مركز أسبار
ASBAR CENTER
Established in 1994

Report

Saudi Water and Food Security: Issues and Strategies

ASBAR Council
An Initiative of Asbar Center

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Contents

Introduction

Asbar Council is so much interested in the various issues of concern to decision- makers that serve society in the Kingdom of Saudi Arabia. Therefore, it hosted several sessions to discuss the status of water and food in the Kingdom over several years. These sessions shed light on the current status of water, food and medicine in the Kingdom, where the discussion tackled water scarcity, resources depletion and lacking awareness on rationalization, despite the efforts made by the State. The sessions held by the Asbar Council also highlighted the close relationship between water and food. This connection is reflected in the consumption of large quantities of water in the irrigation of crops, especially palm trees. It has been revealed through the discussions that the traditional methods of irrigation consume large quantities of water, so proposals were made to reduce this consumption. Debating the status of food and water emphasizes the importance of water and food security for the Kingdom, as there is need to secure life of the future generations. The debates also have greatly expanded on the side of palm trees and dates. This tree and its production represent a strategic source for providing a significant income for the Kingdom if these capabilities were better utilized in line with the international standards and requirements for export and marketing. The discussions presented many proposals and recommendations that can advance the water and food situation in the Kingdom, in order to achieve security in these two aspects, with focus on making tremendous efforts to achieve this.

The National Program to Reduce Food Loss and Waste in the Kingdom of Saudi Arabia

Keynote speaker: Mr. Zaid Al-Shabanat – Director of the National Program to Reduce Food Loss and Waste in the Kingdom of Saudi Arabia

Speaker 1: Mr. Khaled Al-Fuhaid

Speaker 2: Dr. Meshary Al-Naeem

Speaker 3: Ms. Faeza Al-Ajrush

Moderator: Ms. Alia' Al-Bazei

Summary:

The main reason for launching the National Program to Reduce Food Loss and Waste in the Kingdom of Saudi Arabia is the widespread food loss and waste. This program aims at reducing the economic, social, and environmental impacts of this phenomenon. Food loss and waste is a critical issue and results in a responsibility that has to be shared by society at large, including the families and merchants. To encounter this phenomenon more effectively, it is certain that media play a key role in the impact they have on society.

It is worth noting that the percentage of food loss and waste is higher in industrialized countries than in the developing ones. Besides, food waste is more in developed countries after reaching the final consumer, whereas in developing countries it occurs more during production and marketing.

The National Program to Reduce Food Loss and Waste seeks to achieve the goals of Vision 2030, which refers to the utilization of natural resources by following the latest international standards and experiences. The program's goal is to reduce food loss and waste, identify the extent of the problem, and try find possible solutions.

The importance of what was stated in the program related to the necessity of analyzing the economic, social, and cultural causes of food loss and waste in the Kingdom. Also, the program links the issue of providing food with several important issues that touch upon several basic aspects that the entire world is suffering from nowadays, the most important of which are focusing on scarce water resources and the significant economic loss resulting from lacking rationalization in

food resources. Besides, it focuses on the environmental consequences resulting from waste, as well as from lacking social awareness, where there is a society unaware of the problem. When talking about the problem of food loss and waste, many reasons are usually mentioned. Foremost among these reasons are the culture and social patterns, the high economic level of the society in general, and individuals in particular. Moreover, the absence of religious awareness and role models in society makes it difficult to encounter this problem. This goes alongside the environmental consequences that result from waste, as well as lacking social awareness, where the society is unaware of the problem.

Some have argued that food loss is attributed to mismanagement, not to meager cultural effects. As for waste, it is believed that the overall problem is primarily cultural, with a percentage of mismanagement.

Many people say that waste is considered a social discrimination indicator in the first place. Accordingly, considering waste is a class act, it is necessary to exert the societal efforts to reduce it, by creating a good example and follow it. Therefore, this behavior will make consumption rationalization a good one.

Some experts believe that facing the problem of food loss and waste is a societal responsibility, starting from home, school, university, and even organizations with various businesses. They also referred to the importance of the private sector's contribution to establishing and inculcating good spirit in an advanced institutional work that all companies inside the State compete with. Among the proposed solutions is launching awareness campaigns with estimating the appropriate food quantities for the family or guests. Another solution is to avoid wasting food leftovers by not dumping them in garbage bins; recollecting good and safe food and repacking it for distribution to the needy.

Having debated the issue, Asbar Council presented some recommendations, the most important of which are: Enacting laws for preventing food waste through legislations that have to be enforced, while imposing punishments on those who are responsible for food waste. Besides, there has to encouragement for licensing grace-save associations, activating the role of media and social media in spreading a culture of grace-save, sharing experiences and spreading the negative consequences which food waste may lead to. Moreover, educational seminars have to be held with the help of qualified trainers and brilliant volunteers who are responsible for schools and universities to guide male and female students and train them on rationalizing food. Also, investments need to encourage a knowledge economy to harness scientific research in the areas of agricultural research to

monitor and follow up agricultural trade, encourage investments in making use of agricultural research to follow up on the trade of agricultural products. Then, financial and procedural facilities have to be granted to the private sector by establishing factories of international standards in which annual exhibitions are held for dates, citrus, vegetables, as well as milk and cheese. This is to contribute to reducing food waste or losses caused by mistakes in processing, packaging, or transportation. Moreover, the private sector needs to be motivated to play its national role with social responsibility for the effective participation in the importance of reducing food waste and loss.

Introduction:

The importance of The National Program to Reduce Food Loss and Waste in the Kingdom as one of the national transformation programs is to realize the Saudi Vision 2030. This appears in its quest to achieve the best practices with food and seeking to invest its available natural resources, to maintain grace-save.

Therefore, the Asbar Council raised the issue of "**The National Program to Reduce Food Loss and Waste in the Kingdom"** through the paper presented by Mr. Zaid Al -Shabanat, as many contributions took place and the paper discussed the relationship between food loss and waste and the opinion of religion about food loss and waste; the contribution of mobile applications in increasing the problem of food loss and waste, culture, customs and the economic level of individuals and their relationship to the problem of food waste and loss. Also, the Council discussed the problem of food waste and loss and the relationship with management, production, generosity, and wastefulness. Another issue is the loss of agricultural products, water waste problem, seeing awareness and culture of food preservation as a social responsibility. It also stressed promoting role models in society to reduce the problem of food waste and loss, productive families, and their role in reducing the problem. It discussed the experiences in food waste and loss to the utilization of household loss and waste, besides the efforts of international organizations to reduce food waste and loss problems.

The National Program for Reducing Food Loss and Waste in the Kingdom of Saudi Arabia is one of the National Transformation Programs in 2020, as it represents one of the parts of the food security strategy assigned to its implementation.

Why is the program? It is a result of the widespread phenomenon of food loss and waste, to reduce and limit its economic, social, and environmental impacts.

Program themes: Food Loss and Food Waste

Program phases:

- The field survey (to determine the baseline).
- Awareness and rationalization
- Studying the possibility of recycling food leftovers as feed or fertilizers with some sectors.
- Creating an online platform that includes a collection of governmental, private, charitable, or individuals to spread rationalization and quick benefit from food surplus.

Because of the importance of the program, the responsibility is borne by society at large, especially education in various stages, including staff, teachers, and students. Likewise, it is borne by families that are the nucleus of society and by merchants through their assistance and support, and the media that represent the active element in society.

If a part of food in its various forms is lost, this will be considered an important and a waste economic resource. It costs the national economy of any country and it incurs financial burdens to the consumer not only in purchasing it but also in getting rid of it. After the global food crisis that took place at the end of 2007 and the beginning of 2008, international voices raised calling for the importance of finding ways to encounter such a crisis and reduce its frequency. One of the most important ways that were suggested was to reduce the loss and waste that exceeded one-third of the world's food, in response to that at the local level. Moreover, a committee was formed at the level of deputy ministries of many government agencies to study the development of a mechanism that would contribute to reducing food waste and loss. In 2016, the Ministry of Agriculture held a workshop titled, "Reducing Food Waste and Loss", to highlight this problem. Data from the international Food and Agriculture Organization (FAO) shows that more than 1.3 billion tons of food are wasted annually costing about 750 billion dollars.

Food waste is detected to be more in developed countries after reaching the final consumer, while food loss is more common in developing countries during the production and marketing stages. Food is wasted in the industrialized countries more than the developing countries, where the percentage of food waste per individual consumer averages about 116 kg/year in Europe and North America, while this number does not exceed 11 kg/year in some poor countries.

While the state of food loss and waste in the Kingdom was 33.1%, some studies have estimated the value of food waste and loss in the Kingdom at about 50 billion riyals annually. Hence, unfortunately in the Kingdom, food loss and waste are attributed to the following:

- Low level of awareness and education among a group of consumers in society, which affects their behaviors.
- Weak infrastructure and low efficiency of the food supply chain that leads to food loss, such as low efficiency of agricultural production, and weak agricultural marketing capabilities that suit the characteristics of agricultural products.
- Lack of or poor coordination between relevant actors in different stages of production and food marketing.

Many points may have a positive effect to reduce food waste and loss, including:

1- The importance of strengthening the food supply chains by encouraging small farmers to raise the efficiency, organization, diversification, and increase of their production, besides, marketing their products to engage in agricultural cooperatives to find agricultural entities that reduce the fixed costs of production and marketing.
2- Encouraging investment in infrastructure, transportation, food processing, packaging, and cold storage.
3- The importance of finding an appropriate mechanism that contributes to improving the efficiency of the food supply chain and reducing food waste and loss.
4- The importance of benefiting from earlier efforts, whether government agencies or expert-houses inside and outside the Kingdom, in addition to effective coordination among the relevant parties in different stages of food marketing and production.
5- The importance of reviewing plans related to food circulation and its storage, marketing, and consumption, besides, raising awareness among individuals, families, and major consumer groups, such as restaurants, hotels, hospitals, and universities.
6- The importance of training all food workers at all different stages.
7- Developing good practices in production, transportation, manufacturing, marketing and consumption, and taking advantage of food waste and food leftovers after converted to animal feed or manufacturing industries.

The Saudi Grains Organization would succeed in producing positive results that contribute to reducing this phenomenon. This requires cooperation among all sectors of society, whether the public or private sector or consultants.

The National Program to Reduce Food Waste links the issue of providing food with many important issues that touch upon several key aspects that the entire world is suffering from today, including:

- Emphasis on scarce water resources.
-The large economic loss caused by the lack of rationalization in food resources.
-The environmental consequences of waste, and the damages that cause global warming.
- Consumer social behavior that is indifferent to the value of food and grace-save.

It seems that the subject is very complex, as a series of operations emerge which show that waste starts when moving from agricultural production to wholesale and retail stores. Then, waste starts again as a result of inappropriate social behavior in dealing with food at the level of family

and individuals. Therefore, we all know the large waste of food in restaurants and on occasions that never fit the rule of grace-save.

Perhaps we focus here on the important economic aspect associated with the rationalization of food consumption, which initially requires the development of tools of food production and preservation. It is worth noting that food production in seasons is more than needed by the consumers. Moreover, the food industry is week. Considering the preceding two factors, food waste and loss become inevitable. Shipping the crops to the markets requires an advanced handling industry. This necessitates the development of marketing, distribution, transportation, and storage, all of which have so far not been satisfactorily developed.

The social consumption aspect that casts its shadow on the culture of grace-save is the social indifference that destroys the societal culture based on appearances, ostentation, and false generosity that leads to unjustified wastefulness. So, we are facing a strategic "logistical" issue that requires action by the state and the private sector to promote investment in the manufacturing and marketing infrastructure for food. Awareness-raising programs require raising and educating community members to preserve food.

The program confirms that there are no accurate statistics on food loss, which in itself shows the scale of the problem that our society is suffering from. This issue prompted a group of businessmen to establish the "Ita'am-Saudi Food Bank" for grace-save. It is a foundation for the grace-save, an institution that acts as a food bank to reduce waste in food that is ready for consumption. This may not solve the problem, nor part of it because the problem lies in the food production mechanisms and the food supply chains, which puts pressure on resources and strains the economy.

It is clear that the program is very ambitious and draws attention to the negative economical aspect of food loss. It also focuses on awareness and other aspects and sets out scenarios to deal with this phenomenon, but at the same time, it may need to build a cultural social network at the level of food producers and consumers. Moreover, the program must envisage an economic strategic vision based on the utilization of technology in developing the production process, without causing harm to the natural resources.

The National Program to Reduce Food Waste and Loss in the Kingdom is one of the national transformation programs in 2020, and it seeks to realize the goals of Saudi Vision 2030 through efficient use and operation of natural resources. This is done through the program pursuing the latest international standards and experiences to reduce food loss and waste, reach real and accurate numbers on food loss and waste in Saudi society, and show the size of the problem for officials in order to devise possible solutions.

The program advocates the necessity of analyzing the economic, social, and cultural causes of food loss and waste in the Kingdom, not to mention the alarming figures on our food surplus. This is considered a significant waste of resources by using behavioral economics applications to instill the correct product and consumption behaviors.

This is what is believed by the American economist, Richard Thaller, who won the Nobel Prize for Economics 2017 for his book, "Nudge". He said that as human beings, we use the automatic system in our purchasing options much more than the contemplative system and that by providing people with a set of information, pictures, or past experiences there will be a clear impact on the way their choices and consumer decisions are made. So, Thaler emphasized that the "Nudge" formulation means changing any aspect of the purchasing options design process, which if changed will affect the behavior of people without restricting their freedoms or changing the economic incentives provided to them. He stressed the need to take into account the following factors when designing these options: Quantity of information and how to display them. Besides, timeliness and associated environment must be taken into account because of their significant impact on consumer choices, behaviors, and decisions. Therefore, the importance of using behavioral economics applications is strongly supported in several stages of the program.

Some recommendations on the program, in addition to some mistakes and shortcomings, are presented here to support the noble goals of the program, including:

First: The program is assessed by choosing (4) cities in the Riyadh Region only, while (7) cities were chosen in the Eastern Region. Taking a look at the population in the Riyadh Region in 2010, it was 6,777,146 million people, while the population in the Eastern Region in the same year was (4,105,807) million people (according to statistics of the General Authority for Statistics). If we roughly calculate the current population based on the growth rates of (2.7 and 2.5%) for Riyadh and the Eastern regions, respectively, https://www.stats.gov.sa/sites/default/files/eastern_region_ar.pdf, the population will be as follows: Riyadh Region (8,241,009) million people, and the Eastern Region (4,926,936) million people. This means that the population of the Eastern Region is equivalent to approximately 60% of the population of the Riyadh Region, so why have not more cities been chosen than the Riyadh region commensurate with the population? Does the presence of certain specialized charities with previous and field experience in the Eastern Region have a role in this choice?

Second: The small size sample mentioned in the program, which amounted to (50,500) only, compared to the total population of the Kingdom according to the data of the General Authority for Statistics in (2018),

amounted to (33,413,160) million people. This means that this percentage is equivalent to (15, 0%) only, which is less than (0.2%) of the Kingdom's population. So, even if we calculate this percentage compared to the Saudi population only, which is (20,768,627) million people, it will become (0,24%). So, can the experts here tell us that we can rely on the results of this small sample for economic, social, and behavioral decisions? Likewise, the type of target samples was not defined and the question is: Were the questionnaires administered to the different privileged, affluent, and poor residential areas?

Third: The questionnaire was not reviewed properly, so we can help evaluate it in terms of clarity and comprehensiveness of the questions, ease of understanding by the reader, and the possibility of adding other questions that may be useful for the study.

Fourth: It was mentioned in the study that the field survey phase was complete, but the initial result of the data analysis was neither mentioned, nor the baseline was discussed to develop an initial conception.

Fifth: It is important to administer specific questionnaires for the productive families (who agree with some of the stores that sell families' products by renting shelves, and they supply these stores with daily agreed quantities of their products to sell them for a certain percentage, and in the event of not selling for any reason these families are responsible for recovering the extra quantities that were not sold during a specific period). This is to know how to deal with their unsold products, whether to consume them, give to the needy, or dispose of them? This percentage is constantly increasing and deserves study.

Sixth: Among the recommendations to give here, it would not be preferable to put pictures of people who are eating at very lavish tables. This shows the great extravagance that is being practiced in some feasts. Food loss and waste taking place is the responsibility of the host, not the guests.

Seventh: In the theoretical framework of the study, it was mentioned that microeconomic behavior will be studied. If it is intended to study market dynamics, it is also desirable to add the role of behavioral economics to consumers at this stage; to study human behavior along with the market behavior.

Recommendations:

First - Program Recommendations:

- It would be better to focus the study on the most densely populated areas in the Kingdom: Makkah, followed by Riyadh, where the annual average population growth rate in them is (2.8%) and (2.7%), respectively according to the General Authority for Statics. This is a result of the large variation among members of society in those two regions, which requires increasing the sample size in both of them to reduce this kind of mistake.
- Increasing the size of samples to match the volume of the population in the Kingdom; (to get a high level of accuracy, we must choose a sample in the largest number (Newman). Note that there is no consensus among the researchers in setting a specific percentage for the selection of the study sample, but some prefer that the sample size not be less than 5% or 10% of the study population.
- The program must clarify the correlation between the results of the first phase of the field survey to study food loss and waste in the Kingdom and how to reduce them. Besides, the correlation between the steps that must be followed in the third stage of the program, such as determining what kind of priority products can be recycled.
- In the third stage of the program referred to in the previous point, it would be very important to hold many specialized training courses to qualify a large number of girls and women who do not have high educational qualifications. The aim of this is to raise the rate of women's participation in the labor market to achieve the goals of Vision 2030 - in how to use food waste of orange crops as an example: (By cooperating with factories, restaurants, or producing families, so that orange peels are collected after squeezing or using to make cakes or jams, drying and reusing them to produce other products, such as food odors, dietary supplements, and aromatic smells, soap, and candles with orange smell). This is an example only, and more creative ideas may emerge in this field later.
- It was appropriate to focus more on studying extravagance and the erroneous consumption habit during festivals, social occasions, weddings, and obituaries. Those customs are so common especially in the holy month of Ramadan and the accompanying frequent banquets and making fasting breakfast tables in most mosques, which results in massive food losses. Therefore, it is recommended that this be scrutinized as a later stage of the study. This would be necessary after the "FAO" sounded the alarming bell of danger and caution, in a statement issued in various media outlets. It drew attention to the increasing food waste during Ramadan as a result of increased socialization, proximity, and spirituality among people. Moreover, it referred to the Middle East and North Africa where an individual wastes 250 kilograms of edible food annually.

- It is observed that only certain food species are selected for study, whether they are vegetables or fruits. Here it would be preferable to clarify the basic causes of selecting such species. Is it at the level of production or consumption? Then, does the government support some crops relevant to these options?
- Allocating a part of the study to illustrate the true loss and waste in dates that constitute part of the ancient history of the Kingdom as heritage, drawing attention to the Kingdom's large capacity in producing dates. In 2017, the Kingdom produced (754,761) Tons (according to estimates of the statistical book 2017 of the Ministry of Environment, Water and Agriculture, p. 307). It also referred to the growing volume of annual dates' consumption, as it is a basic component of the Saudi table, in addition to the many industries that depend on dates. It is also worth noting that the Kingdom occupies the second position in the production of dates, representing 15% of global production.
- The program must include a strategic plan that aims at raising people's awareness about the rules of smart shopping, consumption rationalization, and waste reduction especially in the month of Ramadan, feasts, and sales. The program addresses the necessity of mandatory awareness of not buying (economic packages, or take one and the other is free) promoted by the merchants, which are factors contributing to food waste, except for those who need them such as large families, productive families, restaurants, hotels, and hospitals.
- A plan for conducting studies in the cities where annual festivals are held by using the intentional or deliberate sample approach (using a sample that depends on the researcher's desire to control an intended and controlling sample, to collect correct, accurate and scientifically documented information on the subject aimed to be studied among the sites and people who are chosen in the research sample. Therefore, it is found that it is appropriate to take dates festivals in the Qassim region to name but a few, as Buraidah market is considered one of the largest markets for dates in the world, as well as the Province of Hareeq which is another example, where an annual citrus festival is held. This festival is held to achieve the economic goal of making use of their comparative (increasing production while ensuring excellence in the product quality at the same time). However, it would be important through this program and the field study to know how much of the loss and waste occur during festivals in the crop of dates and oranges - which were chosen from among the fruits to be studied? Then, at what stage does this percentage increase? How can we work to reduce this percentage in the future? Mr. Al-Shabbanat confirmed in more than one interview on the foundation's care to take advantage of field experiences in food waste and loss with the relevant authorities to enhance the theoretical research aspect. This is to produce realistic results based on scientific principles that achieve the goal of launching this national program. Therefore, these areas will be a good example of a practical application.

Second - general recommendations:

It would be necessary to consolidate all efforts and work together with the officials who are responsible for the program and all concerned government agencies and the private sector to adopt joint initiatives and agreements. Quick and decisive decisions must be taken, community awareness with the culture of food save has to be stimulated, and extravagance in society has to be encountered. Food waste and loss must be avoided, by all means, some of the most important of which are:

1- Accelerating the enactment of laws addressing food waste through regulatory legislation, and expediting enforcement to achieve the desired benefit. Also, penalties need to be imposed on those who waste food and reward those who commit grace-save. Likewise, it is preferred to apply the laws endearingly at the household level, (for example, teaching children not to dispose of their morning breakfast in the trash box for fearing their mother's anger and motivating them to share food with a friend).

2- Activating the recommendations made by the Saudi Family Forum in 2019, which gave some recommendations including:

- Adopting a national project to educate the next generation and young people the smart and rational consumption; developing and raising the next generation since childhood on spending behaviors, and establishing academies to instill saving, rationalization, and conscious behavior to reduce food waste.
- Reviewing misleading legislation and laws, limiting fake advertisements and punishing those who promote fake goods or harmful products, including ads that affect public opinion.
- Adopting target programs by the institutions concerned with the family to guide the consumption patterns of the family and society towards a moderate and rational way.
- Developing educational curricula and incorporating family resources and consumption approaches and rationalizing them in curricula at schools and universities. This is to give children a rational consumption pattern since childhood, as well as giving them the right concepts of strategic planning.

3-Activating the recommendations set by the Ministry of Environment, Water, and Agriculture in 2016, which indicated that the Kingdom comes first in the world in food waste. Besides, about 30% of the food produced is wasted, while the annual value of the wasted food is about 49 billion riyals.

4-Encouraging investments in research, especially in agriculture; to monitor and follow up agricultural trade, highlighting the losses that occur in the entire food chain; pinpointing places of potential food losses, and then conducting an assessment of their size; clarifying the most important agricultural, productive, manufacturing and sound marketing practices, plus raising awareness of the need to use them to reduce food waste and loss.

5-Emphasizing the importance of the role played by the private sector in social responsibility with those who are responsible for this program.

6-Supplying financial, administrative, and legal facilities to the private sector by establishing factories of international standards in the previously mentioned regions, in which annual festivals are held, whether for dates or citrus fruits and vegetables, in all regions with the highest percentage among the various regions of the Kingdom in the volume of waste and loss of food and waste; contributing to the reduction of food waste or losses caused by mistakes in processing, packaging or transportation; and reducing environmental pollution by turning it into fertilizers, nutritional supplements or beauty products ...etc.

7-Giving a special focus on promoting the sale of vegetables and fruits that are not perfect in appearance or shape at the consumer level, which are still safe to consume with attractive prices. The goal is to reduce the shocking percentage of waste due to quality standards. According to the (FAO), about half of vegetables and fruits (45%) are lost in our world, and saving bad fruits is not considered only a moral issue, but a matter of resources. It takes 13 liters of water to grow one tomato and 50 liters of water to produce one orange, it also requires seeds, soil, farmers' work, and even fuel to transport food. All of these resources are lost when the results of these efforts are wasted, especially if we know that the carrots that were chosen from among the vegetables to be studied in the Kingdom are considered to be among the most lost vegetables, where about (25-30%) of the crop is lost before it reaches sale shops due to defects of the external shape.

8-Holding seminars with the help of qualified trainers and accomplished volunteers who occupy positions at schools and universities, to guide male and female students and train them on how to rationalize food consumption.

9-Activating the role of media and social media in the promotion of a culture of grace-save, sharing experiences, and spreading knowledge on the risk of food waste.

10-Producing short television series, especially for housewives, to explain the correct way to preserve food and to warn of the consequences of extravagance. Besides, motivating them to direct all members of the family, including maids, to deal with food as a grace that should be preserved for fear of its demise.

11-Giving specialized courses to housewives on how to recycle cooked food and not dispose of it, like making sandwiches from the chicken leftovers, collecting the remaining bread, drying it, toasting and grinding it to become the bread crumbs used in many cooks).

Finally, although we were brought up in a culture of "amplitude", we often apply what our honorable Messenger says: "Whoever believes in Allah the Almighty and the last day, let him honor his guest", but we should not forget what Allah the Almighty has commanded us: "Eat and drink, and do not be extravagant, because Allah does not like extravagant people," {Al-Araf: Verse 31}.

There is no doubt that the objectives of the program, when applied correctly, especially in the field of awareness-raising and consumer rationalization, whether in the various stages of education or the visual and audio media, it will have a significant impact on mitigating this unhealthy phenomenon. Thus, the program will be influencing the conduct of society. This is realized by using the applications of behavioral economics to contribute to reducing food waste and taking advantage of food surplus to achieve the desired goal of reducing this percentage by up to 50% by 2030. Furthermore, this will lead to having a stable mental image of the Kingdom as the most food-saving and least-wasteful country.

Contributions:

The relationship between food loss and waste:

Food loss means low efficiency, and its treatment may reduce loss, and that developing countries face a problem of loss, and the industrial countries face the problem of waste. In the Kingdom, we have two problems. An example of loss is that more than 50 tons of agricultural products are lost at the end of the farmer day held at the end of the week held in Northern Riyadh due to poor products or bad preservation.

The program consists of two axes of waste and loss. Waste affects the culture of the majority; but the loss is a major component of the nation's economy because of its inverse relation to the national product which reflects the level of growth of its inverse relationship with imports of the same commodities, as well as with the rate of loss. Note that the program is concerned with the stage that precedes the grace-save (the stage of rationalization).

The program is one of the national transformation programs in 2020. This program will be like a media awareness campaign for all sections of society as a second stage, and we will work on a partnership with the various related sectors, whether public or private.

The rules of religion on food loss and waste:

The religious aspect is very important to opening and discussing this issue; Allah, the Exalted, the Majestic, says: "Children of Adam, take your adornment at every place of prayer. Eat and drink, and do not waste. He

does not love the wasteful" (Al-Araf: 31). This noble verse forbids us from excessive eating and drinking, so why don't we start with ourselves first?

The rules of Islam put all the regulations that manage human behavior positively, especially in the aspect of daily dealings and customs, but is it taken into account to the extent required? Looking around, we find that most behavioral practices in terms of wasteful food and drink are not followed as in the preceding verse, and the reason may be:

Either habit, "hospitality,"

The language of discourse is "ineffective".

The prevalence of ignorance and consumerism.

We need rational home management with religious, economic, and social dimensions, in which family members participate and bear their responsibility, as the Messenger of Allah said, "All of you are guardians and are responsible for your subjects".

The contribution of mobile applications to increasing the problem of food loss and waste:

The applications in smartphones helped a lot in enhancing the capitalist tendency among merchants. The question is: How can we reduce the attractiveness of enhanced media for the spirit of food waste?

These applications motivated an Emirati citizen to develop an application via smartphones. The application aimed at reducing food waste in his country, especially in restaurants. This is already applied in Saudi Arabia in some bakery and pastry shops, where they reduce the price to 50% after ten o'clock at night. Therefore, it is found that this application and the method used are nothing but a smart marketing method for restaurants in the first place to get rid of excess quantities at a low price and do not solve the issue of waste. The important question: Doe the one who buys have a real need or just tempted by the cheap price? Here we return to the same problem, which is food waste. This should be the responsibility of all of us, starting with the stores, reaching the consumer who should only buy if he/she needs it.

This application transfers the problem from loss to waste. So, it is not a solution, but a marketing method that is in the interest of restaurants, and increases waste in food, not loss.

Culture and customs and their relationship to the problem of food loss and waste:

Why do we waste food though we know that this contradicts our religious teachings?

Some believe that the reason lies in our culture and social customs. They incite generosity, and everything must be abundant. Furthermore, our

culture does not encourage "capital accumulation", and makes accurate calculations of the future or savings, as economists say.

We redistribute our wealth among ourselves with multiple means, like generosity, gifts, and aids. We may not see this defect in our culture, as generosity specifically wipes out all the bad.

But if we want to speak in numbers and be capitalists; one slaughtered animal with cooking supplies and additions like fruit, sweets, and drinks will usually cost around 2000 riyals, which is reasonable. This meal has nothing to do with the number of guests. Because it will be "sufficient and more than enough", it may suffice for more than thirty guests, and perhaps more.

Moreover, we usually do not count our guests, and how much will they eat as foreigners do. In return, if we want to serve thirty guests, it will be costly, as a person may have a meal calculated as 150 riyals in an average restaurant, which means that we will pay about 4,500 riyals. Thus, the meal in our traditional Saudi way will be financially more affordable even if we have to get rid of the surplus in our objectionable way.

Most Saudi people grew in a culture where slaughtered sheep are cooked and served uniquely. As the cooked meal is cut into only three large pieces, each part of which is put on a large circular rice plate, around which the guests gather.

This hospitality pattern continued to prevail until about 25 years ago, when these particular kinds of banquets were subjected to a defamation and control campaign as a wasteful style of hospitality, in addition to their negative health consequences due to large quantities of fat they contain.

The alternative to the banquet was the open buffet, where food consumption was controlled and healthy. The guests would only eat the quantity that they would take from the buffet. The diversity of the buffet with salads and appetizers would limit the amount of meat and fat that the guest may eat.

People liked the open buffet style which is varied and diverse, after years they had eaten only meat and rice at banquets.

The open buffet features were not used properly, as the healthy feature was not utilized, because many people ate the same amount of rice and meat in addition to the amounts in other dishes. However, the advantage of saving and preserving grace did not work because of the far distance between the buffet dishes and the place where people sit. This made them take large quantities of food more than they need. Essentially, food remains painfully stacked in the guest's dishes after the end of the event similar to what used to happen 25 years ago.

After years of keeping up with the buffet, what happened was not expected, as boredom began to flow in people because of its arrangements,

and some of its dishes are chickpeas, Mouttabal (Syrian dish consisted of grilled eggplant, the tahina - a kind of food, which is derived from the oil of sesame, olive oil, and some spices), tabbouleh (a Syrian salad), stuffed pasta with bashamil (Egyptian dish consists of pasta, minced meat and a cream layer made of milk and flour on the top of the dish), barbecues and ending with deserts (In the luxurious buffet, there are: ravioli, shrimp, etc.). People tolerated their boredom for quite some time, and they were patient with the open buffet not because it is the tastiest, healthiest, or most abundant, but because it is the most luxurious and relevant of other styles, although this luxury also began to wither with habit.

Then, data from the world's major health care homes declared that animal fats were innocent from charges of heart attacks and clogged arteries and that hydrogenated vegetable oils are more harmful than natural animal oils. This declaration satisfied a passion in the hearts of people, who have become increasingly attached to the past (Nostalgia). Not only because they are the most delicious and the most available, but because they bring people together at one plate after the concerns of the world and its troubles dispersed them.

Talking about the sociology of feasting is long and enjoyable in its cultural, social, and healthy aspects, but the economic factor remains the biggest factor in these equations.

There is an open buffet at a Chinese restaurant in America with a written board says "you can take whatever you like provided you eat everything in your plate; we do not accept waste food." This is a matter of education as unfortunately many people of different cultural and social levels do not understand this culture.

The economic level of individuals and their relationship to the problem of food loss and waste:

If we address the issue of food waste from an economic perspective, there is no difference between loss and waste. However, if we deal with it from a social perspective, it can be linked to waste, because it is linked to a group of cultural factors that push the individual to practice some behaviors that compel them to establish banquets so that they do not appear socially unacceptable.

The waste increases with the economic level of many families in addition to socialization related to providing food and drinks. It is also noted that all recreational activities are related to food more than entertainment itself.

It is an irony that we have moved from a subsistence society whose members barely find their daily food into a wasteful society that consumes food and boasts by showing off at dinner tables. These practices reach their peak during events, especially weddings. They reach to the point that

exaggerating hospitality makes you feel disgusted. This waste has negative effects in addition to economic and health damages. Besides, they weave a layer of illusion at the individual and societal levels, classifying individuals into categories and classes, and strengthening class differences and the feelings of aversion, isolation, and division among people in society.

Unfortunately, the expansion and diversification of restaurants and their price exaggeration have contributed to the growth of consumer behavior, which is done by many people to fill the inner void and for the sake of false sophistication, and they live in a big lie that they may not even realize until too late.

Therefore, the success of any initiative to reduce waste, must take into account social and psychological aspects and their accelerating effects on the individual and society, and work to address them before it is too late.

The problem of food waste and loss between management and production:

Food loss is a management problem and its percentage in the cultural framework is low. It can be changed because people search for their material gains through their production, and they accept all that brings them profit.

As for waste, the general framework of the problem is likely primarily cultural, and there is also a percentage of mismanagement.

Also, the issue of marketing globally and locally has a defect, as if we look at two products, namely dates, and camel milk, which are products that are deeply rooted in our environment and civilization, we have not succeeded in marketing dates globally, as required, especially in the Islamic world. Countries like Israel and Tunisia have succeeded, and their products have reached many markets far better than us.

Comparatively, for camel milk, it is an abnormally local and international wasted wealth. The reason is that the real camel owners lack support and awareness of modern economic methods in marketing their product, and they need intermediate institutions to receive their product. Perhaps we saw some elderly people who have some camels carrying milk to give for free. This is because they do not know what to do with it. Moreover, some of them no longer milk their camels for fear of being thrown away in the end, and this is a general problem for the camel owners.

This abundance and misuse also apply to sheep's milk. Such milk can be used in producing cheese as we do not have to remember that the most expensive types of French cheese are made from sheep milk.

A call can thus be made to establish small factories that collect, manufacture, and pack milk from sheep farmers so that the sheep would have an

economic return in addition to their meat. If something like that is done, it may cover the cost of feed and care, which is very high.

Breeding sheep is more economical than camels, because from camels we get only two products: milk and meat, while sheep provide us with several products: milk, butter, ghee, cheese, meat. Additionally, breeding sheep requires no more than small farms on the outskirts of cities with appropriate health care and feed. Whereas camels require open pasture.

Do we place animal husbandry which is economically ineffective in the waste field (feed - money - time)? Camel breeders do not benefit from them that much, as they usually use them as a kind of social prestige.

This applies to a very small class of people. We have around four million heads of camels, which are considered a real wealth. But how can we maximize the benefit? It is a question that must be answered by two types of people: The camel owners themselves, and economists and marketing experts. Some exert believe that breeding sheep is more practical, and do not need expertise as in breeding camels.

The yield of the nutritional value of camels is little for what it consumes, and they destroy the plant cover, which is already scarce. The yield ratios from the most to the little are (fish, chicken, cows, sheep, camels, etc.)

There has to be some sort of assistance for small scale livestock owners and others, with establishing marketing companies that guarantee the marketing of their products.

At another level, there is talk on a different kind of loss, it is a loss of roses in Taif because of the use of primitive laboratories, according to what was stated by the president of the cooperative society for roses in Taif.

