ANKARA YILDIRIM BEYAZIT UNIVERSITY

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A PANDEMIC MANAGEMENT PROGRAM USING STRUCTURAL SYSTEMS ENGINEERING APPROACH: ANKARA PROVINCE APPLICATION EXAMPLE

M.Sc. Thesis by

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A PANDEMIC MANAGEMENT PROGRAM USING STRUCTURAL SYSTEMS ENGINEERING APPROACH: ANKARA PROVINCE APPLICATION EXAMPLE

ABSTRACT

In crisis situations, one of the most important issue will be the supply of products and raw materials. In addition to supply, it is necessary to be prepared, especially in cases where basic necessities are not sufficient for the entire society. With our existing technological capabilities, almost every citizen can be tracked separately, often instantly where and what he is doing can be observed. We will try to put aside the ethical discussions of this part of the subject and focus on how we can benefit from these opportunities. Of course, the most ideal thing is that every citizen, regardless of his/her financial power, position in society, job or title, consumes as much resources as his true need with his consent without any compulsion. But in the case of coercive situations, it may be necessary to ensure that the division is conducted fairly and transparently by the authority. In this study, we will try to put a model proposal for resource management system with using one of the systems engineering methods, “Structured System Analysis and Design Method” and relational database design. Of course the model will be not so detailed, but will be functional for at least vital needs.

Keywords: Database, pandemic, resource management, systems engineering.

YAPILANDIRILMIŞ SİSTEM ANALİZİ VE TASARIM YÖNETİMİ KULLANILARAK BİR PANDEMİ YÖNETİM PROGRAMI: ANKARA İLİ UYGULAMA ÖRNEĞİ

ÖZ

Kriz durumlarında, en önemli konulardan biri ürün ve hammadde temini olacaktır. Arzın yanı sıra, özellikle temel ihtiyaçların tüm toplum için yeterli olmadığı durumlara hazırlıklı olmak gerekir. Günümüzün teknolojisi sayesinde, hemen hemen her vatandaş ayrı ayrı denetlenebilir, çoğu zaman nerede ve ne yaptığı anlık olarak gözlemlenebilmektedir. Çalışmanın bu bölümünde etik tartışmaları bir kenara bırakarak, daha çok bu fırsatlardan nasıl ve ne kadar yararlanılabilir kısmına odaklanılmıştır. Tabii ki en ideal olan, her vatandaşın, finansal gücü, toplumdaki konumu, işi veya unvanı ne olursa olsun, herhangi bir zorlama olmadan rızasıyla gerçek ihtiyacı kadar kaynak tüketmesidir. Ancak zorlayıcı durumlar söz konusu olduğunda, bölüşmenin otorite tarafından adil ve şeffaf bir şekilde yürütülmesini sağlamak gerekli olabilir. Bu çalışmada, sistem mühendisliği yöntemlerinden biri olan "yapılandırılmış sistem analizi ve tasarım yöntemi" ve "ilişkisel veri tabanı tasarımı" kullanılarak kaynak yönetim sistemi için bir model önerisi sunulmaya çalışılmıştır. Tabii ki model çok ayrıntılı olmayacak ancak en azından hayati ihtiyaçlar için işlevsel olacaktır.

Anahtar Kelimeler: Veri tabanı, pandemi, kaynak yönetimi, sistem mühendisliği.

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CHAPTER 1

INTRODUCTION

As everyone knows, there has been a “pandemic situation” all over the world in about the last 3 years. It is also clear how unprepared almost all states and institutions are for the epidemic. Many of the work previously done on paper did not work, and the predictions turned out to be wrong. It is obvious that there are dramatic differences between the conditions of epidemics encountered in history and today and we need new systematic approaches that first and fore top the realities of life and human behavior. Whether the process we are going through is a real pandemic or not, leaving aside whether the disease is as dangerous as it is said, we will look at the results of the taken actions. We have experienced many negativities due to both mandatory vaccination practices and closures. So I’m going to continue to use the word “pandemic” for easy understanding.

Looking at the entire period (March-October) of COVID-19, the export market loss is $14.5 billion, and the decrease in imports is $7.6 billion. The total foreign trade impact is about $22.1 billion. This situation shows that the loss of Turkey in exports in the event of a similar epidemic is much greater than the decrease in imports, and the foreign trade balance deficit increases in the manufacturing industry, which is most closely connected with the global supply chain [1].

During this period, there were serious employment losses. Many workplaces had to give their employees free leave, especially small shop keepers experienced difficult difficulties with their decision to close. Significant reductions in household incomes have been recorded.

In addition to these employment losses, many employees lost some part of their income as they had been benefitting from the short-time work allowance. In May 2020, nonagricultural employment was 8.42 percent below its level in February. Taking into account the beneficiaries of the short-time working allowance as well, the number of employees who lost some or all of their income reached 22.77 percent in May of those

employed in February. Moreover, considering that some employees had to take unpaid leave who were not able to benefit from the short-time working allowance, the real number is higher than the one stated above [2].

Another study notes that the Covid-19 pandemic has affected more than 200 countries and regions, and the international focus of attention is on the losses associated with this disease. In order to circumvent the pandemic process, the IMF predicts that the amounts to be spent on policy investments and taxes will be at the level of $ 3.3 trillion in the same study. The study notes that different countries, for example France, Germany, Italy, Japan and the UK report public sector financing programs in amounts up to 10% of the annual GDP [4, 5].

The impact of the pandemic on the public and especially entrepreneurs has been extremely negative. In a research, it is observed that the business owners have quite negative opinions about the impacts of the Covid-19 pandemic on the economy, and especially they agreed with the expressions “I think economic incentives are insufficient”, “I think small businesses face the risk of closing” and “I think unemployment will increase”. The opinions of business owners do not differ depending on the legal status of their businesses and whether or not they are family-based businesses, but it is found that female business owners, those with a monthly income of 5,000₺ and lower, an annual turnover of less than 100,000₺, undergraduate education level and those with 15 years or less of activity have more negative opinions regarding the effects of the Covid-19 outbreak on the economy [4, 6].

Supply chains around the world have become a complex network. Many countries are able to make their production depending on the raw materials they receive from the outside. Disruptions during the pandemic have made it difficult to supply these raw materials, caused cost increases and negatively affected many sites. In particular, the outages in China, which is one of the most important suppliers of raw materials in the world, known as the source of the epidemic, have deeply affected many countries.

According to World Bank data, the G7 countries consisting of the USA, Japan, Germany, England, France, Canada and Italy, in addition to these, China, India and Brazil meet most of the world supply and demand (GDP), world production and the

world's manufacturing exports. Since they are also raw material importers, all kinds of small or big problems that arise in these countries affect other countries of the world. In this context, the WTO stated that it expects the global trade to decline up to 32% in 2020. The post-pandemic situations become clear with the researches, the structures of the supply chain network and the reformation of international trade should be brought to the agenda and discussed intensively. There will definitely be significant changes in the functioning of both logistics activities and supply chains in many different areas during and after the process that has been experienced so far. At the beginning of these, the stock strategy aimed at producing with or without as little stock as possible, imposed by the just-in-time production strategy adopted by most sectors, is the stock strategy. Strategic changes according to the fields of activity will be on issues such as increasing stocks of raw materials or final goods, maintaining safety stocks. Increasing inventories is important in order to minimize risk, even if it will increase costs [6].

In addition, it is expected that the production part of the countries will develop in this process and reduce dependence on exports. In other words, the adoption of the concept of “field to fork”, that is, from production to consumption, will make this period more comfortable. Localization of the supply chain is also envisaged, along with the conversion of production to internal resources. It is expected that countries with products in their hands will beat the pandemic faster and become stronger. [7].

But all this still did not prevent the emergence of new dollar billionaires. Looking at the results, it is even possible to say that all of these were done for them.

In this study, we will try to develop an alternative pandemic or crisis management plan will be put forward on a provincial basis. We have developed a model for managing large crises in the future. These are not only be crises such as the epidemic disease, but can be wars, scarcity, large amount of people to migrate and change demographic structures.

1.1 The Pandemic

Epidemic can be described as an disease in a community or region, and *pandemic* can be described as a widespread occurrence of disease in many countries or continents [8]. Here is a historical data of some of past pandemic diseases:

Table 1.1 A Timeline of Historical Pandemics [9]

Name	Time period	Type / Pre-human host	Death toll
Antonine Plague	165-180	Believed to be either smallpox or measles	5Mio
Japanese smallpox epidemic	735-737	Variola major virus	1Mio
Plague of Justinian	541-542	Yersinia pestis bacteria / Rats, fleas	30-50Mio
Black Death	1347-1351	Yersinia pestis bacteria / Rats, fleas	200Mio
New World Smallpox Outbreak	1520 – onwards	Variola major virus	56Mio
Great Plague of London	1665	Yersinia pestis bacteria / Rats, fleas	100,000

Name	Time period	Type / Pre-human host	Death toll
Italian plague	1629-1631	Yersinia pestis bacteria / Rats, fleas	1Mio
Cholera Pandemics 1-6	1817-1923	V. cholerae bacteria	1Mio+
Third Plague	1885	Yersinia pestis bacteria / Rats, fleas	12Mio (China and India)
Yellow Fever	Late 1800s	Virus / Mosquitoes	100,000-150,000 (U.S.)
Russian Flu	1889-1890	Believed to be H2N2 (avian origin)	1Mio
Spanish Flu	1918-1919	H1N1 virus / Pigs	40-50Mio
Asian Flu	1957-1958	H2N2 virus	1.1Mio
Hong Kong Flu	1968-1970	H3N2 virus	1Mio
HIV/AIDS	1981-present	Virus / Chimpanzees	25-35Mio

Name	Time period	Type / Pre-human host	Death toll
Swine Flu	2009-2010	H1N1 virus / Pigs	200,000
SARS	2002-2003	Coronavirus / Bats, Civets	770
Ebola	2014-2016	Ebolavirus / Wild animals	11,000
MERS	2015-Present	Coronavirus / Bats, camels	850
COVID-19	2019-Present	Coronavirus	~6.3Mio

Of course it is very important to take lessons from past experiences. But when we compare our environment and abilities with other pandemic periods in history, we can see many differences. Perhaps the most important of these are the development of communication technologies, as well as individualization in society and the dramatic changes in social structures. When we evaluate in terms of the affected mass, even if the closest example is seen as HIV -which has entered our lives since the 80's- when we look at the risk and ease of transmission, old influenza outbreaks can be taken as an example.

However regardless of the similarities, it is not possible to say that Covid-19 is close to previous pandemics in terms of both geographical spread and disease character. When sociological and technological differences are added to this, it is obvious that we are faced with a brand new disease and problems that we have not encountered before. It is clear that we have to look for solutions to these problems that have not been applied before. Many practices and measures taken have been tried to be regulated through trial and error and by observing their effects on both individuals and

society. Although standard ways of fighting influenza viruses have been known for centuries, there must be another explanation for these errors/corrections.

*

One of big difference of our period is undoubtedly the speed and ease of *accessing data*. In addition to ensuring the rapid dissemination of information, evolving communication capabilities have made it easier to manipulate people. It is not clear which information is true and which is false, and the reliability of the sources has been questioned. Even the structures established for this purpose are discussed and suspicions arise that they are working in the interests of the financiers and groups to which they belong. It is also a big problem that people can access all kinds of data so quickly, regardless of whether it is right or wrong, and that it contributes to its dissemination and development by evaluating it completely subjective in line with their own ideas and feelings. There is a laziness in people to turn data into qualified information. Evaluations are generally in line with the directions of the individuals and groups who are followed or valued.

A block chain can be created for accurate and reliable data. But it will matter which areas this is for. We have not added the issue of information security to our model. They completely depend on the decision of the competent authority. Since our model is modular, both security restrictions and the block chain structure can be easily integrated.

Compared to the epidemics in the past, the biggest difference is that there is a breakdown now. This means a huge cost. If we don't have a plan to handle it, we could be face to very serious circumstances. Our model can be used both in epidemic and pandemic, and in fact in various crisis situations. These are huge costs and are difficult to cover. It is necessary to take into account not only material, but also moral costs. We want to respond to unexpected requests.

1.2 Disasters

The term disaster is defined as "a serious disruption of the functioning of society, causing widespread human, material, or environmental losses which exceed the ability

of affected society to cope using only its own resources" by the United Nations (1992) [10].

Disaster classification according to Disaster and Emergency Management Presidency (AFAD) is as follows:

Table 1.2 Types of disasters observed in the world

Geological	Climatic	Biological	Social	Technological
Earthquake	Heat Wave	Erosion	Fires	Mining Accidents
Landslide	Cold Wave	Forest Fires	Wars	Biological, Nuclear, Chemical Weapons and Accidents
Rock fall	Drought	Epidemics	Terrorist Attacks	Industrial Accidents
Volcanic Eruptions	Hail	Insect Infestation	Migrations	Transportation Accidents
Mud Streams	Tornado			
Tsunami	Lightning			
	Hurricane			
	Typhoon			
	Flood			
	Cyclone			
	Snowstorm			
	Avalanche			
	Extreme Snowfalls			
	Acid Rains			
	Fog			
	Icing			
	Air Pollution			
	Forest Fires			

When we say "disaster", everyone may have different thoughts depends on living geography. For example, most people in Turkey think about an earthquake first. Actually, the statistics tell us why this is so [11]:

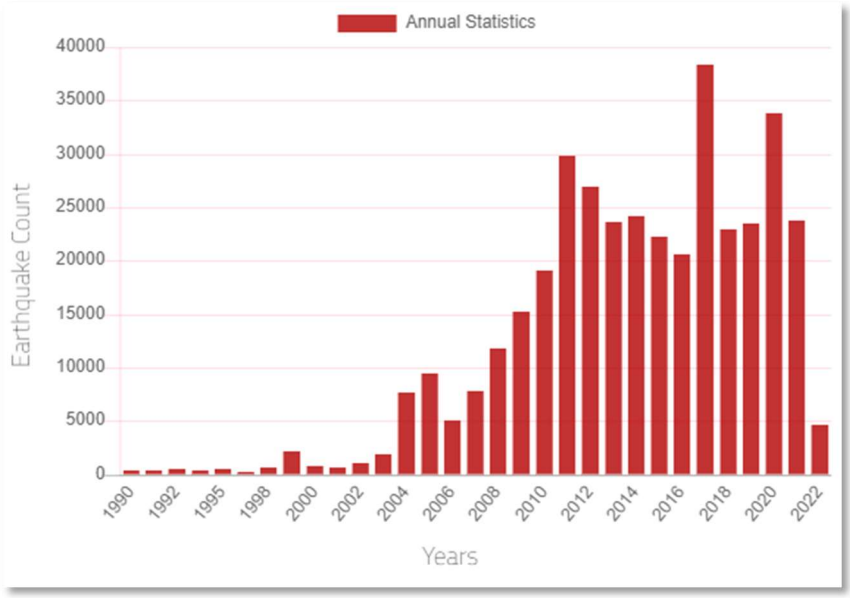

Figure 1.1 Earthquakes by year [11]

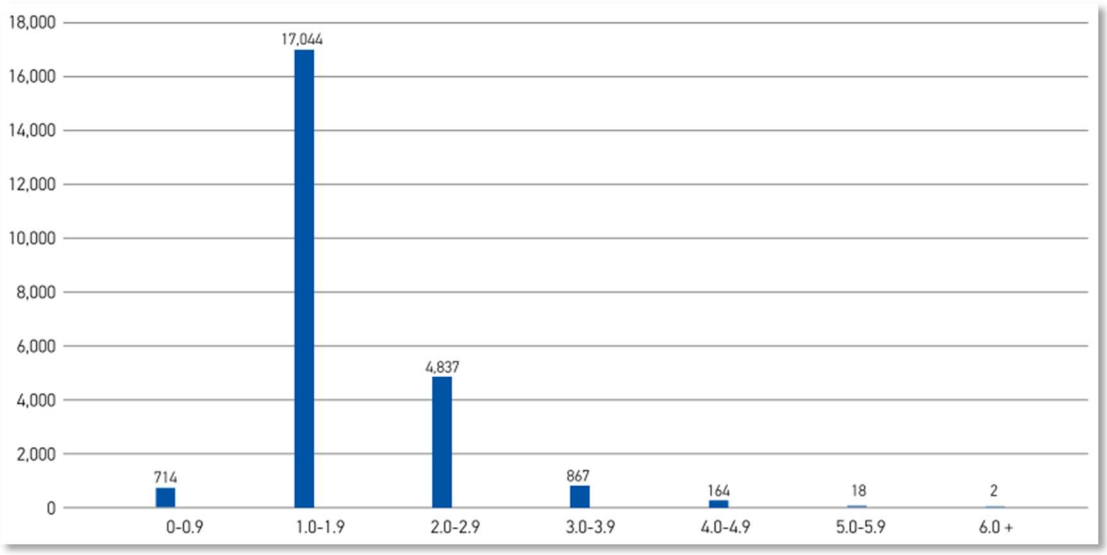

Figure 1.2 Breakdown of earthquakes occurring in 2019 by magnitude [11]

Figure 1.1 shows how large the number of earthquakes is. The average number of earthquakes per year is more than 20 thousand. Even if most of the magnitude of earthquakes is small (Figure 1.2), this always keeps us alert and sensitive. Due to the nature of the event, the earthquakes affects limited region and although its duration is very short, its impacts can be very dramatic. But still, relatively short-term measures

and support from other parts of the country will usually be enough to help and support the affected people.

1.3 Problem Definition

During the pandemic period, many private sectors experienced difficulties. We're in a consumption-based society, and in the early periods when people were locked up in their homes, they couldn't make the purchases they were used to. As a result, sales declined. Physical contact almost disappeared, and because of this there was a significant increase in internet sales. Eventually, there is a shift from physical to online market during Covid-19. Many of the product groups have seen a significant increase in sales compared to 2019 with the effect of panic-buying [12]. Accordingly, there was an increase of 186 percent in the market category, 168 percent in the health category, 108 percent in the cosmetics category, 69 percent in the book/stationery category and 42 percent in the dry food category [7, 8]. Inevitably, there were disruptions to cargo services. In addition, there have been some disruptions to supply chains and deliveries.

Employees have made serious sacrifices to ensure that some critical services can continue without disruption. Many government and municipal institutions have had to close certain departments or limit most of their services. Life has come to a standstill, except for the fulfillment of essential needs.

The measures that needed to be taken were either not taken or were late. As a result, constant changes were made in decisions and practices. From time to time, practices that had no use in fighting the epidemic came into force. The consequences of the practices in society and their effects in the short or medium term were not well calculated. This led to either a got step back or at least a waste of very valuable time.

