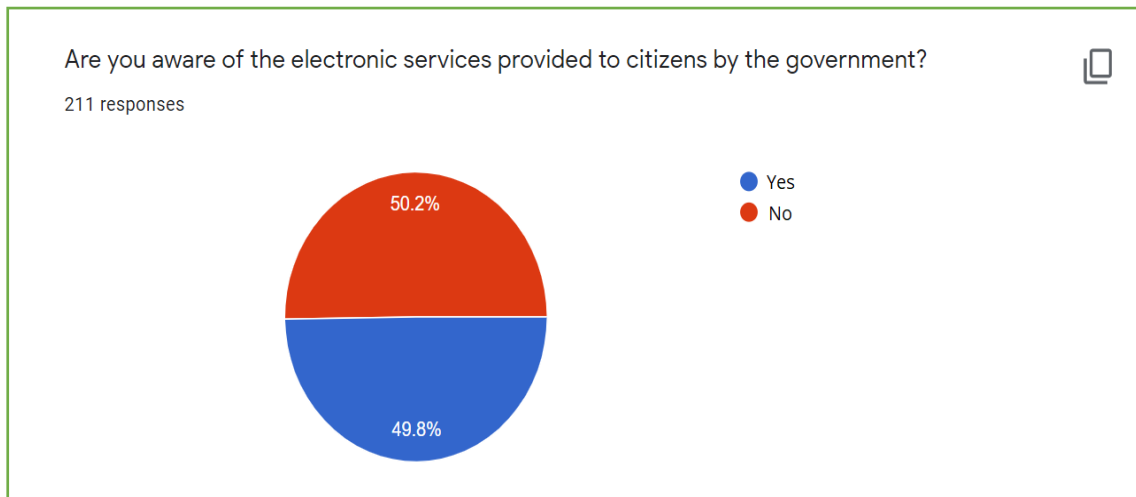
Figure 9.Answer to question 4

Q5

Do you usually experience the long long queue when you go to government service offices like the +10 police?

211 responses

- Seldom
- Sometimes
- Most of the time
- Always

5.2%
25.1%
44.5%
25.1%
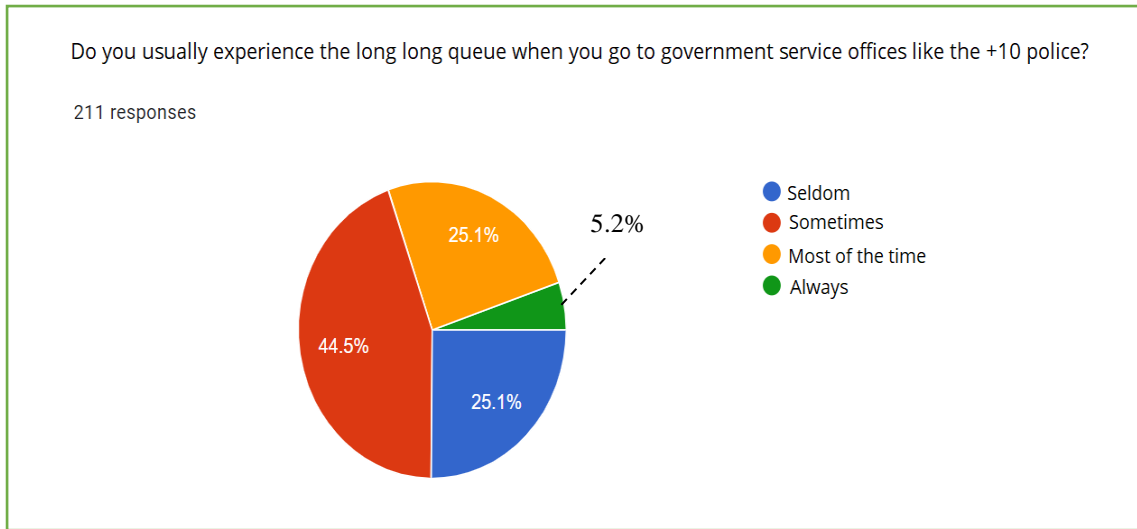
Figure 10.Answer to question 5

Q6

What kind of gateway do you use most to access public electronic services?