Each year, Taif rose farms produce 24 thousand containers of rose oils "fragrant oil extracted from roses" (each container has 11.6638038gm), each one of them loses 40% of fragrant oil. It is indicated that the percentage of lost oil has resulted in losses for investors in the field of roses exceeding ten million riyals each year.

We live in a desert, but the total oases equal the area of both Lebanon and Syria. The "Sarhan Valley", which has simple farms, is alone twice the size of Lebanon. We only need to apply modern agricultural technology to rationalize water consumption and maintain soil quality. Referring to China, which occupies the first position in many agricultural products, it has reached advanced stages of the possibility of reclaiming desert lands.

Generosity and extravagance:

Some believe that one cause of extravagance is inherited generosity and it is a good habit, and this is not that much prodigality. If society competes in generosity, does society compete in supporting the poor, treatment of the sick, and paying the debts for those who are in default? We wit-

nessed objectionable generosity in the payment of blood money, and we did not see generosity in treating a sick or distinguished student in need. This is because other types of generosity are invisible, and do not give the person the ecstasy of presence and excellence. Therefore, some questions about the causes of this unpleasant phenomenon are raised: Is this attributed to the rapid transformation from poor to the rich community because of oil? Such compensatory habits formed which over time became parts of the people's customs.

Is ignorance then the cause, which has not changed with the spread of education and the improvement of sources of knowledge?

Is it some kind of entertainment because the community does not have entertainment?

Are the people of the Arabian Peninsula so keen on giving food to the others even though they are poor, which is something inherited and part of their nature? This entails that this habit if natural and has not resulted from the boom which the country witnessed with the advent of the oil era.

Why could not the teachings of religion regulate this matter? We have nothing but religion that we rely on to regulate our habits and behavior.

Has the society realized the value of money and the value of material things in general?

Do we have a flaw in the system of behavior and priorities? Do we lack the courage to change and criticize as individuals and as a society? Who highlights the problem, and who dares to stop a bad habit even though the majority criticizes it but at the same time do it?

Is imitating the wealthy and the elite one of the reasons behind this habit? Here, we see the lack of a role model, as this mechanism is known for its power to change.

Is there a weakness in the leadership of the family which prevents enforcing rules against extravagance and waste? Some families are like a mess. Members ask for whatever they want, and they eat whatever they want, at any time.

Loss in agricultural products:

In the Kingdom, we consider palm cultivation the most important agricultural product. So, what is the loss that occurred in the process that starts with cultivation until getting the product, or until the product reaches the consumer?

Many parts and components of the palm can be utilized products like fiber, ropes, and wood industries. Also, feed and coal can be made from palm seeds, with vinegar and molasses. Some products are manufactured, but not at a large level because they need laboratories.

There is also a loss in all local products, due to poor marketing, as a small farmer cannot market his product outside his region, and here everyone grows, so the prices go down woefully. They need a marketing company that buys their product to be transported to large markets in cities, and at the same time, factories need to be established for drying or canning and other ways to preserve the products.

Loss is viewed as the quantities lost during the food supply chain, starting from cultivation up to marketing. For example, there are quantities of dates that are not suitable for human consumption, with low efficiency and high labor costs. Moreover, there is irregular irrigation, pests, and diseases that affect dates, in addition to poor marketing and manufacturing infrastructure; all these aspects lead to a poor product and then part of it is lost.

According to the FAO report, it is clear that loss is much higher than waste, especially in non-industrialized countries. What are the reasons? Is it the weak efficiency and techniques of supply chains, the climate, and the economic level of the individual or other reasons?

When loss is inevitable, does the center or other relevant authorities have the means or programs under study to convert the loss into other products that can be used, such as animal feed, fertilizers, or others? As for conversion to fuel, it may be very early and ineffective to judge.

The problem of wasting water:

The biggest waste occurs in seawater desalination, which costs a lot, without mentioning the great drain that occurs in the groundwater, especially in the cultivation of wheat and fodder. Besides, there is misuse of water for washing yards and cars, and watering home gardens.

The issue of water waste is not a new one, and it has been raised a lot, and it may be a subject of a study by the Ministry of Environment, Agriculture, and Water. It has to establish grey water treatment plants in every region to make use of it in agriculture and all indirect human uses; like washing clothes, bathing, cleaning yards and bathrooms ...etc. Thus, there is no harm in being used directly as the technology has concluded stating the treated water is suitable for human use. This saves a lot, perhaps up to 80% of the water used in reprocessing.

In this matter, we hope that the Ministry of Municipalities, in cooperation with the Ministry of Water, will be successful in reviewing the design of homes, commercial and governmental facilities that water will have two sources: desalinated or wells water, and treated grey water. It is a large and possibly expensive project, but I believe that its financial and security returns are clear.

Wasting water takes great care by the State, even though it is not sufficient, but it lacks continuity. So, there are times when there are campaigns

launched for installing these special valves that save water. It also will regulate the drainage of water in the bathrooms and then stop. Later, there are times when you hear about competitions for research projects about water and its provision, then they stop, and you do not know what has been done concerning research ...and so on.

Spreading awareness and a culture of food preservation is a social responsibility:

Related to the issue of food waste is a report issued by "SABQ ONLINE NEWSPAPER", on January 27, 2017.

Under the headlines (Exports reporting to Sabq: Spreading awareness and the culture of food preservation is the responsibility of our society), (Saudi Arabia is first in the world and it calls to reduce waste and preserve food). The report stated: There is a widespread phenomenon of extravagance and waste in food, especially in recent years. The value of annual food waste and loss in the Kingdom is estimated at "49.833" billion riyals, according to the paper presented by the Ministry of Agriculture in the workshop to reduce food waste and loss. Further, despite the existence of some charitable societies that contribute to preserving food as the "Ita'am- Saudi Food Bank" association, this did not prevent the Saudi Shura Council from submitting two proposals to study and enact laws to combat waste and punish wasters.

"Sabq" highlighted the phenomenon of extravagance in food and the resulting penalties:

National Center:

Dr. Ahmed Al-Muffarreh, a former member of the Saudi Shura Council, presented a proposal on the food rationing system to impose financial fines on those who leave excess food in their dishes in restaurants. He also provided "Sabq" a copy of the draft bill. It included the establishment of a national center for rationalization and stranding wastefulness and imposing financial fines on individuals and families who leave food surplus of 20% of the value of the bill paid, provided that the fine is 15% for each party that supervises or hosts a party or an official or a private occasion and 5% for every individual or entity that hosts a large public or private party or event without a license. The amounts of fines shall be deposited in a bank account for the center and that the fines are announced in a prominent place in the restaurants' places and published on the center's accounts. Next, the system exempts from the punishment of any individual, family, or entity which immediately collects and takes surplus food. The center also aims to reduce the phenomenon of excessive eating and contribute to food saving and rationalization. Besides, the center supports the efforts of relevant associations and institutions and educates the community on the importance

of family economics and the negative impact of extravagance, as well as awareness of health damages resulting from excessive consumption of food.

Grace-Save:

On the other hand, the former member of the Shura Council, Dr. Nasser bin Dawood, presented the second proposal related to the anti-ingratitude and grace-save system and enacting deterrent penalties against some "bragging" practices. Examples include those who show off their luxurious feasts, as food is thrown in garbage containers, in scenes that disgustingly provoke the whole world.

There is no system!

Is there a law that punishes wasters who throw surplus food? There is no clear legal text that punishes wasteful and extravagant people in preparing banquets, but there is a regular text that imposes penalties on those who dump food waste in places that are not designated for them, whether restaurants or homes. As stated in the list of fines and penalties attached to the list of fines and penalties for municipal violations issued by the Council of Ministers' resolution No. (218) that imposed a penalty with a minimum 100 riyals, and the maximum of 100 riyals in the event of dumping food waste from houses in places other than those designated for them, and with a minimum fine of 1,000 riyals and 5,000 thousand as maximum in case restaurants food waste is dumped in places other than those designated for them.

The law stipulated a violation for whoever throws food waste only in the undesignated places and did not stipulate a violation for someone who dumps waste and shows extravagance in preparing banquets so that it is not considered a violation by those who disperse in the provision of parties and banquets if they throw food scraps in the designated places.

The first association:

Despite the absence of the law, charitable societies and humanitarian activities were present in serving the aim of grace-save and waste reduction. A group of businessmen decided to transfer the idea of food banks to Saudi Arabia, and the idea of the charitable society for food "Saudi Food Bank", was launched, which contributed to preserving more than 2 million meals since its inception. The Saudi Food Bank started work two years ago by a group of businessmen in the Eastern Region of KSA. When the idea made a success, it was transferred to Riyadh in December 2013. The food charity's main aim is to spread awareness and culture of preserving food in our society, delivering excess food to the beneficiaries according to the best international quality and safety standards, and creating job opportunities for children of the beneficiary families. Moreover, it aims to spread the

spirit of voluntary work in society and professionally promoting charitable work. Agreements have been concluded with many hotels and major wedding halls to package excess food with the best international quality and safety standards, and to form companies with other charities to distribute food to beneficiaries.

Professional image:

"Eta'am" is characterized by that 80% of its employees are young men and women, who were trained to work professionally through training courses. They were classified according to their skills with the best chosen to work either in the packaging team or the distribution team. This is done under the supervision of the operational manager and specialists in food quality and safety. Since the working hours are divided into two shifts; the first period is at noon at the same time as the lunch meal, while the second shift will be late at night, after the end of wedding parties.

We all are responsible

There are so many benefits resulting from the food preservation campaigns:

Estimating the right quantities when preparing food, whether for the family or for the guests, as well as avoiding wasting food leftovers, without throwing them as waste in garbage bins, collecting good and safe food, and repacking it for distribution to the needy. Everyone is a partner in preserving food, including people at home, schools, universities, and institutions of various businesses. The private sector plays a significant role in participation and support of the mission and goals of Eta'am society, which is considered a civilized step in devoting a policy of social partnership between the private sector and non-profit agencies.

The culture of rationalization must be spread in all aspects of life. Here comes the role of schools, mosques, and various media platforms in raising awareness and spreading the culture of food save.

Grace-Save:

Tons of food, the amount of which is equivalent to half of the quantities produced globally, are dumped in KSA, while famines in neighboring countries are increasing. This issue requires the adoption of ideas that contribute to grace-saving and reducing waste. Moreover, the official authorities must enact deterrent laws to limit waste and extravagance.

Studies and statistics:

Recent study results released by the Department of Statistics and Information showed that Saudi Arabia ranks first in the world in food waste by about 250 kg per a person per year, while in developed countries the amount of waste is "115" kg per person, while in poor countries 11 kg per person. On its part, the Ministry of Agriculture in the Kingdom indicates that

there are large quantities of food that are not utilized, and the Ministry attributed this to that there are some consumption patterns that led to this waste. Whereas some experts in the agricultural field called for conducting awareness programs to reduce food waste and loss. Such programs can be launched through television and social media. They have to explain that the subsidy from the State on some goods helped some groups of society.

Role models to reduce the problem of food loss and waste:

There is an important aspect that the program did not address, and this aspect is: setting an example and promoting role models, to achieve a sufficient degree of reducing food waste. It is well known that the biggest individual and family food waste usually concerns other sides, where this conduct relates to bragging, especially in the developing ones, where poverty is widespread and the social class power is established.

Waste is a social indicator in the first place, which the well-off classes practice in many forms. They express socially established consumption values such as generosity, hospitality, or differentiation with peers. The laboring classes also do so to deny poverty and destitution and the need.

Because it is a class behavior, it is necessary to consolidate the social effort to reduce it (set a good role model). This behavior will make rationalization in consumption a good behavior.

- Banquets and formal events.

- Banquets and occasions of dignitaries and the most economically rich classes.

- Banquets and events of leading figures and opinion leaders.

-Struggling to spread the rational consumption patterns of these groups in an inexpensive way, provided it is truly rational.

Any effort to reduce the food waste by the laymen will not lead to good positive results while other classes of society still have food waste practices. The role model is a requirement, though its credibility is only gained through the correct application of what we advocate. In this context, all official forums and conferences that revolve around financial awareness and the importance of consumer rationalization, especially in applying this in practice, are urged to focus on economization and rationalization of the quantities of food and drinks offered to the guests. If we preach for something, it is not advisable to violate what we are preaching for. What if they were the ones who started to implement this in practice, to become a good practical example for the audience, and the positive effect of their credibility before others.

Some still argue for the importance of imposing penalties, which have proved their feasibility in many of our practices and reduced many negative habits. Consciousness alone cannot grow in a society unless it is support-

ed by penalties. The western nations have not generated an educated conscious man, but they have laws and penalties of all kinds. This played a major role in making people conscious and aware of the many bad habits we are suffering from.

Productive families and their role in reducing the problem:

The shops that sell the products of productive families have spread greatly in our cities. Is this an economic solution? Are these products healthy? Who guarantees their quality? As for products that were not sold in a specific period, who will be responsible for them?

This is an economic solution to enable many families to secure a monthly income. As for the validity and safety of these products, this will be the responsibility of several parties. Those families who are registered with "Maroof", which is an approved application by the Ministry of Commerce that guarantees their quality, have quality and trusted products.

The idea of productive families is a brilliant one and its goal is charitable. Many of them however are now dependent on foreign labor under the name of productive families.

We will not reach perfection, and we will always find someone who tries to exploit, and we must realize that "what cannot be completely attained, should not be completely left". Certainly, some productive families have employment and often in the name of female domestic workers under the supervision of a housewife. Yet, there are poor and needy families who work without the help of workers, let it be as long as there is a source of livelihood as it makes them financially independent and does not need any help from others.

Experiences of food loss and waste:

There are some successful experiences in reducing food loss and waste: purchasing bread for schools every day of the week, distributing it by the number of days, and freezing it, provided that the bread is of high quality (higher quality leads to less waste), then taking it out the next day evening and using it without heating.

There is a noticeable waste in our society in the quantities of plastic and paper that we use a lot, sometimes without an urgent need. For instance, when we buy, we bring our purchases with plastic bags of various sizes and shapes. We get rid of them and we do not reuse for other purposes, but we dispose of them as household waste.

Among other wastes are "hangers" that are used by laundries. They are also considered household waste. While they are usable many times because they are not easily damaged like paper. Consequently, we have to think of suitable ways to take advantage of household plastic and metal wastes.

As for non-consumable food leftovers such as vegetable and fruit skins, eggshells, and bones, there is a machine that converts this type of leftovers into fertilizers that can be used in home gardens.

There must be several waste containers in front of homes as they do in some countries so that a container is allocated for plastic, a second for paper, a third for glass, and a fourth for waste that is not subject to classification.

We need to be aware of the seriousness of waste and rationality in using things. Whoever wants to see waste in plastic and metal cans, they can visit the valleys when it rains. They can see the volume of plastic bottles and cans of drinks that the stream carries.

The Saudi Minister of Communications at the Barcelona conference said that 40% of the raw materials that are used to manufacture smart devices in the world were made by Saudi Arabia.

I do not know if this means that they were manufactured inside the Kingdom or funded by Saudi companies. This information is important and is related to a lot of waste in materials that can be used for, or re-exported, to represent a large production capacity.

There are materials that we can benefit from through various methods that help solve problems of waste and loss. This is attributed to their importance in the industry and in generating more income. They especially affect the quality of production, and at the same time reduce waste in raw materials.

On the other hand, more attention and care should be given to food and bread with reinvestment of food waste to convert it into agricultural fertilizers that can be easily used at the individual and institutional levels.

Efforts of international organizations to mitigate the problems of food waste and loss:

At the international efforts and the existing organizations concerning reducing or addressing the issue of loss or waste, questions can be raised: Are there any international guidelines, specifically in western countries, to save food? Then, how is that accomplished? What are the projects and mechanisms followed?

We all watch comics on American TV and they play with eggs and fresh cream, and these programs are a bad example.

In the west, there is a high rate of loss and waste. It would suffice us to visit an American restaurant to see the amount of food in dishes. They are unlike the Japanese restaurants, both of which represent a different culture.

Mr. Mohammed Al-Dandani believed that in the west they have passed this stage. In general, they are not inclined to waste even if they can. He thinks that they have wasted much less than we do, and they have programs on consuming less. In the west, they control loss more scientifically than we do, but their waste is also high. They do so through their advanced food industry.

The Council provided several recommendations following the lengthy discussions. These recommendations can be stated as follows:

- Enacting laws to curb wasting food through regulatory legislation. Such laws can be enforced to achieve the desired benefit, plus imposing a penalty on those responsible for food waste.
- Encouraging investments in the knowledge economy to harness scientific research in agriculture to follow up and monitor the related products. This will also highlight the losses throughout the entire food chain, and demonstrate the potential food losses.
- Granting financial and procedural facilities to the private sector by setting up factories of international standards. Accordingly, annual festivals will be held for dates, citrus, and vegetables, as well as dairy and cheese. This is to reduce food waste or losses caused by errors in processing, packaging, or transportation. Further, this will reduce environmental pollution by turning them into fertilizers, dietary supplements, or cosmetic products.
- Awarding prizes for hotels and restaurants that enter into agreements with grace-save societies.
- Motivating the private sector to play its national role and bear their social responsibility through active participation in reducing food waste and loss in coordination with the authorities concerned.
- Encouraging licensing to establish grace-save associations, since many regions and governorates do not have for grace-save societies.
- Seeking to activate the role of the media and social media in spreading the culture of grace-save, sharing experiences, and raising awareness on the dangers of food waste.
- Producing short TV programs for the housewives, to introduce the correct methods of food preservation, and warn against the consequences of extravagance. Such programs are expected to direct all family members, including female domestic workers, to deal with food as a grace that should be preserved for fear of their demise.
- Calling for educational seminars with the help of qualified trainers and accomplished volunteers in schools and universities, to guide male and female students and train them on food rationalization.
- Specialized courses shall be given to housewives on how to recycle cooked food, for example: (making sandwiches of remaining cooked chicken, as well as collecting the remaining baked goods by drying, roasting, and grinding them into bread crumbs that are used in cooking).

Livestock, Development, and Vision 2030

Keynote speaker: Dr. Hamad Al-Batshan
Speaker 1: Dr. Khaled Al-Fuhaid
Speaker 2: Dr. Abdullah Al-Mutairi
Moderator: Dr. Soliman Al-Tufail

Summary:

The Saudi agricultural fundamental change (i.e., boom) caused expansion in this sector like all other sectors so that it could not only achieve - with the State's support- wheat and other crops self-sufficiency, but also export some of these crops. However, it later became clear to the water and agriculture experts that some of the policies might not have been successful. The Ministry of Agriculture and the Ministry of Water were merged, and they were later combined with the Ministry of Environment. The new Ministry of Environment, Water, and Agriculture adopted a lean strategy for setting a budget to rationalize the consumption of natural resources. The Ministry sets a water budget for agricultural consumption of 8 to 10 billion cubic meters of water per year. The transformation has already begun with huge efforts to fix the environmental needs, with a particular focus on agriculture and livestock sectors that must be transformed into sustainable sectors.

Livestock is a vital sector. It has achieved developmental accomplishments, as its Saudi employees have gained accumulative experience. It has also faced many challenges and pandemics (like Rift Valley Fever, Avian Influenza, and others) and managed to overcome them, winning the recognition and appreciation of global organizations. Despite the noticeable efforts of the officials of this sector to turn it into a sustainable sector, it is still facing some challenges, with which we should deal realistically.

It is highly important to focus on grazing, rangelands, and the environmental aspects, based on a study of forests and rangelands in the kingdom of Saudi Arabia, King Abdulaziz City for Science and Technology in 2006. In this regard, the initiatives of the Ministry of Environment, Water, and Agriculture deserve appreciation. They are concerned with livestock issues (including the initiative of Investigation and Control over Animal Disease Program). This program is one of the 2020 National Transformation programs, which is expected to have good results that would reflect on the increase of the market share of red meat.

Contributions of the session included the following topics:

- The best models for livestock sustainable development.
- The Kingdom of Saudi Arabia's needs for meat and the extent of its offal.
- Questions about the measures and policies of developing livestock in the Kingdom of Saudi Arabia.
- Livestock sector support programs.
- Coordination among the bodies concerned with livestock development.
- Mobile veterinary clinics as models for unique projects of the livestock sector.

Among the prominent recommendations the Asbar Council devised regarding the issue of Livestock, Development, and Vision 2030, are the following:

1- The Ministry of Environment, Water, and Agriculture need to coordinate with the board of cooperative associations to regulate boosting and promoting the agricultural associations specialized in livestock and its services, and encourage other associations for the same purpose.

2- The Ministry of Environment, Water, and Agriculture needs to establish partnerships between the private sector and the non-profit sector, and encourage other professional companies to develop and invest in livestock to undertake and regulate the tasks of development and the logistic services of the sector - especially in veterinary, research, and projects- and the tasks of cattle import and export, besides encouraging the associated transformational industries, on condition that the national gains preserved.

Distant Past: Historically, people in the Arabian Peninsula used to depend on cattle (e.g. camels, lambs, and goats) as main resources for food. They also depended on the limited agriculture and what the land offered of scarce resources, as well as on trade with the countries nearby. The climate-controlled whether cultivated areas will flourish or subside. It also controlled the number of cattle. Back then, there was no clear contribution to poultry or cows in sustaining the people's vital needs. There was always a state of equilibrium among the available resources (such as water and grazing), the area of cultivated lands, and livestock density. It is the rule of the Creator to have equilibrium and biodiversity in nature. To understand the livestock sector, it cannot be presented away from the environment, water, and agriculture.

Recent Past: The fundamental change or boom caused expansion and exponential growth in the agriculture sector like all other sectors, according to the agriculture policies. The Kingdom of Saudi Arabia managed to distribute the barren lands to people, completed building a strong infrastruc-

ture, and provided loans and support. These procedures, in turn, enabled the Kingdom to attain self-sufficiency in wheat and other crops, and also led to export some of these crops. It later became clear, to the water and agriculture experts, that some of the policies might not have been successful (we attribute this to the inaccuracy or insufficiency of information on the application of such policies). As a result, a decree was issued to stop cultivating wheat. Consequently, agriculture started draining even more water, as expansion started in cultivating other crops, especially fodder crop plants as an alternative cash-crop that is profitable and non-expensive (i.e. free lands, loans, and energy subsidies such as electricity and diesel). Everybody started working in Agriculture, even those whose profession was not originally in agriculture. The number of fodder crop cultivated hectares exceeded 600 thousand. As fodder crops and subsides were abundant, the number of cattle in the kingdom so increased that it exceeded at least 25 million cattle heads. The cattle sector was afflicted with "Barley Syndrome" and we started importing around 10 million tons of barley, which was nearly 50% of the quantities available for trading in global markets in some years. Maybe the cost of import is not what concerns us, because what concerns us is expanding cultivating green fodder supplements over barley. Importing barely and cultivating fodder crops increased with the increase in the number of livestock. This, in turn, has made 85% of our water consumption go to agriculture (we consume over 24 billion cubic meters of water per year, 3 billion of which go to the municipal and industrial sectors, and 21 billion go to agriculture - including 15 billion just for cultivating fodder crops). The impact of the huge number of cattle is obvious in the desertification caused by overgrazing and illegal logging. There is no doubt that these numbers exceed the ability of our natural resources.

The Present: As a result of the support and facilitation of the agricultural sector, we now produce 115% of our needs of eggs; 50% of poultry; and around 100% of milk and fresh dairy products. However, we produce only 30% of our needs of red meat, despite the great number of cattle. We are aiming at maintaining growth in the poultry sector, as it is a sustainable sector. We are aiming at maintaining the profits of the dairy sector as well; despite being accused that it is a water-draining sector (the quantity of water consumption in the dairy sector is only around 15% of the consumption used in cultivating fodder crops in the Kingdom). The imbalance lies in the traditional livestock sector, which we have started working on repositioning through turning it into a productive and sustainable sector, rather than a random, traditional, and water-draining sector. Agriculture and Livestock sectors were put on the right track after The Council of Ministers Resolution No.66 (Regulating Agriculture), and No. 235 (Redirecting Subsidies) were issued, according to two studies prepared by The Ministry (the study of

"Suspending Cultivating Green Fodder and the proposed developmental programs to support and implement the resolution", and the study of "Finding barley alternatives and boosting cost-effectiveness of expenditure on fodder crops). Besides, strategies of environment, water, and agriculture were developed to address the dysfunction that was present in the previous policies and keep up with the Saudi vision 2030.

The Future: We relentlessly pursue sustainability. The Ministry continues to implement its strategies to sustain the relevant sectors. Agriculture will not stop, neither will livestock production. However, a roadmap has been set to regulate them and make sure that they do not exhaust the environment and water resources. This is certainly realized through the transformation of unsustainable sectors into sustainable ones while focusing on the comparative advantages of the regions and aiming at future crops.

The poultry sector, which is a target of the National Transformation Program of Vision 2030 (i.e., preserving the earnings of the egg sector and boosting growth in the poultry sector to reach 60%), aims at boosting food security as these industries do not depend on the domestic natural resources. The dairy sector is targeted to preserve its earnings as well. The dairy-product companies have been prohibited from cultivating green fodder crops, and have been instructed to invest agriculturally outside the Kingdom of Saudi Arabia. The previously mentioned two sectors are now highly developed and greatly organized.

For the cattle sector, it needs a lot of work to lower the number of non-productive cattle heads and increase its productivity to provide at least 30% of our needs for red meat. Perhaps, we depend more on the ability of this sector to turn from a traditional grazing method into a more professional grazing one that would not drain natural resources. This may take place through depending on whole fodders and modifying the nutrition of negative practices. In doing so, economic and social considerations would boost and promote food security. Among the most important initiatives of the transformation of this sector in Vision 2030 are: Turning the agriculture sector to wisely invest agriculturally outside the kingdom, (i.e. rationalizing water consumption), establishing the national project for agricultural services, (i.e. raising the cost-effective expenditure and improving the services provided by the Ministry), engaging the private sector, (i.e. privatizing the Center for Veterinary Vaccine Production), investigating and controlling livestock diseases, improving production and productivity, redirecting subsidies for beneficiary ranchers, along with the national plan to develop the cattle sector (i.e. the recently approved targeted Rural Agricultural Development Program).

Conclusion:

As the ministry of Agriculture and the Ministry of Water were merged, and they later were combined with the Ministry of the Environment, the Ministry of Environment, Water, and Agriculture adopted a lean strategy for the budget of its sectors to rationalize the consumption of natural resources. The Ministry sets a water budget for agricultural consumption of 8 to 10 billion cubic meters of water per year. The transformation has already begun with huge efforts to fix the environment needs. Water desalination is not sustainable and risky, at least with the currently available technologies. The agriculture and livestock sectors in particular must be transformed into sustainable sectors. The agriculture and food security strategy concludes that agriculture, as it transforms into sustainability, would contribute around 130 billion riyals instead of 62 billion riyals by 2030.

Livestock is a vital sector and it has achieved a lot. Its Saudi employees have gained accumulative experience. It has also faced many challenges and pandemics (like the Rift Valley Fever, Avian Influenza, and others) and managed to overcome them, winning the recognition and appreciation of global organizations. Despite the remarkable efforts that the officials of that sector have made to transform into a sustainable sector, it is still facing some challenges.

- The importance of the livestock sector lies in its environmental, economic, and health impact on society. It is an organization that overlaps with several sectors, both in inputs and outputs. The fact is that it is facing many obstacles due to the high cost of production and marketing that accompanies the supply chain for this product.
- The livestock sector includes living cattle, (e.g. camels, cows, and sheep) and poultry to produce eggs and poultry meat, in addition to wild and undomesticated animals and migratory birds. This means that the medical services of that sector and providing health care to these animals require a double effort to carry out an accurate follow-up. That is, to prevent economic losses and avoid diseases that are shared with humans. In addition to the services of production and marketing of the output of this sector, the role of the vets, who deal with this type of animal, has become essential. This highlights the importance of raising vets' capabilities and encouraging them, recognizing the important and vital role that they are playing.

The poultry sector is one of the target sectors in the National Transformation Program of Vision 2030. The poultry sector in the Kingdom of Saudi Arabia has achieved developmental leaps as a result of the support and encouragement that have been delivered through the State's loans and some wages to the sites on which the projects are being established, as well as providing other logistic services. This is an important sector, because of its outputs of eggs and poultry meat. However, this sector is still

facing some challenges, including but not limited to the following: High cost of fodders, (representing 60-70% of the total production costs for poultry production), labor force, the decrease of administrative efficiency, and the increase of the morbidity rate that could sometimes reach 50% in some small projects, which could stop or lower their production capacity. This is in light of the distinction and competitiveness of the grand projects, which are dependent on their benefit from the principle of "yield on capacity", their ability to reduce unit cost production, and the completion of imported chicken at lower prices than locally produced.

Among the most important services that the livestock sector provides for the Ministry of Environment, Water, and Agriculture is supervising around 30 animal quarantines through the land, marine, and airports in the Kingdom of Saudi Arabia. The importance of such quarantines lies in preventing the entry of infected animals, especially during the Haj (i.e., pilgrimage) season. This highlights the importance of raising human cadres and detectors' efficiency at the ports and points of entry.

Some other insights that can be presented for discussion:

1- For the importance of creating a sustainable sector that contributes in rural resettlement and reduction of migration to cities, for being overlapped in tasks and functions of the livestock sector with many other sectors, (e.g. Ministry of the Environment, health, municipalities, commerce, and Food and Drug Administration "FDA"), for the growing interest of that sector, as well as the multiplying roles associated with its filed; (such as, festivals held for camels, horses, and eagles), we could suggest establishing an independent entity for that sector to raise the efficiency of its outputs and achieve sustainability.

2- The bad need to encourage and to establish veterinary hospitals and clinics, increase the number of veterinary vaccine centers in the kingdom, and increase the number of vets with boosting their capabilities and encouraging them to work efficiently.

3- The possibility of having the investments fund to establish full livestock (Ana'm) city on one of Jazan islands to receive living cattle; provided that they are slaughtered in slaughterhouses, and be distributed daily over the cities in the Kingdom of Saudi Arabia, and provided that they make the best use of the cattle offal and secure or reduce animal disease.

It is critical to emphasize the subject of grazing, rangelands, and the environmental aspects, depending on the contribution by a study of forests and rangelands in the Kingdom of Saudi Arabia, King Abdulaziz City for Science and Technology in 2006.

The nomadic lifestyle in the Kingdom of Saudi Arabia was prevalent, particularly in the middle and the North, until the 1970s. The nomadic popu-

lation according to Fouad Hamza's book "The Heart of the Arabian Peninsula", made up 58% of the total Saudi population in 1932. He states that about 70% of the northern population, 62% of the Najd population, and 67% of Hasa inhabitants (Al-Ahsa) are living in nomadic areas. It is known that the nomadic lifestyle and residents depend on livestock for food and for providing life necessities. People used to depend on the natural pastures and hay in grazing the cattle, and there were no other food resources. Therefore, the number of cattle used to be affected by drought years. Migrating and moving from one place to another was usually the only way to provide food for cattle, despite limited lands. Our history, before the unification of the Kingdom, was full of fights among tribes over grazing lands.

The change in the lifestyle of the population and the social transformation have changed the numbers and types of cattle, as well as the kinds of fodders and grazing environment.

The rangeland study shows that there is overgrazing caused by the increase in livestock numbers, especially sheep. Through collecting data, we found that there were individuals who had thousands of sheep and hundreds of camels, of which some types, in addition, destroy pastures by removing grass roots, causing them never to grow again. Also, the ease of transporting the cattle from one region to another upon rainfall, and not waiting until the grass is fully grown, has caused an increase in desertification. It was also noted that the traditional grazing areas, especially in the North and in Najd of the Kingdom of Saudi Arabia, are shrinking as a result of the spreading agriculture to rangeland, desertification, and illegal logging on well-known grazing areas.

The grazing environment is suffering from the spread of waste caused by the wastages of fodders and ranchers, and the ignorance of waste disposal methods. Plastic wastes, in particular, harm livestock and plants. Livestock owners, in the Saman region, in particular, have mentioned that many of the gulf ranchers do not care about waste disposal. They wished that those ranchers be prevented to do so, not just because of the wastes, but also because they own a great number of cattle heads and they transport them wherever they want with no constraints.

Contributions:

Best models for livestock sustainable development:

How far can examples of other countries be given, in which their situation is ideal or closer to ideal in the sustainable development of livestock? What are the ideal procedures that they follow for achieving self-sufficiency for this product and for reducing water consumption?

The following model is presented, which entails the best models compared with our situation in the kingdom of Saudi Arabia and other countries.

The Kingdom's meat needs and waste

Given that the Kingdom produces only 30% of our meat needs, the questions raised are: What does this percentage mean in the sense that we have to develop this sector? Are we a population that over-consumes meat to an extent that does not match our actual needs, and the need to develop our health? That is, over-consuming meat is an inherited lifestyle that we no longer need, especially during the conditions of modern life which require less movement and offer various food sources. Long ago, humans used to depend on meat only as a main source of food because of meager agriculture and difficult of import, but now it is obvious that many diseases are caused by meat overeating, especially red meat. So, do we need to increase meat production or import?

In this context, we can say that we are a population that over-consumes and imports red meat, besides our current production which is 6 to 10 million head of cattle per year. That is not to mention chilled, frozen meat, fast food, and processed meat. The Ministry is not seeking red meat self-sufficiency, for we currently do not possess any comparative advantage in that sector. However, there are attempts to enhance that sector through many initiatives to decrease livestock numbers. As the productivity of the sector increases, we expect reaching self- sufficiency of 30% or even 40%. On the other hand, the first study carried out by the Ministry of Environment, Water, and Agriculture for baseline setting of loss and wastage of resources shows that food waste in the Kingdom exceeds 30% (food here refers to general food resources).

We may need what we produce and import of meat, but the quantities are not distributed equally. Some people consume meat more than they need, and others only get a bite once a year. We have great food wastage in Saudi Arabia, including meat. So, can we manage to calculate the number of grams of meat needed by an individual per day, and then multiply the product by the number of people in the Kingdom? In doing so, we will have a daily average number, then a yearly average, of how consumption should go.

It is recommended that the Ministry of Environment, Water and Agriculture and the people of concern shall do the following:

1- Raising awareness about the importance of reducing red meat consumption, based on the health risks that could be caused due to overconsuming.

2- The country should combat meat waste and overconsumption that resulted from bad habits, especially during holidays and weddings...etc.

3. Directing people to diversify their protein resources, such as fish and chicken.

It has been found that information on livestock is so rare. Such information is necessary to draft investment, administrative, and financial policies and to draw up plans for what we need and what we do not. The suggestion made here is to launch a website, as a digital database, to show what is being imported or exported of livestock, and what is being daily slaughtered of all living animals and poultry in the Kingdom, by digitizing all these animals and poultry, to know the volume of surplus or deficit and shortage...etc. It is worth noting that the Ministry has already launched a livestock "Anaam" platform on the following website:

https://anaam.mewa.gov.sa/anaam/LoginUser/Login/

This platform has a record of livestock numbers and owners. All livestock in the Kingdom is digitized for data accuracy purposes. However, there is somehow data inaccuracy because livestock owners exaggerate the count of their cattle heads to increase the benefits they receive from the Ministry, including medicines, vaccines, veterinary services, and labor licenses. It is important to note that the owners hide their true headcount out of fear of having to pay taxes. Therefore, the Kingdom had to digitalize all livestock. The digital project has already started, and it could take up to three years. The issue of data inaccuracy is common among other ministries. However, the situation has begun to improve significantly in all ministries with the start of the National Transformation Program to set a baseline. Today, the Ministry of Environment, Water, and Agriculture have a better estimation, and we are working on to reach perfection through electronic numbering using RFI technique. For the proposed platform, it has been already established and completed for three years.