*

There have been serious problems, especially in the health sector. Both mask and disinfectant production and physical environments in hospitals were insufficient to meet the needs. Leaving aside whether it really works or not, let's take the example of surgical mask supply.

Actually, mask is very basic and easy to produce stuff. Finding a mask was a problem in itself. Initially, overpriced mask sales were made by manufacturers who wanted to take advantage of the opportunity. People were desperate to pay up to 10₺ for 30kr masks. Then, sales of the mask were banned and told they could only be obtained from pharmacies. After that, it was announced that only the codes sent to the phones would be sold. Meanwhile, with tons of medical supplies were provided to many countries, especially those in Europe. Although this behavior is humanitarian, it has caused criticism of the government for primarily helping others rather than meeting the needs of their own people. Some "entrepreneurs" began to produce under dubious conditions in order to take advantage of the opportunity. In short, approximately for first 3 or 4 months finding mask was a very big problem.

It has caused a long debate, as it has not been clear whether the use of a mask is necessary, who should use it even if necessary, by both local authorities and the World Health Organization. At the time of the preparation of this document, the situation was still not clear and satisfactory and many countries like England, Finland, Ireland and Denmark start to remove pandemic restrictions and regulations.

Also trading is/was a big problem. Small tradesmen and SMEs in particular have had a very difficult time and have not been able to get enough support from the state. The government had given limited support them. Low-interest loans and deferred debits were good, but not enough. Because "debit was still debit" and "interest was still interest". Many of other countries have given their small companies unrequited and unconditional monetary support.

In the UK, funds and policies such as the furlough job retention scheme (early cost to the government estimated at £40bn), sector bailouts, the Towns Fund (£3.6bn allocated to 100 towns), the Future High Streets Fund (£1bn available to 100 high streets) and time-limited initiatives like 'Eat Out to Help Out' (100m subsidized meals out with half price up to £10) have been examples of some previously existing and newly hastily devised schemes targeted at certain people, places and sectors [15].

Locking up people and the created atmosphere of *fear* have caused many social and individual problems. Maybe most of us have expected some changes but only started

to realize what was happening in fact after 1 year. In many areas, such as health and trade, as well as education, friendships, eating habits, worship requirements, tourism, behavior of the private and public service sectors, it was necessary to go beyond the usual standards. As the academic researches and many projects carried out were concluded, both sociological and psychological consequences began to emerge about what happened. Since these studies can be done for a limited target audience and certain regions, they are at a level that can only give us an idea about the whole. Undoubtedly, more detailed and comprehensive studies will be conducted over time and due diligence will be made more accurately. Amid rumors and real information, the presence of anguish and anxiety has prevailed [7, 8]. This uncertainty alone can generate a feeling of being threatened [8, 9]; however, in addition to this uncertainty, the various strict guidelines on isolation, social distancing, and wearing a mask can further increase fear. Although the presence of mental health problems due to the pandemic has already been confirmed [7, 8], there has still not been an exact measurement of the anxiety the pandemic has caused [17].

In previous pandemics, although it was seen that it was necessary to provide clear and clear information to the public in order to reduce fear and panic and build trust [19], this sensitivity was not shown. From the early days of the pandemic, *"if you don't...!"* messages of fear continue to be given. It seems that the best solutions of the modern civilization system, such as: globalization, democracy system and modern models of organization management lost their value during the pandemic [20]. Also the reputation of the medical and scientific world has also suffered greatly. Equally clear was that near-shoring, re-shoring and localized distributed manufacturing seemed inevitable, overturning at a stroke over 20 years' growing reliance on off-shoring as a competitive supply chain strategy. Forget management practices such as just-in-time and lean manufacturing: suddenly, inventory holding seemed eminently sensible [21].

In such cases, the actions taken must be within a certain plan and the results must be calculable. In order for the steps taken to be accurate, possible results should have been calculated within reasonable margins of error beforehand. If it is worked within a plan, the probability of encountering such problems is reduced.

Despite a 2.3% increase in world cereal production in 2019 over 2018, the number of people facing severe food insecurity may double from 135 million in January 2020 to 265 million by the end of 2020. The problem of food and nutritional insecurity is severe in urban centers, where the global population is projected to increase (%/year) by 1.84, 1.63, and 1.44 between 2015 to 2020, 2020 to 2025, and 2025 to 2030, and it will increase overall from 54% in 2016 to 60% by 2030 [22].

The production of wheat, corn and rice in Turkey has been static or even declining over the years. According to the UN fifth national report on Biological Diversity (2014), the growing area has been restricted and allowed to be grown in a narrower area due to policies applied to certain types of grain in Turkey over the years. Static or decreasing production amounts in these products were tried to be compensated by an increase in imports [23]. According to the Turkish Grain Board (TMO) 2019 grain sector report, 2.6 million tons of wheat (including durum wheat), 0.05 million tons of barley, 0.4 million tons of corn, 0.2 million tons of rice were imported in 2010. In 2019 the same products, wheat 11.3, barley 0.86, corn 3.9, rice 0.2 million tons were imported (Figure 1.3). Although the numbers have varied over the years, we can say that there have been dramatic increases in imports of products other than rice.

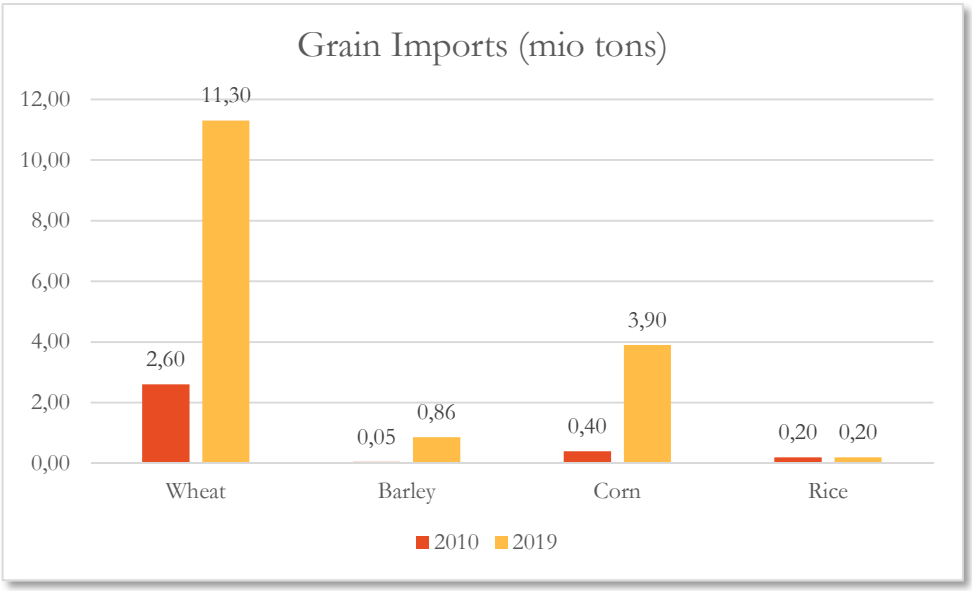

Figure 1.3 Last decade's grain import change in Turkey

Home gardening, urban and peri-urban agriculture (UPA) can be very important. The concept of UPA refers to an industry located within or on the fringe of an urban area, using in situ products, services and human and natural resources, to grow, process and distribute agricultural products [23, 24]. Latest international directives indicate the need for sustainable development, linking socio-economic and environmental aspects, to reach the goals set by Agenda 2030. In this context, peri-urban agriculture can represent the opportunity to increase cities' sustainability, improving their livability level, fulfilling a crucial social part since it assures new sources of job opportunities and territorial requalification [26]. In 1992, a research showed that the components of a Swedish breakfast (apple, bread, butter, cheese, coffee, cream, orange juice, sugar) traveled a distance equal to the perimeter of our planet before arriving to the Scandinavian table [23, 26].

The need for such long distances and long and complex supply chains to reach basic foodstuffs will especially worsen the effects of crises. It will make conditions that are already difficult enough to become even more unbearable. All segments of society will be adversely affected by such situations. Social solidarity and healthy communication will be of vital importance. Therefore, it is necessary to plan these and project them into the future. We think our model will especially respond to this need.

Despite the fact that there are no major difficulties in accessing such materials during the process we live in, when we look at the difficulties experienced, we can say that “we were unprepared”. Entrepreneur Bill Gates, one of the important actors of the Covid-19 process, said in his speech in 2015, “we are not ready for the next epidemic” [28]. The same Bill Gates, moreover, while the world is already in a pandemic, in September 2021, he said, “we are not ready for a pandemic!” made the statement [29].

What about now?

CHAPTER 2

THE SOLUTION

2.1 Studies in Turkey

Turkey, we always say, is a country of earthquakes. In the past years, we have lived many earthquakes. Actually we have a serious experience about quakes. We have the AFAD, a well-organized and experienced institute under the Ministry of Interior. After each earthquake, there is always a high level of solidarity in our society, depending on the magnitude of the disaster. Our people has high sensitivity to help others and we also have many of humanitarian organizations.

However, we have not experienced a serious epidemic in recent history. With the swine flu epidemic, which was also announced by WHO in 2009, the nationwide vaccination campaign, which was tried to be started by the then Minister of Health Recep Akdağ, did not find a response in the society due to the lack of support of Prime Minister Recep Tayyip Erdoğan [30] and the firm opposition of the former Minister of Health Osman Durmuş [31]. As a matter of fact, only a year later, many authorities and scientists, including the WHO, admitted that the issue was exaggerated and that a fear campaign was deliberately carried out [32].

Now, in April 2022 we are still in an official pandemic. If we look the statistics of the disease, the numbers tells us, the situation is very different. In fact, these numbers are/were generated on the basis of PCR, which is an extremely questionable test. So actually we never can be sure about the real numbers.

2.1.1 Health

Approximately 8 months before the announcement of the pandemic by WHO, the ‘Global Flu Epidemic’ circular has been published from the Turkish Presidency. The circular specified the measures that should be taken by public institutions and organizations in case of a global flu epidemic that could affect the vast majority of the population [33]. Yes, if we think about timing of the circular, this could be interesting.

Whether you call it a *prediction* or a *precaution*, WHO really declared a flu pandemic almost immediate after the circular was issued.

Of course, there are many laws, regulations, directives and circulars in our legislation system but mainly, we have two different plans from two different institutes in Turkey for pandemics, general emergency and disaster situations.

One of them is prepared based on the mentioned circular by General Directorate of Public Health with the title The Pandemic Influenza National Preparedness Plan (Pandemik Influenza Ulusal Hazırlık Plânı) in (again) 2019 [19]. In that plan, it is assumed that the pandemic period should be only 12-18 or 10-12 weeks if no intervention is made. The report also includes some -not so accurate- scenarios regarding the severity of the pandemic. That's the way it was predicted, but it doesn't match the truth. We all know “the fact” which is different.

According the document, the plan has been prepared taking into account the regulations and recommendations made by ECDC-European Centre for Disease Prevention and Control and WHO. “WHO took an active part in directing the process, identifying and declaring pandemic levels and mobilizing countries in accordance with the plans and preparations made in advance. There is a need for a more decisive WHO role in the planning of the distribution of medicines and vaccines” the plan says. Actually, when you examine the document, you can see almost every national action has taken by WHO’s directions. For example, WHO has divided whole world to 6 regions and defined same 6 alarm levels for every countries. Our plan has prepared based on this classification. When we compare the document with the actions taken during the pandemic, we can see that all the authorities were almost completely loyal to the plan. However, again according to the same document, the pandemic, which should have a maximum life expectancy of 18 weeks under normal conditions, is still not over for 2 years. So, we can say that something is/was wrong.

On the other hand, how can a plan, a same plan be suitable *for all countries*? Moreover, despite the fact that it said “the pandemic has caused different impacts in different geographical regions at different time intervals”. Even in the same country, the

geographical differences between different regions, people's behaviours or living conditions should affect the policies and measures.

The plan includes two main chapters and one appendixes section. Second chapter has mostly health-related issues that are not related to our main topic. But in the first part of the document, there are two level of organization structure defined: Nationwide and Province. The document only contains governmental institutes and boards, for example we cannot see NGO's or municipalities' responsibilities, maybe for just some basic subjects. It has prepared for only a possible pandemic, text based and defined the boards, institutional duties and human resources planning formats according to these two level. It's complex, hard to read, not easy understanding and needs serious expertise and high level authority to application.

2.1.2 Disasters

The other plan is prepared in 2013 by AFAD: Turkey Disaster Response Plan (Türkiye Afet Müdahale Plânı, TAMP) [34] has very detailed duty distribution between the institutes. Actually, the plan already includes the purpose and scope: "In general, plans are prepared with a *strategic, tactical* and *operational* approach. Strategic plans include the medium- and long-term goals of institutions and organizations, their basic principles and policies, goals and priorities, performance criteria, actions and methods to be followed to achieve their goals, as well as the distribution of resources. Tactical plans define roles, responsibilities, tasks and express the work and actions that service groups will do. Operational plans include details such as personnel, equipment and resource management. TAMP has been prepared with a tactical approach and defines the roles and responsibilities of service groups and coordination units that will take part in disaster and emergency response efforts".

In the plan, in general, according to the levels of disasters, it has determined who will do what where. It has started from the provincial level and goes up according to the degree of the disaster. The service groups are well defined for every event type like flooding, fire, chemical attacks, drought, earth quake and mass population movements.

There are 4 intervention or event levels defined: S1 (province wide), S2 (province wide, need support), S3 (regional, need nationwide support) to S4 (national, need international support).

Here is the graphic of the general structure of the national and local intervention management system:

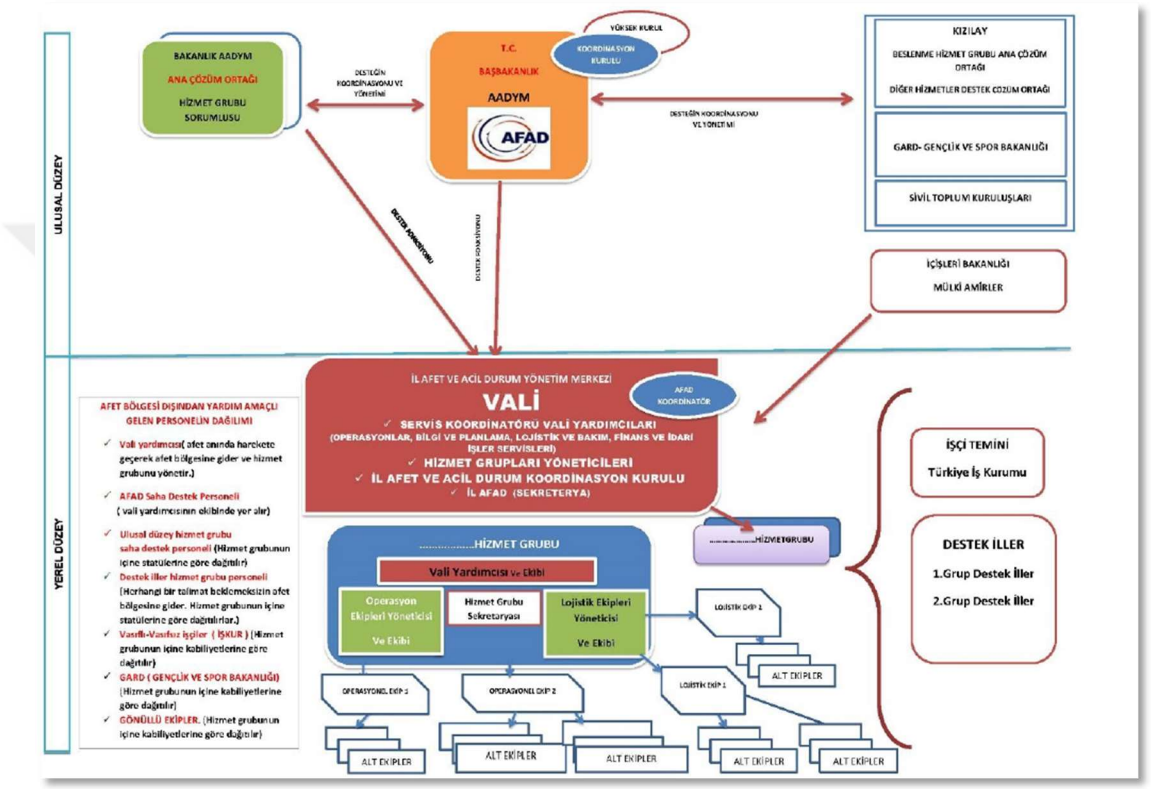

Figure 2.1 National and local intervention management system of AFAD [34]

The national and provincial level disaster response organization charts:

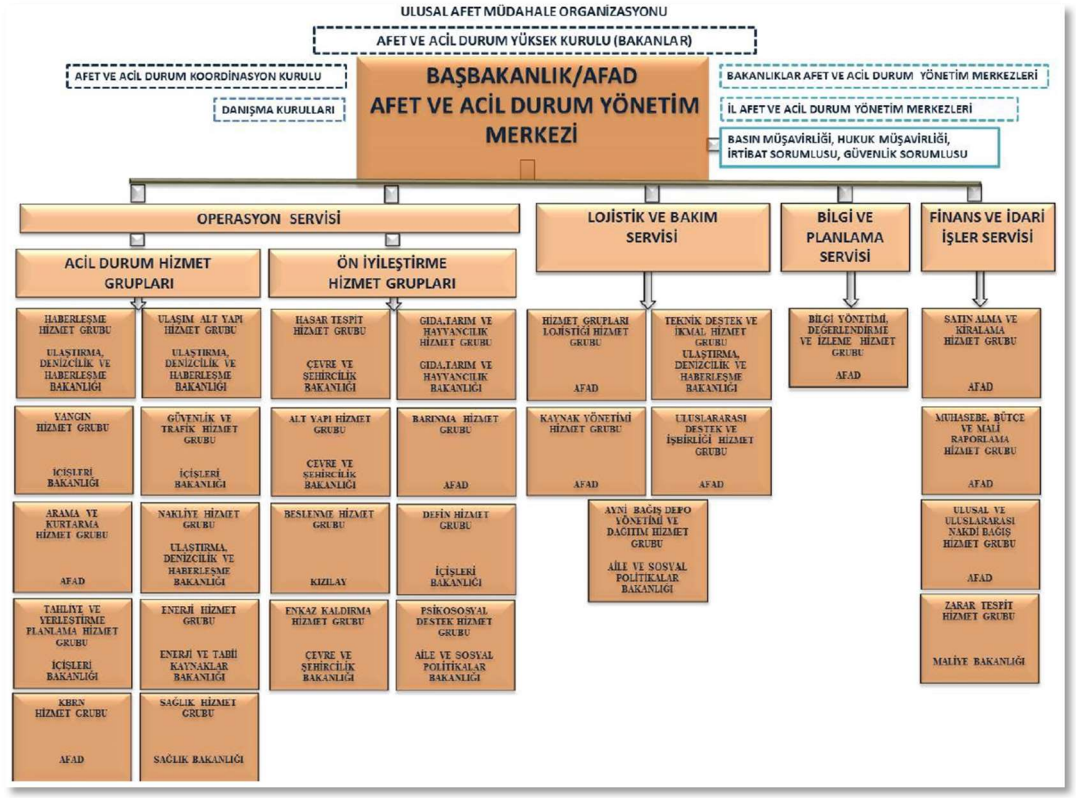

Figure 2.2 National level disaster response organization chart [34]