211 responses

- Public sector mobile App
- Web portal
- I am aware of the existence of electronic service portals, but I have never used them
- I am not aware of the existence of electronic service ports

12.3%
29.4%
36%
22.3%
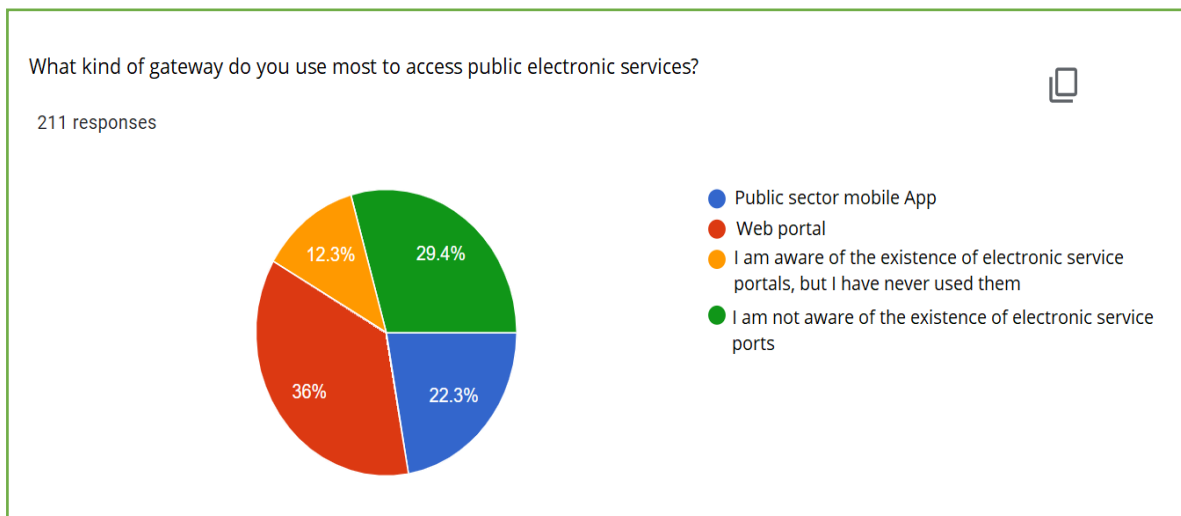
Figure 11.Answer to question 6

Q7

What kind of public e-services have you used?

211 responses

Service	Count
Tax services	29 (13.7%)
Social Security Services	52 (24.6%)
Civil Registration Organization services	95 (45%)
Postal services	41 (19.4%)
employment services	19 (9%)
Services of the Ministry of Science	50 (23.7%)
Medical Council services	27 (12.8%)
Other	26 (12.3%)
None	63 (29.9%)
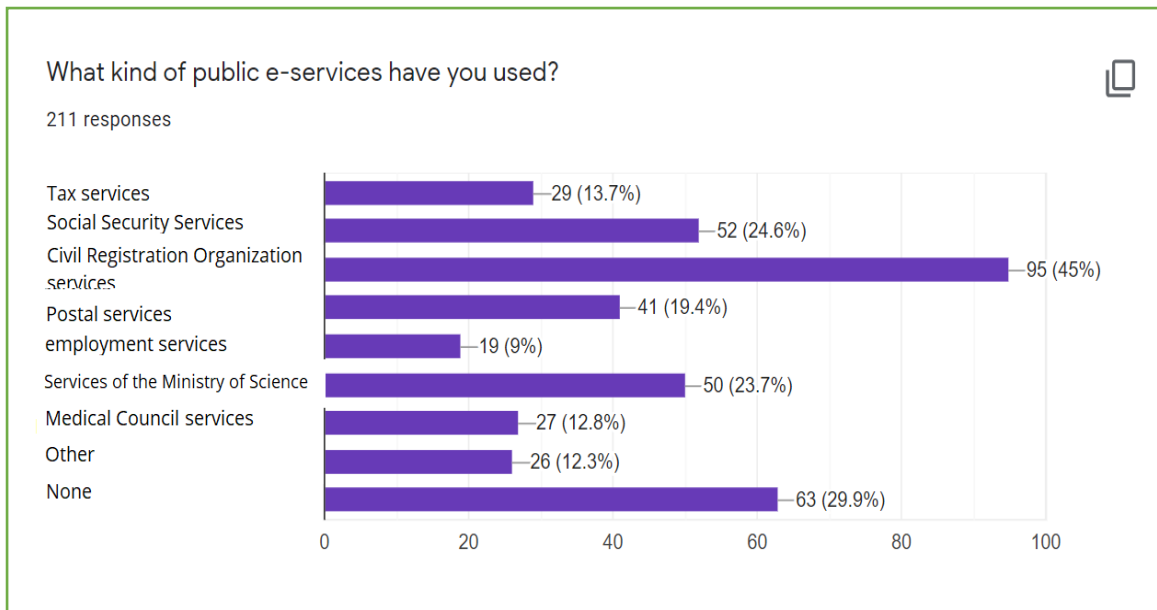
Figure 12.Answer to question 7

Q8

Have you received your national smart card?