Questions regarding the policies and procedures of developing livestock in the Kingdom of Saudi Arabia

We have a huge number of camels, and we know the food they need is essential. We also know that we must balance between what animals consume and the benefits gained from them, such as meat, wool, lint, and leather. Naturally, fish may be the most produced source of protein, where its production can reach up to 80%, followed by chicken, cows, sheep, and finally camels. The important question here is: What is the Ministry's vision of the balance between vegetation and the increasing number of camels and sheep?

The Ministry of Environment, Water, and Agriculture of Saudi Arabia is working on two projects related to vegetation, namely increasing vegetation by planting trees, and reducing overgrazing. The entry of pastoralists and livestock from the Gulf Cooperation Council countries has also been banned, and work to remove those who previously entered based on the decision of the esteemed Council of Ministries is currently underway. Moreover, importing living cattle has not been absent from our strategy that aims

at conserving natural resources; as the weight of exported livestock, today should not be less than a specific weight. Those who export low-weight cattle have to export their feed as well so that they don't graze inside the Kingdom and drain water.

The camel milk is a severely wasted resource because the real camel owners lack the support and awareness of modern economic methods of marketing their product. They need intermediary institutions to receive their products.

Is it not possible for us to find developed and modern ways to invest in the camel sector? given that the production is still following traditional ways, and there is no processing for derivatives of this desert product that we have known in the peninsula throughout both ancient and modern times.

The Ministry of Environment, Water, and Agriculture is working on this through a national plan for developing the livestock sector including camels, and a sustainable agricultural rural development program (SARD). The Ministry is also working on issuing regulations in connection to grazing local livestock, engaging the private sector in this plan, so that it may be more realistic and meet the market needs.

Among the reasons for overgrazing is using means of transportation to quickly move livestock -especially sheep- to pastoral areas where grass begins to grow before reaching even half of their growth period; resulting in ending the season of grazing shortly. Accordingly, the following question is raised: Is there a solution to this problem? given that the numbers of livestock are increasing while grazing areas are decreasing? The answer is that there is an effective regulation will be issued in two strategies concerning pastoral lands and the environment.

Are there any studies or initiatives about benefiting from the Chinese experience in making use of camel milk, as well as making use of Australian camels in investment? The answer is that the board of the Camel Club is currently working on this issue.

To what extent does the livestock contribute to the local product? Is there a statistical survey on the types of industries involved in manufacturing livestock products in the Kingdom of Saudi Arabia? The answer is that most of the livestock production is almost considered to be raw materials. For manufactured industries with added value, they are limited to dairy and poultry sectors, while in livestock (i.e., camels, sheep, and goats), they are rare. Moreover, the Ministry has established a sustainable agricultural rural development program (SARD) and a national plan to develop the livestock sector, besides agricultural development fund strategy. In the light of Vision 2030, it has become important that the Ministry of Environment, Water, and Agriculture, represented in the Livestock Agency, should call for launching a livestock hackathon or call for grouping initiatives, ideas and serious en-

deavors that would contribute to the development of this vital and important sector in the economy and people lifestyle. Engaging the private sector is also considered one of the pillars of Vision 2030. The current most important elements of work in the Ministry are the legislator and the organizer, while the private sector should provide services and investment approaches, as it is more efficient in providing prospective services. There are many examples in the agricultural and water sectors. The Ministry has issued a decision to allocate a certain factory to produce veterinary vaccines, but it will stop the rest of the services, including but not limited to 32 border ports, 20 laboratories, and 182 veterinary clinics.

The Ministry also intended to privatize animal quarantine areas, and its role will be limited in all sectors to set legislation, regulation, policy, and strategy planning. However, the Ministry will not abandon fulfilling its duties. The view is that the private sector could be more efficient in usefully utilizing the available resources to provide services. The first stage towards doing this is to approve the establishment of the National Company of State-owned agricultural services and may be privatized later on, and the company would give the right to the private sector to provide some of its services, including operating quarantine areas. This would enable the Ministry to align with the goals of the Kingdom's vision to achieve the concept of partnership between both public and private sectors, which would increase efficiency and productivity, and reduce burdens and costs for the State. Besides, this would maximize the benefits of financial resources and lead to be a more efficient operation.

The Ministry has been paying great attention to bee-keeping recently. The Ministry also has a unique program in association with the assembly of bee-keepers in the south of the Kingdom of Saudi Arabia, as supporting beekeepers is one of the seven programs in which the sustainable agricultural rural development program (SARD) is financially supporting.

Regarding animals' offal like skin, wool, and others, the question raised is if there is support for their feasibility studies. There is an initiative to establish a center of Excellence for livestock research under the Saudi Transformation Program. The Ministry of Environment, Water, and Agriculture can support programs for those who would like to use animals' offal to set up workshops or factories to isolate sheep wool and goat hair. The hair tents we use the rest areas are usually imported from other countries, including Pakistan or Turkey. We also shouldn't forget that the local carpet industry, which may disappear, is based on sheep wool, which is usually disposed of with skin. For example, it is a loss that more than one million animals are slaughtered in Mecca during the Haj season, and their offal have been never recycled nor reproduced.

The Ministry Livestock Agency should set a budget for qualitative initiatives that result in increasing the efficiency and effectiveness of the agricultural sector in such a way that the Ministry of Water and Agriculture is currently doing. There are five initiatives under the Saudi transformation program, as well as there is an initiative under the sustainable rural agricultural development program with a budget of about 3 billion riyals.

If the Ministry had approved funds for feasibility studies, supported administrative and scientific departments to encourage graduate students to carry out studies, as well as provided logistical support and statistics, the resulting expectations of such studies would have been very high. However, the Ministry supports research, having signed contracts with four universities up to 105 million riyals, in addition to supporting graduate students.

Regarding independent livestock strategy, the livestock has already had an independent strategy in the agricultural sector; because it is impossible that every sector in the Ministry can have a separate strategy. The Ministry includes three sectors and each needs to communicate internally, as well as externally with other sectors. That is, for example, the agricultural sector cannot set a strategy without being integrated with the livestock strategy. The same is true for the environmental strategy, which cannot be set in isolation of agricultural or water sectors, and vice versa.

The institutions, in general, suffer financially from employee's fees and other funds, as well as the policy job nationalization. However, the important question raised here is: how did the Ministry support agricultural institutions in general, and livestock facilities in particular, to adapt to the new phase? The Ministry of Agriculture and the Ministry of Labor has sought not to impose fees on farmers and livestock breeders, who have up to six workers, and they have been allowed to recruit and hire seasonal workers.

There is usually a question raised about the role of technology solutions and electronic applications that develop livestock in the Kingdom of Saudi Arabia, and the ways that deal with them, especially with blockchain technology, which facilitates procedures and follow-up processes instead of the traditional administrative procedures. After the Ministry of Municipal and Rural Affairs developed public markets, including meat shops and slaughterhouses, the Ministry of Environment, Water, and Agriculture began preparation to perform such processes using blockchain technology to manage the whole sector, including the usage of traceability and transparency systems. The Ministry considers blockchain and artificial intelligence a great opportunity to improve and develop livestock.

Livestock Support Programs:

Based on "the need for livestock production", which requires a shift from traditional to professional education, the following questions are raised: What will on-the-job education be like? Does it mean finding specialized companies or other methods? What is the future of traditional education? How long is this shift, as well as how much does it cost?

In this regard, the development of the livestock sector requires its transformation into a sustainable and non-water-wasted sector. Such transformation is possible according to the studies the Ministry performed, and the success lies in involving stakeholders (i.e., livestock breeders). Besides, the Ministry seeks to work with small livestock breeders for professionals rather than traditional work in an estimated time of seven years. For the estimated budget of this transformation, it is around one billion riyals based on the sustainable rural agricultural development program. Today, there are about 150,000 traditional breeders, whom the Ministry will not abandon but it will work with them. The aim is to make livestock breeding a profession, by which the Ministry seeks to find a source of income for workers in this sector when they become old.

The question is raised again: What are the methods and requirements of the livestock profession (i.e.; licenses, conditions, numbers, type of food, etc.)? Workers in this profession are included in the Ministry of Labor like other professions, and they are granted self-employment cards, according to the declaration of the Ministry of Environment, Water and Agriculture in cooperation with the Ministry of Labor.

The applicants mustn't hold any job in the public or private sector and mustn't be students. This formed restrictions to the breeders of livestock or animals, and birds breeding, because the self-employment license should be given to any citizen. So why are such restrictions? The requirement of "not being a student" has been replaced by "being 21 years old", by which the candidate can work. However, subsidies are granted to the beneficiaries only as directed by the Council of Ministers. Generally, the State directs that "support must be only for those who deserve and entitled beneficiaries."

For the national plan for developing the livestock sector, it is illustrated as follows:

For the industry and private sector, the Agricultural Development Fund supports all projects that are in line with the Ministry's strategy, including projects loans of poultry, dairy, and veterinary services.

Some people believe that livestock breeders use injections that speed up the growth of sheep and use other injections against diseases and sell them afterward directly, are these allegations true? If this is true, what is the

role of the Ministry? There have been already some negative practices. Fortunately, such practices can be easily detected in slaughterhouses where such animals are detected and prevented from consumption. Also, these stimulating drugs are not allowed to be imported by the SFDA, but they may be smuggled, however. The Ministry has penalized some pharmacies that sell them illegally. They also can be easily detected after slaughtered, as some signs can be detected on their bodies, but they cannot be detected in living animals.

There is a question raised about regulating grazing periods and increasing the area of natural feeding? Has it been possible to take advantage of private protected areas covering large areas of the best natural pastures? The environmental strategy grazing strategy included an issue of establishing five centers concerned with the environment, including the Center for Combating Desertification, as well as starting to establish private reserves.

There are some other questions raised: What is the educational role of the Ministry's offices in the governorates to guide farmers, livestock owners, and consumers? What is the role of private agricultural associations? It is believed that previous financial resources did not cover these roles, and they focused on guiding vets only. Recently, the Rural Development Program, which the Ministry mainly relies on for funding the National Livestock Sector Plan, was approved. Efforts that are being made to improve the educational process and to address such shortcomings. The plan intends that educations shall not be theoretical only, but it is planned that the investment will be in hand-on experienced farms for livestock farmers.

Regardless of what may be said about the accuracy of the statistics on the proportion of the engaged population in the cattle-breeding profession, there is no doubt that the lives of the inhabitants of the Arabian Peninsula have been closely linked to livestock breeding and agriculture since the very beginning of life, and these two activities have become customs and traditions. Therefore, any real and effective change must depend on the ability to reach and persuade a large segment of society or create a new status quo. In other words, the State must intervene to change and direct the current practices, serving the citizen (as an individual) in such a way that achieves the set goals, and preserves the environment.

The reform of the livestock sector means transforming it from a traditional, random, resource-consuming sector into a sustainable and productive one that is based on productive and sustainable professional education. This must start from what is currently available of cattle, and fully getting a benefit of them, with changing the current situation, in which owners and the State spend a lot of money without achieving real economic returns. It is unrealistic to depend on domestic or foreign investments in this sector in the Kingdom of Saudi Arabia unless the State provides significant facilities,

by which these investments turned into a burden and consequently will fail once the State supports or facilities of investments stop. If we count livestock numbers and estimate their prices, we will discover that they form a very rich natural resource. The question raised here: how can we benefit from this wealth, which is estimated as unused billions of riyals or at least stop the losses and the negative impact on the environment? The following proposed ways can be beneficial in this respect:

1- Merging the existing livestock into economic groups to form companies or cooperative associations, in which the State owns a controlling share (i.e., the Public Investment Fund). The contributions of citizens will be in forms of cattle heads, which they have. In doing so, job opportunities will be available for people, who operate and manage these associations or companies under the supervision and guidance of the concerned authorities in the State. However, the State can sell its shares later if it wants.

2- Setting policies that encourage livestock owners to optionally enter these economic blocs or groups.

3- With governmental support and direction, these associations or companies should develop the current livestock, update the used technologies, benefit economically via advanced technology from all livestock products, and dependent industries, turning them into profitable assets.

4- Withholding any personal support except through these above proposed economic entities.

5- Emphasizing the implementation of the current environmental protection systems, and setting new policies that protect the environment, regulating rangelands and preventing desertification.

6- strongly applying penalties and blacklist the officials who violate them.

Coordination of involved agencies in livestock development

Among the questions that can be raised in this regard, is there an integrated vision or coordination among the relevant authorities that make a balance between food, water, and energy? there are four strategies adopted by the Ministry relative to the environment, water, agriculture, and food security. All of these strategies resulted from discussions with the stakeholders and they were presented to the common people, then approved. The Environment Agency is also coordinating with the Ministry of Energy, and the livestock industry is included within the agriculture strategy since agriculture is concerned with both animals and plants.

However, can't livestock have a separate strategy? Such a strategy has already been devised. However, we must be aware that agriculture and livestock are interconnected, and neither of them can be treated in isolation, nor can they work separately from environment strategy, nor water strategy.

Some questions may also be posed like: should it not be required that any support for the development of livestock in the Kingdom be balanced and coupled with a reduction in the excessive consumption, including red meat, water, and the environment in the Kingdom? For example, is it possible to levy a tax on the excess of meat consumption in celebrations and feasts? That is because of the pretext that such an extra amount distributed to the needy and charities is not convincing and impractical because it can be done in a better and more legal way. In this regard, there is always a need to balance between natural resources and livestock development, and this is stipulated in the livestock strategy in terms of the necessity of aligning with the environment and water strategies. However, the tax may be inappropriate now, and guidance and education may be better.

We have been trying to reduce smoking, energy drinks, soft drinks, and sweetened drinks through increasing people's awareness, but we failed to do so, but imposing a tax seems one of the effective ways to reduce excessive consumption of any commodity. However, it is possible to start with raising awareness, and then imposing the tax gradually. Excessive meat consumption is not less dangerous than some of these substances. This food excess has economic and environmental damages, as well as health damages.

If the development of livestock will affect our water reserves, the issue then is very serious, because the shortage of water may lead to wars. We can import all kinds of meat and we can have fewer quantities of meat in our meals. However, any effect on the groundwater is considered very dangerous, because the question of water is a matter of life and death.

The development of livestock must be sustainable, because the Ministry will reduce the agricultural budget from 21 billion cubic meters of water to 8-10 billion cubic meters/year.

The Ministry is keeping up with achieving sustainability, and activities of agriculture and meat production will never be stopped, by converting the unsustainable to the sustainable, and by focusing on the relative advantages of some areas. Though this is a difficult equation, the remaining question is what are the main national gains that could contribute to achieving it? This is not a difficult equation, because, for example, stopping the cultivation of fodder is encountered by the production of intensive crops, using hydroponic and aquaponic technologies that save 90% of water. This may go hand in hand with the transformation of livestock breeding and feeding systems from green to the whole feeding, as well as coffee and fruit cultivation in the south of the Kingdom, rainfed agriculture in the west of the kingdom, cultivation of agricultural terraces from Jizan to Taif, depending on rain harvest, improvement of genetic assets and genome technology to raise the productivity of wealth, and investment in fish farming in saline wa-

ter. For the most prominent national gains, they are the issuance of regulations and legislations related to agriculture, environment, and water, providing better data, and public opinion awareness and the most important national gains are leaders of the country, who will create the transformation. It was not so easy, but the leadership of the Ministry, which led by his Excellency the Minister, after merging of the Ministry and the birth of a new Ministry, has worked towards achieving the goals of sustainable development and making a balance between various sectors, taking into account the social impact. For example, small farmers who own up or less than 50 hectares are allowed to continue farming, whereas the companies were denied this right and compensated by reasonable agricultural investment outside the Kingdom. Another example is the recent launch of a redistributing subsidy program for young livestock farmers, as well as several other transformation programs.

Mobile veterinary clinics as a model for distinguished projects in the livestock sector:

The Ministry of Environment, Water, and Agriculture use mobile veterinary clinics to solve the problems of remote livestock keepers' access. Currently, the Ministry has about 180 mobile clinics, and another 100 clinics are being supplied. But the ministry is counting on a fundamental change in providing veterinary services to the National Agricultural Services Company to provide better services than what is provided today because of lacking human resources. The Ministry needs at least 3000 veterinarians, while the cadres today are only about 800! Besides, the work of the Ministry is far exceeding the service of livestock keepers. There are about 2000 veterinary clinics that need to be monitored and supervised along with about 1,200 poultry projects, etc. The Ministry is also combating contagious diseases, such as dengue fever, Rift valley, Brucella, and other common diseases that are transmitted from animals to humans. In addition to the initiatives of the National Transformation Program, it is hoped that the allocation of services will be provided in a better way.

Suggestions:

1- Proposing to establish an independent livestock commission whose board of directors will be chaired by the Minister of Environment, Water, and Agriculture. It will be responsible for developing services, supporting and organizing institutions, as well as localizing positions, developing, and investing in the Saudi livestock sector.

2- It is essential to support poultry projects, overcoming the obstacles facing producers in the production and marketing stages, and protecting poultry sector in such a way that raises its rates of contribution to local production and achieve food security. The poultry sector and

targeted economic role in the transformation program 2020 according to Saudi Vision 2030 are also essential.

3- Establishing a cooperative association whose mission is to import and sell fodder at an affordable price, as well as creating other associations that provide logistical services to the livestock sector.

4- Boosting efforts to preserve good national breeds of genetic origins in camels, sheep, and locally produced chickens.

5- Work to transfer public benefit markets, such as slaughterhouses, to be under the authority of the Ministry of Environment, Water, and Agriculture instead of the Ministry of Municipal and Rural Affairs, for specializing and raising efficiency and effectiveness in the livestock sector.

6- For the difficulty of external agricultural investment and its multiple risks, it is proposed to reconsider the issue of limiting local investment to small farmers who own 50 hectares or less, and to do the same for companies.

7- Emphasizing the implementation of the current environmental protection systems, and setting new policies to protect the environment, legalize rangelands and prevent desertification, and deforestation penalties.

8- Developing a database and statistical information related to livestock, and raising the level of coordination with the General Authority for Statistics to attract the livestock investors internally and externally.

Recommendations:

- Setting a timetable for implementing livestock strategy, taking into account the strategies for water and the environment.
- Coordinating the Ministry of Environment, Water, and Agriculture with the Council of Cooperative Associations to organize, support and develop agricultural associations specialized in livestock and their services, and to encourage other associations as well.
- Expanding the Ministry of Environment, Water and Agriculture of partnership with the private sector and non-profit sector, and encouraging the development of specialized companies for livestock and investment of specialized companies to undertake the tasks of development and logistical services for the sector, particularly in the field of veterinary, research and projects, undertaking and organizing livestock export and import operations, and encouraging the associated manufacturing industries with preserving national gains.
- Launching the Animal Wealth Hackathon by the Ministry, represented by the Animal Resources Agency, to encourage initiatives and provide ideas and innovations that contribute to the development of the sector.
- Supporting the development of livestock must be balanced and regulated in terms of penalties and the treatment of excessive consumption of livestock (especially red meat), and the violation of keeping its resources (i.e., water and environment).
- Merging the existing livestock into economic groups in companies or cooperative associations in which the State owns a controlling share (the Public Investment Fund), having the ability to set appropriate policies. The contributions of citizens are the cattle, by which job opportunities will be provided to citizens in forms of operation and management of these associations or companies under the supervision and guidance of the relevant authorities.
- Using modern technologies, especially blockchain technology and specialized electronic applications, to facilitate transactions and procedures.
- Encouraging and supporting investors in the aquaculture and fish farming through hydroponic and aquaponic technology to achieve a rational concept of agriculture.

The Saudi Certificate of Good Agricultural Practices (SCGAP)

Keynote speaker: Dr. Khaled Al-Fuhaid
Speaker 1: Dr. Fawzia Al-Bakr
Speaker 2: Dr. Musaed Al-Muhaya
Moderator: Dr. Al-Jazi Al-Shabiki

Summary:

The issue raised by the keynote speaker relates to people's health and safety, and consequently, their ability to perform the requirements of living, worship, work, and production at the best levels. He also highlights a distinguished- quality initiative under the supervision of the Ministry of Environment, Water, and Agriculture. This initiative is the “Saudi Certificate of Good Agricultural Practices” which is concerned with agricultural production standards. This initiative guarantees the safety and security of food and its production workers and outlines its economic importance and its goals.

The reasons for implementing the initiative are the importance of applying good agricultural practices to modernize and develop agriculture in the country and its sustainability, the demands for the safety local agricultural products to ensure not affecting the consumers' health, reducing the percentage of pesticide residues in crops, whether local or exported and the difficulty some farmers face in marketing their agricultural products, lacking clear integrated scientific management programs for the farmers, which contributed to the high costs of their production and the emergence of many diseases of epidemiology and pests that require integrated management programs to eliminate them and not taking good advantage of the farm's waste by recycling and benefiting from it as fertilizers or forage.

The topic stated above is important, which is derived from the importance of people's health and their healthy eating options. Further, there are so many benefits to obtaining the agricultural certificate of "Good Agricultural Practices", with the Ministry to play a vital role in monitoring and following up the matter.

This initiative would contribute to stabilizing agricultural activity in the Kingdom through an agricultural cycle. This will protect the land and the consumer, and ensure good returns to the farmer's efforts and the financial resources.

The initiative of The Saudi Certificate of Good Agricultural Practices is an attempt to reform the current mostly poor situation where agriculture in

the Kingdom has reached, with the impact of products on the health of all citizens.

Some believe that this initiative may face some challenges, including lacking preparation by some farmers in terms of farm management. This includes organization and records, high costs of production inputs, the current crisis of confidence by farmers towards some regulations issued now, and then, in addition to the crisis of confidence by consumers in the certificate focusing on prices only.

Some negative aspects of this certificate are usually addressed in terms of noting that there isn't any kind of incentive for farmers to adhere to the requirements of the certificate. Instead, they are obliged to comply with it, with the certificate requirements increasing the production costs. Furthermore, farmers' cessation of using chemical fertilizers will negatively affect our most important investment at SABIC company and other similar companies. Besides, the mandatory application leads many farms to quit the market and consequently affect the Kingdom's food security.

Absr Council made many recommendations, the most important of which are:

- Emphasizing the importance of the Saudi Certificate of Good Agricultural Practices and its hoped-for role in raising production efficiency and improving the productive units environmentally and economically.
- Conducting brainstorming sessions to define the importance of this certificate for farmers and consumers through agricultural counseling programs.
- Studying the possibility of uniting the competent authorities responsible for food security and safety to avoid conflict among government agencies.
- Organizing agricultural markets and providing information on them to know the surplus and deficit areas to reduce the impact of seasonal agricultural products.
- Encouraging the private sector to invest in food processing and entering the stages of the food supply chain.
- Setting an appropriate mechanism to clarify the importance of the certificate and the benefits of implementing it for all society sectors, especially those involved in agriculture and food.
- Extending the bridges of communication channels with experienced people inside and outside the Kingdom to increase the success chances of the certificate and evaluating it continuously.
- Ensuring that the requirements of the certificate do not raise the production costs, which lead to high prices for consumers.
- Activating the role of the private sector as advisory bodies for farmers and organizing training programs for them, provided that the Agricultural Development Fund gives loans to interested parties in providing these services.

Introduction:

The Saudi Ministry of Environment, Water, and Agriculture launched the Saudi Certificate of Good Agricultural Practices (SCGAP) which provides a local network that connects farmers and trademark owners in the field of the production and distribution of safe food. This is to reassure consumers, food safety, and traceability. It is also considered a major shift in the quality and safety of agricultural products in the Kingdom, with the aspiration of having a positive effect on the consumer's health in the Kingdom and exported food.

The aim of this certificate is to raise the efficiency of the agricultural sector by focusing on scientific methods in production and marketing and enhancing the consumers' confidence in national products.

The certificate also provides a local network linking farmers and trademarks owners in the production and distribution of safe food. The certificate covers food safety, food traceability, the environment (including biological diversity), workers' health, safety and welfare, and animals' safety.

Therefore, this certificate is an important one that is raised by the Asbar Council. Among the issues that are covered under this topic are the following: obtaining the certificate, expected challenges to the certificate, methods of using water for agriculture, organic product farms, negative aspects of the certificate, supervising and monitoring agricultural products in the Kingdom, reading of the subject of the Saudi certificate of agricultural practices, the importance of agricultural awareness, laws, and regulations of agriculture and agricultural products, agricultural investment in the Kingdom, agriculture in the Kingdom between quality and self-sufficiency, global trends in agriculture, examination and control of products.

Despite its economic, social, and environmental importance and its vital role in achieving food security, in addition to what is imported of food products, the Saudi agricultural sector faces many challenges that may negatively affect its future. Such negative effects may include the deterioration of natural resources (water and land) and the environment (due to natural processes and human activities). This resulted in widespread environmental pollution, low soil fertility, increased desertification, and water scarcity. The deterioration also got worse due to the increasing population, decreasing productivity and efficiency of the producing unit, and inappropriate agricultural practices (excessive use of water, fertilization, and agricultural pesticides), increasing farmers' immigration to cities and foreign labor. All of these factors, together or individually, have led to a breakdown in agricultural activity and caused an imbalance in its supply chain. This has led to adopting the so-called Good Agricultural Practices (GAP), which is a set of

standards for agricultural production that ensure the safety and security of food and those involved in its production. These standards are enclosed in documents, which are adhered to through four basic points related to these practices. These points are the protocol, general legislations, points of control and compatibility with standards, and the checklist and review.

GAP economic and social importance

One of the negative effects of wrong practices during the processes of production and marketing of agricultural products is the low efficiency of the local product as well as low consumers' confidence. This is especially true when accompanied by the high costs of production unit as a result of excessive use of production inputs such as agricultural pesticides and chemical fertilizer. Furthermore, there is the nature of agricultural products such as rapid damage and seasonality. Added to this is the poor infrastructure of the agricultural markets and the availability of information to those markets in various regions of the Kingdom. This consequently leads to the accumulation of losses, as well as not taking advantage of farm waste that ends up burning, which causes environmental pollution. Accordingly, the Ministry of Environment, Water, and Agriculture adopted the issuance of the Saudi Certificate of Good Agricultural Practices. The aim is to raise production efficiency and enhance consumers' confidence. This certificate has positive goals if it is applied as planned. These goals include:

Application:

- Applying good agricultural practices to modernize and develop agriculture in the country and maintain sustainability.
- Claiming for the safety of local agricultural products to ensure that they do not harm health.
- Reducing the percentage of pesticide residues in crops, whether local or exported, through adherence to the pesticide code. The percentage shall be according to the limits allowed by the International Food Constitution. This will encourage farmers to export their products, especially dates.
- Some farmers have difficulty in marketing their products.
- Lacking clear integrated scientific management programs for farmers which lead to high production costs, with the emergence of many epidemic diseases and pests that require integrated management programs to eliminate them.
- Failing to take advantage of the farms' waste by recycling and using it as fertilizers or forage.

To achieve the aim of this certificate, the following points shall be considered:

- Hosting brainstorming sessions for farmers to introduce the importance of obtaining the certificate and how it enhances confidence and their

achievement of a profitable return. This is part of an endeavor to place them in a better competitive position with local and other competitors.

- Awareness messages to consumers to enhance their confidence in the GAP.
- Official bodies taking over the control and work professionally to activate the role of the certificate, and taking advantage of the experiences of the countries that applied it and achieved positive results for both the farmers and the consumers.
- Upgrading the capabilities of agricultural guide men to deal with the means of implementing good agricultural practices and to guide farmers.
- The importance of holding meetings to exchange experiences among workers in the agricultural sector regarding good agricultural practices.
- Expanding training and upgrading the farmers' capabilities by houses of expertise.

We are so concerned about our food and there are so many questions that keep ringing in our minds. Where do we buy our food? How much can we trust the places where we buy our food? Are the vegetables and greeneries grown using clean water? How far hormones are used in poultry? We have so many questions, but with very few answers. However, we all pay the price of wrong agricultural practices. Our country also pays the price due to the pollution of water sources, the atmosphere, and the loss of land. The health, social, and personal price is a concern that everyone cares about. So, will the certificate policy (or what is termed as good food practices) be able to restore consumers' confidence? Then - and most importantly – will it contribute to the stability of agricultural activity in the Kingdom through a clean agricultural cycle that protects the land and consumers, and guarantee parallel benefits to the effort and financial resources performed by farmers?

We will not talk about farmers' immigration to major cities, because this is one of the tangible effects of the poor distribution of development programs since they are already focusing on big cities. Instead, we are witnessing the resolution of many major issues through the ambitious Vision 2030, which is seriously trying to rearrange many issues and priorities. The agricultural sector will be aligned with this vision and is expected to be successful.

Some may raise questions about the ability of farmers to absorb the sophisticated standards included in the GAP. For instance, will a brainstorming session with farmers suffice to establish such legislation that is so important to the stability of the agricultural sector and the improvement of its practices? Such legislation will ultimately achieve the restoration of con-

sumers' confidence, and may even farmers be able to access larger markets through it.

How will the Ministry be able to follow up on the application of these practices on every farm and with every product? We often have cheap and unskilled foreign workers working in agriculture, and it is difficult to find a national alternative at present, and this will make the task of following up on individual agricultural practices extremely difficult.

It is supposed that Saudi Good agricultural practices must have been adopted by the Ministry of Environment, Water, and Agriculture to raise the efficiency of agricultural production and enhance consumers' confidence in the local product.

Undoubtedly, the Ministry's interest in implementing the standards of good agricultural practices and launching of the certificate is a real opportunity according to the information released by the Ministry in the presence of a local network linking farmers and trademark owners in the production and distribution of safe food. This is expected to reassure consumers, food safety, and traceability of sources and environmental preservation. This will also maintain the workers' health, safety, and welfare.

The Ministry certainly seeks to apply these standards to the operators of production units in a gradual manner according to terms and standards over a period of three years. It will start with the production units having an area of 500 hectares or more compulsively within a year, then with a lower area from 200 to 499 hectares compulsively within two years. The area will go down gradually until reaching an area less than 50 hectares where the terms and standards are applied optionally except for vegetable production farms. These standards will also be applied to operators of production units for a greenhouse vegetable area of more than 5 hectares and the open area over 25 hectares compulsively within 3 years.

It is expected that the benefits of obtaining the Saudi GAP certificate will include several aspects, the most prominent of which are: improving agricultural processes and practices, preserving the environment and the safety of those in charge of agricultural programs, enabling small farmers to increase their production and improving quality, reducing the use of pesticides, in addition to enhancing consumer confidence in local agricultural products and their access to a healthy and safe food product.

This step is something that we have been expecting for years. As the project has become a reality, it is hoped that the Ministry will play a greater role in monitoring the operators of production units. This takes place through providing and improving irrigation water consumption in agriculture through the use of modern irrigation methods, rationalizing the use of pesticides and chemical fertilizers, and increasing the use of organic fertilizers that will improve soil properties and fertility. This will improve their ability to

maintain irrigation water. Merchants are looking for the most popular products, and all those aspects that are expected to improve the product will still have a big tax that might make these farmers reluctant or withdraw from this project.

The consumer is indeed looking for quality, but the competition will be intense, and there is a fear that the claim of commitment to quality will be just a slogan only raised by some without adhering to it completely.

On the other hand, the major farmers who will be started with indeed are one of the most influencing producers in the market. Some minor farmers, as well as workers in some farms, who violate the residency laws, are the ones who are considered a trouble to the major farmers; because they are flooding the market with cheaper products.

Success is indeed linked to firmness and justice in applying the law and penalties to all violators. I hope that awareness does not depend on the survival and continuity of this project, as the consumer often searches for cheap and nearby products, which will not be achieved concerning growing crops with more economic added-value, such as fruits and vegetables. Further, that will hinder opening new internal and external marketing outlets, improving the operations and agricultural practices, increasing agricultural production and improving specifications, improving facilities and working conditions and workers, qualifying and training farmers and technicians, and enhancing consumers' confidence in local agricultural products by obtaining a healthy and safe food product.

The cost, a price for the GAP certification which the farmers will obtain, may be an impediment to some farmers who could not go through. Therefore, the gradual implementation of the standards must be consistent with the progressive application of the same standards for farmers to meet the requirements of these standards.

The conditions and criteria for agricultural projects include many aspects, some of which may be stressful for the merchants themselves. Such aspects include risk assessment, record-keeping, self-evaluation of the production unit, ensuring food safety at all stages of production, standards for the use of fuel and energy, and the availability of a documented system for tracking and separating products, the preservatives, fertilizer management, occupational safety and equipment and machinery, in addition to employment registration, the way to deal with them, risk insurance, soil safety and protection, and safety of the water used in agriculture, and the water used during handling the product, in addition to wastewater management, the improvement of wildlife and the protection of environmental diversity, the management of pollutants and waste, the availability of hygiene and public health guidelines, the availability of sanitation and smoking and eating places, the existence of preventive measures against dis-

eases transmitted by visitors, as well as effective planning for the use of fertilizers and pesticides, general harvesting conditions, packing and storing.

In general, such a certificate remains a bright opportunity to have safe, good, and healthy food in an environment that has become threatened by many agricultural products full of pollutants.

Contributions:

Obtaining the Saudi Certificate for Agricultural Practices:

How is the application of obtaining the Saudi certificate for agricultural practices is made? Does this process differ according to the size of the facility, and the geographical area?

The certificate has recently been approved, and according to the website of the Ministry of Environment, measures will be taken to implement it by creating a special unit for SCGAP in the Ministry. As far as the size of the establishments is concerned, applications start gradually, binding on companies and large farmers within one year, and progressing to completion for less than 50 hectares within two years.

Does obtaining a certificate vary in costs according to the land area? Is it a percentage of the product or a fixed amount by area? Is it better for the State to afford it? Can the State afford it? Is the certificate renewed annually?

The costs depend on the farm size and the crop type, and the certificate is renewed annually. It would not be appropriate for the State to bear the costs of certification for companies and large farms, but it may be appropriate for small farmers provided that they join a cooperative association and attend guidance courses for farmers; to encourage them and raise their capabilities and put them in a better competitive position by utilizing the services of the association.

Other questions include: Is there any coordination concerning the Saudi Certificate of Good Agricultural Practices with agricultural colleges or nutrition departments at universities and research centers? Is the certificate originally a product of studies and research in those related universities and centers?

The Saudi Certificate is an authentic work of the Ministry and works with the Global GAP Foundation to obtain accreditation. The management of applying it in the Kingdom is assigned to King Faisal University.

Expected challenges when implementing the certificate:

Concerning the expected challenges when starting to implement the certificate on the ground, they are as follows:

- Failure to establish some farms in terms of farm management, such as organization and records.

- High costs of production inputs.
- Farms management by foreign labor.
- A crisis of confidence from farmers towards some regulations issued from time to time.
- A crisis of consumers' confidence towards the certificate and focusing only on prices.

This means that we need to raise citizens' awareness of the importance of this project and its return on their health. Furthermore, the State may need to subsidize the product to reduce prices at the beginning of the project at least, due to the difficulty of providing the basics of life for some classes of society in particular.

Methods of using water for agriculture:

Why do not we take full advantage of the successful global experiences in reducing irrigation water as a practice of good cultivation, given that we suffer from a shortage of water devoted to agriculture?

The most important thing in the issue of modern agriculture is using water, as it is scarce in most regions of the Kingdom with a severe waste in the ways of its agricultural uses.