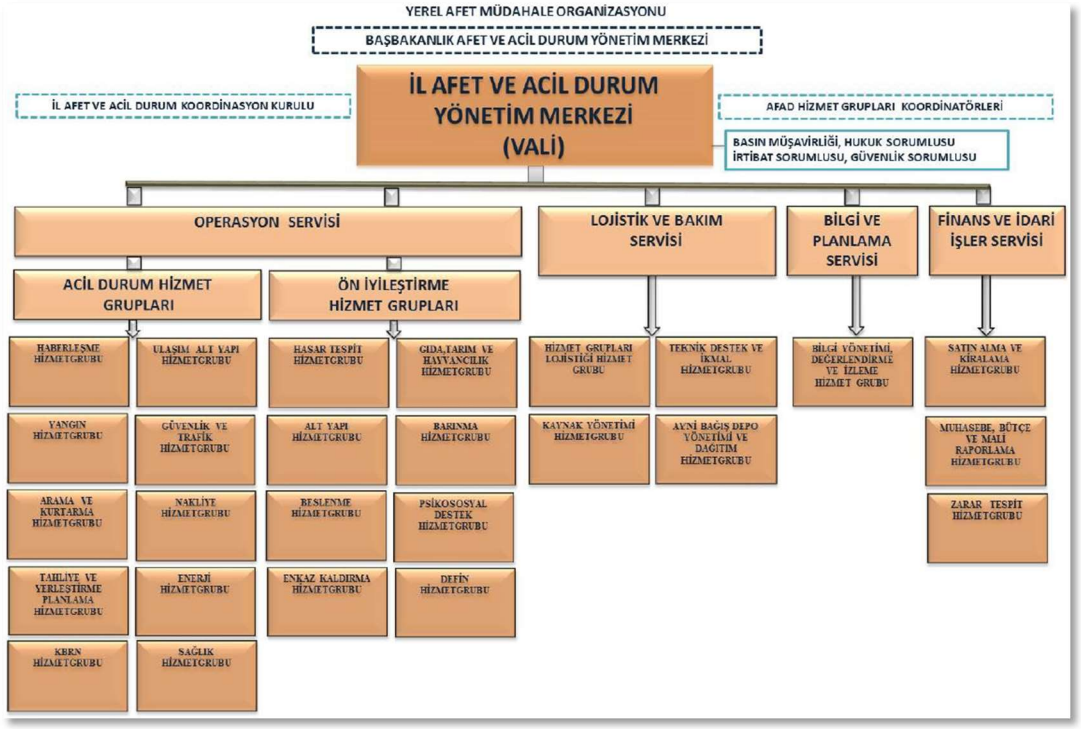

Figure 2.3 Provincial level disaster response organization chart [34]

There is also a separated strategic plan prepared by AFAD, on which this one is based: AFAD Strategic Plan | 2019-2023 [35]. The goals of the plan are clearly defined and summarized under six headings:

- **Goal 1 - Coordination and Communication:** Enhance effectiveness of coordination in disaster and emergency management
- **Goal 2 - Risk Reduction:** Ensure the adoption of a risk-based integrated disaster management approach, and its recognition by all sectors
- **Goal 3 - During and Post-Disaster:** Manage the processes during and after disasters as effectively as possible
- **Goal 4 - Public Awareness:** Ensure disaster and emergency preparedness at all times by raising public awareness
- **Goal 5 - International Influence:** Be one of the leading organizations in the international arena
- **Goal 6 - Institutional Capacity:** To be an organization that continuously learns and improves

Every goal has its own several objectives. Every objective has a responsible unit, activities, plans, calculated risks, strategies, observations, needs and even estimated costs. They are all well-defined.

As a result, if we consider these two AFAD documents together, we can say we have very well prepared plans and strategies especially for disaster situations. But again, this plan only applicable by the governmental authorities like previous one.

*

There is another work, again done by AFAD, “Workshop on the Role of Local Authorities in the Building of Disaster-Resilient Communities”[36]. The booklet has described the purpose of the study as “studies into the responsibilities of local authorities in disaster risk reduction in Turkey, how these responsibilities should be fulfilled and by whom, and the role of local governments in the roadmap for risk identification”. It contains some local studies from İstanbul, Kocaeli, Gaziantep, Antalya municipalities from Turkey, Amadora Region from Portugal and Potenza Region from Italy. Unlike the others, this study includes some common shares with the public. In particular, the “Disaster Preparedness Education Project for the People of Kocaeli” conducted by Kocaeli Metropolitan Municipality was carried out directly with the public:

Figure 2.4 Kocaeli [36]

There are some papers both in Turkey and international academia about disasters and disaster management. Some of them focused to communication problems between institutes.

2.1.3 Situation In Ankara

We have asked the Ankara Governorship and the Ankara Metropolitan Municipality, two authorized institutions of Ankara, some questions about their measures in current and possible future crisis situations. Actually the questions were very same:

1. There is a medical waste of a size that would not be possible under normal conditions. In particular, the consumption of masks is quite a lot. Is there a plan for their destruction?

2. In general, the use of alcohol-based products (disinfectants) is also very increased. Have the long-term or short-term effects of these on both the environment

(atmosphere) and human health (both we breathe and use it on our skin) been investigated? Then have any measures been considered?

3. In the event of a possible crisis, the supply chain will be more important than ever. Have the local production capacities of basic food products been determined in Ankara? Is stock status being monitored?

4. The same question applies to medicines and, in general, medical equipment. As you may remember, even though it was very easy to produce, we had difficulties for a certain period of time even in supplying masks.

5. Have the steps to be taken, especially in terms of safety and continuation of vital activities, been determined in the event of a power outage?

6. Do we have plans for water supply, which is more important than electricity? For example, drilling public wells or making fountains at certain points of the city, etc.

7. Are the regional borders, responsible persons and teams clear for situations where regional closure or various measures should be taken on a regional basis?

8. There are probably state institutions among them, but there are local institutions (municipality, NGO, academy, etc.) is there a central database or application for collaboration? This will be important both for the order of coordination and for the health of the data flow. The same job will not be done twice, and the probability of missing a job that needs to be done will decrease.

9. We think that the responsibilities of each state institution and the work they will do are determined in order of priority, especially in the province. But is this task, responsibility and what needs to be done in the form of a flow chart or an easy-to-understand layout? For example, if the decision "we are currently in a state of emergency" was taken and the button was pressed, what would the Provincial Director of Agriculture do first, what information would he produce, where would he reach, etc. is it well and understandably described? Because even if the responsible ones change, the responsibilities will not change, no matter who they are, they will have to adapt to the situation easily.

10. If for some reason the province needs to be completely or partially evacuated, do we have plans on how and for how long this will be done?

11. As you know, especially small artisans have been negatively affected economically. Are there any specific steps to be taken as a supportive measure?

12. Because of the locked up to homes, there have also been a number of positive changes in nature. Based on this, is the subject evaluated in terms of city design and environmental factors?

13. In general, in the light of the experience gained from the process we are going through, what are the considerations that you say "if we hadn't done this" or "we should have done this that way" and are they included in the active plan?

*

The answers from Ankara Provincial Directorate of Health:

- Medical wastes (masks, medical needles, gloves, aprons, quarantine wastes, etc.) generated as a result of the activities of our Public Health Services Presidency are collected from the place where they are produced by the municipalities / private sector companies, from the designated points, and taken to the disposal area. Our personnel related to medical waste management are given periodic training, health checks and medical wastes are disposed of in a planned manner.

- Use of alcohol-based (disinfectant) products; It has microbicide properties, is effective against various microbes in high dilutions, has high penetration ability, dissolves easily and homogeneously in water, is durable and has a long-lasting effect, is non-toxic and irritant for humans and animals, starts to affect in a short time. Does not combine with external substances and is not inactivated, odorless or fragrant, environmentally friendly, harmless to human and animal health, suitable disinfectant material is used.

- Supply chain in case of a possible crisis; for possible crisis situations, data flow is made with other public institutions and private sector within the framework of the Provincial Health Disaster and Emergency Plan (IL-SAP), and stocks are followed.

- Ankara Provincial Health Directorate is for the health of our people, in order to ensure the use of drugs and equipment, to systematically monitor adverse reactions and benefit / risk balances, to collect information, to record, to evaluate, to archive, to establish contact between the parties and to minimize the harm that may be caused by drugs takes the necessary measures to reduce it.

- In the event of a power outage, there are generators that automatically activate in our health facilities, feed the system one-to-one, and activate without damaging the electronic devices, and there are also electrical power sources that can ensure the operation of the devices.

- For water supply, there are water tanks in our health facilities according to the water usage capacity of them.

Figure 2.5 A water tank in Yaşamkent district.

- For regional closure or regional measures in our city; within the framework of the Provincial Health Disaster and Emergency Plan (IL-SAP), our Ministry determines the regional borders, responsible persons and teams for necessary situations in our province. Data flow and cooperation are provided between local institutions in our

province within the framework of the Provincial Health Disaster and Emergency Plan (IL-SAP).

- Provincial Pandemic Preparedness and Action Plan was prepared in December 2019 with the support of the Presidential Circular and the institutions operating in our province. In this plan, the roles, duties and responsibilities of all institutions and organizations during the pandemic have been determined. In addition, duties and responsibilities are carried out within the framework of the Provincial Health Disaster and Emergency Plan (IL-SAP).

- Plans are made within the framework of the Provincial Health Disaster and Emergency Plan (IL-SAP) in cases where it is deemed necessary to evacuate completely or partially in extraordinary situations.

- Other issues fall within the scope of public institutions and organizations such as Municipalities and AFAD.

*

The answers from Ankara Metropolitan Municipality:

- In order to support garden production as Ankara Metropolitan Municipality, agricultural products that are required and needed on the unused lands of our municipality are produced in the Gölbaşı Agriculture Campus area. During the production phase, joint studies are carried out with non-governmental organizations such as Ata Seed Association, City Council Rural Development units.

- Our administration continues to work on the preparation of the “Ankara Drinking Water, Wastewater and Storm water Management Master Plan” in order to ensure that the drinking water requirement, wastewater disposal and rainwater collection and removal services, which increase in parallel with the growth and development of Ankara, can be carried out in a sustainable and long-term manner in accordance with national and international standards.

The scope of the master plan study consists of the main headings of Water Demand and Water Resources Management, Water, Wastewater and Storm water

Infrastructure, Drinking Water and Wastewater Treatment, Institutional Structure and Financial Analysis and Investment Programs.

The Master Plan study is very important as the increasing global warming, climate changes, drought effects and changing consumption habits in recent years bring with it the necessity of producing innovative solutions in water management. Our work, which started in April 2019, will be completed in October 2023. Within the scope of this study, all options are evaluated by our expert professors and are formed for Ankara until 2054. Within the scope of the project, it is studied in detail where water will be obtained, how it will be collected and how it will be disposed of.

*

When “disaster” is mentioned in these studies, it is meant natural events such as earthquakes, floods, fires, which usually happened in a not very long time and the effects of which are also relatively short. But, for example, there is no action plan for situations of prolonged *famine* or difficult access to vital needs for a period of time. Also we cannot see anything about neighborhood or agriculture and sustainability of fresh food.

Different from these, we will try to make a model to get community together and fairly share the sources in an order.

2.2 System

A few people realize it, but we live in an enormous world and universe whose every detail is delicately calculated, measured, and based on an extremely delicate balance. When we look at the construction and structure of many events or objects, we can see that they actually have much more detail and finesse than they appear from the outside. We can often evaluate them like “the natural course of life, how else could it have happened anyway?” As much as we are familiar with the characteristics of this environment that we have been in since we were born, even so, we are somewhat blind to them.

In particular, we link almost all kinds of corruption in nature to the evil deeds that people do and try to learn some lessons. So, when we turn our heads from these wonders that have not been done by human hands and look at what human beings have done, we can identify many mistakes and negativity made by those responsible, whether you call it smugness or jealousy. Especially the subject in one of the areas where we are experts “here should be like this, why did they do this here” we can make many criticisms. They even say “the master doesn't like the other's work.”

On one side are formations created by Allah (CC) and which everyone believes to be perfect. Although these have been studied and investigated for years, they still have not been reached to the end and no errors have been found in the discovered parts. On the other hand, there are structures that people make and almost everyone needs correction or change, including who make them.

*

Naturally, when you say “System” everyone has a different meaning in their mind. The nature of this meaning is, without doubt, closely related to the education we receive, the work we do, the environment we live in, the events we deal with, in short, with our acquis. The system can be an operating system or network structure for a person interested in computers, a whole set of parts that make up a machine or factory for engineers, and a training process or a supply chain for soldiers. However, even though it is quite big and complicated, such as “health system, education system, economic system” we all hear, there are also organizations where almost everybody unites in a common denominator.

The system can generally be summarized as a whole that interacts with its environment, parts of that whole, and all the relationships between them. According to Aristotle, “*The whole is more than the sum of its parts. The part is more than the fraction of the whole*”. So when it comes to systems, two plus two can be more than four. In the same way, when four of them are split in two, the pieces can be larger than two.

Systems are organized and complex structures. The first structure that needs to be revived in our minds is human. When we went to the starting point, Allah (CC) first “wished” to create man. So at the first stage, man was just an idea. He then gave it the most beautiful shape and shaped it with soil. He then breathed out of his soul and completed the creation. Then man came into the world and had to prepare for world conditions for a while. He learned to survive and take advantage of the world's blessings. Eventually, he got old, died, and returned to the soil. Here we can see that there is a cycle that repeats for each person and has certain stages. If we need to sort the stages of this cycle [37];

- Conception
- Design
- Creation
- Transition to Use
- Use, Life
- Senility, aging
- Replacement

We actually have a similar cycle in the world we live in. Doesn't it all start with an idea and end with death?

Not only these stages, but also inside the body, we see that there is a perfect mechanical system and it is in *balance*. It consists of cells, tissues, organs, organ systems and the organism i.e. the body, respectively. When people come together they form families or communities, then they form tribes or nations. It can be easily identified that each of these is a subsystem of the other (Figure 2.6). So we can talk about a hierarchical structure between systems [38].

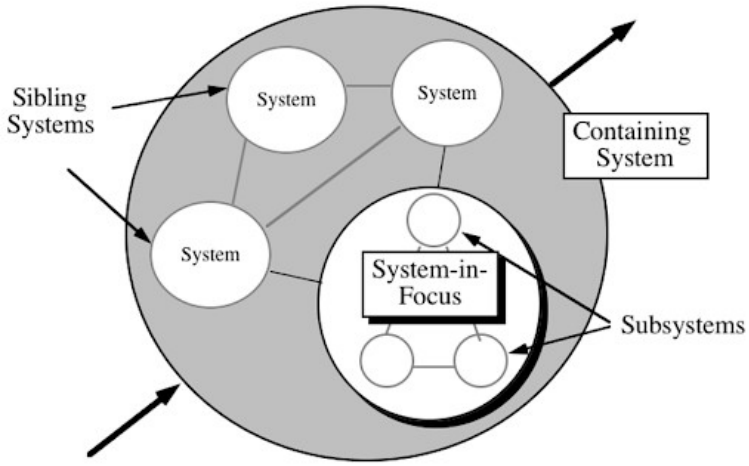

Figure 2.6 Simple system model [38]

Admittedly, like many things, it is possible to classify systems by looking from various angles. For example, some are closed, their borders are clear and can be drawn. Some are open and exchange energy, matter and information with their environment, for example the human cell. Some exist naturally and have a form, like the solar system. There is no need to discuss their purpose. Some exist naturally and serve a purpose, like a human heart. Some are manmade. They are usually organized and made to serve a specific purpose. Let's take a car, for example. Is it a stand-alone system without a driver? Or is it a machine or a tool? What good does it do without a human being and what purpose does it serve? As we can see in this simple example, Man should be defined as part of the system. Man is the focus of the system. A car is a technological machine made to serve human purposes.

The cleaning works, the layout of the house and the supply of the work can always be considered as small systems within themselves. When we look around, we can see many designed / synthesized systems, some of them are interactive, some are hierarchical, some are open or close and some are independent. An open system is in contact with its environment, receives inflows and emits outflows. It is able to adapt to its environment, yet may retain a steady state [39].

A system may be defined further in terms of the following general characteristics [40]:

- A system constitutes a complex combination of resources in the form of human beings, materials, equipment, hardware, software, facilities, data, money, and so on.
- A system is contained within some form of hierarchy.
- A system may be broken down into subsystems and related components, the extent of which depends on complexity and the function(s) being performed.
- A system must have a purpose. It must be functional, able to respond to some identified need, and able to achieve its overall objective in a cost-effective manner.

It is obvious that even if we understand what the system is, it will not be enough. So how do we design a system? What should we pay attention to? When is the "thing" we are trying to do become a functional system? Do mechanical engineers or accountants suffice to design a system like the transportation system? Or is a new actor needed to bring all the disciplines together? Are there any parameters other than what we can see and hold?

2.3 Systems Engineering

Well, would be engineering of the system? What do we actually mean telling by "systems engineering"? Although there are many different definitions according to those who think and care about the subject, there are basically agreed upon certain features. Let's sort these properties before making a definition with a single sentence [39]:

- Wholes
- Synthesis of the whole from complementary parts.
- Finding answers/solutions to 'whole problems'
- Analysis
- Design
- Complexity
- Discipline and science
- Integrity

- Planning

The catch-all definition of systems engineering is;

Systems engineering is the art and science of creating whole solutions to complex problems [39]

---

or

Systems engineering is synthesizing a complex system from less complex systems

The key point here is to isolate the jobs and make them *independent departments* of each other. In other words, “decomposition and abstraction”.