211 responses

- Yes
- No
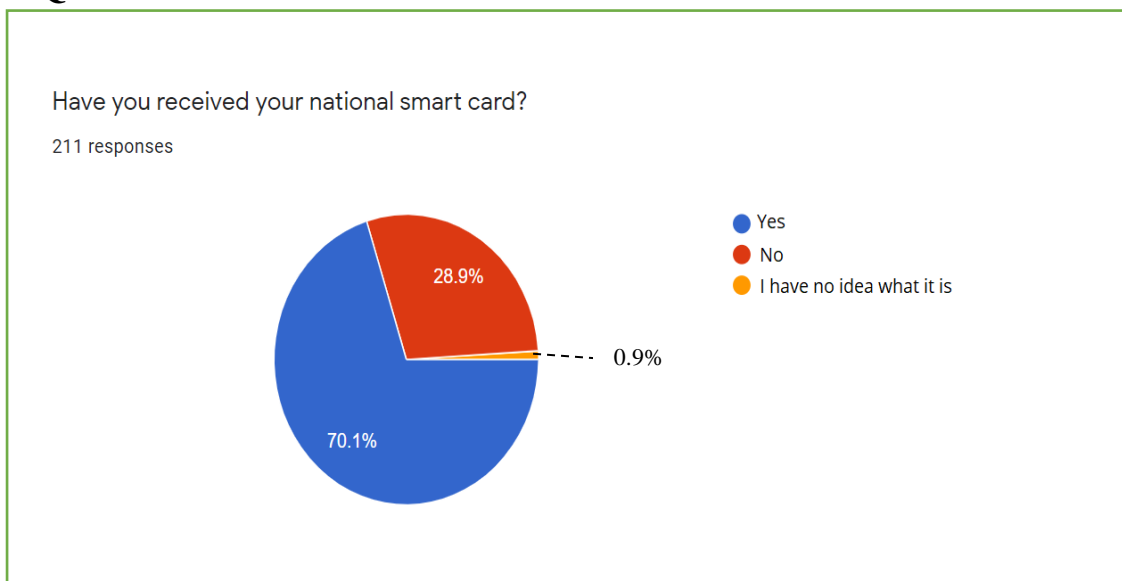- I have no idea what it is
