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Ph.D. in Agro-Food System

cycle XXXIII

S.S.D: AGR/01

Sustainability and Resilience Index of Agro-Food Systems; Country of Analysis: Lebanon

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Matr. n.: 4713604

Academic Year 2019/2020

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Abstract

Food resilience, definition approved worldwide as a result of many studies analyzing this topic, is the "capacity over time of a food system and its units at multiple levels, to provide sufficient, appropriate and accessible food to all, in the face of various and even unforeseen disturbances"[1]; In Lebanon, the resilience and sustainability of the agricultural and food system have always been questionable. In a volatile region with fragile governance policies and institutions, trade distortion, and low food quality, among many other factors, the resilience and the sustainability of the agricultural and food system are worth the attention.

This study will analyze the impact of these systems on food resilience and sustainability, focusing on 7 sub-pillars of the agricultural and food system in Lebanon: (1) Economic, (2) Social, (3) Governance, (4) Institutions, (5) Environmental Practices, (6) Food Safety and Nutrition and (7) Natural resources; merged under three capitals: (1) Socio- Economic Capital, (2) Governance and Institutions Capital and (3) Environmental Practices, Food Safety and Nutrition and Natural Resources Capital. For each pillar, a set of indicators will be analyzed and a list of recommendations and planning will be presented to the ministries accordingly. The interlinks between all these pillars/capitals will portray the ultimate link between all components of the agricultural and food system, and how an ideal performance requires attention to many indicators.

Many aspects missed from international indexes, such as the GFSI (Global Food Security Index) and the Food Sustainability Index, will be added to the index we will be designing. In addition, a comparative analysis will be done using the index before and after the Syrian crisis in order to test the capacity of this index to anticipate coping mechanisms and to understand how the system works when affected by a shock. The index created will be used to track the status each year and is not of a one-off use.

The index for Lebanon, after applying the framework of analysis, is between 0.25 and 0.5, indicating that the country is performing inadequately and is highly at risk if no interventions take place, and will continue to perform this way in the face of a new shock. This supports the conclusion that the food system in Lebanon is not resilient, and that the food security and safety of people in Lebanon is at risk, which overtime might lead to the ultimate consequence – hunger.

Keywords: crisis, sustainability, resilience, index, indicators, food safety, food security, policies, correlation.

[1] Global Food Security/ Food System resilience: Defining the system, 2015. D.M et al.

Thesis Literature Background

As per the FAOSTAT, the number of people undernourished in Lebanon is 0.7 million which means 700,000 individuals. Until 2009, the number has been stable at its lowest 0.1 million (100,000 individuals). After, the number started to increase to reach its highest level in 2017. The analysis will show that each year the number is growing by 0.1 million, considering this pace, in 10 years from 2017, 0.17 million individuals will be suffering from Undernourishment; in other words, 1,700,000 Lebanese people will be undernourished out of 5,000,000 (based on the increase showed by FAO, the number will reach 5M undoubtedly in 2027). These results and many more are alarming for food security and food safety professionals.

In Lebanon, the agricultural sector generates around 3.5% of the Lebanese GDP[2] and employs around 6% of the "Lebanese" labor force[3]. These numbers are considered very low but not surprising for an underdeveloped and undiversified sector relying mostly on non-Lebanese workers and heavily on exports with such a high number of undernourished people in the country.

The need to create a resilient and sustainable agricultural and Food system in Lebanon is high. The country has already been affected by the Syrian crisis, considered as a direct threat to some resilience' aspects and indirect for others; the fragility of the whole system led to negative coping strategies used by people, traders and all the market actors, hence affecting its aim for sustainability. With another disturbance affecting the country, and considering its internal politics it is very accurate, a very high number of people will be food insecure and for the current undernourished group they might turn to be chronically food insecure.

Talking about the food sustainability index[4] by "the Economists' intelligence unit", Lebanon is among the lowest ranked countries surveyed (31st). Lebanon, received minimal scores in the quality of road infrastructure, investment in transport with private participation (0.4% of GDP) and quality of policy response to food waste sub-indicators. The water footprint of Jordan (1st) and Lebanon (2nd) is among the lowest of the countries surveyed. Israel (31.5%) and Lebanon (35.9%) demonstrate some of the highest diversification of the agricultural systems measured (where % is the top three crops as a share of total agricultural production). Meanwhile, Jordan (84.4%), Tunisia (76.5%) and Lebanon (61.2%) register comparatively high percentages of the population reaching the recommended amount of physical activity per week. At the total the Food Sustainability Index in Lebanon is 53,1 and the country is ranked in the "bottom quartile".

Globally, there is a need for reflexive processes that consider the complexity of entire food systems; reflexive processes aiming at sustainability solutions involve various scientific and non-

[2] The Lebanese National Accounts Report, 2017.
[3] Central Administration of Statistics, Statistical Year book 2009, Green Projects and Agriculture.
[4] Sustainable diets are those that are not only healthy for humans and for the environment, but also affordable and acceptable to society: *"Sustainable diets are protective and respectful of the biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources"* FAO, 2012.

scientific actors and perspectives and have a strong normative component. They have the objective to produce not only systems knowledge (which often involves disciplinary mode of knowledge production) but also target knowledge (about the desired future state of a system) and transformation knowledge (on how to arrive at this desired state)[5]. Accordingly, such processes usually include various forms of inter- and transdisciplinary research[6].

The massive changes in food production and consumption have led to an increasing disconnect between food producers and food consumers[7]. Many consumers have grown used to finding a similar standardized food offer around the world. This can be seen as a globalization of diets. While this development is much more advanced in industrialized countries, it is increasingly affecting people in developing countries as well[8]. The extension of markets and the related increase in potential customers promise income and business opportunities, but intensified food production practices also pose risks of adverse environmental and societal impacts[9]. Such risks include high levels of pesticide and fertilizer use, which cause pollution and degradation of water and soils[10]; advancing agricultural frontiers, which destroy forests and other natural habitats[11]; monoculture; and the increasing replacement of diverse agricultural crops with few hybrids and genetically modified varieties, leading to biodiversity loss[12]. On a second hand, there are socio-economic impacts on people's living conditions. Such changes include increased dependency on one or few goods for export; substantial changes in land use and the related social contexts; progressive concentration of land in the hands of fewer people, often linked with a shift from food production for local consumption to other uses, such as production of food for export or agrofuels[13]; and a tendency of healthy and varied diets becoming less affordable for people with low buying power. Another issue that can arise are the shock that any country can face; the shock that any country can be received, consist of natural, political, social or economic shocks. Hence each shock can affect a scale directly and indirectly affecting others considering the interconnections. During a shock, the food system will absorb, react, restore, learn and then build robustness. A strong food system will be considered as robust (capacity to withstand the disturbance in the first place before any food security is lost), redundant (the extent to which elements of the system are replaceable, affecting the capacity to absorb the perturbing effect of the disturbance and avoid as much food insecurity as possible), flexible and thus rapid (with which the food system is able to recover any lost food security) and resourcefulness and adaptability (which determines just how much of the food lost security is recovered). This is called the food resilience action cycle. The food system resilience action cycle includes the learning and preventive action components possible in food systems.

[5] Hirsh hadorn, et al 2006
[6] Pohl& Hirsh Hadorn, 2007
[7] Boehlje, 1999
[8] Reardon, 2015
[9] Tilman, Cassman, Matson, Naylor & Polasky, 2002
[10] Carpenter et al., 1998; Matson, Parton, Power & Swift, 1997; Novotny, 1999
[11] Morton et al., 2006; Richards, 2015
[12] Altieri, 2005; Fahrig et al., 2015
[13] Oliveira, McKay & Plank, 2017

Several authors have made suggestions for integrative approaches to sustainable diets by including different dimensions (e.g., Downs, Payne & Fanzo, 2017; Mason & Lang, 2017; von Koerber, Bader & Leitzmann, 2016). Besides an assessment of the current sustainability of a given food system, the new approaches require collaborative reflection and implementation of innovation strategies and policy options that introduce and support the proposed changes. We define innovation strategies and policy options as changes to the current food system that may be initiated by public administrations, civil-society actors, and private initiatives that do not a priori involve changes to the legal framework.

When searching for policies that can support sustainable development of food systems, it is necessary to examine existing power structures and the ways in which they perpetuate unsustainable activities within the system. Such activities include, for instance, pressure on small-holders from international competition and subsidies in developed countries, or dependencies on multinational companies and international trade[14]. These structures and mechanisms need to be considered when aiming to improve current food systems.
Also, food system approaches are increasingly seen as a way to improve food system' outcomes and sustainability, in order to deal with competing priorities, and address the complex relationships that exist between components of food systems. The food system ultimate outcome is food security defined as "when all people at all times have access to sufficient, safe and nutritious food to maintain a healthy and active life". In order to reach the goal, a set of activities should take place on different scales such as economic, social, political, industrial (food quality) and environmental. Each scale cannot be treated as an isolated part of the food system, for example, a bad industrial process will lead to a low food quality meaning that country export status is less competitive thus affecting its economic scale.

The diverse problems that come with the current global food system are complex and interrelated. Accordingly, they need to be addressed through approaches that are capable of grasping this complexity. Therefore, in this research, we show that it is necessary to consider a more holistic food systems approach to improve human health and well-being, while avoiding adverse environmental impacts.

In order to conduct this study and come up with recommendations, the food system' scales will be indicator-based scales. Before and after the Syrian crisis the study will be conducted to determine whether these indicators can anticipate crisis outcomes.

The entry points usually used during the food resilience studies are as below:

- National or regional food systems: which comprise multiple value chains contributing to food security and other outcomes of importance in the region. This perspective is of particular interest to national policy-makers and governments, concerned about the food security of their citizens

[14] Lapatina & Ploeger, 2013

- Individual food value chains ranging from local to global levels, which form the national and regional food systems, and together lead to the diverse outcomes of food systems. For ex- ample, looking at individual value chains of agricultural commodities. This perspective is of particular interest to individual value chain actors such as industries and retailers, for whom the value chain is generally a well-known management level.
- Individual's perspective in the value chain, and the specific outcomes that concern them: this includes smallholder livelihoods, household food security, consumers' health etc. This entry point to resilience assessments has most often been used in existing studies of resilience of components within food systems.

In this study, we will look at the regional level of the food resilience system but taking into account the whole other aspects.

Thesis structure

Based on the logic stated above, a holistic multi-dimensional approach through seven sub-pillars/aspects or three capitals/pillars was applied to analyze the status and the performance of the Lebanese agricultural and food system.

A. Socio-Economic Capital

Economic Aspects

An environment conducive to equitably shared economic growth is essential to reducing poverty and enabling each and every person to have access to food. A very low Gross Domestic Product (GDP) per caput and widespread chronic undernutrition are generally associated with a crucial need of an economic progress in the agricultural sector to raising incomes of the poor and increasing food supplies.

Analyzing the dependency ratio, trade dynamic and agreements, food market monopoly and many other indicators is considered as a direct economic analysis for the resiliency of a country's agricultural and food system. Having a strong agricultural economic system will attract more investments from external and internal investors. A poor system, will be at risk of not being able to cope with any shock and risk the food security of citizens.

Social Aspects

"Food sustainability is about culture, education, health, equity and respect for the planet we live in[15]*"*

A wide pool of indicators can describe the social aspect and based on each study context and objective these indicators are chosen. In our context, we will be focusing on the sources of income, eating habits, financial education, role of women, etc. all the indicators chosen are

[15] Barilla center for food and nutrition, about macrogeo.

directly related to the food system as consumers play one of the most important roles in the study and in every market-based analysis.

Focusing on the income in this aspect has a wider goal for the study; poor people, often lack sufficient incomes or access to credits to purchase appropriate tools, materials and technologies to practice environmentally sustainable agriculture and, protect and efficiently use natural resources. Hence, the analysis of the population growth has also an impact on the environment and specifically the natural resources; the high number of refugees who entered Lebanon after the Syrian crisis is one of the main examples of the natural resources' depletion highlighted further in the study.

B. Environmental Practices, Food Safety and Nutrition and Natural Resources Capital

Environmental Practices

Agriculture is one of the largest elements of our environmental footprints. As a fact, soil degradation has reduced global agriculture productivity by 13% over the past 50 years. In this study, we will try to analyze the effect agriculture in Lebanon has on environment from water to soil reaching air pollution. In addition, what are the policies applied by the ministries will be at the center of the analysis.

Food Safety and Nutrition Aspects

The establishment of effective food safety system is pivotal to ensuring the safety of the national food supply as well as food products for regional and international trade. As all food security studies will show less importance to the food safety procedures compared to the availability and accessibility of food, in this study we will shed the light about the role the safety has within value chains and how it is correlated with all other aspects.

For this aspect, we will be analyzing the food quality procedures throughout the whole value chain. Starting from the use of pesticides and insecticides in a non-controllable way, to the transportation and storage conditions to reach the industry level. Throughout this, the % of food loss will be analyzed as it has direct link with the low quality of food.

The use of pesticides and polluted water, are contaminating the natural resources considered as essential for the sustainable agricultural production. Unsafe food cannot sustain human health and has tragic social and economic consequences.

Natural Resources

Natural resources, especially those of soil, water, plant and animal diversity, vegetation cover, renewable energy sources, climate, and ecosystem services are fundamental for the structure and function of agricultural systems and for social and environmental sustainability, in support of life on earth.

C. Governance and Institutions Capital

Governance

In a society still in search for solutions for sustainable development, good governance has always been recognized to be a critical tool for advancing sustainable development and a crucial element to be incorporated in sustainable development strategies. Good governance promotes accountability, transparency, efficiency and rule of law at all levels and allows efficient management of human, natural, economic and financial resources for equitable and sustainable development, guaranteeing civil society participation in decision-making processes. Good governance and sustainable development are two concepts intimately tied together. Good governance does not guarantee sustainable development; however, its absence severely limits it and can, at worst, impede it.

Governments are the primary actors in the physical, social, and economic aspects of a nation's food security, so any attempts to improve agriculture and food security outcomes must also consider the governance' role.

In this study, we will clarify the role of the government, the trust stakeholders have in it and what are the practices they are trying to implement in order to improve and sustain the agricultural and food system.

Institutions

Institutions could be contextualized as clusters of rights, rules, and decision-making procedures occurring at all levels of social organizations and with an emphasis on environmental and resource regimes. Institutions from national to international levels, based on many studies, have a role in shaping the whole sector.

In order to reach the resiliency and sustainability of the food system, some institutions should be in place and performing efficiently. Not all institutions should be governmental, some of them are private and other non-governmental or related to a UN (United Nations) agency.

The role of the institutions in strengthening the system is critical. The ministries, chamber of commerce, educational schools, research institutions and quality controller's firms should be in place and operating well.

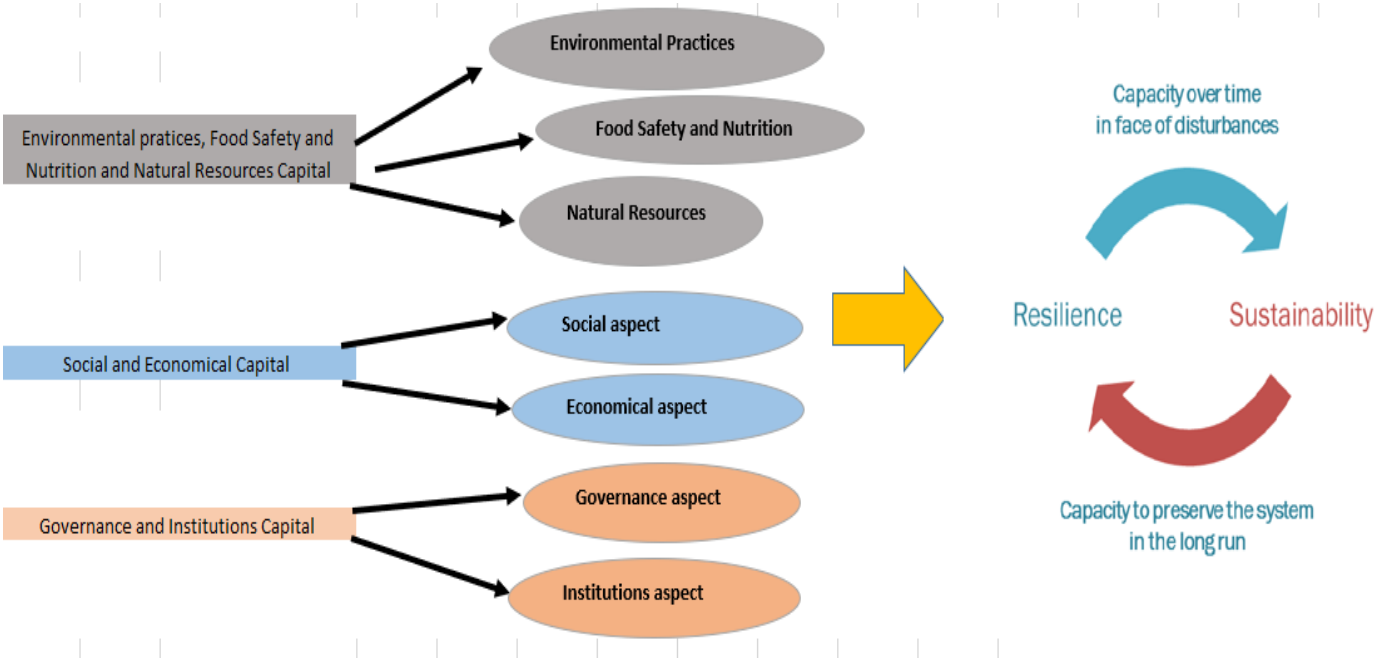


Figure 1: Thesis Analysis Body

Methodology

Objective

The aim of this research is to develop a country-level index measuring the agricultural and food system performance in any given year. The questions this research aims to answer are as below:

- What is the resiliency status of the food system in Lebanon and how it can survive another shock?
- What are the main reasons affecting the sustainability of food systems in Lebanon?
- How the Syrian crisis – considered as a shock – affected the agricultural and food system in Lebanon? Were results anticipated?
- How each aspect cited above is affecting the resiliency and the sustainability of the food system? How they are correlated?
- What are the short-, medium- and longer-term actions we can plan for in order to make the agricultural and food system in Lebanon more resilient?

In order to answer these questions and to develop the index, a combination of qualitative and quantitative research methods was applied to achieve the aim.

- Qualitative research methods:

  - Desk Research: This includes reports and data from FAO STAT, the World Bank, ministries, Development agencies and organizations, academic and non-academic publications and more. The purpose of the desk research is to understand the new trends of agricultural and food system approaches in addition to selected indicators analysis. For

each indicator analysis, the reference has been mentioned. Moreover, the desk research was initially used to define the main stakeholders needed for the field interviews.

- Field interviews (Key Informative Interviews)[16]: The stakeholders involved in this study are the main actors within each aspect: Farmers, exporters, packing centers managers, Micro-Finance Institutions (MFIs), Chambers of Commerce, Retailers, Storage owners, Food processing industries, Ministry of Economy and Trade rep, Ministry of Agriculture rep, Ministry of Health rep. For each stakeholder, a questionnaire was designed according to the role. A total of 67 interviews were conducted, segmented as portrayed on the table.

Stakeholder	**Number**
Farmers	30 (small, medium and big) for different crops
Exporters	3
MFIs	2
Banks	2
School of Agri	1
Retailers	10 (small, Medium and big)
Pesticides seller	2
Cooperatives	3
Food industries	2
LARI	1
Head of Agriculture office in the North	1
Storages supervisors	2
Chamber of Commerce	1
Packaging centers	2
SMEs in Agriculture	5

- Quantitative research methods:

- Online semi-structured Survey: An online survey has been developed to target the skilled and middle/upper class recipients for data comparison within indicators. The survey has been shared through "WhatsApp" mobile application using the Survey Monkey website.

- Field interviews (Key Informative Interviews)[17]: The stakeholders involved in this study are the main actors within each aspect: Farmers, exporters, packing centers managers, Micro-Finance Institutions (MFIs), Chambers of Commerce, Retailers, Storage owners, Food processing industries, Ministry of Economy and Trade rep, Ministry of Agriculture rep, Ministry

[16] For both qualitative and quantitative methods
[17] For both qualitative and quantitative methods

of Health rep. For each stakeholder, a questionnaire was designed according to the role. A total of 67 interviews were conducted.

Index Development

The index is defined as a set of indicators integrated with each other and which makes it possible to carry out an evaluation. These indicators differ from one evaluation to another; In fact, each one has, according to its precise objective and the specific characteristics of the study area, indicators that are specific to it. And there is no reference list of indicators that is applied in the same way in all evaluation cases[18]. Therefore, in order to develop a representative index, a group of suitable indicators has been chosen in our study based on the mentioned three capitals technically and theoretically linked to the resilience and sustainability of the food and agricultural systems in general and in Lebanon specifically.

Thus, it should come as no surprise that the inappropriate selection of indicators' weighting or aggregating methods can cause the index to provide misleading information (Böhringer and Jochem, 2007). In this sense, one of the main challenges in developing and applying the index is to know "when to use what."

- Step 1: Data collection

The data has been collected based on desk review and field questionnaires with relevant key stakeholders (refer to the above). Hence, not all data collected was quantitative, most of them were qualitative data. In order to transfer the qualitative data into the analysis as we need a final number, we used the "Likert Scale" where each qualitative answer is defined on a scale from 0 to 7 where 7 is the most favorable scenario. E.g. (7 =Excellent, 6=Very good, 5=good, 4= moderately good, 3=moderately bad, 2= bad, 1= very bad, 0=Worst).

- Step 2: Normalization

Every step of data transformation and/or normalization increases the probability of uncertainty and measurement error[19]. Accordingly, the choice of the proper normalization technique is indisputably important. In developing composite indicators, the selection of a preferred normalization technique deserves special care, taking into account the objectives of the composite indicators as well as the data properties and the potential requirement of further analysis[20]. Different normalization techniques produce different results and may have major effects on composite scores.

Normalization makes data comparable across indicators, so that the information can be combined in a meaningful way. For example, all indicators need to be estimated such that higher or lower values consistently mean that the achievement is better or worse. A typical approach is to rescale

[18] Pathak *et al*., 2005
[19] Developing Composite Indicators for Agricultural Sustainability Assessment: Effect of Normalization and Aggregation Techniques, MDPI (Multidisciplinary Digital Publishing Institute), November 2017
[20] Ibid

the set of values from 0 to 100, with 0 denoting worst performance and 100 describing the optimum. However, for our indicator, it was specific for each the maximum and minimum[21].

One of the main techniques used in the "min-max technique" which rescales data into different intervals based on minimum and maximum values. The advantage of this method is that boundaries can be set and all indicators have an identical range (0, 1). However, the normalized values do not maintain proportionality, and normalized values reflect the percentage of the range of maxas(Xias) − minas(Xias). This technique is based on extreme values (minimum and maximum), but because these two values can be outliers, the range of max and min strongly influences the final output.

Unless otherwise indicated, indicators are normalized as follows:

> *Indicators = (Value – Min Value)/ (Max Value – Min Value). The final scale of all indicators and aspects is from 0 to 1 where 1 is the most favorable scenario.*

- Step 3: Weighting

Methods for weighting indicators can be broadly categorized into three main groups[22]: (1) equal weighting, (2) statistic-based weighting, and (3) public/expert opinion-based weighting[23]. Equal weighting means that all the indicators are given the same weight. Statistic-based weighting derives weights from the statistical characteristics of the data (OECD, 2008). Unlike equal weighting and statistic-based weighting, public/expert opinion-based weighting relies on inputs from the participating public or experts, whose judgments ultimately determine the weights to be assigned to individual indicators (OECD, 2008). Thus, weights determined by public/expert opinion reflect the value judgments of the participants regarding different aspects of sustainability (e.g., relative importance, relative urgency, or substitution rates).

The weighting assigned to each category and indicator can be changed by users to reflect different assumptions about their relative importance. Neutral weightings are provided in our index:

- Neutral weights for the capitals' indicators, where we assumed that all indicators are equally important and distributes weightings evenly. "Equal weights can be applied on various levels in the structure of composite index. For example, if the composite index is composed from three components, with five indicators in each, it is possible to assign equal weights to each of the three components and/or to each of the five indicators."

- Neutral weights for the final capitals: The socio-economic capital has a higher number of indicators compared to the other two capitals however there is no solid logic behind giving the

[21] When to use what: Methods for weighting and aggregating sustainability indicators, Gan et al, October 2017

[22] However, some experts argue that weighting is a choice and not a method. The expert in question is the thesis referee Piero Conforti: Deputy Director a.i. Statistics Division FAO Rome.

[23] When to use what: Methods for weighting and aggregating sustainability indicators, Gan et al, October 2017

socio-economic capital a higher weight; as per the analysis below, all capitals have equal impact on the agricultural and food systems.

- Step 4: Aggregation

There are three main ways of aggregation techniques:

“The literature of composite indicators offers several examples of aggregation techniques. The most used are additive techniques that range from summing up country ranking in each indicator to aggregating weighted normalized indicators. Yet, additive aggregations imply requirements and properties, both of the indicators and of the associated weights, which are often not desirable and at times difficult to meet or burdensome to verify. To overcome these difficulties, the literature proposes other, and less widespread, aggregation methods such as multiplicative (e.g., geometric) aggregations or non-compensatory aggregations, such as the multi-criteria analysis”.

- Additive Methods:

By large, the most widespread additive aggregation is the linear summation of weighted and normalized indicators. Although widely used, this aggregation entails restrictions on the nature of indicators and the interpretation of the weights. A condition on the nature of indicators is that there should be no phenomena of conflict or synergy among the indicators. Furthermore, the indicators have to be preferentially independent, i.e., any subset of the indicators is preferentially independent of its complementary set of indicators. Preferential independence is a very strong condition since it implies that the trade-off ratio between two indicators is independent of the values of the remaining indicators.

- Geometric aggregation

An undesirable feature of additive aggregations is the full compensability they imply: poor performance in some indicators can be compensated by sufficiently high values of other indicators. For example, if a hypothetical composite indicator was formed by inequality, environmental degradation, GDP per capita and unemployment, two countries, one with values (21,1,1,1) and the other with (6,6,6,6) would have equal composite indicator value (=6) under an additive aggregation. Obviously the two countries would represent very different social conditions that would not be reflected in the composite. Geometric aggregation (i.e., the product of weighted indicators) is a less compensatory approach.

- Non compensatory multi-criteria analysis

In additive or geometric aggregations, the substitution rates among indicators are equal to the weights of the indicators up to a multiplicative coefficient (Munda & Nardo, 2003). As a consequence, weights in those aggregation schemes necessarily have the meaning of substitution rates and do not indicate the importance of the indicator associated. This implies a compensatory logic. Compensability refers to the existence of trade-offs, i.e. the possibility of offsetting a disadvantage on some indicators by a sufficiently large advantage on other indicators. The

implication is the existence of a theoretical inconsistency in the way weights are actually used and their real theoretical meaning. For the weights to be interpreted as "importance coefficients" non-compensatory aggregation procedures must be used to construct the composite indicators (Podinovskii, 1994). This can be done using a non-compensatory multi-criteria approach.

Aggregation is the most crucial step, as mentioned above, three methods exist for data aggregation. Choosing the aggregation formula is the most crucial decision: diverse formulas provide very different composite indexes. What do these imply for practitioners and policymakers?

"E.g., Some examples may help illustrate the relevance of choices. According to our baseline index, Congo and Tanzania rank, respectively, 214th and 196th out of 228: their populations (respectively four and 45 million people) are food insecure. However, if a different choice on the aggregation procedure had been made, for instance a geometric aggregation adopted, these countries would have been ranked 88th and 166th. Not only would their overall rank have been improved, but their relative position would have also been reversed, implying that Tanzania was more food insecure than Congo[24]."

For this study, the geometrical method was used since we don't want to imply full compensability "Geometric aggregation, which is the product of normalized weighted indicators, is used to avoid concerns related to interaction and compensability". Non-comparable data measured in a ratio scale can only be meaningfully aggregated by using geometric functions, provided that indicators are strictly positive. A geometric mean (the formula for evaluating geometric mean is (∏ n i=1 x1) 1 n) takes into consideration differences in achievement across dimensions. Poor performance in any dimension or indicator is directly reflected in the composite indicator's value. According to Hudrlikova and Kramulova, this technique is partly compensable since it rewards composite indicators with higher indicator scores". The final formula used to aggregate Capital Indexes and get the Final Index is as below:

$$Capital\ Index = (Indicator1)^{w1} * (Indicator2)^{w2} * \ (indicator\ m)^{wm} = \prod_{i=1}^{m} (Indicator\ i)^{\ wi}$$

$$Final\ Index = (Capital\ Ind\ 1)^{w1} * (Capital\ Ind\ 2)^{w2} \ * (Capital\ Ind\ m)^{wm} = \prod_{i=1}^{m} (Capital\ Ind\ i)^{wi}$$

[24] Detailed information on the rankings are omitted due to space limitations. For further details, see Santeramo F.G. 2013. "A unified framework to compute FAO SO's scorecards." Unpublished report.

Analysis

Introduction

Lebanon - Geographic Location

Lebanon is located on the eastern shore of the Mediterranean Sea. It borders the Sea in the west, Syria in the north and east, and Israel in the south. Its surface is officially 10,450 square kilometers, but small parts of the borders with Syria and Israel are contested. Lebanon is one of the smallest countries in the region, smaller even than Qatar. Compared to its immediate neighbors, Lebanon is about half the size of Israel, and almost 18 times smaller than Syria. The coastline is 225 kilometers long, Lebanon's land boundaries total 454 kilometers, of which 375 kilometers with Syria and 79 kilometers with Israel.

Demographic and social aspects

This part is about the demographic features of the population of Lebanon, including population density, education level, health of the populace, economic status, religious affiliations and other aspects of the population.

As per the CIA World Factbook in July 2018, the total population in Lebanon is 6.100.075 (4.680.212 Lebanese Nationals, 944.613 Syrians, 469.555 Palestinians refugees and 5.695 Iraqi Refugees). As for the age structure, **0–14 years:** 23.32% (male 728,025/female 694,453) **15–24 years:** 16.04% (male 500,592/female 477,784) **25–54 years:** 45.27% (male 1,398,087/female

1,363,386) **55–64 years:** 8.34% (male 241,206/female 267,747) **65 years and over:** 7.03% (male 185,780/female 243,015) (2018 est.).

About 99% of the population of Lebanon includes numerous Muslim sects and Christian denominations. Because the matter of religious balance is a sensitive political issue, a national census has not been conducted since 1932, before the founding of the modern Lebanese state. Consequently, there is an absence of accurate data on the relative percentages of the population of the major religions and groups. The absence of data and comprehensive statistics also concerns all other demographic studies unrelated to religious balance, due to the all but total inactivity of the concerned public agencies. The only recent (post-war) statistics available are estimates based on studies made by private organizations. There are from 8.6 to 14 million Lebanese and descendants of Lebanese worldwide.

The biggest study made after the independence on the Lebanese Population was made by the Central Administration of Statistics (in French: "Administration Centrale de la Statistique") under the direction of Robert Kasparian and Mgr. Grégoire Haddad's Social Movement: "L'enquête par sondage sur la population active au Liban en 1970"(in English: "The survey on the active population in Lebanon in 1970"). It was conducted on a sample of 130,000 individuals.

Lebanon's religious divisions are extremely complicated, and the country is made up by a multitude of religious groupings. The ecclesiastical and demographic patterns of the sects and denominations are complex. Divisions and rivalries between groups date back as far as 15 centuries, and still are a factor today. The pattern of settlement has changed little since the 7th century, but instances of civil strife and ethnic cleansing, most recently during the Lebanese Civil War, has brought some important changes to the religious map of the country.

Apart from the four and a half million citizens of Lebanon proper, there is a sizeable Lebanese diaspora. There are more Lebanese people living outside of Lebanon (8.6 – 14 million), than within (6.1 million). The majority of the diaspora population consists of Lebanese Christians; however, there are some who are Muslim.

Arabic is the official language of the country. Lebanese Arabic is mostly spoken in non-official contexts. French and English are taught in many schools from a young age.

Governance and Politics in Lebanon

The Republic of Lebanon was established by the enacted Lebanese Constitution of 1926 and won its independence from France on 22 November 1943. Lebanon is a parliamentary democracy. Its capital is Beirut. Lebanon was a founding member of both the United Nations and the League of Arab States. The Lebanese political system is formally based on the principles of separation, balance, and co-operation amongst the powers.

For all important political and administrative functions quota have been established along the lines of the percentage of the population belonging to the different religious communities.

The president of Lebanon is the head of state and the symbol of its unity. The parliament elects the president for a single term of six years. Executive power is entrusted to the Council of Ministers, which drafts general policy and oversees its execution in accordance with the effective laws. The president appoints the head of the Council, i.e. the prime minister, in consultation with the parliament. The constitution states that the prime minister must be a Sunni Muslim.

Legislative power is in the hands of the Assembly of Representatives (the parliament). The 128 parliamentary seats are confessionally distributed but members are elected by universal suffrage for a four-year term. Every religious community has an allotted number of seats. In addition, all candidates in a particular constituency, regardless of religion, must receive a plurality of the total vote. The parliament elects one of its members as speaker for the same term but this, unlike the presidency, can be renewed. The constitution states that the speaker must be a Shia Muslim.

Judicial power rests with judicial courts of various degrees and levels of jurisdiction. Magistrates are formally independent in the exercise of their functions. Their decisions and judgments are rendered and executed in the name of the Lebanese people.

Local Government

Lebanon is divided into six *muhafazat* (both provinces and electoral districts), and subdivided in 25 *qadas* or districts. The *muhafazat* are: Beirut (administrative centre: Beirut), North Lebanon (Tripoli or Tarabulus), Mount Lebanon (Baabda), Beqaa (Zahle), South Lebanon (Sidon or Saida), and Nabatieh (Nabatieh). Local communities or municipalities can vary from villages with 300 inhabitants to cities of half a million inhabitants.

Active Economic Sector

Active economic sectors in country – overall economic background

McKinsey report was published beginning 2019 of 1.274 pages, becoming part of the Lebanese policy-making. The report frames its findings under 8 sections; the study begins with an executive summary and introduction, followed by a macroeconomic evaluation of Lebanon's economy and its evolution which concludes that Lebanon is caught in a *"vicious economic cycle".* The section further presents a detailed sectorial diagnosis across 15 industries, from which McKinsey's national "*Vision 2025*" for Lebanon is derived.

McKinsey' "vicious economic cycle" explores in great details the key macroeconomic challenges of Lebanon: persistent corruption, pending business environment laws and legislations stuck at different stages of the pipeline for 5-10 years, alongside a highly volatile growth, and a reliance on diaspora inflows not channeled into "productive" sectors rather add to the government's indebtedness.

As per McKinsey, the General Targets: from 2017 to vision 2025 & 2035 are as the table below:

	GDP in real 2017 prices	Job creation	Additional industry-specific Target
Industry	$4.6B to $8B to $11.7B	185K to 240k to 250k	-
Agriculture	$1.6B to $2.2B to $3.2B	210k to 214k	-
Tourism	$1.6B to $3.7B to $5.4B	89k to 185k to 211k	**Total Nb. Of Tourists** 1.9M to 4.2M to 6.5M
Knowledge economy	$1.4B to $3.8B to $5.6B	44k to 105k to 123k	**Innovation capacity** Rank: 58 to 30 to 15
Financial Services	$4.8B to $7.8B to $11.4B	50,000 to avg. 50,000 in 2025/35	

Source: BLOMInvest Bank; McKinsey Report, 2018

On a second hand, a scoring methodology has been done in order to identify details regarding some active economic sectors in Lebanon; the study has been done by personal technical consultants. The proposed sectors have been chosen based on a preliminary assessment of existing studies by sector, understanding of the potential for growth by sector and employability of women, youth and minority groups in these sectors.

Six selection criteria have been set for all the sectors: Job Creation Potential, Sector Performance & future Growth, Youth and Women Inclusion, Training Education & Support, Varying Levels of Skill and Geographic Coverage.

Each criterion will be scored according to their performance under each sector; the sum of all the criteria scores will reveal a total score for each dimension. The scoring will be from 1 to 5, with 1 the lowest score and 5 the highest. The score is defined based on participants' personal know-how and expertise, and assessment for each.

The results are as below:

	Tourism	Construction	Agro-Food / F&B	Knowledge Economy / ICT	Fashion & Jewelry	Health
Job Creation Potential	4	2.5	4.5	4.5	3.5	4
Sector Performance & Future Growth	4	2.5	4	4	3	4.5
Youth & Women Inclusion	4	2	4	4	4	4
Training Education & Support	3	4	4	3	3	4
Varying Levels of Skill	4	3	4	3.5	3	3
Geographic Coverage	4.5	4	3	3	3	4.5
SCORE	23.5	19	23.5	22	19.5	23
	1	5	1	3	4	2

Source: GOPA Consultant

1. Tourism

Job Creation Potential	4	There are about 10 sub-sectors under tourism which have the potential to create jobs, including car rental, hotels, travel agencies, tour operators, guesthouses, restaurants and leisure facilities. Each has the potential to create many jobs especially as the industry is expected to experience growth.
Sector Performance & Future Growth	4	The number of tourists visiting Lebanon is at a 10 year high in 2018, with an increasing number of European tourists visiting the country. As of March 2019 the ban on travel to Lebanon was lifted by Saudi Arabia and the industry could well be on the path for more recovery.
Youth & Women Inclusion	4	This is an easy sector for youth and women to work in, especially with the development of rural tourism which favours the inclusion of women in the workforce.
Training & Education Support	3	There are some education programs in hotel and hospitality management, but few training centers or specialized courses notably in ecotourism and rural tourism which are a central focus for the government and offer great potential for the country,
Varying Levels of Skill	4	The industry requires highly educated managerial staff, entrepreneurs but also lower skilled positions as support staff and for servicing, cleaning etc.
Geographic Coverage	4.5	Tourism can be developed across all of Lebanon or almost all of the country, especially if rural tourism is well implemented.

2. Construction

Job Creation Potential	2.5	The construction sector could create a large number of jobs, but given the large pool of unemployed workers for the sector, any recovery in this sector will only guarantee work to those who have lost their jobs or are unable to find work. Also, this sector has historically and still creates jobs for foreigners rather than Lebanese workers.
Sector Performance & Future Growth	2.5	The sector is ailing at the moment, with a very slow activity and a large number of companies reporting poor performance and even bankruptcy. The sector could recover if CEDRE projects are implemented.
Youth & Women Inclusion	2	The sector is male oriented and mostly depends on a male workforce, aside for administrative jobs. The incidence of youths working in the sector is also low.
Training & Education Support	4	There are many training programs and TVETs tackling construction related topics, although employers often complain about these not being optimal or up to date.
Varying Levels of Skill	3	The vast majority of jobs are on the field hard labor jobs which do not require high levels of education and there is a surplus of engineers on the market who are unable to find work.
Geographic Coverage	4	Construction is nationwide, although less developed in rural and remote areas.

3. Agro-Food

Job Creation Potential	4.5	The agro food industry offers great opportunities for job creation through manufacturing, farming and many other types of jobs.
Sector Performance & Future Growth	4	The sector is performing well although the war in Syria has hindered exports and stifled growth. That said, it could easily recover and is being eyed by international organizations and donors for expansion and development.
Youth & Women Inclusion	4	Youths are interested in the sector when it comes to creating new businesses and women can easily work in factories, administration and management. Lebanese youths and women are less interested in farming which is often taken up by the foreign workforce.
Training & Education Support	4	There are many TVETs including some modernized and successful ones like the Qob Elias school which offer up to date programs in consultation with the association of food industrialists.

Varying Levels of Skill	4	Jobs are available for highly educated or less educated individuals whether they choose to work in management, manufacturing or farming.
Geographic Coverage	3	Agriculture and agro food is very concentrated in the Beqaa and some other areas in the North and South

4. Knowledge Economy - ICT

Job Creation Potential	4.5	The knowledge economy or ICT / Digital sector offers great opportunities for job creation across a wide spectrum of activities within very different types of businesses. All companies are going digital and will require a new type of workforce for this purpose.
Sector Performance & Future Growth	4	The sector will see positive growth as it is expanding and growing not only through native ICT/digital companies but also through integration in other existing businesses and industries.
Youth & Women Inclusion	4	The young Lebanese workforce is already interested in the sector, be it through entrepreneurship or joining companies and departments that are related to ICT. There are also plenty of opportunities for women in the sector.
Training & Education Support	3	There are training institutes and programs for ICT although the programs are not always up to date. Coding schools have started to proliferate which is a very positive development for the industry.
Varying Levels of Skill	3.5	The sector offers jobs mostly for well educated workers, although coding could democratize the sector and help to position Lebanon as a digital hub for the region.
Geographic Coverage	3	Developments in the sector are mostly taking place in Beirut where the majority of tech incubators are also located. Many ICT companies outside of Beirut feel left out and at the margins of the ecosystem.

5. Fashion & Jewellery

Job Creation Potential	3.5	This sector has the potential to create jobs, albeit not as many as others given the difficulties that it is currently facing and the small size of businesses in this sector. If manufacturing is further developed then there could be more jobs created.
Sector Performance & Future Growth	3	Both sectors are suffering from the economic downturn and absence of Arab tourists. There could be a recovery but many elements are needed in order to help support growth including facilitating export.

Youth & Women Inclusion	4	The sector is attractive for women and the youth, although jewellers for example are often small family businesses where there are few opportunities for other employees than family members, making them less attractive to the youth.
Training & Education Support	3	There are few institutes such as ESMOD and other jewellery oriented TVETs focusing on training for the sector.
Varying Levels of Skill	3	The sectors can create jobs for artisans and higher skilled managers as well as the creative workforce.
Geographic Coverage	3	There is a large concentration of businesses in these sectors in Beirut although they exist across the country too.