As the first major systems engineering application of the recent period, we can show the command and control system that was implemented by Air Chief Marshal H.C.T. Dowding in England during World War II. The critical issue there was that, it was not known when the German Air Force (The Luftwaffe) would attack, and there was no response on time. In addition to installing a new radar system, he gained a large amount of time, both by changing the pilots' positions and improving the warning signal system. Dowding set the standards for operational systems engineering. The design of the system is almost the same except for the use of current technology in our time. This shows us that a well-designed system can live for a very long time.

People have practiced systems engineering long before this example. The conquest of Istanbul, for example, is a system design success in its own right. Preparations started a year ago. In addition to the steps taken during the siege, such as the casting of suitable cannons, ships carried out by land, walking towers, tunnels dug, the construction of Rumeli Fortress, The Dispatch and administration of the soldiers, and the need for food and drink were met regularly. In fact, many of the military expedition of the Ottoman Empire were successful systems engineering practices. We're talking about a huge structure for thousands of people, including minimum two meals and supplies, toilet

needs, training and morale motivations, equipment and repair and maintenance units. Each unit was a system within itself that interacts with other systems.

When you design a system to solve any complex problem, as you apply what needs to be and correct its errors, you get closer to the perfect, and then the more you start to look like the truly perfect one. The issue here is the “organization” knowledge and ability rather than the technology or possibilities you use.

*

SE deals with solving problems. When searching for optimal solutions various methods are used. The best known of these is the Systems Engineering Problem-solving Paradigm or SEPP (Figure 2.7). It is found open or hidden in most transactions. SEPP is a solution-oriented method [38].

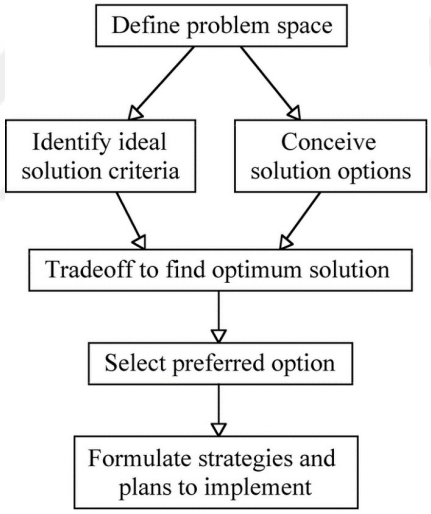

Figure 2.7 SEPP [38]

The successful realization of system engineering principles and concepts is dependent not only on the technology issues and the process for implementing such, but on the management issues as well. As illustrated in Figure 2.3, there are two sides of the spectrum, and each is highly dependent on the other [40].

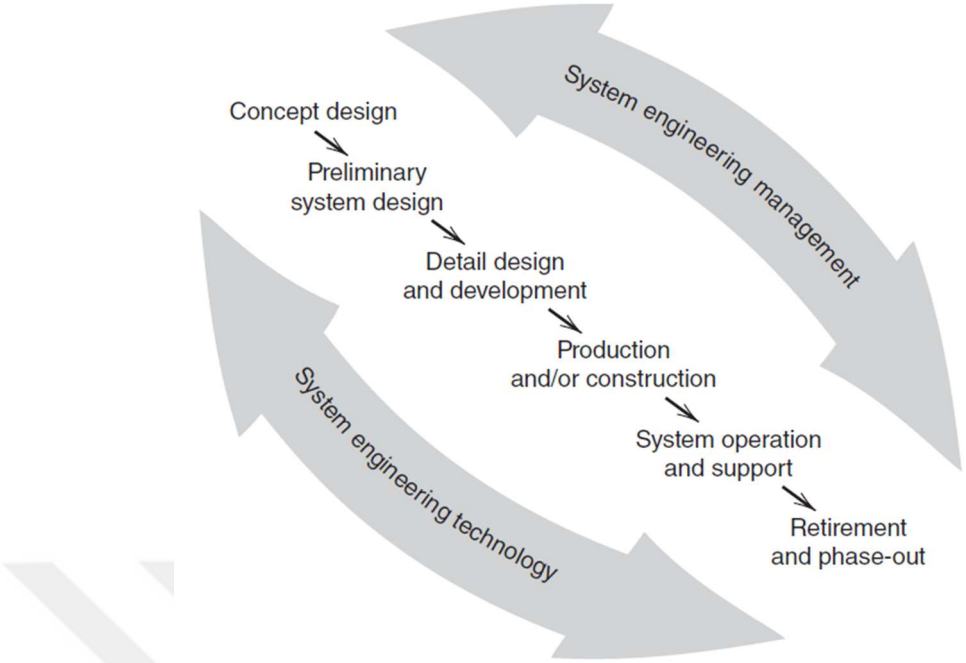

Figure 2.8 Management and technology application to the system engineering process [40]

When look at the world, you can see the hierarchical system structure intertwined, like Matrushka dolls. You can start at human cell and end up at the Universe, if you keep going up, or vice versa if you keep going down. A different kind of model, the 5-layer system model looks at the different layers for the application of systems engineering [39].

- Level 1 - Product SE, the SE of artefacts
- Level 2 - Project Systems Engineering
- Level 3 - Business Systems Engineering
- Level 4 - Industrial Systems Engineering
- Level 5 - Socio-Economic Systems Engineering

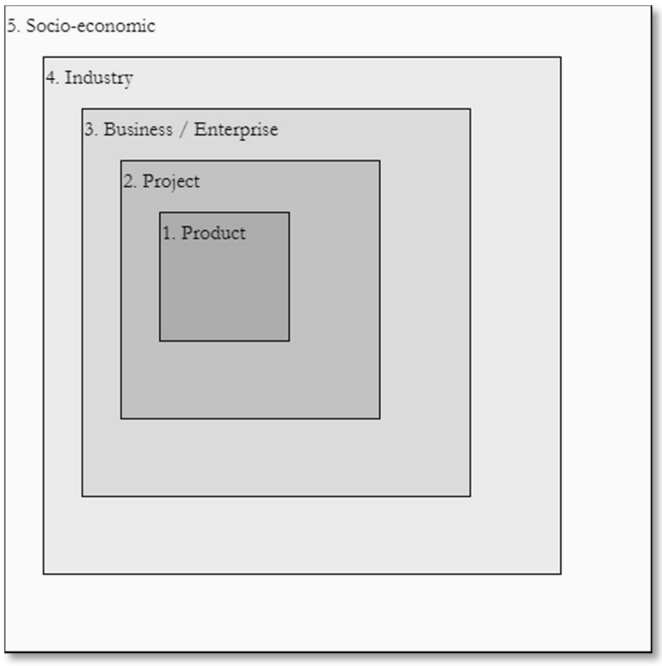

Figure 2.9 The 5-Layer Systems Model

The 5-layer systems engineering model is of the ‘nesting’ variety, i.e., each layer sits ‘inside’ the one above. So, many products (may) make a system, many projects may make a business, many businesses may make an industry and many industries may make a socio-economic system (Figure 2.9).

Systems engineering has different approach to problems than c*lassical engineering.*

First of all, classic engineering approach is mechanical, the systems engineering approach is holistic and also takes into account environmental factors. Main difference is about *whole*. In the first one, the whole precisely equals the sum of the parts but in the second the whole can be greater than the sum of its parts -actually that's usually the case.

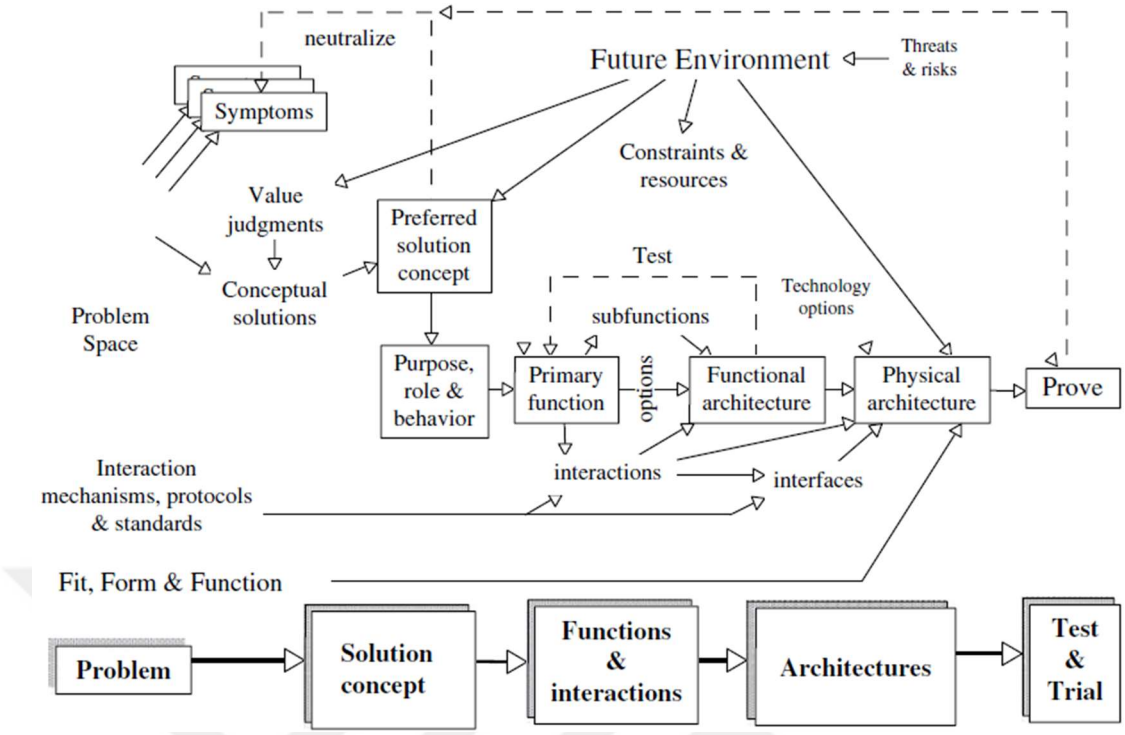

Figure 2.10 Typical Layer 1 systems engineering paradigm: creating an innovative artifact/product The figure is a conceptual process model, starting with some problem, shown on the left in a problem space, and ending with a proven solution to the problem on the right that, as the dotted line shows, is proven by its ability to neutralize the symptoms of the problem [39].

So, classical engineering will focus on the problem itself under existing constraints, acceptances and facts. But when we look at the Figure 2.10, we can see how systems engineering works. The problem space definition, conceptual solutions, future environment, solution space, results or effects of preferred solution and the approvement of the selected solution.

The major difference between disciplines is their approach to the problem. Another one is SE also considers about human factor and outer space of problem. When we reach a solution using the SE approach, this will be a very permanent solution. It will be able to easily adapt to both external influences and changes in internal situations and will continue to be valid for a long time. But with the classical engineering approach, we have to solve the same problem every time. Whether the conditions

remain the same or change, we need to come up with a solution again. By learning from the past solutions will become better, but in this case, time-wasting will be inevitable.

We said that human-made systems are not “perfect” that is, they are not error-free and need constant correction and improvement. As a result of the lessons learned from the many mistakes made, more stable and more robust systems have emerged. But every activity in which the human factor comes into play necessarily carries unpredictable elements within it. Even if these appear to affect only a part of the system, they can actually cause dramatic changes, positive or negative, in the whole. Unlike classical engineering, the systems engineer designs the system with this factor in mind. Human beings are not only physical (material) but also spiritual. This parameter, which cannot be fully scaled but can be predicted, must also be evaluated. It is clear that two people with the same physical characteristics may not be able to work at the same efficiency. There may be many factors that affect people's moods and work, such as their family lives, their circle of friends outside work or their moral values.

*

In fact, system design is a natural part of our lives. Intentionally or not, we use the systems engineering approach and algorithm structure in many areas of our lives. For example, when we cook, we have to act in a certain order.

- Get the recipe
- Make ingredients list
- Provide them with correct amounts
- Use them in a certain order and way
- Prepare according to the cooking method (pre-heated oven, on fire, boiling etc.)
- Cook for a certain time
- Service

We can go to a sub-level for any of this list items or, we can say that, each item actually a system and has its own subsystems. We can also add some other items (subsystems) to the list. Supplying of the ingredients or servicing are issues that needs to be

organized in themselves. Even just one item in the list doesn't exist, we cannot complete the recipe. So we have to plan how we should get the ingredients before start to make the meal.

Using systems engineering approach, we are looking for solutions to be applied in situations of crisis in general and pandemic in particular.

2.4 Localization

In crisis situations, access to vital resources will be more important than ever. Localization of food products, in particular, will both reduce the risk and make it easier for the public to reach. For this, alternative food networks may need to be established. Alternative food networks are commonly defined by attributes such as the spatial proximity between farmers and consumers, the existence of retail venues such as farmers markets, community supported agriculture and a commitment to sustainable food production and consumption [41].

Due to the globalization of food supply chains and dependencies, the challenges brought by global crises to the food industry have also magnified, especially for countries which, at some extent, rely on imported food. For example, when it comes to acquisition of temperate crops such as cereal grains, 27% of the world's population have access within a radius of fewer than 100 kilometers. When disrupted by logistics constraints and outflow channels, difficulty in both supply and local availability would arise [42]. The distance that a person can reach on foot is important and should be taken into account mainly. Every step of the supply chain for foods needs to be robust and, if possible, have alternatives. In addition, it should be tried to ensure that the number of steps is small. Access to vital foods should be available as quickly and over short distances as possible. Food is a perishable substance due to its nature. In particular, fresh fruits and vegetables should be delivered to those in need as soon as possible after they are collected. Resource management must be made to ensure this.

Even if we have made our model on a neighborhood basis, it has the potential to be applied modularly even on a district, provincial, regional and even state scale. In addition, details such as food values, daily needs of families, household and street

needs can also be kept. The fact that the needs are scalable will allow the management of resources that need to be found, the possible bottlenecks to be identified in advance. It can also be used to determine priorities when it is possible to ensure product diversity or when it is decided to direct limited opportunities.

It is recommended to pay attention and manage challenges in the food industry as soon as possible to avoid problems escalating to much more severe situations and creating a chain of other problems [42]. State-led efforts of food localization have been conducted across mainland China under the umbrella of Vegetable Basket Project since the end of the 1980s, with the purpose of addressing urban food security. Food localization as a counter movement to globalization has been extensively studied for its debatable role in promoting the sustainability of food systems in developed economies [43]. On the other hand, the ongoing debate in Europe on urban food supply is currently rescaling local food policies. New actors are now taking part in this debate, including urban public authorities and civil society organizations involved together in shaping local food governance [44].

Studies of the urban model show the importance of collaboration amongst collaborators, citizens, corporations, and governments to shape a business model that solves problems both in the district, city-wide, national even global level [45]. But, there should be a good communication and well defined network between the actors. For example, there was no fully authorized central body to supervise and implement mitigation measures as per the available data and expert projections across the states. There was a lack of coordination between federal and state governments, and between the state and the NYC administration [46]. Out model eliminates such a problem.

Lifestyle changes, increasing leisure time, a ‘quality of life’ orientation and growing environmental and climate change concerns have all contributed to urban society’s increasing interest in having agriculture at its doorstep [47]. The closures and restrictions we experienced as part of the pandemic measures encouraged people to buy their own gardens and engage in agricultural activities there. Many wanted to own a small piece of land. Instead of staying indoors in apartment-style houses where we

usually live in, the number of people who want to have houses with gardens that can be planted and mowed down when necessary and offer outdoor space has increased.

The home garden is a farming system which combines different physical, social and economic functions on land around the family home to supplement supply of fresh food at the household level. Logistically, home gardens provide easy day-to-day access to fresh vegetables and fruits, leading to enriched and balanced diets by supplementing proteins, vitamins, and minerals [12, 21]. Through supply of medicinal herbs and an opportunity for physical activity, home gardens are also important to human health and wellbeing [22]. Home gardens can be described as a mixed cropping system that encompasses vegetables, fruits, plantation crops, spices, herbs, ornamental and medicinal plants as well as livestock that can serve as a supplementary source of food and income [48].

Urban agriculture is already producing about 15–20% of the world's food supply, and this can play an even more critical role in achieving food security during a global crisis such as that created by the Covid-19 virus [22].

*

When we look at the research and literature conducted, we see that the world is going in this direction and that many scientists are working on this issue. Therefore, we think that it is a subject that should be focused on and studied with precision in our country too.

The point we want to reach here is to create a model that allows people with the opportunity to meet their basic needs, rather than commercialize production, so that they can easily and fairly deliver surplus, especially fresh food production to other people. In this model, in particular, we can include local governments (both municipalities and provincial directorates of state institutions) to guide citizens and provide them with the necessary educational and physical opportunities. Not only agricultural products, but also animal products such as eggs, milk or yoghurt, medical equipment and medicines, various hand tools and machines can also be included in the system.

CHAPTER 3

3.1 The Method

3.1.1 Architecture of the System

Planning is critical to mitigating the sudden and potentially catastrophic impact of an infectious disease pandemic or crisis situations on society. When we say crisis, we are talking about events such as wars, large migrations and enormous natural disasters that can deeply affect society and even change the demographic structure.

National pandemic policy documents cover a wide variety of control options, often with nonspecific recommendations for action [49]. Pandemic preparedness in Turkey began in 2004 and entered into legislation with the Prime Minister's circular in 2006 [50]. As mention before, The Pandemic Influenza National Preparedness Plan was published by the Ministry of Health in December 2019. It has very detailed instructions but includes mostly preparation rules about health field and arrangements of human resources. There is almost nothing inside it about material resource planning, economy or production. The plan does not include any actions related to the management of the production and distribution of vital necessities, in particular.

For crisis situations, we need a useful plans that also have some alternative applications. Epidemic prediction algorithms, mathematical modeling and simulations can be used to guide decision makers. But due to mutations and variants of the virus, accurate prediction may not always be made. However, even if it cannot meet all possible scenarios, there is a need to meet the basic needs of both society and individuals and to plan to maintain vital functions.

First we try to design a system and use the data we have. After designing phase, a simulation can be useful to understand what can be happened in which circumstances. Eventually, it comes to *speed* and *reliability*. But we do not have unlimited resources and we have to use them effective and wisely.

There could be some methods (or tools) for designing systems. In this study we are going to use “Structured System Analysis and Design Method” (SSADM) and try to show the system with charts through to certain level. We are going to show the governorship, the district governorship and the neighborhood levels. After that, we will show a relational database structure of our proposal model.

We will try to present a useful, changeable and adaptable plan to manage pandemic for a province with using this method.

3.1.2 SSADM

The structured systems analysis and design method (SSADM) is the standard structured method used for information systems in UK government departments in the early 80's. SSADM separates logical design from physical design. A hardware/software independent logical design is produced which can be translated into an initial physical design. This helps the developers to address one problem at a time and prevents unnecessary constraints being added at too early a stage in development. This also helps communication with users who may not be computer literate but are able to validate a logical specification or design of their system [51].