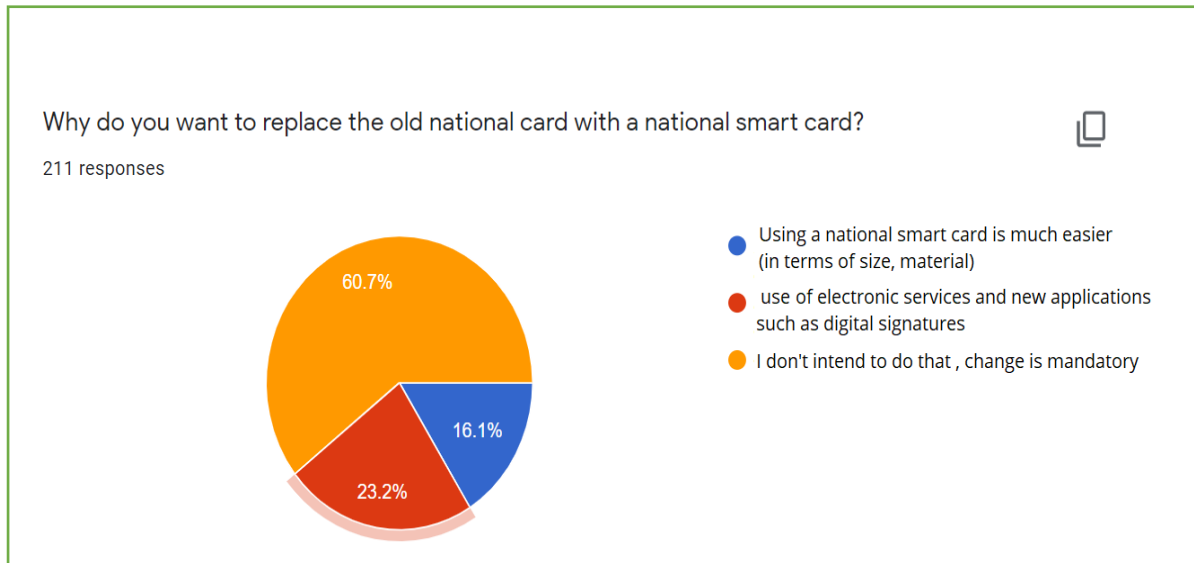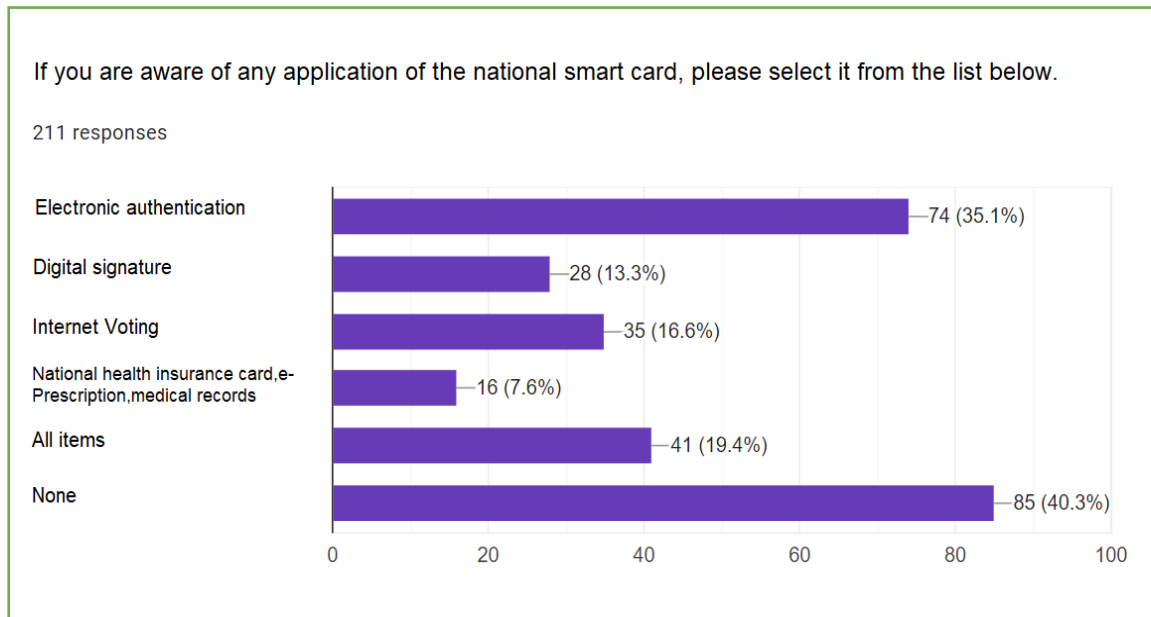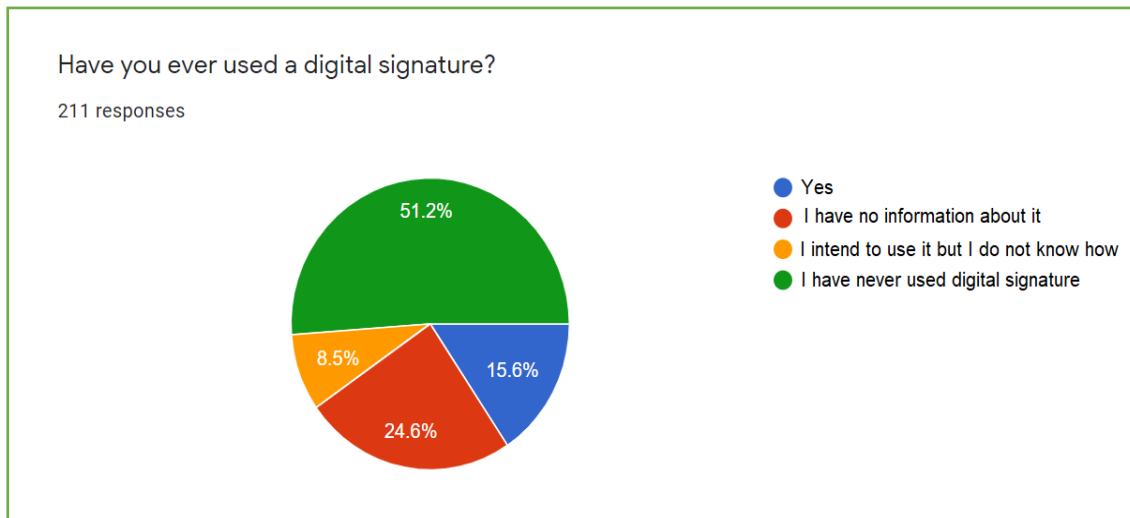
28.9%