6. Health

Job Creation Potential	4	The health sector can create jobs across many different types of activities from medical doctors, to nursing, health and wellness (spas, etc.) related types of jobs, new medicine and alternative medicine, etc. and with the ageing population and increasing health awareness, this is definitely a potential sector.
Sector Performance & Future Growth	4.5	In light of the new developments in the sector, it will likely see more growth in the future. The sector is performing well and if the government succeeds in reviving medical tourism there could be a further boost.
Youth & Women Inclusion	4	The industry is largely lacking nursing staff which can be youths and women. Hospital staff already have a lot of women staff in administrative positions and young graduates in medicine start their careers through internships at hospitals.
Training & Education Support	4	Hospitals have their own training systems given through internships and others. Health education is very advanced in Lebanon, although there might be a need for more nursing schools.
Varying Levels of Skill	3	Working in the health sector normally requires at least a certain level of education and / or training.
Geographic Coverage	4.5	Healthcare is needed throughout the country and there is a fair national coverage.

Analysis of the tables above:

Comparing the income from agriculture to other active sectors such as industry or tourism will show us the level of effort, motivation and willingness to invest in a sector. Gaps will be highlighted based on the numbers we get. Hence, more details related to the raw materials, time level needed and so on are needed.

Being financially educated is not only for investors, its even for each member of the society. People can anticipate risks and based on this they can better cope with a shock. The lack of financial education can put families under the risk of negative coping strategies and even food insecurity.

Based on our geography textbooks, Lebanese school students grow up learning that Lebanon has a strong agriculture sector with practically each region excelling at growing a certain type of fresh produce – from the citrus fruits in Sidon and Tyre to the olives in Koura, North Lebanon and South Lebanon to the many crops in Bekaa Valley and Akkar.

Once out of school, however, we see that the reality is not quite so simple or rosy. We learn that agriculture in Lebanon contributes to only 5 percent of growth, and that Lebanon actually imports up to 80 percent of its food needs – this according to a yet to be published report acquired by Executive and prepared for the United Nations Economic and Social Commission for Western Asia (ESCWA) entitled "Strategic Review of Food and Nutrition Security in Lebanon". This situation does not have to be permanent, though, and Lebanon's agricultural sector has the potential to be modernized and improved, as demonstrated by some efforts on the level of educational institutions and private sector operators.

Agricultural Sector Overview

Lebanon's moderate climate, rich soil, and abundant water resources provide it with key enablers to stand out in the region as an ideal location for agricultural activity. Rainfall in the country remains relatively abundant, at an average of 2.2 billion cubic meters per year, significantly higher than the regional average[25].

Major regions for crops, meadows and pastures include the Bekaa plain (where more than 40% of the land is cultivated), the North, especially in Koura and Akkar, and the South with the coastal region from Sidon to Tyre (where intensive agriculture is also present in greenhouses). Mount Lebanon and Nabatiyeh are also important agricultural zones, albeit with lower shares of cultivated land due to their rough landscape[26].

[25] Sector in focus, Agriculture and Livestock, Invest in Lebanon (IDAL), 2017
[26] Ibid

Key facts and figures[27]:

- In 2017, the agriculture sector generated around 5% of Lebanon's GDP with its contribution growing at a CAGR of 2% between 2004 and 2017.
- It employs roughly 11% of the Lebanese labor force and is the 3rd largest employer in the country.
- Exports of fruits and vegetables products have been on the rise over the last couple of years reaching 1.1 million USD (294 thousand tons) in 2018 mostly driven by increasing demand from Gulf countries for fresh produces.
- Key agricultural and livestock products include fruits which accounted for 39% of total agricultural exports in 2018; vegetables which accounted for 20.4% and coffee and spices accounting for 19.7%. Livestock exports accounted for 5% of total agricultural exports.
- Banana exports registered the highest exports share accounting for 28% of the total fruits exports in 2018 followed by malus including apples and pears (19%) and grapes (15%).
- Potatoes accounted for the highest share of vegetables exports with 37% of the total in 2018 followed by lettuce (23%) and dried leguminous (17%).
- Coffee exports accounted for 62% of total coffee and spices exports in 2018 followed by the export of ginger, saffron and turmeric accounting for 28%.
- Bulbs and tubers; live sheep and goats; and exotic fruits (dates, figs, pineapples, avocado, mangoes …) were identified as Lebanese agricultural and livestock products with high potential for growth given their export trend data. Exports of bulbs and tubers registered a CAGR of 53% between 2009 and 2018 while live sheep and goats increased by 27%, followed by exotic fruits with 20%.
- Lebanon's main export markets for agricultural products remains the Middle East accounting for 76% of total exports in 2018. Five major Arab countries represent Lebanon's main export markets with a 58% share: Syria (15%), Saudi Arabia (13%), Qatar (12%), UAE (9%) and Kuwait (8%).

Competitive advantages:

- Highest proportion of fertile agricultural land in the Middle East: Agricultural areas cover around 65% of the Lebanese territory (nearly equivalent to 6800 km^2).
- Moderate climate and abundant water resources: Lebanon's climate contributes to its unique biodiversity allowing the cultivation of 60+ types of crops and 10+ livestock products.
- Governmental support: The government through IDAL provides agriculture exporters with financial and non-financial support aimed at increasing exports and widening access to new markets. Moreover, the Ministry of Agriculture has a dedicated center for Research and

[27] Ibid

Development called the Lebanese Agricultural Research Institute (LARI) that supports the development of the sector.

- Access to competitive financing: The Central Bank of Lebanon offers subsidized loans for the agriculture sector to support the development and expansion of productive industries including agriculture production.
- International treaties and agreements: Lebanon's exports benefit from favorable export terms and access to external markets thanks to a number of bilateral and multilateral agreements most notably EU- Lebanon Association Agreement, EFTA, GAFTA, GSP…

Market opportunities:

- **Lebanon economic vision:** The Lebanon economic vision developed by Consultancy in 2018 identified the agriculture sector as a priority sector to be supported by the Lebanese government in terms of export and investment promotion. This is expected to accelerate growth in the sector in the short to medium term. (explained below in section 2).
- **Agrytech cluster[28]:** Berytech, a major startups incubator, launched in 2019 the agrytech cluster, **QOOT[29]**, to support innovation in the agriculture sector and help in the development of new innovative products that can be exported.

Land status:

General Data	
Total land area	10230 sq.km
Urban land area	2317.5 sq.km
Rural land area	8081.99 sq.km

Source: World Bank data 2010

Land Type	**Number estimation**
Agricultural land (% of land area)	Roughly 64% (till 2016 more or less); 658 thousand hectares[30]
Arable land (% of land area)	Roughly 12% (till 2016 more or less); 132 thousand hectares[31]
Land under cereal production (ha)	61234 (2016)
Permanent crops	12.06% (2011)
Irrigated Land	1.040 sq.km (2003)
Agricultural area organic	1 thousand hectares[32]
Other	77.22%

[28] https://agrytech.org/
[29] https://qoot.org/ Promoting Lebanon's agri-food sector to new heights of sustainable prosperity and innovation
[30] Knoema.com, world data atlas, Lebanon.
[31] Ibid
[32] Ibid

What is agricultural area organic?

Sum of areas under “Agricultural area certified organic” and "Agricultural area in conversion to

Arable land is the land under temporary agricultural crops (multiple-cropped areas are counted only once), temporary meadows for mowing or pasture, land under market and kitchen gardens and land temporarily fallow (less than five years). The abandoned land resulting from shifting cultivation is not included in this category. Data for “Arable land” are not meant to indicate the amount of land that is potentially cultivable.

Land area is a country's total area, excluding area under inland water bodies, national claims to continental shelf, and exclusive economic zones. In most cases the definition of inland water bodies includes major rivers and lakes.

Natural resources:

Lebanon may have significant oil & gas resources, which are currently untapped ▪ In 2010, USGS estimated that 1.7 billion barrels of recoverable oil and 122 trillion cubic feet of recoverable natural gas may be found in the Levant Basin Province Despite long delays, there have been several recent achievements supporting the development of Lebanon’s oil & gas sector: ▪ Exploration & production licenses for 2/9 blocks were awarded to a consortium made up of Total, Eni and Novatek (Dec 2017) ▪ Regulatory and governance framework for the sector has been developed, with several laws being passed (e.g. law to establish a Sovereign Wealth Fund)[33].

On a second hand, the main natural resources in country are: limestone, iron ore, salt, water-surplus state in a water-deficit region, arable land.

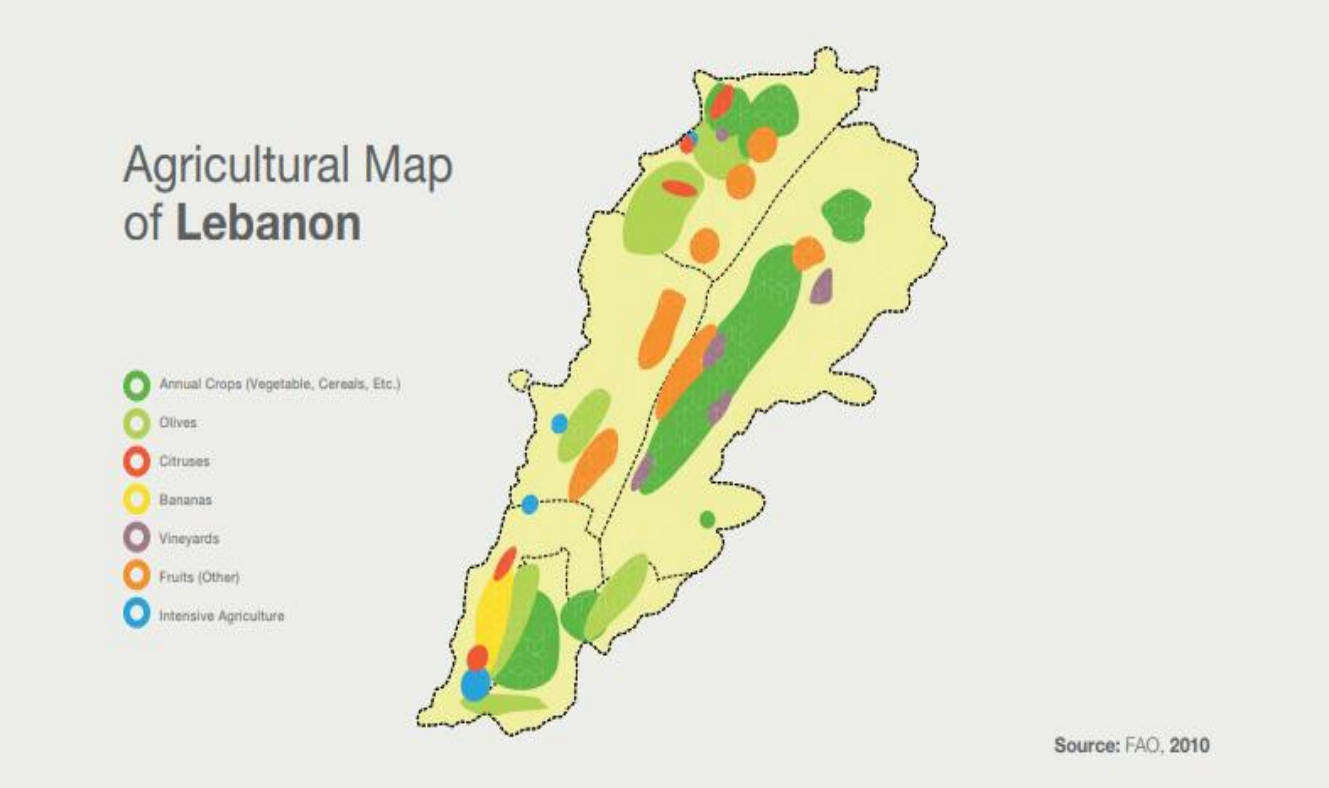
Crop production

Lebanon produces varying agricultural and farming products including: citruses, potatoes, olives, wheat, tomatoes, oats, tobacco, as well as sheep and goats. The 5 five major categories: cereals, fruits, vegetables, olives, and industrial crops (sugar beet and tobacco).

The top exports crops include: Fruits (apples, bananas, grapes, orange, etc.), Vegetables (Potatoes and Lettuce), Raw tobacco, Spices and Live sheep.

The image below, show the distribution of crops in Lebanon:

[33] Lebanese Economic Vision, Ministry of Economy and Trade, 2018



Source: FAO, 2010

Agro-Industry data

The agri-food sector is a major contributor to Lebanon's industrial sector growth and is expected to continue to play a major role in the economy driven by government support and private sector initiatives to boost its competitiveness.

Industry in numbers[34]*:*

- In 2017, the agri-food sector was the largest contributor to the industrial sector output at 34% of total and generated 2.4% of the country's GDP.
- The sector has an estimated size of 1.4 billion LBP (922 million USD) and has registered a 3.5% Compounded Annual Growth Rate between 2004 and 2017.
- There are around 1,400 agri-food companies constituting the largest share of total industrial firms in Lebanon. More than 45% of the agri-food factories are located in Mount Lebanon Governorate and are engaged in the production of dairy, confectionary, dried fruits and nuts, baked goods, olive oil and wine.
- Exports of agri-food products accounted for 15% of total exports and 16% of total industrial exports in 2018. Despite all external and internal challenges, agri-food exports

[34] Sector in focus, Agriculture and Livestock, Invest in Lebanon (IDAL), 2017

have been growing at a compounded annual growth rate of 4% since 2009 demonstrating the sector's potential and resilience.

- Lebanese agri-food production is diversified with a wide range of traditional and innovative products being exported to regional and international markets. Top three exported agri-food products in 2018 included dried fruits and nuts at 8.3% followed by processed chocolate (8.1%) and sauces and condiments (7%).
- Dried fruits and nuts, prepared sauces and condiments and milk and cream were identified as Lebanese agri-food products with high potential for growth given their export trend data. Exports of dried fruits and nuts registered a CAGR of 43% between 2009 and 2017 while sauces increased by 29% and milk and cream by 23%.
- Arab countries and in particular the GCC are importing the highest share of Lebanese agri-food products with Saudi Arabia, UAE, Qatar and Kuwait importing around 30% of total Lebanese agri-food exports in 2018.

Competitive advantages:

- **Large and diversified agriculture land:** Lebanon has the largest agriculture land share from its territory in the Middle East at 63%, supporting the development of a competitive agriculture processing sector.
- **A large diaspora network**: Lebanon has a large diaspora estimated at around 10 million people spread around the world which is a major demand driver for Lebanese agri-food products.
- **Skilled labor force with competitive wages:** The agri-food sector benefits from a cost-effective labor force that can support its development and growth.

Governmental support:

- The Government offers many tax advantages for agri-food manufacturing companies as well as fiscal exemptions granted through IDAL.
- Agrofood exporters are also supported to attend international fairs and exhibitions under the Agro Map program developed by IDAL.
- The Ministry of Industry through the Industrial Research Institute and ELCIM center provides technical assistance to manufacturing companies including agri-food producers to improve their production processes.
- LIBNOR, a public institution under the Ministry of Industry, is the only organization responsible of preparing, publishing and amending national standards, as well as granting the Lebanese Conformity Mark NL.

Market opportunities:

- **Lebanon economic vision:** The Lebanon economic vision developed by Mckinsey Consultancy in 2018 identified the agri-food sector as a priority sector to be supported by the Lebanese government in terms of export and investment promotion. This is expected to accelerate growth in the sector in the short to medium term.
- **Agrytech cluster:** Berytech, a major startups incubator, launched in 2019 the Agrytech cluster, **QOOT**, to support innovation in the agri-food sector and help in the development of new innovative products that can be exported.
- **Gastro diplomacy initiative:** The Ministry of Foreign Affairs launched in 2018 a **gastro-diplomacy initiative**[35] to help in the marketing of agri-food products worldwide and especially in diaspora communities.

Economic aspect of the Food System in Lebanon – Agricultural economics

An environment conducive to equitably shared economic growth is essential to reducing poverty and enabling each and every person to have access to food. A very low Gross Domestic Product (GDP*) per caput and widespread chronic undernutrition are generally associated with a dependence on agriculture as a major economic sector, shown by a high share of agricultural GDP in total GDP (and a high ratio of rural to urban population). In Lebanon, this is not the case; Agriculture, as mentioned above, share 3,5% of the Lebanese GDP only and inputs mainly are imported where import represents 46.3% of the GDP and the export 23.6% as per the World Bank data (2017).

On a second hand, the trade in Lebanon has a high share from the GDP and it reached 69% in 2017 (WB data); the number is explainable considering the geographic location of Lebanon and how it connects the gulf with Europe. However, we can tell from the WB data that this number has started to decrease after the Syrian crisis who started in 2011 where borders and routes have been distorted: In 2010 Trade % in GDP was 96%, in 2008 it was 107.8%.

The prevailing agricultural production systems in Lebanon are not resilient and sustainable. The problems facing this sector are numerous and threaten the food security of people. As per the FAOSTAT, the number of people undernourished in Lebanon is 0.7 million individuals, which means about 11.5% of the 6,1 million country population. Until 2009, the number has been stable at its lowest 0.1 million, less than 2.5% of the Lebanese population in that year. Afterwards, the number started to increase to reach its highest level in 2017. The analysis shows that each year the number is growing by 0.1 million; considering this pace, in 2027, 0.17 million Lebanese people will be undernourished out of a population which could range between 8,1 million (applying the 2.09% yearly increase rate observed in the last 5 years) and 9,0 million (supposing the yearly increase rate will reach 4.01%, as in the average of the last 10 years). In other words, the undernourishment rate could reach between 18,8% and 20,9% of the country's population. These numbers are enough to alarm food security and food safety professionals. As per "The Economists Intelligence Unit", Lebanon is among the lowest ranked countries surveyed

[35] http://www.businessnews.com.lb/cms/Story/StoryDetails/6508/Gastrodiplomacy-initiative-launched

(31st out of 34). Lebanon received minimal scores in the quality of road infrastructure, investment in transport with private participation (0.4% of GDP) and quality of policy response to food waste sub-indicators. Lebanon (35.9%) demonstrate some of the highest diversification of the agricultural systems measured (where % is the top three crops as a share of total agricultural production). At the total the Food Sustainability Index in Lebanon is 53,1/100 and the country is ranked in the "bottom quartile".

In Lebanon, the agricultural sector generates around 3.5% of the Lebanese GDP and according to the latest available figures, employs around 6% of the "Lebanese" labor force[36]. These numbers can be considered very low but are not surprising for a neglected sector relying mostly on non-Lebanese workers and largely devoted to exports, in addition to such a high number of undernourished people.

The country has already been affected by the Syrian crisis, considered as a direct threat to all its economic active sectors; with another disturbance affecting the country, and considering its internal political instability, a very high number of people is under the risk of food insecurity. However, the market system, has been using coping mechanisms to survive and so far, the country didn't face any type of chronic food insecurity or hunger. This result, appearing as a positive one, is in fact covering serious issues and problems inside the system and will no longer be positive if another shock faces the country; a significant number of people might face critical food insecurity and possibly hunger.

Additional facts from ESCWA data:

- Lebanon imports 80% of its food needs.
- Lebanon produces less than 10% of grains and wheat.
- 0,5% of the total budget is allocated to the Ministry of Agriculture which is 5 times less than neighboring countries.
- Lebanon is only self-sufficient when it comes to fruit (147%) and almost self-sufficient when it comes to vegetables (93%); hence, it imports 80% of its remaining food needs.
- Fruit and vegetables are mainly exported, specifically potatoes with 55% share of vegetables exports – still the number is low compared to the production level.
- Lebanon's landscape and size, do not allow the country to be fully sufficient but the country should be producing a wider variety and be more competitive.
- Lebanon has no food security strategy.
- 49% of Lebanese are worried about their ability to secure sufficient food.
- 13% of Lebanese claimed that they did not have healthy food over the past year.
- Food accounts for 16% of the total of the total import bill, second after fuel.
- Consumed food items in Lebanon: 35% for bread and cereals, 11% milk and dairy products, 8% for meat and poultry, 46% others (vegetables, fruits, fish, etc.)

[36] Sector in focus, Agriculture and Livestock, Invest in Lebanon (IDAL), 2017

- The food market is totally dependent on imports of: sugar, sweeteners, coffee, sesame seeds, cocoa beans, rice, spices, vegetable oil, sunflower oil, tea.
- The food category most consumed through imports is cereals, especially wheat and maize, of which 76% and 99% are imported, respectively.
- Agriculture employ 25% of the total employment where 40% of its workers are considered poor.

Syria Crisis

Background

Syria's civil war began during the Arab Spring in 2011 as a peaceful uprising against the country's president, Bashar al-Assad. It has since escalated — shattering the lives of Syrians, destroying cities, straining global politics, and spurring diplomatic efforts. Now in its 10th year, the Syrian refugee crisis is the largest refugee and displacement crisis of our time.

About 5.6 million Syrians are refugees, and another 6.2 million people are displaced within Syria. Nearly 12 million people in Syria need humanitarian assistance. At least half of the people affected by the Syrian refugee crisis are children[37]. These families are highly likely to remain in Lebanon and do not seem to have plans to return to their country in the near future due to the continuing levels of insecurity. Those without the support of family and friends in Lebanon remain in the North and Bekaa and arrive with very few belongings and without the prospect of adequate housing, water, food, healthcare, employment, protection or education.

The Lebanese communities have reacted in a positive way by hosting many refugees but this has put additional strain on already poor communities in North and East Lebanon. Hosting communities are among the most economically depressed areas of Lebanon, and the addition of so many thousands of refugees has placed additional strains on local area. In particular, those nearest the northern border, who have previously been reliant on trade with Syria, are now in a fragile socio-economic position.

The crisis impact on Lebanon

The influx of refugees has overburdened local services and undermined local labour markets, often in areas already suffering from poverty and affected by the economic pressure caused by the almost complete loss of cross border trade. Due to the protracted nature of the crisis, Syrian refugees and local Lebanese communities already struggling pre-crisis with high unemployment rates and a weak economy are becoming increasingly vulnerable.

While its humanitarian aspects and its consequences on Eurasian politics have been widely discussed, much less attention has been given to its economic consequences on Syria and on neighboring countries. This could be understandable given the uncertainties of a complex war and the difficulty of obtaining the data needed for good quality research. But these are not the

[37] https://www.worldvision.org/refugees-news-stories/syrian-refugee-crisis-facts

only reasons. Economists give little attention to the economics of wartime and, according to Betts and Collier (2017), they often forget that refugees are "consumers, producers, buyers, sellers, borrowers, lenders and entrepreneurs", and not just a humanitarian matter.

The changed environment has impacted sectors in the following way:

a. Macro economy & Micro economy: The already existing problems of the Lebanese economy were further aggravated by the Syrian crisis to varying extents. As a result, all sectors in the economy were negatively impacted however in varying degrees[38]. The balance of payments also witnessed a historic deterioration during the same period of time. The fiscal performance was also negatively affected by the Syrian crisis. However, the Lebanese economy has proven, once more, its resilience. This was naturally helped by the significant assistance received by UN organizations and other agencies. The ripple effects of the Syrian conflict on Lebanon include increased poverty rates, higher debt burdens, deteriorating labor markets, especially for youth and women, and more restricted access to public services such as health care and electricity[39].
b. Lebanon's Business environment: The private sector in Lebanon is dominated by small firms where more than 99 percent of all private enterprises have fewer than 50 employees, of which 93 percent have fewer than 5 employees[40]. Lebanon's unemployment rate almost doubled post-2011 to reach 20%. According to the ILO's latest estimates, unemployment in Lebanon stood at an average rate of 9% in the period from 1990- 2010. The Lebanese labour force totaled approximately 1.5M individuals out of a population of 4.3M. Thus, around 138,000 persons were "unemployed" in all of Lebanon. The ILO in collaboration with the United Nation's Dept. of Economic and Social Affairs documented the Lebanese population (i.e. excluding non-nationals) to have reached 4.8M persons, and in tandem, Lebanon's unemployment rate doubled to approximately 18-20% post-2011, with the increase particularly afflicting young Lebanese workers aged 15-24 years, according to the World Bank (2013) and European Commission (2016)[41].
c. Industry: The large manufacturing enterprises are struggling to maintain output. SMEs have been highly affected since they are unable to cope with the challenges emerged from the Syrian crisis, notably high cost of operations, specifically imports and exports and high cost of energy[42].

   Since the onset of the conflict, Lebanese communities have been cut off from their income sources as they have heavily relied on cross-border activities (cheaper goods originating from Syria)[43].

[38] The World Bank, Economic and Social Impact Assessment of the Syrian Conflict, 2013
[39] The World Bank, The Ripple Effects of the Syrian Conflict in the Mashreq Region, June 2020
[40] UNDP, Lebanon SME strategy, 2014
[41] The Impact of Syrian Refugees on the Lebanese Labour Market, BLOM Bank, June 2018
[42] The World Bank, Economic and Social Impact Assessment of the Syrian Conflict, 2013
[43] Ibid

d. Trade and Services: The services sector has been severely affected by the crisis, especially tourism, with the number of tourists, especially from the Gulf countries decreasing. The banking sector side has been resilient. The international trade sector has been affected in mixed manners by the Syrian crisis. Food items, pharmaceutical products, and textiles and clothing were positively affected by the presence of Syrian refugees[44]. However, the increases in those imports were not substantial enough to affect terms of trade. Instead, the trade situation was more affected by the imports of large items such as the barges for the electricity company EDL or the airplanes purchased by the national carrier MEA[45]. Similarly, on the export side, no causality can be drawn. Figures excluding mineral fuels and precious stones are not indicative of any particular trends. Land trade has been severely disrupted, which has affected Lebanon's exports to Iraq and to the Gulf countries, in addition to exports to Syria. Exports of perishable products, such as fruits and vegetables, have been particularly impacted by the disruption of land trade[46].
e. Agricultural sector[47]: One negative effect has had to do with the rise in the cost of shipping Lebanese agricultural products by land to Arab markets. "The deteriorating security situation on the Lebanese-Syrian borders has encouraged drivers to increase their shipping costs by land, prompting farmers to hike their prices in a bid to cover their expenses," says head of the Lebanese Farmers' Association Antoine Howayek. Furthermore, there has been a drop in the consumption of Lebanese commodities by the Syrian population. "For instance, Lebanon used to export 90 percent of its banana crop to the Syrian market but this has fallen by over 50 percent since the beginning of the crisis," Howayek says. According to Ramiz Osseiran, head of the Farmers' Association in the south of Lebanon, Syrians' consumption of Lebanese produce dropped by around 70 percent due to the population's lower purchasing power in the war-ravaged country. "This could also be caused by the fact that a huge number of Syrians have left their country," he adds. Moreover, the arrival of more than a million Syrian refugees to Lebanon has driven down agricultural wages in the country due to the resulting surplus of labor. "Syrian immigrants compete with impoverished Lebanese over scarce jobs, driving down wages while increasing unemployment among local nationals," says Hussein Zeaiter, assistant professor at LAU's Department of Economics. At the same time, the flow of Syrian refugees to Lebanon has not made a great difference in the domestic consumption of locally grown agricultural items, despite the substantial increase in the country's population. Howayek attributes this phenomenon to the lack of protection by the government for the sector, and to

[44] The World Bank, The Impact of the Syrian Conflict on Lebanese Trade, 2015
[45] The World Bank, The Impact of the Syrian Conflict on Lebanese Trade, 2015
[46] Ibid
[47] The impact of the Syrian crisis on Lebanon's agricultural sector and local consumption, LAU, 2015

the flow of cheaper products from neighboring countries to Lebanon. “We have a free market, and this allows merchants to import products that are already available in Lebanon at cheaper prices,” he says.

Capital’s analysis

Socio-Economic Capital

Objective: The objective of the study is to analyze some of the main social and economic indicators’ effect on food security, sustainability and resiliency. Economic and Social indicators are various and unlimited and based on each study, relevant indicators will be selected from a wide pool. Moreover, a socio-economic index will be created and compared to the global Socio-Economic Index. Using the index created, we will measure the impact of the crisis on the food system in Lebanon from social and economic perspectives. Case studies and interviews took place, in addition to a summary of the “Unemployment Study” done in 2019 for the Ministry of Labor.

Abstract

The prevalence of food insecurity varies by country of residence; within countries, it is strongly associated with household socioeconomic status, but the local environment may also play an important role. Food insecurity is strongly related to household income level48, although not all households living in poverty are food insecure. For instance, at a global level, the degree of human development of countries is tightly linked to food insecurity, hunger, and undernourishment[49]. Active public policies to decrease poverty are seen as major ways to ensure food security for all; thus, even among developed countries, the prevalence of food insecurity varies[50]. One study has even found US state-level characteristics such as low average wages, high rental housing costs, and residential instability, to be significantly related to food insecurity. Understanding how these factors relate to food insecurity could inform approaches to sustainable food system reforms that could help to combat this public concern. On a second-hand Agriculture – if developed, diversified and prioritized by the government – can be one of the most important branches of the national economy, with various functions such as: main source of business activity that uses the workforce, ecological factor for the protection of the environment, technical and cultural tradition, representing a civilization in itself. Lebanon’s small agricultural sector, endowed with a variety of agro-climatic zones, remains important in the national economy. Agriculture makes a steady contribution to national output and employs significant numbers, particularly in rural areas. The sector’s indirect contribution to the economy is

[48] [Nord M, Parker L. How adequately are food needs of children in low-income households being met. Child Youth Serv Rev. 2010; 32:1175–1185. doi: 10.1016/j.childyouth.2010.03.005 -Economic determinants and dietary consequences of food insecurity in the United States.*Rose DJ Nutr. 1999 Feb; 129(2S Suppl):517S-520S]*

[49] [FAO. The State of Food Insecurity in the World (2009): Economic crises - impacts and lessons learned. 2009.ftp://ftp.fao.org/docrep/fao/012/i0876e/i0876e02.pdf.

[50] [Nord M, Hooper MD, Hopwood H. Household-level income-related food insecurity is less prevalent in Canada than in the United States. Journal of Hunger and Environmental Nutrition. 2008; 3:17–35. doi: 10.1080/19320240802163498.

important due to strong inter-sector linkages. Agriculture also plays a vital role in the natural resources' management, being the main livelihoods for rural communities, and contributes significantly to sustainable development[51].

The socio-economic capital can vary based on the type of the study selected; Therefore, in order to develop a representative index, a group of suitable indicators was chosen for the purpose of our study. The social capital is thought of as a group-level attribute, but does not have a consistent definition[52]. In broad terms it identifies the richness of social connections, trust, shared norms, and reciprocity among residents living within an area[53]. High social capital may allow residents to obtain food from neighbours or other institutions more easily in times of need, and mobilize for collective action to address food insecurity issues. Additionally, neighbourhood disorder, sometimes resulting from a break-down in the social structure of the area, may dissuade food service establishments, and other institutional supports from locating in particular areas, and fear may prevent residents from accessing nearby food resources[54]. High disorder may itself also negatively impact social capital. Hence, focusing on the level of education, reliance on agriculture, labor dynamics and many other indicators will be analyzed to see how directly and indirectly are affecting the Food Security of people.

The economic capital is one of the most important aspect to analyze for this study considering that the country is situated in the most hostile region and on the verge of an economic crisis. The economic capital is divided between 5 sub-groups (Import-Export, Macroeconomic analysis, Agri-Market Trends, Infrastructure and Market Logistics, Market Environment and Dynamics) which affect from a micro and macro perspective, the country's performance in general and its agricultural sector in particular.

Introduction:

The state of agriculture in Lebanon is far from glamourous. Indeed, food security (i.e. ensuring food availability, access and utilization, and the stability of these three conditions over time)[55] remains a challenge and the country is dependent on cereal imports as 83% of consumed cereals comes from abroad[56]. Agriculture is dramatically neglected in the economy in favour of the tertiary sector, supporting mainly finance and real estate. In this neoliberal environment, conventional agriculture, characterized by monoculture, mechanization and the use of phytosanitary products is supported in order to increase yields and to compete on the world market. Within the Lebanese context, other issues are often claimed to be more important as the

[51] Economic Opportunities and Job Creation, AGRICULTURE Sector, UNFAO, November 2016
[52] Reconciling the three accounts of social capital.*Kawachi I, Kim D, Coutts A, Subramanian SV Int J Epidemiol. 2004 Aug; 33(4):682-90; discussion 700-4.*
[53] [Kawachi I, Subramanian SV, Kim D, editor. Social Capital & Health. New York: Springer; 2008.].
[54] [Place effects on health: how can we conceptualise, operationalise and measure them? *Macintyre S, Ellaway A, Cummins S Soc Sci Med. 2002 Jul; 55(1):125-39.*]
[55] FAO. Policy Brief – Food Security. Issue 2, June 2006. In: http://www.fao.org/forestry/13128-0e6f36f27e0091055bec28ebe830f46b3.pdf
[56] FAO. Country Briefs – Lebanon. July 2017. In: http://www.fao.org/giews/countrybrief/country.jsp?code=LBN

country is suffering from the lack of basic infrastructure such as electricity and water supply or waste management.

The agricultural sector contribution to GDP was on average 6.8% annually in the 1994-2007 period, and dropped to an average of 3.9% per annum in the 2008-2013 period[57]. In recent years, the sector has been severely impacted by the Syrian conflict. Since 2010, the agricultural sector has received increased government attention, evidenced by increased outlays. In 2018, the agriculture sector generated around USD 1.8 billion or 3.2% of Lebanon's GDP with its contribution growing at a CAGR[58] of 2% between 2010 and 2018. 4% of total employment or around 63,616 workers are engaged in agricultural activities[59].

Although the role of agriculture in the national economy of Lebanon is declining in relative terms, it still plays an important role in the rural economy and has a significant impact on rural livelihoods. Agriculture represents an important source of income for a large share of households in rural areas, particularly in the poorest districts of Akkar and Baalback-Hermel where agriculture is the primary source of income and employment for the poor[60]. Hence, in order to sustain adequate standards of living, combat poverty and substantially increase and maintain food security in the geographical areas affected by the influx of Syrian refugees and returnees into Lebanon, it is important to strengthen and enhance the sector of the local economy that currently provides livelihoods for the vast majority of the local population. Fewer services and resources are available in rural areas, and the quality of foods may vary depending on the location of stores. Growth in supermarket size and food system innovations have enabled prices to decrease and quality to increase. Because large tracks of land are needed, these stores are increasingly relocating from urban to suburban areas[61], which may impact negatively on food availability and access for disadvantaged urban dwellers.

Hypotheses were that low social cohesion, high disorder, and high material/social deprivation would each increase the likelihood of food insecurity, even after accounting for household socioeconomic status (SES) and other potentially important explanatory factors. Even though some previous studies have found rural living to be negatively associated with food insecurity, it was hypothesized that rural living would be positively associated, given than another study conducted in Québec (even if the context is different than Lebanon) uncovered disparities in food access by location of residence, with less access for residents in rural areas[62].

[57] CAS official numbers until 2013
[58] Compound annual growth rate, or CAGR, is the mean annual growth rate of an investment over a specified period of time longer than one year. It represents one of the most accurate ways to calculate and determine returns for individual assets, investment portfolios, and anything that can rise or fall in value over time
[59] Investment Development Authority of Lebanon (IDAL), Sector in focus, Agriculture
[60] Agriculture is reported to report up to 80% of the local GDP according to the MoA
[61] [USDA. Access to Affordable and Nutritious Food: Measuring and Understanding Food Deserts and Their Consequences. 2009.]
[62] [Economic access to fruits and vegetables in the greater Quebec City: do disparities exist? *Drouin S, Hamelin AM, Ouellet D Can J Public Health. 2009 Sep-Oct; 100(5):361-4.*].

Several assessments have been conducted in Lebanon since the start of the Syria crisis, which have assisted in better understanding of the situation and living conditions of the different population cohorts residing in Lebanon. Based on the results from the Regional Refugee and Resilience Plan 2015-2016, it is estimated that 182,000 Lebanese, 1.1 million Syrian Refugees, 46,000 Palestinians Refugees are food insecure.

Indicators analysis

Economic Aspects

- **Import/Export**

1- Import Dependency Ratio (IDR)

Import Dependency Ratio indicates the extent to which a country's supply of commodities came from imports. A high ratio implies greater dependency on importation.

Over the years, Lebanon's total food imports value has increased at an average annual rate of 8% reaching USD 3,615 million in 2014, representing about 17.6% of Lebanon's total imports. However, the increase in imports value is mainly attributed to rising international food prices, while the volume of food imports has only increased by a compounded annual growth rate of 2.4% over the period 2010-2014, reaching 3,036,000 tons imported in 2014. As such, the cost per ton of food imports rose from USD 1,060 in 2010 to USD 1,190 in 2014, reflecting the fact that rising international food prices during that period have been transmitted to the local economy through the rise in cost of food imports. As international food prices started to decline as of mid-2014, the total value of imports has decreased by 11% in the period between January-August 2014 and January-August 2015. As such, the volume of imported food increased by 3% y-o-y to 2,040,000 tons as at August 2015. For this reason, the cost per ton of imported food decreased from USD 1,235 in August 2014 to USD 1,069 in August 2015, thereby declining by 13.4%. Over the past five years, Lebanon's value of food exports has increased at an average annual rate of 10.9% reaching USD 781 million in 2014 and representing 24% of Lebanon's total exports. The volume of exports has also increased over time as well but only at slower rate than the increase in value of exports, as it grew by 3.5%, reaching 9,514 tons by 2014. As for the cost per ton of food exports, it rose from USD 614 in 2010 to USD 821 in 2014. Nevertheless, as international food prices plunged since mid-2014, the value of exports has decreased by a y-o-y 5.4% as at August 2015. It is worth noting that, over the years, Lebanon has witnessed consecutive trade deficits. However, as at August 2015, total trade deficit has declined by 17% annually.[63]

Value: minimum (0), Maximum (100), Value before crisis (59,77), Value after crisis (84,4)

Source: Qualitative data, FAOSTAT

[63] Analysis of Lebanon's food market, BankMed, 2016

Analysis:

IDR= Imports * 100 (production + imports - exports)[64].

The Data has been using the FAO statistical book for each country available only for 2007 and 2017. The comparison will take place between these years, hence, can be considered as before and after the Syrian crisis.

2017: (after)

Imports of food: 2,595,000 USD

Export of food: 604,000 USD

Production: 1,087,000 USD

IDR (2017) = (2595)/ (1087+2595-604) *100 = **84,4%**

2007: (before)

Imports of food: 1,426,000 USD

Export of food: 271,000 USD

Production: 1,231,000 USD

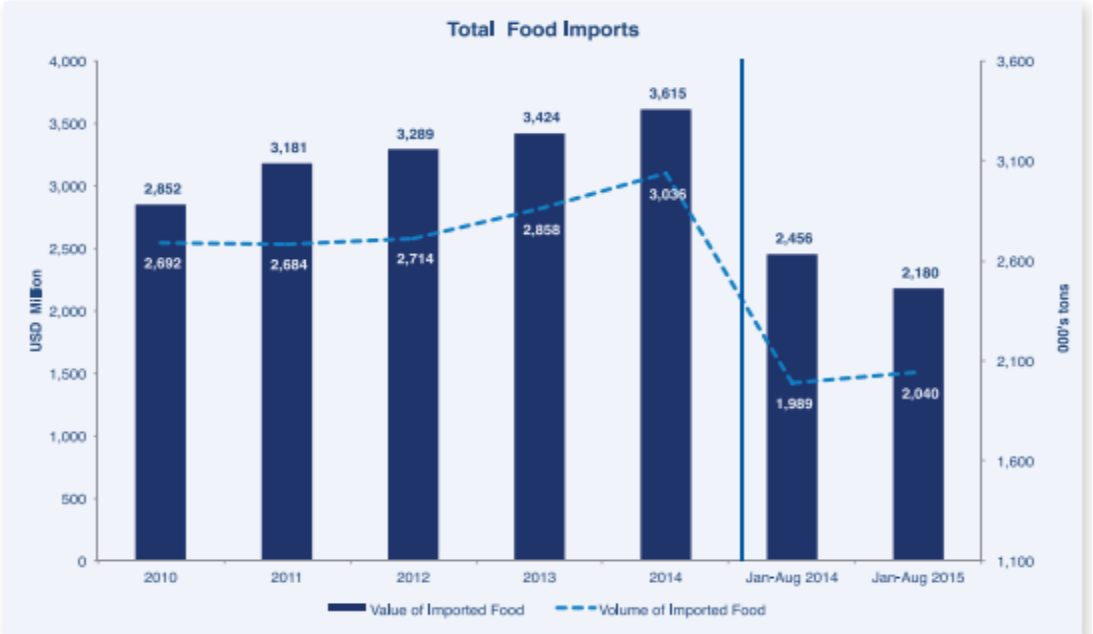
IDR (2007) = (1426)/ (1231+1426-271) *100 = **59,77%**

Lebanon is a net importer of food, with the latter accounting for 18 percent of the country's total imports in 2018, according to the World Bank, and covering a wide range of categories from wheat to rice, sugar, fruits and vegetables, food preparations (such as spices and oils), and cattle. The reliance of domestic consumption on these imports is striking and best captured by imports to consumption ratios across food categories: these ratios exceed 80 percent for major categories such as cereals and 100 percent for others such as refined sugar, rice, and vegetable oil[65]. This heavy dependency on imports raises concerns over the availability and stability of a large range of items, not just wheat[66].

[64] As per the FAO: "Import dependency ratio (IDR) is defined as: IDR = imports x 100/(production + imports - exports). The complement of this ratio to 100 would represent that part of the domestic food supply that has been produced in the country itself. However, there is a caveat to be kept in mind: these ratios hold only if imports are mainly used for domestic utilization and are not re-exported".

[65] World Bank Data

[66] Dependency on import should not be an issue per se, rather in terms of its relation with the ability to export. Heavy reliance on domestic food markets for a small country may be an even higher source if instability.