Adopting modern methods of irrigation is the issue that we are supposed to pay more attention to. This is to conserve water and reduce its uses, and to take advantage of available water with high efficiency.

The issue of “water harvesting” and the need to think seriously about this has been raised. Traditional dams may not be a sufficient solution. What has been previously proposed in this regard is the construction of large groundwater tanks after torrents and the storage of rainwater for agricultural purposes.

It is noticed that there are large amounts of rain with temporary lakes formed in some areas. They dry up after several weeks without being optimally utilized.

Water harvesting does not have any ecological damage, given that the water evaporates in open areas. However, the water that remains in some locations for long periods is the one that creates problems for it creates marshes.

Organic productions farms:

There are private farms that produce organic vegetables. They sell their products for shops and also deliver homes on certain conditions. The question raised concerning these farms is: Do these projects (organic farms) have a future in the Kingdom? Are they oblige as sellers to obtain such a certificate? The answer is that it would be easy for an organic farmer to get the Saudi GAP. The Ministry is currently considering regulating the matter. In terms of the future of organic agriculture, it has its customers, and they

receive the State's support. However, the production quantities are less and not comparable to traditional agriculture because it does not use chemicals.

The negative aspects of the Saudi GAP:

Among the negative aspects of the Saudi GAP is that there isn't any kind of incentive for farmers to adhere to the requirements of certification.

The certificate requirements will also increase the cost of production which leads to higher prices for the consumer, and placing the Saudi farmer in a position that they won't be able to compete with the imported products unless the same requirements are applied to the exporters in their countries, which is impossible. Also, if farmers stop using chemical fertilizers, it will negatively affect our most important investments in SABIC and similar companies.

This mandatory application may lead to the exit of many farms from the market, and affect the food security of the Kingdom.

The best is to reduce the requirements and focus on the issue of water. It would be preferable to make the certificate optional to provide the farmers with the opportunity to compete with those who do not have the Saudi GAP.

Controlling agricultural products in the Kingdom:

It is known that vegetables, foliage, and fruits reach the consumers in the Kingdom either through import or local production. The Food and Drug Authority is the agency responsible for inspecting what reaches the market through import, while the Ministry of Municipalities and the Ministry of Environment and Agriculture are responsible for inspecting local agricultural products. Through research, it has become evident that the bulk of the problem (unfortunately) lies in local products, due to the poor and difficult supervision.

A. The relationship of pesticides to human food: Pesticides contain different types of active chemicals based on which they are classified as pesticides. They have different effects on living organisms that are not limited to insects, and some of them remain in our environment for a long time. If these substances enter the human body, they can attack as well as they do with insects. There are currently no pesticides that can differentiate between insects and humans. Mostly, pesticides work by affecting insect neurotransmitters. If a person uses food contaminated with pesticides, these pesticides can also attack the neurotransmitter of the human body. When pesticides are sprayed on crops, they can be absorbed by the soil, where they find their way into the fruits and water. Hence, insecticides can affect humans through various methods, such as mouth and skin and inhalation. Repeated exposure to them can cause acute and chronic diseases, such as rash, blurred vision, fever exhaustion, fever cramps, and neurological

diseases. Because of the side-effects of pesticides, it has become necessary to control their use to be within the permissible limits.

B. Pollution of vegetables and greeneries with heavy metals: Wastewater is used illegally to irrigate crops. Studies have identified several heavy metals that are detected among the most dangerous in wastewater: cadmium, lead, mercury, and nitrite. These substances cause great harm to human health. Wastewater contains many other materials of chemical and bacterial pollutants that have very precise international standards that must be adhered to before this water can be used to irrigate crops, especially vegetables and greeneries that are eaten raw without being cooked. According to many studies, treated wastewater may only be used to irrigate crops that are not included in the human food chain. "Sewage irrigation should be limited to non-food production, whether human or animal." The wastewater that is allowed to be used for the irrigation of crops that are not eaten raw must be triple-treated and sterilized, and it should never be used to irrigate crops that are eaten raw even after treatment and sterilization.

C. Current procedures of market inspections in cities: Random samples are taken from the markets. There are certain procedures followed in their analyses. However, there are weaknesses and shortages in the process.

D. Basic requirements:

1. Establishing a sufficient number of modern and equipped laboratories to examine vegetables, fruits, and foliage, and to determine how much they are influenced by pesticides and fertilizers, or irrigation with polluted water.
2. Intensive awareness of farmers

It is known that pesticide production companies place a label on the package of the pesticide or fertilizers indicating the amount of material to be sprayed and the time they stay on the plant before the vegetables can be picked up. The majority of farmers know this, but the problem with the labor who work for them is that they do not fully understand or apply the instructions. So, we find that there is excessive spraying sometimes, and often vegetables and fruits are picked up before the end of the prohibition period; the period during which the pesticide decomposes.

3. Spreading health awareness among consumers and urging them to buy healthy products, and not making incentives for the products that have not been tested by a laboratory.
4. Listing licensed farms that are allowed to be origins of the products that enter the market.

5. A survey study of farms in cooperation between the ministries of municipalities and the environment, for knowing the types of pesticides used in farms and making a list of them.
6. A survey study of the stores of agricultural inputs to find out the types of pesticides available in the market and list them.
7. Identifying any internationally prohibited pesticides in Saudi Arabia.

E. Perfect Market Control:

1. Applying an elaborate system for monitoring and controlling goods entering the central vegetable markets in cities.
2. Every person who introduces goods to the market must have an identification card issued by the secretariat and the Ministry of Environment so that they can be referred to after examining their goods. It would be possible to prevent those who do not carry an identification card from selling in the market.
3. Enacting fines and punitive procedures for violators, provided that they are progressive and accompanied by guidance and awareness programs so as not to confuse the market or cause the farmers' activities to stop. Presently, there is no regulation that farmers can return to, and allow them to be punished if they violate the law of spraying pesticides.

Readings in the Saudi Certificate for Agricultural Practices:

Do we have a specialized class that depends on this profession for a living? Farmers in Saudi Arabia are mostly Egyptians, Indians, and Nepalese, and they manage and direct the small and medium farms for Saudi owners either for a salary or rent. So those who work, not those who own, must be trained. As for the farmers' migration, it includes all people because of lacking opportunities and our failure to develop and improve the regions, which began to reflect negatively on the Kingdom where people are crowded in cities and citizens are reluctant to return to their areas.

Chemical fertilizers are indispensable today because seeds are complex and genetically treated. They do not grow as supposed without fertilizers. Perhaps there are sources of seeds other than the treated ones, and the Ministry of Agriculture should provide the appropriate seeds that live without massive amounts of fertilizers. The Ministry is also required to legalize the prohibition period, which means that the product will not be marketed before a certain period. The product may combine chemically with natural fertilizers to reduce or eliminate the damage, and this requires specific timing and good agricultural engineering supervision.

Before being so careful about the healthy product, we must find effective solutions to legalize the use of water in agriculture, rainwater storage, and most importantly gray water treatment. The treatment has reached a level

in which water becomes fit for human use. Very important is the adoption of modern methods in agriculture including hydroponics to reduce soil consumption, which means making hydroponics part of the agricultural cycle of the land. Besides, the floors cultivation is applied in hydroponics. Besides protecting the soil from being consumed, it is also useful to protect plants from harsh weather conditions.

Furthermore, the vegetation should be protected from overgrazing, because the higher the grazing is, the greater the desertification becomes, and this destroys the agricultural environment in terms of a large amount of dust and other direct and indirect negative influences.

All that is said above is linked to the economic and commercial feasibility. So how do we protect the national farmers and their products from market fluctuations and competition with the foreign importer? There must be reasonable profitable cooperative societies to supply farmers with seeds, fertilizers, and technical supervision, and there must also be marketing companies. Accordingly, we will ensure that farmers continue to work.

Importance of agricultural awareness:

The value of the agricultural certificate is so clear, as the certificate is an attempt to fix the current bad situation. The status of agriculture in the Kingdom has reached a situation that needs fixing because the negative effects of the products on our health are undeniable.

Because of the importance of awareness in this field, it is necessary to focus on qualifying the Saudi youth by creating a diploma that is granted after high school for a period ranging from one to two years. Accordingly, a trainee gets the necessary qualification to be an agricultural guide or observer affiliated with the Ministry of Agriculture. They will be tasked with making field visits to the farmers, and ensure that they conform to the requirements of obtaining an agricultural certificate. They also become familiar with pesticides and fertilizers, and how to use them, ensuring that the product has a healthy way to the consumer. Agricultural labor - which, unfortunately, cultivates, harvests, transports, and sells the products - are ignorant of many hygienic methods of product safety. The Ministry of Agriculture should also support the private sector that works in training by including that diploma in its qualifying and training programs, to graduate a qualified agricultural guide and supervisor, who works under the supervision and guidance of agricultural engineers.

Laws and regulations for agriculture and products:

The enactment of regulations, even if their goals are positive, may be accompanied by side effects. This means that SCGAP may be accompanied by a rise in the production and marketing costs of the producing unit. To address such an impact, it can be recommended that the State bears

the costs of obtaining the certificate for the production units with an area of fewer than 50 hectares (500 dunums) and that this is conditional on the farmers' involvement in an agricultural cooperative association in their area as members, and taking a course in agricultural guidance to know how to perform good practices on their farms.

Concerning food safety, this is a subject that has its gray areas and interactions with many government agencies that are hoped to cooperate harmoniously. For example:

-Imported fresh vegetables and fruits are the responsibility of quarantine areas in the outlets of the Ministry of Environment, Water, and Agriculture.

-Imported canned food, medicines, and feed are the responsibility of the Food and Drug Authority.

-Food on the market is the responsibility of municipalities.

Agricultural investment in the Kingdom:

Some believe that if we look at the basic components of agriculture, we do not find them available in the Kingdom to undertake huge projects in agriculture. The expansion of agricultural investment during the past forty years, especially in the cultivation of grains and fodder, was very damaging and even catastrophic in the long run, the most important of which was the depletion of water reserves.

There is hope that the Ministry of Agriculture would, for years, before it was too late, issue legislations to regulate the great expansion of agricultural investment, as well as issue this certificate of good agricultural practices to conserve water and the environment on the one hand, and the health of citizens and residents on the other.

We must now apply this certificate with full determination and accuracy. We do not want agriculture that harms the environment and drains our natural resources or agricultural products that harm our health. As for investment, it needs to be directed to other areas where we have competitive advantages.

Investment is unfortunately not large in this sector because of its weak capabilities and lacking water resources. It is necessary to develop our ability to meet the local needs, at least, in the good agricultural practices as intended by this certificate.

We must work to reach sufficiency and follow the requirements of the agricultural certificate so that health (which is the most important capital and most important investment) in the Kingdom is taken into account, and there is no harm then in not investing more in agriculture.

Some believe that conserving water and health comes first, then comes self-sufficiency in agricultural products. As for the issue of water scarcity, it is not contrived but real, due to the expansion in the production of wheat

and other crops, more than the Kingdom's needs for many years. The desalination of seawater is very expensive, but we are forced to resort to it now.

There are oversimplification and understatement of agricultural resources in the Kingdom because of the lack of understanding and lack of information on the agricultural resources and capabilities in the various regions of the Kingdom. There are centuries-old farming areas with important products and skills, but the economic mismanagement of resources in the past decades after the oil boom led people to abandon their areas.

Indeed, we do not have running rivers but with successful strategic management of existing resources including seasonal cultivation, renewable surface water and permitted groundwater, it will be sufficient to meet a large part of the country's needs and will create job opportunities for a large segment of the population in the rural areas. This is especially true because, in the northern and southern regions of the Kingdom, there is an excellent climate for agriculture.

Agriculture in the Kingdom: Quality and self-sufficiency:

Over the past several years some many visits and committees traveled and convened, and we heard about the news of cooperation between countries in the agricultural field, and about successful university studies and experiences in agriculture. Horticulture has many projects that have been announced, and there have been many young people who got scholarships to study agriculture in areas such as citrus, wheat, and others.

Self-sufficiency is not a goal but the goal is food security and safety, and this is done by raising the efficiency of using natural resources, particularly water, and the optimal use of comparative advantages in the regions to achieve a reduction in the cost of production and raise its efficiency. There needs to be a focus on appropriate activities, such as greenhouses, poultry and fish, and apiaries, with the encouragement of food processing. This goes in line with Vision 2030, but more regulations are needed. Perhaps the SCGAP is one of them, and it may be appropriate to encourage the establishment of more regulations, whether in production or marketing, as the reality of agricultural markets in the regions requires reorganization to provide information about them to both the farmer and the investor (the intermediary).

The frustrating fact is that we do not follow up, monitor, and hold accountable, or ask, where did all this go? Every time a new minister comes, new projects and initiatives emerge with different names and plans for the same goals. Unfortunately, these projects and media coverage were for show off only, with no results on the ground.

Agriculture - unfortunately - has been used by many over the past decades to make a living and earn wealth from public money, and the Agricultural Development Fund was one of the sources of funding for projects that ended with personal gains for some individuals or families. However, there have been no results on the ground.

However, the situation has changed now, and it is clear that the State is in the process of benefiting from past experiences, and there are no loans without repayment, nor projects and initiatives, except after conducting a study and having good results.

What is lacking in the agricultural sector in the Kingdom is proper and orderly marketing. It is assumed that there was a modern agricultural State-owned marketing company that markets products and can purchase and store according to seasons. Simple farmers cannot market their products, and lose much, especially during seasons.

Public transportation means play a big role in the problem. The lack of a network (for example) of low-cost trains linking the main cities with rural and agricultural oases in the north and south and Hijaz - made it difficult for farmers to sell their products promptly.

Talking about the quality of agriculture comes ahead of finding many solutions before that, such as the quality of products by regions according to the sale outlets, or preventing the import of what we have the sufficiency to pay the local farmers or legalizing the crops that need more water than is available, or establishing a national company for refrigeration and packaging. Many things must precede quality.

The small farmers received sinister hits by hypermarkets that export all products from abroad, to the point that the general vegetable markets for sellers became deserted and barely any consumers can be shopping there. Large quantities of lettuce, tomatoes, or cucumbers are imported by a huge hypermarket company from abroad and distributed the branches. The cost of these items is almost nothing, at the same time they are sold at the same prices as the local items, which costs the small farmer a lot.

Currently, there is a great tendency for establishing consumer cooperatives, and these usually have agreements with local farmers and their associations, and this may be the solution.

Local products are credible and popular if they are strengthened by certificates from local laboratories and cooperative societies with goals reaching beyond economic profits.

Global trends in agriculture:

The program of the Saudi Certificate of Good Agricultural Practices must receive its due concern. Some standards have appeared recently in some areas, including:

-Standards of excellence or quality.

-Performance tracking is the key to success.

If there are positive aspects, they must be reinforced and the negative ones addressed; otherwise, it will end up like many previous initiatives.

It is important to focus on the global trends in hydroponics, and the Ministry is interested in this matter. There are multiple loan programs for investors in this field. Among the evident problems is the weakness of food industries. For instance, the prices of products go down during their high seasons because of available large products. To solve this problem, a manufacturing project can be established. It is worth noting that the contributions of agricultural cooperative societies are limited in this respect.

Product inspection and control:

There is an examination made by some municipalities or specialized agencies, according to which many products are excluded from the market and confiscated. Some farmers use models of such tests to give their product credit.

Is it not possible for the State to secure such testing devices in the vegetables and fruits markets? Is it possible for such testing devices to be sold at a nominal price and such devices run by specialists who provide services to consumers? There are a number of these devices on the market.

Recommendations:

- Emphasizing the importance of the Saudi Certificate of Good Agricultural Practices (SCGAP) and its role in raising production efficiency and improving the status of production units, both environmentally and economically.
- Creating brainstorming sessions to define the importance (SCGAP) for farmers and consumers through agricultural guidance programs.
- The State shall bear the costs of issuing the certificate to small farmers whose farms are less than 50 hectares, provided that they join one of the cooperative societies, and attend a counseling program in this regard.
- Studying the possibility of unifying the competent authorities responsible for food security and safety to avoid overlaps among many government agencies.
- Organizing agricultural markets and providing information about them, to know the surplus and deficit areas to reduce the impact of the seasonality of agricultural products.
- Encouraging the private sector to invest in food processing and contributing to the stages of the supply chain.
- The importance of activating the role of agricultural cooperative societies and encouraging farmers to join them. The goal is to find a united purchase and concluding contracts to sell their products to achieve a better competitive position.
- Establishing an appropriate mechanism to clarify the importance of the certificate and the benefits of its application to all groups of society at all levels of their educational and social levels, especially those involved in agriculture and food.
- Benefiting from similar successful experiences at regional and global levels.
- Maintaining a balance between the use of modern agricultural methods and the rationalization of water use.
- Authentication of authentic agricultural products, such as dates, olives and coffee, and some animal breeds such as sheep, and some camel strains of Saudi origin.
- Building channels of communication with houses of expertise inside and outside the Kingdom to increase the success chances of (SCGAP) and its continuous evaluation and follow-up.
- Ensuring that the certificate requirements do not raise the cost of production to farmers, which if happens would raise prices to consumers.

- Working to find a mechanism to balance the requirements of the certificate and the country's industrial investments.
- Thinking of a proposal that the certificate will be optional at the beginning so that there is an opportunity to compete between whoever holds it and who does not.
- Activating the role of the private sector as a consultative body for farmers and organizing training programs for them, provided that the Agricultural Development Fund gives loans to those wishing to provide these services, as a funding agency for the agricultural sector.
- The importance of obtaining a professional permit for farmers to practice agriculture.
- Encouraging the food industries and stimulating cooperative societies in this regard.
- The importance of finding pathways in technical institutes and agricultural colleges to qualify Saudi youth to perform monitoring and agricultural guidance roles, to contribute to the success of the Certificate.

Palm Cultivation, Production, and Marketing in the Kingdom of Saudi Arabia

Keynote speaker: Dr. Ali Al-Tukhais
Speaker 1: Dr. Khaled Al-Fuhaid
Speaker 2: Dr. Suleiman Tufail
Moderator: Dr. Al-Jazi Al-Shabiki

Summary

The issue of palm cultivation in the Kingdom is divided into two major parts: The first is the cultivation of palm trees and the associated field operations that include plowing, planting the seedlings, designing an irrigation network, defining optimal distances between adjacent palm trees and the use of fertilizers and pesticides. The other part relates to dates themselves, their types, quantities, and marketing locally and internationally, and the challenges facing their production, distribution, and marketing, and supporting the palm farmers.

The second part receives main interest due to its direct relationship to food security, economy, export, job creation and entry of the private sector through investing in the production and sale of dates; These all aim to achieve the Kingdom's vision 2030.

It is noticed that the Kingdom of Saudi Arabia has been concerned with palm trees and dates in terms of various economic aspects. The Kingdom has also been working to support and encourage the private sector to invest in this field, contribute to achieving the goals of the Kingdom's vision 2030 economically. The Kingdom's production of dates represents 17% of global production. The quantities exported are about 100 thousand tons representing 7.6%, and the manufactured quantities are 276 thousand tons representing 23%, and they can be used in some local industries. For 70% of the dates, production is subject to personal judgments and demand and supply in the local market. Domestic consumption is estimated to be approximately one-third of the produced quantity, and there is a loss and waste of this product, whether due to the poor quality of the product or the farmers' inability to collect their crops. Besides, there are quantities produced by palm trees in the cities.

There is a great dearth of statistical data on the palm and dates of all kinds, and this is one of the biggest obstacles to its growth and competition locally and globally. The available data in this regard are very weak and do not aid the decision-maker, the investor, nor the dates market to enter the competition locally, regionally, and globally. Unfortunately, there is confu-

sion and lack of ability to distinguish between date palm and ornamental palm trees (i.e., the desert fan palm or Washingtonia).

Experts agree on the importance of date palm cultivation in the Kingdom because of its economic impact and its role in supporting the national economy. However, views diverge on ways to overcome the obstacles of date palm cultivation in the Kingdom as well as the efforts to support the production and marketing of dates, although these elements complement each other.

Contributions on the issue included the following themes:

- Statistical data on date palm cultivation in the Kingdom.
- The rate of Saudis' consumption of dates and the adequacy of the Kingdom's production to the local market.
- Obstacles of palm cultivation in the Kingdom and ways to overcome them.
- The balance between the expansion of palm cultivation and the issue of future water shortage.
- Tunisia's experience in producing dates.
- Efforts to support the production and marketing of dates in the Kingdom.
- The role of cooperative societies regarding investing in palm cultivation.
- Dates manufacturing industries: feasibility and development.

Recommendations:

1. The importance of having a clearly defined vision and strategy for date palm cultivation and production.
2. Looking at the date palm tree as a strategic commodity in the sense that it harnesses all the possibilities available for its development, and thinking about setting up a large company that caters for the palm tree and its products similar to Aramco in the field of oil. The goal is to establish a one-stop-shop for everything that serves the production and marketing of dates, technical supervision, and logistical support for date palm farmers. This will have a major role in organizing date exhibitions at home and abroad.
3. Focusing on manufacturing industries dependent on the palm trees and their derivatives, such as making paper, compressed coal, oil, feed, and others.
4. Focusing on studies, research, awareness programs, training, and marketing in the field of date palm products.

The subject of date palm cultivation in the Kingdom is divided into two major parts: The first relates to planting palm trees and the associated field operations including plowing, planting, designing an irrigation network, and

specifying optimal distances between adjacent palm trees and using fertilizers and pesticides. The other section relates to dates, their types, quantities, and marketing locally and internationally, and the challenges facing the date production, distribution and marketing, and supporting the palm farmers. The second part of the subject receives more interest for the reasons stated above in the summary.

It is well known that the first part of the subject is considered an invisible business and its expenses are many. More interest in this section reflects positively on the quantities of production and the improvement of the quality of the dates of various types, and this will increase the value of the product in the markets.

The palm tree is one of the blessed trees mentioned in the Holy Qur'an. Dates themselves are complete food elements, so caring for palm trees and dates production is very important and an important part of the equation of food security in the Kingdom. One of the features of the palm tree is that it endures the harsh desertification conditions due to high temperatures and droughts, and lives on fresh and saltwater.

The keynote speaker addresses the point below:

- First: Date production (number of palm trees, quantities, and types of production)
- Second: Palm pests
- Third: Investing in dates cultivation and production
- Fourth: Expanding palm cultivation and water consumption
- Fifth: Internal and external marketing and related obstacles
- Sixth: The National Center for Date Palm
- Seventh: The International Dates Council

First: Number of palm trees and dates production

It is noticeable that the number of palm trees increases dramatically year after another without planning or without specifying an annual increase rate. This happens mostly with individual efforts without the intervention of the Ministry of Environment, Water, and Agriculture. This situation is a constraint on what is known as sustainable agriculture and a major threat to the sustainability of water resources. Statistics of the Ministry of Environment, Water, and Agriculture indicate that there are about 30 million palm trees in the Kingdom that produce about 1.3 million tons of dates that belong to more than 76 varieties.

The distribution of palm trees in the Kingdom varies from one region to another depending on the type of soil, the quantities, and types of water sources and the geographical, topographical, and climatic location. Palm trees cultivation flourishes in flat areas with thick agricultural soil and is reduced in mountainous areas. More importantly, cultivation abounds where

there are real farmers who inherited the cultivation profession from their ancestors. The palm trees in the Kingdom are distributed as follows:

1. Riyadh region, about 7 million palm trees.
2. Makkah region, about 1.23 million palm trees.
3. Al-Madinah Region: 4.62 million palm trees.
4. Al-Qassim Region: 6,98 million palm trees.
5. The Eastern Region: 3.73 million palm trees.
6. Asir Region: 1.03 million palm trees.
7. Tabuk Region: 0.84 million palm trees.
8. Hail: 1.8 million palm trees.
9. Northern Borders Region: 0.23 million palm trees.
10. Jazan Region: 8,581 palm trees.
11. Najran Region: 385,623 palm trees.
12. Al Baha area: 70,612 palm trees.
13. Al-Jouf Region: 848,217 palm trees.

As for the types of dates, there are 76 varieties of dates that vary in quality and from one region to another. One area can be characterized by more than one first-class item. Dates varieties and quality depend on a group of elements, including geographical location, climate, temperature, soil quality, availability of water, and salt concentration in both soil and water, in addition to caring for the palm, fertilizing, removing fronds, pruning and pollinating.

There are so many processes relating to dates including harvesting, collecting, preparing, sorting, fumigation, washing, sterilizing, drying, packing, and pressing in the date factories that have spread in recent years in the private sector.

Perhaps it is useful to mention the most important data-based industries that include the following:

1. Date jam
2. Date honey (molasses)
3. Date chocolate
4. Date butter
5. Tahina with molasses
6. Dessert porridge dates
7. Juice of dates
8. Date yeast
9. Date stuffed with almonds
10. Date vinegar
11. Date dessert

Second: palm pests

Many pests attack the palm tree and dates. They shorten life and affect the production of the palm tree, the most important of which are the following:

1. Red palm weevil insect

This insect is very destructive to palm trees including the ornamental palm trees. The life of this insect is complex and its scientific name is Red Palm Weevil. The danger of this pest lies in that it is difficult to detect the infection early.

This pest was not known in the Kingdom forty years ago. It was introduced to the Kingdom through importing ornamental palm trees, and it was concentrated on a small scale in Al-Ahsa, despite the efforts made by the Ministry of Environment, Water, and Agriculture at that time to prevent the transfer of palm seedlings from one area to another unless the seedlings were checked and examined. The security inspection centers on the roads were largely cooperative. However, the red palm weevil insect spread through smuggling in a variety of ways and reached all regions of the Kingdom. It became a serious pest and affected small and large farms and resulted in economic losses that are difficult to assess.

Since the discovery of this insect, the Ministry of Environment, Water, and Agriculture has made strenuous efforts at the national, regional, and international levels through technical committees and many control teams. Likewise, committees were formed at the level of the Gulf Cooperation Council, with the assistance of experts, bodies, and international organizations. However, these efforts were not up to expectations.

2. Smaller and greater date moth

3. Date Palm Mite Oligonychus (Abu Ghubair)

Third: Investing in dates cultivation and production

There are good opportunities to invest in date palm cultivation and date production, for example:

1. Establishing modern factories to clean, squeeze, and package dates due to the presence of about 30 million palm trees distributed in various regions of the Kingdom.

2. Investing in food and non-food industries based on dates and palm trees.

3. Investing in exporting dates of competitive quality to foreign markets.

Fourth: Expanding palm cultivation and water consumption

After starting to implement the decisions to stop receiving the wheat crop and gradually reducing fodder, the quantities of groundwater used to irri-

gate palm trees are nowadays being consumed most at the level of all agricultural So, plans and programs must be made to sustain groundwater for the future generations. A study funded by the Agricultural Development Fund (2014) indicates that palm water consumption reaches about 4.5 billion cubic meters, despite the use of pilot irrigation methods such as drip irrigation systems.

There are fears that palm numbers will continue to increase to the point that they will be the main threat to the sustainability of water resources. There are also fears that their products will exceed domestic consumption with the continued failure of their marketing abroad. Referring to the story of wheat production, they were not clear strategies. The production of wheat in 1992 reached more than 4 million tons, a quantity far exceeding the local need. The Kingdom began to export wheat at a price below the cost price and ranked sixth in the export of wheat dependent on non-renewable groundwater.

There are charitable agricultural projects (endowments) for date palm cultivation and date production that depend on non-renewable groundwater, including a project in Qassim with (200,000) palm trees. Such a project consumes large quantities of non-renewable groundwater. If there are no other alternatives available, it would be better to consider changing the activity from planting palm trees to a non-agricultural project that does not depend on water. This is to preserve the groundwater resources because the idea of charitable projects is that they should not cause harm to the public interest.

Fifth: Internal and external marketing and related obstacles

One of the most important obstacles facing the agricultural sector, in general, is the lack of marketing of all kinds of agricultural products. Except for the agricultural companies, and the absence of an effective mechanism to help the farmer sell their crops, guarantee them a profitable profit commensurate with their large efforts in growing these crops, the agricultural sector will not succeed in achieving its goals.

The Ministry purchases dates from farmers according to a specific mechanism and price and supplies them to the Al-Ahsa dates factory. The State provides part of this production to the World Food Program (the quantity was about 25,000 tons annually and the quantity may be more at present).

It is noted that the Ministry's role in directing farmers to grow specific crops for each region according to the relative advantages has not been up to the expectations. The Ministry's failure to coordinate with farmers and direct them to grow crops that are commensurate with the comparative ad-

vantage of each region led the farmers to decide on their own what to grow. The result is that the majority of them grow the same crop, and production exceeds the market's need, leading to the sale of their crops for less than the cost price. Here the need arises for the presence of a company or companies for cooling and marketing.

Sixth: The National Dates Center

- The National Center for Dates and Palm (https://ncpd.org.sa)
- Initiatives of the National Dates Center (https://youtu.be/9xHxVRNlg4s)

Seventh: The International Dates Council

Royal Decree No. M / 4 dated 24/1/1438, was issued approving the statutes of the International Dates Council.

It was decided that the headquarters of the aforementioned council would be in the city of Riyadh while bearing the operational costs for a period of two years at the rate of 30 million riyals (4 million dollars) for each year.

Recommendations:

1. Reducing the cultivation of palm trees that depend on non-renewable groundwater.
2. The Ministry of Environment, Water, and Agriculture supported palm tree farmers by replacing their low-quality palm trees with better species because they consume the same quantities of water.
3. The Agricultural Development Fund shall provide subsidies and soft loans to convert from immersion irrigation to drip irrigation applied to the palm tree farms.
4. The establishment of the Public Investment Fund to create storage and refrigeration companies and collect crops from farmers for selling.
5. The Public Investment Fund establishes a marketing company to sell, export, and import food products, including dates.
6. Utilization and manufacture of palm waste.
7. Proposing an annual award to be granted to the farmers who export more quantities of dates.

Contributions:

It is noticeable that the Kingdom of Saudi Arabia is concerned with palm trees and dates from various economic aspects. It performs a lot of effort to support and encourage the private sector to invest in this field to realize the goals of the Kingdom's vision 2030 at the economic side.

The number of palm trees in the Kingdom is estimated at more than 30 million, and its annual revenue is 6 billion riyals, forming 16% of the value of local agricultural production, while global production of dates is estimated at 7.5 million tons. Among the most important countries that have the highest production quantities is Egypt 1.4 Million tons, Saudi Arabia 1.3 million tons, Iran 1.15 tons, Algeria 0,80 million tons, Pakistan 0.54 million tons, and Iraq 0.66 million tons. Global production is expected to increase to more than 10 million tons due to the insistence of the date-producing countries and the private sector to develop this high-value crop. Further, there is the desire of some non-dates-producing countries to plant large areas during the coming years.

The Kingdom's production of dates represents 17% of global production, and the quantities exported are about 100 thousand tons at 7.6% of local production, and 276 thousand tons are manufactured at a rate of 23% and can be used in some local industries. For 70% of production, this percentage is left to personal judgments according to demand and supply in the local market. Domestic consumption is estimated to be approximately one-third of the produced quantity, and there is a loss and waste of this product, whether due to the poor quality of the product or the farmers' inability to collect the crop. Besides, there are quantities produced from the palm trees on the street sides in the cities.

There are more than 3,000 varieties of dates known globally, but most of them are of low productivity and poor quality. There are only less than 50 items that can be considered good quality and of commercial value. There are about 400 varieties common in various regions of the Kingdom, of which about 50 are marketable items. The Saudi date varieties have been divided into famous varieties and non-famous varieties by the fact that they are common in 3 regions at least.

The number of factories and packaging factories for dates in the Kingdom is more than (170) factories and laboratories, most of which are factories with different production capacities. There are also large numbers of small laboratories that exceed this number. Dates are sold through the shops, while some families package dates at home, and they use dates dough in making some food products. With the growth of this industry, which accounts for approximately (40%) of the Kingdom's production, it has also strengthened the importance and necessity of marketing the surplus externally.

The number of palm trees is increasing in various regions of the Kingdom significantly, and this is due to the increase in palm seedlings in the early years of the palm tree. Among the most important factors affecting the spread of palm trees is the different comparative advantages of those regions that depend on the different natural ingredients suitable for the production of dates.

Red palm weevil: It is an economic plague caused by an insect that entered the Kingdom in 1987 by importing palm trees and the Washingtonia tree species from India. Its first appeared in the province of Qatif, and the insect cannot fly more than 3 km and produces more than 300 eggs. Then it appeared in Al-Beda Governorate in Tabuk, with a distance of more than 1500 km from where it first appeared in Qatif. Due to inaction and lack of cooperation in combating, it spread in the Kingdom's regions. Then, the transfer of seedlings outside most of the date palm cultivation areas was prohibited, which caused a problem for farmers which led them to circumvent and try to transfer them illegally. Under these circumstances, experiences accumulated among the experts at the universities, King Abdul Aziz City, and the Ministry of Environment, Water, and Agriculture. Despite the enactment of regulations and legislation and the imposition of fines on violators, the weevil spread. This may be attributed to defects in the control system applied by the government agencies and to the farmers who were unaware of its seriousness that causes massive economic losses. However, despite these conditions, the production of dates kept increasing due to the increase in the number of palm trees, as indicated previously, in a percentage exceeding the number of palm trees affected by this pest.

Among the most important obstacles facing the production and marketing of dates are the following:

- Low production efficiency, as the average palm tree production rate currently ranges between 50-60 kg, while it is assumed that it should not be less than 100 kg. The rate varies according to the different varieties, which means that in the event of inefficiency, there is a loss and waste in natural resources, the most important of which is water, low prices, and the inability to sell the product, which results in marketing problems. This requires training the farmers, enhancing confidence in the agricultural guide men, and encouraging farmers to engage in agricultural cooperative societies. This will contribute to reducing the costs of production, especially the fixed costs of the production unit through the unified purchase of production items. Besides, farmers' abilities need to be enhanced to market their products through associations. So, they need to know how to conclude contracts and overcome marketing obstacles as well as open marketing channels inside and outside the Kingdom through export development.

- The multiplicity of agencies that are linked to dates production and marketing (agriculture, labor, trade, municipalities, universities, the Council of Associations, and the Agricultural Development Fund, King Abdulaziz City). This contributes to finding gray areas that affect the type of services that are provided to farmers.

- Despite the incentives to switch from traditional irrigation, where dates are purchased (25 thousand tons by the State) from those farmers using the modern irrigation systems for 5 riyals while the State pays 3 riyals for dates produced by the traditional irrigation systems. The Fund provides a subsidy of up to 70% for the rationalized irrigation systems. However, some farmers still use traditional irrigation systems, wasting large quantities of water.

Recommendations

- The importance of joining efforts in serving dates production and raising the efficiency of using this product by supporting and enhancing the roles of the National Date Palm Center which was established in 2011. This Center was planned to be managed by the mindset of the private sector to contribute to overcoming the obstacles of marketing dates internally and externally and to build an identity for the Saudi dates.

- Encouraging farmers to engage in agricultural cooperative societies to benefit from seasonal employment services, reduce costs, and raise production efficiency.

- The importance of benefiting from the experiences of successful date festivals and generalizing the experience to the date palm cultivation areas.

- The importance of introducing, generalizing, and benefiting from the successful experiences of date palm farmers in the production and marketing of dates.

- Establishing a database on controlling red palm weevil to benefit from successful experiences.

Characteristics of palm trees and dates:

1. Palm trees are among the most cultivated plants in moderate, arid, dry, and salty regions. They are resistant to high temperatures, cold, and severe hurricanes. This gives an economic competitive advantage for palm cultivation in the Kingdom.