The techniques of SSADM give standards for how each step and task is to be performed. The rules of the syntax and notation of each technique are supplemented with guidelines on how it should be applied in a particular step. The diagrammatic techniques of SSADM are data flow diagrams, logical data structuring, entity life histories and logical dialogue design [51].

The components used in the creation of SSADM are as shown in Figure 3.1 and stages in Figure 3.2. The context boundary indicates the limits of the system. It enables the internal and external environment of the system to be handled separately. Activity boxes form the sub- elements of the system. These are the activities required for the system to function. The activity number is used to specify the number of activity boxes. Material flow and information flow arrows are used to indicate the flow of raw material, stuff, and data. Material and information stores are the areas where materials and data are stored. They may be a physical warehouse or a data storage device such

as a computer. A regular storage symbol is used for continuous storage. For external sources such as suppliers and customers, the external resource symbol is used. Also, the symbol of regular external resource is used for continuous resources [52].

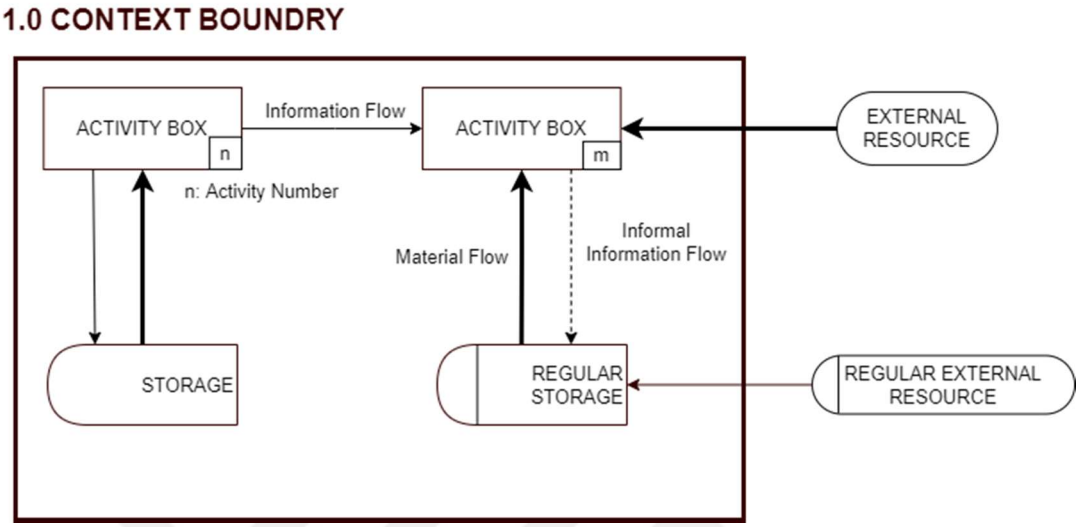

Figure 3.1 Components of SSADM

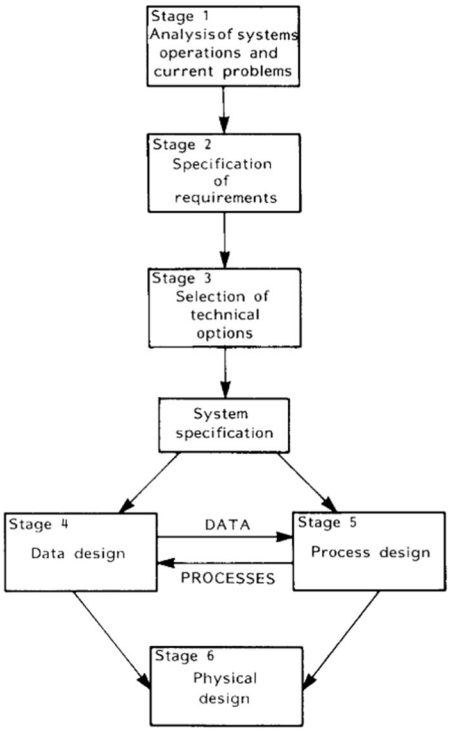

Figure 3.2 Stages of SSADM [51]

On the other hand, we will try to put a proposal model for managing resource management with using information technologies' relational database design method.

3.1.3 Implementation

We can ask two type questions, "why" and "how".

The answer of the "why" question is actually very simple. Because of the supply chain problems we have *nearly* lived while the Covid-19 period, we can easily say that we have to make our access to vital resources sustainable. We have to keep agricultural production wide, regular and coordinated. For example, if we are unable to use motor vehicles for transportation, we should be able to get especially foods and water within walking distance. In this case, neighborhood and sharing become very important. The authorities have to support the ordinary people with giving tools, seeds, fertilizer and education for plantation of fresh food on their gardens.

The "how" question has a little bit more complicated answer.

Here is our general model map:

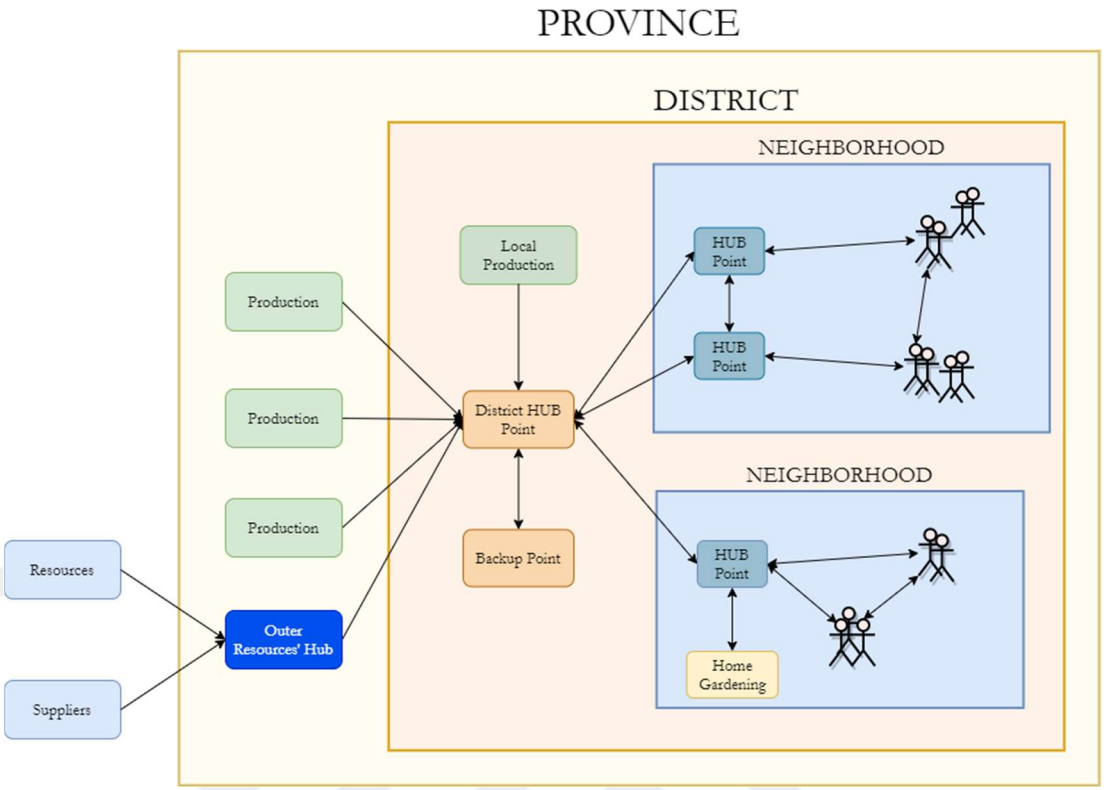

Figure 3.3 The model map

The basic idea of model in Figure 3.3 is based on “resource sharing”. As mentioned before, *localization* is the key concept of our model.

Diagram of the administrative structure of the Republic of Turkey:

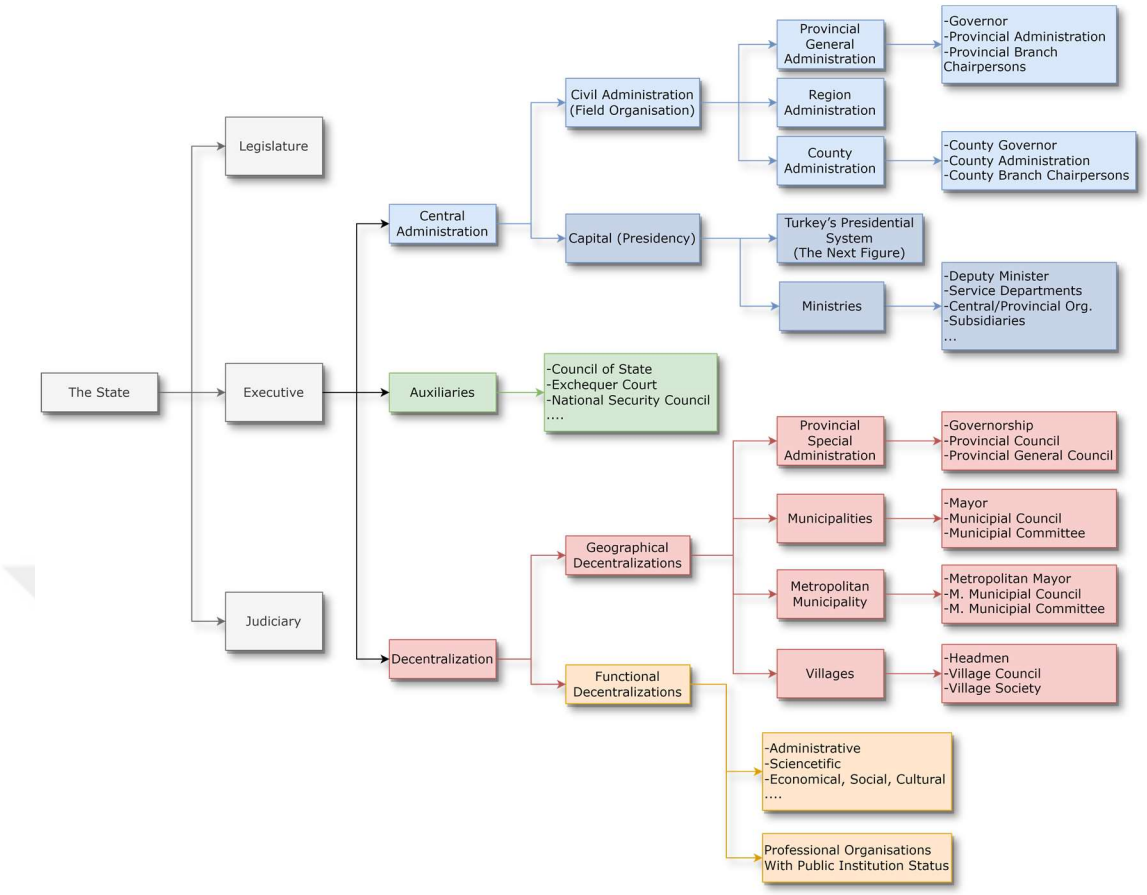

Figure 3.4 The structure of the Republic of Turkey

When we examine the current structure of the Turkish state (Figure 3.4), we see one main branch in the executive section directly related to our study: Decentralization. Of course the institutes of the Central Administration, some ministries, councils and offices affiliated to the presidency (Figure 3.5) are also can be part of our model. But localization is very important for crisis situations that cause people to be prevented from accessing certain resources at a distance. It will be vital that people be able to reach foods or supplies simply by walking.

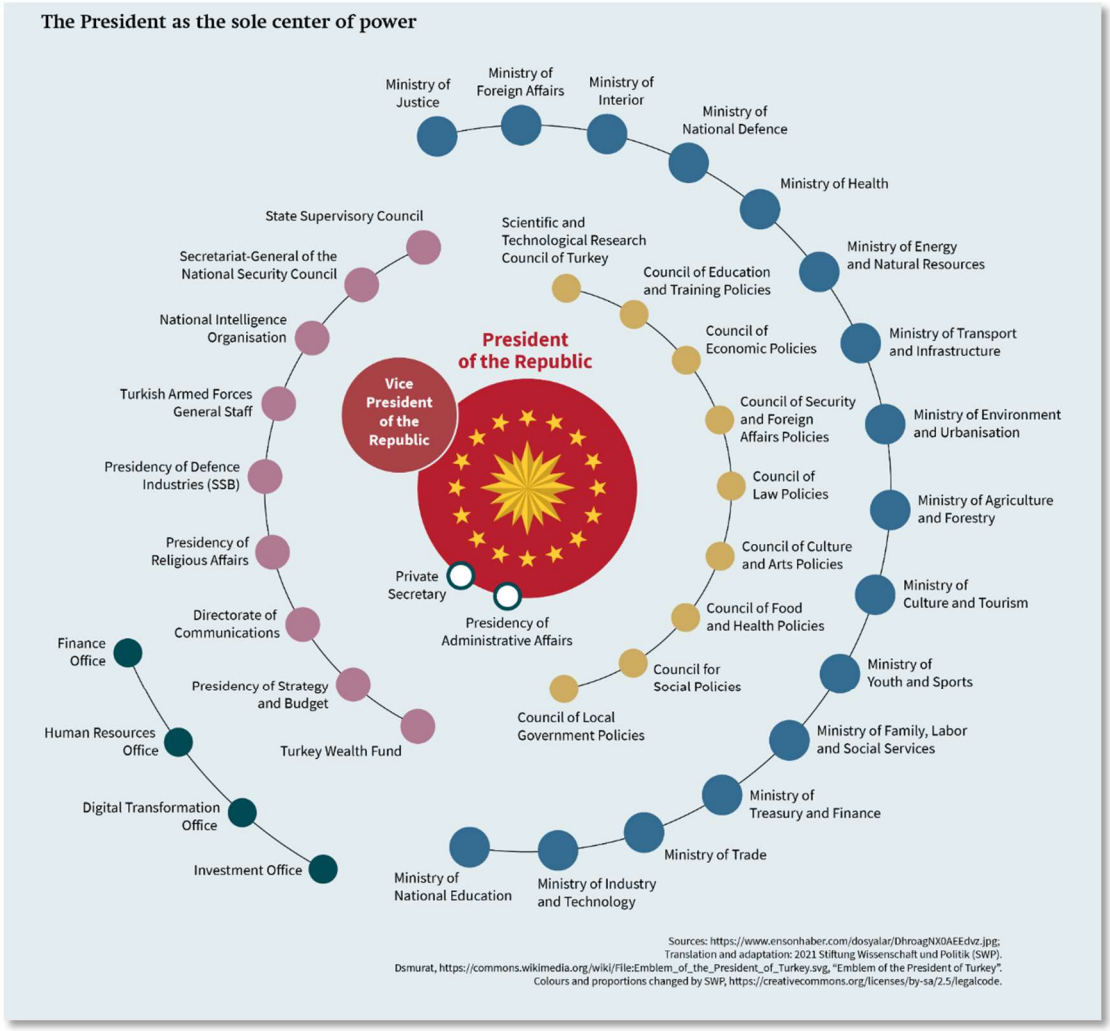

Figure 3.5 Turkey's presidential system [53]

The last link in the current hierarchy of the state is the headmen, who is in charge of the village or neighborhood. Our model also starts from the neighborhood level and reaches the provincial level.

Here is the first and top level of the SSADM diagrams:

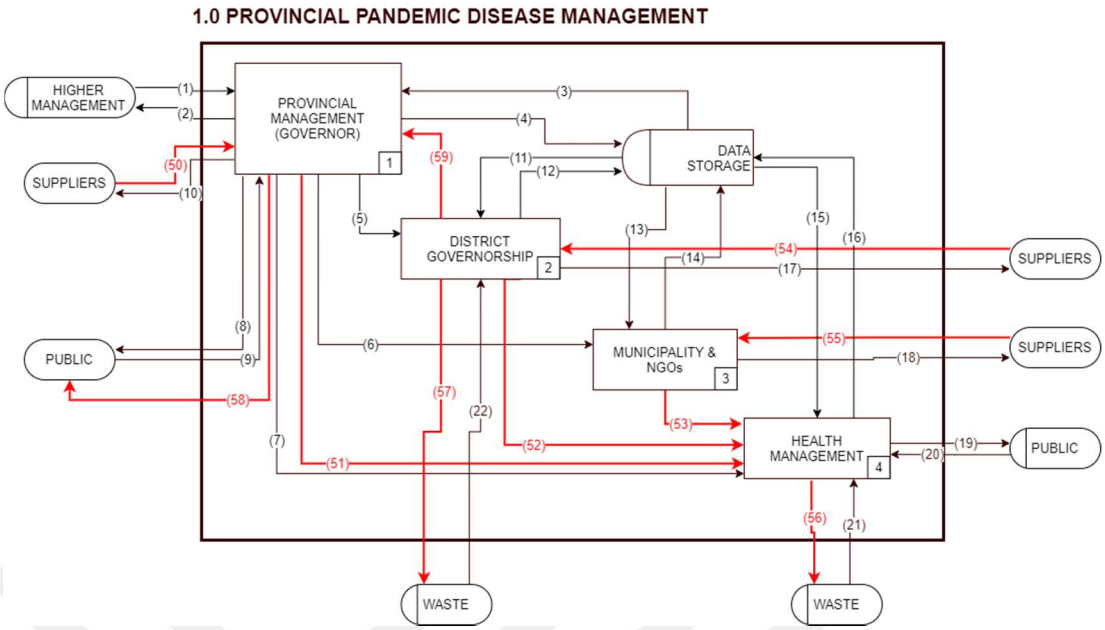

Figure 3.6 First level of SSADM

There are 4 independent departments and 1 data store:

1. Provincial Management (Governor). This department is headed by The Deputy Governor who is accountable to the Governor. Because, the Governor has to manage all province and has other responsibilities. In the board, the Departments, the Mayoralty, law enforcement, scientists, provincial directorates of ministries, food sector, some SMEs and some key suppliers are represented. This department manage the crisis. It gets the general policy from and reports the situation to the Higher Management.
2. Municipality Management. It should ready to serve to the public more than ever. Because, the city has a significant amount of supplies and manpower. It must have made them available to the Health Management.
3. Private Institutions and NGOs. Companies and organizations also get advices and orders from the Governorship and supports the Health Management.
4. Health Management.
5. Data Storage. Central software and database warehouse. Every department *must* connect this store and share information.

Inputs:	**Outputs:**
(1) General Policy	(2) Report
(9) Public Information	(8) Public Information
(20) Determine infected people	(10, 17, 18) Supply Request
(21) Waste Information	(19) Treatment and patient follow-up
(50, 54, 55) Supply Materials	(56) Special waste

Departmental Relations:

(51, 52, 53) Medical and vital supplies and medicine

The rest is information sharing via the Data Store.