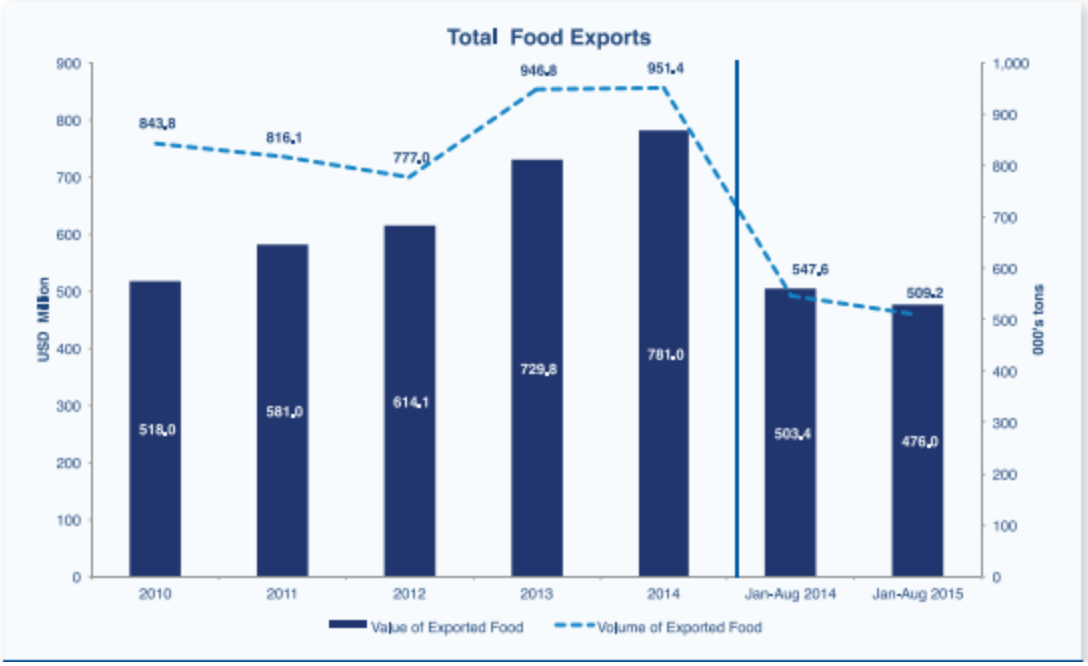


Source: Lebanese Customs

Lebanon's Food Imports by Type

USD Million	2010	2011	2012	2013	2014	Jan-Aug 2014	Jan-Aug 2015
Prepared Foodstuffs	971.7	1,106.2	1,258.3	1,285.8	1,280.0	854.0	810
% Change	*19 %*	*14 %*	*14 %*	*2 %*	*0 %*		*- 5 %*
Fruit and Vegetable Products	715.6	849.6	867.6	922.8	966.0	675.2	614
% Change	*14 %*	*19 %*	*2 %*	*6 %*	*5 %*		*- 9 %*
Animal Products	866.1	867.1	824.3	891.6	1,050.0	717.0	569
% Change	*15 %*	*0 %*	*- 5 %*	*8 %*	*18 %*		*- 21 %*
Animal and Vegetable Oils	128.3	173.5	194.6	199.5	187.0	130.3	112
% Change	*- 2 %*	*35 %*	*12 %*	*2 %*	*- 6 %*		*- 14 %*
Beverages	170.1	184.9	144.4	124.2	132.0	76.8	75
% Change	*22 %*	*9 %*	*- 22 %*	*- 14 %*	*6 %*		*- 2 %*

Source: Lebanese Customs



Source: Lebanese Customs

Lebanon's Food Exports by Type

USD Million	2010	2011	2012	2013	2014	Jan-Aug 2014	Jan-Aug 2015
Prepared Foodstuffs	263.1	302.0	312.2	352.6	437.0	273.8	265.8
% Change	*13 %*	*15 %*	*3 %*	*13 %*	*24 %*		*- 3 %*
Fruit and Vegetable Products	154.1	160.6	171.2	215.7	207.0	122.7	109.2
% Change	*28 %*	*4 %*	*7 %*	*26 %*	*- 4 %*		*- 11 %*
Beverages	61.1	77.8	80.0	100.0	78.0	68.0	59.3
% Change	*22 %*	*27 %*	*3 %*	*25 %*	*- 22 %*		*- 13 %*
Animal and Vegetable Oils	22.7	21.5	30.8	36.5	33.0	22.5	21.9
% Change	*20 %*	*- 6 %*	*44 %*	*19 %*	*- 10 %*		*- 2 %*
Animal Products	17.0	19.1	19.8	24.9	26.0	16.5	19.3
% Change	*14 %*	*13 %*	*4 %*	*26 %*	*4 %*		*17 %*

Source: Lebanese Customs

2- SSR: Self-Sufficiency Ratio

The self-sufficiency ratio (SSR) is defined as: SSR = production x 100/(production + imports - exports). The SSR can be calculated for individual commodities, groups of commodities of similar nutritional values and, after appropriate conversion of the commodity equations, also for the aggregate of all commodities. In the context of food security, *the SSR is often taken to indicate the extent to which a country relies on its own production resources, i.e. the higher the ratio the greater the self-sufficiency*. While the SSR can be the appropriate tool when assessing the supply situation for individual commodities, a certain degree of caution should be observed when looking at the overall food situation. In the case, however, where a large part of a country's production of one commodity, e.g. other cereals, is exported, the SSR may be very high but the

country may still have to rely heavily on imports of food commodities to feed the population. The self-sufficiency rate (as defined above) cannot be the complement to 100 of the Import Dependency Rate, or vice versa.

Value: minimum (0), Maximum (100), Value before crisis (51,59), Value after crisis (35.31)
Source: Qualitative data, FAOSTAT

Analysis:

Using the same values as the IDR and for the same relevant years:

SSR = production x 100/(production[67] + imports - exports).

2017: (after)

Imports of food: 2,595,000 USD

Export of food: 604,000 USD

Production: 1,087,000 USD

SSR (2017) = 1087* 100/(1087+2595-604) = **35,31%**

2007: (before)

Imports of food: 1,426,000 USD

Export of food: 271,000 USD

Production: 1,231,000 USD

SSR (2007) = 1231*100(1231+1426-271) = **51,59%**

As per the FAO definition, the greater the ratio (or percentage), the greater the self-sufficiency. In 2007 the ratio is greater than 2017, which is reflected in the main variables (import, export and production of food). Between 2007 and 2017, the value of import drastically increased compared to the slight increase in exports; in addition, the country-level production has decreased throughout. The Syria crisis has no direct impact on the import/export except starting 2011 where the main export trade route through Syria to Jordan to the Gulf countries has been disrupted which will automatically disrupt the export. (the analysis of the trade routes will be detailed in another indicator to be able to reflect the whole imagine of the import/export situation).

3- Cereal Import Dependency Ratio

The cereal imports dependency ratio tells how much of the available domestic food supply of cereals has been imported and how much comes from the country's own production. It is

[67] Food production

computed as (cereal imports - cereal exports)/(cereal production + cereal imports - cereal exports) * 100 Given this formula the indicator assumes only values <= 100. Negative values indicate that the country is a net exporter of cereals.

This indicator provides a measure of the dependence of a country or region from cereal imports. The greater the indicator, the higher the dependence.

Time Coverage: The indicator is calculated in three year averages, from 1990-92 to 2014-16, to reduce the impact of possible errors in estimated production and trade, due to the difficulties in properly accounting of stock variations in major food.

Value: minimum (0), Maximum (100), Value before crisis (92,88), Value after crisis (86,87)
Source: Qualitative data, FAOSTAT

Analysis:

As per the FAO, the average percentage of CIDR between 2000 and 2011 is 92,88%. From 2012 till 2016, the average percentage of CIDR is 86,78%.

The indicator measures the cereal self-sufficiency of a country and the reliance on cereal imports, both of which reflect policy decisions regarding imports and food prices. Low cereal import dependency can reflect restrictive trade policies and high vulnerability to variations in domestic supply, while high cereal import dependency can reflect low capacity for local supply and high vulnerability to international prices, especially in rural areas. In this case, Lebanon is considered forever – before and after the crisis – a highly vulnerable country, excessively relying on cereal imports; hence, the availability of cereal in Lebanon might is at high risk and automatically putting the food security of people in the red zone.

4- Food Aid Dependency

While emergency food aid has undoubtedly saved lives in the face of famine, drought, and conflict in many parts of the developing world, there is less consensus regarding what the long-term impact of Food Aid is on local markets and production systems. In a statement in 1957, the US Politician Hubert Humphrey is quoted as saying that reports on dependency on the US by food aid recipients was "good news" as "if you are looking for a way to get people to lean on you and to be dependent on you, in terms of their co-operation with you, it seems to me that food dependence would be terrific"[68].

Food Aid has been used as convenient method for donor countries to dispose of their surplus production and meet aid targets at the same time. An example of this is known as the 'tortilla crisis' in Mexico, which in the space of a few decades became dependent upon imports of US corn. The country was therefore hard hit when prices of corn shot up with the sharp demand of corn for agro-fuels. The dependence on US corn started with the Structural Adjustment

[68] https://www.penhanetwork.org/blog/2014/04/09/contrasting-food-sovereignty-food-security#_ftn14

Programme (SAP) policies of the 1980s, which effectively dismantled government programmes and institutions in rural Mexico. These policies, combined with the unilateral liberalisation of agricultural trade and the North American Free Trade Agreement (NAFTA) severely eroded peasant agriculture in Mexico. As a result, it became a net food importer, and was taken into "a state of acute food insecurity, permanent economic crisis, political instability and uncontrolled criminal activity."[69] In light of this example, it would seem problematic that the notion of Food Security does not address the problem of aid dependency, and is not inherently concerned with building long-term stability and resilience of regional markets and production systems.

In Lebanon, Syrian refugees are almost completely dependent on food aid, provided primarily by the WFP's cash-for-food voucher programme at participating stores. Indeed, only 11 percent of Syrian refugees in Lebanon were food secure in 2015, a figure which has fallen from 32 percent in 2013. The Lebanese fare relatively better, but they too are starting to show signs of widespread food and nutrition insecurity. Before the crisis, among certain segments of Lebanon's population (for instance in the South and Bekaa) almost half of those surveyed exhibited forms of food insecurity. Now, due to lack of money and resources, 49 percent of Lebanese have reported being worried about their ability to source enough food, while 31 percent say they were unable to eat healthy and nutritious food over the course of a year[70].

Value: minimum (0), Maximum (7), Value before crisis (5), Value after crisis (1)
Source: Qualitative data, FAOSTAT

Analysis:
Considering that there is no defined indicator related to food security measuring the impact of dependency on food aid, the analysis will use Likert Scale linked where we analyze the percentage of people relying and/or in need of food aid out of the total population: The more percent of people food insecure, the lower the number is on Likert Scale.

%	**Likert**
70+	0 (the lowest)
60	1
50	2
40	3
30	4
20	5
10	6
0-10	7

[69] Ibid
[70] STRATEGIC REVIEW OF FOOD AND NUTRITION SECURITY IN LEBANON, May 2016, ESCWA

As per the ESCWA report, after the Syrian crisis, 31% of the Lebanese population needed food aid support in addition to 89% of Syrians. The average population in Lebanon is around 6.849 Million[71], the average in need of food aid is around 60% (89+31/2). Hence, the value after the Syrian crisis will be 1 on Likert Scale.

Prior the crisis and the influx of refugees, poverty in Lebanon was significant and regional disparities in living conditions were acute. Nearly 1 million Lebanese were estimated to be poor (living on less than USD4 per day)[72]. Hence, based on the official data prior to the crisis, the total population in Lebanon is 5 million, then 20% of this population was food insecure. As a result, and based on Likert scale, the value of our indicator before the Syrian crisis is 5.

5- Trade Agreements and Routes Diversity

For the present state of Lebanon, the importance of trade and mobility extends from the country's positioning on the trade routes between Asia and Europe that are emerging as 21st century Belt and Road iterations of the Silk Road—with all implications for the need to develop Lebanese logistics, marine shipping, and port operations—to responsible care and expansion of 20th century aviation patterns between Lebanon and its relevant but diverse travel markets in the Arab world, Africa, and Europe. These trade issues, some of which have been getting considerable attention by the political circles in the country, will be integral for the success of the Lebanese economy.

Lebanon's biggest export market, by government figures, in 2019 was Switzerland (28%), followed by the United Arab Emirates (12%) and the European Union (11%). Easily the biggest exports are jewelry, gems and precious metals, with agribusiness very undeveloped[73].

The economic effects of the war in Syria extend beyond the country's borders affecting also the neighboring countries. In particular, trade is one of the main channels through which the effects of the crisis are transmitted to neighboring countries. This effect of the Syrian conflict has been heterogeneous across exporters. It has mainly affected exporters highly exposed to the Syrian market, while it has not had a significant impact on relatively marginal exporters[74].

- Trade agreements

Lebanon strengthened its openness to international trade by signing an Association Agreement with the EU, working toward accession to the WTO and signing a free-trade agreement with the Gulf Cooperation Council (GCC) in May 2004. On the other hand, the share of trade in GDP has been declining gradually in recent years and stood at nearly 63% according to World Bank (2018). Lebanon mainly exports minerals (gold), electric & electronic equipment, printed materials, sugar, diamonds, jewellery, oil products, pharmaceutical products and food

[71] World Bank Data
[72] World Bank data
[73] https://thearabweekly.com/lebanon-faces-rewards-obstacles-export-strategy
[74] https://www.worldbank.org/en/country/lebanon/publication/the-impact-of-the-syrian-conflict-on-lebanese-trade

preparations. The country mainly imports mineral fuels, vehicles, drugs and pharmaceuticals, gold, diamonds, live cattle, metal products, electrical equipment, and parts and accessories for vehicles.

Lebanon has traditionally been a country with a free and open trade regime. Efforts towards trade liberalization have focused on the European Union (EU), the WTO, and the Arab world. Lebanon has neither a free trade arrangement nor a bilateral investment treaty with the United States. On December 1, 2006, the two countries signed a Trade and Investment Framework Agreement (TIFA), but the TIFA never came into force.

Lebanon gained observer status to the WTO in 1999, but the accession process has stalled since then.

Lebanon's Euro-Mediterranean Partnership agreement came into force in April 2006. The agreement provides for reciprocal free trade on the majority of industrial goods. It also liberalizes trade on a large basket of agricultural and processed agricultural goods. The Euro-Med Partnership aims at establishing a free trade area for the Mediterranean region; efforts to achieve this goal are ongoing.

Lebanon and the European Free Trade Association (EFTA) signed a Free Trade Agreement (FTA) in 2004. In November 2010, Lebanon and Turkey signed an association agreement to establish a free trade area and reduce barriers to the free movement of goods, services, capital, and people between the two countries over the subsequent ten years. The agreement is not yet ratified. Lebanon also signed the Greater Arab Free Trade Agreement, which gradually replaced the bilateral FTAs signed with Arab countries including Tunisia, Morocco, Egypt, Iraq, Jordan, Syria, Sudan and the Gulf Cooperation Council states. A regional Economic and Trade Association Council between Lebanon, Syria, Jordan, and Turkey was announced in July 2010. However, given the outbreak of the Syrian crisis, this agreement did not enter into force. Lebanon launched free trade agreement negotiations with MERCOSUR countries[75] in 2016.

Lebanon has signed bilateral investment agreements with the following (in alphabetical order, as of January 2012): Armenia, Austria, Azerbaijan, Bahrain, Belarus, Belgium/Luxemburg, Benin, Bulgaria, Canada, Chad, Chile, China, Cuba, Cyprus, Czech Republic, Egypt, Finland, France, Gabon, Germany, Greece, Guinea, Hungary, Iceland, Iran, Italy, Jordan, Korea (South), Kuwait, Malaysia, Mauritania, Morocco, Netherlands, OPEC Fund, Pakistan, Qatar, Romania, Russia, Slovak Republic, Spain, Sudan, Sultanate of Oman, Sweden, Switzerland, Syria, Tunisia, Turkey, United Arab Emirates, Ukraine, United Kingdom, and Yemen. For more information, please visit the Ministry of Finance's website.

Lebanon does not have a bilateral taxation treaty with the United States. A full list of all the

[75] Mercosur is an economic and political bloc comprising Argentina, Brazil, Paraguay, Uruguay, and Venezuela.

countries with which Lebanon has signed taxation agreements can be found on the Ministry of Finance's website.[76]

Value: minimum (0), Maximum (7), Value before crisis (5), Value after crisis (3)
Source: Qualitative data

Analysis:
Focusing on the agricultural products, the disruption of trade routes to the GCC (Gulf Cooperation Countries) and Iraq is having a drastic impact on the country's export of agricultural products to these lucrative markets, particularly exports of fresh produce (mainly fruits and potatoes).

Based on the food market study done by BankMed in 2016, the main countries for import and export before the Syrian Crisis (2011) are:

Export (Million USD)		Import (Million USD)	
Syria	83.2	Brazil	239
Saudi Arabia	73.4	France	216.8
Iraq	37.4	Egypt	122.2
UAE	33.2	USA	161.6
Egypt	24.5	Spain	80

After the Syrian Crisis figures (latest for 2015):

Export (Million USD)		Import (Million USD)	
Syria	58.4	Brazil	149.5
Saudi Arabia	73.4	France	107.6
Iraq	57.9	Egypt	106.4
UAE	31	USA	82.2
Egypt	20.3	Spain	92

Based on the figures above:

- Lebanon has a lot of trade agreement that some has not been put into force for political reasons. The agreements should be done based on analysis of what we import and what we export from the countries. E.g. Brazil. Lebanon imports mainly from Brazil compared to other countries and is exporting almost nothing to this country; the government before signing any trade agreement, should make sure that this is mutual and so the countries can barter products and reduce the impost costs.

[76] https://www.privacyshield.gov/article?id=Lebanon-Trade-Agreements#:~:text=Lebanon%20has%20traditionally%20been%20a,treaty%20with%20the%20United%20States.

- Lebanon has been relying on the Syrian market for export, either for the Syrian market directly or Syria as a trade route to the GCC. The country should adapt a variety for trade routes in case one has been disrupted. As per our interview with the citrus farmers in Akkar North Lebanon, the marine aviation shipping is expensive, more complex for farmers and not all of them do have access to it. Hence, here the country should empower these routes for international markets.
- The variety of the trade routes in Lebanon is not in its worst condition. Exporters – and mainly the big ones – can consider these options. In addition, the country still should consider more trade agreements with the far east and more African countries.

Based on the above, the Likert scale will be used to analyze the situation. For this indicator, the vagueness will remain, however based on facts the situation before the Syrian Crisis was good and after was a bit less considering the routes through Syria. Before: 5, After:3

Likert: 7 =Excellent, 6=Very good, 5=good, 4= moderately good, 3=moderately bad, 2= bad, 1= very bad, 0=Worst.

- **Agri-Market trends**

6- Food supply variability[77] per capita

Calorie supply per capita is amount of food available for consumption, measured in kilocalories per capita per day. This figure is reached by dividing the total available food supply for human consumption by the population. Hence, the value does not include any waste/food loss, only the available food for consumption.

Food supply variability results from a combination of instability and responses in production, trade, consumption, and storage, in addition to changes in government policies such as trade restrictions, taxes and subsidies, stockholding, and public distribution (Lele et al., 2016).

Value: minimum (0), Maximum (245), Value before crisis (29.33), Value after crisis (68.5)
Source: FAO DATA

Analysis:
Based on the FAO online data portal measuring the indicator for the majority of countries from 2000 till 2017, the average has been calculated for the time before the Syrian crisis (2000 till 2011) and after (2012 till 2017). Very high variability in per capita food supply means that the food system is not working well and analysis should take place. Short term disruption cannot be measured directly as the indicator is measured yearly. As per the FAO data, the numbers for Lebanon showed a high variability from 2014 till 2017[78] compared to the years before (approx. 180-200%). This variability shows that the food system is not stable. For consumers to access food products at cheaper prices, markets need to facilitate the introduction of reforms that result

[77] Variability: The extent to which data in a series or a statistical distribution diverge from the average value.
[78] As per the food production index analysis, the production has significantly increased between 2012 and 2015 which had its impact till 2017 in addition to export.

in the maximum number of importers bringing in the same products, especially in input markets. Doing so will reduce market concentration, increase supply, place downward pressure on prices and facilitate more flexibility in trade with the outside world. Increasing food supply from imports will also require a revamp of Lebanon's import capacity and logistical competitiveness, given that costs of importing food are significantly higher than that of the region. In Lebanon, food is relatively sufficient and available, even though some improvements to logistics would increase food supply levels by reducing spoilage and wastage and, in turn, improving overall access[79].

Lebanon has such well-functioning supply chains it has proved itself able to adapt to food supply requirements of its resident and refugee populations[80].

Opening up the food market to more foreign competition without increasing the competitiveness of the local agricultural sector from the bottom-up is likely to prove detrimental to Lebanon's food and nutrition security by making the country even more food import dependent, and thus vulnerable, to food price shocks caused by import inflation.

7- Food Production Index

Food production index covers food crops that are considered edible and that contain nutrients. Coffee and tea are excluded because, although edible, they have no nutritive value.

Value: minimum (39.12), Maximum (211.35), Value before crisis (96.32), Value after crisis (90)
Source: FAO DATA

Analysis:
The country with the highest value in the world is Lao PDR, with a value of 211.35. The country with the lowest value in the world is St. Kitts and Nevis, with a value of 39.12. Lebanon food production index fluctuated substantially in recent years, it tended to increase through 1967 - 2016 period ending at 87.9 index in 2016.

In Lebanon, public investment in agriculture is comparatively low, despite Lebanon's vulnerability to external price shocks. Several Middle East and North Africa (MENA) governments have indeed started considering increasing domestic food production in order to reduce their vulnerability to international market prices and stabilize domestic food costs. While such an approach incurs economic costs, and needs to be considered in accordance to each country's comparative advantages, Lebanon's investment in the agricultural sector remains lower than regional averages. The Ministry of Agriculture (MoA)'s total budget allocation is around 0.5 percent of the total budget in any given year81. This constitutes a considerably smaller share

[79] Strategic Review of Food and Nutrition Security in Lebanon, ESCWA, 2016
[80] Ibid
[81] Ministry of Agriculture. (November 2014). Ministry of Agriculture Strategy 2015-2019, page 12. Retrieved from http://www.agriculture.gov. lb/Arabic/NewsEvents/Documents/MoA%20 Strategy%202015-19%20-%20English-for%20 printing.pdf

compared to neighboring countries where the allocation tends to exceed five percent of national budgets[82]. However, despite relatively high production potential, actual agricultural production is limited with internal market mechanisms being inefficient due to market failures, import inflation, faulty value chains, and lack of employment opportunities.

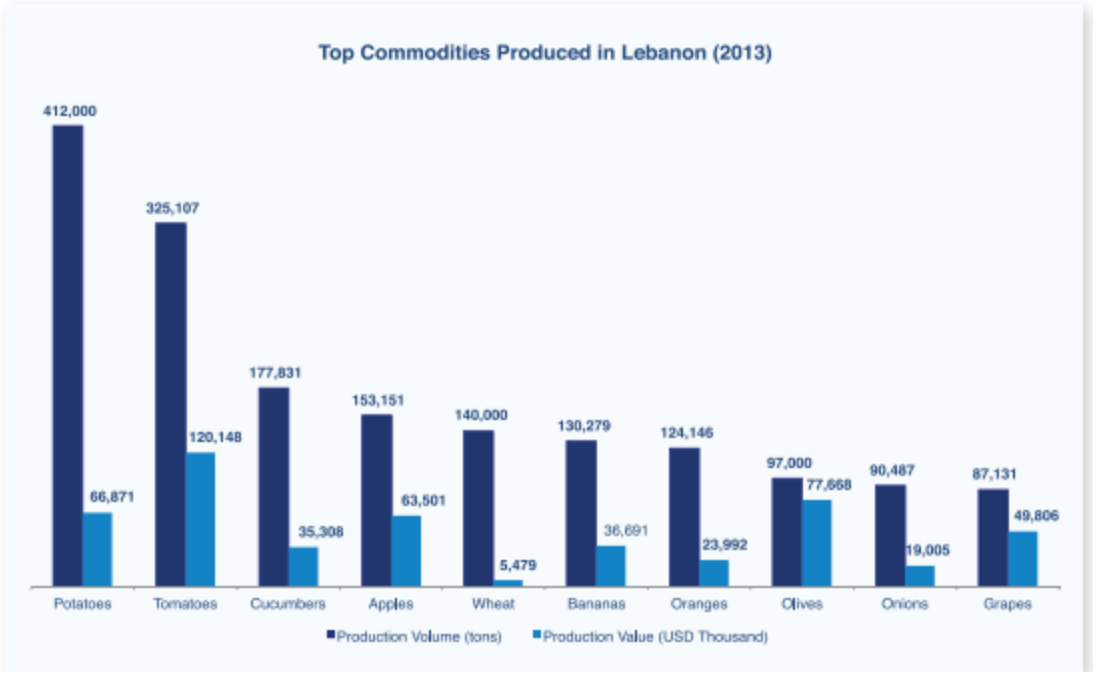
8- Crops Production Diversity

Crop diversity in genetics is the foundation of agriculture, enabling it to evolve and adapt to meet the never-ending challenge of sustainably producing sufficient and nutritious food for an increasing population. More recently, the UN Sustainable Development Goals have challenged the global community to eradicate hunger, and highlight the protection and use of crop diversity as highly important in the target " Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries and landlocked developing countries, in accordance with their respective programmes of action". Crop diversification can be used as a tool to increase farm income, generate employment, alleviate poverty, conserve soil and water resources. It is therefore reckoned as an important strategy to overcome many of the emergencies faced by agricultural household in developing countries[83].

Value: minimum (0), Maximum (7), Value before crisis (2), Value after crisis (1)
Source: FAO DATA

Analysis:
The main crops grown in Lebanon in 2013:

[82] Ibid
[83] Joshi PK, Ashok G, Birthal PS, Tewari L. Agriculture diversification in South Asia: patterns, determinants, and policy implications (No. 57), Washington, D.C. 20006; 2003.



Source: FAO Database

In 2018 - very close to 2013, top produced crops included potatoes (387,791 tons) followed by tomatoes (300,157 tons) and cucumbers and gherkins (151.558 tons)[84]. If we look at the graph, we realize that the main crops grown in country are fruits and vegetables except Wheat. The Wheat quantity however, is way less than the country consumption needs and this is reflected in the previous indictor "the cereal dependency ratio", where the country heavily imports cereals.

Hence, as per the food supply indicator, the Lebanese population have available food in their markets with high quantity and no recorded reports show that any essential crop was missed from the Lebanese market. However, this availability of varieties is a result of imports and not crop production variety which puts the country is a very critical position. What if the import routes have all been disrupted once? For how long the Lebanese people can survive on fruits and vegetables?

Also, over the past 50 years, we are seeing that diets around the world are changing and they are becoming more similar - what we call the 'globalized diet'[85]. Recent studies on food consumption patterns of the Lebanese young and adult population showed a shift in the food consumed toward increased intake of fat, milk, and animal protein and decreased intake of whole wheat bread and cereals. It seems that the Lebanese Mediterranean diet is converging with a pattern high in saturated fat, sugar, and refined foods and is low in fiber[86].

[84] Investment Development Authority of Lebanon (IDAL), Sector in focus, Agriculture
[85] Crop diversity decline 'threatens food security', By Mark Kinver, BCC, 2014
[86] Lebanese Traditional Diets and Health Effects, Nahla Hwalla and Dalia Tannous Dit El Khoury.

Boosting the crop diversity is highly needed for the sustainability and resiliency of the communities. In Lebanon, crops that are produced in high quantity and not being able to be sold or exported should be substituted by new crops needed for the Lebanese diet and depending intensively on imports. In this way, the Lebanese population' diet diversity will be protected in case of import disruption (war or conflicts or worldwide prices fluctuations). E.g. Lebanon can substitute some of the potato field by cereal production. Potato in Lebanon is the most grown crop and is facing issues related to the imports of Egyptian and other potatoes. Instead of having a surplus of potatoes not sold, the farmers can substitute potato by wheat or cash crops. The substitution needs extensive analysis and what can farmers grow in their area and what not.

The indicator does not have a specific way to measure it. Hence, the FAO has used Household Diet Diversity Scale[87] to measure on household level the access to diverse food. This scale is different than our analysis and focus on the Syrian refugees and the most vulnerable segments of the population; the goal is to check if the households have physical and financial access to markets. In this indicator we are analyzing the mega image of agriculture in terms of crop diversity to sustain food security.

Moreover, a questionnaire has been done by farmers in Akkar to check the diversity and they mentioned that after the Syrian crisis, refugees are renting the lands and directly substituting the citrus trees by the production of green leaves; the head of the union in Akkar was worried that after few years, we might become net importers of citrus if the tree are kept getting cut. The reason behind this act is that the green leaves production is less costly than citrus trees and Syrian are more experienced in it.

Finally, as a summary, some studies and specifically the Ministry of Agriculture in Lebanon believe that the country is growing a diversity of food. However, the diversity is not planned well between areas, is mainly around fruits and vegetables, and does not ensure the long-term food security of a country neither reduce its import dependency.

Based on the above, the Likert scale will be used to analyze the situation. For this indicator, the vagueness will remain, however based on facts the situation before the Syrian Crisis was good and after was a bit less considering the substitution of crops by Syrians (the numbers are still low). Before: 2, After:1

Likert: 7 =Excellent, 6=Very good, 5=good, 4= moderately good, 3=moderately bad, 2= bad, 1= very bad, 0=Worst.

9- Livestock Production Diversity

"The latest data available for this indicator is from the National report on the situation of animal genetic resources in Lebanon submitted to FAO in March 2012 in response to the request

[87] Guidelines for Household Diet Diversity Scale, FAO

for national reporting on progress in the implementation of the Global Plan of Action for Animal Genetic Resources – 2007 to 201"

The livestock sector does not meet local needs, except for the poultry sector, whose production has reached 135 thousand tons of white meat and 762 million eggs. The quantity of milk produced has reached 241.7 thousand tons and red meat has reached 29.7 thousand tons[88]. The rates of animal imports in 2011 were as follows: (imports of living animals) 202 000 cows; 400 000 sheep; and 3 400 goats. The ratio of animal product exports reached 29.7 percent[89].

The livestock in Lebanon is the property of the private sector. Animal species raised in Lebanon include cows, sheep and goats, which are kept for food products such as meat and milk or for non-food products such as leather and wool. The livestock sector, and especially cattle, has received great interest from the state and international institutions. Several projects have been launched and have contributed to the organization and development of the sector, including farms for raising milking cows and the establishment of factories for milk processing. In addition, there has been a project to develop fodder cultivation to help the owners of smallholdings, who constitute a high proportion of the cattle producers in Lebanon[90].

Value: minimum (32.6), Maximum (359.7), Value before crisis (96.2), Value after crisis (82.7)
Source: FAO DATA

Analysis:
The poultry sector, in which the integrated system is applied, is the most developed sector. For many years, poultry meat companies have been raising turkeys, but production is related to holidays and it is limited in terms of quantity. Lack of information about animal genetic resources is the result of the non-execution of continuous surveying of animal genetic resources since 1975 due to persistent wars and events in Lebanon. Therefore, an agricultural policy shall be established to improve knowledge of breeds or groups of genetic resources.

The analysis and value of the indicator will be the "Livestock production index". Livestock production index includes meat and milk from all sources, dairy products such as cheese, and eggs, honey, raw silk, wool, and hides and skins.

In 2016, livestock production index for Lebanon was 74.9 index. Livestock production index of Lebanon increased from 32.3 index in 1967 to 74.9 index in 2016 growing at an average annual rate of 2.77% [91] .

The highest recorded index was in Bahrain at 359.7 and the lowest in Antigua and Barbuda at 32.6[92].

[88] the National report on the situation of animal genetic resources in Lebanon, FAO, 2012
[89] Ibid
[90] Ibid
[91] World Bank Data
[92] Ibid

To calculate the value before and after crisis we did the average of the years based on the downloaded excel sheet from the World Bank Data. The average is from the year 2005 till 2011 and after from 2012 till 2016.

Value before the crisis: 96.2

Value after the crisis: 82.7

Value in both cases is low compared to other countries and compared to the maximum value.

10- Supply of inputs – Availability and Cost

Supply of inputs in Agriculture can be subdivided into three types of services: Fertilizers and chemicals. Seeds and planting materials. Machinery and equipment.

Agriculture is an input intensive sector. The price and quality of input can affect the comparative advantage of agriculture production and as a result, affect the income of farm households and the sector as a whole.

To improve agricultural productivity, the agri-input delivery system will require a holistic approach that considers access, affordability, availability, and incentives to adopt technological packages. The package will comprise approaches to holistically deliver agri-inputs, climate-resilient and nutritionally enhanced crop varieties, Integrated Soil Fertility and Water Management and Integrated Pest Management (IPM) practices which are essential to achieving food security.

It is common knowledge that the vast majority of farmers are resource-poor and therefore cannot afford expensive inputs. In many instances, the high cost of inputs is largely due to inappropriate policies.

Value: minimum (0), Maximum (7), Value before crisis (5), Value after crisis (2)
Source: DATA, field interviews

Analysis

The Syria Crisis has had a major impact on imports of agricultural inputs and their cost. Before the crisis, Lebanese farmers, particularly in the border regions, treated their crops with cheaper Syrian products that they had bought through informal trade or "smuggling" routes. Syrian products were cheaper as a result of being heavily subsidized by the Syrian government. Lebanese farmers say their production costs have increased as they have been forced to buy more expensive Lebanese or imported agricultural input[93].

A Food Security and Livelihoods Assessment of Lebanese host communities has been done by FAO and REACH in June 2015. One of the main key findings is that "Agricultural inputs were chosen as the third most important need by 13 per cent of households after food and health".

[93] Lebanon, Plan of Action for Resilient Livelihoods, Food Security Response and Stabilization of Rural Livelihoods. Addressing the Impacts of the Syria Crisis. 2014-2018. FAO

When disaggregated at the operational area level, data shows that the main reasons why households in the Bekaa area have debt are to buy agricultural inputs (62 per cent of households mention it as one of the main reasons) and to buy tools/machinery for other livelihoods use (42 per cent) while in the South% mentioned that buying agricultural inputs is the reason that caused them to incur debt in the last 24 months.

As per the above and based on the KIIs done with farmers in Akkar, the agricultural availability is not an issue to farmers – inputs do exist in the market – but it's the financial access to these inputs is what impacting them. Agricultural cooperatives should work hand in hand to set a price for inputs, the government should re-update its policies and subsidies the agricultural inputs otherwise the sector will be critically disrupted.

Hence, the agricultural sector might be the most impacted sector in case of an economic crisis, as since the end of the 1975-1990 war, its main actors – local wholesalers and resellers, farmers… – have been living on credit. Even their current cash flow is financed by credits from input import companies, which see it as a means of guaranteeing the sale of their seeds, fertilizers and other phytosanitary products.

Furthermore, the production of inputs is absent in Lebanon where everything in imported by the input suppliers.

As a result of the above, the availability of inputs remained the same before and after the crisis, however the costs have drastically changed, leading us to the final estimation based on the Likert Scale:

Before the Crisis: 5; even if the costs are low, the situation cannot be described as very good unless the country started adopting sustainable plans such as reduce the import of inputs (develop local seeds, consider composts instead of chemicals and empower farmers to rely less on the input suppliers and formal/informal credits.

After the Crisis: 2; in addition to the absence of the sustainable plans, the costs of inputs have drastically increase where the availability remained the same.

"Likert: 7 =Excellent, 6=Very good, 5=good, 4= moderately good, 3=moderately bad, 2= bad, 1= very bad, 0=Worst."

- **Macro-context analysis**

Policymakers and policy analysts working on agricultural issues in developing countries should understand macroeconomics aspects and relevant topics to do their job. The initial analyses of the connections between macroeconomic policies and agriculture in developing countries typically emphasized a more limited set of concerns, focusing on relative price incentives for the agricultural sector compared to other sectors[94]. However, the impacts on agriculture, rural

[94] Krueger, Schiff and Valdés, 1988; Schiff and Valdés, 1992

development, and food security – given the vast array of macroeconomic policies and conditions– involve a larger number of variables and channels.

Various macroeconomic conditions and policies influence agriculture and this should be taken into account in developing countries, particularly in countries where agriculture represents a significant percentage of GDP (nationally or in rural areas), employment, trade and even fiscal receipts linked to import/export. In those cases, the performance of the agricultural sector will determine growth, inflation, balance– of–payment conditions and fiscal balances.

11- Unemployment Aspects

Unemployment refers to the share of the labor force that is without work but available for and seeking employment. The unemployment rate is defined as the number of unemployed people as percent of the labor force. The labor force includes the people who are either employed or unemployed, i.e. who don't have a job but are actively looking for one. The labor force does not include people who are not looking for work, children, and the retired[95].

Unemployment is one of the main economic indicators that may have an impact of the food security status of people. High unemployment rates among low-income populations make it more difficult to meet basic household food needs. Unemployment is often used as a measure of the health of the economy. High rates of unemployment are a signal of economic distress, but extremely low rates of unemployment may signal an overheated economy. High, persistent unemployment can signal serious distress in an economy and even lead to social and political upheaval. Unemployment can be classified as frictional, cyclical, structural, or institutional:

- Frictional unemployment: Occurs as a result of people voluntarily changing jobs within an economy. After a person leaves a company, it naturally takes time to find another job. Similarly, graduates just entering the workforce add to frictional unemployment.
- Cyclical unemployment: is the variation in the number of unemployed workers over the course of economic upturns and downturns, such as those related to changes in oil prices. Unemployment rises during recessionary periods and declines during periods of economic growth. Preventing and alleviating cyclical unemployment during recessions is one of the key reasons for the study of economics and the purpose of the various policy tools that governments employ on the downside of business cycles to stimulate the economy.
- Structural unemployment: comes about through technological change in the structure of the economy in which labor markets operate. Technological changes—such as the replacement of horse-drawn transport by automobiles or the automation of manufacturing—lead to unemployment among workers displaced from jobs that are no longer needed. Retraining these workers can be difficult, costly, and time consuming, and

[95] Definition by the Global Economy

displaced workers often end up either unemployed for extended periods or leaving the labor force entirely.

- Institutional unemployment is unemployment that results from long-term or permanent institutional factors and incentives in the economy. Government policies, such as high minimum wage floors, generous social benefits programs, and restrictive occupational licensing laws; labor market phenomena, such as efficiency wages and discriminatory hiring; and labor market institutions, such as high rates of unionization, can all contribute to institutional unemployment.

"Even though some types of unemployment could zero out, others will always remain – meaning the overall rate will never reach zero percent".

Value: minimum (0.1), Maximum (30), Value before crisis (6.419), Value after crisis (6.23)
Source: DATA, field interviews

Analysis

Lebanon is suffering from cyclical and structural unemployment mostly driven by major political, social and other issues which have hindered economic growth and job creation in the past few years. Moreover, there is a growing gap between the labor supply and labor demand in the market which is further aggravating the situation notably in terms of youth employment, inclusion and new skills in demand[96]. Moreover, while donors and international organizations are investing in helping to create jobs in rural and other areas, and while there is a fairly developed startup ecosystem in the city of Beirut, there are still many gaps to fill in order to take the Lebanese labor market to another level.

According to the World Bank, around 23,000 individuals set foot in the Lebanese labor market every year. But for this market to fit all of them, it needs to create at least 6 times the work opportunities currently available. This means that, out of the 23,000 citizens, only 3,833 do secure a job, which is around 17% only.

[96] Unemployment in Lebanon, Joumana Brihi, Abir Takieddine and Myriam Zmeter, 2019

Unemployment aspects	**2010 Before the Syrian Crisis %**	**2019 After the Syrian Crisis %**	**2019 Global Maximum Value %**	**2019 Global Minimal Value %**
Unemployment rate[97]	6.419	6.23	28.5[98]	0.1[99]
Unemployment- Female (% of female labor force)	10.55	9.88	40.6[100]	0.4[101]
Unemployment- Male (% of male labor force)	5.116	5.047	26.5[102]	0[103]

Source: World Bank Data, Web Portal, Modeled ILO estimate

The minimum and maximum for this analysis will be using the minimum and maximum global value as 100% is not a real value as no countries has reached it.

Minimum: 0.1; Maximum: 30%

Before: (value - minimal value)/(Maximal value - Minimal value) = (6.419-0.1)/(30-0.1)=6.319/29.9= 0.211

After: (value - minimal value)/(Maximal value - Minimal value) = (6.23-0.1)/(30-0.1)=6.13/29.9= 0.205

However, since the scenario shows that 0.1 is the most favourable value and 30 is the worst, the value of "After" should be less than the value of "Before" the crisis. Hence, the final number will be as:

Final value = 1-initial value

Value final after= 1-0.211= 0.789

Value final before = 1-0.205= 0.795

12- Economic Growth Rate

An economic growth rate is the percentage change in the value of all of the goods and services produced in a nation during a specific period of time, as compared to an earlier period. The

[97] The unemployment rate is defined as the number of unemployed people as percent of the labor force. The labor force includes the people who are either employed or unemployed, i.e. who don't have a job but are actively looking for one. The labor force does not include people who are not looking for work, children, and the retired
[98] South Africa
[99] Qatar
[100] West Bank and Gaza
[101] Niger and Qatar
[102] South Africa
[103] Qatar

economic growth rate is used to measure the comparative health of an economy over time. The numbers are usually compiled and reported quarterly and annually[104]. In most cases, the economic growth rate measures the change in a nation's gross domestic product (GDP).

The GDP represents the value of all goods and services produced over a specific time period within a country's borders. Economists can use GDP to determine whether an economy is growing or experiencing a recession. Investors can use GDP to make investments decisions—a bad economy means lower earnings and lower stock prices.