2. Palm trees differentiate into male and female, each of which begins to thrive as of the fifth year and begins production as of the seventh year. Good dates production continues between 30-40 years and often the age of the palm extends for more years than that.

3. A palm tree begins production as of the seventh year. It produces between 7-15 kilos and then increases gradually until the production in later

years reaches one hundred kilograms annually. It is worth noting that some palm trees give a higher product such as (Al-Barhi, Al-Majdool, Al-Khedri, Al-Helwa, and Shaqra as well as Umm Khashab, which was called by this name as their clusters are supported with wood due to its large size, for fear of breaking). Some palm trees produce 200 to 400 kilos annually. However, 50% of the palm trees in the Kingdom belong to the species of Al-Khlas and Al-Sukkari. Their production is weaker because farmers and investors are searching for quality in taste, size, and color of dates, which makes them reduce the number of clusters of the bunch by cutting a large part of it. This invites us to research in the classification of palm species according to quality, nutritional value, age, gender, and quantity of production. This will result in getting basic facts related to the production market and thus the ability to control production and prices and then the competition.

4. From palm trees, we can get dates and many derivatives. It also gives raw materials including the residues of palm and dates such as the trunk, branches, fronds, fibers, the date cores and peels, and others, which constitute raw materials necessary to establish a variety of manual factories (handcrafts) and advanced industries of wood and sweets of all kinds.

5. Dates are considered an almost complete food. They contain most of the elements which the human body needs. Dates contain sugars, carbohydrates, protein and fat, and several important elements and vitamins necessary for human life. Chemical analyses have proven that dry dates contain 70.6% of carbohydrates, 2.5% of fats, and 1.32% of the minerals that include calcium, iron, phosphates, magnesium, potassium, copper, manganese, cobalt, and zinc, and 10% of fibers, in addition to vitamins that include vitamin A, B2, B2C, and varying levels of sugars and proteins. Accordantly, date products can be used in the medical industries for food products that depend on dates of all kinds.

Our options regarding the date palm are almost clear in the necessity of investing in the cultivation of the palm and the production of dates as much as possible. However, some experts advocate for not focusing on the number of palm trees in the Kingdom, as it is possible to cultivate in other countries such as African countries and thus benefit from the external food investment program provided by the State. So, the goal will be to get good quantities of raw materials from dates and palm residues to better produce and export them globally. This with no doubt is an investment view. This calls us to take care and be careful not to deplete our resources indirectly. Here the need emerges to talk about the great damage caused to the cultivation of palm trees and date markets in the Kingdom by mostly hidden workers, who sometimes maybe the reason for this. This calls for the estab-

lishment and adoption of strict regulations to protect date palm cultivation in general.

Glimpses

1. The swords and the palm are the components of the emblem of the Kingdom of Saudi Arabia since the 1950s. While the two swords symbolize strength and sacrifice, the palm symbolizes vitality, growth, and prosperity. This makes us assure that our wise leadership is following a clear approach since the foundation of the Kingdom. The Saudi Vision 2030 is identical to the vision of the founder, the late King Abdulaziz bin Abdul Rahman Al Saud. The Vision 2030 aims to realize three main goals: a vibrant society; an ambitious homeland; a prosperous economy. These goals are inspired by the implications of the three palm trees (vitality, growth, prosperity).

2. There is a great dearth of statistical data on the date palm and its fruit (dates of all kinds). Unfortunately, the data sometimes are confusing regarding the difference between date palm trees and the ornamental palm (Washingtonia).

3. There is a need to change people's perceptions of date palm and date industry. For example, in many entrances and in our cities, we see palm trees on roadsides as if they were planted for decoration and not for production. Even worse, the products of this type of palm trees are collected by passersby people. Such products are polluted with car exhausts, pesticides, and dust. This means they cause harm to human health without people's being aware of this and perhaps they spread many diseases. Such palm trees consume large quantities of water, where each palm tree consumes one thousand liters of water per week. This represents a high waste of water and economic resources. Palm trees can be replaced with trees that are more beautiful, shaded, and less water-consuming.

4. With the Saudi Vision 2030's support to local industries, raising the percentage of local content, employment, support to young people, and empowering women and productive families, it would be important to develop industrial projects to raise the quality of date products and their derivatives. This also applies to the industries that depend on the waste of palm trees and dates, especially handcrafts. Some associations must be supported in this field. It is not enough to encourage the facilities and loans granted by the State. Rather, the State must be supported by the Public Investment Fund.

Recommendations:

1. The Kingdom seeks to be the first in the world in the cultivation of palm trees by targeting the planting of one hundred million palm trees by the end of 2030. This can be realized through the use of modern and advanced technologies in agricultural operations and by supporting internal

and external investment in palm cultivation and the manufacture of dates and their derivatives.

2. Supporting and encouraging scientific innovations and inventions that contribute to the development of palm products, including having patents for the conservation and rationalization of water consumption.

3. Using modern electronic applications in marketing palm products by reaching the farmers or the source directly with no need to purchase from markets. This will minimize fraud and manipulation of date markets in general.

4. Allocating lands in the major regions of the Kingdom to establish industrial complexes specialized in research for the development, production, and cultivation of palm trees and the manufacture of dates, laboratories, and stores, provided that these lands or complexes be in the palm plantations in each region.

5. Supporting and encouraging exports of dates and providing exemptions for raw materials, semi-manufactured materials, and finished materials that are included in the components of the date production and palm cultivation to achieve a comparative and competitive advantage. This will help to penetrate the global markets with no difficulties by the local products, including dates or their derivatives such as honey, molasses, chocolate, and others.

6. Establishing a huge company by the State in palm and date cultivation, similar to the Saudi Aramco company that is operating in the field of oil. Palm trees and dates are like oil and can be a finished material, and they can be used in many other industries and products to constitute a global and national wealth.

- **Statistical data on date palm cultivation in the Kingdom**

Why are there different figures reported by researchers on palm trees? Is there an official body that provides valid data? The statistics on palm trees and dates are unfortunately very weak due to failure in controlling palm cultivation. There is chaos in the cultivation process without solid studies being conducted on water, areas, or markets. As for the data of the General Authority for Statistics, which states that the total palm trees are approximately 28 million, they are inaccurate because they also include the Washingtonian species.

Some experts believe that the difference in figures of palm trees is something natural because the concerned authority receives estimates of the number of palm trees. These figures are sometimes exaggerated because the reporting body seeks to obtain more government subsidies. However, each figure presented on the palm trees has its justification. The Ministry of Environment, Water, and Agriculture is responsible for the validi-

ty of these figures. For instance, the Ministry is required to conduct an agricultural census every five years.

- **The rate of Saudis 'consumption of dates and the adequacy of the Kingdom's production to the local market**

A question is usually raised on how many kilos does a Saudi consume of dates per year? Does the production cover the local market so that we can think about export? There has been a survey study conducted on the consumption patterns of unripe and ripe dates in the Kingdom of Saudi Arabia in the Eastern Region. About 700 questionnaires were administered to a random sample of families in the cities of Al-Ahsa, Abqaiq, Khobar, Dammam, and Qatif in the Eastern Region. The results of the study showed that the number of palm trees in farms ranges between 17 - 1500, while the general average number of palm trees per farm for the study sample was 88.5. The five most consumed unripe dates were Khlas, Hilali, Shishi, and Raziz, according to the order of preference of their consumption by the study sample. As for the ripe dates, there were three main types, namely Khlas, Shishi, and Raziz, according to the order of preference of their consumption by the study sample. A large percentage of the study sample stores the unripe dates in the refrigerators for use in the off-season. The average stored quantity of unripe dates by the family in the refrigerators was 47.9 kg. The results indicated that the availability of fresh fruit does not affect the consumption of unripe dates in the season. The average quantity of dates that a family consumes per year is about 236.6 kg. A large percentage of consumers (60.8%) preferred consuming pressed dates, 22.8% preferred single dates, and 16.4% preferred stuffed dates. A large percentage of 63.4% of the studied families were storing dates in plastic bags, 24.1% storing dates in plastic boxes, and a small percentage of 12.5% storing in tin containers. The percentage of those who confirmed that the current method of dates marketing and packaging is inappropriate was 27.2 and 35.6%, respectively. This confirms the need to develop methods for dates marketing and packaging. The study also showed that the largest percentage of the sample prefers consumption of dates as it is without manufacturing (77.6%), and those who prefer its consumption through its use in sweets and baked goods amounted to 15.8%, which indicates the need to develop the use of dates in manufacturing candy and bakery.

If the average Saudi family's consumption is 236 kilos per year and the average members of the Saudi family are 6.7 individuals, then this means that every Saudi consumes an average of 33 kilos per year. Based on the foregoing, the Saudi individual consumes 90 grams of dates per day, and this is a very reasonable rate. However, it can be inferred that our dates are barely sufficient for local production due to high demand.

- **Obstacles of palm cultivation in the Kingdom and overcoming ways**

When we talk about having about 30 million palm trees, this means that the Kingdom of Saudi Arabia has significant natural wealth. However, it is worth noting that caring for this plant by the farm owners, the Ministry of Environment, Water, and Agriculture is below the expected level. There are indications or evidence that confirm the lacking attention to the palm trees in general. Among the observed reasons is that the farm owners do not receive technical support from the Ministry. This support is supposedly intended to provide consultations that contribute to the success and production of a crop of dates that meet the export standards. The farmers also face a shortage of workers with experience in palm cultivation, which makes them quit this activity or give in to expatriate labor that gets the highest share of production.

Many farmers with extensive experience in palm cultivation can be a source of benefit. The palm tree needs a lot of care, where farmers have a rich and large experience that the Ministry of Environment, Water, and Agriculture can refer to them in this regard.

The tragedy is that small farmers sell their produce on the palm trees. They don't even have enough labor to collect and care for them. It is also noticed that the large number of palms belongs mostly to individuals from small farmers and not companies, and small farmers here mean those who own hundreds, not thousands of palm trees. The Ministry of Environment, Water, and Agriculture must undertake the issue of meeting international standards so that marketing companies can export to countries with high standards.

There has to be a focus on the research conducted on the cultivation and care of dates. For example, there is the problem of weevil, which, as mentioned in the documents, started in 1986. After more than 30 years, the problem remains, and the question: What is the role of the Faculties of Agriculture and the Ministry of Environment, Water, and Agriculture? Faculties of Agriculture are practical colleges, and graduation research is supposed to focus on proposing solutions to existing problems and developing agricultural products. Some countries have a great deal of agricultural research, specifically about palm trees, and they have outperformed Saudi Arabia, such as Israel and Australia. For instance, Australia has specifically succeeded in settling and refining the production of Al-Barhi date species. Israel worked on many varieties of dates, including Al-Majdul. These facts indicate that serious research can localize date palm cultivation and production in countries where the date palm is not grown mainly. The experiences of these countries give us concrete evidence on how to improve the product in terms of volume, safety, and being free from pests. We have no

excuse and justification for the lack of interest and neglect of the research impact in improving the local product for a strategic commodity such as dates.

Some experts blamed the Ministry of Environment, Water, and Agriculture for our backwardness in date palm industry. They attribute this to many reasons:

- Lack of a clearly defined vision and strategy for date palm cultivation and date production.
- The chaos of investment in financing palm cultivation projects without linking this to clear performance standards that raise the level of local content and product quality.
- The widespread phenomenon of cover-up in the labor force has contributed to the existence of a black and disorganized local market that is beyond control.
- The lack of research centers specialized in the manufacture of dates and training for national cadres.
- Poor coordination among the agencies related to date palm cultivation and date industry.
- Failure to take advantage of global technologies and discouraging patents.
- Poor coordination with the Export Fund and the Industrial Development Fund programs to support the product locally and globally.

Unfortunately, there has been a weak competition of Saudi exports during the past twenty years, which did not exceed 2% of the volume of India's imports of dates, which is the largest importer of dates in the world. Also, the United Arab Emirates and Bahrain achieved superiority over the Kingdom in exporting dates. We know with certainty that a number of their citizens invest in palm cultivation and date manufacturing in the Kingdom and they re-export them. This clearly shows that foreign investment plays a large role in investing in this type of production. It would have been better to encourage foreign investment in palm cultivation and date industry, with a focus on raising the percentage of local content and employment. Likewise, the Ministry of Environment, Water and Agriculture has started recently to pay attention to the organization and support of agricultural products in the Kingdom in general, including palm cultivation, and it is currently working in every way to encourage investors in this investment sector, including:

- Educating investors about these programs and raising their awareness; because ignorance of the market is a reason to refrain from investing.
- Establishing a permanent international exhibition to encourage domestic and foreign investment to pay attention to the date industry and its derivatives.

- Organizing and codifying date markets.
- Obliging investors to apply modern technologies to rationalize water and use modern technology.
- Encouraging and supporting the establishment of specialized cooperative societies to work on these projects.

- **The balance between expanding palm cultivation and the issue of future water shortage**

There can be no balance between expanding palm cultivation and the issue of the future water shortage in the Kingdom. Most palm plantations are located in areas that depend on non-renewable groundwater. If treated wastewater can be used to an advanced degree, large quantities can be produced that increase as palm and dates increase. This water was not trusted by farmers because they used the groundwater for free without restrictions. We are now experiencing agricultural booms that harm the future of water resources, some of which we have already tried:

1. Wheat and barley production boom in the late 1970s, 1980s, and 1990s.
2. A boom in the production of fodder is undergoing despite the issuance of orders to organize it.
3. A boom in date palm cultivation and production is now at its height.
4. A boom in expanding olive cultivation, where some agricultural companies have millions of trees that are irrigated with non-renewable water, and we compete with Spain, Italy, and others that depend on rainwater.
5. We compete with the Netherlands in the production and export of roses.

Nevertheless, we have neither, nor will we, achieve food security or water security.

There has been a study conducted by the Water Guidance Department in the Irrigation and Drainage Authority in Al-Ahsa Governorate over a period of three years. The study concluded that the quantity of irrigation water used to irrigate palm trees in the Kingdom exceeds the actual palm needs by more than one-hundred percent. The study scheduled irrigation of palm trees through a system of continuous monitoring of the moisture content in the soil, where the amount with fewer losses was extended and good production rates of dates were maintained. The study indicated that the appropriate quantity for watering a palm tree per year is 63 cubic meters of water. The study also indicated that the palm tree consumes more water in the summer than in the winter. The palm tree is given 200 liters per day, equivalent to 44 cubic meters per hectare during the summer months which last from May to the end of September. In the winter month, the palm tree is given 150 liters per day, equivalent to 33 cubic meters per hectare during

the winter months which last from the beginning of October until the end of April, assuming that the number of palm trees per hectare is 220 palm trees. The study pointed out that it had tested the drip and bubble irrigation systems, as the former helped to increase the efficiency of utilizing this quantity with the least amount of losses. The latter system, however, has relatively higher subsurface losses than above it as a result of deepening water under the root zone. This reduced the stored water and the efficient use of palm trees, and this was reflected in palm production.

Is it more appropriate to use water in palm cultivation, or achieve balance among palm, wheat, and fodder, even if in reasonable amounts, as part of food security? Why was the Agricultural Marketing Company that was established in 1998 not successful, and how could this failure be capitalized on? Regarding the first question, the goal of reducing wheat and fodder production was to preserve the non-renewable water and after the reduction, the palm needs became the highest because no action was taken to reduce these needs. There is no interest in expanding the production of any agricultural crop whose needs exceed water sources sustainably available. We want sustainable agriculture, but sustainable food security cannot be achieved due to limited renewable water. Concerning the second question, the lack of success of the Agricultural Marketing Company, which was established in 1998, seems to be due to the lack of economic feasibility studies, the absence of real partners, the diminishing role of the private sector, and the lack of culture and concept of investment.

- **Tunisia's experience in producing dates**

Tunisia, despite being the least productive of dates, is on the list of the first ten producing countries, but it is the first in the world to export and has a successful experience that can be benefited from. It is noted that Tunisia was able to reach this level with simple organizational work only. It established the Joint Professional Complex of Dates. The Complex comprises producers, exporters, and manufacturers of dates in addition to government representation. Tunisia was suffering from the same problems that Egypt suffered from weak exports, but through the organization that was established there for dates, it managed to control the specifications of dates that are exported. It, therefore, prohibited exporting any product that harms the reputation of dates. Although there are few exporters of dates in Tunisia, they are nonetheless committed to quality and quantity. There are mutual relations between the Kingdom and Tunisia in developing exports, and the dates will be one of them.

- **Efforts to support the production and marketing of dates in the Kingdom**

The Kingdom's production of dates remains weak, not exceeding one and a half million tons annually. The reason is that there is a waste of date

products, many of which are certainly not monitored and not registered. Nearly 50% of date production is confined to two types. The first is Khlas and the second is Sukkari, while the rest of the dates constitute the other 50%. Accordingly, there is a need to control the production of dates and not to tamper with the quantities and yield. Date merchants buy the dates while still on the palm tree, and they usually cut off a lot of parts of the dates bunch so that the remaining volume becomes larger and its value rises. This is a type of monopoly to raise prices.

Given that if we have 30 million palm trees, this does not mean that all this number of palm trees is a product. There is a percentage of palm trees that do not produce every year, with another percentage that is not producing because they are still young. There are other percentages of production that are weak palms and few in number. Therefore, the method of multiplying the number of palm trees by the average of the date palm production will not give us numbers on which to build important strategies. Hence, there is an imperative to conduct an agricultural census every five years, for example, to obtain numbers and production quantities that will form a database for any marketing or manufacturing.

It may be useful to establish an association, federation, or a body for date palm farmers and date producers to coordinate among them and know the developments in the date industry and its products so that they are aware of what is going on in this sector. There is also an urgent need to coordinate the marketing process through a time-sensitive calendar and region.

In addition to establishing a special association for date producers, the Ministry of Environment, Water and Agriculture must establish a special department for dates, as well as research centers in universities linked to the colleges of agriculture, in addition to benefiting from the palm trees themselves in terms of paper, rope and wood industry.

Marketing is one of the challenges that face selling dates and its manufactured products! So, what do we need to reach a distinguished level in marketing products related to palm cultivation in general and dates in particular? In this regard, festivals are indeed important to the marketing process and are part of it, but they are not a strong component of spreading the date industry in the Kingdom. Festivals reflect the harvest and they are a way of selling raw products of dates, but in reality, we need a global exhibition of dates that shows the power of industry and crafts in the manufacture of dates and palm products in which many countries related to production and processing participate. It is important to show products and derivatives of dates bearing international brands so that global markets can be penetrated.

The efforts in marketing dates are still the same, and there is no real competitive industry. Among the reasons is the absence of a very important segment of society. There are six million students in general education who do not eat dates the way adults do with coffee. If the products were made attractive to sell in schools, and simulate famous products such as “Kinder” and other sweets with attractive packaging, distinctive taste, and high nutritional value of dates, this would lead to a successful industry. This will not be done except with the participation of male

The competition in the export of dates is no longer confined to Arab countries as it was before. The competition was stormed by two fierce rivals; America through its extended farms, especially in the deserts of California, and Israel, which has been marketing dates from the palm trees of the Negev desert and scattering them in European markets under the name (Israeli products). It is necessary to work on obtaining the specifications certificate for the products of Saudi dates, especially in Europe, to raise the export rate.

We should look at the date palm tree as a strategic commodity, meaning that all the available resources for its development shall be harnessed in the best possible manner. The Saudi dates are a strong competitor in global markets, not only dates but also what can be extracted from the palm trees and dates. Therefore, care should be given to the palm tree, as it is a product that may be one of the good contributions in diversifying the Kingdom's income and contributing to achieving the Vision 2030.

Regarding the efforts to support the production and marketing of dates in the Kingdom, the following points are suggested:

- The need to pay attention to the infrastructure and logistics to export dates and their products.
- The need for universities to cooperate much more in preparing studies related to dates.
- The Export Development Authority is still working on establishing the export infrastructure, including the establishment of the Export Bank, and they should take into account dates and all their products.
- A local and international media campaign is necessary to introduce not only dates but all related products.
- It is necessary to restructure the agencies working on the development of the cultivation and manufacture of dates to prevent conflicts, repetition, and even unhelpful competition.
- The development of the principle of seasonal recruited labor.
- An integrated review of the needs of the dates sector and the agricultural sector in the workforce. Why should the external and Saudi labor contracts be annual? They can be made weekly or monthly.

The first international conference for secondary palm products was held in December 2018, which is concerned with products other than dates, especially those that go to waste, the most prominent of these recommendations are the following:

1. Issuing binding legislations for palm owners to prune and service palm annually.
2. Supporting NGOs and institutions working in various fields to manufacturing by-products of palm trees.
3. Evaluating the value chain of palm by-products to determine the optimal areas for using these products.
4. Carrying out technical and economic feasibility studies to select projects based on the use of palm by-products.
5. Deploying business and technology incubators to support the initiators of new industrial projects based on palm by-products.
6. Recording, collecting, and preserving the cultural and technical heritage associated with secondary palm products.
7. Supporting and providing venture capital for new projects based on palm by-products.
8. Carrying out studies to estimate the available quantities of palm by-products at the national, regional, and international levels.
9. Inviting designers to establish a live dialogue to rediscover the identity and aesthetics of palm by-products available in their countries for sustainable development.
10. Formulating and publishing awareness programs on the economic and development value of secondary palm products as a renewable and sustainable material base.
11. Establishing the International Date Palm Products Authority - the first of its kind in the world - to ensure continued efforts directed at supporting the use of secondary palm products for sustainable development.
12. The continuation of the international conference for secondary palm products to support the use of palm secondary products to achieve sustainable development.

There is an important social dimension that should be receiving attention. This is related to educating the community and the new generation about the importance of dates so that they can return to their fundamental value as an important food. Accordingly, the following can be recommended:

1. Intensifying awareness programs locally to encourage young people to use dates and their by-products and to create distinctive and entirely new ways to attract young people.

2. Organizing school educational programs that help integrate students in the culture of dates and their by-products and appreciation as a local resource that deserves direct personal attention.

3. Supporting date-based industries as local alternatives to some imported products, especially in light of the high prices and the failure of many families financially, for example, manufactured cooking oils.

4. Carrying out promotional competitions through influential institutions and effective media.

- **The role of cooperative societies regarding investing in palm cultivation**

The cooperative sector is one of the components of the non-profit sector whose contribution is required to achieve the Kingdom's Vision 2030, and approximately 40% of cooperative societies in the Kingdom are agricultural societies. If we want to build a guiding model for investors in palm and dates through cooperative societies, this will depend on the nature of existing practices and the extent to which the formed departments are prepared for cooperative societies that often lack investment methods. This model is assumed to take the participatory form that takes into account the engagement of the private and cooperative sectors. The former carries thought and management, while the second provides resources and other logistic services.

There is no doubt that the participation of the public sector of this model will have a tangible impact through the support, facilities, and exemptions provided. It is worth noting that cooperative societies contribute more than 40% to the GDP of the Dutch economy, and there are more than 60,000 cooperative societies in Turkey, while in Egypt and Malaysia they exceed 30,000 cooperative societies. For this, the establishment of cooperative societies specializing in the production and cultivation of date palm and dates are of great economic and social importance. The most important is the type of palm trees and dates, the degree of their quality and nutritional components, and their acceptance. Such societies will be a great help in production efficiency and in reducing costs. They will also play a role in overcoming marketing barriers by unified procurement of production inputs and marketing contracts.

- **Dates manufacturing industries: Their feasibility and development**

Besides dates, there are manufacturing industries that depend on the palm trees and their derivatives, which are an important source of income (such as making paper, compressed coal, oil, feed, and other products). The questions that may be raised in this regard include: How economical they are? Why is investment still weak?

Manufacturing and exporting are inseparable processes. An advanced industry without export is a waste of resources. Therefore, the manufacture of dates and their derivatives requires advanced export programs supported by high marketing programs to know global markets and ways to enter and access them. There must be a clear parallel line with a starting and ending points to know the path of the product from dates so that efforts are not wasted.

Manufacturing some date products does not require high technology, and this is what makes investing in this tree a lucrative worthwhile business since the Kingdom's production of dates is abundant and worthwhile. Fortunately, each region of the Kingdom has a cultural peculiarity concerning products related to dates, as sweets that are made from dates in Al-Jouf is not known in other regions of the Kingdom, in addition to the sweets in Qassim, which also depend on molasses as one of the main components. We may find the same in Al-Ahsa, Bisha, Hail, Al-Kharj, and Najran. There is richness in the Saudi culture in this section, which is something that can be used economically so that we do not find recurring products, which creates unique job opportunities in every region without fear of falling into repetition or harmful competition.

In this regard, we can refer to the efforts of the sons of Prince Abdul Rahman Al-Sudairy in the city of Al-Ghat, and Al-Fakhera Farm with its products from dates and date juice that are produced and packaged outside the Kingdom in Europe. We may also refer to the paste of the seeds of the dates which form a very suitable material for animal feed, after being soaked, cooked, and treated in simple ways that do not require advanced technology. Thus, there is no doubt that the palm tree has many economic benefits, and if taken care of it will be a suitable source of income for many farmers, after solving the water problem.

Many products emerge through the derivatives of dates and in various forms. They are used in the manufacture of sweets, refreshments, and powder, as well as in medicinal drugs, fodder, etc.

However, the most important factors in the dates industry for the Kingdom's products of dates or palm trees to be known regionally and even internationally are the following:

1. Sustainability by reducing the amount of wastewater per kilogram of dates or making use of healthy water recycling in line with the environmental requirements.

2. Localization of all phases of the date industry and studying it so that this industry will be an integral part of the social and economic balance in the Kingdom, where certain nationalities control the stages of production as well as the final product.

Recommendations:

- Setting up a national program under the supervision of the Investment Fund concerned with palm trees and their products, to find a one-stop-shop for everything that serves the production and marketing of dates, providing technical supervision and logistical support for date palm farmers. This will have a major role in organizing date exhibitions at home and abroad. This will also draw attention to the date palm tree and dates as strategic commodities in the sense that all the possibilities available for its development are harnessed.
- The importance of having a clear vision and strategic objectives and goals for date palm cultivation dates production and the manufacturing industries dependent on it. This will be based on statistics that are constantly updated, and dates will be included as a strategic food commodity in the Kingdom.
- Part of that strategy is showing interest in manufacturing industries dependent on the palm and its derivatives, such as making paper, compressed coal, oil and feed, and using palm waste to produce alcohol, wood, and fertilizers.
- Entrusting the Export Development Authority with establishing a department specialized in exporting palm products.
- Benefiting from successful international experiences in exporting dates, such as the experience of “Tunisia” in establishing a joint professional complex of dates that includes producers, exporters, and date manufacturers with representation by the government sector.
- Activating the results of scientific studies and research in irrigation of date palm farms, particularly in drip irrigation, to provide groundwater in the Kingdom. Besides, providing awareness, training, and marketing programs in the field of date palm products and dates.
- Providing supervision by the Ministry of Environment, Water and Agriculture on the establishment of educational courses aimed at empowering farmers to familiarize them with the international best practices in the palm sector to improve the production, manufacture, and marketing of Saudi dates, and to enable the farmers and producers to compete at the international level.
- The importance of obtaining permits and coordination by the competent authorities for palm cultivation operations based on the feasibility of water availability, area distribution, and marketing.
- The need for establishing a global exhibition demonstrating the power of industry and crafts in the field of date palm cultivation and the manufacture of date derivatives, with thinking about highlighting a competitive brand in global markets.
- Inviting male and female students in schools to workshops to understand their preferences and achieve more of their inclinations in making attractive date-dependent candy products.

- The importance of local dates companies under the umbrella of the Public Investment Fund to intensify their investments in the field of date manufacture and strive for further development and progress in this vital field.
- Encouraging and stimulating the establishment of more cooperative societies in palm cultivation and the manufacture of date derivatives to achieve the Kingdom's vision in the non-profit cooperative sector. This may take place through support, facilitation, and tax exemptions to perform their role in raising production efficiency, reducing costs, and overcoming marketing barriers through the unified purchase of production inputs and marketing contracts.
- Healthy recycling of date palm cultivation in compliance with environmental requirements.
- Localizing all stages of the date industry to be part of the social and economic balance in the Kingdom.
- It is important to take into account the comparative advantage of date cultivation in the regions, governorates, and cities of the Kingdom.
- The Ministry of Environment, Water, and Agriculture should encourage national cadres specialized in date palm cultivation, support, encourage and protect investors in this field and the date industry to preserve this large economic resource. The Ministry should also provide technical, consultative, and logistical support in general for the benefit of palm farmers, individuals, and facilities. This support includes overcoming difficulties and procedures with the relevant government agencies.
- Considering the possibility of establishing water treatment plants, especially in major cities and governorates, to reduce water waste and benefit in palm cultivation.
- Reducing investment chaos in financing palm cultivation projects that does not link this to clear performance standards. This will raise the level of local content and product quality.
- Establishing controls to limit the spread of the phenomenon of covering up in the labor force that negatively affects palm cultivation in the Kingdom.
- Coordinating with the Export Fund and the Industrial Development Fund programs to support date products locally and globally.
- Establishing a balance between encouraging foreign investment and raising the percentage of local content and employment in date palm cultivation and date industry.
- Paying attention to the logistics and infrastructures for the export of dates and their products.
- Allowing the recruitment of seasonal workers during the harvest time for a period of two months. This can be done through recruitment companies or agricultural cooperative societies.

- Supporting date-based industries as local alternatives to some imported products in light of the high prices.
- Submitting a proposal to the Ministry of Education through its Research and Development Office that the research efforts should be collected from centers and chairs that are concerned with date palm cultivation and date production under one umbrella.
- Creating a database that includes the latest data on palm and dates, research results, and experiences on red palm weevil and its various names and documenting the stories of the elderly on it.
- Hosting promotional competitions and giving awards to families producing Saudi cake with dates under certain conditions to reach the international similar to Zakher Cake (Austria), Donuts (America), Cheesecake (Britain). The collective effort may prosper through developing the Kleja sweets to be marketed on a larger scale than the Gulf region and to promote this through effective media institutions.
- Create an award in the name of King Salman along the lines of the Khalifa International Prize for Date Palm and Agricultural Innovation, and for the abundance of exports, manufacturing dates leftovers, and rationalization water used for irrigating palms.
- Stopping date palm cultivation in areas where groundwater consumption exceeds standard economically feasible production, to preserve water.
- Supporting and encouraging centers and companies specialized in exporting and marketing dates and their derivatives globally.
- Providing the necessary exemptions for raw materials, semi-manufactured materials, and finished materials that are included in the components of the dates production and their derivatives to achieve the competitive advantage of the Kingdom's dates in the global markets.
- Establishing procedures that regulate the rights and duties of both the farmer, investor, producer, and exporter alike under laws, legislation, and rules. This means that the palm sector shall be managed through clear joint management in which there are no gray areas between the government and the private sector and the Ministry of Environment, Water, and Agriculture and the National Date Council and the relevant authorities.
- Establishing an electronic platform for date palm cultivation, production, and marketing of dates, in which the farmer, investor, researcher, official and interested parties will find sufficient data and information on the date palm and their leftovers.
- Spreading specialized knowledge among all target groups to highlight international and regional efforts in combating the weevil.
- Interest in conducting economic feasibility studies to get acquainted with the profitability of manufacturing date palm and waste, and the extent to which it can achieve economic efficiency and its impact on the national economy.

- Establishing specialized centers for collecting palm waste, to facilitate manufacturing operations, and setting incentives.
- The local media should play their role in disseminating specialized scientific knowledge among all the targeted groups, and agricultural guidance by guiding farmers on the importance of making the best use of their palm cultivation and the utilization of their fruits, waste, and leftovers in many industries and sensitizing them to cooperate to achieve the goals of sustainable development.
- Urging the responsible authorities to take the initiative to supply the Saudi embassies abroad with sufficient quantities of Kleja to distribute them as gifts alongside dates. This can be part of promoting Saudi exports and products. Moreover, a booklet titled **Types of Dates Famous in the Kingdom** may be distributed as gifts. The book is issued by the Ministry of Environment, Water, and Agriculture in Arabic and English, and it won Khalifa International Award for Dates.
- Establishing date factories that are near the historical tourist attractions (Al-Diryia, Al-Madinah, ...), that open their doors to students and visitors of different nationalities in coordination with the relevant authorities, with each factory containing a museum and live displays of palm-related activities.

Desertification and Environmental Offences in the Kingdom of Saudi Arabia

Summary:

Desertification is an environmental challenge that faces the Kingdom of Saudi Arabia, which is exerting good efforts to overcome through applying the "Convention of Combating Desertification" and other mechanisms included in the Saudi Vision 2030 that aim at pursuing environmental sustainability.

The Kingdom of Saudi Arabia is classified among the dry regions that are severely affected by the increasing effects of desertification in most regions. This led to the degradation of productive lands and multiplied effects. The Kingdom has varied natural resources that constitute the main basis of economy and lifestyle. However, such resources have been decreasing as a result of harsh environmental conditions, including dry and semi-dry climates, as well as infertile soil of most regions, which makes these resources highly degraded and leads to spreading desertification.

The development in its comprehensive sense does not only paying attention to economic resources and their utilization, but it also includes the preservation and maintenance of the environment and the optimal use of its resources. This confirms the need to encounter the problem of environmental desertification and ensures a comprehensive compatible development with Vision 2030.

The Kingdom is threatened by desertification due to its geographical nature. Raising awareness at public and official levels becomes essential to show and encounter the catastrophic impacts of this phenomenon, to reduce its repercussions, and to preserve the remaining aspects of the environment.

There are issues related to environment of the Kingdom that are difficult to control, although there are some less-expected and limited efforts; such as, projects that combat sand shifts, establishing national parks in some areas, encouraging environmental tourism, and emerging social parties that have a voluntary desire to afforestation and increasing vegetation, though they are lacking in organization, and relying on individual efforts that are dominated by enthusiasm and commendable competition in governorates.

There are two main causes of desertification: climate change and human activities. Overlogging is an indicator of desertification in the Kingdom of Saudi Arabia, which increase when weather conditions becomes cool, in addition to overgrazing in poor pastures. Desertification also increase due to spreading rock crushers, garbage disposal areas, landfills in valleys, as

well as increasing deserted lands due to stopping cultivation of some crops. All this is magnified by the low level of interest in environment by a large proportion of people.

Mitigating the effects of desertification also includes enacting laws that limit desertification. They curb activities and punishing violators that cause desertification. In addition to law's enactment, awareness is raised on the risks of desertification on environment and people.

There is an official interest in encountering the problem of desertification, including the establishment of an integrated program by the Geological Survey Authority to study desertification. The program is concerned with desertification and its degree and extent in various regions of the Kingdom. Further, it identifies and determines the hydrological, climatic and geological factors that are causing desertification. In addition, the Ministry of Environment, Water and Agriculture launched two initiatives for sustainable development of forests and rangelands that regulate investment and combat desertification.

Wrong human behavior is a contributor to desertification. This is in addition to reverse migration to cities, expansion in the construction of housing and industrial cities at the expense of cultivation and agricultural lands, as well as the over-hunting of animals and migratory birds, overlogging, and water waste, which are all fundamental causes that result in desertification.