Our aim will be to present key activities as clearly and comprehensively as possible, to establish a model that going to be easily adapted to various situations.

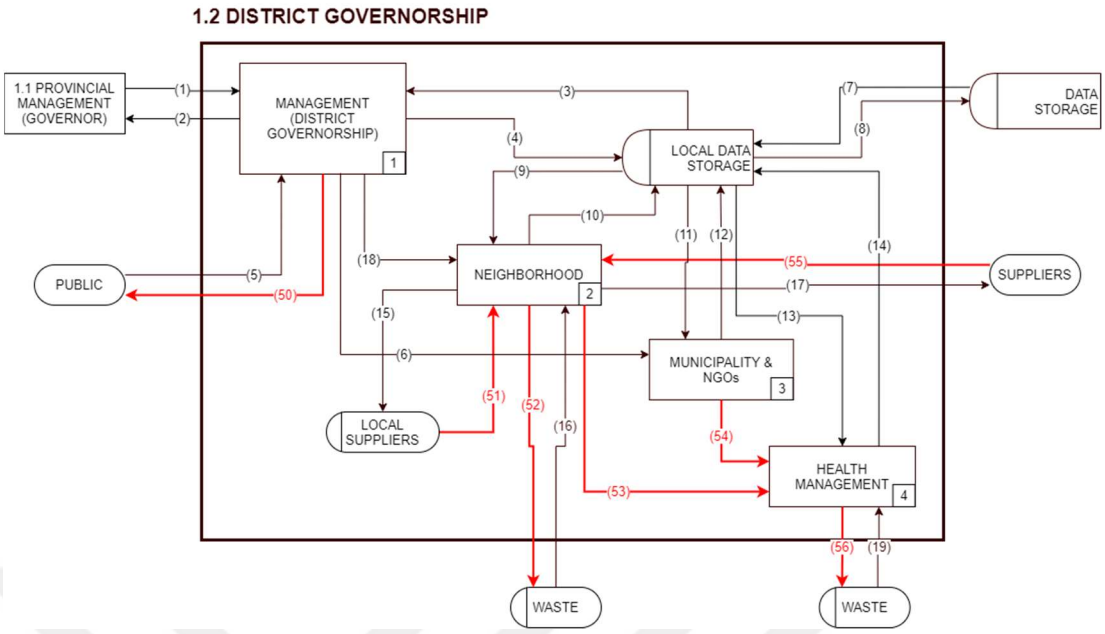

Figure 3.7 Second level of SSADM

In this second level (Figure 3.7), district governorship, we have 4 departments, 1 local data store and local suppliers sections.

The aim of the local data store is to contribute to ensuring data security and create an alternative backup center for local data. The data at the municipal scale will be collected and processed in this center, and the gotten results and necessary details will be consolidated and sent to the central data store. In the event of a possible interrupting between the central data store and the municipality, the local data store will be able to

continue to operate and be a resource without losing its function. Synchronization can be restored by ensuring the connection, even at intervals.

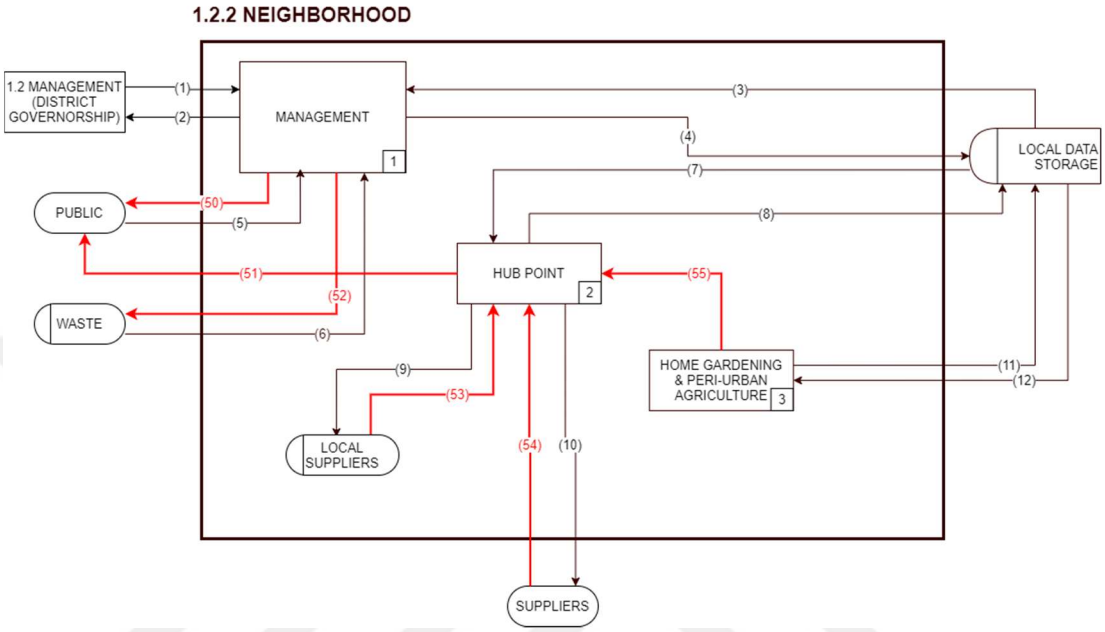

Figure 3.8 Third level of SSADM

Home gardening and peri-urban agriculture are -as mentioned- additional resource of food production and they could be very important support nutrition needs of public. However, these resources will need to be directed within a specific system shown Figure 3.8. In different regions of the province, determining the products that should be grown in accordance with the conditions of them and directing the producers will be important in terms of efficiency. When we say conditions, not only soil structure and environmental conditions, but also people's habits, experiences and acquis in general make up the conditions. In places where truck farm has been produced for a long time, it will not be appropriate to conduct another type of agriculture. Or in places where waterless agriculture should be done, products suitable for the situation should be preferred.

Another issue will be to ensure diversity in production. Planning is important for the production of a significant part, if not all, of the needs of the society. Instead of

producing food produced in one place in other places, producers should be encouraged for certain products and necessary training and support should be provided. Foods that will provide medical support should be given importance and should at least be considered as a complementary treatment alternative.

3.2 The Database

3.2.1 Relational Database

We have designed a relational database model (Figure 3.9), which stores data about material and goods supply chain. But first, let we make some quick explanations about the database.

MySQL, one of the most popular Open Source SQL database management system, is developed, distributed, and supported by a private corporation [54]. We used MySQL to design the database and the chart prepared with MySQL Workbench application. But it doesn't matter which database application is used. What we are trying to present here is a model. Since the vast majority of databases work in a similar way, this model can be used for any other database.

Each box in the chart (Figure 3.9) shows the database tables. The rows in the tables refer to the information stored, that is, the columns. Dashed lines between them were used to show the relationship between tables. In this design, it was enough to use only one-to-many type relationships. This means that there can be an infinite number of records in the associated table, for a single record in the source table. For example, a father may have more than one child, but each child can have only one father. Another example is that an invoice has only one header record, but can have an infinite number of details.

Another thing about relationships is data consistency. By establishing a relationship between tables, for example, a detail record of an invoice without a header record cannot be entered. Even if it cannot be controlled by the software, the database engine does not allow such inconsistencies. Similarly, record deletions that can cause inconsistency are prevented.

3.2.2 The Database Model

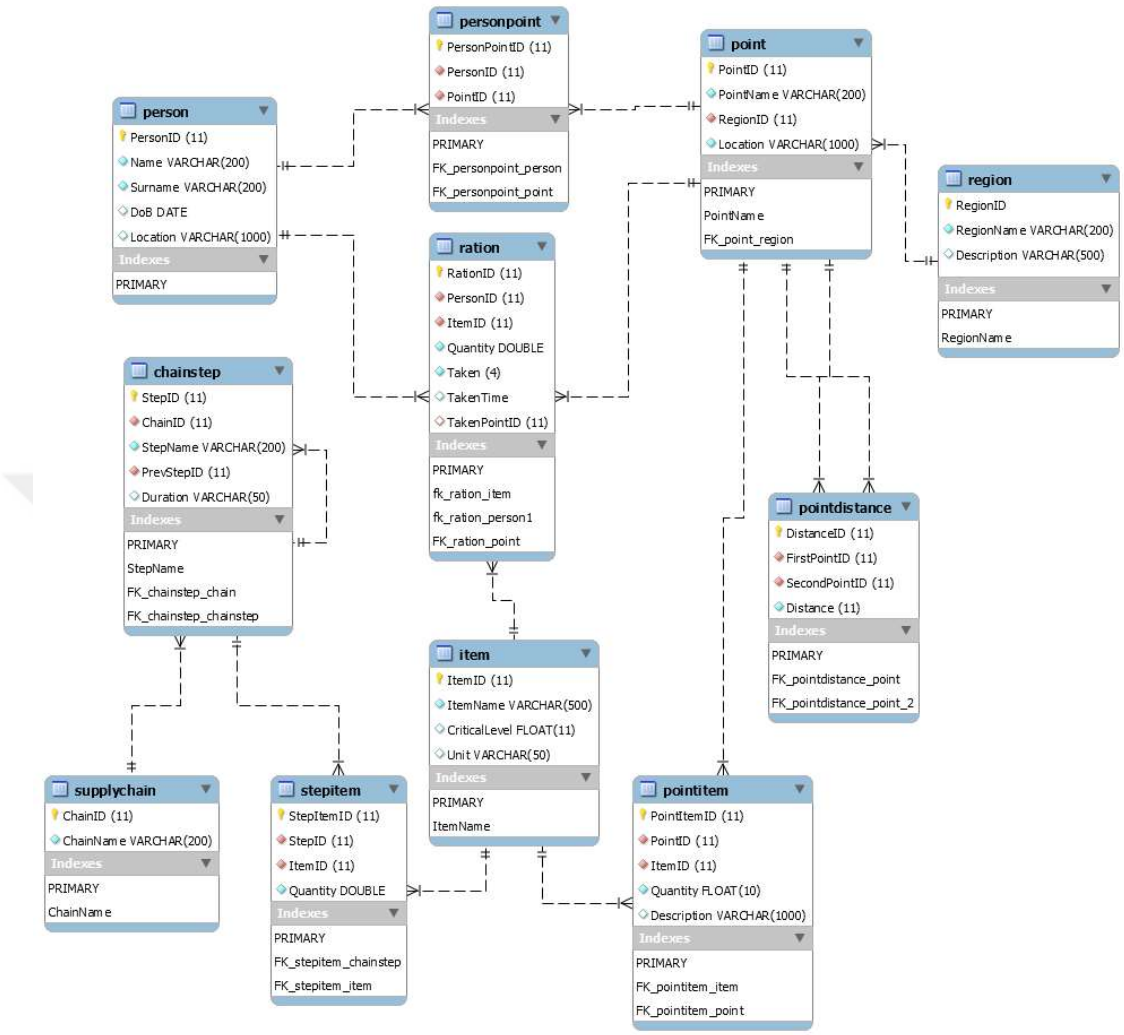

Figure 3.9 Relationship diagram [55]

Fields with yellow key are primary keys (or indexes). Records in these fields must be unique within the entire table. This means that there cannot be two records with the same value for this field. The red diamonds indicate the fields associated with one of the other tables. For example, before assigning a person to a point, you need to define a “person”. The identity (ID) of each person should also be stored in the “personpoint” table. There is also a similar relationship between the tables “point” and “pointitem” etc.

Indexes section shows index fields of the table. These fields are used to search data faster and access certain records, even if they do not have unique values.

*

There are 3 main (core) objects in the database: Person, point and item. The other tables have been used to describe the relationships between these objects. “The ration” is at the center of the diagram, but it depends on the main objects. Without them, we can't define any rights. Ration is a fixed amount of a commodity officially allowed to each person during a time of shortage, as in wartime or a crisis situations. But we do not have to define rations for all regions. It should depend on the current situation of the region. Some districts may not be required to store ration data due to the situation.

In addition, if local farmers or other suppliers identify their goods and services to the system and leave them at delivery hub points, it will be possible for people in need to have information about this situation and access vital nutrients without the need for any intermediaries. Each point belongs to a region or we can say, neighborhood. So each region can have more than one points. With using an application, like modelled in the next section of this document, any person can reach the resources easily.

Let we detailed explain some of the tables.

Person:

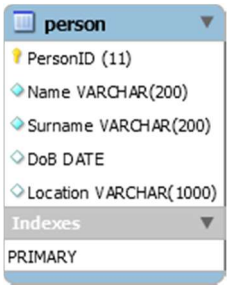

Figure 3.10 DB table: Person

There are two critical information for our system here: PersonID and Location (Figure 3.10).

PersonID identifies the person, location tells where the person located is. With this data we can know the closest points. When the person wants to access to any item or wants to make some donation, the application can easily redirect them. The other fields (name, surname, date of birth) are just for information and we can add some other data here like phone number, allergies, blood type etc. We can enforce the person to enter some of these or not. Location data can be any format even a description like “near the Mosque”.

Point:

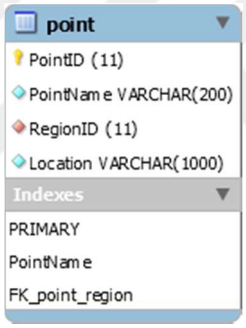

Figure 3.11 DB table: Point

Point means “hub point” or “delivery point”. Basically, resource items collect at these points. Each point belongs to a region. “`FK_point_region`” foreign key provides this. Points may have some storage facilities like cooling devices. There is no need for any person to manage a point. Because, current storage status and item list can be track with the application. The “location” data is the same as in the person table. So a person’s easily find any point. We can keep in the table (Figure 3.11) the type of the points already indicated in SSADM charts at Figure 3.7 and Figure 3.9. Just by adding a “`Type`” field, we can find out whether the point is “Supplier”, “Local Supplier” or “Waste”. We can also add some other additional data like population etc.

Item:

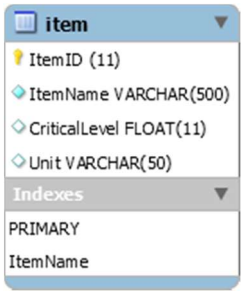

Figure 3.12 DB table: Item

Item field in Figure 3.12 defines resource items. This may be almost everything which a human needs for living. The critical level is a province-wide or region-wide value and may trigger an alert depending on the current stock status of the points. Like other tables, we can add some additional data to this table like extra description, priority, type, unit weight, size etc.

Region:

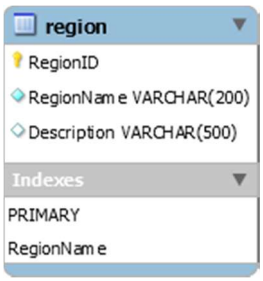

Figure 3.13 DB table: Region

Region in Figure 3.13 is a kind of group of points. We can use this information to group hub points by neighborhoods or districts. Of course we can use any other criteria other than the municipal area, for example geographical conditions. We can add some

extra fields to the table like exact borders, area, population, connected regions of the region etc.

PointItem:

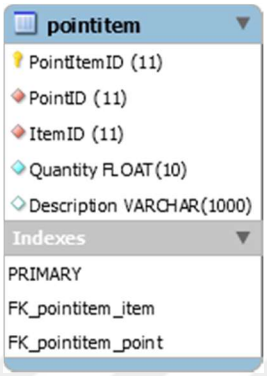

Figure 3.14 DB table: PointItem

The table shown in Figure 3.14 keeps which point stores which items in what quantity. Before going to the relevant point, the person can check the point stock list. Using the quantity data, we can calculate the stock amounts at the regional or provincial level. Unit information is already available in the item table. There are two foreign keys in this table. One of them connects the data to "`items`", the other one is for "`points`".

PointDistance:

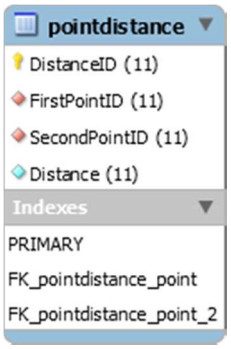

Figure 3.15 DB table: PointDistance

We keep the distances between hub points in this table (Figure 3.15). Due to the possibility that some items may not be found at some point, the application may direct the person to the nearest alternative point. This could be useful for donation also.

Ration:

Figure 3.16 DB table: Ration

Not only at what points the products can be found, but also the amount of rations of each person, from which points they can obtain these rights, can be stored until the date and time they receive delivery. As mentioned earlier, this table (Figure 3.16) may

be used depending on the circumstances. We put this one just in case. Our model should have supported this feature. By the data of this one, we can track every citizen's ration quantity and if they took their goods or not. As an idea, the ration is set automatically but it can be change by the authority.

PersonPoint:

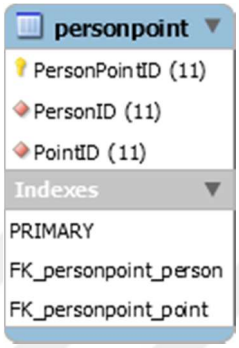

Figure 3.17 DB table: PersonPoint

This one is also not necessary. The idea in Figure 3.17 is that we can identify who is connected to where and which point will need which items as soon as possible. We can know, which point serves how many people. Of course, a person can be connected to more than one point. Or even if a person not connected to a point, he/she can still get service from it.

Supply Chain:

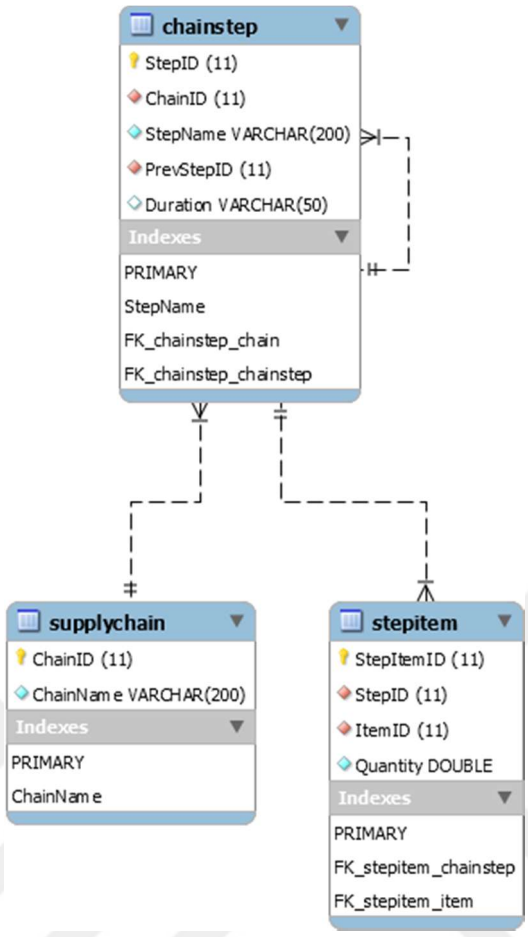

Figure 3.18 DB tables: Supply chain related tables

With our database design, the supply chain of each product can be defined step by step (Figure 3.18). It can be defined how long these steps take, how many quantities the product or sub-products can be produced or used at a time, which chain belongs to which regions. The `stepitem` table has relation with the `item` table. So we can know the items' history.