0.9%

70.1%

Figure 13.Answer to question 8

Q9

Figure 14.Answer to question 9

Q10

Figure 15.Answer to question 10

Q11

Have you ever used a digital signature?

211 responses

- Yes
- I have no information about it
- I intend to use it but I do not know how
- I have never used digital signature

51.2%

8.5%

15.6%

24.6%

Figure 16.Answer to question 11

Q12

If you received your national smart card, what have you used it for so far?

201 responses

Digital signature — 6 (3%)
Digital authentication — 28 (13.9%)
Medical records — 4 (2%)
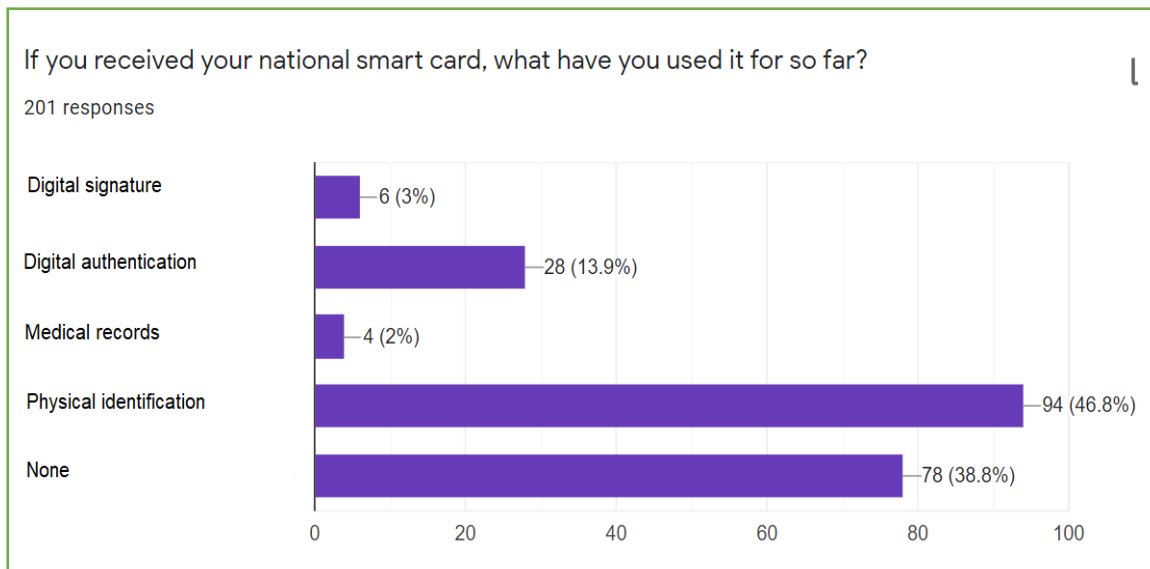Physical identification — 94 (46.8%)
None — 78 (38.8%)