Recommendations:

A number of recommendations were given relating to desertification including:

- Engaging unemployed youth in land reclamation with the support of banks in financing their projects as a matter of social responsibility.
- Establishing environmental police with executive powers to fight saboteurs who are hunting or overlogging through imposing severe penalties.
- Enforcing factories to plant specific numbers of trees to mitigate the effects of carbon emission.
- Using treated wastewater to grow tree fenders to stop the drift of sand to cities.
- Encouraging research to find innovative solutions that stop desertification and draining of natural resources.
- Changing the name of the Wildlife Conservation Authority into the Environment Preservation Authority.
- Encouraging the cultivation of small home gardens.
- Creating natural reserves.

Introduction

Desertification is an environmental challenge that faces the Kingdom of Saudi Arabia, which is exerting great efforts to overcome the negative consequences through applying the "Convention of Combating Desertification", and through using other mechanisms included in Vision 2030 that aims at pursuing environmental sustainability.

The Kingdom of Saudi Arabia is classified among dry regions that are severely affected by the increase of the impact of desertification on all of its regions except the southwestern region that falls within the semi-arid region due to multiple rainy seasons and heavy rain. The effects of desertification appeared in most parts of the Kingdom, and resulted in degrading rich soil and amounting impacts. The rich and varied natural resources of the Kingdom of Saudi Arabia constitute the main base of its economy and residents' lifestyle, but such resources have been decreasing as a result of harsh environmental conditions, including dry and semi-dry climates, and infertile soil of most regions, which make them highly degraded and which lead to spreading desertification.

Therefore, desertification and aggressions against the environment in the Kingdom of Saudi Arabia are important issues raised by Asbar Council under the themes: desertification and its impact on agricultural production; official interest in the problem of desertification; some visions to confront desertification, Riyadh Municipality's initiative to encourage individuals to cultivate crops; environmental, economic, and social consequences of desertification; increasing desertification and environmental imbalance; Vision 2030 and the expansion of reserves; human activities and weak environmental awareness; most important factors of desertification; some ideas for reforming the human behavior beyond desertification; making use of ablution water in planting trees.

Before talking about "desertification", it is necessary to point out that development in its comprehensive concept does not only mean keeping and benefiting from economic resources, but it also includes preserving environment, maintaining and optimizing the use of its resources. This confirms the necessity of facing the problem of environmental desertification, which results in comprehensive development that is consistent with Vision 2030.

According to the United Nations Convention to Combat Desertification (1994), which was effective in 1996, desertification refers to “land degradation in arid, semi-arid, dry and sub-humid areas, due to many factors, including climate changes and human activities."

According to the United Nations reports, the desert areas in the world are about 46 million square kilometers, of which the Arab world's share is about 13 million square kilometers, or 28% of the total desert areas. Deser-

tification loss is annually estimated $ 40 billion of agricultural crops and increasing prices. The desertification loss of developing countries is estimated $ 16 billion annually.

The Kingdom of Saudi Arabia is included within the highly fragile and desert areas, due to its dry desert climate except parts of the southern region. Moreover, forests represent 1% (2.7 million hectares), while vegetation represents 70% of the land area of the Kingdom of Saudi Arabia. Surveys of the Saudi Ministry of Environment, Water and Agriculture (conducted in 2017) indicate that there are 131 plant families in the Kingdom that include more than 2,500 plant species that are threatened by desertification due to soil impoverishment and the decline of vegetation, which resulted in diminishing animal diversity and disrupting the ecosystem.

The causes of desertification in the Kingdom can be related to several factors, including:

- Climate change and recurring droughts
- High temperatures
- Intensive usage of natural resources
- Increased population activity
- Overgrazing and over-logging
- Water erosion, and wind gusts that are followed by dune sand creep
- Wrong agricultural methods

If we exclude the climatic factors, the phenomena of drought, high temperatures and sand creeping as natural uncontrollable factors, we realize that human activity is central to desertification. Human activities include overusing natural resources, expanding agriculture using wrong irrigation methods, harmful logging and grazing, the population and urban sprawl, building and construction, lacking scientific methods of waste recycling and using machines that cause environmental pollution.

Don Shatti (1996), a development expert who conducted extensive field studies in the Sultanate of Oman and Lebanon, noted that cars, for example, in the Gulf and the Levant region contributed a lot to the desertification of some pastoral areas where grass and plants grow that do not need plenty of water, including some valleys, like the valleys of Makkah (i.e., the valleys of Fatima and Numan), and the valleys of the southern region (Bisha and Tathleeth) despite the heavy and sufficient amounts of rain in these valleys (Ministry of Environment, 2017).

There are several official bodies in the Kingdom of Saudi Arabia directly concerned with desertification, including the Ministry of Environment, Water and Agriculture, the Saudi Wildlife Authority, the Ministry of Municipal and Rural Affairs, the General Presidency of Meteorology and Environmental Protection, and the Geological Survey Authority. The latter has carried out

extensive studies on desertification in the Kingdom of Saudi Arabia, which concluded several results, including:

Desertification is a global phenomenon associated with global warming, and it is extremely important to be monitored in the Kingdom by remote sensing methods, setting indicators for desertification, monitoring related hydrological and geological factors, limiting land usage methods, and identifying areas prone to desertification. The study recommended the need to maximize the benefits from voluntary associations and their role in spreading environmental awareness, and the role of the Ministry of Environment, Water and Agriculture in afforestation. The study also focused on the importance of public awareness to preserve environment, which results in economic return. Desertification, according to global reports, leads to poverty and migration from countryside to cities, impoverishing resources, causing environmental implications which, in turn, affect the overall development process.

Finally, the issue of desertification is totally technical. However, the researcher wanted to emphasize that the Kingdom of Saudi Arabia is liable to desertification because of its geographical nature. Therefore, it is essential to raise public and official awareness of this serious phenomenon to reduce its repercussions and preserve the remaining aspects of the environment.

Regardless of different desertification definitions, the most appropriate one should contain environmental and human factors. The Food and Agriculture Organization (FAO) summarized the definition in a group of geological, biological, human and climatic factors that lead to physical, chemical and biological degradation components of soil in arid and semi-arid regions, which lead to an impact on environmental diversity and human groups. However, the environmental factors of the Kingdom of Saudi Arabia, are difficult to control, although there are limited efforts such as projects of combating sand creeping, establishing national parks in some areas, encouraging environmental tourism, and emerging community bodies that have the voluntary desire to increase planting trees and vegetation. Such projects are rather undisciplined and subject to some enthusiastic individual efforts with commendable competition. In addition, there is no specialized high-level center in the field of desertification control in spite of the bad need to do so.

Desertification in the Kingdom of Saudi Arabia includes:

- Overlogging during times of lower temperatures.
- Pastoral overgrazing in poor pastures.
- The spread of crushers, landfills and waste recycling in valleys.

- Increased deserted land after stopping the cultivation of some crops, resulted in increased desertification, dust, and abandoned wells that became traps for people.

- Lacking interest and knowledge of a large segment of society members in various forms of environment.

The Ministry of Environment, Water and Agriculture launched initiatives that was lacking implementation, such as:

- Developing forests and tree site, which aims to plant 10 million trees, and to rehabilitate vegetation in an area of 60,000 hectares by the end of 2020. This initiative is limited to using local plant species with the use of renewable water sources, such as the use of rain harvesting techniques and treated wastewater to maintain water resources.

- Reducing pressure on rangelands, developing vegetation, transforming into modern patterns of livestock breeding, and boosting the efficiency of animal production.

- Developing national parks in all regions to be biological diversity centers.

- Supporting Ecotourism

The impact of desertification can be mitigated or reduced through:

- Creating a reference desertification authority that manages the efforts of multiple agencies, and establishing an advanced research center to combat desertification, which includes an advanced database with outputs that reduce the impact of desertification.

- Promoting the use of wastewater around cities.

- Expanding the activities of Royal Reserves to include adjacent areas.

- Expanding the development of agricultural terraces in the southern and southwestern regions.

- Encouraging the private sector to invest in developing national parks, establishing external gardens, and taking advantage of the relative features of each region, as well as investing in importing wood.

- Establishing the environmental police sector.

- Allocating prizes to environmental activists in the community, and promoting the concept in educational institutions of all levels.

- Organizing societal environmental bodies in the regions and enhancing their efforts.

Desertification is defined in Wikipedia as: A global problem, from which many countries around the world are suffering. It is also defined as a decrease in the biological production capability of the land, or the deterioration of fertility of productive lands at a rate that creates conditions similar to the desert climate conditions. Therefore, desertification decreases the plant life

production. The total desertified areas in the world have reached up to 46 million square kilometers, of which the Arab world shares about 13 million square kilometers, or about 28% of the total desertified areas in the world. It should be noted that desertification affects the proportion of some crops production, caused by drought in many regions, especially in the Arab world.

In sum, there are two main causes of desertification:

- climatic changes

- Human activities are divided into governmental and individual matters. The first has a greater effect. The second is less effective, and it can be somehow controlled.

The ways of mitigating the effects of desertification are:

- Enacting laws that limit desertification-causing activities, and punishing those who violate them.

- Increasing awareness of desertification impacts on the environment in general, and on people in particular.

- Launching projects to combat desertification (there are many proposals, the most important of which are planting trees that are suitable for the environment).

In sum, human consciousness is the outcome of all the above points, because, regardless of any governmental efforts, low awareness level and lacking individual responsibility in dealing with environment will remain one of the biggest causes, particularly in environments that are mainly deserts with low cultural and social levels. The problem of desertification will face the same obstacles that threaten mankind due to bad practices of the human beings themselves. Some of these problems are completely human such as drugs, smoking and obesity. However, some problems humans can largely control, such as poverty, epidemics, and some diseases. Human control of some other problems is weak, such as environmental and climate problems, including desertification. This does not mean that everyone will give up responsibility, but rather we must study the matter more logically, and mitigate its effects on humanity.

Since the very beginning of existence, the Earth has been in a state of constant but slow and unnoticeable change over centuries, which may have transformed environment from one state to another. So, Man was not really responsible for such changes, though some of human practices help them to happen. However, changes have been inevitably taking place, whether Man stops or continues their practices.

Contributions

Desertification and the impact on agricultural production:

More help is needed regarding the current impact of desertification on agricultural production, and on human and animal food, because desertification includes vegetation in particular and does not include lands designated for agricultural production and irrigation.

The food resources in the Kingdom of Saudi Arabia are secured only through import or local agricultural production (i.e., vegetables, animal, poultry, fish). It is expected that desertification will have an impact on the quantity or quality of agricultural production, either directly or indirectly, especially open cultivation. However, the use of technology in the field of local food production, such as greenhouse projects, hydroponics, fresh dairy projects, or poultry projects, may limit such impact.

The present agricultural production in the Kingdom does not take into account the environmental conditions correctly. I mean in this respect the abuse of water resources and lacking the use of appropriate irrigation methods that take into account water scarcity that comes mostly from non-renewable resources of groundwater. The problem started to appear in the regions of Al-Qassim and Hail, as in some areas water went deeper, and agriculture became impossible, and resulted in a shortage of animal feeding and increasing import prices.

In sum, desertification means shrinking vegetation and agricultural production in general, of which some problems farmers also faced as a result. For example, the government stopped buying wheat from farmers in high-promoting prices, because of the shortage and depletion of water, and preferred to import it. In other words, desertification is also linked to water scarcity and lacking the proper usage of the available water.

The Official concern of desertification problem:

Is there a synergy in the efforts of concerned bodies? What are the existing initiatives that these authorities are presenting to eliminate desertification? How can such initiatives be developed to get better results?

The Saudi Geological Survey has established an integrated software to study desertification (Desertification Application). The program aims at exploring the degree and extent of desertification in various regions of Kingdom of Saudi Arabia, defining the indicators of desertification, and determining hydrological, climatic and geological factors causing desertification, as follows:

- Determining and evaluating current land uses.

- Identifying areas that are prone to desertification through using remote sensing techniques and geographic information systems in analysis and monitoring.

- Implementing some field studies of areas that are subject to degradation, including hydrological and soil studies, as well determining natural and cultivated vegetation and the extent of degradation.

- Evaluating lands for different uses, and the optimal practices in line with the plan of agricultural and social development in the Kingdom of Saudi Arabia.

- Preparing a monitoring program to determine the current land degradation, in addition to monitoring sand drift.

- Developing appropriate and scientific solutions and recommendations to limit the spread of desertification, and preserve areas that will be subject to future deterioration.

- Identifying factors that help develop infrastructure and economy for local communities, and improve their living conditions.

- Training national cadres to prepare land usage maps, monitoring and evaluating the resulting changes, and establishing and managing databases.

Here is a quote from an article published in Al-Hayat newspaper on March 24, 2018 stating: The Ministry of Environment, Water and Agriculture launched two initiatives for sustainable development of forests and rangelands, organizing investment and combating desertification, by planting 4 million trees, providing 6 million seedlings, as well as reclaiming 60,000 hectares of pasture lands, and rehabilitating more than 100 targeted sites for on-road parks, as well as the development of 24 public parks in the next four years, in addition to 17 initiatives to develop and promote environmental work. The article also reviewed the initiative of the application of "afforestation" intended to be launched soon.

The Ministry also celebrated the "World Forest Day," and it confirmed on its online site the effects of climate change in cities, pointing out that air pollution annually kills about 5.5 million people around the world.

The Ministry stated that a single tree can absorb about 150 kilograms of carbon dioxide annually, and city trees contribute to mitigating the effects of climate change. In the same vein, the "Chicago Trees" initiative in the United States of America estimated that a single tree stores 521 thousand dollars of carbon annually.

A recent study revealed that one large tree can be enough to provide four people with oxygen for the whole day. City trees contribute to reducing pollutants and harmful particles, and help combat air pollution. The study showed that a forest in a city removes 1,821 metric tons of air pollution.

Forests in Saudi Arabia cover 27 thousand square kilometers with a percentage of 1.26% of the total area of Saudi Arabia. The majority of forests are located in the southwestern regions, specifically in the highlands. The

vegetation in the Kingdom, whether forests, pastures or parks, suffers from reducing production, diminishing biodiversity, and expanding desertification.

The 'Cooperative Association for Yusr and Desert Plants' has referenced the deterioration of the desert vegetation in the Kingdom to the following reasons: expanding urban growth and increasing livestock, which is reflected in the inflation of the overgrazing process, the increase in demand for firewood, which accelerated the growth of the logging process, as well as increasing population, and facilitating the possession of cars, liability of plant communities to be crushed, in addition to the lack of environmental awareness in social communities, the lack of integrating protection processes from the concerned authorities, and the harsh environmental conditions in the desert environment.

These are the factors that led to the deterioration of the vegetation cover in these environments. There are calls made to the concerned parties to exert their best effort to avoid this degradation, and find ways of treatment. Thus, it is important to establish environmental police.

The initiative of planting 4 million trees and 6 million seedlings is wonderful, but this may lead to over-usage of water, so this is a critical question. Instead of using natural grass, it has recently been noticed that artificial grass is used. Though it has a beautiful sight-seeing, it increases the causes of desertification.

Ways of combating desertification:

Large quantities of water can be provided by wastewater treatment. There has to be a system adopted to know how they are delivered to neighborhoods to irrigate trees. For parks and streets, tanks can be used until an independent network is constructed.

Another source of water usage to increase water conservation is to designate a pipeline for bathrooms and gardens from treatment plants.

There is a proposal for using surface water, as it is not deep and does not need deep wells, some of which is used in neighborhoods and for building works.

In terms of benefit and return for human beings from different kinds of animals, the livestock and camels do not produce enough food for humans. This means that the quantities of food eaten by animals do not result in enough quantity of protein. For example, if a living sheep's weight is 30 kg, only half of such weight will remain for human consumption. In case of poultry, the return may be the same as the case of fish farms up to 80%. Therefore, we do not have the luxury relying on protein sources of red meat. However, some people may say that this is an exaggeration, but it is true. Therefore, increasing natural reserves and preventing grazing for not less than five years is essential. It is noticed that the protected lands from

individuals or military training areas, which people do not visit, are rich with vegetation.

There are contributions in nurseries and cultivation of desert plants in some areas of the Kingdom with less in the northern region. These plants can be planted in rainy seasons, as well as spread around cities, since they do not need much water.

We have thousands of camels belonging to people in the Gulf region, not only got benefits of the grazing areas in Samman and the north, but sadly benefit from the State's subsidized low-price barley.

In addition, we should reduce dependence on red meat for its environmental cost. Import as a solution may be better than consuming our environment. The Tree Day or Tree Week can be activated, in which students go out to plant trees in their city or village. Some active associations on Twitter interested in the environment are also campaigning to grow wild plants in the desert pasture. Some people have called for establishing a security force to combat unjust logging, particularly the plants that have a role in soil consolidation. The basics of logging are to cut the dry part of the tree.

It is important to prepare professional film materials that stimulate interest of more vegetation, educating hikers and herdsmen that their interest in this vegetation and planting tree types are for their goodness. In doing so, a person is contributing to create a better future for their land, especially the country is heading to fight against logging and opening imports of firewood and coal from multiple external sources in the present.

Such film materials should be qualitative, short and selective of wonderful ideas. They also should be published via social media, and every single material should be celebrated and praised over social networking. In fact, individual-designed materials have wide acceptance and audience.

Riyadh Municipality's initiative:

This is an amazing initiative in this context, which we need in all Saudi regions. At individual level, Riyadh Municipality launched a service to encourage individuals to cultivate by logging in the website: tashgeer.com to order trees. The requesting person is contacted and a committee checks their location and tree-site suitability, then the tree delivered on site.

If the person does not know how to plant the tree, the Secretariat has provided through its site graphic details on how to plant. The site also provides pictures of some proper trees for planting and beautifying sidewalks with available graphics for every type. There is also a support team for assistance.

Environmental, economic and social consequences of desertification:

According to some studies on the topic, there are many environmental, economic and social consequences of desertification, including:

First, environmental results:

- The deterioration of plant and animal life, as some plant and animal species have already become extinct.
- Degradation of soil and pastures.
- Decreasing agricultural area.
- Shortage and deteriorating quality of water resources, including high salinity. All these are resulting from the improper and misuse of the resources.

Ultimately, environmental degradation can be a major factor in climate change.

Second, direct economic results:

- Land degradation and desertification appear in the disability of countries to produce food, which in consequence, is reflected in reduced regional and global food production capabilities, causing food deficits in threatened areas.
- Impacts on food reserves and food trade in the world. In other words, desertification has a negative impact on food security.
- Because desertification causes the destruction of plant life and the decrease of many plant and animal groups, it is one of the main causes of the loss of biological diversity.

Third, social consequences of desertification:

- Reverse migration, which represented in the increase of the migration of the village dwellers to the cities seeking work and better life. The reverse migration results in increasing pressure on the limited capabilities of the cities, and contributes to increasing the rate of population growth in faster than the growth of the villagers.
- High urban growth rates are a burden on governments to provide consumptive social services at the expense of productive infrastructure. The village-urban migration pressure generates many social problems in cities, such as, low life standard, unemployment, lack of health and education services, and lack of housing, social tensions and conflicts, and disturbing security...etc.
- Emptying inhabitants of villages and abandoning the land also contributes to continuous desertification.

Growing desertification and environmental imbalance:

Environmental imbalance is a main factor leading to desertification. Some documentaries also prove that the causes of weakening or dying Talh trees is hunting of migratory birds, which resulted in spreading insects that live between the outer shell and the root of the tree, blocking food and water transport from the tree veins to the upper branches. Moreover, these insects penetrate the outer shell and lay their eggs under the bark. The timing of proliferating and mating of these insects coincides with the season of bird migration. Birds were feeding on these insects; which people began hunting randomly and at a large scale. Therefore, birds become instinct and no longer eating these insects, which reproduced fast and quickly, and resulted in imbalance between these insects and bird numbers, and in insect's predominance and an inevitable elimination of acacia trees.

2030 Vision and expansion of reserves:

Expanding the reserves according to Vision 2030 is a positive step. To complete successfully, reserves should be distributed over big companies, such as Aramco, SABIC, and some banks, which optionally choose how to develop within the framework of their social responsibility, creating a competition between them through designating an annual award to the best developed reserve. In doing so, desertification control can be achieved.

Some scholars believe that there must be criteria for assigning reserves to corporate social responsibility programs, such as Aramco, SABIC and some banks, because these companies are not specialized in environmental life. They may bear the financial part, but the most important part is execution.

Human activities and poor environmental awareness are the most important factors in desertification:

More focus should be given to the issue of desertification and aggression on the environment, including an article, entitled: "Dubai plans to implement a huge park that is friendly to environment", *Journal of Environment and Development,* July /August 2017 / number 232*. The article states that “Dubai is working on a promising plan to build a public park that is environment-friendly, with an area of 1.43 square kilometers. This park will be the largest in the Emirate. Upon completion, it will provide various purpose areas that allow people to practice their favorite activities all the year.

The park includes 20 km running tracks, 30 km paths, more than 7 km of natural roads, over 14 km of bike paths, 45 different sports fields, 5 major activity areas, 55 children's play areas, in addition to dedicated spaces for shops, restaurants and cafes.

The park will adopt clean solutions that help protect environment and support sustainability efforts, because it will use innovative solutions that help reduce water consumption up to 5 liters per square meter, in addition to cultivating between 10 thousand and 15 thousand local and acclimated trees.

The park will not only be a sport and leisure destination, but a place to test new innovations and environmental sustainability solutions. It is planned to use innovative solutions for on-site electricity generation, applying reverse osmosis desalination, waste recycling, natural shadow technologies, as well as smart cards for tickets, purchases and Wi-Fi technologies.

Dubai Municipality and the investment group "Dubai Holding" signed a memorandum of understanding to launch the park, which is scheduled to start the implementation of its first phase by the end of this year, according to the information office of Dubai government.

Public-private partnerships in UAE provide an effective way to accomplish sustainable development projects, through their contribution of attracting national, regional and foreign investments, achieving economic and social goals that concern society, and boosting the State's competitive position.

The second article entitled: (The Arab Environment in Ten Years: Statement and Public Opinion Poll) - July / August 2017 / No. 232*. The "Arab Environment in Ten Years" mentions the topic of the tenth annual report issued by the Arab Forum for Environment and Development (AFED), which will be launched at its annual conference to be held in Beirut next November. The report tracks environmental changes over the past decade, based on 2008 Forum Report as a basis of comparison. It highlights changes in environmental management and policy, with a particular focus on the topics of water, energy, food, air quality, environmental scientific research, and green economy. The report documents success stories, as well as failures, to conclude and suggest remedial actions, and to chart a better course for the future.

The Forum had discussed the report drafts at meetings held in Cairo, Amman, Beirut and Marseille, to benefit from the experts' comments in preparing the final texts. Secretary-General Najib Saab said: in the subject of governance and environmental policies, drafts showed that regional decisions did not turn into actions on the ground, despite dozens of environmental declarations issued by the League of Arab States. Conversely, actual developments took place at the national level, since 12 Arab countries adopted sustainable development strategies, and policies were launched to enhance efficiency and adjust energy and water price subsidies. The Arab countries were shown as they allocated more resources in the fields of green economy and finance, and initiated measures to diversify and green

economy, as in “Saudi Vision 2030” ″, and in green economy strategy in the United Arab Emirates.

Though there are positive changes in water management, renewable water shortage continued due to overpopulation, pollution and droughts. Wastewater treatment did not exceed 60 percent, as well as most of the treated water was not used due to lack of infrastructure. The desalination industry is still almost entirely dependent on imported technology and equipment, even though the Arab countries are the most producers of desalinated sea water.

The report drafts revealed an increasing interest in energy efficiency because of huge investments in renewable energy, particularly in Morocco, UAE, Saudi Arabia, and Jordan. A trend in recent years was marked in some Arab countries to use nuclear energy and coal in a type of energy mix, in a reverse direction of global decline in both areas. Carbon dioxide emissions were doubled in ten years, while air pollution levels in Arab cities rose seven times than the accepted level the World Health Organization accepted.

In conjunction with the report, the Forum is conducting an Arab public opinion poll to track changes in environmental attitudes for comparison with a similar poll that was conducted in 2006. The new poll included more than 20,000 participants from 22 countries, which were sorted and analyzed for publication in conjunction with the report. The preliminary figures show that about 70 percent of the respondents found the environmental situation in their countries decreased over the last decade.

Civil society organizations of 12 Arab countries will participate in a session to present their views on how to integrate all parties in the sustainable development process. A special session entitled “We are the Future” will be hosted by university students of the region, and will be managed by Dr. Maria Ivanova, Director of the Center for Environmental Management and Sustainability at the University of Massachusetts in Boston.

The lack of security, instability of economy, wars, conflicts and occupations are factors of hindering real progress in the fields of environment. However, this does not justify neglecting environmental work, because the sound resource management is also an effective factor of stability.

It is noticed that human activities and lacking of environmental awareness are the most important factors for desertification and the retreat of green spaces. Therefore, we need the cooperation of several bodies and institutions to deal with this phenomenon. We also need national programs and strategy to protect our environment.

Some ideas of fixing human behavior that causes desertification:

It is clear from members' contributions that the wrong human behavior is essential to the issue of desertification. Reverse migration to cities, expansion in the construction of housing and industrial cities at the expense of cultivation and agricultural lands, as well as the over-hunting of animals and migratory birds, over-logging, and water waste are all fundamental causes that result in the problem of desertification.

The aggressive behavior of humans on the environment should be corrected and fixed soon. The idea of establishing environmental police is a good idea, but increasing people's awareness and adopting a policy of positive change in human behaviors is the biggest challenge. The more human intervention is in natural environmental balance of living organisms, the more environmental problems that affect negatively the quality of human life will be. The same applies to the work on land reclamation. The unemployed youth in particular can participate in this effort, with the cooperation of banks that finance these projects as social responsibility.

Hence, the issue of desertification is a matter of social responsibility, in which all people of different classes, each in their field, must participate, because one party won't be able to achieve any significant environmental reform.

Recommendations:

- Reviving the concept of land reclamation, and engaging the unemployed youth in this effort. Banks may also be called for this effort through funding reclamation projects as part of their social responsibility.
- Launching expanded community initiatives to have green cities and increase afforestation, whereby people have to plant one or more trees in front of their houses.
- Activating the Tree Week in participation of schools and universities in planting a specified number of trees annually in and around cities.
- Establishing environmental police with executive powers to fight saboteurs and unjust logging, and to impose severe fines on violators.
- Requiring factories to plant specific numbers of trees to reduce the carbon impact.
- Using treated wastewater to plant buffers from trees, to stop the sand drift in cities.
- Encouraging research based on innovative solutions to halt desertification and drain natural resources.
- Preparing professional film materials that stimulate more vegetation, educating hikers and herdsmen that their interest of vegetation is rewarded.
- Encouraging cultivating small home gardens.
- Keeping natural reserves.

The Future of Water Resources and Sustainability in the Kingdom of Saudi Arabia in Light of Vision 2030

Keynote speaker: Dr. Ali Al-Tukhais
Speaker 1: Dr. Othman Al-Othman
Speaker 2: Mr. Mohammed Al-Shehri
Moderator: Mr. Walid Al-Harthi

Summary:

Some variables affect the future and sustainability of water resources, the most important of which are: traditional water resources that include surface water and groundwater, unconventional water resources that include desalinated seawater and wastewater, and agricultural and industrial treated water. Other variables include water supply and demand, which represent two sides of the same coin, and both affect the other, either negatively or positively.

There is a big difference between the demand for water and distributed water, and this difference is often covered by private wells, which are often non-renewable water resources. The agricultural sector consumes a very large amount of water, and this means that the strategic planning of water should focus on demand management policies.

Some experts in the field believe that thinking about the traditional resources of water in the Kingdom is useless and that investment and support in protecting and providing water resources should be creative. They also recommend that the efforts must be unified and concentrated in producing water for the main uses in the best and fastest possible ways and at the lowest costs by making use of modern science and technology.

Water scarcity is an important challenge in the Kingdom. The risk lies in the fact that water is a depleted natural resource, so we have to work on achieving a balanced consumption. The estimation of water resources in the Kingdom, especially non-renewable groundwater, is one of the most difficult tasks and may not mean anything but mere numbers, and that the water sector in the Kingdom has suffered from the succession and mismanagement of different administrations. So, there is either an exaggeration in estimating water resources or neglect and indifference.

According to water use statistics, the agricultural sector is the largest consumer of water, and this means that the agricultural sector has become a threat to the strategic water reserve.

There are some suggestions usually made for water rationalization, including applying water harvesting to save rainwater which might take place through digging large tanks at the end of torrents and valleys to benefit from their water in agriculture. Rationalization also may take place through using drip irrigation systems in greenhouse farming and gardens. This can be bolstered through choosing the appropriate trees that do not consume plenty of water. Further, the consumption of water for drinking may be reduced, which will lead to environmental, economic, health, and other benefits. Such benefits may be realized by not expanding the establishment of sewage treatment plants and easy treatment that results from having no water surpluses.

Many recommendations were presented by the end of the presentation and discussion of the topic. The most important of these recommendations are: Linking the sustainability of water resources with the sustainability of renewable energy and providing food to overcome the major challenges facing the Kingdom during the next five years.

Another recommendation relates to modernizing and reforming the water sector, including the National Water Company, and evaluating its administrative and technical performance. Other recommendations were that the investment and support by the government to water technology and treatment must be just as important and valuable as they are towards energy and diversification. Furthermore, it is recommended that regulations and legislations be established that guarantee stopping discharging waste in the water. This will contribute to water development and investing as well as creating a monitoring agency independent of the concerned ministry to address water issues and water bills. The recommendation is also made to monitor the performance and productivity of public and private water companies. More recommendations focused on future and technical research and studies to target water production for the main water use, including drinking and irrigation in cities, industries, and large industrial facilities, and in agriculture, especially in large agricultural companies. Finally, effort needs to be done on making community education and awareness of participation better so that members of the community get engaged and become part of this effort.

Introduction:

Saudi Arabia is ranked ninth on the list of countries in the world liable to water shortage during the next 25 years, but the projects and ideas presented in the "Saudi Vision 2030" confirm that there are plans to overcome this anticipated crisis, whether by rationalizing consumption or by investing in water. As stated in the Saudi Vision 2030, work will be done to combat desertification and there will be an optimal investment of water through ra-

tionalization and use of treated and renewable water, through projects funded by government funds and the private sector.

This vision also confirmed that water use in agriculture will be rationalized, thereby reducing the value of warnings issued by a report of the American Stratfor Research Institute concerning the water crisis in Saudi Arabia, although at the same time, the Institute praised Saudi Arabia's vision 2030 for not neglecting this challenge.

Although technology can alleviate the water shortage and scarcity crisis, in addition to the projects presented in the context of the ambitious and huge goals of the Vision 2030, which will form the future of Saudi Arabia in the post-oil era, yet continuing with the same consumption pattern and the absence of the awareness of rationalization remain the biggest challenge.

Therefore, Asbar Council raised the issue of “The future of water resources and their sustainability in the Kingdom of Saudi Arabia in light of Vision 2030” through the paper presented by Dr. Ali Al-Tukhais, and several contributions made while discussing it including The future of water in the Kingdom, attention to the issue of water in the Kingdom at the official and individual levels, the variables that affect the future of water resources and their sustainability, some proposals for water rationalization. The relationship between reducing water consumption and the possibility of sustainability, examples on the water recycling process, how to continue to maintain the strategic reservoir of groundwater, the balance in consumption to face water scarcity, discoveries that need research and development to sustain water and reduce waste, suggesting the idea of installing a saline water pipeline from the Gulf to Riyadh and establishing a desalination plant in Riyadh, responsibility for supervision on agriculture and water in the Kingdom.

Contributions also covered the feasibility of thinking about traditional sources of water, statistics about the rates of water consumption in the Kingdom, the relationship between water consumption and the volume of water consumption in agriculture, food security, and activating the principle of integrated water resources management.

The Kingdom of Saudi Arabia is located in the southwestern corner of Asia and is described as one of the most desertified and dried countries, with an annual average of rainfall of about 60 mm, including the desert of the Empty Quarter. There are no natural freshwater sources permanently flowing, such as rivers and lakes that feed the aquifers, which are the natural strategic reservoir for all current and future water uses.

It may be beneficial to know about the Kingdom's geology so that we can understand the issue of water better, because of its close relationship to storing groundwater tens of thousands of years ago. Geologically, the Kingdom is divided into two main regions:

1. The Arabian Shield, which includes a third of the Kingdom's area, extending parallel to the Red Sea and includes West Tabuk, West Al-Ula, Hail, West Qassim, West Riyadh, Madinah, Makkah, Jeddah, Taif, Al Bahah, Asir Najran, and Jizan.

The rocks of the Arabian Shield are of igneous rocks and highly solid metamorphic rocks that are scarce in water sources that depend on annual rainfall rates which increase as we head from the north where the Kingdom borders with Jordan until reaching the borders with Yemen. Surface water is defined as the running water caused by torrents and floods and is stored in valleys and in rocks that have been subjected to erosion. Due to the relatively high rainfall rates in the southwestern region of the Kingdom that may reach 400 mm/year, the Ministry of Agriculture and Water has created hundreds of dams to store the flowing water into the valleys, the most famous and largest of which is the King Fahd Dams on Wadi Bisha, the Wadi Baysh Dam, Jizan Dam, Najran Dam, Al-Laith, Khulais, Marwani, and Rabigh…etc.

2. The area of the sedimentary shelf, covering two-thirds of the area of the Kingdom with sedimentary rocks that vary from sandstones to lime, shale clay (torrent). Each type of these rocks has its geological and hydrogeological properties and its hydraulic treatment that affects its ability to store and transport groundwater.

Some variables affect the future and sustainability of water resources, the most important of which are:

First - Water resources:

1. Traditional water resources, which include surface water and groundwater.

2.Unconventional water resources, including desalinated seawater, and treated wastewater, agricultural and industrial water. The competent authorities have many regulations, controls, and laws aimed at preserving water sources from pollution and depletion, but following up on the implementation of these regulations faces many obstacles even though there are many controls for violators of these regulations, the main reason for that being due to conflict of interests.

The environment, with its various elements; water, agriculture, and soil, including wildlife faces bad individual behaviors that increase the acceleration of desertification, and affect sustainable development in general, and water resources in particular, and the following are practiced:

- Excessive logging with its impact on the cohesion of soil and its structure, and the relationship of this negative behavior to the ability of the soil to retain shallow groundwater.

- Overgrazing also exceeds the capacity of natural pastures, where there are hundreds of thousands of livestock of sheep, camels, and others. So, the need for these animals exceeds what is known as the grazing load of pastures, overgrazing stripes the soil and raises its dust at the slightest transient air storm as well.

- Overhunting and encroaching on natural reserves. Here, the call is not made to stop the use of firewood or to stop the feeding of livestock. Rather, the idea here is to put forward some solutions that preserve our environment and begin investing it ambitiously. The most important solutions for excessive logging and grazing are investing in them through importing the necessary materials from countries that have ample resources.

Second: Water supply and demand:

Water supply and demand are two sides of the same coin, and each influences the other, either negatively or positively. Continuing to meet the increasing demands for water to meet the municipal, agricultural, and industrial needs require the constant search for new water sources, developing the existing ones and increasing their efficiency.

The demand for water is increasing significantly, exceeding the rates of natural feeding of water, especially non-renewable groundwater, and here comes our role as individuals, societies, specialized bodies and civil society organizations to work together to manage a diminishing resource in the first place, by reducing the rates of consumption of water to extend the life of the remaining water sources.

At the level of the individuals in the Kingdom, the rate of daily consumption is considered very high compared to other countries. Perhaps the development and improvement of livelihoods, housing patterns, the transformation of luxuries into necessities, the multiplicity of household consumption (where multiple toilets in one house may exceed the number of family members), and the popularity of swimming pools and home gardens that are irrigated with public water networks and others, all have become a source of water waste that increases the possibility of frequent visible and invisible leaks inside homes, which is reflected on the monthly water bill.