Per capita gross domestic product (GDP) is a metric that breaks down a country's economic output per person and is calculated by dividing the GDP of a country by its population. Per capita GDP is a global measure for gauging the prosperity of nations and is used by economists, along with GDP, to analyze the prosperity of a country based on its economic growth. Small, rich countries and more developed industrial countries tend to have the highest per capita GDP.

As of April 2019, Luxembourg ranked the top 1 country with the highest GDP nominal per capita: $116,730[105]. However, China has the world's second-largest GDP ($15,270 billion) with the world's largest population (1.4 billion) leading to a low per capita GDP ranking ($10,870)[106]. Also, South Sudan ranked the lowest country with GDP per capita of $275[107], where the country struggles economically, because of poorly developed infrastructure and a low standard of living.

Value: minimum (0), Maximum (7), Value before crisis (6), Value after crisis (0)

Source: Literature review

Analysis:

The economy of Lebanon is classified as a developing, upper-middle income economy.
The nominal GDP was estimated $54.1 billion in 2018[108]. Government spending amounted to $15.9 billion in 2018[109], or 23% of GDP. The Lebanese economy significantly expanded after the war of 2006, with growth averaging 9.1% between 2007 and 2010[110]. After 2011 the local economy was affected by the Syrian civil war, growing by a yearly average of 1.7% on the 2011-2016 period and by 1.5% in 2017[111].

As for Lebanon, the country has been ranked 67 out of 186 as per the IMF estimates in 2019 for the GDP per capita, averaging $9,654. Considering that Lebanon is one of the smallest countries, comparing its GDP per capita to the small countries such as Luxembourg ($10,870), Qatar ($69,690) and Monaco ($81,150), we can conclude that the Lebanon' GDP per Capita is really low.

[104] https://www.investopedia.com/terms/e/economicgrowthrate.asp
[105] International Monetary Fund. "GDP per Capita, Current Prices.
[106] Ibid
[107] Ibid
[108] "Middle East: Lebanon — The World Factbook - Central Intelligence Agency". Central Intelligence Agency.
[109] "Lebanon's cabinet agrees 2018 budget with lower deficit". Reuters.
[110] "GDP growth (annual %)". Worldbank.
[111] Ibid

Comparison of Lebanese GDP Growth rate over the past 10 years:

Lebanon GDP Growth Rate - Historical Data		
Year	GDP Growth (%)	Annual Change
2019	-5.64%	-3.71%
2018	-1.93%	-2.78%
2017	0.85%	-0.68%
2016	1.53%	1.32%
2015	0.21%	-2.25%
2014	2.46%	-1.35%
2013	3.81%	1.27%
2012	2.54%	1.67%
2011	0.87%	-7.11%
2010	7.98%	-2.26%

Source: Macrotrends.net

The Bureau of Economic Analysis (BEA) tracks GDP growth rate because this is a vital indicator of economic health. Broadly speaking, increased demand leads to increased production and a higher economic growth rate. An increase in the economic growth rate is usually seen as a positive. If an economy shows two consecutive quarters of negative growth rates, the nation is officially in a recession. To put it baldly, if an economy shrinks by 2% from the previous year, its overall population has experienced a reduction in income of 2% in that year[112]. Economic growth only comes from increasing the quality and quantity of the **factors of production**, which consist of four broad types: **land, labor, capital, and entrepreneurship**.

As a summary, the ideal Economic Growth rate is about 2 to 3% and Lebanon has -5.64% in 2019 growth rate as per the WorldBank and it was 7.98 (annual%) in 2010. To measure the indictor for our analysis using the Likert Scale:

%	**Likert**
Minus	0 (the lowest)
0-0.5%	1
0.5-1%	2
1-1.5%	3
1.5-2%	4
2%-3%	5
3%-9%	6
9% plus	7

[112] https://www.investopedia.com/terms/e/economicgrowthrate.asp

13- Sectors contribution to GDP Index – focus on Agriculture

In 2019, the share of agriculture in Lebanon's gross domestic product was 5.29 percent, industry contributed approximately 12.83 percent and the services sector contributed about 75.91 percent[113]. The distribution gives the percentage contribution of agriculture, industry, and services to total GDP, and will total 100 percent of GDP if the data are complete. Agriculture includes farming, fishing, and forestry. Industry includes mining, manufacturing, energy production, and construction. Services cover government activities, communications, transportation, finance, and all other private economic activities that do not produce material goods.

Value: minimum (0), Maximum (100), Value before crisis (0.2392), Value after crisis (0.2483)
Source: DATA

Analysis:
The Agri-food sector is a major contributor to the Lebanese economy; however, the Agriculture is not. In 2018 the Agri-food sector generated an estimated 38% of the industrial sector output[114] and around 2.9% of the country's GDP[115]. The Agri-food sector added value has increased at a CAGR[116] of 9.5% over the 2010-2018 period, with an estimated size of USD 1.6 billion in 2018[117]. In 2018, the agriculture sector generated around USD 1.8 billion or 3.2% of Lebanon's GDP with its contribution growing at a CAGR of 2% between 2010 and 2018[118].

To get the value before and after the crisis, we will produce an index based on the three sectors as the below:

Index after the Crisis:

"In 2019, the share of agriculture in Lebanon's gross domestic product was 5.29 percent, industry contributed approximately 12.83 percent and the services sector contributed about 75.91 percent"

Agriculture: maximum value (%of GDP): 100%, minimum value 0%, current value (2019): 12.83%. Score (value - minimal value)/ (Maximal value - Minimal value): 5.29/100= **0.0529**

Industry: 12.83/100= **0.1283**

Services: 75.91/100= **0.7591**

We will give Agriculture the highest weight of this analysis for two main reasons:

[113] Lebanon: Share of economic sectors in the gross domestic product (GDP) from 2009 to 2019, Published by H. Plecher, Jul 28, 2020
[114] Lebanese National Accounts, 2018
[115] Ministry of Industry, The Lebanese Industrial Sector Facts & Findings 2007
[116] Compound annual growth rate, or CAGR, is the mean annual growth rate of an investment over a specified period of time longer than one year.
[117] Lebanese National Accounts, 2018
[118] IDAL, Sector in focus, Agriculture, 2018

- We are focusing on Agriculture in our study and want to show that the final index is low if agriculture is not a sector of importance: the relative economic importance of the sector is how much this sector contributes to the GDP; if Agriculture has very low GDP contribution, the sector won't be important and further ignored. Good to note that the low contribution is initially from negligence.
- Since agriculture is the primary sector of the market[119], once it's forgotten the market will be disrupted.

Sector	**Index**	**Weight (Total of 1)**	**Final Index (Index*Weight)**
Agriculture	0.0529	0.5	0.02645
Industry	0.1283	0.25	0.032075
Services	0.7591	0.25	0.189775
Total		**1**	**0.2483**

Index before the Crisis:

"In 2011, the share of agriculture in Lebanon's gross domestic product was 3.8 percent, industry contributed approximately 14.51 percent and the services sector contributed about 73.54 percent"

Agriculture: maximum value (%of GDP): 100%, minimum value 0%, current value (2019): 12.83%. Score (value - minimal value)/ (Maximal value - Minimal value): 3.8/100= **0.038**

Industry: 14.51/100= **0.1451**

Services: 73.54/100= **0.7354**

Sector	**Index**	**Weight (Total of 1)**	**Final Index (Index*Weight)**
Agriculture	0.038	0.5	0.019
Industry	0.1451	0.25	0.036275
Services	0.7354	0.25	0.18385
Total		**1**	**0.2392**

Index low before and after the crisis for the Agricultural share.

14- Debt to GDP ratio (fiscal performance)

The debt-to-GDP ratio is the metric comparing a country's public debt to its gross domestic product (GDP). By comparing what a country owes with what it produces, the debt-to-GDP ratio reliably indicates that particular country's ability to pay back its debts. A country able to continue

[119] The three-sector model in economics divides economies into three sectors of activity: extraction of raw materials (primary), manufacturing (secondary), and services (tertiary).

paying interest on its debt--without refinancing, and without hampering economic growth, is generally considered to be stable. A country with a high debt-to-GDP ratio typically has trouble paying off external debts (also called "public debts"), which are any balances owed to outside lenders.

A study by the World Bank found that countries whose debt-to-GDP ratios exceeds 77% for prolonged periods, experience significant slowdowns in economic growth. Pointedly: every percentage point of debt above this level costs countries 1.7% in economic growth. This phenomenon is even more pronounced in emerging markets[120], where each additional percentage point of debt over 64%, annually slows growth by 2%[121].

"The Formula for the Debt-to-GDP Ratio Is: Debt to GDP=Total GDP of Country/ Total Debt of Country"

Worldwide, and as per the World Bank statistics:

- By 2020, Lebanon' Dept-to-GDP is 157.81% ranking the 5th on the list of the highest Dept-to GDP.
- Brunei, recorded the lowest Dept-to GDP in 2020 with 2.63%.
- Japan, recorded the highest Dept-to GDP in 2020 with 237.54%.

Value: minimum (2), Maximum (300), Value before crisis (137), Value after crisis (157.81)
Source: DATA, field interviews

Analysis:
Lebanon's public finances were structurally weak prior to the Syrian shock and are now becoming severely strained, with the deficit estimated to widen by USD2.6 billion over the 2012-14 period[122]. Following half a decade of robust growth, Lebanon experienced a remarkable decrease in its debt-to-GDP ratio, from about 180 percent in 2006, to 134 percent at the eve of the Syrian conflict in 2011[123]. The country's improved public finances, however, were to a large extent due to a cyclical improvement, as strong structural reforms envisaged as part of the Paris III conference have yet to be fully implemented. The Syrian conflict shock is putting Lebanon's public finances under severe and rapidly escalating strains, unsustainable given Lebanon's initial weak public finances. On the revenue side, spillovers from the conflict are estimated to cut USD1.5 billion in revenue collection over 2012-14, due to a combination of direct impact on key sectors (e.g., tourism) and indirect impacts through weaker economic activity. On the expenditure side, total budgetary spending by the Government alone is estimated to grow by up to USD1.1 billion over 2012-2014 because of

[120] An emerging market is a market that has some characteristics of a developed market, but does not fully meet its standards. This includes markets that may become developed markets in the future or were in the past.
[121] World Bank. "Finding The Tipping Point -- When Sovereign Debt Turns Bad.
[122] https://www.worldbank.org/content/dam/Worldbank/document/MNA/LBN-ESIA%20of%20Syrian%20Conflict-%20EX%20SUMMARY%20ENGLISH.pdf
[123] Ibid

the Syrian conflict and the associated sharp increase in demand for and consumption of public services by refugees from Syria. The wider fiscal deficits, lower economic growth, and rising interest risk premium due to the Syrian conflict have halted Lebanon's remarkable progress in reducing its debt-to-GDP ratio; for the first time since 2006, Lebanon's debt ratio rose again in 2012 with further increases projected[124].

Lebanon continues to face several long-term structural weaknesses that predate the Syria crisis, notably, weak infrastructure, poor service delivery, institutionalized corruption, and bureaucratic over-regulation. Chronic fiscal deficits have increased Lebanon's debt-to-GDP ratio, the third highest in the world; most of the debt is held internally by Lebanese banks. These factors combined to slow economic growth to the 1-2% range in 2011-17, after four years of averaging 8% growth. Weak economic growth limits tax revenues, while the largest government expenditures remain debt servicing, salaries for government workers, and transfers to the electricity sector. These limitations constrain other government spending, limiting its ability to invest in necessary infrastructure improvements, such as water, electricity, and transportation. In early 2018, the Lebanese government signed long-awaited contract agreements with an international consortium for petroleum exploration and production as part of the country's first offshore licensing round[125].

Before: (value - minimal value)/(Maximal value - Minimal value)= (137-2)/(300-2)= 0.4530

After: (value - minimal value)/(Maximal value - Minimal value)= (157.81-2)/(300-0)= 0.5228

However, since the scenario shows that 0 is the most favourable value and 100 is the worst, the value of "After" should be less than the value of "Before" the crisis. Hence, the final number will be as:

Final value = 1-initial value

Value final after= 1-0.4530= 0.547

Value final before = 1-0.5228= 0.4772

15- Fiscal expenditures per year on Agriculture

As mentioned in the previous indicator (Debt-to-GDP), Lebanon is a highly indebted country. The main reason for the fiscal deficit comes from (a) interest payments who consumed 48% of domestic government revenues in 2016, thus limiting the government's ability to make needed investments in infrastructure and other public goods[126], (b) the halt in subsidized lending by the central bank (BdL) that was being channeled via commercial banks to (mostly) the real estate sector, providing a rare source of growth impetus since 2012, (b) Import of goods, (b) increased

[124] https://www.worldbank.org/content/dam/Worldbank/document/MNA/LBN-ESIA%20of%20Syrian%20Conflict-%20EX%20SUMMARY%20ENGLISH.pdf
[125] Lebanon Economy Profile 2019, IndexMundi
[126] "Lebanon embarks on long-delayed reforms but debt problems mount". Reuters, Barrington, Lisa (30 August 2017).

transfers to Electricite du Liban (EdL) due to more expensive fuel, (e) a surge in transfers to municipalities, likely motivated by electioneering in 2018[127] and (f) salaries.

The general government final consumption expenditure (formerly general government consumption) includes all government current expenditures for purchases of goods and services (including compensation of employees) and was recorded at 15.22% in 2019[128].

On average, the Lebanese budget allocation to the Ministry of Agriculture represents about 0.5 percent of the total public expenditures, which is a very small share as compared to neighbouring countries where it exceeds 5 percent of the national budgets[129].
It is worth mentioning that total public spending on agriculture is not limited to MoA government budget allocations. Various agricultural programmes were adopted and financed by the government since 2011, most important are: - the Programme for the development of cereals and legumes (wheat, barley, lentils and chick-peas) adopted by Council of Ministers in 2012, managed by the Ministry of Economy and Trade in collaboration with MoA and LARI with an annual budget of LBP 20 to 40 billion; - The Export Plus Programme, implemented by the Investment Development Agency for Lebanon (IDAL) was reactivated in 2011 with an annual budget of LBP 50 billion; - The forage and livestock development programme in Lebanon approved by the Council of Ministers in 2012, with an annual budget of LBP 28 billion[130].

How the debt impact agriculture and the food system: an indebted country will not focus on improving the economic sector specifically if the share of GDP is low, this is why the government with – if any – excess of money will focus on the other sectors such as the services (banking and Tourism sectors mainly). The Agricultural sector has witnessed through the past few decades the lack of long-term support policies aiming at the growth of the sector and the development of the rural areas, as well as the lack of priority of food and agriculture sector at national level. This has been translated in reduced public spending on agriculture and consequently low MoA Budgets[131]. In addition to the fact that these are annual Budgets that do not include any long or medium-term vision, burdened by a weak public finance administration, inefficiencies and inadequate expenditure mechanisms. This has been reflected also into a poor infrastructure, weak public sector (structural, organizational, regulatory, etc.), and inadequate law enforcement in inspection and control.

Value: minimum (0), Maximum (20), Value before crisis (0.5), Value after crisis (0.5)
Source: DATA, field interviews

Analysis:

[127] The World Bank, country overview, Lebanon
[128] World Bank Data
[129] Ministry of Agriculture Strategy 2015 - 2019
[130] Ibid
[131] Ibid

An estimation of a maximum of 20% on national budgets allocated to Agriculture[132] and 0 as the lowest value. The value did not change before and after the crisis.

16- Consumer Price Index (CPI)/Inflation Rate

Inflation is a quantitative measure of the rate at which the average price level of a basket of selected goods and services in an economy increases over some period of time. It is the rise in the general level of prices where a unit of currency effectively buys less than it did in prior periods. Often expressed as a percentage, inflation thus indicates a decrease in the purchasing power of a nation's currency. Inflation can be contrasted with deflation, which occurs when prices instead decline.

Depending upon the selected set of goods and services used, multiple types of inflation values are calculated and tracked as inflation indexes. Most commonly used inflation indexes are the Consumer Price Index (CPI), the Wholesale Price Index (WPI), and the Producer Price Index (PPI).

- The Consumer Price Index (CPI): The CPI is a measure that examines the weighted average of prices of a basket of goods and services which are of primary consumer needs. They include transportation, food, and medical care. CPI is calculated by taking price changes for each item in the predetermined basket of goods and averaging them based on their relative weight in the whole basket. The prices in consideration are the retail prices of each item, as available for purchase by the individual citizens. Changes in the CPI are used to assess price changes associated with the cost of living, making it one of the most frequently used statistics for identifying periods of inflation or deflation.
- Wholesale Price Index (WPI): The WPI is another popular measure of inflation, which measures and tracks the changes in the price of goods in the stages before the retail level. While WPI items vary from one country to other, they mostly include items at the producer or wholesale level. For example, it includes cotton prices for raw cotton, cotton yarn, cotton gray goods, and cotton clothing.
- Producer Price Index (PPI): The producer price index is a family of indexes that measures the average change in selling prices received by domestic producers of goods and services over time. The PPI measures price changes from the perspective of the seller and differs from the CPI which measures price changes from the perspective of the buyer[133].

In this analysis, we will calculate the CPI, from it we can extract the Inflation Rate based on the defined formulas used by the majority of governments:

CPI= (2019CPI-2011CPI)/2011CPI = X

[132] During 2012–2016, on average, Malawi (16.4%), Bhutan (13.0%) and Uzbekistan (11.9%) had highest share of agriculture in the central government expenditure.
[133] Bureau of Labor Statistics. "Producer Price Indexes.

Inflation Rate= X*100

Value: minimum (0), Maximum (100), Value before crisis (10.457), Value after crisis (23.867)
Source: DATA, field interviews

Analysis:
After the Syrian Crisis: reference year 2011 till 2019

Year 2011 – CPI = 104,971

Year 2019 – CPI = 130,025

CPI= (130.025-104.971)/104,971= 0.2387

Inflation Rate: 0.2387*100= 23.867% after the Syrian Crisis

Before the Syrian Crisis: reference year 2008 till 2011

Year 2008 – CPI = 95,033

Year 2011 –CPI = 104,971

CPI= (104,971-95,033)/95,033= 0.10457

Inflation Rate: 0.10457*100= 10.457% Before the Syrian Crisis

"the lowest the value the better the rate": Minimum is 0%, Maximum is 100%

Before: (value - minimal value)/(Maximal value - Minimal value)= (10.457-0)/(100-0)= 0.10457

After: (value - minimal value)/(Maximal value - Minimal value)= (23.867-0)/(100-0)= 0.23867

However, since the scenario shows that 0 is the most favourable value and 100 is the worst, the value of "After" should be less than the value of "Before" the crisis. Hence, the final number will be as:

Final value = 1-initial value

Value final after= 1-0.10457= 0.8954

Value final before = 1-0.23867= 0.76133

Reason: This price inflation is attributed to an increase in demand due to population growth, the injection of cash and food/cash vouchers, and the reduced access to cheaper goods from Syria.

17- Gini coefficient

In economics, the Gini coefficient, sometimes called the Gini index or Gini ratio, is a measure of statistical dispersion intended to represent the income inequality or wealth inequality within a nation or any other group of people[134].

The Gini coefficient measures the inequality among values of a frequency distribution (for example, levels of income). A Gini coefficient of zero expresses perfect equality, where all values are the same (for example, where everyone has the same income). A Gini coefficient of one (or 100%) expresses maximal inequality among values (e.g., for a large number of people where only one person has all the income or consumption and all others have none, the Gini coefficient will be nearly one)[135][136].

May studies analyzed the strong link between economic inequality and growing levels of poverty, food insecurity, and obesity for the bottom segments of the economy.

Value: minimum (0), Maximum (100), Value before crisis (31.38), Value after crisis (50.7)
Source: DATA, field interviews

Analysis:
The calculated pre-tax Gini coefficient of 50.7% placing Lebanon at a rank of 129 from 141 countries in income equality, for which World Bank estimates are available[137], while keeping in mind that the calculated index does not reflect Lebanon's overall inequality, but income inequality across private sector employees, self-employed individuals and proprietors. Lebanon Gini index was 31.8 % in 2011[138]. Although the figures are now dated, it is fair to assume that with little region-specific development policies since, regional inequalities have remained largely unchanged with a likelihood of also having widened after 2011, owing to the uneven regional effect of the Syrian conflict and the concentration of refugees in regions where poverty is extensive[139].

Following a cross-country analysis and a literature review, broad medium-term measures to help narrow the gap between income groups are proposed. An adequate regulatory environment to foster formal sector growth, provision and relevance of education, female labor participation, and policies that support employment in disadvantaged rural and urban districts, are recognized as key factors in the promotion of inclusive growth and income convergence. Short of the proposed measures, inequality in Lebanon is at risk of widening further over the long term with the

[134] Gini, C. (1909). "Concentration and dependency ratios" (in Italian). English translation in Rivista di Politica Economica, 87 (1997), 769–789.
[135] "Current Population Survey (CPS) – Definitions and Explanations". US Census Bureau.
[136] Gini coefficient could be near one only in a large population where a few persons has all the income. In the special case of just two people, where one has no income and the other has all the income, the Gini coefficient is 0.5. For five people, where four have no income and the fifth has all the income, the Gini coefficient is 0.8. See: FAO, United Nations – Inequality Analysis, The Gini Index Module (PDF format), fao.org.
[137] Estimates by the World Bank for the Gini coefficients are for the closest available year to 2014.
[138] World Bank Data
[139] World Bank (2013). Lebanon economic and social impact assessment of the Syrian conflict.

introduction of the petroleum industry into the economy and the potential uneven spillover of its gains.

In short, policy makers and civil society actors must pay greater attention to systematic national and global shifts in the economy in order to craft policies which effectively promote a more inclusive and equitable food system. In today's world, national food systems are deeply interlinked through patterns of trade and investment that are often referred to as global value chains (GVCs). An important feature of value chains is the role played by powerful lead firms – large food processing firms, trading companies, and national and multinational retail and restaurant chains – in setting the terms by which farmers may participate in the food system. Such firms typically favor large, well-capitalized suppliers who control lots of land, placing smallholders at a disadvantage and exacerbating the barriers faced by marginalized groups seeking markets for their products. Thus, the consolidation of monopolies and oligopolies in the processing and retailing segments of food value chains have important knock-on effects for the farming sector, typically in favor of larger and better-financed agricultural entities[140].

At the national level, policy makers must recognize that the current structure of food systems around highly consolidated value chains, creates unique pressures for small farmers that require innovative policy solutions that go beyond the agricultural policies of today, which emphasize large-scale, highly capitalized agriculture. Such policies should promote market access for small-scale and local farmers through a combination of capacity building and the creation of incentives for preferential sourcing arrangements among private and public buyers. National competition policies should also be better implemented, in order to place reasonable limits on the market power currently enjoyed by monopolies and oligopolies along the food chain. Crafting effective policies in this area will require a great deal more empirical knowledge around exactly how agri-food chains are governed across key commodities in each country and how these generate challenges for small-scale and sustainable farming models. Civil society can play a crucial role in producing and disseminating knowledge of these trends to policy makers and the public at large[141].

Before: (value - minimal value)/(Maximal value - Minimal value)= (31.38-0)/(100-0)= 0.3138

After: (value - minimal value)/(Maximal value - Minimal value)= (50.7-0)/(100-0)= 0.507

However, since the scenario shows that 0 is the most favourable value and 100 is the worst, the value of "After" should be less than the value of "Before" the crisis. Hence, the final number will be as:

Final value = 1-initial value

Value final after= 1-0.3138= 0.6862

[140] Changing Food Systems and Inequality: Implications for Food Security and Public Policy, Oxfam
[141] Ibid

Value final before = 1-0.507= 0.493

18- Minimum wage levels

A minimum wage is the statutory minimum wage that employers can pay per hour. Higher wages increase incomes and are likely to cause higher consumer spending. A significant increase in minimum wages could lead to higher growth. It could also contribute towards inflation for two reasons: Higher costs for firms and Higher spending by workers. However, the minimum wage is only one factor that affects growth and inflation[142].

How to set the minimum wage?

One formula suggested the following:

$$Minimum\ living\ wage = (poverty\ line * household\ size)/\ number\ of\ workers\ in\ the\ household$$[143]

While it is generally accepted that a minimum living wage should provide workers and families with a decent standard of living, the difficulty lies with the definition and measurement. Views diverge on the quantities of specified goods and services that are necessary to achieve this objective[144].

The most common proposed indices for the minimum wage include different versions of the Consumer Price Index, personal consumption expenditures, employment costs, and hourly earnings. Based on a review of seven possible indices and a simulation of federal minimum wage rates under different indices, the minimum wage in 2016 would have been highest had it been indexed to average hourly earnings and lowest had it been indexed to personal consumption expenditures. Linking the value of the federal minimum wage to consumer prices would have generally resulted in minimum wages higher than the current rate, depending on the starting point[145].

Value: minimum (0), Maximum (7), Value before crisis (2), Value after crisis (2)
Source: DATA, field interviews

Analysis:
The cost of living in Lebanon is high. Expenditures vary from buying the main basic needs, health costs, transportation, electricity, water, childcare, education, clothing, rent and so on. In Lebanon, the citizens have to pay two electricity bills, two water bills and health care costs to get it an adequate and respected amount of all.

[142] Effect of minimum wage on economic growth, inflation and AD/AS, 25 February 2019 by Tejvan Pettinger
[143] Anker 2016
[144] At what level should minimum wages be set? Patrick Belser & Kristen Sobeck: Conditions of Work and Employment, International Labour office (ILO)
[145] The Federal Minimum Wage: Indexation, Congressional Research Services, 2016

In January 2012 Decree No. 7426 was adopted increasing the monthly minimum wage for private sector employees from $333 USD to $450 USD and providing for a living cost increase up to $200 USD[146]. Comparing the increase in CPIs and inflation rate:

- Before the Syrian Crisis, the inflation rate has increased by 10.457 (check point above), hence 333*10.457%= 34.82; final wage should be set considering this only fact at around 368 USD, however it was set at 450 USD considering the 200 USD increase in living cost[147]. Considering this fact adding 200 USD on the 333 minimum wage to cover the living costs, the minimum wage should be set at 533 USD.
- From January 2012 till 2019, we had an increase of 23.867% hence 450*23.867%= 107.402; a new minimum wage – if following this one criterion without the analysis of the increase of the living costs – should be set at 558 USD per month. Assuming each 10 years the living costs increase by 200 USD, the at least the wage should be set at 650 USD per month.

Hence, A short summary of Beirut expenses by Numbeo includes that the monthly cost of living for a four-person family is $2,756 without counting rent, and for a single person, the monthly cost of living is **$756**, not counting rent.

Considering the above, and to rate the minimum wage in Lebanon, the wages are low compared to the living costs and the increase in prices, however the value is considered fine for public private sector employees in rural areas. Good to mention, that the market in Lebanon is highly informal and not all employers abide by this change. Employers are substituting Lebanese workers with cheaper labors such as Egyptians and Syrians so they can pay less than the – initially low – minimum wage. The minimum wage set value in Lebanon do apply for the agri-industry sector but does not apply for the agricultural production sector. The majority of labours work on a daily basis and are paid hourly (based on field interview. The Lebanese farmers, employ low wages Syrian refugees instead of monthly contracts with Lebanese workers.

Based on the above and based on the Likert scale, the value of the minimum wage remaining the same since January 2012 – one year after the Syrian crisis – and considered as bad.

"Likert: 7 =Excellent, 6=Very good, 5=good, 4= moderately good, 3=moderately bad, 2= bad, 1= very bad, 0=Worst."

19- Monetary Policy: Interest and Exchange rates

[146] Understanding Policy-making in Lebanon: An Application of the Multiple Streams Framework to the 2012 Wage Hike, Lea Bou Khater, Issam Fares Institute for Public Policy and International Affairs.
[147] Note: a striking increase of living cost took place between 1996 and 1997 – only CRI's CPI was available during this period – whereby prices increased around 100% from 1996 to 2011. Furthermore, between 1996 and 2011, transport fees were four times increased whereas wages were only increased by 16% instead of 121% based on calculated prices increase during that period.

Monetary policy directly affects interest rates; it indirectly affects stock prices, wealth, and currency exchange rates[148]. Most economists would agree that in the long run, output—usually measured by gross domestic product (GDP)—is fixed, so any changes in the money supply only cause prices to change. But in the short run, because prices and wages usually do not adjust immediately, changes in the money supply can affect the actual production of goods and services. This is why monetary policy—generally conducted by central banks such as the U.S. Federal Reserve (Fed) or the European Central Bank (ECB)—is a meaningful policy tool for achieving both inflation and growth objectives[149].

The question is, then, what monetary policy framework will align growth, inflation and competitiveness in a way that supports the whole economy, agricultural development and food security in normal times, and will, at the same time, help maintain reasonable levels of those variables when the economy and the agricultural sector suffer external or internal shocks? There is little analysis of this topic in general, and even less applied to the Middle East. More detailed analyses will be needed to elucidate the impact of different monetary regimes and the selected target level for inflation on agricultural performance, food security and poverty alleviation[150].

Value: minimum (0), Maximum (7), Value before crisis (2), Value after crisis (2)

Source: DATA, field interviews

Analysis:

The central bank of Lebanon adopted exchange rate targeting in 1994 and it has exploited several instruments (particularly interest rate) since then to stimulate foreign financial inflows. Theories have indicated that an easing monetary policy leads to higher inflation, which is very likely to have a negative effect on long-term growth. Thus, central banks usually try to preserve price stability through controlling the level of money supply and interest rates. An expansionary monetary policy leads to a fall in real interest rates, which in turn lowers the cost of capital, causing a rise in investment spending, thereby leading to an increase in aggregate demand and a rise in output. Conversely, an increase in interest rates translates into an increase in investment cost of capital because financing through debt becomes more expensive. This discourages corporations and households from investment, thereby reducing output.

From the Monetary Policy and Economic Growth in Lebanon, Ali Awdeh, Journal of Central Banking Theory and Practice, 2019, 2, pp. 147-171, 2018:

[148] Note: According to the theory of uncovered interest rate parity, an interest rate increase should translate into appreciation of exchange rate. As a result, the prices of imported goods in domestic currency decrease and prices of exported goods in foreign currency increase. This boosts imports and reduces exports. Conversely, when real interest rates fall, domestic assets dominated in local currency become less attractive relative to those denominated in foreign currencies. As a result, the value of local currency assets relative to other currency assets falls, and results in local currency depreciation. A lower value of local currency makes domestic goods cheaper than foreign goods, thereby causing a rise in net exports and aggregate output.

[149] Monetary Policy: Stabilizing Prices and Output, International monetary Funds (IMF).

[150] Macroeconomic policies and agricultural, Food, agriculture and rural development 2030/in Latin America and the Caribbean, FAO, 2019

In Lebanon, monetary policy plays a dominant role in shaping monetary, banking, and financial landscape, as well as economic landscape due to the absence of medium- and long-term fiscal and economic policies. The central bank of Lebanon adopted exchange rate targeting in 1994 and has pegged the Lebanese pound to the U.S. dollar since end-1997, a strategy that requires holding sufficient foreign currency reserves. Therefore, the central bank uses the spread between local and international interest rates, in addition to some non-traditional practices recently in order to attract foreign financial inflows. This practice has proved to be very successful in attracting large financial inflows that expended banking sector deposits, heightened central bank reserves, and improved current account balance for more than two decades. Nevertheless, this strategy has had serious repercussions on economic growth in Lebanon. This was detected by using cointegration analysis and Vector Error Correction system on a dataset of monthly monetary, banking and economic variables between January 2002 and June 2017. The empirical analysis was conducted to detect the impact of the central bank strategy on economic growth through two channels: directly via monetary tools and banking variables, and indirectly via the association between financial inflows and some macroeconomic variables. Regarding the direct channel, the monetary tools (interest rate and money supply) show to have a long-run negative impact on economic growth. Therefore, interest rate may have obstructed both investment and consumption (according to the interest rate channel) and increased government cost of borrowing. Furthermore, money supply may have resulted in high inflation, which hindered economic performance. The negative effect of money supply may also be linked to a high leakage of funds out of the economy (i.e. money earned but not injected in the economy), where a large proportion of bank deposits is kept at the central bank. Furthermore, aggregate money supply or demand shocks have resulted in real output fluctuations (Bhattacharya, 2003). Conversely, bank credit and capital show to have a short- and long-run constructive impact on GDP growth, proving the existence of transmission channel through these two variables. As for the indirect channel, we found that the inflow of foreign capital may have deteriorated economic activity. This was concluded due to the negative short- and long-run association between the deposits of non-resident private sector and economic growth. This relationship was also complemented with a long-run negative effect of public debt and imports on GDP growth. These findings may call for considering the repercussions of the adopted monetary strategies on economic growth, and suggest the necessity to balance between preserving currency stability and improving economic performance and welfare. Finally, it is worth noting that in a dollarized economy, asymmetric shocks cannot be solely corrected by changes in the monetary policy or the exchange rate policy, particularly if the fiscal policy does not play a countercyclical role in shaping this adjustment (Mitrović-Mijatović and Ivanović, 2017). Therefore, the adjustment must be made through structural reforms that can increase the flexibility of the economy and the relative price and wage adjustments.

Based on the above and based on the Likert scale, the monetary policy of the central bank in Lebanon, had a one goal of preserving the currency stability without improving the economic performance and welfare. Considering the analysis above, the monetary policy adopted by the

country is considered as “bad” (value equal to 2 before and after crisis) since it has a negative impact on the economic growth. Hence, if we want to put the value of “1” which is very bad we will be neglecting that this practice has proved to be very successful in attracting large financial inflows that expended banking sector deposits, heightened central bank reserves, and improved current account balance for more than two decades.

“Likert: 7 =Excellent, 6=Very good, 5=good, 4= moderately good, 3=moderately bad, 2= bad, 1= very bad, 0=Worst.”

- **Infrastructure and market logistics**

20- Logistics Performance Index

The World Bank and Turku School of Economics, Logistic Performance Index (LPI) Survey uses six key dimensions to benchmark countries' performance and also displays the derived overall LPI index. The scorecard allows comparisons with the world (with the option to display world's best performer) and with the region or income group (with the option to display the region’s or income group's best performer) on the six indicators and the overall LPI index.

The logistics performance (LPI) is the weighted average of the country scores on the six key dimensions:

1) Efficiency of the clearance process (i.e., speed, simplicity and predictability of formalities) by border control agencies, including customs;

2) Quality of trade and transport related infrastructure (e.g., ports, railroads, roads, information technology);

3) Ease of arranging competitively priced shipments;

4) Competence and quality of logistics services (e.g., transport operators, customs brokers);

5) Ability to track and trace consignments;

6) Timeliness of shipments in reaching destination within the scheduled or expected delivery time.

The scorecards demonstrate comparative performance of all countries (world), regional and income groups.

Value: minimum (0), Maximum (5), Value before crisis (3.34), Value after crisis (2.72)
Source: DATA, field interviews

Analysis:
The value from the World Bank, in 2018 as 2.72 for Lebanon out of the maximum 5. The value before the Crisis in 2010 was 3.34.

Lebanon ranks 94 out of 264 countries/nations in The World Bank's 2018 Logistics Performance Index, not least due to the lack of rail infrastructure since the civil war. Compared to the rest of the MENA region, the quality of roads and warehousing, as well as the operational efficiency of customs agencies and freight forwarders is relatively low[151]. The clearance and delivery of exports is half as efficient as imports, which heavily affects the profitability of local agricultural production since most exports happen via sea routes[152]. The average export cost per kilometre in Lebanon is USD 20 per kilometre for sea and airfreight compared to USD 2 per kilometre in the MENA region[153]. In 2014, the time it took to export by land from Lebanon averaged 12 days compared to 4.2 days in the region. Imports show broadly the same inefficiencies with a cost of USD 40 for sea and airfreight compared to the regional average of USD 2.90 per kilometre[154]. The number of documents required for both imports and exports in Lebanon is roughly twice as many as the rest of the region, although inspection times are shorter[155].

There have been efforts to improve Lebanon's transport and logistic infrastructure. Since the end of the civil war, the Council for Development and Reconstruction (CDR), a public authority under Lebanon's cabinet, has been in charge of internal logistics and transport infrastructure, though plans to build rail networks in the north of the country have not materialized[156].

21- Domestic Logistics Performance Index

The Domestic LPI looks in detail at the logistics environments in the country. For this measure, surveyed logistics professionals assess the logistics environments in their own countries. This domestic evaluation contains more detailed information on countries' logistics environments, core logistics processes and institutions, and time and distance data. This approach looks at the logistics constraints within countries, not just at the gateways, such as ports or borders. It uses four major determinants of overall logistics performance to measure performance:

- Infrastructure,
- Services,
- Border procedures and time, and
- Supply chain reliability.

To be able to measure this index, a big pool of indicators will be taken into consideration and we will be creating our own index based on qualitative/quantitative analysis mentioning the source of the data:

[151] The World Bank IBRD-IDA. (2014). Logistics Performance Index. Domestic LPI, Environment and Institutions: Lebanon 2014. Retrieved from http://lpi.worldbank.org/domestic/environment_institutions/2014/C/LBN/R/MNA/I/UMC#chartarea
152 Ibid
153 Ibid
[154] Ibid
[155] Ibid
[156] STRATEGIC REVIEW OF FOOD AND NUTRITION SECURITY IN LEBANON, ESCWA, May 2016

Indicator	Min	Max	Value		Weight (equal to 1)	Value: (value - minimal value)/(Maximal value - Minimal value)		Final Value	
			Before	After				Value*weight	
						Before	After	Before	After
Internal roads Infrastructure[157]	0	100	50	33	0.4	0.5	0.33	0.2	0.132
Warehousing/transloading facilities[158]	0	100	33	33	0.3	0.33	0.33	0.099	0.099
Power Generation/Electricity[159]	0	7	3	2	0.3	0.428	0.285	0.1284	0.0855
Final Index (sum of the final value)								**0.4274**	**0.3165**

Value: minimum (0), Maximum (1), Value before crisis (0.4274), Value after crisis (0.3165)
Source: DATA analysis

Analysis:
In addition to the analysis on the indicator above (20 – Logistics Performance Index), the majority of locally produced food reaches markets through small market actors who do not enjoy economies of scale. The retail supply market for agricultural products is dominated by small retailers, and is considered to be in a state of transition from traditional procurement channels towards greater market concentration among supermarket retailers providing food to consumers[160].

This supermarket transition tends to render wholesale markets obsolete, given that large retailers introduce long-term supply contracts with specialized wholesalers to ensure reliable quality and comparable standards[161]. Supermarkets, which account for less than a third of the market, were introduced in Lebanon in the 1990s and they are generally owned by local investors. However, weak state regulations coupled with political instability have kept public and private investment

[157] World Bank, Domestic LPI
[158] Ibid
[159] The electricity in Lebanon is bad and does not cover all the needs. Citizens and all value chain actors' resort to private generators which increases the cost of production and disrupt the whole value chain. Before the Syrian crisis the electricity was better compared to the last 5 years. The high number of refugees put some burden on the electricity use however this is not the main reason; buying fuels has been always the main issue.
[160]Karin Seyfert, Jad Chaaban and Hala Ghattas (2014). Food security and the supermarket transition in the Middle East, two case studies. Retrieved from http://www.opml.co.uk/publications/food-security-and-supermarket-transition-middle-east-two-case-studies
[161] Ibid

low, which extends the lifespan of Lebanese small-scale farmers and the economic function of the wholesalers[162].

- **Market Environment and Dynamics**

22- % Foreign Direct Investment in Agriculture (FDI)

Foreign direct investment or FDI is when a business owns another business in a different country. Under this type of investment, the investing company do not simply put their money into assets in another country— which is commonly known as foreign portfolio investment. In FDI the foreign company is directly involved with day-to-day operations of the business based in the other country. This means, user foreign direct investment, apart from funds, foreign investors also bring in knowledge, technical skills, managerial knowhow, new tech, and more job opportunities[163].

FDI is reported on an annual basis, i.e. how much new investment was received in the country during the current year. It typically runs at about 2-3 percent of the size of the economy measured by its gross domestic product. If a country routinely receives FDI that exceeds 5-6% of GDP each year, then this is a significant success[164]. Hence, The average value for Lebanon during that period was 6.19 percent with a minimum of -0.01 percent in 1988 and a maximum of 14.88 percent in 2008. The latest value from 2018 is 4.79 percent. For comparison, the world average in 2018 based on 180 countries is 3.36 percent[165].

Value: minimum (0), Maximum (28), Value before crisis (0.45), Value after crisis (3.7)
Source: DATA analysis

Analysis:
Lebanon has been traditionally open to foreign direct investment. However, according to the 2020 World Investment Report published by the UNCTAD, FDI inflows decreased from USD 2,6 billion in 2018 to USD 2,1 billion in 2019, mainly due to political instability, macroeconomic imbalances and a foreign currency crisis. FDI stock reached USD 68 billion in 2019, an increase of more than USD 20 billion in ten years. Traditionally, FDI fuelled job creation and information, technology and industry sectors are expanding. Although, the unstable situation in Syria, the massive inflow of refugees that resulted from it, and the global economic slowdown weakened this dynamism. Also, regulatory and institutional bottlenecks affect the prospects for FDI diversification. Main investors are France, the United Arab Emirates, the United States, Germany, the United Kindgom, the Netherlands, Jordan and Egypt. FDI are mainly oriented towards trade, real estate, services, tourism and agriculture[166].