Figure 17.Answer to question 12

Q13
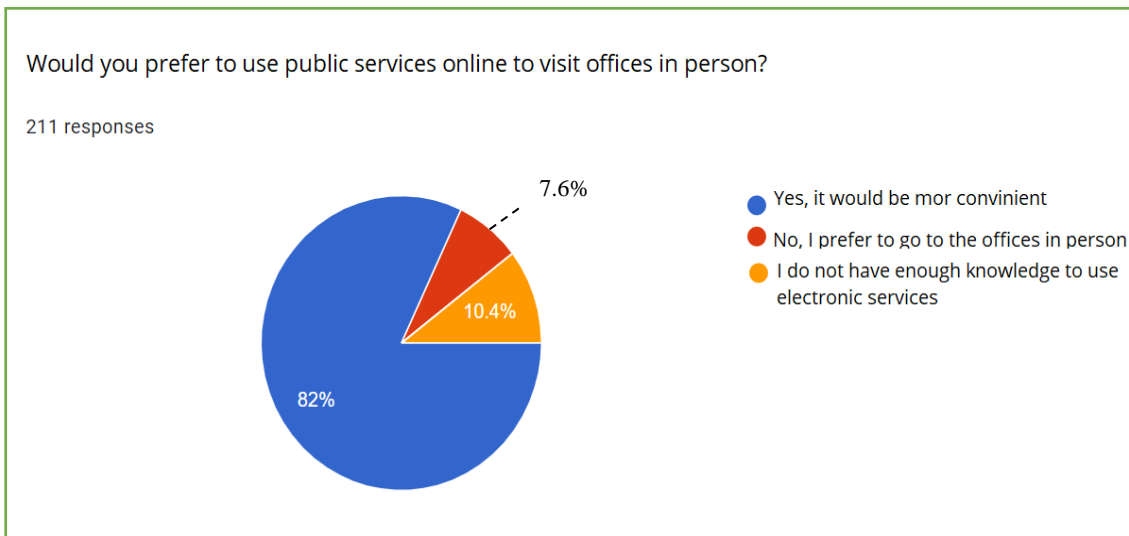
Figure 18.Answer to question 13

Q14
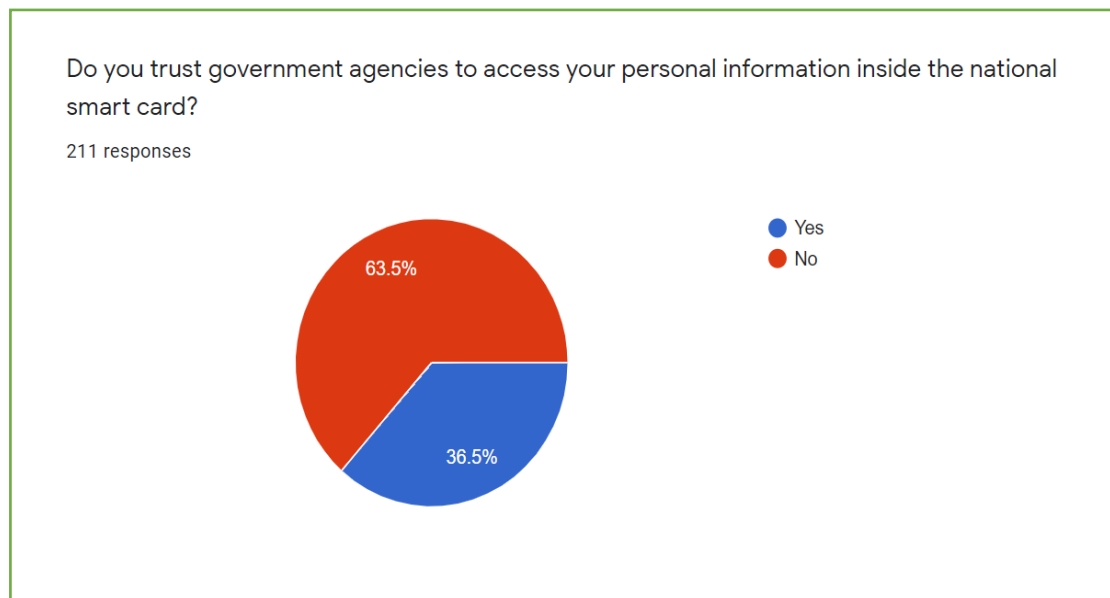
Figure 19.Answer to question 14

Appendix 2– Survey NO2 results
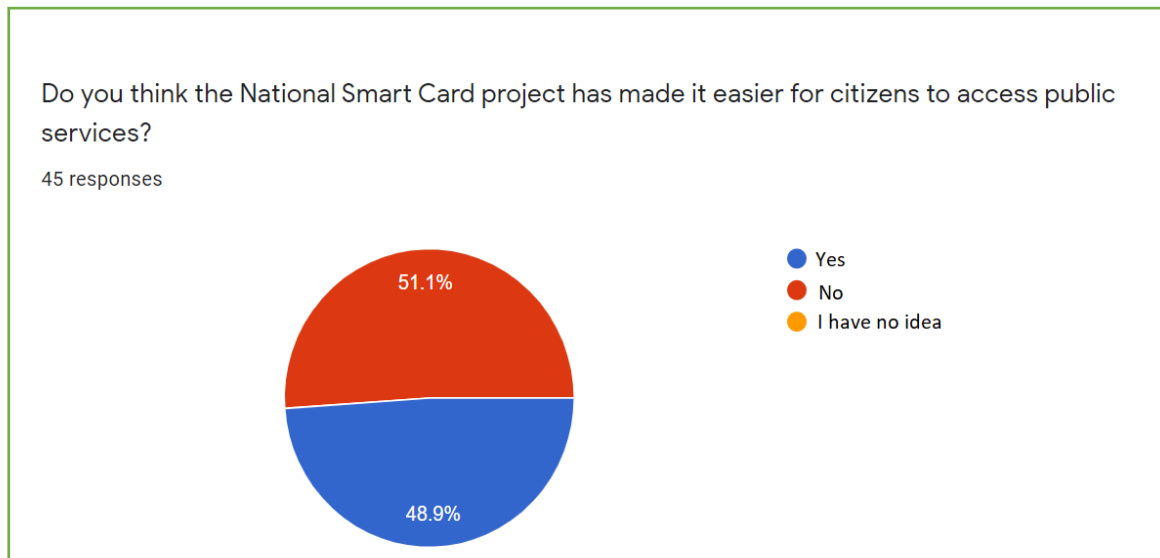
Q1

Do you think the National Smart Card project has made it easier for citizens to access public services?

45 responses

- Yes
- No
- I have no idea

51.1%

48.9%

Figure 20. Answer to question 1

Q2

Can you confirm that currently, the national smart card in Iran can enable citizens to access public services online?