*

With some small improvements, many details and vital information can be integrated into the system. For example, by exchanging data with the citizenship and address system, the population and address of each family can be provided. After local manufacturers define their net capacity in the system, supply and demand in a specific geographical area will be determined. If we go one step further, there may be problems

with citizens' access to an extremely vital substance such as water due to failures in the water distribution system. In this case, again, with this database design, fair distribution of local water resources, such as special built water lines or drilled wells, can be made.

Because you can imagine that "the item" can be anything.

3.3 The Application

We have designed an application to implement the model. This application can be developed as a mobile or web application and can work locally or globally. We will just show the some important screen mockups. Of course, these can be improved and elaborated.

The whole application has two main departments: The Client and The Administrative.

3.3.1 The Client

For very understandable reasons, simplicity will be very important in applications like this. So many people may use this application. They can have different education levels and different acquisition. Everyone should be able to use it easily.

The people has an identity number in Turkey. Therefore, you will not need to create a user or register to somewhere. But you can login the system with a password provided by the authority.

The very first screen will be similar to standard logins:

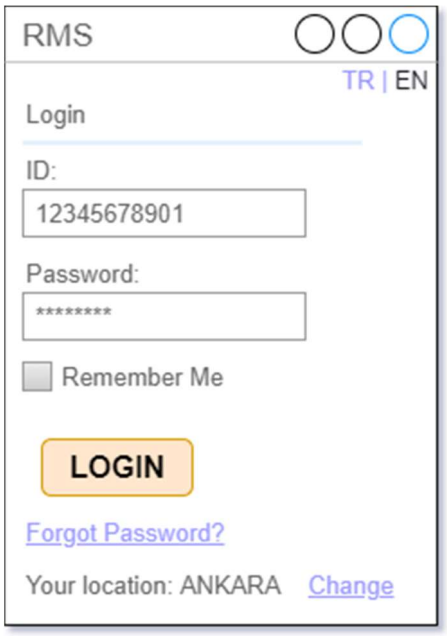

Figure 3.19 Login screen of resource management system

Not necessarily, but by logging in you can save your history, maybe keep your resource items, track your hub points, favorited some data etc. The registration or logging in should not be mandatory. Because not everyone can able to access or could be lose the password. But each citizen *must* be enter the id number at least one time. After the first login (Figure 3.19), if the “remember me” checkbox is ticked, this screen will be not shown until that the person has logged out. Before logging in, you can change your location or language preferences.

After the login screen, the application welcomes the citizen with one information line and two simple options. “Donate” and “Demand”.

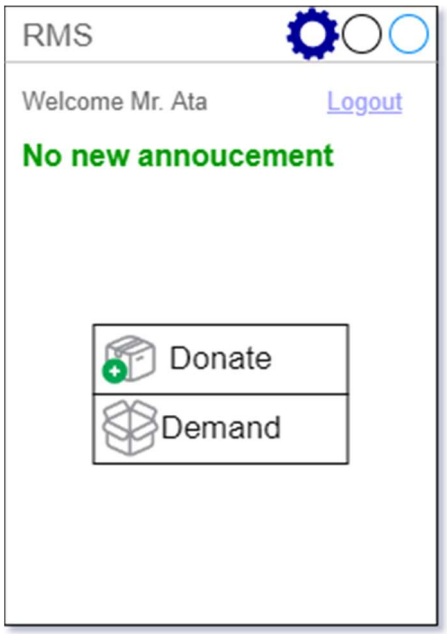

Figure 3.20 Main options

The first information is for announcements from the authorities. This could be anything and color of the text can be change by type of the announcement.

After clicking the “Donate” button on the screen shown Figure 3.20, two text boxes will appear as in Figure 3.21. You can pick an item you want to donate from the first text box. The items are listed by prioritizing the ones you have previously defined in your portfolio. If you don’t have any item in your portfolio, you can select them in alphabetical order. The second text box is for hub points that you want to deliver your items. Here, points in your area or near your current location will be listed. This prevents you from selecting points that are too far or difficult to access for you. The text boxes have “Autofill” feature so the user can reach the right data quickly.

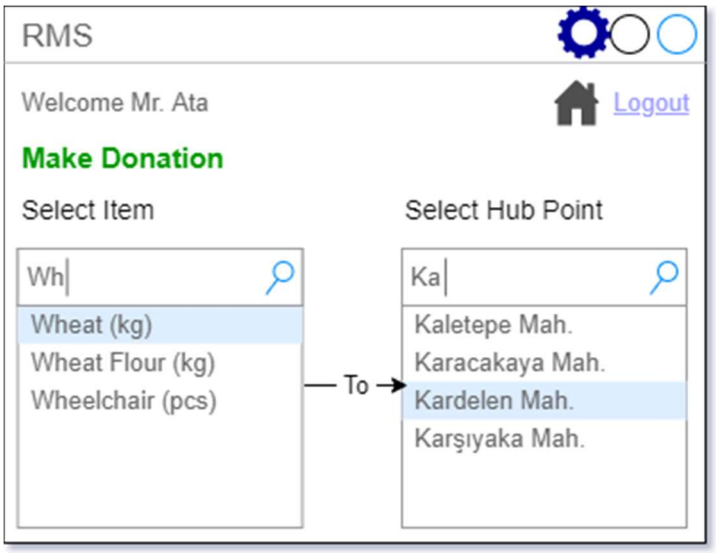

Figure 3.21 Donation

When you arrive the relevant point you can input the quantity of the item you delivered. This information is very important and should be entered as accurately as possible. Because the app will calculate the overall stock status using the quantity of the items. It should not be forgotten that those in need will act with this information. This is a model and application for community and everything in it is modelled for that purpose. If someone who needs an item thinks it exists at the relevant point and cannot find it, their confidence to the system will be shaken. This can lead to a decrease in the general morale of the society, which is no one wants to be happen.

Another simple screen for entering the amount is shown in Figure 3.22:

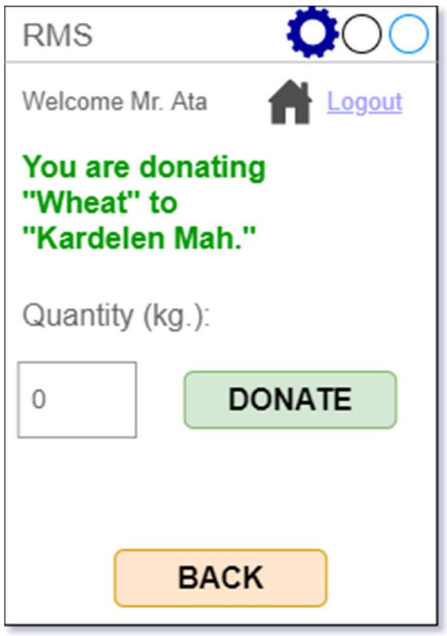

Figure 3.22 Donate quantity

The green information tells us which item to put at which point. The person can change his/her mind and cancel the operation by clicking the BACK button.

The demand operation will be a little different. After clicking on the “Demand” button on the main screen, just one textbox will be displayed (Figure 3.23).

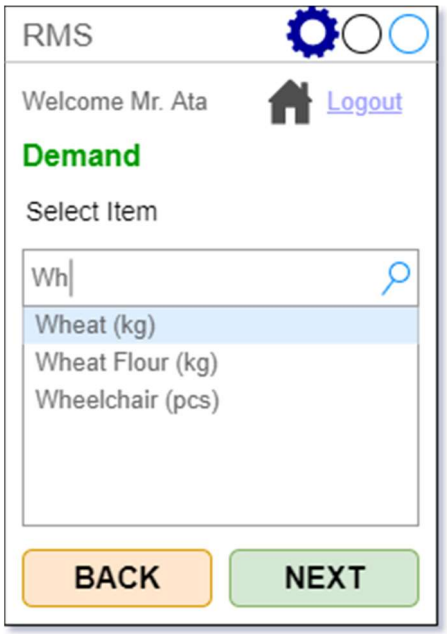

Figure 3.23 Demand

After the citizen has selected the item, s/he has to choose the point where s/he wants to take it:

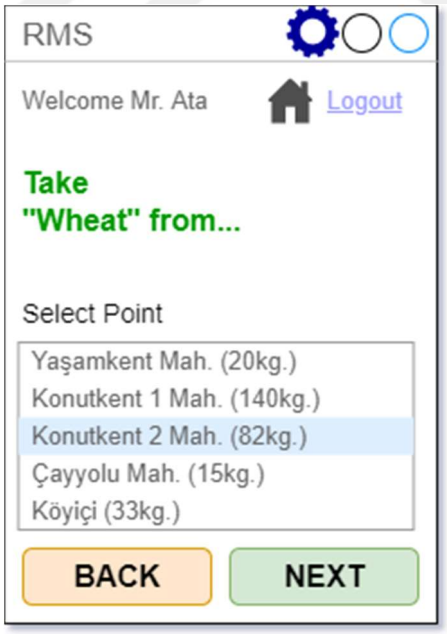

Figure 3.24 Taken point

There are two information in the point list (Figure 3.24). The name of the point and the quantity of the item that can be found at that point. “The quantity” info can be change with binary data like “yes/no” or “true/false”. For ease of use, only the first five points already have the item are listed. The points are ordered according to the points preferred (starred) by the citizen and the distance between the current position of the citizen and the point.

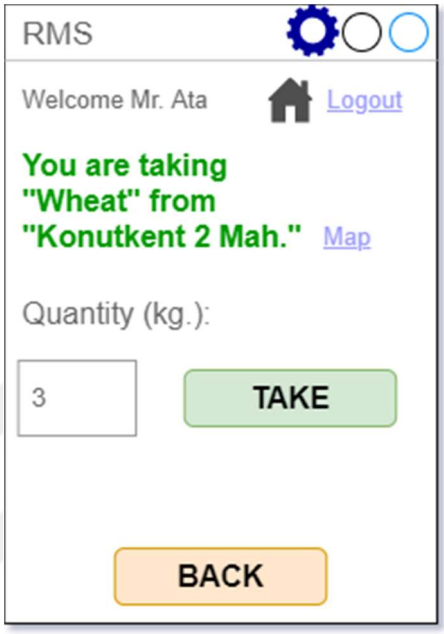

Figure 3.25 Demand quantity

The green information on the Figure 3.25 tells us which item is taken from which point.

When identifying points, the authority can enter map or visual description of them as an image. If so, this information can be accessed by the person by clicking on the “map” link right next to the green text.

After entering the quantity and clicking the “Take” button, the application will display the main screen.

*

The client application also has an “Options” screen. Anyone can change some preferences by clicking on the “gear” icon at the top of the screens. For example, some may add some points to favorites to reach them easily.

3.3.2 The Administrative

This part will be more complicated but basically has three sections: Parameters, Reports and Definitions. Supply chain is a different story.

3.3.2.1 Definitions

We have 4 main tables in our database: `Region`, `point`, `item` and `person` (Figure 3.26). So we have to provide them and their relationships. But `person` data comes from an outer system, so we don't have to consider about it. We just get some information about the citizen from that system.

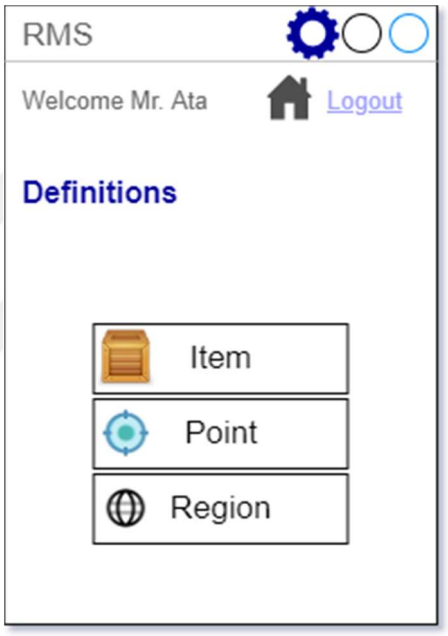

Figure 3.26 Definitions

In general, all of definition tables have unique keys. While saving data, the application should check if they exists or not before.

The operation started from the "item" definition (Figure 3.27). This is the mockup design of item definition as a sample how definition screens can be:

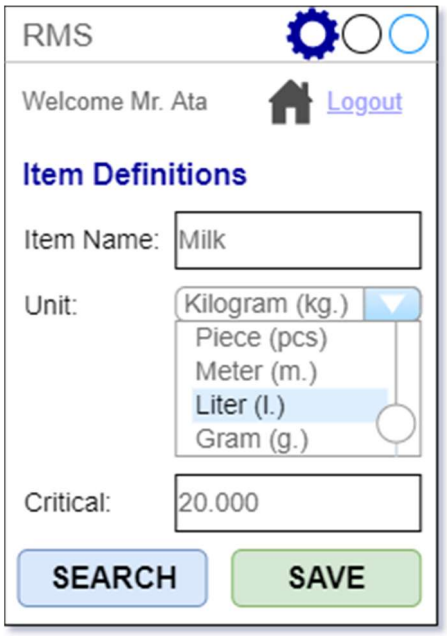

Figure 3.27 Item definition

Every item should be defined in the system. Without definition, nobody can demand or donate items. If a citizen needs to donate or demand any undefined item, must enter a request. This procedure may vary depending on the current conditions. The rights to add or modify records may be distributed to the community. Because it can be a heavy workload, at least in the beginning.

Also the user can search and find items (Figure 3.28) from here:

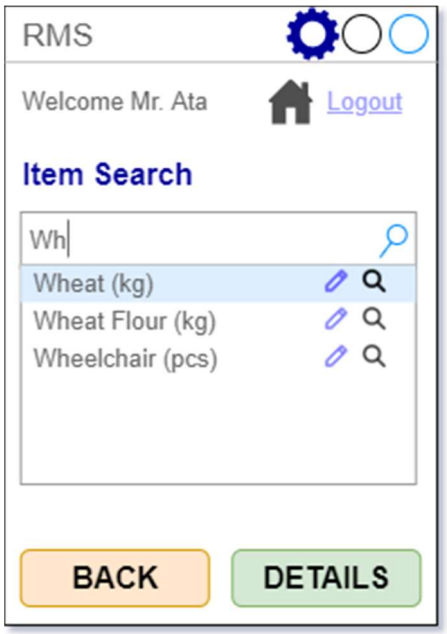

Figure 3.28 Search items

The total amount of the item can be displayed on the detail screen (Figure 3.29). Periodic increase and decrease graph of the amount can be displayed. The most produced and consumed regions or points can be shown. Need analysis can be done for resource transfer or production. A sample screen of an item details can be like this:

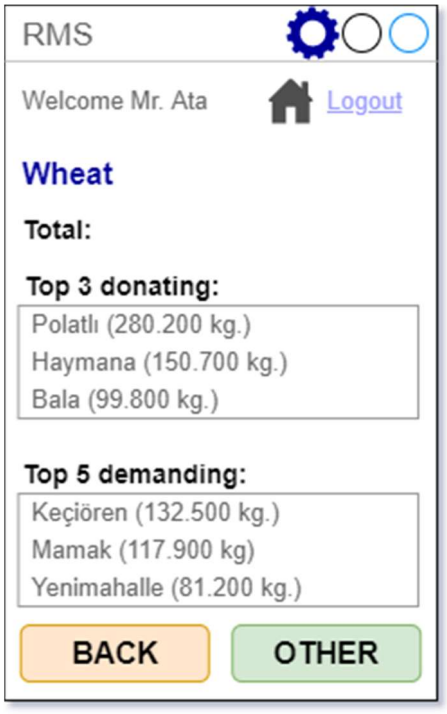

Figure 3.29 Item details

The “other” button shows different screen with other information includes reports.

Similar details and information can be shown on the region and point screens. For example, what are the most needed products at that area? Are there any surplus products over there, and if so, where would it be useful to transfer them? The exact map location of the points can also be entered. So the application can offer the nearest point that has the needed item.

3.3.2.1 Reports

Report modules are indispensable parts of almost all applications. Data is valuable only when it is accessible. Because no matter how many there are, there is no point in collecting data after evaluating and not reaching a conclusion. It is also necessary to be able to get the right reports in order to extract the right meanings from the incoming data and make accurate decisions. In general, a hierarchical structure can be mentioned in reports. Depending on the user's permissions, either the content or the scope of the report may change. For example, a stock supervisor can only get reports about stocks, while a user with administrative authority can access all reports. On the other hand, the district user can only access the data in his own district, while the provincial user can follow the entire province. In our model, this is not much different.

All reports run according to the privileges and rights of the logged in user. If the user has the district usage rights, they can see everything in a particular district. They can also access reports and information about their districts and take necessary actions. For example, they can make an emergency call and demands for items that are declining or approaching critical levels in their regions/neighborhoods. When we think on a point basis, these requests will first be forwarded to the district centers. Because that will be the closest central procurement point. Possible demands of the district will be conveyed to the provincial center. It would not be wrong to assume that the possibilities here are wider. Both the amount of items and the means of transportation will be more.

The reports can be various. But, we can classify them into 3 main groups (Figure 3.30) like definitions.

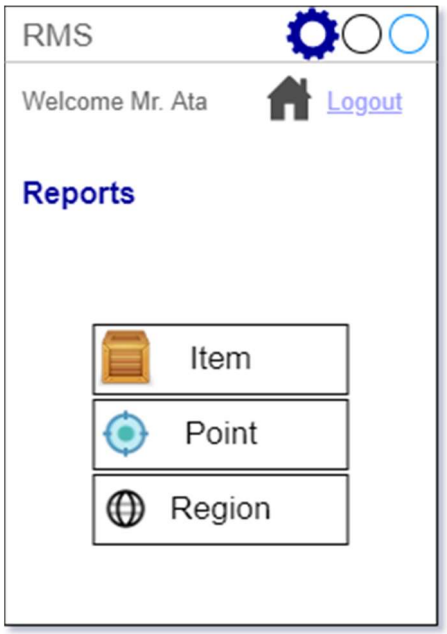

Figure 3.30 Reports

Let's take the example of crops grown from the ground. As we have mentioned before, it may be important not to plant randomly, but to focus on the products that are especially needed within the possibilities. Products suitable for the soil structure of the region and with high yield should be preferred. Especially citizens who have a garden of a certain size should be supported and encouraged to grow related products. For this, information is very important. Within the holistic approach, all stages from seed to product should be followed by the authority and citizens should be guided by taking into account regional differences.