[162] Ibid
[163] WHAT IS GREENFIELD INVESTMENT— TYPES OF FDI, FDI India, June 2020
[164] Lebanon: Foreign Direct Investment, percent of GDP, The World Bank
[165] Ibid
[166] Foreign direct investment (FDI) in Lebanon, Nordea Trade

More than 70% of foreign investment flows came in form of real estate acquisitions, based on estimates from the Central Bank of Lebanon, the General Directorate of Real Estate, UNCTAD, the Financial Times and Moody's. This was distributed between the Lebanese diaspora's acquisition of real estate (49.3% of total acquisitions) and foreigners' acquisitions (28.8% of total acquisitions). Meanwhile, cross-border mergers and acquisitions constituted 14.6% of total FDI with major acquisitions concentrated in the tourism and financial sectors (e.g. Saudi-based company Kingdom Holding sold its stake in the Four Seasons Hotel in Beirut for USD 120 million to a group of Lebanese and Arab investors). The remainder of FDI took the form of greenfield FDI projects[167] (5.6%), re-invested earnings (1.7%) and intra-company loans (0.1%). FDI in industrial and agriculture sectors continue to be low for the time being as these sectors are not attractive (no exact percentages for each).

To analyze the indicator as maximum and minimum, we will do the following:

- ✓ The main 11 stock market sectors are: Materials, Industrials, Financials, Energy, Consumer discretionary, Information technology, Communication services and Real estate.
- ✓ In Lebanon, the major economic sectors include metal products, banking, agriculture, chemicals, transport equipment, real estate and tourism.
- ✓ Exports: jewelry, base metals, chemicals, consumer goods, fruit and vegetables, tobacco, construction minerals, electric power machinery and switchgear, textile fibers, paper.
- ✓ Imports: petroleum products, cars, medicinal products, clothing, meat and live animals, consumer goods, paper, textile fabrics, tobacco, electrical machinery and equipment, chemicals

Analyzing the import/exports in light of the main economic sectors, investments should focus more on reducing the imports and increasing the exports by introducing new FDIs. The government should annually plan the needs of foreign support based on its import/exports balance sheets. Dividing the FDI support over the 7 major economic sectors in Lebanon, each sector should get at least 14% of FDIs. However, currently Real estate represents 70% of FDIs as mentioned above. The minimum of the value will be set at 0 and the maximum at 28 (double the sector amount in case on sector has been replaced). As per the above "The remainder of FDI took the form of greenfield FDI projects (5.6%), re-invested earnings (1.7%) and intra-company loans (0.1%)", we will assume that agriculture has the half of the remainder percentage (5.6+1.7+0.1=7.4/2= 3.7%).

Before the Syrian Crisis and based on IDAL FDI report in 2009: The leading sectors for foreign investments in 2009 were the real estate and residential sectors (Figure 4) which generated around 70% of total FDI inflows, backed by strong demand from Lebanese expatriates and Gulf investors. Tourism is also a key growing sector, attracting around 22% of total FDIs, which are

[167] In economics, a greenfield investment (GI) refers to common type of foreign direct investment (FDI) where a company establishes operations in a foreign country. Under greenfield investment, the firm that is set to invest constructs new facilities (sales office, manufacturing facility, etc.) cross-border from the ground up.

mainly channeled to the hospitality sub-sector. Other service sectors which include media, financial services, education and trade have generated a combined share of 7.1% of total investments for 2009. FDI in industrial and agriculture sectors continue to be low for the time being. The remaining 0.9% (100-70+22+7.) is for both industry and agriculture; dividing the amount by 2, each will get 0.45% of all the FDIs in 2009.

23- Percentage of remittances inflows

There is empirical evidence that remittances contribute to economic growth, through their positive impact on consumption, savings, and investment. Remittances can also have negative impact on growth in recipient countries by reducing incentives to work, and therefore reducing labor supply or labor force participation[168]. Remittances inflows have increased significantly in recent years and have become the main financial external inflow in some developing countries, surpassing other inflows that traditionally play an important role in these countries, such as official development assistance and foreign direct investment. The World Bank estimates that remittances now make up about a third of total financial inflows in developing countries.

Based on the IMF study results[169]:

"A better understanding of input-output sectoral linkages is key to properly capture the full impact of remittances inflows on the recipient economy. Our results indicate that even when utilized for non-investment purposes, remittances may expand domestic production of consumption and intermediate goods necessary to support the increase in consumption. Furthermore, when remittances are spent within sectors that have strong linkages with the rest of the economy, the sectors that do not directly benefit from remittances inflows may still experience output growth. The overall expansion of output will create employment opportunities and stimulate demand for investment goods. Hence, the external stimulus provided by remittances inflows would be more beneficial to a country, the more its economy is diversified, and its production structure integrated. This underscores the importance of diversifying the SSA economies. Also, to foster employment and growth, policymakers should devise stimulus policies targeting sectors that exhibit high vulnerabilities to sharp declines in remittances inflows, including those due to worsening economic conditions in sender countries".

Value: minimum (0), Maximum (40), Value before crisis (17.985), Value after crisis (13.991)
Source: DATA analysis

Analysis:
Migrant remittances have been Lebanon's main source of capital inflows for most of the post-war period, and their abundance is considered, by some, an indicator of the country's economic well-being. These transfers are regularly made by Lebanese nationals working abroad to their families residing in Lebanon. Most of the country's economists welcome these inflows, claiming

[168] The Impact of Remittances on Economic Activity: The Importance of Sectoral Linkages, the IMF, August 2019
[169] Ibid

they contribute to economic growth, as additional income tends to increase overall consumption and investment. They are also believed to serve as social safety nets, compensating for the lack of essential public goods and alleviating poverty[170].

The World Bank estimated the inflows of expatriates' remittances to Lebanon at $7.2bn in 2018, constituting an increase of 1.8% from $7.1bn in 2017, following a decline of 7% in 2017.

Further, expatriates' remittances to Lebanon were equivalent to 13.991% of GDP in 2019, which constituted the 14th highest such ratio in the world and among developing countries, as well as the first highest ratio among Arab countries. Expatriates' remittances to Lebanon were equivalent to 12.63% of GDP in 2018 and 13.3% of GDP in 2017. The World Bank estimated remittance inflows to Arab countries, excluding Syria, at $60.3bn in 2018, up from $55.1bn in 2017, and equivalent to about 2.8% of the region's GDP last year.

The highest value reported was equivalent to 38.52% of GDP (to be used 40% for our analysis as a maximum value) for Haiti in 2019 and minimum of approx. 0% (to be used 0% for our analysis as a minimum value) of GDP in many countries such as Venezuela.

24- Access to Information and Market Linkages

Recent years have seen an increased interest in the provision of market information. In part, this reflects the movement away from state-sponsored marketing in many countries and especially those which have been undergoing structural adjustment. This has been accompanied by a recognition that if marketing activities formerly carried out by the state are to be taken over by the private sector then some government support needs to be provided to promote the creation of a competitive market. Even countries in which the private sector has always played a thriving role in agricultural marketing are increasingly coming to recognize the need for a greater measure of official assistance in areas such as legislation, infrastructure provision, marketing extension and Market Information Services (MIS)[171]. Well-analyzed historical market information enables farmers to make planting decisions in line with urban consumer demand, including those related to new crops. It also permits traders to make better decisions regarding the viability of intra and, perhaps, inter-seasonal storage. Moreover, information of this type assists agricultural planners and researchers and can make an important contribution to our knowledge of urban food marketing systems.

FAO has developed a working definition of a Market Information Service, as follows:

“A service, usually operated by the public sector, which involves the collection on a regular basis of information on prices and, in some cases, quantities of widely traded agricultural products, from rural assembly markets, wholesale and retail markets, as appropriate, and dissemination of

[170] Rethinking the role of remittances inflows in the Lebanese Economy, Samer Talhouk, October 2019.
[171] The Role of Market Information, FAO.org

this information on a timely and regular basis through various media to farmers, traders, government officials, policymakers and others, including consumers."

Value: minimum (0), Maximum (7), Value before crisis (5), Value after crisis (5)
Source: DATA analysis

Analysis:
In Lebanon, considering the informality of the market and its linkages, all Value Chain Stakeholders are able to access information regarding the prices, weather, pests and more, either formally or informally[172]. However, as mentioned during the field interviews, the linkages between farmers, producers, input suppliers, processors, service providers, traders, transporters, retailers, packers, distributors, and exporters need to be strengthened, specifically between different regions, and rural to urban.

The main applications and projects are as below:

Name	**Type**	**Developed by**	**Target**	**Objectives**
AGVISOR	Mobile Application	The Chamber of Commerce, Industry and Agriculture of Zahle and the Bekaa, in cooperation with local experts, funded by Expertise France.	Agriculture value chain actors (production, commercialization…)	Advise its users on market prices, studies conducted/good agricultural practices and giving access to a directory on the various value chain actors.
IoTree	Mobile Application of SMS	Youth Entrepreneurs: Nisrine El Turky and Christina Chaccour.	Farmers	IoTree is a solution able to capture, detect, and warn the farmers about the med fly that is the most dangerous pest targeting the agricultural market in the MENA nowadays.
LebPhyto Application	Mobile Application	Ministry of Agriculture (MoA)	Agriculture value chain actors	To report queries related to registered

[172] Based on our Field Interviews with farmers, LARI and exporters

		and IDS (Integrated Digital Systems)	(production, commercialization…)	pesticides, with the ability or the option to search by crop, pest, active ingredient, lesions, country of origin, supplier, formulation and other attributes…
LARI-LEB	Mobile Application	LARI is an independent governmental organization.	Agriculture value chain actors (production, commercialization…)	Info about sowing dates, irrigation efficiency information, and pest and disease management. It has a tab that provides 10-day weather and rainfall rates for specific regions and compares this data to the previous year and to long-term averages

*Collected by the author**

The main Agricultural Value Chain development projects in Lebanon supporting/supported in the last 5 to 10 years the Access to Information and Market Linkages:

Project Name	**Donor**	**Goal(s)**	**Start-end Date**	**Location and target**
Lebanon—Industry Value Chain Development (LIVCD)	USAID	-Build linkages between farmers, producers, input suppliers, processors, service providers, traders, transporters, retailers, packers, distributors, exporters, and ending with consumers.	2012-2019	National, All Value Chain actors (farmers, producers, input suppliers, processors, service

		-Strengthen coalition of local actors to ensure that economic benefits from rural tourism remain in those communities. -Facilitate access to markets and to financing opportunities for rural actors through public-private partnerships and co-investments in order to increase income of the rural population and promote rural wealth creation.		providers, traders, transporters, retailers, packers, distributors, exporters)
Lebanon Country Programming Framework (CPF)	FAO	FAO promoted innovative actions to increase efficiency of crop value chains which remain underdeveloped. Special emphasis was placed on the development of the seed sector, support of key value chains, and enhancing agricultural marketing through conducting marketing studies and establishing a marketing intelligence system.	2016-2019	National
AGRI-AKKAR AGRI-BEKAA	Expertise France	-Setting up a value chain information system for continuous data collection on markets, trends and stakeholders. -Promoting marketing, sales and communication to raise the profile of the selected crops, carry out ongoing market analysis on national and international market	2017-2019	Akkar and Bekaa,

		trends and identify new channels of distribution. -Establish vertical linkages between producers, aggregators, traders and input suppliers		
Agriculture and Value Chain Development in Baalbeck-Hermel	Welthungerhilfe (WHH)	AVD project activities are designed to support these farmers in all phases starting from plantation to marketing and selling the final products and crops. The project also aims at introducing new value chains' techniques and new market channels that will help the farmers sell their crops at good prices, thus boosting economy and bringing welfare to this sector as a whole.	2019	Baalbeck-Hermel, Bekaa region

Using Likert Scale and based on our own analysis and as per the above, the Access to information and market linkages was not impacted by the Syrian crisis. Although, the situation is considered good in Lebanon; however, the Market Information System needs to be formalized using few platforms and implementors need to cooperate better in order to reduce confusion amongst actors. Besides the mobile apps, some Social Media pages specific for agricultural products (prices and suppliers) are also available.

Value (Before and After): 5[173]

25- Use of and Access to technology

Under this indicator we will analyze the use and access to information and non-information technology by all Value Chain actors e.g. devices, machines, sensors, information technology and more.

[173] "Likert: 7 =Excellent, 6=Very good, 5=good, 4= moderately good, 3=moderately bad, 2= bad, 1= very bad, 0=Worst."

Technological innovations have greatly shaped agriculture throughout time. From the creation of the plow to the global positioning system (GPS) driven precision farming equipment, humans have developed new ways to make farming more efficient and grow more food.

Modern farms and agricultural operations work far differently than those a few decades ago, primarily because of advancements in technology, including sensors, devices, machines, and information technology. The benefits of technology use include: Higher crop productivity; Decreased use of water, fertilizer, and pesticides, which in turn keeps food prices down; Reduced impact on natural ecosystems; Less runoff of chemicals into rivers and groundwater; Increased worker safety. Hence, Greater efficiencies and lower prices; Safer growing conditions and safer foods; and, Reduced environmental and ecological impact[174].

Value: minimum (0), Maximum (7), Value before crisis (3), Value after crisis (2)
Source: DATA analysis

Analysis:
Country initiative:

- Lebanese Reforestation Initiative (LRI): LRI is promoting the use of specialized mapping tools in native tree reforestation projects in the country. One of the newest technologies adopted by the LRI is the use of GIS, remote sensing software, and the ArcGIS Online platform. The goal of web mapping is to allow reforestation specialists to use and share maps and data of suitable planting sites, site planning and monitoring, vegetation mapping, wildfire prevention, climate change impact on species distribution as well as on environmental threats, by projecting spatial data about environmental and social characteristics onto maps of specific areas of interest. Additionally, the mapping platform enables reforestation stakeholders to reach out to the private sector and the diaspora with reforestation proposals presented as story maps.
- The Litani River Authority (LRA): Implementing and managing irrigation and hydro-electric infrastructures on LRB.
- The Lebanese Agricultural Research Institute (LARI): The Tel Amara station (in Central-Bekaa) dates back to the 1940s and constitutes the largest of LARI's centres, including several departments and covering different agricultural subsectors (plant breeding, irrigation and agro-meteorology, plant biotechnology, pomology and viticulture, poultry science, plant protection, crop production and machinery).
- A recent project using an innovative technological instrument was described. It aims at assessing and developing the operation of a smartphone application used for on-farm irrigation management. It is conducted in partnership with the IAM[175] of Bari (Italy), the CNR[176] of Italy, and a consortium of Italian enterprises. These enterprises are funding the

[174] United States Department of Agriculture, National Institute of Food and Agriculture, Agriculture Technology.
[175] Institut Agronomique Méditerannéen
[176] National Research Council

project. This application, (called Blue Leaf) is currently sold in Italy by the consortium whose goal is to adapt it to the Lebanese agricultural sector and market[177].

- The project, called "Agriculture Response for Development" (ARD) in 2015/2016, was partly funded by the United Nations Development Programme (UNDP), and included a component focused on improving water management by implementing and promoting innovative and efficient pilot technologies and practices. A pilot study was conducted on a 3ha apple orchard, and involved construction of an automated irrigation system using a set of sensors: humidity and temperature sensors placed in the soil, photogram sensors measuring the water and ions flow in the trunk, and a weather station providing data on rainfall, temperature and humidity. These devices were connected to a computerized system which was in turn connected to an irrigation controller giving orders to irrigate.
- Agrytech: Agrytech is a program jointly funded by the Kingdom of Netherlands and Berytech and aims to source and accompany startups with innovative ideas in the Agri-Food sector. The Agrytech program identifies the needs in the agri-food sector which require innovative solutions. These needs can be listed as follows: robotics, remote sensing, automation, e-commerce, traceability, big data, artificial intelligence, sensors, IoT, internet, logistics, drones, energy efficiency, payments, urban agriculture, and supply chain.

As a summary, Lebanon is still at a stage of piloting technological initiatives. The majority of small-scale farmers are still using traditional production techniques. Since the border closures with Syria, traditional export routes within the region have become less available and more expensive. Availability and distribution of high-quality inputs, equipment and technologies are limited and prices are high. Banks and microfinance institutions do not offer competitive finance schemes[178].

"In Lebanon, the transfer and adaptation of new technologies in the Agricultural sector are still at an early stage; they require high investments and remain restricted to individual initiatives"[179].

Using Likert Scale[180] and based on our own analysis and as per the above, the sector needs a lot of support (financially and technically) to be able to purchase and adopt new technologies and be more efficient. The situation before the Syrian crisis was better when it comes to the financial ability of purchasing new technologies, however, 10 years from now (crisis started in 2011), new information and non-information technologies have emerged worldwide. Lebanese youth should be given more opportunities to innovative ideas as they are capable to learn and use new technologies.

[177] FAO, Stakeholder mapping and needs assessment – Lebanon, TECHNICAL REPORT: CAPACITY DEVELOPMENT SERIES
[178] Value Chain Analysis Lebanon Fresh Fruit and Vegetables 2018, Ministry of Foreign Affairs
[179] Technology in the Lebanese agriculture sector and support for small-scale farmers, ESCWA, August 2019
[180] "Likert: 7 =Excellent, 6=Very good, 5=good, 4= moderately good, 3=moderately bad, 2= bad, 1= very bad, 0=Worst."

Value before Crisis: 3

Value after crisis: 2

26- Access to Finance

Financial services for smallholder farmers and rural Micro Small and Medium Enterprises (MSMEs) are critical to achieving financial inclusion goals. Many Microfinance Institutions MFIs and banks see potential growth from extending financial services to these unbanked clients.

Value: minimum (0), Maximum (7), Value before crisis (3), Value after crisis (3)
Source: FAO DATA

Analysis

Micro, Small and Medium-sized Enterprises (MSMEs) in peripheral and agricultural areas in Lebanon, are mostly below their growth potential. Access to finance is a major challenge for their development. They lack information on subsidized or dedicated loan programs designed to meet their constraints.

The Lebanese lending scene remains dominated with high collateral requirements, high interest rates and tightened monetary policy prohibiting the access to finance working capital and seasonal loans. Financial institutions have indicated that they are willing to go down-market and up-market respectively in their financing schemes, yet they need to know more about the sectors, and more about how to serve these businesses and farmers[181].

Based on the Central Banque (Banque Du Liban) list of MFIs, there are 73 MFI in Lebanon where 10 are mainly active[182]. As a result of data obtained from MFI heads, the results seem to show that NGOs MFIs give more credit to men than to women, and a low percentage of credit goes to startups. In addition, beneficiaries have a low level of education, poor or moderately poor, and are located in rural areas.

In 2011, Lebanon was ranked as 38th «in terms of a business environment conducive to microfinance but remains below the world average» (Lebanon this week, 2011). «Microcredit institutions in Lebanon provide micro and small loans to start-ups, employees and micro-entrepreneurs », according to the report of the Ministry of Economy and Trade (2014, p.7). The credit can then take the form of « working capital, fixed assets and/or real estate investments» (Report of the Ministry of Economy and Trade, 2014, p.7). Moreover, the activity of microfinance financial institutions in Lebanon "affects only 11.5% of the population, hence the importance of potential development"[183].

[181] Private Sector Development Programme, Expertise France. https://www.psdplebanon.com/acces-to-finance/
[182] Microcredit_in_Lebanon_First_Data_on_Its_Beneficiaries Inaya Wahidi, 2017
[183] IFC, 2008, http://ibr.ccsenet.org International Business Research Vol.10, No.4; 2017 33 cited by Mayoukou et al., 2013, p.4

Based on Key Informative Interviews (KIIs) and field interviews done by Dr. Inaya Wahidi with the 10 most active MFIs[184], the sectors of activity of their beneficiaries shows a high ranking for services. For some MFIs, the gap between the service sector and the trade sector is not too high. For other sectors such as industry and agriculture, their percentages are relatively low, except for AEP where agriculture represents 40% of the beneficiaries. This seemed relatively consistent because 35% of the loans goes to beneficiaries located in the Bekaa where agriculture is the main occupation of the people living there (men and women).

Lack of access to finance by non-bankable entities undermines agricultural operations and development, even small scale. The first direct impact of the extremely high informality in agriculture (92.4%)[185] concerns the access to finance. Without a formal legal status, banks and lending institutions will not provide financing opportunities to farmers, unless they present collateral. Acquiring a loan requires a farmer (1) to take out a personal loan (with the contingencies governing these types of loans) or (2) to provide collateral186 to get loan approval. With many farmers not having the required collateral, this limits the possibilities of small farmers of accessing finance.

Loan guarantees for agriculture extended by Kafalat increased between 2008 and 2010. Since then, the number of projects guaranteed decreased from 435 in 2011 to 313 in 2015, while the amount of loans remained in the range of 35-39 Million dollars annually[187]. Over the Kafalat loan guarantees extended in the 2008-2016 period amounted on average of 96,000 USD per project. The figures show a trend of stagnation of sector investment and a need to increase support for access to finance for agriculture. It also shows that the main beneficiaries of the Kafalat program are relatively larger farmers who can afford to take relatively large loans. Furthermore, additional credit schemes where established in support of small-scale farmers and agricultural cooperatives to help address the funding gap in the agricultural credit market in Lebanon[188]. Furthermore, agriculture as a sector is not highly appealing to youth - the 2010 agricultural census reported less than 11% of total agricultural holdings being held by individuals less than 35 years old. Few youth own properties and thus do not have the collateral needed for agricultural loans and investment projects.

As a result of the above, qualitatively analyzing the situation on the Likert Scale the status remained the same before and after the Syrian crisis as moderately bad with potential of support.

[184] Al-Majmoua, Vitas, Emkan, ADR, AEP, Hariri foundation for sustainable human development, Makhzoumi foundation, CFC, Al-Tamkeen, and ESFD

[185] Towards decent work in Lebanon: issues and challenges in light of the Syrian refugee crisis, ILO 2015

[186] Collateral is an item of value used to secure a loan. Collateral minimizes the risk for lenders. If a borrower defaults on the loan, the lender can seize the collateral and sell it to recoup its losses.

[187] Kafalat official data

[188] Under the EU-funded ARDP Programme MoA established in 2012 in partnership with Kafalat, the CARD scheme (Credit for Agricultural and Rural Development) in order to increase access to credit for small-scale farmers and agricultural cooperatives. "CARD" was meant to complement the existing 'Kafalat agriculture guarantee scheme' and help fill major gaps in the agricultural credit market by supporting small short-term and large long-term loans. This credit scheme is made up of two financial products: (i) one for small loans (up to €35 000), "Kafalat small agriculture", and (ii) another to meet the long term credit needs of the agricultural sector that require an extended grace period (e.g. tree farming.), "Kafalat trees agriculture".

The situation cannot be stated as completely bad as some MFIs do target directly farmers in addition to NGOs working in Lebanon. Hence, the government is also aware of the required support for the business environment.

"Likert: 7 =Excellent, 6=Very good, 5=good, 4= moderately good, 3=moderately bad, 2= bad, 1= very bad, 0=Worst."

27- Market power: Unions and Cooperatives

Cooperatives are key economic actors worldwide, in both developed and developing countries alike. In many countries, cooperatives are an important contributor to the economy. Their value and governance systems have allowed them to overcome many of the challenges of small-scale economic actors in both rural and urban settings. Policy makers look at cooperatives as powerful structures able to create job opportunities, alleviate poverty and mitigate rural exodus (ILO 2011). In particular, agricultural cooperatives provide small and medium-scale farmers with strong economic benefits including sharing assets, and resources, improved access to markets, strengthened bargaining power and therefore higher return on their production (ILO, 2011). for example, in Italy cooperatives represent 13 per cent of all bank counter operations, 30 per cent of consumption and distribution sector, 50 per cent of all agro-food "made in Italy", totaling 127 billion Euro of turnover and 7.5 per cent of Italy's national GDP in 2013[189].

Value: minimum (0), Maximum (7), Value before crisis (2), Value after crisis (2)
Source: ILO DATA, Ministry of Agriculture

Analysis:
The Ministry of Agriculture in its 2015-2019 strategy mentioned the below:

"The weakness of cooperative work in Lebanon is affecting negatively the agricultural sector as whole. National and local policies and programs for the development of cooperative work are absent, leading to a weak public sector support to cooperatives and for insurance against natural disasters at different levels: structural, regulatory and legislative, planning, operational, monitoring and control. There is a large number of inactive agricultural cooperatives, a decrease in the percentage of farmers' enrolment into cooperatives (because of lack of motivation), as well as a decrease in the number of young members. In addition, there is a lack of Cooperative Extension and Services Centres, and cooperatives are unable to obtain investment loans".

Because of the small size and fragmentation of agricultural lands, farm investments in technology come with high cost for a farmer to bear. At the same time, farmers still resist to organize in cooperatives whereby equipment could be shared[190]. Today, 51% out of the 1,250 cooperatives in Lebanon are dedicated to agriculture[191]. However, only 4.5% of Lebanese

[189] This figure was 2.5per cent in the late 1990's. See Verasani (2013).
[190] Field study done by FAO, Economic Opportunities and Job Creation: AGRICULTURE Sector, November 2016
[191] Personal communication. General Directorate for Cooperatives to the report authors

farmers are members of cooperatives[192]. Cooperatives in Lebanon are male dominated (81.5%). However, it is worth noting that of the 18.5% women cooperatives, the majority are members in women led and controlled agro-food cooperatives[193]: Cooperatives in Lebanon are divided between producers' cooperatives mainly from farmers from the same value chain and agro-food cooperatives, the processers cooperatives.

Many studies have been done in country analyzing the main barriers facing cooperatives in addition to recommendations. Based on all studies such as the "Lebanon Honey Value Chain Analysis Report, ACTED, May 2018" and "ILO (2018). Agricultural and agro-food cooperative in Lebanon. ILO: Geneva", cooperatives while generally weak in Lebanon, should be tapped into because they have the potential to tackle several problems in the value chains while reducing barriers. It is important to find a way that can turn cooperative management into a for-profit corporate management, where members would be more incentivized to use revenues and funds efficiently in the right direction and for the right expenses.

"The Lerner index and Herfindahl index are generally used to measure market power. In perfectly competitive markets, market participants have no market power. A firm with total market power can raise prices without losing any customers to competitors. A firm with market power has the ability to individually affect either the total quantity or the prevailing price in the market[194]."

Considering each cooperative (producers or processers) is a firm in the Lebanon market. The cooperatives cannot control the price of the market as the majority of food (fresh or processed) is imported from a lot of firms (which is linked to our previous indicator Food supply variability per capita). In addition, local processors and large-scale famers can control the prices in specific areas but personally using their power and not through the cooperatives. In summary, the cooperatives have no market power in the very competitive, free and import-related market.

As a result of the above, qualitatively analyzing the situation on the Likert Scale the status remained the same before and after the Syrian crisis as bad with potential of support. The situation cannot be stated as completely bad as some cooperatives are still working and being supported by the international organization to access markets.

"Likert: 7 =Excellent, 6=Very good, 5=good, 4= moderately good, 3=moderately bad, 2= bad, 1= very bad, 0=Worst."

28- Market Informality

Despite the debates and critiques, the informal economy has continued to prove a useful concept to many policymakers, activists, and researchers because the reality it captures—the large share of economic units and workers that remain outside the world of regulated economic activities

[192] Lebanon Honey Value Chain Analysis Report, ACTED, May 2018
[193] ILO (2018). Agricultural and agro-food cooperative in Lebanon. ILO: Geneva
[194] https://www.tutor2u.net/economics/reference/measuring-market-power-the-lerner-index

and protected employment relationships—is so large and significant[195]. Today there is renewed interest in the informal economy worldwide. This re-convergence of interest stems from two basic facts. First, despite predictions of its eventual demise, the informal economy has not only grown in many countries but also emerged in new guises and unexpected places. Second, despite continuing debates about its defining features, supporting informal enterprises and improving informal jobs are increasingly recognized as key pathways to promoting growth and reducing poverty.

While production or employment arrangements in the informal economy are often semi-legal or illegal, most informal workers and enterprises produce and/or distribute legal goods and services.

Value: minimum (0), Maximum (7), Value before crisis (3), Value after crisis (3)
Source: DATA

Analysis:
The challenge of informality in Lebanon transcends its spread in most sectors; Informality is largely concentrated among poor workers. For example, %82.5 of the poorest individuals (the poorest %20 of Lebanese) are informal workers, while this percentage does not exceed %35 among the wealthiest group (the richest %20 of Lebanese) (Gatti & al., 2014, P. 11). This gives us a strong indication of the interdependence between informality and poverty in Lebanon.

In this context, the World Bank report (2015) indicates that formal employees account for no more than %29 of the total labor force in Lebanon, while informal self-employed represent %32 and informal workers %19, hence, the size of the informal economy in Lebanon is estimated to be equivalent to 30 percent of GDP, according to a report by the International Monetary Fund (IMF). The evolution and expansion of Lebanon's informal economy is increasingly being documented (see Fakhri, 2016; Turkmani & Hamade, 2019, forthcoming; Fawaz, 2017; Errighi & Griesse, 2016; Ismail et al., 2018), with multiple reasons as to why it is so entrenched: An uneasy state formation, bureaucracy, disrupted government functions, regional conflict and consequential waves of migration, and several domestic conflicts. Today, with the influx of over a million Syrian refugees into the country, and the ensuing increase of employment-related informality (Ajlouni & Kawar, 2015), there is a dire need to further contextualize 'informality' and understand its many layers.

In Lebanon, this oft-ignored sector called agriculture is considered "legally informal", with no agriculture-related policies enacted since the Fouad Chehab era (1958-1964). Until today, the status of Lebanese farmers has not been legalized and agricultural workers do not fall under the labor law — or any other law, for that matter. Besides, one of the main direct impact of the extremely high informality in agriculture (92.4%)[196] concerns the access to finance. Without a formal legal status, banks and lending institutions will not provide financing opportunities to

[195] Rethinking the Informal Economy: Linkages with the Formal Economy and the Formal Regulatory Environment Martha Alter Chen, July 2007
[196] Towards decent work in Lebanon: issues and challenges in light of the Syrian refugee crisis, ILO 2015

farmers, unless they present collateral. Moreover, this high level of informality is prohibiting businesses to export legally without referring to main exporters, prohibiting policy makers to work on policies to improve the sector, and impact the workforce where the Lebanese labors prefer to resort to sector where they can have social security (teachers or all other governmental jobs, registered private businesses and more).

Considering all the debates on the importance of both formal and informal sectors, there is no data showing what is the perfect percentage for a sector to be formal or informal. It's a special case for each country based on many other variables. Based on the above analysis, the informal agricultural sector is being impacting somehow by this informality for the main reasons listed and these reasons are putting the sector in a moderately bad situation. Since long time, the agricultural sector has been informal relying on the Syrian refugees as the main workforce which remained after the Syrian crisis.

The value before and after the crisis on Likert scale is moderately bad which is 3.

29- % market monopoly in agricultural VC: competitiveness

The concentration of economic power in every segment of food and agriculture can harm both farmers and consumers. Farmers can pay more for supplies when only a few firms sell seeds, fertilizer and tractors. They also sell into a highly consolidated market, and the few firms bidding for crops and livestock can drive down the prices that farmers receive.

For nearly 80 years, academic studies have documented the negative impact of agriculture's consolidation and industrialization, which aligns farms more closely with food manufacturers than their local communities. The rising economic concentration has contributed to the decline in the number of farms and the increased size in the farms that remain. Communities with more medium- and smaller-sized farms have more shared prosperity, including higher incomes, lower unemployment and lower income inequality, than communities with larger farms tied to often-distant agribusinesses.

Value: minimum (0), Maximum (7), Value before crisis (2), Value after crisis (2)
Source: DATA
Analysis:
Lebanon's lack of competitive capacity to the failure of the agriculture sector to adapt to market changes due to the emerging feudal type of agriculture, whereby the big farmers have locked the smaller farmers into their system of marketing and agricultural practice[197].

In addition, the Lebanese agricultural sector is characterized by the existence of some large monopolies controlling the distribution of agricultural inputs such as seeds, fertilizers and pesticides. At the same time, there are some large wholesale traders controlling about 90% of

[197] Examining Lebanese Stakeholders' Frames in the Fields of Agriculture, Water and Rural Development with Regards to the Effectiveness and Potential of European Trade and Assistance Policies in Lebanon, MEDREST, October 2018

total agricultural revenues. Thus, farmers pay high prices for the inputs and get lower prices for their output due to these market imperfections. The agricultural sector suffers also from a lack of credit which has become very serious in recent years. Agriculture's share in total bank credit has been less than 2% since 1985 (Table 1.1).

Lebanese agriculturalists are constantly adjusting their production to an unregulated local and regional export market, which has led to the growing concentration of wealth into the hands of a privileged few with access to the necessary capital to remain competitive. [198]

Lebanon's markets never fully opened up to benefit from free trade because, among other factors, key market reforms such as those related to regulating competition and intellectual property never materialized. As a result, Lebanon has a consumer market typified by low concentrations of suppliers together with exclusivity rights and little to no market regulation. As of this writing, Lebanon is still working to pass the legislation required to enter the World Trade Organization[199].

While the economy is free and open, markets in Lebanon are beset with inefficiencies. Markets are not conducive to consumer welfare (choice and pricing) or competitiveness that helps alleviate poverty. An estimated half of the products sold in the Lebanese market originated from sectors with a high concentration of a few suppliers (i.e. 40 percent of the market is owned by four companies or less)[200]. In sectors such as cement, soft drinks, soap and metal coatings over two-thirds of the market are controlled by less than five firms[201]. According to the latest available market studies from over a decade ago, about 58 percent of product markets are controlled by three firms, having at least 40 percent of each product market—the value of these markets at the time was USD 8 billion[202]. These figures rise to 60 percent market control in 52 percent of markets among the five firms in each product market[203].

There are no barriers to enter the market in Lebanon, however, the indirect barriers set by the globalization, fewer suppliers, fewer exporters and large farmers do explain the reasons mentioned above and hence entering the market in Lebanon is not easy not forgetting the absent governmental regulations. In fact, a monopsony[204] is what describes the market in Lebanon from the view of the small-scale farmers and businesses who will enter the market and have a direct contact with consumers.

As a summary, almost all the Lebanese products are controlled by very few firms. In agriculture, the figures are similar. Based on the field interview done by a citrus exporter in North Lebanon,

[198] The Agrarian Question in Lebanon Today: A View from a Camp in the Bekaa Valley, By: China Sajadian, August 2020
[199] STRATEGIC REVIEW OF FOOD AND NUTRITION SECURITY IN LEBANON, ESCWA, May 2016
[200] STRATEGIC REVIEW OF FOOD AND NUTRITION SECURITY IN LEBANON, ESCWA, May 2016
[201] Consultation and Research Institute. (2003). Competition in the Lebanese Economy: A Background Report for a Competition Law for Lebanon. Retrieved from:http://www.economy.gov.lb/public/uploads/files/7390_7419_1422.pdf
[202] Ibid
[203] Ibid
[204] "In economics, a monopsony is where there are many sellers and one buyer. It's the opposite of a monopoly, which is where there are many buyers and one seller. In fact, a monopsony is sometimes called "a buyer's monopoly."

Akkar, the exporter mentioned that he is the only one from the area who export in addition to be the only one with a packaging center and one of the biggest farmers. Hence, the small-scale farmers do depend on him to set the prices, package and export their products.

No specific index measuring the indicator and no defined method can be set to use it for future analysis as each product has its own number of suppliers. However, knowing the disadvantages of "monopoly", "oligopoly" and "monopsony", the agricultural market with 10+ stakeholder for each Value Chain step (including the import/export) is considered to be moderately good (however not applied to all value chains).

Finally, based on the above facts, qualitatively the indicator in Lebanon is "bad" valuing 2.

30- Urban Absorption and Promotion Capacity

Urban absorption capacity: a measure of the capacity of a country to work under the stresses caused by urban growth and still ensure food security. Urban cities and activists can help small-scale farmers to be exposed to new markets and promote their products.

Value: minimum (0), Maximum (7), Value before crisis (3), Value after crisis (3)
Source: DATA

Analysis:
Lebanon is one of the most urbanized countries in both the world and the Arab region, with 87% of its population of 6.849 million living in urban areas and the majority - estimated at 64% - residing in the metropolitan areas of Beirut and Tripoli. Urban expansion in Lebanon is concentrated in and around the main coastal cities (Beirut, Tripoli, Saida and Tyre), between secondary cities and in the form of informal areas on the belts of cities[205].

Main Urban initiatives:

- Created in 2004, Souk el Tayeb is the first farmers' market to open in Lebanon and is now a forum to share food, traditions and hospitality in a way that has helped bring together fractured communities. Souk el Tayeb promotes unity around a common respect for food, land, and agricultural traditions. It aims to preserve food traditions and the culture of small farming in Lebanon protecting the interests of the small farmers and producers enabling them to compete with industrial and globalized food trade. Souk el Tayeb's weekly farmers market hosts around 100 small producers from all over Lebanon who offer fresh, local, seasonal food products and organic produce, ranging from fruits and vegetables, "mouneh", dairy products, ready- to- eat food and sweets alongside traditional, handmade crafts.
- Eat like the locals – at the Via Appia farmers' market. Held every Saturday afternoon from 5pm until 10pm and featuring regional produce and delicious snacks, the market brings together people with one thing in common, a love of good food. The farmers'

[205] Lebanon – Urban issues, UN Habitat, https://unhabitat.org/lebanon-urban-issues

market was set up by VIA APPIA BYBLOS, a non-profit organization that was established in 2008, to support local rural development. The market takes place in the small market square next to the Crusader Castle in the ancient town of Byblos, across from the Wax Museum. With a focus on traditional agricultural and craft products, there are aromatic herbs and spices, fruit and vegetables, delicious juices, wines and jams as well as pottery and basketry for sale.

- Souk aal Souk is a mobile farmers' market that aims at promoting healthy traditional food from local farmers and small producers originating from different Lebanese areas. It intends to build and strengthen linkages between urban residents and rural producers by offering urban dwellers access to healthy traditional food; and the small producers a channel to market their local produce. On average, 20 producers and farmers from across Lebanon regularly participate in Souk aal Souk, offering the consumers a wide choice of traditional food, pastries, manakish, sweets, mouneh products, fresh juices, fresh fruits and vegetables, locally grown plants and flowers, handcrafts etc.
- The Earth Markets (Souk el Ard) in Lebanon (Beirut, Tripoli and Saida) are part of an international network of farmers' markets, a project that started in Italy. The aim of the program is to "rediscover and promote markets as the historical and most immediate retail outlet for farmers, which have today been overshadowed by commercial developments. The commitment is to create a system that revitalizes local food production that is representative of its region and season and that meets the expectations of responsible and informed consumers."

Farmers contend with woeful infrastructure, directly resulting from a chronic lack of state investment, and have weak bargaining positions against wholesalers and retailers. This makes Lebanese-made food neither particularly abundant nor cheap, with imported foods often being more affordable. Upon leaving the farm, produce is typically sold by small-scale farmers to the local wholesale point (the hisbeh), because the farmers lack strong connections to retailers and / or their farms do not have proper (cold) storage infrastructure. These trader middlemen often split well over half the goods' final sale price with the retailer, leaving less than 30% (on average) for the farmer[206]. The consumer ultimately bears these extra charges when they are reflected in the food product's final price. Hence, the urban consumers, comparing the prices, would refer to the imported cheaper products.

The dynamic between the Lebanese Urban and Rural communities was as the below:

- Before the Syrian crisis, the farmers used to sell their products inside the Syrian market where the absorption capacity was much bigger than Lebanon considering the size of the country and the population. Farmers and exporters were selling the minimal into the

[206] Riachi, R and Chaaban, J (2012). The Agricultural Sector in Lebanon: Economical Features and Challenges

Lebanese market by then only[207]. Meanwhile, the import of goods has been on-going making the urban population used to its variety.

As a summary, the food markets in the cities are useful for farmers and they are continuous, however, more effort to link farmers and local producers in rural areas to cities and prioritize their products. This should be done through certificates supported by the ministry of agriculture and economy to make the Lebanese more competitive nationally.

As a summary and based on Likert scale, the situation is moderately bad before and after the crisis as the urban capacity remained the same – used to varieties and import. An in-depth analysis should be conducted to see how much the Lebanese consumer consumes locally produced food.

"Likert: 7 =Excellent, 6=Very good, 5=good, 4= moderately good, 3=moderately bad, 2= bad, 1= very bad, 0=Worst."

31- Locally available food processing industries: producing and processing access

Industries encourage the farmers to produce more. This will help to increase the income of the farmers as well as there will never be scarcity of raw materials for industries. Industries and agriculture are interdependent.

Value: minimum (0), Maximum (7), Value before crisis (4), Value after crisis (4)
Source: DATA

Analysis:
There are around 1,400 agrofood companies constituting the largest share of total industrial firms in Lebanon. More than 45% of the agrofood factories are located in Mount Lebanon Governorate and are engaged in the production of dairy, confectionary, dried fruits and nuts, baked goods, olive oil and wine[208].

Exports of agrofood products accounted for 15% of total exports and 16% of total industrial exports in 2018. Despite all external and internal challenges, agrofood exports have been growing at a compounded annual growth rate of 4% since 2009 demonstrating the sector's potential and resilience[209].

Lebanese agrofood production is diversified with a wide range of traditional and innovative products being exported to regional and international markets. Top three exported agrofood products in 2018 included dried fruits and nuts at 8.3% followed by processed chocolate (8.1%) and sauces and condiments (7%)[210].

[207] From the field interviews with farmers and traders
[208] Agro-Industry, IDAL, export
[209] Ibid
[210] Ibid

As per the field interviews conducted, the majority agro-food industries do buy their raw materials from local farmers and then import the materials not available from local suppliers. Hence, the situation between both in Lebanon is good but worth the support to link more farmers to more industries, support the development of new ones in rural areas and not only in urban ones.

Situation for this indicator is moderately good but still needs improvement. "Likert: 7 =Excellent, 6=Very good, 5=good, 4= moderately good, 3=moderately bad, 2= bad, 1= very bad, 0=Worst."