45 responses

- Yes
- No
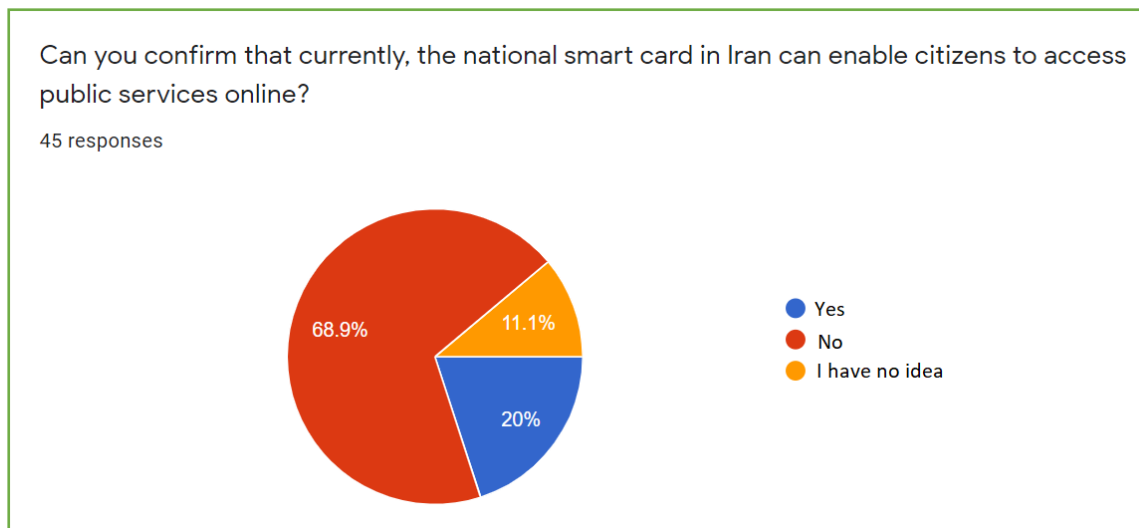- I have no idea

68.9%

11.1%

20%

Figure 21. Answer to question 2

Q3

Do you think the use of the national smart card has reduced the current bureaucratic delays that citizens have in accessing government services?
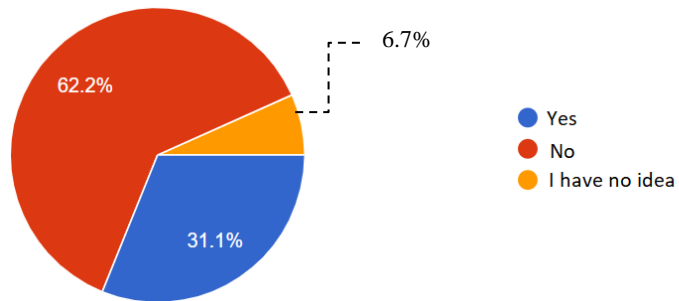
45 responses

62.2%

6.7%

31.1%

● Yes
● No
● I have no idea

Figure 22. Answer to question 3

Q4

As an employee of Civil Registration Organization , Do you prefer to use your smart national card to use electronic services or you would rather to access public services in the traditional (offline) way?
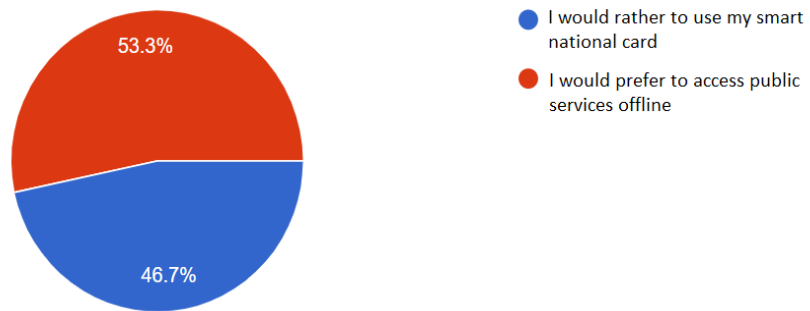
45 responses

53.3%

46.7%

● I would rather to use my smart national card
● I would prefer to access public services offline

Figure 23. Answer to question 4

Q5

What do you think have been the challenges or limitations of the public sector to access Iranian citizens to access public services online so far? (Several options can be selected simultaneously)