Reporting is important at this point. In the item reports (Figure 3.31), information such as which ones are insufficient, which ones are preferred more, and which ones will be needed and when can be accessed. Similarly, in regional and point reports, the production and demand amounts of the products in the region, even the list of suitable products, demand forecasts based on population information can be listed.

Figure 3.31 Item Report

This report can also be accessed from directly item details screen. One of the reports can be prepared to track the reduction of product quantities. Thanks to reports like this, the trend of need for the product can be easily seen. This is especially important for plants that can be used to make natural medicines. Because such plants are needed not only in terms of nutrition, but also for treatments. At this point, the classification of products and the retention of additional information about them may come up. For example, it is known that natural plants such as thyme or sage tea are good for many diseases. Information about them, such as how to grow, what conditions should be provided, where or how to use them, can be included in the application.

In addition, a report such as in the Figure 3.32 can be prepared, showing the stock status of items whose amount has fallen below a certain level.

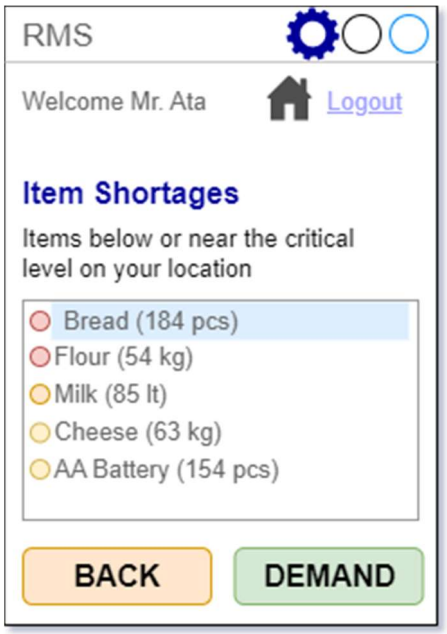

Figure 3.32 Item Shortages

The user can make a demand directly by selecting the item from here. The request will be forwarded to a higher level center according to the location of the place made. If the current user is in the neighborhood, the request will be sent to the district, and if it is in the district, to the province. Of course a report showing the stock status in the nearby regions can also be prepared.

3.4 A Different Approach

You can think about the electricity and the internet existence. But, we focused especially food and vital needs here. Therefore, the main idea was how to find a solution if such needs become difficult to reach. On the other hand, we can use this model and application on paper or by radio too. But in this case, we have to assume something that we already have: A certain amount of energy. Without even a small amount of energy, any model or solution will obviously not work. This means that we are already back in the “stone age”. With current technology, we can support a significant part of our lives by using batteries powered by sunlight or wind energy. Internet access may not be available, but there must be radio and paper, at least.

Actually, there is no reason why the model in Figure 3.3 should not work with the radio supported paperwork as well. Radios and energy sources like batteries should also be considered as items. Undoubtedly, in this case one or more volunteers will have to deal with the paperwork. Because hub points will be critical and stock tracking will be done here. The procedures will have to be followed during certain hours or by a shift procedure. Citizens who do not have the opportunity to communicate remotely will need to be provided with access not only to resources, but also to information, provided that they are within walking distance. It should be ensured that the announcements made from the central stations reach the majority of the society. We believe that the difficulties brought about by the environment and conditions can be overcome by living together decently.

The topic of “walking distance” is of critical importance not only for this, but for all conditions. The distribution of the hub points and the selection of their locations are important. Arrangements can be made within a certain hierarchy. This hierarchy will be made in accordance with the currently valid administrative structure. Because this is the order people are used to. The location that any person describes needs to be clearly understood by everyone. Citizens should know the locations of critical points and should not be indecisive about where to go in an emergency. Loss of time at critical moments may cause irreparable damages.

It will be informative to keep population information and distances of other points at district points (Figure 3.33). With this information, it will be known which point may need more resources or donation amounts. In addition, it will be ensured that people in need can be directed to the right points.

ÇAYYOLU DISTRICT

Hub Point	~Population	Distance (km)	Water Well
Yaşamkent	22.500	4	35
Konutkent	9.300	2	28
Ümitköy	14.800	2	23
Çayyolu	7.600	1	19

Figure 3.333 Point information

If the number of water wells near the relevant point is listed in the same table, it can be easily decided where to look first if needed.

In fact, the methods to be followed when paper enters the process are more or less clear. For example, the methods we used to be accustomed to can be used such as categorizing the items and keeping their records in a certain standard, registering in the catalogues, following the lists in alphabetical order.

Keeping daily stock movements with balances can be a good method (Figure 3.34). Items can be tracked daily by creating cards similar to the one below and writing necessary information on each line.

Figure 3.344 Daily item movements

In addition to the daily follow-up in this way, separate cards can be prepared for each product for each month or week (Figure 3.35). The hub points can keep these information.

Green Bean-13108 — August

Date	Donated/Taken By	Amount	Balance
Previous Month			5
1	D Ahmet amca	10	15
1	D Tuba Ata	20	35
1	T Ayşe Demir	2	33
2	T Ahmet Fırıncı	3	30
2	T Meryem teyze	1	29

Figure 3.35 Item movements

Of course, these tables can be varied and detailed according to needs. However, discipline and stability will also be important in manual follow-up.

CONCLUSION

In this study, we tried to put a model proposal for resource management system with using one of the systems engineering methods, “Structured System Analysis and Design Method” and relational database design. We have designed a system using SSADM, and then designed a simple model map based on the designed system, and then designed a relational database based on the model map, and designed an application and screen mockups of it based on the database, and then designed some paper-work forms and manual operations consistent with the model.

With the first method, we have revealed the general system design and its limits. We started from the provincial level (Figure 3.6) then went down to the district level (Figure 3.7) and to the neighborhood level (Figure 3.8). Each design has its own inputs and outputs. Using this design, it will be possible to both go up to the upper levels and go down to the lower levels.

We have showed a combine of the SSADM charts in the model map in Figure 3.3. There are also levels three in that model. In this simple model, the operation of the system in general is shown.

We designed a database model based on the two designs just mentioned (Figure 3.9). There are 3 main (core) objects in the database: Person, point and item. We have made very detailed explanations for each table of the database.

Additionally, we have made an application model and designed screen mockups for the application. We tried to keep the application very simple. So many people may use this application. They can have different education levels and different acquisition. We also have made an effort to ensure that our application can also be useful in real life.

On the other hand, we have tried to make this model and application possible to be used on paper or by radio. There are some forms and pages in the thesis that we have prepared.

Beyond all of these, the topic of “walking distance” is of critical importance not only for this, but for all conditions.

*

As a result of our research, we could not find such an application. The key point of logic here is to solve problems using a systematic approach. The application model here is just to show how the system works. But the human factor is always there, and the *sine qua non* of this work is “goodwill” and “honesty”.

We can use crises as an opportunities. In fact, we must make an effort to correct the disorders that we know but have not dared to change so far. So we will have more hope for the future. “Corruption doth appear on land and sea because of (the evil) which men's hands have done, that He may make them taste a part of that which they have done, in order that they may return.” says Allah. Many of the difficulties and troubles we experience happen to us because of the evils we have done with our own hands and as a result of them.

If we want to avoid disturbing the balance of nature, we have to correct ourselves first.

REFERENCES

[1] Alkan, R. E. "Küresel Arz Zinciri Çerçevesinde Covid-19'un Türkiye Dış Ticaretine Etkisi", Hasan Kalyoncu University, 2021.

[2] Yürek, S. "The Impact of Negative Income Shocks on The Prices of Private Label Products: The Covid-19 Episode", Middle East Technical University, 2021.

[3] Çulak, Ö. "Covid-19 Ve Türkiye Ekonomisine Etkileri", Başkent University, 2021.

[4] Ahmad, T., Haroon, H., Baig,, M., & Hui, J. "Coronavirus Disease .(COVID-19) Pandemic and Economic Impact", Pakistan J. Med. Sci., 36, COVID19-S4, 73–78, 2020.

[5] Işık, S., A. N. "Kovid-19 Salgınının Ekonomi Üzerindeki Etkileri: Türkiye'de İşletme Sahipleri Üzerinde Bir Araştırma", J. Turkish Stud., 15(4), 765–789, 2020.

[6] Hava, H. T. "Covid-19 Salgınının Küresel Tedarik Zinciri ile Uluslararası Ticarete Etkilerinin Analizi", Turkish Stud., 15(4), 2083–2100, 2020.

[7] Pilikoğlu, A. "COVID-19 Pandemi Sürecinde ve Endüstri 4.0 Çerçevesinde Tedarik Zinciri Uygulamalarının Değerlendirilmesi: Lojistik Sektöründe Bir Uygulama", İstanbul Ticaret Üniversitesi, 2021.

[8] Üstün, Ç. "Pandemi Tarihinde Üç Hastalık ve Covid-19 Pandemisinin Sosyal Etkisinin Bu Hastalıklarla Değerlendirilmesi", J. Turkish Stud., 15(4), 1215–1226, 2020.

[9] LePan, N. Visualcapitalist. Retrieved September 05, 2022 from https://www.visualcapitalist.com/history-of-pandemics-deadliest/. 2022

[10] Caymaz, E., Akyon, F. V., & Erenel, F. "A Model Proposal for Efficient Disaster Management: The Turkish Sample", Procedia - Soc. Behav. Sci., 99, 609–618, 2013.

[11] AFAD. 2019 Overview of Disaster Management and Natural Disaster Statistics. 2020.

[12] Gündeş, E. H. "Changing Shopping Habits in Supermarket During Covid-19". Sabancı University, 2021.

[13] Muradoğlu, C. Covid-19'la Birlikte Türkiye'de Online Harcama Tutarında Nasıl Bir Değişim Yaşandı? - Webrazzi. Retrieved September 21, 2021 from https://webrazzi.com/2020/04/07/covid-19-la-birlikte-turkiye-de-online-harcama-tutarinda-nasil-bir-degisim-yasandi/. 2021.

[14] İnce, C. "Yeniçağın Nosofobisi: COVİD-19 Salgını", Avrasya Sosyal ve Ekonomi Araştırmaları Dergisi (ASEAD) Eurasian Journal of Researches in Social and Economics (EJRSE). 2021.

[15] Tallon, A. "COVID-19 and Regenerating Towns and Cities", J. Urban Regen. Renew., 14(2), 124–127, 2020.

[16] Torales, J., O'Higgins, M., M. Castaldelli-Maia, J., & Ventriglio, A. "The Outbreak of COVID-19 Coronavirus and Its Impact on Global Mental Health", https://doi.org/10.1177/0020764020915212, 66(4), 317–320, 2020.

[17] Hakim, M. P., Zanetta, L. D. A., & da Cunha, D. T. "Should I Stay, Or Should I Go? Consumers' Perceived Risk and Intention to Visit Restaurants During The COVID-19 Pandemic In Brazil", Food Res. Int., 141, 110152, 2021.

[18] Taha, S. A., Matheson, K., & Anisman, H. "H1N1 Was Not All That Scary: Uncertainty and Stressor Appraisals Predict Anxiety Related to A Coming Viral Threat", Stress Heal., 30(2), 149–157, 2014.

[19] TC Halk Sağlığı Genel Müdürlüğü. Pandemik İnfluenza Ulusal Hazırlık Planı. 2019.

[20] Nowicka-Skowron M. & Stachowicz, J. "Strategic Management Processes in Organization Challenges During the Pandemic", Organ Manag., 4, 52, 2020.

[21] Khan, O. "Beginning In January 2020, The Covid-19 Pandemic Inflicted Massive Disruption on The World's Supply Chains", Focus, 50–51, 2020.

[22] Lal, R. "Home Gardening and Urban Agriculture for Advancing Food and Nutritional Security in Response to The COVID-19 Pandemic".

[23] Aydın A. & Güner, A. "COVID-19 Salgınının Tarım Sektörü ve Gıda Güvenliği Üzerine Etkisi: Türkiye Üzerine Bir Değerlendirme", Artuklu Kaime Uluslararası İktisadi ve İdari Araştırmalar Derg., 3(2), 155–171, 2020.

[24] Benis K. & Ferrão, P. "Potential Mitigation of The Environmental Impacts of Food Systems Through Urban and Peri-urban Agriculture (UPA) – A Life Cycle Assessment Approach", J. Clean. Prod., 140, 784–795, 2017.

[25] FAO/WB, "Urban Agriculture for Sustainable Poverty Alleviation and Food Security."

[26] Zanzi, A., Vaglia, V., Spigarolo, R. & Bocchi, S. "Assessing Agri-food Start-ups Sustainability in Peri-urban Agriculture Context", Land, 10(4), 2021.

[27] Gunther, T. M. "Quantitative Assessment of Future Development of Copper/Silver Resources In The Kootenai National Forest, Idaho/Montana: Part II-Economic And Policy Analysis", Nonrenewable Resour., 1(4), 267–280, 1992.

[28] Gates, B. Bill Gates: Bi' Sonraki Salgın mı? Hazır değiliz. | TED Talk. Retrieved September 28, 2021 from https://www.ted.com/talks/bill_gates_the_next_outbreak_we_re_not_ready/transcript?language=tr#t-66824. 2015.

[29] Gates, B. Bill Gates Uyardı: 'Pandemiye hazır değiliz!' Bill Gates'ten Pandemi Uyarısı | Gündem Haberleri. Retrieved September 28, 2021 from https://www.haberturk.com/bill-gates-uyardi-pandemiye-hazir-degiliz-bill-

gates-ten-pandemi-uyarisi-3192272. 2021.

[30] CNNTurk, “Erdoğan Domuz Gribi Aşısı Olmayacak.” Retrieved March 24, 2022 from https://www.cnnturk.com/2009/turkiye/11/03/erdogan.domuz.gribi.asisi.olmayacak/550253.0/index.html. 2009.

[31] Youtube, “Osman Durmuş / Domuz Gribi Hakkında.” Retrieved March 24, 2022 from https://www.youtube.com/watch?v=ApIXlRYEyOM. 2021.

[32] T24, WHO da İtiraf Etti. Retrieved March 24, 2022 from https://t24.com.tr/haber/who-da-itiraf-etti,69686. 2010.

[33] Şahin, S. Cumhurbaşkanlığından ‘Küresel Grip Salgını’ Genelgesi. Retrieved March 07, 2022 from https://www.aa.com.tr/tr/turkiye/cumhurbaskanligindan-kuresel-grip-salgini-genelgesi/1451085. 2019.

[34] AFAD. Türkiye Afet Müdahale Planı (TAMP). 2013.

[35] AFAD. Strategic Plan 2019-2023. 2019.

[36] AFAD. Disaster Resilient Communities Best Practices. 2018.

[37] Hitchins, D. K. Youtube Video. Retrieved February 20, 2021 from https://youtu.be/BEvW9B64tsM?t=292. 2015.

[38] Hitchins, D. K. System Models Website. Retrieved March 01, 2021 from http://systems.hitchins.net/systems/systems-models/index.html. 2015.

[39] Hitchins, D. K. "Systems Engineering: A 21st Century Systems Methodology", Wiley, 2007.

[40] Blanchard B. S. & Blyler, J. E. "System Engineering Management" (5th Ed), Wiley, 2003.

[41] Jarosz, L. "The City In The Country: Growing Alternative Food Networks in Metropolitan Areas", J. Rural Stud., 24(3), 231–244, 2008.

[42] Montenegro, L. D. & Young, M. N. "Operational Challenges in The Food Industry and Supply Chain During The COVID-19 Pandemic: A Literature Review", 7th International Conference on Frontiers of Industrial Engineering (ICFIE), 1–5, 2020.

[43] Zhong, T., Si, Z., Shi, L., Ma, L. & Liu, S. "Impact of State-led Food Localization on Suburban Districts' Farmland Use Transformation: Greenhouse Farming Expansion in Nanjing City Region, China", Landsc. Urban Plan., 202, 103872, 2020.

[44] Duvernoy, I. "Alternative Voices in Building A Local Food Policy: Forms of Cooperation Between Civil Society Organizations and Public Authorities in and Around Toulouse", Land Use Policy, 75, 612–619, 2018.

[45] Anandhika, M. R., Hassan, F. R. & Nugraha, Y. Towards A Collaborative "Framework for The Large-scale Social Collaboration: A Case of Jakarta's Response to The Covid-19 Pandemic", 7th International Conference on ICT for Smart Society: AIoT for Smart Society, ICISS 2020 - Proceeding, 1–7, 2020.

[46] Zahidie, A., Iqbal, M. & Hussain, S. W. "Worsening of The COVID-19 Pandemic in New York City: Analysis of Response Gaps and Challenges at The Public Policy And Community Levels", J. Coll. Physicians Surg. Pakistan. 30(1), 32–36, 2020.

[47] Zasada, I. "Multifunctional Peri-urban Agriculture—A Review of Societal Demands and The Provision of Goods and Services by Farming", Land Use Policy, 28(4), 639–648, 2011.

[48] Galhena, R. F. K. M. DH "Home Gardens: A Promising Approach to Enhance Household Food Security and Wellbeing", Agric. Food Secur., 2(1), 8, 2013.

[49] Shearer, F. M., Moss, R., McVernon, J., Ross, J. V. & McCaw, J. M. "Infectious Disease Pandemic Planning and Response: Incorporating Decision Analysis", PLoS Med., 17(1), 1, 2020.

[50] Wikipedia Web Page. Retrieved March 10, 2021 from

https://tr.wikipedia.org/wiki/Pandemik_İnfluenza_Ulusal_Hazırlık_Planı. 2020.

[51] Ashworth, C. M. "Structured Systems Analysis and Design Method (SSADM)". Inf. Softw. Technol., 30(3), 153–163, 1988.

[52] Üstünyer, P. "Systems Engineering Methodoligies in a Turn-key Project Desing: A Vermicompost Production Example". Unpublished master's thesis, Ankara Yıldırım Beyazıt University. 2019.

[53] Adar, S. & Seufert, G. Turkey's Presidential System After Two and a Half Years. Retrieved February 16, 2022 from https://www.swp-berlin.org/10.18449/2021RP02/. 2021.

[54] MySQL. Retrieved May 30, 2021 from https://dev.mysql.com/doc/refman/8.0/en/what-is-mysql.html.

[55] Gündoğan, M. & Ata, M. "Resource Management in Crisis Situations", Avrupa Bilim ve Teknol. Derg., 27, 935–941, 2021.

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