A- Social and Labor Aspects

32- % of Lebanese households relying on agriculture as main source of income

Although agriculture represents a small portion of Lebanon's service-oriented economy, it is a major source of livelihoods for its population. Indeed, approximately 20 to 25% of Lebanon's active population is involved in the agricultural sector, including full-time and part-time workers as well as seasonal family labour[211]. Female farmers constitute some 9% of the total farmers, involved mainly in the production of dairy products, food preserves and subsistence farming[212]. Moreover, the agricultural sector is a main source of income particularly for the poorest segments of the population in rural areas and vulnerable communities. Many of Lebanon's poorest families depend on agriculture as the primary source of income and employment. In many villages in the South as well as in Baalbek and Hermel — which are part of the poorest areas of the country — agriculture is reported to contribute to 80% of the local GDP and represents the major income-earning and employment opportunity. According to UNDP, over 20% of heads of households engaged in the sector are classified as very poor, with the North governorate being among the hardest hit areas, with one in four agriculture workers likely to be poor[213]. Finally, with its strong forward and backward linkages within rural settings and with other sectors of the economy, agriculture has been described by the World Bank as a major source of stimulus for growth and income generation in Lebanon[214].

Value: minimum (10%), Maximum (70%), Value before crisis (17%), Value after crisis (14%)
Source: Data, field interviews

Analysis

For people who have only the agriculture as source of living, they will fight in order to save their livelihoods and do everything they can to protect and develop the sector. However, when many sources of income exist, the less interest is showed to one source which is the case in Lebanon for agriculture: people in general have many sources of income alongside agriculture like governmental jobs (army, teachers), small business, etc. other jobs Lebanese have mainly more

[211] World Bank, Lebanon Agriculture Sector Note: Aligning Public Expenditures with Comparative Advantage (January 2010)
[212] Ibid
[213] Ibid
[214] Ibid

revenue to people, secured and in the formal sector where they have insurance. The agricultural sector is mainly an informal sector – which we will describe in other parts – and farmers are insured in anyway.

The Lebanese rural population involved in the agriculture sector (not solely depending on agriculture) reached 817 000 (out of 5 million) equivalent to 17% of the total population in 2010 with an average household size of five persons per household[215] e.g. South Lebanon is highly dependent on agriculture, as it represents the main source of income in this part of the country; half the working population in the south earn their living entirely from agriculture and constitute overall almost 70 percent of the total household income[216].

The 2010 agricultural census showed that there is a total of 170,000 Lebanese farmers or holders with an average age of 52 years, half of which depends solely on agriculture for their livelihoods: 85,000 farmers. These 85,000 farmers who depend solely on agriculture, will be multiplied by 5 as average family member: 425,000 out of 4.8m individuals.

As per the FAO, Farm households are diverse and typically engage in non-agricultural economic activities as well as in agriculture, although poorer rural households tend to rely more heavily on agriculture than better-off households. Hence, over 20 percent of heads of households engaged in the sector are highly vulnerable[217].

Furthermore, the value after the Syrian crisis has decreased since Lebanese farmers rented the lands for Syrian investors. Land rental prices have been trending upwards in the North, due to increased demand for land, mostly from Syrian farmers who will invest in the land and put tents to live there in parallel[218]. The main motive for Lebanese farmers to do so is that the land rental prices have increased from 700,000 LBP to 5 million LBP per hectare over the last 4 years[219]. In this case, the Lebanese farmer will secure an amount of money from the Syrian farmers who will invest the land on his behalf. The % decrease is estimated by 3% amongst Lebanese framers - since no official data is shared, it was personally estimated based on field interviews with farmers, their main answer was around 3%. The Lebanese farmers once they rent the land to Syrians, they will have free time to focus on other economic activities.

To calculate the index, we will rely on the 2010 agricultural census where 85,000 farmers depend solely on agriculture. After multiplying the value by 5, we will get 425,000 individuals out of 4.8m equivalent to **8.85%.** Based on the field interviews and analysis, the value after the crisis has been reduced by 3% equivalent to **5.85%. The low percentage is a sign of the weak sector; the strongest the sector is, the more people will get involved in and rely on as their main source of income.**

[215] Ministry of Agriculture strategy, 2015/2019, p13
[216] FAO
[217] Lebanon at a glance, FAO in Lebanon
[218] Emergency Market Mapping and Analysis – Agriculture, March 2013.
[219] Ibid

The minimum value that could be set for this indicator is 0% where zero households rely on Agriculture as their main source of income (the worst scenario). For the maximum value, many factors should be considered: Considering the Lebanese context, if we can reach 17% out of the total population relying on agriculture as main source of income (initial all farmers as above), we should be aiming that the sector got stronger and not people got more vulnerable. Maximum of 17% is a fair number where all farmers since 2010 only focus on agriculture and improve the sector.

Before: (value - minimal value)/(Maximal value - Minimal value)= 8.85/17= 0.520

After: (value - minimal value)/(Maximal value - Minimal value)= 5.85/17= 0.344

33- Consumer behavior and knowledge

Many factors influence consumer food preferences hence exposing them to food insecurity. Factors such as age, women's type of work, husband's salary, crowding index and others affect food security and eating behavior. Proper food consumption behavior and food security management will lead to self-reliance and social justice.

Perceiving information, attitude and awareness influence behavior changing. Hence, it is needed to promote informative information, better knowledge about food security and safety, stronger awareness and good attitude of the food security which can lead to positive change in behavior. Human, especially youth need to access adequate nutrition, clean delicious food and free from chemicals and toxins at all time[220].

Value: minimum (0), Maximum (7), Value before crisis (3), Value after crisis (3)
Source: Data, field interviews

Analysis
In October 2016, a group of scientists from the "Holy Spirit University of Kaslik" in Lebanon, conducted a cross-sectional study on randomly selected 340 women living in Akkar-North Lebanon[221], aging between 20 and 60 years old and showing a crowding index above 1[222]. The results of the study came as: among the participants, 99.1% are food insecure and are unable to access food. In addition, 96.2% of the study sample is adopting unhealthy eating behavior which could potentially lead to chronic health problems. Moreover, 71.5% are showing a low awareness level concerning the health importance of good eating habits; thus, this poor awareness level is significantly affecting the population food choices.

Based on an improvised questionnaire shared with 31 educated and upper-middle class youths via "WhatsApp" using mobile phones:

[220] Inspiration and Consumption Behavior of Consumers for Enhanced Food Security Management, Chuleewan Praneetham, November 2015
[221] One of the poorest rural area in Lebanon
[222] According to the ECI, a value greater than 1 indicates a household is crowded.

- 50% mentioned that prices influence their purchasing behavior.

- 50% stated that health and quality of food influence their purchasing behavior.

- 70% are adapting a healthy eating habit, 30% are not, and 10% sometimes in between.

- 60% out of the 30% mentioned that the "Lack of awareness concerning the health importance of good eating habits is what making them adapting a unhealthy eating habit. Where 40% mentioned that they lack money to buy healthy food.

- 73% out of the 70% adapting a healthy eating habit stated that they have high awareness level concerning the health importance of good eating habits and 27% are considering the environmental impact of the food production systems.

Comparing both samples done between the group of youths and the women in Akkar, we can conclude that the more the person is educated the highest the awareness concerning the health importance of good eating habits is. Hence, poverty and knowledge are interlinked and impact the food security of people. What was mentioned by the youth regarding the lack of money, is that the healthiest food such as organic is very expensive in Lebanon even if you have an average salary.

As a conclusion, future national studies and programs could be settled to increase the awareness about food security and good eating practices among both vulnerable and educated communities in Lebanon, and reduce food insecurity risk in this specific population.

Based on Likert scale as the above, the situation in Lebanon, before and after crisis is moderately bad considering the high levels of vulnerability in the Lebanese communities. The value om Likert Scale will be 3 where the minimum is 0 and maximum is 7. Likert: 7 =Excellent, 6=Very good, 5=good, 4= moderately good, 3=moderately bad, 2= bad, 1= very bad, 0=Worst.

Before and after: (value - minimal value)/(Maximal value - Minimal value)= 3/7= 0.428

34- % of youth working in agriculture

The influx of Syrian refugees has had a dramatic effect on the Lebanese population, which has been undergoing a demographic transition with decreasing fertility rates; Lebanon's demography increasingly resembles that of a more developed country. Natural population growth has fallen to below 1 per cent per year. Estimates suggest that about two-thirds of population growth in Lebanon since the year 2000 has been from in-migration, much of which has consisted of either refugees or migrant workers. The recent influx of Syrian refugees is the latest, largest and perhaps most consequential episode in the history of immigration in Lebanon. According to some estimates, one in every four persons in Lebanon is a Syrian refugee. High unemployment persists, indicating its structural nature, population growth fueled by immigration and combined with disproportionate growth of the working age population and growing participation rates

(especially among women), resulted in an estimated doubling of the labour force in Lebanon over the period 1990–2010. In tandem, employment grew such that unemployment rates averaged below 9 per cent throughout this period, although the absolute number of unemployed nearly doubled. Unemployment rates among women were about twice the average and, for youth in the 15–24 cohort, more than three times the average[223].

Child labour is a re-emerging issue after some recent progress Combating child labour has been one area that has received government commitment in Lebanon and, while exact numbers are not available, progress was being made. Nevertheless, it is a re-emerging phenomenon with the large influx of Syrian refugees, the majority of whom are children (53 per cent below the age of 18), with 73 per cent of these not attending school and thus, in principle, available to supplement their families' earnings through work. A recent survey of 1,500 street children found that the majority were Syrians and were engaging in petty trade.

Unemployment was more rampant in graduates whose studies related to services (25%), agriculture (20%) and education (17%)[224]. Many youths headed into the service sector such as restaurant and nightclubs where approximately half of all employees are under the age of 30[225]. Lack of economic opportunity outside the greater Beirut area leads many youths in peripheries to pursue public sector work, often in the army[226].

Value: minimum (0), Maximum (38), Value before crisis (6%), Value after crisis (10%)
Source: DATA

Analysis:
6% of Youth were employed in Agriculture, before the Syrian crisis, which is the less between all active economic sectors and the highest is 38% for the services sector[227]. Lebanese youth are often searching for jobs outside the sectors stated above. Social pressures have pushed Lebanese to search for jobs in the services and banking sectors, or even in the public sector. Working in agricultural or industrial fields is often frowned upon by family members, which often leads graduates from TVETs to work in jobs outside their field of expertise. Likewise, graduates often migrate to neighboring Gulf Cooperation Council (GCC) or European countries to obtain better living conditions and higher salaries.

The involvement and the interest of youth in agriculture is a major aspect to maintain the sustainability of the sector because they are the future. Based on field interviews, in Lebanon, youth are scared to get involved in agriculture because they have bad perception of the sector based on what they see and hear from farmers on field. Youth have a role to play along the value chain; they can be entrepreneurs at the supply level, distributors, producers, exporter, marketing, running packaging centers and more. The technical schools are so important to teach all these

[223] Towards Decent Work in Lebanon: Issues and Challenges in Light of the Syrian Refugee Crisis, ILO, 2015
[224] AUB et al. 2009
[225] Lebanese Parliament, & UNDP 2013a
[226] CAS & UNICEF 2009
[227] Kawar & Tzannatos (2012). Youth Employment in Lebanon: Skilled and Jobless.

topics to youth, and in Lebanon technical and agricultural schools are in general poorly equipped with materials that enable teachers to use new teaching methods, such as computers, audiovisual equipment, laboratories, libraries, etc. One of the main reasons also, is that the agricultural sector is informal where workers are not insured in the National Social Security Fund.

The minimum and maximum values in addition to the after crisis have been estimated. The percentage of youth interested in agriculture after the Syrian crisis is estimated to increase by 4% based on the international organizations' projects in Lebanon. These organizations, distributed grants to start-ups and existing businesses to work in agriculture; in addition, a lot of value chains projects have been implemented where youth have been receiving vocational trainings on good agricultural practices (pre, post and harvest trainings), agricultural apprenticeships, seeds and equipment distribution. In recent years, a gradual transition has been witnessed to decrease reliance on direct assistance among vulnerable host and refugee communities in Lebanon. Humanitarian actors have stepped up to increase income generating opportunities and employment, improve the workforce's employability, and empower the enabling environment for job creation in Agriculture. Focus has been increasingly placed on the sustainability and scalability of such livelihoods interventions, with activities largely focused on Micro Small and Medium Enterprises (MSMEs) coaching and sub-granting, apprenticeship placements, and vocational and life skills trainings. However, as refugees are only legally permitted to work under specific sectors (Agriculture, Construction and Environment), operational space is increasingly limited as interventions must be designed to fit within the legal environment.

Considering that the minimum value is 0% of youth are interested and working in Agriculture, the ideal scenario will be where 38% of youth do work in Agriculture (same value as the services sector). When youth are involved in agriculture, the future of the sector will be promising and changes will take place.

Minimum: 0%; Maximum: 38%; value before crisis: 6%; value after crisis: 10%

Before: (value - minimal value)/(Maximal value - Minimal value)= 6/38=0.1578

After: (value - minimal value)/(Maximal value - Minimal value)= 10/38=0.2631

35- Human Development Index

The HDI is a summary measure for assessing long-term progress in three basic dimensions of human development: a long and healthy life, access to knowledge and a decent standard of living. A long and healthy life is measured by life expectancy. Knowledge level is measured by mean years of education among the adult population, which is the average number of years of education received in a life-time by people aged 25 years and older; and access to learning and knowledge by expected years of schooling for children of school-entry age, which is the total number of years of schooling a child of school-entry age can expect to receive if prevailing patterns of age-specific enrolment rates stay the same throughout the child's life. Standard of

living is measured by Gross National Income (GNI) per capita expressed in constant 2011 international dollars converted using purchasing power parity (PPP) conversion rates[228].

Value: minimum (0), Maximum (1), Value before crisis (0.732), Value after crisis (0.757)
Source: DATA

Analysis:
Lebanon's HDI value for 2017 is 0.757— which put the country in the high human development category—positioning it at 80 out of 189 countries and territories. The rank is shared with Azerbaijan and the former Yugoslav Republic of Macedonia. Between 2005 and 2017, Lebanon's HDI value increased from 0.732 to 0.757, an increase of 3.4 percent.

The highest HDI score that can be given to a country is 1. Some countries such as Norway has a HDI of 0.953 and Switzerland in the second place with a score of 0.944. Hence, the lowest HDI was for Niger (0.354). There is no country with a "Zero" HDI however this is the minimal value of the index.

The value has been done in 2017, which is after the influx of the refugees and the Syrian crisis and as mentioned above the value before the crisis will be considered as (0.732). Good to mention, that the crisis is not linked to the increase of this value, however, the level of living and education has been increased in the country in general.

Despite high rates of Human Development, the economic growth in Lebanon will not be achieved without significant improvements in governance, reducing corruption in the financial, judicial and public administration systems. Rather than focus exclusively on economic growth, the Government should focus on increasing access to quality education, efficient health services and social security and delivering basic public services. This shows the dynamic link between the economic growth and the human development, but still without governance, Lebanon cannot achieve any increase in any active economic sector such as the agriculture.

Minimum: 0; Maximum: 1; value before crisis: 0.732 value after crisis: 0.757

Before: (value - minimal value)/(Maximal value - Minimal value)= 0.732/1=0.732

After: (value - minimal value)/(Maximal value - Minimal value)= 0.757/1=0.757

36- International Wealth Index (IWI)

Asset based wealth indices are widely used instruments for measuring the economic situation of households in developing countries. Most household surveys currently available for these countries include such an index based on the possession of consumer durables and housing characteristics[229].

[228] UNDP, http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/LBN.pdf.
[229] Global Data Lab, International Wealth Index

The International Wealth Index (IWI) is the first comparable asset-based wealth index covering the complete developing world. It is based on data for over 2.1 million households in 97 low- and middle-income countries. IWI is a stable and understandable yardstick for comparing the performance of societies with regard to wealth, inequality and poverty.

IWI runs from 0 to 100, with 0 representing households having none of the assets and lowest quality housing and 100 representing households having all assets and highest quality housing.

IWI is constructed in the same way as most other wealth indices. Information collected in household surveys on the possession of consumer durables, access to basic services and housing characteristics is entered into a factor analysis (PCA) from which the first factor is selected as the wealth index. The IWI scale is additive; possession or higher quality of a certain item raises the household's IWI value with a specific amount (the re-scaled asset weight). If the household has all items and highest quality housing, its IWI value is 100. If it has none of the items and lowest quality housing, its IWI value is 0[230].

Value: minimum (0), Maximum (100), Value before crisis (68.6), Value after crisis (68.6)
Source: DATA
Analysis:
Based on the Global Data Lab, Lebanon has scored in total 68.6 over 100 from 2010 till 2016. The final score which is 68.6 is the average of all Lebanese areas where the lowest has been scored in Northern Lebanon (53.9) and the highest in Mount Lebanon at (72.7). Moreover, the scores between poor and nonpoor were 58.3 and 71.5 respectively. The score across the country has been unchanging for 6 years even after the Syrian crisis who occurred in 2011.

The final score of Lebanon (68.6) means that households in Lebanon have the majority of assets and the quality of housing is acceptable. For the poor scoring 53.9, this means that poor families have half of the main assets they need where the quality of housing is medium neither low or high.

37- Women's role in agriculture

5-a- Gender Development Index (GDI)

In 2014, the GDI has been introduced, based on the sex-disaggregated Human Development Index, defined as a ratio of the female to the male HDI. The GDI measures gender inequalities in achievement in three basic dimensions of human development: health (measured by female and male life expectancy at birth), education (measured by female and male expected years of schooling for children and mean years for adults aged 25 years and older); and command over economic resources (measured by female and male estimated GNI per capita). The GDI is calculated for 164 countries. The 2017 female HDI value for Lebanon is 0.701 in contrast with

[230] Ibid

0.788 for males, resulting in a **GDI value of 0.889**, placing it into Group 5. In comparison, GDI values for Jordan and Kuwait are 0.857 and 0.990 respectively.

Women produce between 60 and 80 per cent of the food in most developing countries and are responsible for half of the world's food production, yet their key role as food producers and providers and their critical contribution to household food security is only recently becoming recognized. FAO studies confirm that while women are the mainstay of small-scale agriculture, farm labor force and day-to-day family subsistence, they have more difficulties than men in gaining access to resources such as land and credit and productivity enhancing inputs and services. Food security' in fact, has been defined by the FAO not only in terms of access to, and availability of food, but also in terms of resource distribution to produce food and purchasing power to buy food where it is not produced. Given women's crucial role in food production and provision, any set of strategies for sustainable food security must address their limited access to productive resources security must address their limited access to productive resources.
Women's limited access to resources and their insufficient purchasing power are products of a series of interrelated social, economic and cultural factors that force them into a subordinate role, to the detriment of their own development and that of society as a whole.
The international initiatives and efforts developed especially since the 1975 World Conference on Women in Mexico have contributed to a greater recognition of women's key participation in rural and other domains of development, however, much remains to be done.
Research in Africa, Asia and Latin America has found that improvements in household food security and nutrition are associated with women's access to income and their role in household decisions on expenditure as women tend to spend a significantly higher proportion of their income than men on food for the family.
Women's wage income from farm and non-farm employment and from other income-generating opportunities is of particular importance for landless and near-landless rural households.
Women's purchasing power may not only be used to buy food and other basic assets for themselves and their families, but also to pay for the inputs used in food production. Since food crops are consumed, the inputs for these have to be provided from income earned in other agricultural enterprises or non-farm income generating activities. Thus, to improve food production for the household, greater priority has to be given to increasing women's participation in market production as well as other income-generating ventures.
The understanding of food security has evolved over the years through increasingly integrated attention to the social, gender, environmental, technical and economic dimensions of the problem. The challenge for the future will be to pursue a concrete attainment of equity in access to resources by women to produce food, and purchasing power to buy food where it is not produced there enhancing their potential to generate food security Specific policy measures are required to address the constraints facing women farmers and special consideration given to the needs of female heads of households. The FAO has recommended that such measures aim to:

- ensure that women have equal opportunities with men to own land;

- facilitate women's access to agricultural services tailoring such services to their needs;
- encourage the productions of food crops through the use of incentives;
- promote the adoption of appropriate inputs and technology to free up Women's time for income-producing activities;
- improve the nutritional status of women and children;
- provide better employment and income earning opportunities;
- promote women's organizations;
- review and re-orient government policies to ensure that the problems that constrain the role of women in food security are addressed.

5-b- Gender Inequality Index (GII)

The 2010 HDR introduced the GII, which reflects gender-based inequalities in three dimensions – reproductive health, empowerment, and economic activity. Reproductive health is measured by maternal mortality and adolescent birth rates; empowerment is measured by the share of parliamentary seats held by women and attainment in secondary and higher education by each gender; and economic activity is measured by the labour market participation rate for women and men. The GII can be interpreted as the loss in human development due to inequality between female and male achievements in the three GII dimensions.

Lebanon has a **GII value of 0.381**, ranking it 85 out of 160 countries in the 2017 index. In Lebanon, 3.1 percent of parliamentary seats are held by women, and 53.0 percent of adult women have reached at least a secondary level of education compared to 55.4 percent of their male counterparts. For every 100,000 live births, 15 women die from pregnancy related causes; and the adolescent birth rate is 11.8 births per 1,000 women of ages 15-19. Female participation in the labor market is 23.2 percent compared to 71.1 for men.

Value: minimum (0), Maximum (1), Value before crisis (0.6135), Value after crisis (0.635)

Source: DATA

Analysis:

Since a lot of studies and indexes have been done to measure the role of women, and instead of using one modality and one number, The Likert scale can be used to summarize all numbers mentioned above, working here as summary:

GDI (2017) = 0.889; GII (2017) =0.381. Considering for this analysis, both indexes have the same weight, then our indicator value will be: Value (2017) after Syrian Crisis = (0.889+0.381)/2 = **0.635;** The number showed in this study is 2017 which is after the Syrian crisis.

The GDI and GII values were not calculated for Lebanon before 2011 to get the value of the before crisis. Hence, since both are directly linked to the Human Development Index (HDI), we can assume that since the HDI has been increased by 3,4% since 2005, then the same logic will be used for GII and GDI here:

GDI (2005) = 0.889*3,4%= 0.030; 0,889-0.030=0.859;

GII (2005) = 0.381*3.4%=0.013; 0.381-0.013=0.368;

Hence,

GDI (2005) = 0.859; GII (2005) =0.368. Considering for this analysis, both indexes have the same weight, then our indicator value will be: Value (2005) before Syrian Crisis = (0.859+0.368)/2 = **0.6135;** The number showed in this study is 2005 which is before the Syrian crisis.

Final Value where 0 is the minimum and 1 is the maximum:

Before: (value - minimal value)/(Maximal value - Minimal value)= 0.6135/1= 0.6135

After: (value - minimal value)/(Maximal value - Minimal value)= 0.635/1= 0.635

38- Reliance on international labor - Labor dynamics in agriculture

The private sector is the engine of growth: creating jobs, increasing trade, providing goods and services to the poor and generating tax revenue to fund basic public services such as health and education. The private sector creates nine out of ten jobs in the developing world, which makes it a powerful force for raising living standards[231].

The private sector plays a central role in the neoliberal economic model implemented in Lebanon, contributing to 80 percent of GDP[232]; primarily in the services sector, particularly banking and finance as well as construction, trade and tourism. The very vibrant private sector greatly contributed to the country's growth and recovery. Despite the political turmoil and the economic crisis, the private sector stabilized the economy and protected Lebanon from falling into a recession.

The view that the Syrian state through military, political and ideological control played a key role in imposing a flood of unwanted Syrian migrants on Lebanon was always opposed, however, by a less popular "pro-Syrian" case which saw economics and the division of labour as playing the decisive role in Lebanese employment of Syrians. Nasri Khoury, for example, the General Secretary of the Syrian-Lebanese High Council responsible for cooperation and coordination with Syria, maintained that those who saw nothing but the hand of Syria in Lebanon's absorption of Syrian migrants had "political goals and intentions", for the economic reality was that "the Lebanese labour market requires this labour power"[233].

In fact, Syrian seasonal labour in Lebanon, according to 'Awwad, represented a positive process of globalization. "While it is said", he wrote, "that there are tens of thousands of Syrians in

[231] WB WDR 2013 Jobs, p. 7. and IFC Jobs Study: Assessing Private Sector Contributions to Job Creation and Poverty Reduction. January 2013
[232] Promotion of the private sector at the expense of obstructing sustainable development, ANND
[233] Al Sharw, 1 July 1997

Lebanon, there are more than 600 thousand Egyptian workers in Syria and 1.5 million Sudanese in Egypt". Lebanon, too, has long exported and received labour power and benefited from forms of regional integration: "from ancient times, Lebanon is considered the greatest country in the world for emigration and the export of labour power in proportion to the number of its population."

Since the poor in rural areas depend disproportionately on wage labor, a decline in hired labor can be interpreted by some as evidence that agricultural productivity growth has had adverse effects on the poorest households. The recent literature on the effects of agricultural productivity on rural labor markets mainly focuses on labor reallocation between agriculture and non-agricultural sectors while taking labor supply as fixed (Foster and Rosenzweig, 2004).

For workers in the farm economy, there are three employment options: home production, family-owned farm, other farms. In a canonical neoclassical model with positively sloped labor supply, an increase in agricultural productivity shifts the labor demand curve to the right, and thus results in an increase in agricultural wage and labor employed in agriculture.
Labor surplus households use more labor-intensive technology, and a rise in agricultural productivity increases their labor demand. Such heterogeneity can lead to higher wages and lower hired labor as surplus households reallocate labor to own farming in response to an increase in agricultural productivity, and thus the supply of labor to the market goes down. It is, however, important to appreciate that if the labor market response is driven by reallocation within the market activities, then we should not observe any change in the total labor supply to market work.
The regions of Akkar and the Bekaa employ the largest number of paid seasonal agricultural workers in Lebanon[234] , even prior to the Syrian conflict. Syrian migrant agricultural labor is readily available mainly due to the proximity of both regions to Syria and the easy commute between both countries. Syrian migrant workers make up the bulk of farm laborers, and due to the different agricultural seasons in the North and in Bekaa, often move from one season to the next between North Lebanon, the Bekaa Valley and their homes in Syria based on the demand for labor. Seasonal workers are either contracted on a daily basis or engaged on a fixed contract, usually month-to-month. The number of seasonal migrant workers working on a daily basis in early 2011 can be estimated to around 12,000 workers in the Bekaa and 9,000 in Akkar[235] .
Seasonal workers working on daily basis generally work 5 to 9 hours a day (depending on season and crop type), and up to seven days a week to support their families. Syrians working as fixed laborers were generally contracted on a monthly basis. The wages for fixed and daily migrant workers varies by region, sex, and in some cases by crop. Generally migrant workers are paid each 10 to 15 days, however financial constraints encountered by some farmers result in a delay in payment to migrant workers, until the produce is sold. In the case of daily migrant workers,

[234] 2010 Agricultural Census, Draft Report. Ministry of Agriculture and Food and Agricultural Organization, 2010.
[235] According to the MOA/FAO 2010 Agricultural Census data, a total of 1,375,277 of paid seasonal working days are required in Akkar, 1,168,782 in Baalback-Hermel and 652,045 in the rest of the Bekaa. The vast majority of seasonal workers are migrant workers, and as such, these working days were used to estimate number of actual seasonal workers in each region.

the risk of nonpayment is secured by the Shawish who pays the worker regardless of the delay in payment from the farmer.

A significant part of the labour market is composed of non-Lebanese and vulnerable workers, indicating high levels of exclusion; The Lebanese labour market has historically had an open-door policy to migrant workers. Almost all these workers are engaged in low-skilled jobs from services to construction to domestic work, where most lack access to minimum labour standards. Beyond this have been the significant refugee populations who remain vulnerable. The largest group are Palestinian refugees, who do not have the right to work in many professions under Lebanese law since 1948, and, of course, Syrian refugees who, as a result of their large presence, can face hardships and exploitation in the labour market. According to ILO surveys, both populations work almost exclusively in the informal economy, with no social protection, long hours and, on average, earning less than the minimum wage[236].

A vast number of workers in Lebanon are vulnerable and suffer from social exclusion. High rates of informality, low female labour market participation and high levels of unemployment further contribute to the effectively low social protection coverage. In addition, the social protection system is very fragmented and provides only a limited range of benefits. When broader schemes were available, such as various subsidies, they were often poorly targeted. Social security is not only a universal human right and a necessity, but also plays a pivotal role in alleviating poverty, facilitating economic and social development and fostering decent work. When some categories of workers are excluded this creates labour market distortions which are likely to jeopardize the functioning of the whole labour market and the productivity of the workers themselves. What is needed in Lebanon today is a new approach towards social protection; one which is based on social solidarity, redistribution. In this regard, it is essential that Lebanon develops a coherent national social security system which brings together under 7 one policy framework the different types of programmes, target groups and modes of provision. As a first step in this direction, Lebanon should consider adopting a national social protection floor which would ensure a minimum set of social protections guarantees for all those who are not covered by any social security system. These guarantees should comprise, at least, essential health care; basic income security for children; basic income security for persons in active age who are unable to earn sufficient income; and basic income security for older persons[237].

Value: minimum (0), Maximum (7), Value before crisis (2), Value after crisis (1)

Source: DATA

Analysis:

Reliance on international labors in agriculture has many effects on the sector by itself. Relying on international labors is a negative sign regarding sustainability when it comes to building local capacities able to take the sector further. In Lebanon, in addition to the above, the agricultural sector is informal and labours automatically excluded from the life insurances; If a sector is

[236] Towards Decent Work in Lebanon: Issues and Challenges in Light of the Syrian Refugee Crisis, ILO, 2015
[237] Ibid

controlled by the informality at all its level such as no contract or insurance, people won't be willing to be taking such risk specially citizens who will prioritize governmental jobs.

Lebanon' agricultural sector employs, before the Syrian crisis, 70% Syrians mainly male and 30% Lebanese[238]; after the crisis, the number of Syrian refugees increased and now living with their families in Lebanon which means that the whole household (male and female) are working; the number after the crisis is assumed to be 80% Syrians and only 20% Lebanese[239]. To reflect this using the Likert Scale: 7 scale = 10% international labors, 6=30%, 5=40%, 4=50%, 3=60%, 2=70%, 1=80% and 0=95%. There is no scenario that 7 is equal to zero international labors and 0 as 100% since these 2 cases are not relevant and do not reflect the reality in any country. The highest the percentage of international labor is, the lowest is the score. Employing international labors impact the sustainability of the sector as these labors are investing and working, and once they leave the country that will leave a gap and the national labors will be out of skills.

As a conclusion, the final numbers will be: Before the crisis is 2 and after the crisis is 1.

<u>Final Value where 0 is the minimum and 7 is the maximum:</u>

Before: (value - minimal value)/(Maximal value - Minimal value)= 2/7= 0.2857

After: (value - minimal value)/(Maximal value - Minimal value)= 1/7= 0.1428

39- Income Distribution: Agricultural wages

Economists have discussed the existence of an income gap between agricultural and non-agricultural workers since the 1950's. It was difficult to discern whether this income gap was due to productivity differences, or the persistent underestimating of agricultural income by researchers.

Agricultural income is difficult to measure because many workers are informally employed, and, often, many of the products produced on a farm are consumed onsite. Another difficulty in measuring output is counting the number of hours worked by agricultural workers. Through surveys, it was found that non-agricultural workers worked about 1.1 times as many hours as agricultural workers[240], which would not fully explain the gap in wages. Another theory about the existence of the agricultural income gap is related to worker quality, which includes productivity and education differences between agricultural and non-agricultural workers. In fact, the difference in education between agricultural workers and non-agricultural workers is significant, with the average non-agricultural worker having 1.3 times more education than the average agricultural worker[241].

[238] Data from field interviews with farmers
[239] Ibid
[240] Down on the Farm: Agricultural workers receive lower wages than other workers, Daniel O'Keefe, February 2015
[241] Ibid

The same farm workers who work hard to provide food to the country often struggle to make ends meet and provide food for themselves and their families. In fact, farm workers have the lowest annual family incomes of any U.S. wage and salary workers[242].

Value: minimum (0), Maximum (7), Value before crisis (2), Value after crisis (1)

Source: DATA

Analysis:

In Lebanon, as it is not highly industrialized, the agricultural sector is labor-intensive. The workforce on farms is generally composed of unskilled labor[243], half of which is foreign workers, mostly Syrians. Farming is seasonal, so many workers are temporary, and tend to be paid per day, per week, or based on their output[244]. Among the different sectors of the economy, the labor-intensive service sector has the lowest average salaries compared to the other sectors, which are more capital-intensive. Some service segments, in particular telecommunications and banking, consist of relatively few companies employing large numbers of skilled workers on a monthly salary. The trade sector, on the other hand, comprises a high number of small, often family-run companies. Trade employees are usually also paid on a monthly basis, while daily, weekly, or production-based wages are more common in agriculture and construction[245]. Salaries tend to be highest in the capital-intensive building sector. Engineering professionals and construction managers are the best paid of all sectors. Overall, high intersectoral labor mobility helps to equalize wages across sectors.

Also, in Lebanon, a country with high number of foreign workers, differences in salaries are also due to the nationality and legal status of the worker, the amount of time he invests in his job, his experience and skill, and the sector in which he is active[246]. There are also some exceptions made for working hours. An employer may demand a maximum of 48 regular work hours per week. This applies to all businesses except agriculture, which is recognized to have more irregular hours and seasonal work[247].

The abundant labour supply alone is sufficient to depress wages, yet this is further compounded by the influx of refugee workers, many of whom are undocumented, low skilled and prepared to work for low wages[248]. Which means, after the Syrian crisis the agricultural salaries have more decreased than before.

Other factors besides low wages also contribute to agricultural workers' poverty. Many workers are day laborers, and migrant workers must chase crops to make a living. Farm workers are also constantly at the mercy of variable conditions like natural disasters and bad weather. Finally, in addition to low wages and a lack of job security, most farm workers lack benefits that labor laws

[242] National Farm Worker Ministry, Low Wages, Cesar Chavez, 2019
[243] The Complete Guide to the Lebanese Labor Market, World Bank
[244] Authors' field Interviews
[245] The Complete Guide to the Lebanese Labor Market, World Bank
[246] Authors' field Interviews
[247] The Complete Guide to the Lebanese Labor Market, World Bank
[248] Zafiris Tzannatos: Economist and human development specialist.

guarantee to workers in other industries. For instance, most do not receive overtime pay, nor do they get sick time or maternity leave[249].

The latest analysis of the wages distribution for all economic sectors was done in 2007 by the Central Administration of Statistics (CAS) and figures as per the below image:

TABLE 2: AVERAGE SALARY FOR WOMEN AND MEN BY ECONOMIC SECTORS (THOUSANDS LBP)

	Women	Men	Lebanon	Gender pay gap %
Agriculture	[233]	295	**288**	21.0
Manufacturing	455	596	**569**	23.8
Trade	531	595	**578**	10.8
Transport, Post & telecom	[664]	1070	**965**	38.0
Services, Financial intermediation & Insurance	736	785	**768**	6.2
All Sectors *	660	702	**690**	6.0

[_] Too small for reliable estimate
. USD 1= 1.507,5 LBP (source: Banque de Liban)
. Minimum Salary in 2007 = 300,000 LBP
* except construction

Source: Central Administration of Statistics – 2007

The image above, shows that agriculture is the less paid sector in Lebanon. After the Syrian crisis and nowadays – based on field interviews – the sector is still paying less than any other active sector. One of the reasons stated above is the abundant labor supply. These facts are directly linked to the development of the sector. Agriculture is not a sector of interest for educated youth and even for investors.

To measure the indicator on the Likert Scale, the agriculture is the least paid sector and hence will be rated as 1 on Likert scale which means that its position is very bad for both before and after the crisis.

Likert: 7 =Excellent, 6=Very good, 5=good, 4= moderately good, 3=moderately bad, 2= bad, 1= very bad, 0=Worst.

Final Value where 0 is the minimum and 7 is the maximum:

Before and after: (value - minimal value)/(Maximal value - Minimal value)= 1/7= 0.1428

[249] The Lebanese Labor law does not cover agricultural workers

40- Social inequalities and discrimination

The impacts of the different pressures contributing to food insecurity are felt disproportionately by the poorest countries and the most vulnerable within those countries (small-scale farmers, indigenous peoples, and others who depend on land and water resources for their livelihoods). Hunger is not the result of insufficient levels of production, but rather of unequal access. The food insecure cannot afford the food that is available on the markets or they lack the necessary resources to produce food themselves[250].

Further, the food insecure are often not just hungry; they are disadvantaged over a range of rights. They may face gender, religious, or ethnic discrimination; be illiterate; unemployed; lack property, property rights or access to resources; or have a medical condition such as HIV/AIDS. These factors often work in complement to prevent the food insecure from realizing their right to food, essential services, and just remedies. Strengthening the entitlements of the food insecure as legal entitlements, including through access to justice and legal empowerment approaches, can significantly contribute to sustainable food security. Finally, empowering rights-holders will increase their capacity to participate in food and nutrition-related decisions that concern them[251].

Value: minimum (0), Maximum (7), Value before crisis (3), Value after crisis (2)

Source: DATA

Analysis:

Lebanon has some discriminatory laws such as the nationality one where women cannot give the Lebanese nationality to their children, discrimination at the work place where women are paid less than men, in some areas there is no freedom of movement and women are not allowed to work and should be dependent on men in the family (husband, father or brother) who is in general the breadwinner. These all put women and sick people at risk of food insecurity.

In order not the confuse, the poverty indicator will be analyzed when analyzing the economic indicator and here the focus is only on food insecurity related to social discrimination.

After the Syrian crisis, the level of social discrimination has been increased towards refugees. The number represents the refugee population mainly since the Lebanese one remained the same before and after the crisis. Many refugee women said they struggle to meet the high cost of living in Lebanon and to afford food or rent which has exposed them to greater risk of exploitation. Some said that they received inappropriate sexual advances from men or offers of financial or other assistance in exchange for sex[252].

In a climate of widespread discrimination against refugees in Lebanon, refugee women who managed to find jobs to support themselves reported being exploited by employers who paid

[250] Briefing Note, SPECIAL RAPPORTEUR ON THE RIGHT TO FOOD, COUNTRIES TACKLING HUNGER WITH A RIGHT TO FOOD APPROACH (2010) [hereinafter SPECIAL RAPPORTEUR, COUNTRIES TACKLING HUNGER].
[251] SPECIAL RAPPORTEUR, COUNTRIES TACKLING HUNGER supra note 11, at 13 (2010)
[252] https://www.amnesty.org/en/latest/news/2016/02/lebanon-refugee-women-from-syria-face-heightened-risk-of-exploitation-and-sexual-harassment/

excessively low wages. “They know we will agree to whatever low wage they offer because we are in need,” said “Hanan” a Palestinian refugee from Syria whose name has been changed to protect her identity. Several women also said they had left a job or not taken a job because they felt the employers’ behaviour had been inappropriate[253].

As a summary, the main discrimination aspect is towards women and refugees in Lebanon; hence the discrimination towards refugees is higher and more direct then discrimination against Lebanese women. The discrimination towards refugees threaten the social cohesion and social peace in Lebanon. Many cases have been reported by the head of municipalities where tension and crimes has been taken place between both communities.

The percentage of women and refugees is high. Keeping up the discrimination against these groups will put them at risk of food insecurity.

Analyzing the figures above, the indicator will be calculated qualitatively based on Likert Scale. The situation after the Syrian crisis is considered as bad with a value of 2 out of 7 and before the Syrian crisis was moderately bad as the country was not witnessing high number of refugees with a value of 3 out of 7. Likert: 7 =Excellent, 6=Very good, 5=good, 4= moderately good, 3=moderately bad, 2= bad, 1= very bad, 0=Worst.

Final Value where 0 is the minimum and 7 is the maximum:

Before: (value - minimal value)/(Maximal value - Minimal value)= 3/7= 0.4285

After: (value - minimal value)/(Maximal value - Minimal value)= 2/7= 0.2857

41- % of people undernourished

Few studies have addressed the association of food insecurity and undernourishment with the social capital; high social capital is associated with positive health outcomes. Also, malnutrition increases health care costs, reduces productivity, and slows economic growth, which can perpetuate a cycle of poverty and ill-health.

Value: minimum (0), Maximum (7), Value before crisis (3), Value after crisis (2)

Source: DATA

Analysis:

Based on the latest statistics, the World Bank estimates the total population of Lebanese people at 6.849 million citizens. As per FAO data, between 2017 and 2019, 0.4 million (400.000) of the population as undernourished; also, before the Syrian crisis, between 2009 and 2011, 0.5 million (500.000) of the 5 million total population was undernourished.

The value of the indicator will be calculated as the minimum zero percent of citizens are undernourished and maximum 100% (the whole population) are undernourished.

[253] Ibid

Percentage before the crisis: 500.000 million undernourished out of 5.000.000 citizen = **10%** of population.

Percentage after the crisis: 400.000 million undernourished out of 6.849.000 citizen = **5.8%** of the population.