The competent authorities also have to monitor leaks from public water networks, as some water pipes explode on public streets as a result of high pressures, and huge amounts of high-cost water are wasted without supervision or accountability. This requires updating and replacing public water networks at a faster rate than what is applied currently. This work requires new initiatives that are in line with the Kingdom's vision 2030, in agreement with the private sector, by investing in refurbishing networks and replacing damaged ones.

Water and food security:

Water and food security in regions that are suffering from water shortage such as the Kingdom of Saudi Arabia can be likened to two poles of magnets, as they are incompatible and cannot meet. This is what the competent authorities responsible for water and food are suffering from. The agricultural sector consumes 84% of the total annual water consumption, and more than 95% of this water comes from non-renewable groundwater, while the municipal and industrial sectors consume 10% and 60%, respectively. So, we have not achieved food security or water security.

The issue of water security in any country is an integral part of comprehensive security. Water is generally used to extinguish fires, and if it is not properly used, it will be a cause for burning countries. Therefore, we as individuals, societies, and stakeholders must deal with water resources with high efficiency and reasonable use, and take into consideration that the water resources currently available are not only the right of this generation but also the property of future generations.

Water - Food - Energy:

Within the modern concept of sustainable development, the sustainability of water resources must be linked with the sustainability of renewable energy, and the provision of food. This is one of the biggest challenges facing countries, including the Kingdom of Saudi Arabia, in which figures indicate that the world's population in 2050 will reach 9 billion people, and these need to provide 55% increase in water supply, 60% increase in food supply and 80% increase in energy. These frightening numbers need us to stop and reflect on possible solutions that will help achieve this difficult equation.

One of the most difficult challenges facing the Kingdom is how to manage a water resource that is constantly decreasing while meeting the requirements of sustainable development. From this standpoint, the Kingdom's vision 2030 came to be the real beginning to find a balance between the needs of each developmental sector of water in a way that ensures the durability of water resources. On this basis, the competent authorities have presented initiatives that the private sector will be engaged in.

Investing in water supply:

Investment in providing part of water needs by the private sector is considered the best innovative solution at present. The Ministry of Environment, Water and Agriculture put forward several initiatives as part of achieving the Kingdom's vision, these include, but are not limited to:

1. Privatizing the Saline Water Conversion Corporation by privatizing its future projects and current assets, to reduce dependence on government

funding. This is also realized by engaging the private sector in financing the stations and improving the efficiency and effectiveness, reaching financial sustainability, and adding financial returns to the Kingdom.

2. Expanding the various target regions in the Kingdom and the engagement of the private sector.

3. Reusing treated wastewater.

4. Enhancing Groundwater Resources.

5. Enhancing surface water resources through dams and harvesting rainwater.

6. Reducing waste in water networks.

7. Measuring water consumption in the agricultural, industrial, and commercial sectors.

Back to the dual problem of water in the Kingdom of Saudi Arabia, which is the scarcity of sources and the increase in consumption, some statistics on water highlight the extent of the problem.

First: Statistics:

- Demand and distributed production:

Demand			**Distributed production**		
	Quantity (billion m3 / year)	Percentage	Source	Quantity (billion m3)	Percentage
Municipal	3.15	13.5	Wells	0.975	31.0%
Industrial	1.00	04.3	Desalination	3.175	69.0
Agricultural	19.20	82.2			
Total	23.35	100.0	Total	3.150	100.0
Treated water (billion m3 / year)					1.55
Percent of treated reused wastewater (%)					16

- *The average consumption per person is 265 liters /day.*
- *Saudi Arabia's water demand increase by one third by 2050.*
- *(Globally), the demand for water for agriculture is expected to increase by 80%, and by 60% for energy by 2025.*

Second: A look at numbers:

Based on the numbers above, it can be said that:

- The agricultural sector consumes a very large quantity of calculated water. This means that strategic water planning must focus on demand management policies.
- There is a big difference between the demand for water and distributed water, and this difference is often covered by private wells. These are often non-renewable water resources. According to the United Nations reports, the use of groundwater for irrigation is the main reason for the depletion of groundwater.
- Desalinated water accounts for almost 70% of the distributed water.
- Although there is a good quantity of treated water which is approximately half of the desalinated water, yet the reuse rate is low (only 16%).

Third: Water demand management:

- **Definition:**

  Water demand management can be defined as: “Any practice, technology, instrument, or policy that results in water being used in a more effective, equal and sustainable manner.”

- **Mechanisms:**

  There are three main mechanisms for managing water demand, and these are:

- ***Rationalizing the consumption of available water resources:*** *This includes many procedures, such as:*
  - Raising the efficiency of water transmission and distribution networks through (systems, maintenance, standards, and technologies).
  - Improving usage practices to reduce water losses.
  - Improving consumer behavior (awareness and rationalization).
  - Developing irrigation methods and raising the efficiency of field irrigation.
  - Changing the crop composition, and devising new strains and species of crops that consume less water and withstand higher degrees of salinity.
  - Avoiding policies that increase water consumption.
  - ***Developing available water resources:*** *This may take place through many procedures, such as:*
  - Dams and reservoirs projects.
  - Reducing water losses by evaporation from tank tops and waterways.
  - Treating leaks from water transmission networks.

- ***Adding new water resources:*** *This may include the following:*
  - Adding traditional water resources such as surface water and groundwater, through transferring water from one country to another through pipelines as done in oil and gas pipelines, and exploring new groundwater reservoirs.
  - Adding unconventional water resources: Reference can here be made to:
  - ✓ Treating all three types of wastewater (industrial, agricultural, and sanitary), and re-using them for irrigation of agricultural lands, industry, and even for human use (under certain), instead of discharging them without treatment and causing environmental problems.
  - ✓ Saline water desalination.

- **Theoretical considerations:**

Turton (1999) summarizes theoretical considerations related to water demand management as follows:

-Arid regions tend to have sensitive aquatic ecosystems, which means that sustainable management of these fragile resources must be based on a strong understanding and quantification of the (Threshold) concept.

-The use of any water that crosses this threshold will have devastating long-term effects on the environment, the economy, and the areas of social and political life. Here, sustainability becomes an important component of the overall goal of the policy.

-As countries develop in arid regions, they must increasingly withdraw more water resources, this is what is known as (Supply-sided Management).

-Supply projects have become more complex. They work to the extent that the threshold is exceeded and they fail to meet the increasing demand, especially during droughts.

-Drought crises allow the renegotiation of water policies, through concepts of sustainability that relate to demand management strategies.

- The initial stages of demand management are politically exhausting; because they involve reallocating resources away from the privileges (tariff rescheduling, for example).

- For this reason, a successful transition to an era of demand management needs strong political institutions, supported by the political and legal will to change the necessary policies, while continuing to survive.

-Policies must strive to achieve a clear goal, which reinforces the need for a strong institutional basis for implementing demand management.

-One aspect that makes demand management complex is its need to change people's perceptions of water.

-Human perceptions are derived from social and cultural aspects, which makes it difficult to change them.

-One of the existing perceptions means that water at the economic level has a unique characteristic in the form of a large difference between an average price and margin price.

-Tariff structures alone are a necessary but insufficient tool to achieve effective water demand management.

- **A global experience:**

Hermanus Town (South Africa): A tourist coastal town with a stable population of 20,000, being tripled during the holiday seasons. It depends on the water in a dam which was established at the end of the seventies. With the end of the apartheid era in South Africa and the improved economic conditions, demand exceeded the design capacity of the dam.

- **Study options:**

The aqueous geographical analysis was conducted, and it was found that:

1. Increasing the capacity of the dam will have little effect, which means canceling the solution from the supply side.
2. The groundwater is promising but needs a high cost for purification and distribution.
3. Desalination requires very expensive energy.

Based on the exclusion of all of the above solutions to increase supply, a plan was adopted that can be summarized as follows:

1. Structuring tariffs according to categories and seasonal needs.
2. Increasing the efficiency of the dam.
3. Using local labor in appropriate jobs (for example: cleaning the dam and its tributaries from unwanted weeds).
4. Engaging the community in monitoring consumption as a way of raising awareness (for example school students read the school meters and monitor the amount of consumption, then doing the same in their homes).
5. Water loss management.
6. Reforming program (assisting residents to monitor meters and their accuracy, repairing leaks, using rationalization methods, etc.)
7. Rationalizing garden watering (also includes selecting suitable plants).
8. Prepaid meters.
9. The enactment of water systems.

10. Effective communication with the community.

The result is a clear reduction in the rate of water consumption.

- **Other experiences:**

- Saragossa, Spain, through a participatory Education for Water Demand Management Plan, reduced daily consumption from 113 liters to 96 liters in 10 years.

-Abu Dhabi Emirate managed to reduce the lost water to approximately 17% by raising the efficiency of network monitoring and repair.

-Sydney, Australia, has been able to keep its total consumption constant for more than 10 years, with the population increasing by 850,000.

-There are multiple successful experiences in Australia to reuse water in the industrial sector and reduce dependence on clean water.

Fourth: Investment opportunities:

Investment opportunities in water can be divided according to the sub-sectors of the water sector, which are:

- Production
- Transport
- distribution
- Drainage and treatment
- Reuse

Fifth: Closing questions:

- Any change process faces three basic problems: orientations (interests), continuity, and uncertainties. How can they be overcome in water sustainability issues?

- In case of privatizing the water sector, how can we ensure a balance between the strategic desire to rationalize and the desire of the investor (the company) to increase sales?

- How can the complexity in the relationship between water, food, and energy be broken down to reach a more sustainable and secure decision?

Talking about water, especially in the Kingdom of Saudi Arabia, is one of the most important matters of life and survival. This becomes more important if we know that Saudi Arabia is one of the most desertified and arid countries. The issue of water at the level of many countries is considered one of the most crucial issues that threaten its survival. Many studies indicate that the future of conflicts between nations will be over water resources, and if we refer to conflicts between peoples historically, we will find that they were based on sources of pasture and water.

Thinking about the traditional sources of water in the Kingdom is useless and investment and support must be in the field of protecting and providing water sources in innovative and new technical ways.

Recently, the Saudi Water Forum was held under the sponsorship of the Minister of Water, Environment, and Agriculture, to review successful international experiences in water production and distribution, in which international experts participated by reviewing many successful experiences.

It would be helpful to review what was reported in Okaz newspaper about this forum, and it can be summarized as follows:

1. Jordan: Former Minister of Water and Irrigation, Dr. Hazem Al-Nasser, in which he said:

-There is a need for regional platforms to increase public awareness and knowledge of water on a regional scale.

- Fourteen Arab countries are facing the threat of water poverty.

-The percentage of water losses in the Arab world is 50%.

-The Arab individual's water consumption is the largest in the world, ranging from 200 to 300 liters. Al-Nasser indicated that global statistics estimate the natural consumption of the Arab individual at 130 liters per day.

-Water tariffs will limit the unjustified consumption of water in the Arab world.

2. California in combating drought, developing strategic plans aimed at:

-Providing water at a lower cost and diversifying crops that consume less water.

-Encouraging the private sector to invest in water storage, which has contributed to fighting water scarcity in Southern California.

-The necessity of international cooperation in combating climate change.

3. Australia: Water Security Strategy in Western Australia.

-The climate of Western Australia is similar to the Kingdom.

-Reducing evaporation and finding new sources by circulating water.

-Educating the community through the media, especially the new media, and educational curricula. This experience had good results, confirming that the campaign succeeded in reducing the individual's water consumption from 1985 to 2015 by up to 40%.

- 50% of the water was from desalination, and this option was very expensive until the journey of wastewater treatment and pumping it into distribution networks began after setting a legal framework for the use of this water, indicating that the community awareness campaign lasted about 15 years, a long-lasting process which started from 2004 until it was practically successful in 2016.

4. Experience from China:

- Successful experiences in urban wastewater treatment in China.

- Enforcement of the Environmental Protection Law since 2015.

-Treating wastewater, using modern technologies, and continuing to educate society to rationalize water consumption.

5. "Harvesting Water from the Desert Air" by Dr. Omar Yaghi, a Professor at the University of California – Berkeley, USA, winner of the Prince Sultan International Prize for Water, and the best ways to benefit from green spaces. Dr. Omar confirms that 160 countries implement the technology of harvesting water from desert air. He also reviewed an experiment for the students of the University of California in harvesting water from the air using a simple device. The students succeeded in collecting pure water suitable for drinking in hot and low humid atmospheres, explaining that this technology can be used in humid places at an affordable cost.

6. Japan:

Mega technology system development by Dr. Masaru Korihara from Toray Industrial Corporation in Japan. As Dr. Masaru emphasized that the climate is dry, and there is a large concentration of salinity in the water in the Middle East, especially in the Kingdom, and using membranes can recover 20% of the water that is usable, switching from thermal stations to membrane stations for seawater.

7. United Arab Emirates:

The Emirates has experience in raising the efficiency of individual use and maximizing benefits, in which the cost has been reduced by up to 50%, in addition to the significant shift in the design and implementation of desalination plants in the and the high efficiency in these operations.

This was addressed by Mr. Thomas Altman, Vice President of Technology, Aqua Power in the Emirates. Mr. Thomas has confirmed that there are experiences of accelerating innovations in desalination, stressing that 2018 is the year of "desalination", and that there is an international competition in the desalination sector.

8. Saudi Arabia:

"Techniques and uses of regenerated water," the experience of the General Irrigation Corporation in the use of regenerated water, and its model was "Al-Ahsa Oasis". This was mentioned by the Director of the Department of Water Quality Laboratories at the General Irrigation Corporation, reviewing the institution's strategy for the safe use of recycled water for irrigation purposes, the development of irrigation water sources, in addition to the Saudi regulations for the re-use of recycled water to monitor the quality of recycled water and ensure that its quality meets the standards.

Al-Basitah area in the Al-Jouf region accommodates Al- Wataniah Farm. It is an amazing project in terms of the magnitude of agricultural projects. It should be noted that there are similar projects in other regions of the Kingdom, like Tabuk, Hail, Al-Dawasir, and others. A system of palm irrigation is

used by Al-Wataniya, which is drip irrigation under the soil. This system makes water reach the roots of the palm tree directly under the soil. Water savings in irrigation have reached 60%, and this is amazing and it should be generalized to palm plantations that consume large amounts of water.

The aim of discussing local and international experiences in the field of water technology and its sources is to emphasize that there are hundreds if not thousands of experiments and research in this field.

The recommendations for this topic should be of qualitative and sustainable value, and specialists and researchers in the field of water and technology may assess what is the use of such recommendations including:

First: Government investment and support in water technology and treatment should be just as important or valuable as it is towards energy and the diversity of its sources.

Second: Adopting and supporting the Prince Sultan International Prize for Water, and expanding its scope, to benefit from international experiences in the field of water technology treatment.

Third: Focusing on research and studies on the production of water for the main water uses, such as:

- Drinking water.
- Water used for irrigation in cities.
- Water used in manufacturing and major industrial facilities.
- Water used in agriculture, especially in large agricultural companies.

Other fields must be addressed, such as laws and regulations, tariffs and fees, etc. However, efforts must be consolidated and concentrated on **producing water for the main uses in the best and fastest possible ways and at the lowest costs, through using modern science and technologies.**

Contributions:

The future of water in the Kingdom:

There are warnings related to the inevitable thirst as a result of the scarcity of water that the Kingdom would be exposed to if the existing indicators related to the rates of individual water consumption and agricultural consumption ratios persist.

1. Some experts think that this is an exaggeration and they say that it is true that the national water balance is negative. This means that the quantities of water withdrawn from the water layers, surface water, and treated wastewater which are used for all purposes – are much more than the water that feeds the aquifers. This is a strategic mistake if the situation is left

without a quick move to find the balance required between supply and demand on a sustainable basis.

2. Some criticized the project of providing (200,000) cubic meters per day of sewage treated in Al-Kubar. There is no economic feasibility for the project. However, the point of feasibility is usually missed, as not all projects were based on economic feasibility studies. Are road and tunnel projects, hospitals, schools, universities, water, and sanitation, etc. based on economic feasibility studies?!!

There are more than 20,000 traditional farmers in Al-Ahsa oasis who have no sources of income other than work in traditional agriculture. The government implemented the irrigation and drainage project in Al-Ahsa nearly half a century ago to solve the problem of agricultural drainage resulting from the abundance of water sources at that time. After the springs ran out and the levels of water in the Neogene layer have drained, the farms suffered from a lack of water sources for the farms to remain a source of income for the people of the Al-Ahsa oasis. So, how do we call for an economic feasibility study for the project? More than (60%) of the irrigation water sources in the Al-Ahsa irrigation and wastewater project are currently being provided by treated wastewater from Al-Ahsa and Al-Khobar stations.

3. The desalinated seawater must reach the areas where there is groundwater. The increase in the percentage of using desalination water that exceeds (50%) is risky. For example: Who can ensure that economy will be powerful forever? Who guarantees the abundance of energy? In some cities, the desalination of seawater is considered the strategic choice because of its distance from groundwater sources, such as in cities of Jeddah, Makkah, Madinah, Taif, Al Baha, Asir, and Jizan.

4. As for constructing dams, based on the claim that it collects water. Some believe that is unscientific, illogical, and lacks the necessary geological background.

The problem in wasting groundwater in agricultural and dairy products is that they are of little economic feasibility. The Ministry of Agriculture had previously flattered the owners of farms and agricultural companies, or maybe it was not firm about reducing the waste of groundwater and others. Some believe that the biggest mistake is wasting water to grow products that we can import from many sources. Water is life, and we are wasting it with amazing ease.

There is evidence that one agricultural company in the Kingdom consumes the same amount which Riyadh consumes. A Saudi Minister of Water and Electricity said in 2016 that “The cost of producing one liter of cow's milk in Saudi Arabia is estimated at 500 liters of drinking water. This in-

cludes cows drinking water, manufacturing needs, and feed irrigation water. The dairy sector is draining groundwater.

Further, according to the "Makkah" newspaper, field studies revealed that 96% of the quantity of water used in milk production is used to meet the water needs of locally grown fodder to feed the cattle herds.

According to the latest statistics of the Ministry of Agriculture, the Kingdom's production of raw milk reached 1.78 billion liters, in contrast with the total consumption of milk production farms that consume 892 million cubic meters of water. This makes the dairy sector a major component in the cultivation of fodder that depletes groundwater.

To support groundwater, the Council of Minister approved to stop cultivating green fodder for a period not exceeding three years.

Attention to the water issue in the Kingdom at the official and individual levels:

The issue of water in the Kingdom is important and dangerous. Unfortunately, in the past decades, it did not receive the attention and care it deserves, whether at the office or individual levels. There was always a lot of talk on the subject but without tangible results. The water issue in the Kingdom is old and chronic, and the problem and some of its solutions can be summarized in the following two main points:

1. The water sector in the Kingdom suffered from confusion and mismanagement of successive administrations. It also suffered from overestimating water resources. There has been negligence and indifference to the point that the Shura Council's water committee demanded that the Ministry conduct studies and provide reliable information on estimating water resources. It also called for establishing a water system clarifying the responsibilities of the various bodies, and laying down general guidelines for the State’s policies in this regard before the privatization takes place. The Shura Council was unable at that time to obtain anything. The questions remained about these studies and the accurate estimates of water resources in the Kingdom.

Some experts do not agree with saying that the main cause of the water problem is individual behavior, not even saying that the rate of per capita consumption in the Kingdom is one of the highest in the world. They justify their belief by saying that the information provided is false and inaccurate. How do we hold the citizen responsible for wasting water while waste in the public network in the main cities reaches 35%, and some reports even go to 50% in Jeddah?!! There is also chaos and lack of control of water taken from the network for municipal purposes, and there is no guarantee that a large part of this water does no go for other purposes. It suffices to take a look at the performance of the water network in the capital to know the ex-

tent of neglect and indifference to this vital sector, in which citizens rely on ground tanks that are filled once or twice a week. Everyone knows how polluted this water can be in the future. The Ministry could have constructed central tanks distributed in different areas of the city that feed homes directly, and through them, the water quantities and quality can be controlled as is the practice in modern cities.

2. With the declared scarcity of water, the Ministry did not adopt important policies to rationalize the use of water. Such policies failed to be at the level of the problem. Rather, it left matters open without control, and it was possible to:

a. Adopting water recycling initiatives and reuse a large percentage of water in toilets and gardens, so that there are two lines: one for drinking and human use, and another for toilet and gardens. These policies can be imposed on new plans and mosques or at least in the shopping centers.

b. Raising energy efficiency by imposing dual production of water and electricity on all new electricity production plants, and striving to implement the Cabinet's decision issued in this regard, as the energy wasted when producing electricity in the Kingdom is enough to produce the drinking water needed by the population.

c. Restricting investments in industry and agriculture to surface water and unconventional water sources, such as treated wastewater and agricultural water.

d. Preserving non-renewable water resources as a strategic store for drinking in emergencies and for future generations.

e. Benefitting economically from urban tree-planting.

f. Building sanitation and water networks, as most villages and many cities lack such utilities, which causes waste of water resources.

However, estimating water resources in the Kingdom, especially non-renewable groundwater, is one of the most difficult tasks, and it may not mean anything but mere numbers, for the following reasons:

1. The groundwater layers in the Kingdom are divided into two parts: The main layers, which contain large quantities of non-renewable groundwater that have been stored for twenty thousand years or more, which represent the strategic reserve of the Kingdom, and include the layers of Al-Saaq, Tabuk, Al-Wajid, Al-Manjour, Al- Wase', Al-Bayad, Umm al-Radhma, and Neujin. The sub-layers are limited in geographical extent, thickness, and amount of water, and are utilized on a small scale, and they include the layers of Khuff, Al-Jalla, Hanifa, Jubail, Arabs, and Al-Sulayh, among others.

All layers extend vertically to depths that sometimes exceed (2000 meters) in the ground, and some extend horizontally for several hundreds of

kilometers in which they sink under the newer layers, and they extend towards the east and north-east. They often disappear under Al-Nofoud sands or Al-Dahna' sands or the sand of the Empty Quarter (Al-Rubae Al-Khali). From a purely scientific point of view, it is necessary to know the extent of these layers in each direction, determine their saturated thickness with water, and know the quality of water as well; because some aquifers have groundwater, which is saltier than seawater.

Some believe that the best way to estimate the quantities of non-renewable groundwater is to compare the levels of water or what is known as the level of fixed water for each layer in each region (these measurements are available from studies that were done in the sixties and seventies of the last century, and can be used as a guideline). For example, the springs of Al-Ahsa were effervescent and because of the large consumption, they got depleted. The recommendation of the water sector in the Ministry of Agriculture and Water in the mid-eighties was recently implemented to withdraw an amount of (200,000) cubic meters of wastewater treated from the Dammam station to bridge the water gap in the irrigation and drainage project in Al-Ahsa. The project was implemented almost three years ago.

The layer of Al-Wajid in Wadi Al-Dawasir was also effervescent, and the constant water level reached (60) meters above the ground surface in the sixties, and now the water level reaches (250) meters below the surface of the earth.

Concerning the National Water Company and its illogical readings, there are already many complaints about the high amounts of water bills. All the company was doing is providing them with a list of licensed companies from the National Water Company to commission the appropriate ones to do a study on the problem of leaks inside homes. These companies do the required studies, and the problem of bills persisted in the next month, and so on.

As for limiting investments in industry and agriculture to surface water, and renewable water sources, etc., some believe that such restriction is very risky due to not guaranteeing the availability of this water throughout the year except in Asir and Jazan regions. Yet, it is possible to invest in non-renewable groundwater sources in providing drinking water for cities and villages.

The process of building water and sanitation networks is ongoing, but the horizontal expansion of cities and villages and the adoption of new plans prevent the completion of these networks in a short time. Opening investment in implementing these networks and their accessories, such as treatment plants, reservoirs, and others, is very important.

Variables that affect the future and sustainability of water resources:

Although variables are acknowledged in the water industry, there are questions raised like: Where is the human being, and the human factor, whether the consumer or the investor? What are the roles of human beings?

Needless to say, man is the axis of changes, whether positive or negative. A small group of people (individuals and companies) made their interests come before the public interest, especially those working in the agricultural sector, in addition to weak implementation of the regulations and decisions issued by the competent authorities.

To sense how difficult to get water, we have to ask many questions: How did this water get to the house? What is its source? How much does it cost and how much effort is made to provide it under the best standards? The source of this water is desalinated seawater, groundwater, or both.

We may know that desalination is an economically expensive process because water is transported away from desalination plants that are located on the beaches, and they need enormous energy to produce them and transfer them to areas above the sea levels hundreds or thousands of meters, and for distances of hundreds of kilometers.

As for groundwater, it is obtained by drilling wells with varying depths between less than (1000) meters to more than (1500) meters in the ground, and they are cooled and their salts get treated, and their advantage is their proximity to cities and villages in need of drinking water.

Some suggestions for rationalizing water:

There have been some suggestions for rationalizing water because the lack of water is an obsession for everyone. We are in a desert and an arid environment, but our awareness of using water is not as it should be. There is a clear waste in using it while we can rationalize if we want. These proposals relate to water conservation and the sustainability of available resources. These suggestions are as follows:

- Using air suction toilettes in the houses instead of water siphons, which consume a lot of water. Air siphons are like the ones used on airplanes.

- Recycling kitchen water (dishwashing water that has to be separated from the sewers), and using it to clean the yards instead of the public water.

- Using the drip in the home and gardening, with the selection of appropriate trees that do not consume a large quantity of water.

- Application of "water harvesting" to save rainwater, and this may be by digging large tanks at the end of the estuaries and torrents to benefit from their water in agriculture.

-The “water harvesting” proposed in the previous paragraph can be used for two main purposes: growing wheat for human nutrition, and forage for animal feeding; to create self-sufficiency in fodder, meat, and dairy as well.

- Rationalizing water for domestic use through water-saving taps.

The use of air suction in the toilettes is a reasonable idea, but it cannot be implemented for because we have many considerations, the most important of which are the availability of small siphons (with a capacity less than 4 liters) compared to (12) liters in the past, reliance on foreign labor at homes, and the dangers to which our children may be exposed to in the absence of the housewife during her work, as well as the low level of awareness among some people which may lead to many problems.

Concerning the use of the drip irrigation method in-home farming and gardens, it is already applied, and the treatment of waste here is shown in the water bill. The application of water harvesting to save rainwater is appropriate in the Arabian Shield region, but some factors must be provided for the success of the idea, the most important of which is the availability of rainwater, and the presence of a large thickness of sediment to save rainwater, and dams are currently doing the same task.

As for the rationalization of water at homes using water-saving pipes, which flow for several seconds, this method is suitable for other societies that believe in rationalization. Our society is mostly impatient. The Ministry has distributed free water-saving supplies, but not many people used them.

Regarding the use of water harvesting to create self-sufficiency in wheat, fodder, meat, and dairy, water harvesting will not achieve self-sufficiency.

The relationship between reduced water consumption and sustainability:

Will reducing our water consumption allow water to last only longer? Or is there anything further? Reducing consumption is a better way for the sustainability of non-renewable resources, saving energy, reducing drainage, extending the life of plants, pumps, and other devices.

However, if we think of hundreds of years ahead, we must take immediate procedures, like the mandatory reduction of the quantities of non-renewable groundwater to a level equivalent to the annual feeding of rain, and the return of water levels to their status four decades ago, which this is difficult to achieve. Our challenge now is how to manage a water source that is constantly decreasing?

Reducing consumption in drinking water will have environmental, economic, health, and other benefits, by not expanding the construction of sewage treatment plants and ease of treatment. This will inevitably protect the environment and public health from insects, mosquitoes, dengue fever, and others.

Examples of water recycling:

There are great examples of water recycling. In Singapore, wastewater is treated to an advanced degree, and it is sold in the supermarket as second-class drinking water, and it has a special color known to those who go to these markets.

We have wastewater that is treated for the third degree, but the used quantity in agriculture and industry does not exceed 16%. The reason is that the treatment plants are far from the areas of use such as large farms, so these projects are very expensive to connect, the farms have their wells, and the groundwater is free. So, there is no justification for using treated wastewater in agriculture. This type of water can be injected into aquifers, and used in irrigation of city and village gardens, highway afforestation, and so on.

How to continue to maintain the strategic reservoir of groundwater:

How can the strategic reservoir of groundwater be maintained if its layers cross borders with countries that do not agree with the Kingdom in preserving this reservoir? Then, what is the importance of good casing concerning the proper use of a reservoir?

No country does not want to maintain the strategic reserve of groundwater. Rather, there is a country or maybe countries that want to benefit from transboundary groundwater, and Jordan is the first case because Jordan is one of the poorest countries in the world in water resources. Amman has been suffering from scarcity in sources of water, and formally submitted to the Kingdom of Saudi Arabia a request to establish a water project in Al-Disi basin, known in the Kingdom as Al-Saaq layer. The request was carefully studied, and controls and distances were established on the borderline to protect groundwater in the two countries, and a technical committee was formed from both competent authorities to monitor the water conditions through monitoring wells dug in each country.

Concerning other neighboring countries, the Ministry has carried out a hydrogeological study of the transboundary water layers with neighboring countries, to determine the direction of the flow of groundwater in the transboundary water layers.

There are bilateral treaties between countries to manage transboundary groundwater, such as the agreement between France and Switzerland, as well as the agreement of four or five countries in Latin America to manage the Guarani basin and many others.

On the importance of wells casing, the use of casing tubes is very important and these tubes must be lowered, the length of which varies according to the depth of the well. If wells penetrate more than one geological layer, casing tubes must be lowered to extend inside the water layer for ten

meters or more. This depends on whether there are filters or not. Then, wrapping casing tubes is made from the bottom of the well until the cement comes out of the wellhead under geological supervision, and this process prevents what is known as the overlapping of the layers i.e. water leakage from the target layer to the layers above. Whoever mixes the layers and gets discovered is subject to the penalties prescribed by the law of preserving water sources.

The water rationalization program in buildings and housing was excellent. The rationalization tools were distributed for free, but in the absence of the appropriate law, the program almost stopped. In agriculture, we talk and decide about wheat and fodder, and no one talks about the high need for palms to water. When we stopped wheat cultivation, we forgot fodder (except for Almarai Company initiative). Then we returned to allow small wheat farmers.

Balanced consumption to meet water scarcity:

Water scarcity is undoubtedly one of the most important challenges if not the most important in our country, and the challenge is that water is a depleted natural resource if we are not successful in achieving a balanced consumption.

When the topic of population growth and its relationship to the country's economy and resources is offered, here emerge the issue of water, rationalization of consumption, and its link with other issues of population growth. This is a matter of studying the issue at a high level of planning, which requires knowledge and determination to the number of populations that we cannot go beyond.

Agriculture forms a very high rate of consumption, and here we have two options the best of them is bitter; either sacrificing food security or water security, so to speak. It is known that there are two types of water reservoirs: some of them are rechargeable and others cannot be rechargeable. These are related to the depths and also there are the so-called sealing faults or cracks that allow rainwater to enter the reservoirs. Unfortunately, all giant agricultural projects are fed from deep reservoirs that are very low below the water level.

Let us talk about agriculture being the largest consumer of water, and how to address this matter, even if gradually, through:

1. Reducing green areas such as the cultivation of clovers and fodders. This policy has already started, but this is allowed in areas not exceeding 50 hectares. However, some experts believe that this limit should be lifted.

2. Relying on modern techniques of hydroponics for greeneries and vegetables, as a large part of the water is reused, whether treated or natural; the adoption of dripping and planting productive trees. In general, we

are talking here about whatever application of modern methods in all that saves water. For example, this includes, adding materials around a tree that can hold water, and here evaporation and consumption will decrease.

3. Starting to reduce giant farms and encouraging farmers to go out of the Kingdom to invest in agriculture. We have heard days ago about agricultural and animal investment in Australia, and thus we preserve the rest of the water for human consumption, and it may recover over time by raising the water surface level.

4. Reducing livestock to reduce feed import and maintaining vegetation. Some experts suggest that people in the Kingdom should depend on chicken and fish as sources of protein. The nutritional value consumed in raising camels and livestock gives about 50% of meat, while chicken gives 80% and fish 90%.

As for human consumption, there are many ways to reduce consumption, including:

1. Reviewing the house design and separating the toilets in terms of water sources. It is inevitable to make the treated water the source and require the municipalities and engineering offices to abide by this planning.

2. Spreading awareness continuously in reducing consumption, and applying what keeps slow water flow in faucets, showers, and other uses in homes and industrial areas.

3. Spreading awareness on social media platforms, the most important of which is raising educating children at schools to take care of water.

A solid plan must be in place so that we gradually get compensated for every liter of water until we reach at least 80%. Here we reach a reasonable balance.

If the oil companies seek to compensate the reserves by applying as much technology as possible to compensate production and have their knowledge and binding laws, so how can we neglect what is more important than oil?!

Finally, research, exploration, and upgrading hydrology is one of the most important sciences worldwide for water-rich countries. How would it be for us living in the desert?

Discoveries need research and development for water sustainability and waste reduction:

At present many discoveries need some research and development to sustain water and reduce waste, namely:

1. Developing ultraviolet sources that can kill microbial plankton with high efficiency. These sources are made up of LED lamps that need low energy and they are environment-friendly.

2. The metal-organic framework can extract water from the atmosphere and store it, and then pumps it as water. These materials need development and testing. The success of this experiment is similar to solar cells in the energy field, and this is considered a breakthrough in the field of water.

3. Development of membranes for water treatment and this is very important for recycling.

4. Reducing the percentage of network leakage by developing sensors for this purpose.

The development of water treatment membranes and reducing the percentage of leaks from networks by developing sensors for this purpose - is one of the priorities of the concerned authorities.

Suggesting the idea of installing a saline water pipeline from the Gulf to Riyadh, and establishing a desalination plant in Riyadh:

Is it possible to install a saline water pipeline from the Gulf to Riyadh, and then establish a desalination plant in this city, instead of transporting the local water from the Eastern Region to Riyadh?

Some experts believe that there is no benefit in installing a saline water pipeline from the Arabian Gulf to Riyadh, as there are matters related to saving in desalination costs, pipelines costs, etc.

The Ministry of Agriculture and Water had previously studied the idea more than twenty years ago, and the results were not encouraging and even more harmful. The idea was to create a large lake around Al-Khafs north of Riyadh. Accordingly, the saline water will reach the main water layers and pollute them.

Also, desalination of water in Riyadh away from the Gulf will cost more in terms of how to get rid of rejected water containing salts exceeding (000,70) parts per million, and this water will pollute the soil and eliminate plant life, and it needs vast areas of thousands of square kilometers. Lakes will be formed of water with temperature exceeding the boiling point.

Some experts believe that installing the suggested pipeline from the Gulf to Riyadh is ineffective for two main reasons: One is economic; because the cost of transporting saline water is much higher than the cost of transporting desalinated water due to the damages caused by the salts in the transport pipes, pumps, and other devices. The other reason is environmental, because of the damage the highly saline water would cause, and the cost of disposing of it will be high.

Responsibility for the supervision of agriculture and water in the Kingdom:

Some questions are usually raised about the responsibility for supervising and monitoring agriculture as well as water. Fifteen years ago, the supervision of agriculture was separated from the supervision of water in two

ministries, as there was a conflict of interest since the growth of agriculture is based on the consumption of water sources. Five years ago, the responsibility for supervising agriculture and water was made one, and it became the responsibility of one minister, despite a conflict of interest.