45 responses

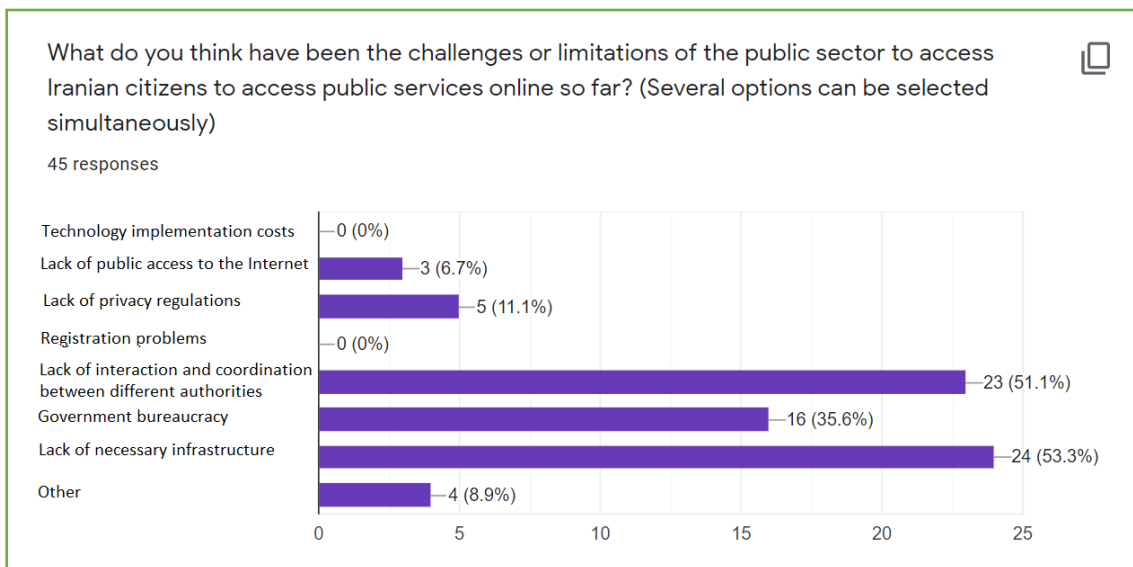| Option	Value
Technology implementation costs	0 (0%)
Lack of public access to the Internet	3 (6.7%)
Lack of privacy regulations	5 (11.1%)
Registration problems	0 (0%)
Lack of interaction and coordination between different authorities	23 (51.1%)
Government bureaucracy	16 (35.6%)
Lack of necessary infrastructure	24 (53.3%)
Other	4 (8.9%)

Figure 24. Answer to question 5

Q6

آگر یاسخ سوال قبلی "دیگر" است چالش یا محدودیت مورد نظر را بیان کنید.در این قسمت میتوانید هر نقطه نظری در این رابطه دارید بیان کنید

3 responses

به علت تحریم های آمریکا ساخت بدنه کارت به تعویق افتاد و این یکی از علت های تاخیر صدور کارت بود

با سلام
احتراماً به عرض میرسانم، با توجه به پیشرفت جوامع و لزوم تسهیل امور شهروندی و نیز امکان شناسایی افراد در امور جاری و بروکراسی جوامع بشری، داشتن کارت شناسایی که بتواند دسترسی دوطرفه شهروندان و کارگزاران امور جامع را در هر جامعه ای تسهیل کند ضروری بنظر میرسد، اما لازمه اجرایی شدن و به زبان ساده کر محبوبیت این امکان در کشورها بستگی به فرهنگ سازی آن در کل جامعه دارد، متاسفانه در ایران با توجه به محدودیت ها و تحریم ها در خصوص زیرساخت های لازمه آن تا کنون موفق نبوده و کاری که باید ظرف یکسال یا کمتر انجام شود بالغ بر پنج سال طول کشیده و همچنان بیست درصد از آن بی بهره و حدود پنجاه درصد در انتظار دریافت آن هستند، و از طرفی هنوز این کارت امکانات حداقلی را در کشور هم پشتیبانی نمیکند، بطوری که در بسیاری از مراکز باید همراه شناسنامه ارائه شود تا احراز گردد، و این خود نشاندهنده، عدم کارایی و توانمندی این کارت در کشور است، این در حالی است که در کشورهایی توسعه یافته، این کارت به تنهایی هویت شهروندان است، و با کاری مشابه این، از کلیه خدمات شهروندی، بدون درد سر بهرمند هستند.
نتیجه:
الف: فرهنگ سازی اهمیت استفاده از این کارت در دستگاه های دولتی
ب: فرهنگ ساز آن در صنوف و سازمان ها ی خصوصی و مراکز خدمات دهنده
ج: فرهنگ سازی آن در جامعه و بین مردم
د: زمان بندی درست و اجرایی کردن آن به مردم بعد از قطعی شدن زیرساختهای لازم
ه: لزوم اجرایی شدن در کل کشور در یک زمان مشخص
موفق باشید

Figure 25.Answers to the open question