Final Value where 0% is the minimum and 100% is the maximum:

Before: (value - minimal value)/(Maximal value - Minimal value)= 10/100= 0.1

After: (value - minimal value)/(Maximal value - Minimal value)= 5.8/100= 0.058

However, since the scenario shows that 0 is the most favourable value and 100 is the worst, the value of "After" should be less than the value of "Before" the crisis. Hence, the final number will be as:

Final value = 1-initial value

Value final after= 1-0.1= 0.9; Value final before = 1-0.058= 0.942

Socio-economic Index – Annex 1 attached to this study

For each indicator: Ind1 = (Value – Min Value)/ (Max Value – Min Value).
Weight has been divided equally for all indicators while calculating the final capital index:

$$Capital\ Index = (Indicator1)^{w1} * (Indicator2)^{w2} * \ (indicator\ m)^{wm}$$
$$= \prod_{i=1}^{m} (Indicator\ i)^{\ wi}$$

For this capital, we will be dividing the index into 2, for each of the pillars – the data are copied from the Annex 1:

Indicator	**Weight**	**Value before crisis**	**Value after crisis**	**Final Value = Value^ weight**	
				Before	**After**
Social Pillar					
% of households relying on agriculture as main source of income	0.1	0.52	0.344	0.936699599	0.898785059
Consumer behavior and knowledge	0.1	0.428	0.428	0.918637938	0.918637938

% of youth working in agriculture	0.1	0.1578	0.2631	0.831401301	0.875008123
Human Development Index	0.1	0.732	0.757	0.969284143	0.972544737
International Wealth Index	0.1	0.686	0.686	0.96301358	0.96301358
Women's role in agricultural	0.1	0.6135	0.635	0.952316824	0.95560271
Reliance on international labor - Labor dynamics in agriculture	0.1	0.286	0.143	0.882341291	0.823253534
Income Distribution: Agriculture wages	0.1	0.143	0.143	0.823253534	0.823253534
Social inequalities and discrimination	0.1	0.4285	0.2857	0.918745199	0.882248694
% of people undernourished	0.1	0.9	0.942	0.989519258	0.994042814
Index Social	**1**			**0.419961935**	**0.384321782**
Economic Pillar					
Indicator	**Weight**	**Value before crisis**	**Value after crisis**	**Final Value = Value^ weight**	
				Before	**After**
Import Dependency Ratio (IDR)	0.03225806	0.4023	0.156	0.971054375	0.941828355
Self-Sufficiency Ratio (SSR)	0.03225806	0.5159	0.3531	0.97887654	0.966976802
Cereal Import Dependency Ratio (CIDR)	0.03225806	0.0712	0.1322	0.918297127	0.936812394
Food aid dependency (% of population)	0.03225806	0.7142	0.142	0.989200919	0.938975937
Trade Agreements and Routes Diversity	0.03225806	0.714	0.428	0.989191982	0.972996077
Food supply variability per capita	0.03225806	0.112	0.28	0.931814821	0.95976827
Food Production Index	0.03225806	0.333	0.296	0.965150356	0.961490271
Crops Production diversity	0.03225806	0.285	0.143	0.96031641	0.93918852

Livestock Production Diversity	0.03225806	0.195	0.153	0.948632262	0.941238588
Supply of inputs - Availability and Cost	0.03225806	0.714	0.285	0.989191982	0.96031641
Unemployment aspects	0.03225806	0.789	0.795	0.992384342	0.992626891
Economic Growth Rate	0.03225806	0.857	0.001	0.99503439	0.742963951
Sectors contribution to GDP index	0.03225806	0.2392	0.2483	0.954904715	0.956055535
Dept to GDP ratio	0.03225806	0.547	0.4772	0.980726653	0.976417373
Fiscal expenditures per year on Agriculture	0.03225806	0.025	0.025	0.887811253	0.887811253
Consumer Price Index (CPI)/Inflation Rate	0.03225806	0.89543	0.76133	0.996443397	0.991242176
Gini Coefficient	0.03225806	0.6862	0.493	0.987925548	0.97744389
Minimum Wage Levels	0.03225806	0.285	0.285	0.96031641	0.96031641
Monetary Policy: Interest and Exchange rates	0.03225806	0.285	0.285	0.96031641	0.96031641
Logistics Performance Index	0.03225806	0.668	0.544	0.987069262	0.980552683
Domestic Logistics Performance	0.03225806	0.4274	0.3165	0.972952047	0.963569452
% Foreign Direct Investment in Agriculture (FDI)	0.03225806	0.01607	0.1321	0.87524481	0.936789526
% of remittances inflows	0.03225806	0.449	0.349	0.974500665	0.966612558
Access to Information and Market Linkages	0.03225806	0.7142	0.7142	0.989200919	0.989200919
Use of and Access to technology	0.03225806	0.4285	0.2857	0.973032723	0.960392406
Access to finance	0.03225806	0.429	0.429	0.973069328	0.973069328
Market power: Unions and Cooperatives	0.03225806	0.2857	0.2857	0.960392406	0.960392406
Market Informality	0.03225806	0.429	0.429	0.973069328	0.973069328
% market monopoly in Agri VC: internal competitiveness	0.03225806	0.2857	0.2857	0.960392406	0.960392406
Urban absorption and promotion capacity	0.03225806	0.429	0.429	0.973069328	0.973069328

Locally available food processing industries: producing and processing access	0.03225806	0.5714	0.5714	0.982108257	0.982108257
Index Economic	**1**			**0.339500386**	**0.226228476**

$$Capital\ Index = (Indicator1)^{w1} * (Indicator2)^{w2} * \ (indicator\ m)^{wm}$$
$$= \prod_{i=1}^{m} (Indicator\ i)^{\ wi}$$

Same weight for the two indexes – Refer to Annex 1:

Indexes	**Weight**	**Before crisis Index**	**After crisis Index**	**Final Value Before = Value^ weight**	**Final Value After = Value^ weight**
Index Social	0.5	0.41996194	0.38432178	0.648044701	0.619936918
Index Economic	0.5	0.33950039	0.22622848	0.582666616	0.475634814
Final capital Index	**1**			**0.377594013**	**0.294863581**

The final Socio-Economic Capital Index before the Syrian Crisis = **0.377594013**

The final Socio-Economic Capital Index after the Syrian Crisis = **0.294863581**

Conclusion:

The detrimental effects related to our current food system include: rapid population increase, economic growth as the primary policy goal, consolidation of the food system by large corporate and national players, commodification of food, increased marketing and advertisement leading to overconsumption, and the ineffectiveness of regulations at institutional, national, and global

scales, among other things[254]. In addition to economic interventions, social interventions are crucial adjuncts to improve and maintain a long-term food security and develop the agricultural sector. Socioeconomic status is a fundamentally multidimensional construct, and it is important that some studies should be designed to measure dimensions of socioeconomic sustainability that are most relevant to the subject country and population.

Several indexes and analysis frameworks have been developed to analyze the social and economic status of households, countries and food systems. For each index a set of indicators were chosen by the researchers to answer a specific goal and hypothesis. For this study, the social indicators chosen look at the socioeconomic conditions of households, social inequalities, role of women, labor dynamics in agriculture, the Human Development Index and more. The economic indicators chosen look at macroeconomic aspects, financial access, import/export and more. A bottom-up approach where people and farmers are the center of our analysis has been adopted; examining the socioeconomic conditions of people up to the macroeconomic policies is a central methodology to assess fairly and correctly the situation in country and develop an action plan with less possible gaps. Putting people at the center of attention is important to ensure socioeconomic sustainability. New ways of thinking about food and food systems yield sustainable and healthful associations with food. Based on the food sovereignty economic approach: inventing equitable and socially just forms of economic organization that re-territorialize food systems and wealth production whilst creating free time and livelihood security for farmers and other citizens.

The socioeconomic indicators chosen are directly linked, e.g. (i) understanding the role of women in agriculture (social indicator) complement the analysis of the Gini coefficient (economic indicator) where the social inequalities are highlighted; (ii) the macroeconomic trends directly influence the social dynamics: weak fiscal and monetary policies will impact the import/export dynamics which may an increase in some basic commodities' prices putting more people at risk of food insecurity. (iii) the financial access to food will reduce the social tensions and directly impact the Human Development Index where people can invest in education.

On a second hand, In the absence of socioeconomic favorable policy incentives, the increasing population pressure on agricultural resources will create a crisis in the development of sustainable agriculture. Neglecting the agricultural sector through the absence of foreign direct investments and government spending on agriculture, will disrupt the labor dynamics and disrupt the sector: weak labor dynamics will result in income depreciation and poverty aggravation. In many cases, government policies and international markets have, directly or indirectly, reduced the incentives for agricultural production so contributing to stagnation. Hence, the agricultural wages should be equal to the non-agricultural sectors considering their limited capacity to provide alternative employment for the increasing population.

[254] Whitmee S, Haines A, Beyrer C, Boltz F, Capon AG, de Souza Dias BF, et al. Safeguarding human health in the Anthropocene epoch: report of The Rockefeller Foundation–Lancet Commission on planetary health. *Lancet* (2015) 386:1973–2028. doi: 10.1016/S0140-6736(15)60901-1

Finally, it has consequently become increasingly clear that shifting the food system to a more sustainable path requires qualitative socioeconomic changes, even while the political and public motivation to do so remains in short supply.

One of the Human Development Indices dashboards[255] developed by the UNDP is the socioeconomic sustainability dashboard. This dashboard contains a selection of 10 indicators that cover economic and social sustainability. The economic sustainability indicators are adjusted net savings, total debt service, gross capital formation, skilled labor force, diversity of exports and expenditure on research and development. The social sustainability indicators are the ratio of the sum of education and health expenditure to military expenditure, changes in inequality of HDI distribution, and changes in gender and income inequality[256]; as per UNDP, the number of indicators in which Lebanon performs: better than at least two thirds of countries (i.e., it is among the top third performers), better than at least one third but worse than at least one third (i.e., it is among the medium third performers), and worse than at least two thirds of countries (i.e., it is among the bottom third performers). Some of the chosen indicators for our analysis, have been influenced by the HDI dashboards developed by UNDP such as the Gender Inequality and the Human Development Index. However, the UNDP dashboard is not directly related to the food system nor the agricultural labor dynamics.

The improvised framework of analysis for this index is as below (refer to excel model):

[255] which provide an assessment of countries' achievements on different aspects of human development, and tables covering a variety of dimensions of human development, such as education, health, national income and composition of resources, work and employment, human security, international integration and demography; as well as subjective well-being indicators and a selection of fundamental human rights conventions and when countries ratified them.

[256] Inequalities in Human Development in the 21st Century, Briefing note for countries on the 2019 Human Development Report, Lebanon, UNDP

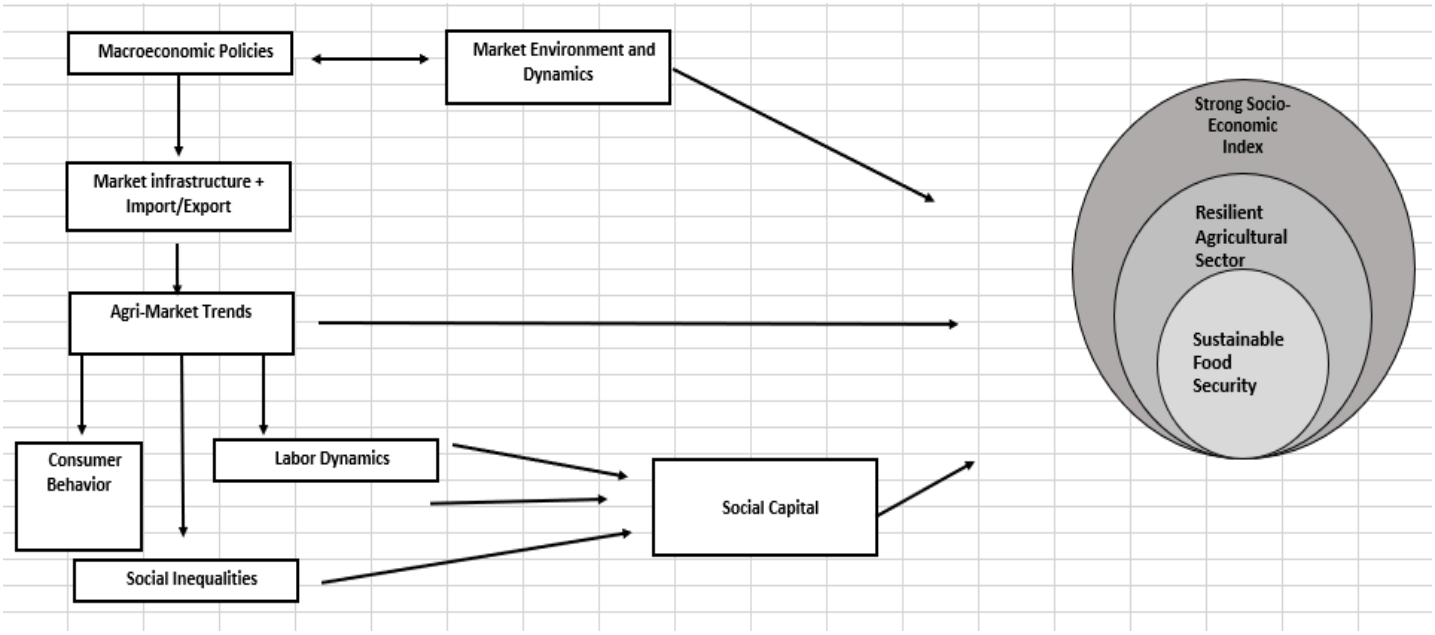


Figure 2: Improvised Framework of Analysis

Both Social and Economic sub-pillars are equally important; hence, the image below is improvised to be linked further to the action plan:

Figure 3:Index Grading

If the index is between:

- 0 and 0.25: The socioeconomic status is very bad. Then, both criteria mentioned above should be analyzed and be included in an action plan including short, medium- and long-term interventions.

- 0.25 and 0.5: The socioeconomic status is moderately bad. Then, both criteria mentioned above should be analyzed and be included in an action plan including short, medium- and long-term interventions.
- 0.5 and 0.75: The socioeconomic status is moderately good. Then, an analysis should be done to find out what indicators are not performing well. Once the indicators are defined, then an action plan can be set.
- 0.75 and 1: The socioeconomic status is very good. Then, an on-going analysis should be done to make sure the long-term policies and action plans won't be impacting the index in light of any global and national change.

In Lebanon, as mentioned above, the final indicator before the Syrian crisis was **0.377594013** and after **0.294863581** which means that **the Socio-Economic Index is moderately bad closer to the very bad status.** For some indicators the situation in Lebanon can be very bad as per the analysis above for each indicator and an in-depth revision should take place the soonest. Hence, the analysis should prioritize the economic index at first starting from the revision of macroeconomic policies. The burden of the Syria crisis and the high influx of refugees has put a lot of pressure on the already weak social and economic structures.

Action Plan

In order to improve the agricultural socioeconomic index, below some recommendations:

Term	**Aspects/criteria of intervention**	**Action Plan**
Short-Term	Economic Intervention: Import/Export	- A committee led by the Ministry of Economy and Trade (MoET), formed from economic, agricultural and trade experts to update the seasonal calendar. After, a rough assessment seasonally for the Lebanese needs and agricultural outputs to be done. Both update and assessments to be matched together in order to develop a seasonal plan showing the needs from imports and hence control and reduce the unorganized imports. - In parallel, introduction of reforms that result in the maximum number of importers bringing in the same products, especially in input markets is highly needed - On field assessment by logisticians and technicians regarding the domestic Logistics including marine shipping and port operations.
	Socioeconomic Intervention	- Empower rural urban linkages through more market exhibitions financed by the ministry of agriculture and more effort to link farmers and local producers in rural areas to cities and prioritize their products. This should be done through certificates supported

		by the ministry of agriculture and economy to make the Lebanese more competitive nationally. - Re-update the agricultural curriculum in TVETs agricultural schools where new skills should be introduced. The Ministry of Agriculture should work closely with the Lebanese Universities – Faculties of Agriculture, to support updating the curriculum for TVETs agri schools. - Respond to the multi-faceted nature of food insecurity by, for example, incorporating measures to modify discriminatory values and customary laws/practices that limit women's access to and control over resources.
	Local Economic Interventions	- Create a program "Local Agricultural Development Plan" to be adopted by all the municipalities – mainly rural – in Lebanon. The plan will result in a detailed assessment of the agricultural and agro-industry sectors, farmers, in addition to threats and opportunities. Public-Private-Partnerships can take place where Public is decentralized through municipalities.
Medium-Term	Economic Intervention	- The plan developed by experts and led by MoET to be put into action and based on it the government to reupdate its trade agreement. As per the analysis above: the country should consider more trade agreements with the far east and more African countries. - The country should adapt a variety for trade routes in case one has been disrupted. - Develop Lebanese logistics, marine shipping, and port operations. - Incentives to promote the private sector to take part in any proposed new plan are also necessary. - Empower the Micro-Finance Institutions through programs related to youth: seeds funds for start-ups, support to existing businesses with very low interest rates and more; including youth in the Value Chain will directly reduce the percentage of monopoly as mentioned previously.
	Labor Market Intervention	- Need to restructure parts of the agriculture sector, allocate lands, set up regulatory mechanisms, and support relevant legislation through overarching policies to improve employment in agriculture: supervision and logistic coordination of the new interventions could be provided by government programs, civil society, or private sector organizations.

		- Including the Agricultural Workers under the Labor law for many reasons such as create decent jobs for workers, reduce the sector informality, attract more foreign investments, increase the interest of youth in Agriculture.
	Social Intervention: Education and Awareness	- Education and social awareness to change the consumer behaviors towards healthiest diets through early education at school and through social gatherings and events. The ministry can use social media to disseminate such information. In this context, effective policies and education in hospitals, workplaces, and schools are instructive in promoting a transition in the way people perceive food and health
Long-Term	Economic Intervention	- On the long-run and while the import has been controlled, a plan for crops diversification based on the most imported crop should take place. Incentives should be given to farmers of all sizes to start planting the most imported crop. - Public investments (through more fiscal expenditures) in agriculture to increase; considering increasing support the domestic food production will increase in order to reduce their vulnerability to international market prices and stabilize domestic food costs. - Key market reforms such as those related to regulating competition and intellectual property should be materialized for Lebanon to fully benefit from free trade.
	Socioeconomic intervention	- An update regarding the minimum wages and income composition and distribution between sectors is a must to decrease poverty and risk of food insecurity.

Case study

The transition from rural to semi-urban settings has faced the majority of Lebanese villages previously relying on agriculture. It is one of the main indicators of the social index, however, it requires a separate study and a lot more of details.

The case study is included under this indicator and the paper done has been already published:

The effect of rural to semi-urban transformation on livelihoods – using a livelihoods index – Middle East Journal of Agriculture Research:
http://www.curresweb.com/mejar/mejar/2017/1123-1128.pdf

THE EFFECT OF RURAL TO SEMI-URBAN TRANSFORMATION ON LIVELIHOODS - USING A LIVELIHOODS INDEX

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Abstract

In the past 50 years, excluding populated cities, the majority of areas in Lebanon have shifted from rural to semi-urban. The main drivers of this transition are increased access to education and technology, coupled with the development of the private sector, as well as internal and external factors like the civil war and the Syrian crisis. To determine the consequences of this transition on people's lives, a livelihoods index study will take place in one particular area of Lebanon; Kobayat – Akkar, one of the largest villages in Lebanon. The stakeholders taking part in this study are people who have experienced both the rural and the semi-urban periods, e.g. farmers, business owners, head of municipalities, etc. The study will include quantitative and qualitative data collected in the field using one questionnaire to draw a comparative analysis of before and after assessments. For the qualitative data collection, a Likert scale will be used to translate the qualitative answers into numerical figures. The findings of the study will shed the light on the difference between the indexes of this same area, Kobayat, both as a rural and as a semi-urban agglomeration. The study will also provide details about how each kind of capital (natural resources, economic, social, human and physical) has been negatively or positively affected as a consequence of this transition.

Keywords: Livelihoods capitals, rural, semi-urban, index modification.

Introduction

In Lebanon, changes in how people make living, changes in where people live, and changes in how people interact with society and the state, have all undergone transformations in the past 50 years. Lebanon, a middle-eastern country which encountered frequent internal and external crises beginning from the French mandate, going on to the civil war in 1975 and the invasion of 1982 all the way to the current Syrian/regional crisis, underwent a significant metamorphosis to its governmental, social and economic condition. These changes have affected the people nationwide – in both rural and urban settings – in an attempt to cope with each upheaval. Some of these transformations had a more long-term effect than could be attributed to a coping period; gradually, they indirectly transformed the whole society's organization. The Lebanese rural society – in which the majority of people relied on agriculture as their main source of income – has decreased significantly since 1960 when it represented 58% of the total Lebanese population hitting a low of 12% in 2015 (World Bank online data).

As per field interviews with people who encountered both phases, Kobayat, one of the largest rural villages in Lebanon, was directly and deeply affected by all the changes that affected the Lebanese landscape until becoming nowadays a semi-urban area.

Although several definitions exist in literature and in the common vernacular about rural, urban and semi-urban areas, in this paper, we make reference to the structural approach suggested by Blanc, not simply based on the geographic and demographic characteristics of the space, but on the study of the representation that social actors have on it, specifically how the rural (or former rural) area is lived by those who are part of it, daily. (Blanc, 1997; De Gennaro and Fantini, 2002).

During the French mandate between 1920 and 1943, people were relying on agriculture as a main source of living. Some of the lands were used mainly for personal use or for food staples sold through the local market; the majority of the people working in agriculture were workers in the lands of local aristocratic groups known as Bakawat (Houranu, 1985). The livelihoods plan for the families – considered as large in size by then – was mainly meeting basic needs such as food and shelter while primarily working in the land; for people owning the lands, the plan was to pass them down to their sons resulting in low educational levels for a couple of upcoming generations. The rising of insecurities following the French mandate coupled with changes in land structures, have upset the Lebanese rural society, made them feel that their livelihoods are at risk: relying on agriculture only was not enough anymore for a sustainable life (Ghazi, 1997; Geha, 2016). Since then, people started pursuing governmental positions such as military and public teachers to feel secure. In 1975, the civil war in Lebanon took place, and it was the main trigger for increasing the fear within societies, mainly the rural ones. The poor delivery of services became even poorer (health, finance, water, sanitation and transport) and failed to reach the poor in rural locations, in this time of change. However, people became more educated than before in order to be capable of joining some sustainable governmental jobs and secure health and other basic needs. The families decreased in size and the interest in agriculture dwindled as this sector was no longer able to secure any basic service, a minimum right for civilians. This period was sculpting the society and pushing it forward to an inevitable transition in its livelihoods' capitals. What little interest remained in

agriculture coupled with the reduced size of families in addition to non-secured future plans, pressed the parents to focus more on their kids' education. After the civil war, the situation became more stable and the education of people increase as did the living standards. Governmental positions turned out to be less attractive, limiting the youth's ambitions, adding to it the absent governmental support in addition to a perpetual fear of another war. These were the main reasons that triggered the high levels of immigration amongst educated youth, the continuing switch to private businesses such as commerce, the remarkably low interest in agriculture and the dependence on tourism, etc. Accordingly, this situation is still considered –to date- as an on-going phase for Kobayat.

The objective of the paper is to draw a comparative analysis of the livelihoods' index in Kobayat and how each capital (natural resources, economic, social, human and physical) has been negatively or positively affected as a consequence of this transition.

Materials and Methods

The paper is grounded on secondary and primary data collected in Kobayat, North Lebanon carried out in May 2017 with the head of Kobayat's municipality, 35 farmers, the head of the agricultural cooperation in the area and the director of North LARI (Lebanese Agricultural Research Institute). The data was collected using two structured questionnaires – one for the farmers and the other one for the head of the municipality, the head of the agricultural cooperation and the director of North LARI.

The first questionnaire – addressed to farmers – highlights data about respondents (age, gender, educational level, family size, etc.). Additionally, farmers have been asked about details related to the land structure, income sources, the availability of water, general services and the social relationship between each other. Some of the answers were qualitative and in order to translate them into numbers, a Likert scale from 1 to 5 was applied. The interviewed people are elderly men and they experienced all the phases of the transition in Kobayat.

On the other hand, another questionnaire was dedicated to opinion leaders, namely the head of the municipality, the head of the agricultural cooperation and the LARI director. The data received from them was more qualitative than quantitative, focusing on the bigger picture of the society and how it was shaped through history. Moreover, tests on water and soil have been collected by the Author and checked with LARI. The main groups of variables derived from the farmers and the leaders' questionnaires and the author's tests, referring to the different kinds of capital, are summarized in Table 1.

Table1: Different kinds of capital and related groups of variables

Capitals	**Main groups of variables**
Natural Resources Capital NC	Soil structure, fertility, chemical properties; water quantity and quality
Economic Capital EC	Agricultural income, productivity, perspectives; Non-agricultural income, tourism, aquaculture, beekeeping

Human Capital HC	Education, knowledge, health
Social Capital SC	Relations among farmers, with the cooperative, with religious and political groups
Physical Infrastructures Capital PC	Roads, housing, electricity, internet; Municipality services, agricultural and post-harvest services, irrigation networks

*Source: Author's elaboration based on the questionnaire survey.

Results and Discussion

Each type of capital index is defined from a set of indicators integrated with one other and collected throughout the two surveys. These indicators differ from one kind of capital to another; in fact, each capital has, according to its precise objective and the peculiar characteristics of the study area, indicators that are specific to it. And there is no reference list of indicators that is applied in the same way in all evaluation cases (Pathak P. et al, 2005). Therefore, in order to develop a representative index, a group of suitable indicators was chosen for the purpose of our study. The indicators were mostly based on the agricultural sector and were integrated in all livelihoods' capitals. In addition, an overview of each type of capital was added and reflected by indicators apart from the agricultural sector.

After conducting the interviews, the answers have been compiled in one sheet and all the qualitative answers were translated into numbers based on a Likert scale. Each capital's indicators have been weighted one by one in order to calculate the specific kind of capital index and the different capital indexes have been weighted to obtain the final index. Two formulas have been used:

1- Capitals index:

For each indicator: Ind1 = (Value – Min Value)/ (Max Value – Min Value).
Weight has been specified based on the importance of each indicator and each capital while calculating the final index:

Capital index: $(Ind1*w_1) + (Ind2*w_2) + (Ind3*w_3) + \ldots$

Final index: $(NC*W_{NC}) + (EC* W_{EC}) + \ldots$

The results of study are shown as in table 2:

Table2: Comparison of before and after capital indexes

Capitals	**Kobayat Rural Standards**	**Kobayat Semi-Urban Standards**
Natural Resources Capital NC	0,644	0,184
Economic Capital EC	0,605	0,408
Human Capital HC	0,448	0,69
Social Capital SC	0,353	0,63
Physical Capital PC	0,390	0,52
Index	**0,528**	**0,47**

**Source: Author's elaboration based on the questionnaire survey results.*

The shift from rural to semi-urban has affected the five livelihoods capitals in varying ways.
To dive deeper into the results of the questionnaires, it is better to start with the **natural resources capital** that is mainly and negatively affected by this transition. Many factors impacted this capital which is considered as the most sensitive, based on its indicators that are associated with the physical/chemical properties of water and soil. People nowadays have more access to pesticides and are using them in a much unsystematic way, not taking into consideration the harmful consequences on the land and the water's structure; their main aim of using these pesticides – in a non-controllable way – is to increase the quantity of products thereby generating a higher profit; hence, the government is not testing the final products consumed by consumers nor is it testing the land and the water's chemical properties. In addition, several factors affect natural resources, and in 2011, IFAD (International Fund for Agricultural Development) has generally identified all of these factors; some of which are climate change, increased market competition, human activities other than agriculture, overexploitation of forests and unsustainable agricultural practices (traditional method, monoculture, etc.) (IFAD, 2011). To re-enforce this theory, a sample from the water and soils was checked by LARI's laboratories in North Lebanon and the results show that the underground water is polluted and the lands' chemical properties have been significantly modified (e.g. pH 8); these results have been compared to the LARI's previous data (e.g. pH 5.5) considered in line with the international standards.
Moreover, the land owners are not caring for their own land and are irresponsibly using the "free" natural resources such as water. The crop rotation is out of consideration, the irrigation systems are traditional and an abundant quantity of water is wasted (which, moreover, negatively affects the relationship between farmers who are struggling to get control over water sources, the main indicators of the social capital). However, as per the head of the agricultural cooperation in Kobayat, new irrigation systems have been in place in order to help farmers but the lack of agricultural knowledge is preventing them to access it; this knowledge deficiency is linked to the low number of farmers, itself a consequence of the conversion from rural to semi-urban area.
The analysis of the **economic capital** will make the above analysis stronger. All of the surveyed farmers stated that they don't depend on agriculture as their main source of income; working in

agriculture is an added source of income; as a consequence, investments in the lands are modest, since even the future generations are showing no interest in agriculture. Additionally, the tourism in the rural areas has been improved and people are increasingly relying on private non-agricultural businesses; these are considered more secure than agriculture, where the nearby markets are over-saturated with products. However, the increased income is associated with an increase in expenses for families, in response to the current living standards; therefore, the transformation is negatively affecting the economic capital, represented by the sum of revenues when compared to the expenses.

The Syrian civil crisis has badly affected the situation of farmers in North Lebanon and mainly the large farmers who rely on agriculture as their main source of income. The Syrian internal borders have been closed in front of the North Syrian farmers. This led them to dump all of their products into the Lebanese markets, taking advantage of the complete absence of the Lebanese government. The hard situation of the large farmers is considered an extremely discouraging situation for anyone planning to invest in agriculture in the whole area. Additionally, Syria was considered the main route for trade to the Arab gulf. In addition to all of the above, the **social** and the **human capitals** have been significantly affected by this transition. From an agricultural and non-agricultural perspective, these capitals have been positively affected by the transition. People are considered remarkably more educated than before (for instance, instead of one official school in Kobayat, there are now 4 public schools and 1 private school). Consequently, people have more access to basic services (life insurance, education, health, etc.), more public places such as restaurants and cafes, less gender barriers that enable women to work, a significant increase in the marriage age, etc. Hence, from an agricultural perspective, more agricultural engineers are available for further technical support, in addition to the orientation seminars held by the ministry of agriculture, the municipality, the head of agricultural cooperation and other NGOs (non-governmental organizations).

Finally, the **physical infrastructures capital** indicators have been, in general, positively affected when it comes to the agricultural sector. The infrastructure of the rural area was positively reformed. The roads are much more accessible -in some areas new roads have been constructed- the access to electricity is higher, the information system via mobile phones is used by farmers in order to track the weather conditions, new seminars, ministry-disseminated information, etc.

Finally, the synthetic index calculated by summing up all capitals multiplied by their weight. Each capital is given a weight which is relative to its standard value. That is to say, the greatest weight is given to the capital with the greatest value, and so on. Then, the capital is aggregated with their respective standard values and weight together to deduct the value of the expected synthetic index.

Two scenarios have been studied, one where all capitals have the same weight (Table 3), and in the other one the natural resources capital were weighted the highest. (Table 4).

Scenario 1:

Table3: Synthesis of before and after capital indexes with the same weight

Capitals	**Kobayat Rural Standards**	**Weight**	**Value × Weight**
Natural Resources Capital NC	0,644	0,2	0,1288
Economic Capital EC	0,605	0,2	0,121
Human Capital HC	0,448	0,2	0,0896
Social Capital SC	0,353	0,2	0,0706
Physical Capital PC	0,390	0,2	0,078
Total			**Index Σ= 0,488**

Capitals	**Kobayat Semi-Urban Standards**	**Weight**	**Value × Weight**
Natural Resources Capital NC	0,184	0,2	0,0368
Economic Capital EC	0,408	0,2	0,0816
Human Capital HC	0,69	0,2	0,138
Social Capital SC	0,63	0,2	0,126
Physical Capital PC	0,52	0,2	0,104
Total			**Index Σ= 0.486**

**Source: Author's elaboration based on the questionnaire survey results.*

Scenario 2:

Table4: Synthesis of before and after capital indexes with different weights

Capitals	**Kobayat Rural Standards**	**Weight**	**Value × Weight**
Natural Resources Capital NC	0,644	0,3	0,1932
Economic Capital EC	0,605	0,25	0,15125
Human Capital HC	0,448	0,2	0,0896
Social Capital SC	0,353	0,1	0,0353
Physical Capital PC	0,390	0,15	0,0585
Total			**Index Σ= 0,528**

Capitals	Kobayat Semi-Urban Standards	Weight	Value × Weight
Natural Resources Capital NC	0,184	0,3	0,0552
Economic Capital EC	0,408	0,25	0,102
Human Capital HC	0,69	0,2	0,138
Social Capital SC	0,63	0,1	0,063
Physical Capital PC	0,52	0,15	0,078
Total			**Index Σ= 0.436**

**Source: Author's elaboration based on the questionnaire survey results.*

Conclusion

It can be concluded that in order to develop an index for the evaluation of natural resources, the five different capitals must be studied. At the level of this paper and following the study of capitals, two indexes with an average value of 0.528 for the rural phase and 0.436 for the semi-urban phase were obtained. Each capital has its own characteristics and defects requiring recommendations to increase its score in order to improve the overall value of the index.

Transitioning from rural to semi-urban is not always a positive transition especially when the agricultural sector is neglected. The potential impact of infrastructure and services is lowered by the difficulty of disseminating information amongst a reduced group of farmers. The importance of natural resources is underestimated and nobody will assume the cost of negative externalities on land degradation and environmental pollution. Comparing the indexes between both phases - through those are two different scenarios- the synthetic rural index is higher than the semi-urban one which is calculated through all the capitals. Hence, the natural resources capital was the higher capital in the rural context and the lowest in the semi-urban one. To re-increase this capital, a couple of recommendations should take place such as: more seminars to local citizens about the importance of agriculture and natural resources protection, more support from the government in controlling the import/export of agricultural products by respecting the seasonal calendar, secure the link between farmers and buyers (for local and international markets), better storage capacities such as refrigerated storage containers, include GAP practices dissemination during training and awareness sessions.

Governance and Institutions Capital

Objective: In this study, we will clarify the role of the government, the trust stakeholders have in it and what are the practices they are trying to implement in order to improve and sustain the food system in Lebanon. Furthermore, we will highlight actions by government and other stakeholders that will be required to meet response gaps and accelerate progress towards

achieving food security, and, if possible, provide an overview as to how such actions could be implemented and funded, including through the private sector and civil society.

Abstract:

In a society still in search for solutions for sustainable development, good governance has always been recognized to be a critical tool for advancing sustainable development and a crucial element to be incorporated in sustainable development strategies. Good governance promotes accountability, transparency, efficiency and rule of law at all levels and allows efficient management of human, natural, economic and financial resources for equitable and sustainable development, guaranteeing civil society participation in decision-making processes. Good governance and sustainable development are two concepts intimately tied together. Good governance does not guarantee sustainable development; however, its absence severely limits it and can, at worst, impede it.

Governments are the primary actors in the physical, social, and economic aspects of a nation's food security, so any attempts to improve agriculture and food security outcomes must also consider the governance' role.

In this analysis, we will study the role of the Lebanese governance and how it is contributing to decrease or increase the food security levels amongst citizens, in addition to where it stands in terms of food sustainability and resiliency plans and priorities; the index will be created and compared to before and after the Syrian Crisis to see also what measures the government in Lebanon must take and/or improve.

Introduction:

Food Safety in Lebanon is a major issue, which affects access and ability among consumers, and competitiveness among exporters. Food safety is regulated by a plethora of ministries and public institutions with no coherent structure or vision for an integrated framework that encompasses the farm-to-fork philosophy[257]. Efficient functioning of the food safety sector is, however, vital for Lebanese agriculture exporters' ability to market in countries where stringent food safety practices are in place[258]. Even so, several international food safety standards are applied at different levels in the country including Hazard Analysis Critical Control Point and International Organization for Standardization (ISO) management standards such as ISO 22000:2005 and ISO 9001:2000 as well as local standards set by the Lebanese Standards Institution (LIBNOR), the official standards setting body that is housed at the Ministry of Industry. However, lack of consistent application and rigorous residue traceability standards has prevented imported crops from being exported to markets in Europe[259].

[257] Fadi El Jardali etal. (November 2014). Protecting Consumers in Lebanon: The Need for Effective Food Safety System, American University of Beirut. Retrieved from https://www.aub.edu. lb/k2p/products/Documents/K2P%20BN%20 Food%20Safety%20English.pdf.
[258] Ibid
[259] International Donor. (March 2016). Key Informant Interview.

Lebanon has recently passed a Food Safety Law with the aim to reform the sector. The law covers all types of food and beverages and well as processed foods[260]. The law also describes requirements for the process of food safety from farms, food transport and display, to tracking and record keeping[261]. Finally, the law sets out the overall governance structure of the food safety sector under the auspices of a public multi-stakeholder body named the Food Safety Lebanese Commission.408 However, the government has yet to appoint the members of the Commission and thus the law has not effectively been enacted[262].

Hence, The Government of Lebanon and its concerned Ministries together with national and international partners are collaborating to address the country's food security and nutrition challenges and to progress towards the implementation of Agenda 2030's sustainable development goals. In their support, and to study the current situation with a view towards enabling the prioritization of policy reforms, the United Nations Economic and Social Commission for Western Asia (ESCWA) and the World Food Programme (WFP) joined forces to commission an in-depth analysis of the country's food security and nutrition context.

Known for its mercantile history, Lebanon's markets are one of its lifelines: up to 80 percent of the country's food needs are imported in any given year. Being market savvy, however, comes with both blessings and drawbacks. Since the end of the civil war in 1990, the political tempo has been high; governments have come and gone and policy has been fragmented, not least with respect to food and nutrition security. Tax bases have remained low while successive governments have adapted to spending requirements through borrowing, mostly from local banks. The political turmoil has resulted in economic growth not keeping pace with rising debt which now stands as one of the highest in the world compared to GDP. Partially as a result, social safety nets remain underdeveloped and the poverty rate has remained at around 30 percent[263].

In 2007/2008 commodity prices sky-rocketed; food and nutrition security in Lebanon faltered. The government responded by re-introducing subsidies on wheat, bread and flour that it had been phasing out, but the effects on economic access to food were still enormous. In 2008 alone, average food prices in Lebanon rose by 18.2 percent[264] and have only recently begun to enter negative territory. The Lebanese felt these prices hikes both in their wallets and their bodies[265].

At present, the Ministry of Agriculture's budget totals around 0.5 percent[266] of its overall allocations and, without proper funding and technical capacity, the ministry has not been able to

[260] Food Safety Law Draft. (November 2015). Law No 48. Retrieved from: https:// www.lp.gov.lb/admin/uploads/files/19-%20 %D8%B3%D9%84%D8%A7%D9%85%D8%A9%20 %D8%A7%D9%84%D8%BA%D8%B0%D8%A7%D 8%A1(2).docx.
[261] Ibid
[262] Daily Star ambitious law passed.
[263] Strategic Review of Food and Nutrition Security in Lebanon, ESCWA, May 2016
[264] Ibid
[265] Ibid
[266] Ministry of agriculture (November 2014). Ministry of agriculture Strategy 2015-2019. Retrieved from http://www.agriculture.gov.lb/Arabic/NewsEvents/Documents/MoA%20Strategy%20 2015-19%20-%20English-for%20printing.pdf

offer appropriate extension services to small farm holders. As a result, small farm holders do not greatly benefit from information on good agricultural practices, access to research and finance, or a well-organized cooperatives sector[267]. In recent years, the general budget allocation to the MoA is only around 0.5 percent of the state's budget, compared to a regional average of around five percent[268]. However, during the period from 2009 to 2012 the government increased the ministry's absolute budget from USD 27 million to USD 66 million[269].

Reliance on trade has been the central policy of the government to ensure food supply. Lebanon's stated trade policy is to adopt trade liberalization, modernize trade legislation, minimize restrictions and simplify procedures, something that is immediately relevant to the food sector[270]. Lebanon has taken partial steps to enter the World Trade Organization (WTO), which would have a significant, yet uncertain effect on food supply. The country began accession proceedings in 1999 and has since progressively reduced trade barriers on a number of levels. However, Lebanon is still an observer to the WTO because it has not taken a series of mandatory measures to regulate and open its markets[271], including the implementation and enforcement of a competition law to prevent collusion, price fixing, as well as the establishment of the related institutions (e.g. an independent competition authority)[272].

Efforts to expand capacity at Beirut's port are on hold. Plans are afoot to expand the Beirut Port by around 1.4 square kilometers, 1.2 square kilometers of which will be reclaimed from the sea[273]. However, a recent initiative to install a multi-purpose terminal for some USD 129 million, build a new quay to accommodate larger vessels and fill one of the basins has not begun because of legal disagreements between port operators and the interests of transport syndicates[274].

Moreover, Lebanon lags behind its regional peers in a number of indicators including institutions, infrastructure, macroeconomic environment and market size and thus, ranks 113 out of 144 in the World Economic Forum's Global Competitiveness Index. Among the country's key concerns are the high levels of bureaucracy, corruption and persistent government instability[275].

[267] Strategic Review of Food and Nutrition Security in Lebanon, ESCWA, May 2016
[268] Ministry of agriculture (November 2014). Ministry of agriculture Strategy 2015-2019. Retrieved from http://www.agriculture.gov.lb/Arabic/NewsEvents/Documents/MoA%20Strategy%20 2015-19%20-%20English-for%20printing.pdf
[269] Ibid
[270] Republic Of Lebanon Ministry Of Economy And Trade. (2016). International Agreements. Retrieved from http://www.economy.gov.lb/index. php/subCatInfo/2/26/9/5
[271] The World Trade Organization. (2 December 2005). Accession of the Lebanese Republic, Factual Summary of Points Raides Revision 1. Retrieved from http://www.economy.gov.lb/public/ uploads/files/7573_5923_1446.pdf
[272] Republic Of Lebanon Ministry Of Economy. Lebanon's WTO Accession in Brief. Retrieve from http://www.economy.gov.lb/public/uploads/ files/7258_4520_6365.pdf
[273] Ace and Rambol. (19 December 2013). Danish companies expand the port of Beirut. Ramboll group. Retrieved from http://www.ramboll.com/ media/rgr/port-of-beirut
[274] Jeremy Arbid. (July 23 2015). Church and state, the growing battle over the port of Beirut's future. Executive Magazine, Economics & Policy. Retrieved from http://www.executive-magazine. com/economics-policy/church-and-state
[275] The World Economic Forum. (2014). The Global Competitiveness Report 2014-2015, Lebanon section 2.1 Country economy profiles p. 244 and 245. Retrieved from http://reports.weforum. org/global-competitiveness-report-2014-2015/

Lebanon's government responds to food affordability by subsidizing the production process of bread. Because Lebanon is vulnerable to international cereal price shocks, the government has instituted a conditional subsidy on the complementary products of wheat and bread. Since 1959 the Directorate General of Cereals and Beetroot (DGCB) at the Ministry of Economy and Trade (MoET) has subsidized wheat and sugar beets with the purpose of encouraging the production of cereals and beetroot as well as safeguard necessary quantities[276]. With the approval of the Cabinet, the directorate purchases wheat from the international market and sells it to private flour mills at subsidized prices. The DGCB also subsidizes local wheat production, which consists of about 1,300 farmers producing a harder variety than imported whole wheat called durum wheat[277]. Local wheat is purchased from farmers by the DGCB and sold to mills at discounted rates. The government pays wheat farmers a price per dunum, or acre of wheat farms. Subsidies on bread are linked to that of wheat. The government sets the price and weight of one bag of Lebanese bread and therefore any changes have direct impact on the poor given their high consumption of cereals[278].