The usefulness of thinking about traditional sources of water:

Some experts do not believe in thinking of traditional sources of water as futile; this is because conventional water is surface water and includes rainwater and torrents that are reserved in dam lakes to achieve various goals, as well as renewable groundwater with its two types that depend on rainfall rates and their recurrence, and non-renewable water that has been stored in the geological layers thousands of years ago.

There are successful global experiences in developing water resources and increasing the efficiency of their use. Many of them have been tried in the Kingdom, but they have not been successful because of the weakness or lack of elements of success from the relevant authorities and the private sector alike.

Furthermore, the experiment of harvesting water from desert air was tried in the Ministry of Water and Electricity in Salboukh field, north of Riyadh, and it did not succeed, because the success of an experiment requires the elements of success to be available, the most important of which in this case is providing moisture at certain proportions and specific temperatures. This experiment may succeed in the coastal areas and the southern region, yet the expected production will not be equivalent to producing a well from groundwater.

Statistics on the rates of water consumption in the Kingdom:

According to the Saudi newspaper, Al-Iqtisadiah, May 14, 2017, the per capita water consumption in Saudi Arabia during the past year 2016 was about 271 liters per day, compared to 268 liters per day in 2015.

The per capita consumption achieved the lowest growth rate in the four years, specifically from 2013 to 2016, where the average per capita consumption in 2016 increased from its levels in 2015, with a growth of 1.1 percent; equivalent to three liters.

According to the report of the Economic Reports Unit in the same newspaper, based on the data of the General Authority for Statistics, the quantity of domestic consumption of water during the past year 2016, amounted to about 3.129 billion cubic meters "3.129 trillion liters" compared to 3.025 billion cubic meters "3.025 trillion liters" in 2015.

Public consumption in the Kingdom recorded the lowest growth rate during the previous four years, specifically from 2013 to 2016, as last year's consumption grew by 3.4 percent compared to the consumption in 2015.

The data of the General Authority for Statistics did not mention the number of subscribers to water by the end of 2016, as they reached 1.99 million subscribers by the end of 2015.

The percentage of desalinated water in the total amount of water consumed in Saudi Arabia was about 38% in 2016, compared to 43% in 2015.

The percentage of desalinated water from the total water consumed is the lowest percentage since 2010 when it reached 37%, then it increased to 50% in 2012, and it decreased to 43% in 2015, then to 38% in 2016.

The Kingdom's consumption of water in 2016 amounted to about 173.84 million water tanks with a capacity of 18 cubic meters, compared to about 168 million tanks in 2015. When distributed over the number of days of the year, it appears that the Kingdom consumed about 476.3 thousand tanks per day in 2016, compared to about 460.5 thousand tanks in 2015.

Thus, per capita in Saudi Arabia had a share of water consumption in 2016, of about 5.48 water tanks, the capacity of each tank is 18 cubic meters (18 thousand liters) compared to 5.42 water tanks in 2015.

By distributing consumption to the regions of the Kingdom, it becomes clear that the region of Riyadh is the most consuming during the past year, with 1.032 billion cubic meters, which constitutes about 33 percent of the total consumption of the Kingdom. The Makkah region ranks second in the regions that most use water by 707.12 million cubic meters, representing about 22.6% of the total. While the Eastern region ranked third with consumption of 659.1 million cubic meters, constituting about 21.2% of the total. These are followed by the Medina region with consumption of 183.7 million cubic meters of water in 2016. Then came the Qassim region with 123.8 million cubic meters, then the Asir region with 100.6 million cubic meters, followed by Tabuk with 71.4 million cubic meters, then “Jizan” with 60.4 million cubic meters.

Hail came in ninth with 55.9 million cubic meters. Al-Jouf region came tenth with 44 million cubic meters. Al-Baha came eleventh with 43.2 million cubic meters.

While Najran ranked 12th with a consumption of 24 million cubic meters, and finally, the "Northern Borders" ranked 13th with a consumption of 23.7 million cubic meters.

Water consumption in the agricultural sector is 84% of the total consumption, and 95% of this consumption comes from groundwater that is not compensable in the foreseeable future. Despite this, we have not reached full food security.

With appreciation to all the initiatives that have taken place over the past years, yet they have not done enough to address this serious dilemma.

Does the Kingdom need to have the two largest cows and dairy-producing farms in the world? Not only for domestic consumption but also for export. Why do we keep increasing the green spaces in our cities (mainly grass) that drain a lot of water? Can't it be replaced with artificial grass?

Talking about rationalizing water consumption, despite its importance, will have little effect if the waste continues in the agricultural sector. Do we want to keep planting and die as a result, or reduce what we plant to continue living?!

I think we need to prioritize and make critical and speedy decisions to save future generations.

The relationship between water consumption and the volume of agricultural water consumption:

Whenever water consumption is referred to, the agricultural water consumption gets mentioned, as water is scarce in many areas due to the volume of water depletion. The Ministry has recently banned many agricultural varieties, such as fodder, to conserve water. Without a doubt, the scale of palm water consumption is huge.

According to the statements and speeches by the Ministry's officials to senior producers and exporters of dates on the importance of the role of the palm and dates in national food security, they stress that everyone should work to maximize the benefit of palm trees and raise the efficiency of irrigation using modern irrigation methods. This will ensure the perfect use of water for irrigation, noting the strategic goal that the Kingdom will be the first source of dates under the National Transformation Program 2020, in which the Kingdom now ranks third in terms of value.

The agricultural sector consumes 84% of the total annual water consumption. Only three crops consume 89% of the total consumption of the agricultural sector, namely fodders, grain (wheat), and palm. After the procedures that will be applied to fodders and wheat, the palm will be the largest consumer of water. The competent authority should focus on reducing the rates of palm consumption of water. There are palm trees that are subsurface irrigated and there are palms that are irrigated by immersion. We should not be deceived by what Palm farmers say about reducing consumption by using rationalized irrigation methods with the absence of a neutral body that monitors, measures, and applies penalties and violations.

Likewise, the non-renewable groundwater, when depleted, cannot be compensated, and the pieces of evidence are clear before us, such as the depletion of the Aflaj lake, the depletion of Al-Ahsa and Al-Kharj springs.

With all this water waste in the agricultural sector, we have not and will not achieve food security. Food security is not just wheat.

Do we all know that each cup of milk consumes (500) liters of non-renewable water, including fodder cultivation, cleaning and so on, and unfortunately, we find Saudi milk and dairy products spread in all neighboring countries even those rich in rivers as if we are exporting non-renewable groundwater?

When the State stopped receiving wheat from farmers, it started importing it at lower prices than the State used to pay for domestic wheat.

The Ministry of Agriculture encouraged agricultural investment abroad and failed to implement it. The agricultural companies succeeded in this role and they invested in Egypt, Sudan, and countries in Latin America. However, they succeeded by increasing their income but failed to reduce their share of the locally cultivated areas.

Food security also includes poultry production that does not consume water and the Kingdom is still far from achieving self-sufficiency in poultry. Fish is also an important part of the equation for food security, and we have thousands of kilometers of beaches that are not yet invested. Growing vegetables in greenhouses did not get the attention it deserved, despite the State's subsidies to farmers by 70% of the costs of irrigation systems and others.

If this huge waste in the water is for dairy products that part of it is exported abroad, so why not recommend a request to limit the expansion of milk production, or at least give these farms a specific quota for groundwater use, and reduce it according to a timetable? To answer this question, it can be said that wastewater does not only go to exported milk but rather, the total waste of all agricultural products consumes 84% of the total annual water consumption.

According to water use statistics, the agricultural sector is the largest consumer of water, and since most of the water sources in the country are non-renewable, why is there no correlation between renewable water sources and the rate of growth of the agricultural sector? The agricultural sector is becoming a threat to the strategic water reserve.

Also, why aren't new laws enacted, especially in the construction sector, to take advantage of greywater, recycle it, and use it for additional purposes?

The water used in all domestic, government, commercial and industrial buildings is considered black water (wastewater). Therefore, laws must be enacted to separate wastewater from gray water in all construction sectors (water used for cleaning and washing only).

Food security and activating the principle of integrated water resources management:

Some experts suggest that part of food security can be achieved by activating the principle of integrated water resources management through:

1. Maximizing the utilization of renewable water in the Arabian Shield region.
2. Optimizing the use of treated wastewater, which is currently discharged either in seas or in valleys (currently only 16% of the treated water is used).
3. Imposing a small fee on the non-renewable groundwater consumers, and it will be placed in a fund for future generations.
4. Trying to reduce the numbers of live animals whose consumption exceeds the capacity of natural pastures (pastoral load), and focusing on importing our need for imported meat.
5. Changing the food pattern and limiting the continuous use of meat because of its negative health effects and its role causing obesity, diabetes, and cholesterol, among others.

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Recommendations:

- Linking the sustainability of water resources with the sustainability of renewable energy and providing food to overcome the major challenges facing the Kingdom during the next five years; promoting the principle of integrated water resources management in the Kingdom.
- The competent authorities monitor the leakage of public water networks in practical ways that reduce the waste of huge amounts of water.
- Public water networks to be modernized and replaced at a faster rate than the current method through new initiatives that are in line with the Kingdom's vision 2030.
- Investment and support by the government in the areas of water technology and treatment should be just as important or valuable as it does towards energy and diversity of its sources.
- Reconsidering the investments that use groundwater, and stopping any waste or drain resulting from its use.
- Restricting agricultural investments to modern agriculture based on renewable water, and those that use modern technologies that rely on saline water and water recycling.
- Laying down the systems and legislations that guarantee to stop waste in water, contributing to its development and investing investment, and finding a monitoring body independent of the concerned ministry to address water issues and water bills and monitoring the performance and productivity of public and private water companies.
- Purchasing lands from companies by the public investment fund with large areas for use in implementing drinking water projects wherever these farms are located; because these companies do not need them in light of the legalization of growing grains and fodder with a high water consumption which threatens the future and sustainability of water resources.
- Speeding up the implementation of water connection projects between the Kingdom's regions, cities, and villages.
- Modernizing urban water networks and linking houses with water tanks for distribution within cities, so that it is easy to control the types and quantities of water, as is the case in the cities of the Eastern Region.
- Modernizing and reforming the water sector, including the National Water Company, and evaluating its administrative and technical performance.
- Setting a direct special number to communicate with a body that handles any leaks or water waste in public places.
- Developing industries and research projects specialized in water desalination systems and devices.

- Stricter implementation of the Cabinet's decision regarding dual water production with electricity when licensing new power plants.
- Working (individuals, societies, specialized bodies, and civil society organizations) to reduce the consumption rates of different sectors of water, to extend the life of the remaining water sources.
- To prevent the export of water-based products, or to raise taxes on them.
- Emphasizing the optimum use of treated wastewater and agricultural drainage.
- Ministry of Agriculture works to prevent irrigation by flooding in agriculture, be it on small or large farms, and replacing it with modern irrigation methods that save water.
- Developing rainfed agriculture and mountain terraces in the southern region.
- Working to organize and support marketing local agricultural products in the agricultural areas in the Kingdom, and to deliver them to markets in major cities, and give them priority in the State's purchases.
- Converting the charitable agricultural projects that rely on non-renewable groundwater into investment projects for non-agricultural activities.
- Making an inventory of government-owned agricultural lands and disposing of areas that no longer need to be cultivated as public parks or selling them for use as housing or light industry headquarters to avoid environmental pollution; restricting the agricultural areas of overwhelming consumption of groundwater, by expropriating them or transferring them to other industries, to save water.
- Benefiting from some existing springs, such as the Zamzam well, in distributing drinking water in consumer quantities at economical prices in various packages.
- Adopting and supporting the Prince Sultan International Prize for Water, and expanding its scope to benefit from international experiences in water technology and treatment.
- Focusing on targeting future research and technical studies to produce water for the main water drains, which are: water used for drinking, irrigation, and watering in cities, industrialization and large industrial facilities, and water used in agriculture, particularly in large agricultural companies.
- Providing generous support to water research in research and development centers, and considering them as an urgent research priority, while directing researchers and inventors to uncover new ways related to water, its treatment and its consumption methods economically.
- Community education and awareness to participate, so that community members integrate into awareness and be part of it.

Food and Drug Security:
Reality, Challenges, and a Future Outlook

The concept of security in contemporary societies is no longer confined to specific aspects, as it was in its traditional form focusing on the political aspect of state stability, or criminal security related to crime control. The concept of security has become more comprehensive to include other dimensions that were not previously the focus of attention, including food and drug security.

(A) Food security:

The concept of food security is defined as the ability of society to provide adequate, qualitative, and quantitative food to citizens in a manner that enables them to enjoy complete physical, mental and spiritual health. The Food and Agriculture Organization of the United Nations (FAO) defines food security as providing food for all citizens in any society, at all times and obtaining it sufficiently and easily according to the economic and social systems, provided that it be healthy and commensurate with the physical needs of the person and in the preferred quality, which contributes to enhancing the activities and health of the human body.

In this context, a distinction must be made between what is termed absolute food security and relative food security. Absolute food security means producing food within a single State equaling or exceeding domestic demand, and this level is synonymous to complete self-sufficiency. It is noted that the State misses the possibility of benefiting from international trade based on allocation, labor division, and utilization of comparative advantages. As for the relative food security, it refers to the ability of a country or a group of countries to provide the needs of society members with goods and food and to ensure the minimum of these needs regularly.

In the past, food security was seen as fighting and preventing famine and providing food to members of society. The concept has developed and the debate has become related to safe food through the application of legislations, regulations, and specifications. Moreover, an effort has been made towards guaranteeing the safety of food products, with more methods for examining and verifying the food products. Today the topic has evolved to more than that, so the conversation has become not only about the availability of food but also about healthy food for its importance in promoting people's health.

Food security is based on three main pillars:

- Providing food for the community at all times (times of prosperity and times of crises).
- Providing safe food that meets specifications or legislation.
- Educating community members about healthy food and providing easy and effective access.

The Saudi government paid great attention to food and drug security. This is more motivated by the fact the Kingdom is one of the countries that imports about 85% of its food needs. However, some of the food needs which represent 15% are locally produced. So, many plans have been put in place to ensure that all needs are provided. Perhaps one example of this is the establishment of Salik Company for Agricultural Investment and Animal Production outside the Kingdom to take advantage of the resources available in other countries that may not be available in the Kingdom.

There is a need to educate community members about food security through raising awareness of healthy food and reducing the quantities of waste in food products. The Kingdom is one of the highest countries in food waste. According to a study by the Ministry of Environment, Water and Agriculture, in cooperation with the General Corporation for Grains, it has been shown that an estimated 13 billion riyals were the value of food loss in the Kingdom in 2018.

In line with the Kingdom's Vision 2030, with understanding the role of Food and Drug General Authority in contributing to the promotion and protection of public health, and in light of the policies and procedures recommended by the World Health Organization (WHO) aiming at reducing non-infectious diseases, as well as reducing consumption of sugar, salt and fat, the Authority has developed a strategy to participate in regulating healthy food. This strategy will be implemented in partnership with many government and private agencies. Bolstering this effort, the Council of Ministers approved the establishment of a national nutrition committee. The Founding Committee of the National Committee for Nutrition is working on determining the financial, human, and technical needs.

The National Transformation Program also includes initiatives that seek to achieve food security in the Kingdom, including the following initiatives:

- The initiative of a national program to limit food wastage. The program will be based on international standards and good practices. The initiative aims at encouraging conducting studies and estimating quantities of loss and waste of food. It is also intended to develop harvest techniques and infrastructure to support food production.
- Establishing the National Marketing Center and encouraging the consumption of fish products. This initiative aims to raise public awareness of healthy food by promoting a culture of seafood consumption and appro-

priate promotion of fish products. It also aims at developing export and import quality and setting high-quality standards to ensure fair competition between the local and the imported products.

The initiatives to achieve food security are linked to many government agencies. Many government agencies work alongside the Food and Drug Authority to achieve food security and have many initiatives under the national transformation program and the Kingdom' Vision 2030. For example, the Ministry of Environment, Water, and Agriculture has initiatives in utilizing water resources and their applications in the agricultural field and promoting investment in livestock and sustainable animal production. Besides, it encourages consumers and promotes consumer behavior in consuming fish in a manner that enhances investment in this area and enhances community health as well.

(B) Drug Security:

There is no specific international definition of drug security, but it can be said that national drug security is linked to the availability of medicines at affordable prices at all times, as well as encouraging investment in the pharmaceutical industry.

There are currently 40 pharmaceutical factories around the Kingdom for medicines, in addition to 4 factories that partially produce vaccines and vital medicines. It is hoped that in the future the technology and manufacturing will be fully transferred in a way that enhances drug security in the Kingdom.

Among the important challenges facing the Kingdom in drug security are related to technology transfer and localization of the pharmaceutical industries. The Kingdom needs running capital to invest in research and development and take advantage of the existing capabilities in Saudi universities as is the case in other countries such as the European Union and the United States of America.

As part of the Kingdom's efforts to achieve drug security, a National Transformation Program has been included to achieve the Kingdom's Vision 2030. Among the several initiatives of enhancing investment opportunities in medicine, there are two important ones:

- Creating a unified electronic system. This initiative aims to develop and unify procedures for registration, licensing, inspection, clearance, exporting, and enforcing the law for investors in the Food and Drug General Authority.
- Interactive Outreach Programs: This initiative aims to have specialized awareness campaigns, based on the need and level of target groups. Besides, there will be orientation programs introducing the role and laws of the Food and Drug Authority relevant to the consumer.

Also, the executive plan of the National Transformation Program included a specific strategy to achieve basic goals, among which is ensuring the sustainability of vital resources, including food and drug security through:

- Promoting good practices for the safety and sustainability of agricultural products through educational programs and systems.
- Strengthening the stability of food supplies across mechanisms and frames for companies; activating cooperation, and sharing in organizations and international conventions.
- Developing a sustainable food production system by raising the sufficiency of goods that are locally convenient and improving productivity and sustainability.
- Providing main medicines from their external sources, while connecting them with the tracking system and strategic storage.

The Present and Future Water Resources in Saudi Arabia

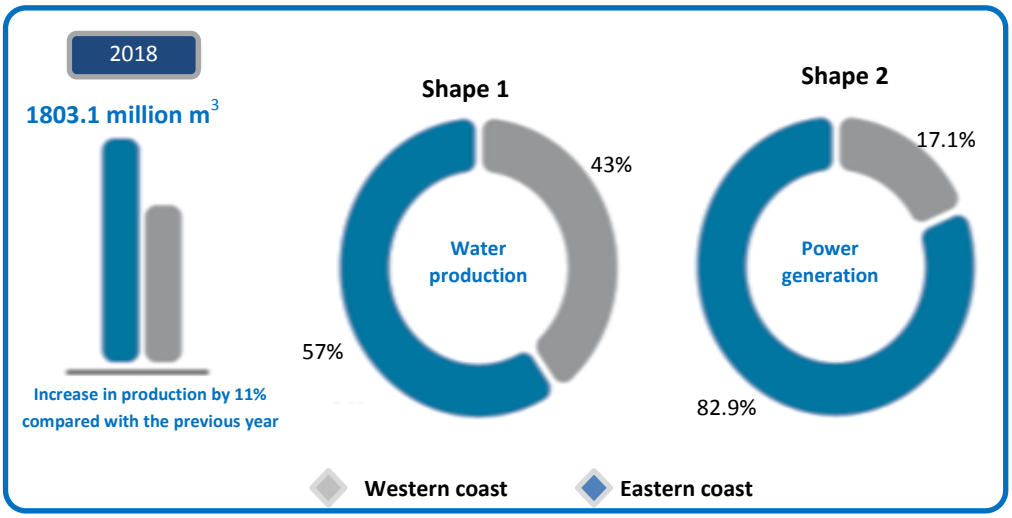
Water shortage threatens development in the Arab region in general. The decreasing and fluctuating rates of rainfall, high evaporation rates, and the recurrence of droughts result in degenerating the ability to depend on water resources and their availability. Although the Arab countries occupy about 10% of the world's area, their average annual rainfall is only 2.1%, and the amount of internal renewable water resources in the region does not exceed 6% of the average annual world's rainfall of 38%. Most of the region's area is classified as arid or semi-arid (desert), where the amount of rainfall is less than 250 mm per annum, except for some regions, including southwestern Arabia and countries bordering the Atlantic Ocean and the Mediterranean Sea, due to their high rates of rainfall.

By focusing on the status of Saudi Arabia, it is found that the water resources divided into five categories, including: (desalinated water, non-renewable groundwater, renewable groundwater, surface water, treated water).

Regarding the desalinated water, Saudi Arabia currently has 35 water desalination stations on the Eastern and Western coasts of the Kingdom. The latest data indicate that the total production capacity of desalinated water reached 6.28 million cubic meters per day in 2015. It is expected that this production capacity will increase to reach 7.4 million cubic meters per day by 2020. The Saline Water Conversion Corporation (SWCC) has the majority of saline water desalination stations in Saudi Arabia. They represent 73% of the total present production capacity.

Three types of technologies are used in desalinating saline water: Multi-stage flash distillation, reverse osmosis, and multiple effect distillation. The multi-stage flash distillation is considered the prevalent technology at the water desalination plants in Saudi Arabia. They represent 62% of the total present production capacity.

The quantity of desalinated water produced in Saudi Arabia in 2018 was about (1803.1) million cubic meters, scoring an increase by (11%) over the previous year when (775) million cubic meters were produced from the stations of the Western coast, representing (43%) of the total production of the corporation. Production of the Eastern coast stations was (1028.1) million cubic meters, representing 57% of total production. The total electricity generated from the corporation's stations in 2018 was about (40.75) million megawatts/ hour. About (6.95) million megawatts/ hour were generated from the Western coast stations, representing (17.1%) of the corporation's total production, whereas 33.80 million megawatts/ hour were generated from the East coast by (82.9%).



Saudi Arabia has a reserve of non-renewable groundwater that spreads across many water layers. The groundwater gathers in more than 20 primary and secondary groundwater layers in Saudi Arabia, and it serves many regions. Renewable groundwater is found in Saudi Arabia in shallow and deep layers, and in surface water in valleys. According to preliminary estimates, renewable groundwater is currently estimated at 2.8 billion cubic meters annually in the Arabian Shield area.

As for the surface water, the total reserve in dams that can be utilized is 1.6 billion cubic meters per annum. Around 73% of this total quantity lies in: Asir, Mecca, and Jazan. These areas have abundant renewable groundwater and surface water because of their terrains that are rocky and nonporous at the level of Arabian Shield.

Saudi Arabia treats wastewater to a degree that makes it safe to use for various purposes, including industrial processes, refrigeration, and agriculture. Treated water is an important resource in a country that suffers from water scarcity, and should be taken into account in the supply system. The total amount of treated wastewater reused in Saudi Arabia in 2015 reached 0.61 million cubic meters per day, of which 0.40 million cubic meters are daily used in agriculture, the average reused quantity is only 17%.

In addition to the present resources, several additional water resources need further study to determine their full potential, including greywater and rainwater harvesting.

Indeed, Saudi Arabia faces great challenges due to the unsustainable use of water resources, as well as the limited non-renewable groundwater reserves, which are experiencing accelerated depletion. Besides, with arid climatic conditions, renewable water is extremely rare.

The problem of water scarcity in Saudi Arabia is exacerbated by the high demand for water in the agricultural sector. The government bears a high cost for water production and sanitation in the urban sector. However, ser-

vice levels remain below the optimal level, and the sector also suffers from institutional conditions and inappropriate governance mechanisms.

Saudi Arabia has a limited reserve of non-renewable groundwater that can be utilized, as well as low feed rates. This situation is attributed to arid climatic conditions. The water requirements in Saudi Arabia, which were estimated at 24.8 billion cubic meters in 2015, have been witnessing a steady annual increase by 7%, noting that the agricultural sector is the largest consumer of water in Saudi Arabia, with 84% of the total water demand. Thus, the use of water in the agricultural sector represents an environmental challenge. This sector depends on non-renewable resources which represent 90% of the total water supplied to the sector.

The high use of water in the agricultural sector is attributed to gaps in the water sector policies, legislations, and general shortcomings in use, as fodders alone consume 79% of the water in the agricultural sector, and irrigation efficiency is 50% at present compared to more than 75% according to the global best practices. Under the current rates of consumption, some regions in the Kingdom may face depletion in reserve water in the next twelve years, and this requires immediate action to solve this problem. Despite water scarcity, treated wastewater is insufficiently utilized due to the limited infrastructure and challenges related to the acceptability of the use of this water in some areas, and the limited legislative supervision and pricing incentives.

Water consumption in the urban sector provides everyone with many opportunities for improvement, and this can be achieved by reducing water losses from the network (estimated at over 25% in different areas) and in buildings, and by setting price indicators and incentives for water conservation. In light of the heavy dependence on water desalination (60% of the total water supply in the urban sector), and in addition to the present support, this sector imposes many burdens on the national economy, and the relatively high cost of production unit increases due to the high transport costs by pumping water from the coasts to the inland. The sector is also highly dependent on fuel in desalination, which represents more than 25% of the national fuel production. Also, desalination leaves a broad environmental footprint, due to the disposal of salt and mud sediments, as well as greenhouse gas emissions.

The Ministry of Environment, Water, and Agriculture in Saudi Arabia has undertaken the task of developing a unified reference framework for the water sector, which includes a comprehensive water strategy. The framework integrates the trends, policies, legislation, and practices in the water sector at the national level. This is in addition to the main goal of facing major challenges and restructuring the sector. The scope of the framework has many elements, including engaging the stakeholders, evaluating the present situation of the sector across a range of dimensions, such as water demand, water resources, sector operations, enabling factors, and determining the nature and size of gaps between supply and demand, in addition to the economics of the sector under different scenarios.

KSA Water Strategy for 2030

Objectives	Supply security	Quality and excellence in customer services	Environmental sustainability	Economic sustainability	Costs management

Strategic fundamentals	**Demand (Agriculture, Urban, Industry & Environment)**	**Water resources Surface water, groundwater, desalination, treated sewage, alternative resources)**	**Supply chain**
	Agricultural demand for water and efficiency	Supply mix	Storing
	Urban demand for water and demand management	Water harvest, feeding layers of groundwater	Transport and connection
		Cost-effectiveness and power consumption	Distribution, reducing loss Collecting and treatment
			Customer service
	Integrated approach for managing water resources at the local and national levels		

Strategic empowerments	Institutional framework	Policies and legislation	Potentials	Economic requirements	Performance management
	▪ Sector's organization and tasks	▪ Policies	▪ Organizational structure	▪ Financial requirement	▪ Monitoring & control
	▪ Private sector's engagement	▪ Legal framework	▪ Human capital	▪ Models of financing	▪ Communication & participation
	▪ Contributions by NGOs	▪ Organizational framework	▪ Planning procedures	▪ Work on a commercial basis	
			▪ Technologies & systems	▪ Job nationalization opportunities	
			▪ Research & Development		

Saudi options for food security

Keynote speaker: Dr. Ali Al-Tukhais is a member of the Water and Public Works Committee of the State Shura Council and a former Undersecretary of the Ministry of Water and Electricity for Water Affairs in the Kingdom of Saudi Arabia

Despite the limited renewable water resources in the Kingdom of Saudi Arabia, the agricultural sector consumed 17.5 billion cubic meters of water in 2012, or 84 percent of total consumption. Most of this quantity came from non-renewable groundwater, and about 80 percent of it was used to grow just three crops including grains, fodder and dates.The overconsumption of groundwater during the past four decades has had negative effects, the most important of which has been the persistent declining levels of groundwater in the main layers. In some regions they have reached critical levels, where pumping in the future has become economically unfeasible. The quality of groundwater in several places has become more saline at deeper levels as sea water mixed with it, so their treatment for drinking purposes has become more expensive.

There are opportunities to develop the agricultural sector in Saudi Arabia, in line with plans to conserve groundwater resources. Among such plans is increasing the utilization of treated wastewater, which amounted to about 3.6 million cubic meters per day in 2012. Part of this quantity, (i.e., 17%) was reused, which means around 0.6 million cubic meters per day only. The experience of the Irrigation and Drainage Commission in Al-Ahsa is one of the pioneering experiences in the utilization of treated wastewater. This option was resorted to after the natural springs that had been feeding Al-Ahsa Oasis for centuries got dry. The Commission is currently overseeing the distribution of 145,000 cubic meters per day of treated wastewater up to a triple degree. This represents 60 percent of the total irrigation water supplied by the Commission to grow 8,200 hectares of palm trees, which produce 120,000 tons of dates annually, in addition to lemon crops. It is expected that the quantity will reach 450 thousand cubic meters per day after the completion of the undergoing projects. The remaining 40 percent of the irrigation water supplied by the Commission comes from the aquifers and agricultural wastewater. It is certain that the quantities of treated wastewater will increase in the future with increasing amounts of urban wastewater due to the increasing population.

Around 420 dams had been built up to 2012 with a total storage capacity of about 1.9 billion cubic meters. They were designed to either feed the aq-

uifers, guard against cities, villages, farms, and properties from floods, or to provide drinking water or irrigation to nearby communities. There will be a good possibility to enhance the utilization of surface water stored by dams if evaluation studies are conducted by consulting offices specializing in the design of rain harvest projects and the implementation of agricultural projects that fit the region's environment and climatic conditions. There are no documented scientific studies on global climate change and impact on agriculture in the Kingdom. Recently, abnormal weather phenomena have been recorded, such as long-term dust storms and short-term rainstorms, accompanied by strong, devastating floods.

About twenty years ago, a company carried out a unique experiment, cultivating the silicornia crop on seawater, and the company was provided with facilities and soft loans. The experiment was successful, but the company lost focus on its primary goal and the project stumbled. However, this experience may open up high hopes for the future in developing sea water agriculture and choosing the most suitable crops that grow in salty water.

Self-sufficiency?

Countries of the arid desert are facing the food security issue, and they are preparing plans and strategies to provide food commodities, each according to their climatic, water and economic conditions. However, the Kingdom of Saudi Arabia seeks to achieve a certain level of food security by maintaining a strategic stock of food commodities sufficient for consumer needs for at least six months. Several options have been studied to achieve food security, and the Kingdom has chosen to proceed in three tracks at the same time. The first is the production of a portion of food commodities locally, taking into account the limited water resources and benefitting from the comparative advantage of each region. The second is that the private sector continues to import food commodities from abroad and sell them according to the supply and demand mechanisms. The third is the adoption of the King Abdullah's initiative for agricultural investment abroad.

Regarding local food production, the Kingdom achieved a good percentage of self-sufficiency. In 2012, the self-sufficiency ratio of wheat was 27.6 percent, but this percentage was declining and was expected to reach zero by 2016. This is an action taken by the government to conserve water resources, because the wheat depends on non-renewable groundwater. In general, the percentage of self-sufficiency in cereal crops was 7.4 percent, vegetables 88 percent, fruit 57.4 percent, table eggs 117.7 percent, fresh milk 112.4 percent, red meat 34 percent, poultry meat 44.6 percent, and fish 37.9 percent.

A number of serious initiatives were developed to advance the agricultural sector and transform it from traditional agriculture that relies on non-

renewable groundwater to what is known as sustainable agriculture that relies to a large extent on renewable water. Such initiatives include the provision of facilities, subsidies, and soft loans. But if the required measures for the success of this transformation are not taken, and if the farmers do not receive the right guidance to grow the appropriate crops, taking into account the economic value of each water unit and focusing on crops with low water consumption and high economic value, it will be expected that the Kingdom will face difficulty in the future in maintaining these percentages as part of its pursuit towards reaching sustainable agriculture.

Over the past decades, the private sector has played an important role in providing food commodities through import from abroad. These commodities included rice, pasta, sugar, vegetables, fruits, vegetable oils, red meat, poultry meat, fish, etc. Many Saudi businessmen and agricultural companies have partnered with government and specialized agencies in some countries that are rich in water resources, to produce specific crops such as grains, rice, fodder and others and export them to Saudi Arabia. These partnerships have achieved great success, despite the existence of serious risks.

The Kingdom of Saudi Arabia, as a food importer, is affected by global events, especially the political and economic conditions in the producing countries and the effects of climate change on the food production areas. Droughts, floods, frosts and other natural disasters could damage crops and reduce global stocks of food, thereby raising global prices as happened in 2008.

To encounter such fluctuations, Saudi Arabia adopted the King Abdullah's initiative for agricultural investment abroad. This initiative made it possible to provide food commodities to the consumer at balanced prices, and to secure a safe strategic stock of basic food commodities. This can achieve the Kingdom's food security and ensure the continued flow of goods to local markets and price stability throughout the year. Food commodities involved include wheat, barley, rice, sugar, vegetable oil, red meat, poultry meat and fish.

The King Abdullah initiative for agricultural investment abroad is considered one of the ambitious global initiatives that sought to establish agricultural investment partnerships at the government level. Its technical and economic feasibility has been studied, after officials in the agricultural, commercial and financial sectors visited many countries with flourishing agriculture, abundant water resources, rich soil and trained labor. Many agreements were concluded with countries in East Asia, Africa, Northern Europe, Argentina, Brazil and others. The Saudi government will provide various facilities, subsidies, and soft loans to agricultural investors abroad. According to the available information, the results of this initiative will be encouraging and attractive for agricultural investment, and will achieve food security for the Kingdom.

There remains an essential element for the success of this initiative and businessmen in importing food commodities, before and after the start of the initiative, which is providing strategic stocks to preserve these commodities for sufficient periods.

Necessary measures to achieve Saudi food security

- It is noted that the rates of self-sufficiency in food products in the Kingdom of Saudi Arabia are very low compared to the quantities of non-renewable groundwater extracted from the deep-water layers. The quantitative and qualitative analysis of water consumed in the agricultural sector and the quality of cultivated crops shows that grains, fodder and dates alone consume about 80 percent of irrigation water.
- The irrigation efficiency is very low and is estimated at 50 percent, which indicates the consumption of more irrigation water than the actual plants need. This is an impediment to finding a solution to the persistent shortage of groundwater resources in an arid desert environment.
- There is a need for a quick review of the cropping pattern to exclude crops with high water needs and replace them with crops that consume little water and have an appropriate economic and nutritional value, with the necessity of introducing highly efficient irrigation systems.
- The nutritional pattern in daily life involves severe water loss and waste, which results in direct or indirect water wastage. Therefore, the dietary habits must be reviewed in terms of quantity and quality.
- It is time to review the subsidies to the agricultural sector, so that farmers who use modern highly efficient irrigation systems, such as spraying or drip irrigation, are encouraged. The low fuel prices that contributed significantly to the excessive consumption of non-renewable groundwater to irrigate open fields intended for the cultivation of grains and fodder must also be reviewed.
- Optimization of each unit of water must be maximized, and the return per cubic meter of groundwater for different crops must be determined.
- Encourage the utilization of renewable water resources, including reuse of treated wastewater and surface water kept behind dams, and seek new water resources such as rain harvest.
- Enhance food security by providing facilities and subsidies whenever possible to establish more poultry and fishing projects, as they are an integral part of agriculture and do not pose a threat to water resources. Saudi Arabia is still far from achieving efficient self-sufficiency in poultry and white meat.
- Study the relationship between water security, food security, and energy security in the light of climate change, the volatility of global economy, and political instability in many countries of the world.
- Strategic storage is one of the basics of food security and a security and social stability factor. Therefore, strategic storage projects must be given the highest priority to preserve the various food commodities as long as possible, not less than a year.

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