The government has the power to employ price controls but rarely uses this facility. The MoET has the legal power to regulate prices in the market so they do not exceed 100 of cost prices, while the Minister of Economy and Trade also has the right to set marginal prices and profit percentage ceilings on all goods and services[279]. The MoET also has the legal right to ask any private sector player to reveal their profits margins to the ministry. However, these prerogatives are rarely employed.

Institutional fragmentation constraints policy cohesion and implementation of the Ministry of Agriculture (MoA) 2015- 2019 strategy. When it comes to food and nutrition security, several governmental institutions are involved in the implementation of policy. For example, the Council for Development and Reconstruction (CDR) regularly awards infrastructure projects targeting the agricultural sector. The Investment Development Authority of Lebanon (IDAL)[280] manages the Agri-Plus programme, which benefits local producers through export subsidies and other incentives. At the same time, the MoET implements major subsidy programmes for wheat and bread production while the Ministry of Finance administers subsides for tobacco farmers[281].

[276] Decree 143/59. Legally the directorate can collect revenues from a number of sources including international grants (subject to cabinet approval) and tariff duties. Which since 1995, have become the purview Lebanese Customs, which falls under the Ministry of Finance.
[277] The percentage of durum wheat used in traditional Lebanese bread is around 20%
[278] Abou Zaki R. (April 24 2012). Lebanon: Give us this Day less of Our Daily Bread. Alakhbar English. Retrieved from http://english.al-akhbar.com/ node/6548
[279] Law No. 73 of 1983, Articles 6, 7 and 9.
[280] The Investment Development Authority of Lebanon is the national investment promotion agency of Lebanon. IDAL was established in 1994 with the aim of promoting Lebanon as a key investment destination, and attracting facilitating, and retaining investments in the country.
[281] Ministry of Agriculture. (November 2014). Ministry of Agriculture Strategy 2015-2019, page 12. Retrieved from http://www.agriculture.gov. lb/Arabic/NewsEvents/Documents/MoA%20 Strategy%202015-19%20-%20English-for%20 printing.pdf

Finally, while Lebanon cannot be self-sufficient in food and nutrition in the foreseeable future, it certainly can become more food sovereign if mechanisms and policies related to food and nutrition security are institutionalized, applied, and monitored.

Indicators' analysis:

A- Institutions

1- Agriculture Research & Development

Economists reveal that the agricultural growth is related to increasing of human resources, available capital and especially technical development so that nowadays all countries have focused on Research and Development (R&D) and attracting external researches gradually enhancing their economical capacity and manufacture more products therefore training of human resources seems a must-issue, this despite the fact that R&D costs appear in forms of invention, technical changes and technology.

Researches and Developments in agriculture causes to increase production. In Iran, after 3 decades 168 governmental institutes and 28 private associations activate. Studies of International Food Policy Research Institute showed that by 2008, Iran has been in 2nd degree among its neighbor which is as sign of R&D development importance in Iran[282].

RELATIONSHIP BETWEEN EFFICIENCY FACTORS OF R&D IN AGRICULTURE

Figure1 depicts that firstly agriculture researches causes to improvement of technology which also will develops agriculture productions.

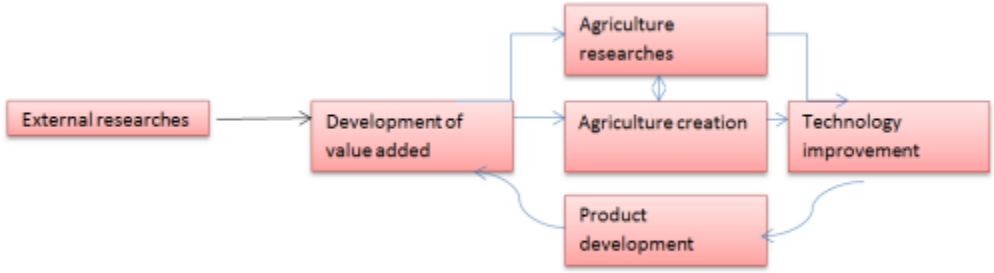


Figure 1: relationship between agriculture research and development (internal and external) with production values

Value: minimum (0), Maximum (7), Value before crisis (2), Value after crisis (3)

Source: Qualitative data

Analysis:

The last agricultural R&D Indicators Factsheet about Lebanon was published by the "International Food Policy Research Institute" in 2014. The three key indicators compared between 2009 and 2012 are: Total Public Agricultural Research Spending (57% increase), Total Number of Public Agricultural Researchers (61% increase), and Agricultural Research Intensity

[282] The Role of Research and Development in Agriculture and Its Dependent Concepts in Agriculture, Bahare et al, November 2015

(also an increase). However, Lebanon still lags in comparison with developed countries. Its gross expenditure on research and development (GERD) in 2013 was approximately 0.22 percent, which is below the regional average of 0.3 percent[283].

The gross domestic expenditure on research and development in 2014 which means after the Syrian crisis who started in 2011 and 2009 represents the number after the crisis; the R&D related to governmental initiatives usually, however, this can be considered as a positive of Syrian crisis where a lot of researches has been done for the sake of programming mainly but still all data shared can still be considered as valid and useful. Based on that and on the value before – considering that no data is available after 2014 and we estimate that also a small percentage of increase might be shown, on Likert Scale we will consider 3 after crisis and 2 before and it is still based on estimation: Likert: 7 =Excellent, 6=Very good, 5=good, 4= moderately good, 3=moderately bad, 2= bad, 1= very bad, 0=Worst.

Before: (value - minimal value)/ (Maximal value - Minimal value) = (2-0)/ (7-0) =2/7= 0.285

After: (value - minimal value)/ (Maximal value - Minimal value) = (3-0)/ (7-0) =3/7= 0.428

2- Ministries' Regulatory quality, fragility and Stability

The Quality Infrastructure is normally associated with quality management, quality assurance and quality control, inspection and certification, accreditation, conformity assessment, quality marks and labels, standardization, metrology[284], testing, market surveillance, etc. A Quality Infrastructure operates on the basis of a number of components taking into account the needs, resources and limitations of the society[285].

When it comes to the quality of food and the concerned ministries and their regulatory interventions, the Need for Effective Food Safety System is still a need. Some facts from the Lebanese law around Food Safety:

- Food safety has a major impact on the health of the population and the economy of the country. Pathogenic microorganisms are being detected in Lebanese foods, food poisoning outbreaks are being reported, and some Lebanese food product exports are being rejected while no changes have been made in the food safety practices.
- To date, there is no food safety law in Lebanon, there are only decrees from the 1960s and 1970s which are outdated.
- There are nine agencies in Lebanon that govern food safety with overlapping functions and lack of accountability.
- Lebanese food safety practices do not conform to international standards and do not ensure the safety of Lebanese consumers.

[283] Lebanon sets sights on being R&D hub for the Middle East, Rida Mawla, March 2017.
[284] The scientific study of measurement
[285] Protecting Consumers in Lebanon: The Need for Effective Food Safety System – American University of Beirut, November 2014.

- The current draft food safety law suggests a centralized approach to the food safety system coordinated by an independent food safety board and authority
- The new food safety law in Lebanon should be context-specific and accompanied by appropriate legislative decrees that take into account implementation considerations

Recently, there have been serious public concerns about food safety in Lebanon. In November 2014, the Lebanese public has been overwhelmed with the latest food contamination scandal when the Minister of Public Health publicized a list of restaurants, supermarkets and other food provider services that did not meet the ministry's food regulation standards with some products testing positive for salmonella, E. coli, and obligate aerobes. This adds to already existing concerns about food safety in Lebanon as illustrated by several cases of spoiled food, expired food[286] and the food poisoning outbreaks[287]. Despite recurring incidents and public concerns about food safety and the weak control over food production in Lebanon, the food safety practices have not changed.

Value: minimum (0), Maximum (7), Value before crisis (2), Value after crisis (2)

Source: Qualitative data

Analysis:

Despite the presence of nine food related agencies[288] considered as stakeholders in the food Value Chain (e.g. According to the current Lebanese food safety system, several institutions are responsible for controlling dairy production. Libnor develops the standards, the ministry of public health approves and controls the use of food additives, the ministry of industry controls the production of dairy and the ministry of economy and trade and the local municipalities control the sale and trade of dairy products), they have overlapping functions and poor coordination, lack of accountability, no existing food laws, no scheduled inspection programs, and poor control of microbiological and chemical hazards and food additives[289].

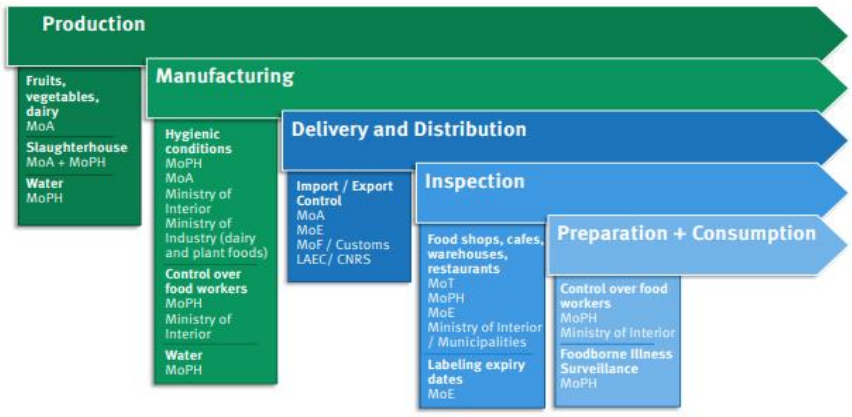
[286] The Daily Star, 2013

[287] FAO/WHO, 2005

[288] 1: MOA: Ministry of Agriculture 2: MOPH: Ministry of Public Health 3: MOE: Ministry of Economy 4: MOF: Ministry of Finance 5: LAERC: Lebanese Atomic Energy Commission 6: CNRS: National Council for Scientific Research 7: MOT: Ministry of Tourism 8: MOPH: Ministry of Public Health 9: MOI: Ministry of Industry

[289] Fadi El Jardali etal. (November 2014). Protecting Consumers in Lebanon: The Need for Effective Food Safety System, American University of Beirut. Retrieved from https://www.aub.edu. lb/k2p/products/Documents/K2P%20BN%20 Food%20Safety%20English.pdf.

Figure 1 Stakeholders in the Lebanese Food Chain



1: MOA: Ministry of Agriculture 2: MOPH: Ministry of Public Health 3: MOE: Ministry of Economy 4: MOF: Ministry of Finance 5: LAERC: Lebanese Atomic Energy Commission 6: CNRS: National Council for Scientific Research 7: MOT: Ministry of Tourism

Considering the above analysis, food is not controlled by ministries and this can be having a 2 over 7 on Likert Scale[290]. Hence, the cases of food poisoning are relatively high in Lebanon; however, the majority of food is imported either processed or fresh, but many other reasons can affect it such as the storage quality and more (to be analyzed in the Environmental part). The Syrian crisis in this issue has nothing to do with how the relevant ministries ways of managing the food quality.

Moreover, institutions effectiveness and policy coordination are also bad, There is no structure that oversees the totality of the functions of these agencies or coordinates activities among them, the current draft food safety law suggests a centralized approach to the food safety system coordinated by an independent food safety board and authority, this draft law suggests establishing an independent food safety authority and board under the auspice of the council of ministers that is responsible for food related policies, research, and standards as well as coordinating the function of the other ministries in regard to food control activities.

Hence, a lot of basic enabling factors to restructure the food system lack from institutions such as:

- Computerized systems and upgraded laboratories
- Education training and awareness
- Coordination, communication, and transparency
- Appropriate legislation, clear national policy, enforcement

[290] Likert: 7 =Excellent, 6=Very good, 5=good, 4= moderately good, 3=moderately bad, 2= bad, 1= very bad, 0=Worst.

3- Effectiveness of Agricultural Education Institutions

Agricultural Education is far more important than just an elective curriculum. It is widely perceived that conventional agricultural education is now not meeting the emerging needs of agricultural development. This is more so in the economically developing world which now more than ever needs new agricultural knowledge to meet new challenges such as participating effectively in globally competitive markets and adapting rapidly to climate change, reduced access to natural resources, narrower agricultural biodiversity and new pests and diseases from afar that spread rapidly.

Value: minimum (0), Maximum (7), Value before crisis (2), Value after crisis (2)
Source: Qualitative data – field interviews

Analysis:

For the setting of a new strategy for agricultural development in Lebanon and for rehabilitation of the most deteriorating subsectors, namely administration, research and extension, the interaction and coordination among the different higher agricultural education institutes remain essential. The Faculty of Agricultural Sciences (FAS) at the Lebanese University was independently able to contribute to some needs of the agricultural sector in Lebanon. Other faculties of agriculture have also had their share of contribution[291].

Based on our meetings with the technical agricultural school' director in Abdeh North Lebanon, she mentioned that the agricultural technical part is not included within the TVETs directorate managed by the Ministry of Education; the agricultural schools are separate and managed through the Ministry of Agriculture. Hence, TVETs directors are free to select a course they find relevant for the market and can generate employment which can include agricultural post-harvest activities. As per her, the Lebanese youth in the area who finished a certain level of education, are only interested in being enrolled in governmental positions. The TVETs and the agricultural school are only the way to get a certificate in order to be eligible for any military position.

The Lebanese agricultural schools face major structural gaps, as per the school director, LARI and a study done by ACTED, such as: lack of teacher training, limited availability of equipment in schools, insufficient practical competence of the students and lack of linkage with the job market. The schools need urgent transformation institutionally. The reasons attributed to this failure are the lack of adequate investment and curriculums that do not meet the aspirations of the students and the needs of their employers.

There are several key trends that are impacting educational institutions in their transforming agricultural knowledge systems in Lebanon. These include re-envisioning the role of these Institutions to make their roles broader beyond increasing agricultural production and productivity, introducing new trans-disciplines in their academic agendas, consolidating them for greater efficiencies and academic excellence prior to investing in them, changing leadership,

[291] The Higher Agricultural Education And Training Programs In Lebanon, Mouin Hamze - Wafa Khoury - Wafa Dikah – Hala Chahine, 1994

curricula, widening the catchment by offering education in new academic area and providing off-campus, distance, and open learning using new ICTS and considering them as hubs for agriculture and agribusiness innovation.

Based on the Likert Scale and on the analysis mentioned above, the situation of the agricultural school in Lebanon is bad.

B- Governance

The World Bank defines governance as "the manner in which power is exercised in the management of a country's economic and social resources for development". Governance is not just about government; civil society and the private sector actively participate and influence pubic policies affecting people's lives. Governance compromises all of these actors and their interrelations at all scales[292].

Food Security requires governance at national and local levels. Certain trends affecting governance on all levels – including globalization, the power of transnational cooperation and the weak regulation, are major drivers of food insecurity in the world[293]. The successful integration of policies and programs into agricultural and nutrition interventions depends on two complementary aspects of governance:

- Supply-side governance: refers to the ability of a government to implement policies and services that effectively respond to the needs of the stakeholders within agricultural and nutrition value chains.
- Demand-side governance: refers to the institutions and mechanisms through which agriculture and nutrition value chains frame and articulate their concerns to government representatives, exercise their legal parts and rights, participate in political processes, and hold governments accountable.

Moreover, governance practices depend on each country's system but in general, good governance compromises the rule of law, transparency and accountability in the management of public affairs, respect for human rights, and the participation of all citizens in the decisions that affect their lives.

4- Local Peace Level: Political stability and absence of violence/terrorism (index)

Lebanon gained its independence from the international mandate system in 1943. Composed of many communities including Shiites, Sunnis, Druze and several Christian sects, difficulties emerged from the attempts to address religious and other differences about the identity of the country and its role in the Arab World.

[292] Good Governance Barometer (GGB), USAID, FH360, April 2015
[293] Governance, Agriculture and Food Security, Catalyzing integration, FH360

This tension was exacerbated by Lebanon's role in the Arab-Israeli conflict from 1948. Lebanon took in Palestinian refugees; and Palestine Liberation Organisation (PLO) fighters launched operations against Israel from Lebanese territory, prompting Israeli attacks which led to the country's military invasion in 1982 and several attacks afterwards, mainly in 1998 and 2006[294].

A civil war was sparked in 1975 by a right-wing militant attack that killed 27 Palestinians. The war involved secular leftists, right wing Christian militias, the PLO, Muslim and Druze fighters, Syria, Israel, and their proxies. Syrian troops entered Lebanon in 1976 and dominated its policies till 2005 when prominent Sunni Prime Minister Rafic Hariri was assassinated; and Israel invaded as well, prompting the deployment of a UN peacekeeping force[295].

Further conflict took place in 2006 in an Israeli war that affected all Lebanon's infrastructure. Hence, the often clashes between Israel and Lebanon is on-going putting the people in south Lebanon under risk of attacks in any moment. Moreover, Israel keep threatening Lebanon with a war which will indirectly frighten the investors and citizens.

The Syrian civil war has now caused an influx of 1.5 million Syrian refugees into Lebanon, putting further pressure on already fragile institutions. The high number of refugees is putting pressure on the job market and tensions in some areas are occurring from time to time. Apart from its economic and social impacts, the involvement of one Lebanese party in Syria – Hezbollah – is threatening the peace of Lebanon after many warnings from the international community.

Internally, also some security challenges may occur, and as seen in October 2019, a revolution started in Lebanon, where people took over the streets and blocked the roads in response for additional taxes and corruption.

Value: minimum (0), Maximum (7), Value before crisis (5), Value after crisis (4)

Source: Qualitative data

Analysis:

Lebanon has never been a highly peaceful country. However, in some years the country did not face any peace challenges and the situation was calm. In numbers it has been estimated based on the qualitative research to be 5 before the crisis which is a "good" and slightly less to 4 after the Syrian crisis because of the high refugees' influx and tensions in few areas. This indicator is relevant to be assessed since it can affect all the active economic sectors in the country and it shows how the government is not taken any efficient step to solve the issue. Hence, since Lebanon is located in a hostile region, serious peace issues might occur, and this will affect drastically the food security in the country starting from cities to rural agricultural areas.

[294] Lebanon, Conflict and Peace, peaceinsight.org
[295] Ibid

Moreover, the whole situation might affect the business growth including agriculture since the multi-national investors will hesitate to invest in Lebanon.

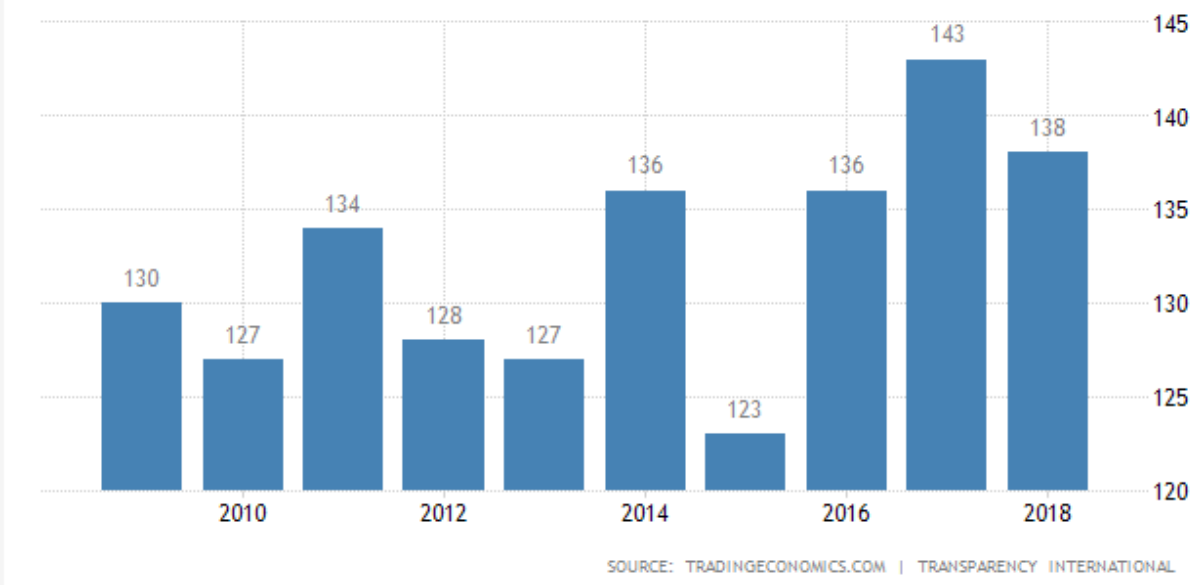
Before: (value - minimal value)/ (Maximal value - Minimal value) = (5-0)/ (7-0) =5/7= 0.7143

After: (value - minimal value)/ (Maximal value - Minimal value) = (4-0)/ (7-0) =4/7= 0.5714

5- Corruption Levels

Lebanon is the 138 least corrupt nation out of 175 countries, according to the 2018 Corruption Perceptions Index reported by Transparency International. Corruption Rank in Lebanon averaged 115.25 from 2003 until 2018, reaching an all-time high of 143 in 2017 and a record low of 63 in 2006.

The image below, show the corruption rank of Lebanon throughout the years, and this shows that the level is high throughout the years which is above 100.



For decades and to this day, there has been much hype, statistical data and a plethora of documentary evidence on corruption plaguing the Lebanese bureaucracy and putting the nation under the yoke of large budgetary deficits. However, efforts of the Lebanese administration to establish a system based on merit and fight corruption were of little or no avail. Data from NGOs and multilateral organizations like Transparency International (TI), World Bank Group (WBG), Organization for Economic Cooperation and Development (OECD) and others indicate that corruption is a major reason for poverty and an obstacle to development and prosperity. Bribery, corruption, nepotism and other malfeasances have huge ramifications on any organization

leading most of the time to ineffectiveness and even to systemic failure especially in the absence of controls[296].

In the Lebanese public space, corruption takes several forms and is committed via public contracts and procurements, facilitation or "grease" payments, embezzlement of public funds, abuse of office, trading in influence and other suspicious acts.

Results achieved so far on the administrative reform level provide ample evidence that old-school reactive control measures are useless and ineffective in detecting fraud, and fall short of framing an offense against complicit public servants who should otherwise be criminalized under the law.

Coupled with political meddling and reform politicization, these malpractices can only exacerbate the problem and turn the fight against corruption into an uphill battle which becomes more costly if won over by corruption conduits.

Having said that, and since Lebanon has lately enacted a bundle of modern laws underscoring the importance of transparency and disclosure of wrongdoing known as "Whistleblowing", immediate attention should be given now to hiring a new mindset and caliber to fight fraud and corruption[297].

In a nutshell, these new skill sets may contribute to better governance in the public sector and will definitely serve as a deterrent to culprits who are often driven by bad intent to bribe or get bribed through giving or receiving financial or other advantages in connection with the "improper performance" of a position[298].

Finally, if Lebanon still wishes to attract foreign direct investments, protect financial integrity, and mitigate reputational risks, the "government" needs to introduce drastic reforms to create a more transparent and accountable public sector capable of criminalizing wrongdoers and bringing them to court for a just trial instead of concealing their true identities.

Value: minimum (0), Maximum (100), Value before crisis (24), Value after crisis (28)
Source: quantitative data, Transparency International

Analysis:
Since its inception in 1995, the Corruption Perceptions Index (CPI), Transparency International's flagship research product, has become the leading global indicator of public sector corruption. The index offers an annual snapshot of the relative degree of corruption by ranking countries and territories from all over the globe. CPI Score relates to perceptions of the degree of corruption as seen by business people and country analysts, and ranges between 100 (highly clean) and 0 (highly corrupt). Lebanon in 2019 got 28/100 (after the Syrian crisis) and 24 in 2011 (before).

[296] https://en.annahar.com/article/915724-on-lebanons-corruption
[297] Ibid
[298] Ibid

Before: (value - minimal value)/ (Maximal value - Minimal value) = (24-0)/ (100-0) = 0.24

After: (value - minimal value)/ (Maximal value - Minimal value) = (28-0)/ (100-0) = 0.28

The corruption in Lebanon has nothing to do with the Syrian crisis and its impact; however, a week governance, will translate its impact on the services people should receive when a crisis occurs. The Syrian crisis had occurred, it didn't change the level of corruption, but people asked for more services and then the it showed that the governmental entities were not able to respond. Good to note, that when the Lebanese government started receiving aid from the international communities, an informal source mentioned that a big amount from this money had been stolen but this is never formally confirmed and still doesn't affect the level of corruption.

As for the food security, like all sectors it is affected by the corruption and lack of services and policies offered by relevant institutions mainly the Ministry of Agriculture and its allies (Agricultural head of unions in the area, Agricultural technical schools, Lebanese Agriculture Research Centers, etc.). In addition, the food safety laws are not applied, the seasonal calendar for food imports/exports is neglected, usage of expired fertilizers and insecticides, and more. All these are the result of corruption and fraud translated into lack of money to send ministries' controllers, apply serious trainings, offering and supervising all the usages of chemicals. The FAO and other institutions are supporting farmers from the corruption, however, when done through any governmental entity, question marks will be raised regarding the fraud and impact. Finally, the corruption will put barriers to competitiveness on Lebanon's ability to bring food to markets where Lebanon lags behind its regional peers in a number of indicators including institutions, infrastructure, macroeconomic environment and market size and thus, ranks 113 out of 144 in the World Economic Forum's Global Competitiveness Index[299]. Among the country's key concerns are the high levels of bureaucracy, corruption and persistent government instability[300].

6- Food Security and Rule of Law

Food insecurity is at least in part connected to social inequalities and discrimination. Strengthening the entitlements of the food insecure as legal entitlements, including through access to justice and legal empowerment approaches, can significantly contribute to sustainable food security[301]. By anchoring responses to food security in the right to food, policies and programs are more likely to be responsive to the priorities of rights-holders: the right to food "empowers people to be active participants in decision making"[302]. Further, by viewing people as rights-holders, rather than passive objects of policy, new insights are gained into causes of food

[299] The World Economic Forum. (2014). The Global Competitiveness Report 2014-2015, Lebanon section 2.1 Country economy profiles p. 244 and 245. Retrieved from http://reports.weforum. org/global-competitiveness-report-2014-2015/
[300] Ibid
[301] Ibid
[302] FAO, RIGHT TO FOOD, MAKING IT HAPPEN: PROGRESS AND LESSONS LEARNED THROUGH IMPLEMENTATION at 170 (2011)

insecurity such as discrimination and socioeconomic exclusion[303]. It should be noted that there are two indivisible dimensions of the human right to adequate food: the right to be free from hunger and the right to adequate food. The right of everyone to be free from hunger implies an obligation that takes immediate effect.

As part of their obligation to promote the right to adequate food, States should develop a responsive and efficient legal and regulatory framework that clarifies the rights and obligations of rights-holders and duty-bearers and provides an enabling environment to implement the right to food[304]. The development of such a framework has implications for national constitutions, laws, courts and administrative fora, accountability mechanisms, and government policies and programs.

Upholding the right to food requires that people understand their rights and can access claims mechanisms and receive timely and fair outcomes. A key challenge is that those most vulnerable to having their right to food violated – such as the poor, minorities, women, customary rights holders, and pastoralists – are often those least able to access justice. These groups often have little insight into formal legal constructs: laws may not be well disseminated, be available in local languages, or may be too complex to understand. Even when such persons are aware of their rights, they may have difficulty accessing and enforcing their rights because of practical obstacles, such as cost, time, distance to travel, and barriers to communication, as well as the procedural complexity of laws[305].

Value: minimum (0), Maximum (7), Value before crisis (5), Value after crisis (3)

Source: Qualitative data

Analysis:

The Constitution of the Lebanese Republic does not contain provisions related to the right to adequate food. In addition, the right-holders which are the Lebanese people, are also not aware of their rights and that the duty-bearer hereinafter the state is obliged to preserve their right to food. In addition to that, the economic access and the level of discrimination is still considered low mainly in the rural areas which put people at risk of food insecurity. There has been no relevant data to calculate the number, however, it can be linked to domestic violence, the poor disabled people, malnutrition amongst kids and more. After the Syrian crisis, the numbers have been increasing specifically amongst refugees. These people have been de-attached from their original livelihoods in their home-country, left their houses and lands behind and seeking refuge in another place which already suffers from poverty.

The number before crisis based on the Likert Scale[306], will be estimated at 5 using the Likert Scale which is good because no case of death from hunger has been reported, however, social

[303] Ibid
[304] VALÉRIA BURITY ET AL, EXIGIBILADADE: MECHANISMS TO CLAIM THE HUMAN RIGHT TO ADEQUATE FOOD IN BRAZIl at 11-13 (FAO, Right to Food Studies, 2011); FAO, MAKING IT HAPPEN supra note 17, at 7
[305] https://www.usaid.gov/sites/default/files/documents/1866/IntegratingRuleofLawandGlobalDevelopment.pdf
[306] Likert: 7 =Excellent, 6=Very good, 5=good, 4= moderately good, 3=moderately bad, 2= bad, 1= very bad, 0=Worst.

workers believes that a not so small number in Lebanon face issues in reaching food. Hence, since no low exists also people are put under higher risks.

After the crisis the number will be put as 3 (moderately bad) since refugees has been helped by humanitarian organizations and no case of death from hunger was also reported. However, these people have been discriminated from the host community in some places. Fighting over resources and jobs in the Lebanese market has put both communities – Syrian and Lebanese – at higher risks of food insecurity[307].

7- Government effectiveness in reducing food insecurity

The main effectiveness indicators are represented as the scheme below[308]:

Figure 4:Effectiveness Indicators

The world Bank has defined an effectiveness indicator for governments; The index of Government Effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.

The index varies between: -2.5 = weak; 2.5 = strong. The World Bank provides data for Lebanon from 1996 to 2017. The average value for Lebanon during that period was -0.31 points with a minimum of -0.54 points in 2016 and 2017 and a maximum of -0.01 points in 1998. Lebanon's institutional system, and particularly its executive branch, is highly inefficient in designing, prioritizing and implementing strategic policies. Whereas institutions, such as the

[307] Unemployment in Lebanon, ECOSOC, Jan 2019, Myriam Zmeter (Co-Author)
[308] Good Governance Barometer (GGB), USAID, FH360, April 2015

central bank or poorly equipped army, still administer some crucial state functions, the government is based on principles and methods that regularly undermine effective governance[309].

Value: minimum (0), Maximum (7), Value before crisis (3), Value after crisis (2)

Source: Quantitative data – World Bank

Analysis:

The negative value cannot be considered as negative while calculating the index, hence it will be transferred to LIKERT Scale as the below:

WB scale	**Likert**
-2.5	0 (the lowest)
-2	1
-1	2
-0.5	3
+0.5	4
+1	5
+2	6
+2.5	7

The value before the crisis is (-0.515) which is the median of data from 2000 to 2010 done by the World Bank, on LIKERT scale equivalent to (3); the value before the crisis is (-0.78) which is the median of data from 2011 to 2017, on LIKERT scale equivalent to (2) since -0.78 is closer to (-1) than (-0.5).

The low data in Lebanon shows that the government is not efficient when it takes to any role related to food insecurity or other; Lebanese ministries' representatives raided in 2017 several warehouses in Lebanon where tons of food products not in compliance with health standards. Hence, machines used to print the forged expiry dates were also found in many shops and areas. These raids show that the government is serious in being efficient when it comes to the food safety of the people however, no more raids has been heard about through the media after this and the results of the raids also (if the shops were closed or no). The Lebanese people still believe that many food products consumables are expired and do not meet the health standards after these raids which is worrying. After the crisis the number has slightly decreased which can be analyzed that the Syrian crisis and the refugee influx challenged the efficiency of the Lebanese establishment where serious leadership, management and vision were needed; hence, till moment the issue is remaining in Lebanon regarding the government position to the Syrian crisis and the high number of refugees in Lebanon.

[309] https://www.bti-project.org/en/reports/country-reports/detail/itc/LBN/

8- Voice, Accountability and Transparency

As per the World Bank, "Voice and Accountability" captures perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. Lebanon has ranked 137th globally and second in the MENA region on the Voice and Accountability indicator. Compared to the region, Lebanese people do have a role in selecting the government where they elect their parliament representatives who have the role to select the president and monitor the role of the ministers. The Lebanese political system allows for freedom and expression and of the media. However, the freedom of press has always been at risk and economic, religious, political and legal pressures control sometimes the freedom of expression of journalists.

The access to information law prescribes that virtually all government entities – including public administrations, judicial authorities (civil and religious), municipalities, state-owned enterprises, private companies managing public assets and government concessions such as Electricite du Zahle – are required to automatically publish: an annual report and the laws, decrees or decisions they issue and the rationale behind issuance; and expenditures on their websites. A number of these entities currently do not have websites, so it is unclear how soon those offices could comply with this aspect of the law.

The country is consistently perceived as corrupt, according to global watchdog Transparency International, and Lebanon does not rate highly on the World Bank's ease of doing business index. Enforcement of the new law might, over time, help improve those rankings, as well as the business investment environment and the quality of services the government provides to the public – all while coercing Lebanese authorities to be more transparent and accountable to the citizens. The law came into effect in February but, while this magazine has not yet put it to the test, its implementation could face some obstacles, and another law is still required to establish a key body crucial to define what information actually is accessible[310].

Value: minimum (0), Maximum (7), Value before crisis (3), Value after crisis (3)

Source: Qualitative data – World Bank

Analysis:

Since the law has not yet been implemented yet, and the Lebanese people don't know anything related to information from official entities. This can affect all the sectors in country and what deals have been done, how much money has been stolen and others. The food system as all the business environment is harmed as well as the quality of the services delivered by specific ministries (Ministry of Agriculture, Ministry of Economy and Trade, etc.)

The average or median number as per the excel sheet done by the world bank before the Syrian crisis shows that the value is (-0.412) where -2.5 is the lowest and +2.5 is the highest. Same, after the Syrian crisis, where the value is (-0.45143). on the Likert Scale as the table below: the

[310] https://www.executive-magazine.com/special-feature/a-step-toward-transparency

two numbers are the same and refer to the "3" on the scale. The Syrian crisis has not directly affected how much the Lebanese establishment is transparent or no, it is an issue facing the country at all times.

WB scale	**Likert**
-2.5	0 (the lowest)
-2	1
-1	2
-0.5	3
+0.5	4
+1	5
+2	6
+2.5	7

9- Decentralization levels

"Decision making should not be centralized and not involving sub-national stakeholders". Decentralization has been a necessity in view of government capacity constraints; it has been a critical mechanism for engaging communities and ensuring more transparent governance[311]. Decentralization can be a critical element of good governance and development when it becomes a necessity for a government to be able to serve an underserved population from a close proximity. Decentralization is good for increasing transparency but can pose new challenges to coordination and resource mobilization.

In Lebanon, since the end of the civil war, politicians and academics have been discussing the decentralization while debated about major structural changes are still on-going. This small country of 4.5 million inhabitants has 1,108 municipalities, an extremely high ratio by international comparison. Some argue that the central government has set up local authorities to fail by encouraging the creation of smaller and therefore weaker municipalities, drawing more power as local tiers of governments became weaker, allowing political élites to distribute resources among themselves and among the sectarian groups they represent. Financially, local authorities are kept on a tight leash by the central government, which uses its discretionary power to control the revenues of the "Independent Municipal Fund" (IMF), irrespective of legal deadlines and criteria. This set-up favours central political control over good management and local autonomy[312]. The current decentralization framework in Lebanon includes municipalities and federations of municipalities (sometimes called "unions") – both of which are henceforth

[311] Governance and Institutions – World Economic and Social survey, 2014/2015.
[312] Reforming decentralization in Lebanon: The state of play – Democracy Reporting International, April 2017.

referred to as “local authorities”. Of late, the Syrian refugee crisis, the continuing waste management crisis and several security incidents added concerns for government officials and civil society actors alike and activated their interest in enhancing the role of local authorities across the country.

Value: minimum (0), Maximum (7), Value before crisis (3), Value after crisis (2)

Source: Qualitative data

Analysis:

In practice, Lebanon’s politicians have hindered the effective implementation of municipal governance. Lebanese local authorities suffer from a chronic lack of financial resources to initiate and implement sustainable development projects[313]. Partly because of financial limitations, local authorities are understaffed and unable to hire enough civil servants to perform their duties. In addition to the range of political, administrative and financial constraints on administrative decentralization, local authorities now accommodate around 1.5 million refugees from Syria, most of whom reside in the Beqaa Valley, around Beirut, and in the North[314].

An analytical framework that may be applied to the study of rural-urban linkages would allow policy-makers to address some questions from the point of view of the present discussion, such as how can decentralization contribute to the promotion of self-sustaining local development and food security, for example through strengthening rural-urban socio-economic linkages?

Self-sustaining agricultural development may be difficult to achieve locally without rural income diversification. There is evidence that a "virtuous circle" of reinvestment of non-farm income in agriculture, leading in turn to more non-farm income (through spinoff effects) and further reinvestment, can be set in motion[315]. Specific agricultural production decisions can often be traced back to measures of (non-farm) income diversification, which may be the safest and most sustainable means to ensure a sufficient level of agricultural productivity and hence medium-term food security.

A most important aspect relating to the potential of decentralized development is an improved income distribution. To the extent that decentralization measures lead to decentralized development by facilitating the diversification of rural households' income portfolios, they may contribute to poverty alleviation, rural development and food security. Without interrelated policies, there is no reason to assume that decentralization will by itself lead to lower income groups' obtaining more work and/or higher incomes, or to being better able to cope with risk. If carried out in a participatory fashion, the restructuring of rural institutions and local governments

[313] Ibid

[314] UNHCR. (2015–2016). Regional Refugee & Resilience Plan in Response to the Syria Crisis; Strategic Overview. United Nations High Commissioner for Refugees.

[315] See Evans and Ngau, 1991

under decentralization will create more and/or wider political spaces, and will help win legitimacy, for some of the marginalized stakeholders in rural development issues[316].

Considering all the facts above, including the weak decentralization in Lebanon and rural development initiatives, the local governance is weak before and mainly got weaker after the Syrian crisis; however, because of the refugee influx, International and National Non-Governmental Organizations alongside United Nations (UN) agencies, has received funds and implemented rural development projects more than any time before. Hence, this won't remove the fact that the local governance is still struggling because of the refugees' influx and the value would be 2 on Likert Scale after the crisis and 3 before.

Institutions and Governance Index – Refer to Annex 2 attached to this study

For each indicator: Ind1 = (Value – Min Value)/ (Max Value – Min Value).
Weight has been divided equally for all indicators while calculating the final capital index:

$$Capital\ Index = (Indicator1)^{w1} * (Indicator2)^{w2} * \ (indicator\ m)^{wm} = \prod_{i=1}^{m} (Indicator\ i)^{\ wi}$$

Indicator	**Weight**	**Value before crisis**	**Value after crisis**	**Final Value = Value^ weight**	
				Before	**After**
Local Peace Level: Political stability and absence of violence/terrorism (index)	0.166666667	0.7143	0.5714	0.945467871	0.910940559
Corruption levels	0.166666667	0.24	0.28	0.788318781	0.808834508
Food Security and Rule of Law	0.166666667	0.7143	0.428	0.945467871	0.868108406
Government effectiveness in reducing food insecurity	0.166666667	0.428	0.285	0.868108406	0.811224036

[316] Decentralization and rural food security: some theoretical and empirical relationships, Rural Institutions and Participation Service Rural Development Division – FAO

Voice, Accountability and Transparency	0.166666667	0.428	0.428	0.868108406	0.868108406
Decentralization levels	0.166666667	0.428	0.285	0.868108406	0.811224036
Total	**1**			**0.461017391**	**0.365409012**
Agriculture Research & Development	0.333333333	0.285	0.428	0.658084437	0.753612204
Ministries' Regulatory quality, fragility and Stability	0.333333333	0.285	0.285	0.658084437	0.658084437
Effectiveness of Agricultural Education Institutions	0.333333333	0.285	0.285	0.658084437	0.658084437
Total	**1**			**0.285**	**0.3263707**

$$Capital\ Index = (Indicator1)^{w1} * (Indicator2)^{w2} * (indicator\ m)^{wm}$$
$$= \prod_{i=1}^{m} (Indicator\ i)^{wi}$$

Indexes	**Weight**	**Before crisis Index**	**After crisis Index**	**Final Value Before = Value^ weight**	**Final Value Before = Value^ weight**
Index Gov	0.5	0.461017391	0.365409012	0.678982614	0.604490705
Index Inst	0.5	0.285	0.3263707	0.533853913	0.571288631
Final capital Index	**1**			**0.362477525**	**0.345338667**

The final Capital Index before the Syrian Crisis **0.362477525**

The final Capital Index after the Syrian Crisis = **0.345338667**

Conclusion:

The final indicator before the Syrian crisis was 0.362477525 and after 0.345338667. Considering "1" is the most preferred and best value and "zero" is the lowest and worst, both indicators are considered as bad in Lebanon.

Successful governance of a country requires sustainable development, the benefit of future generations, clear assignment of roles and responsibilities, accountability of decision-making, accuracy and transparency of information, sound performance and the rule of Law. Governance and Institutions impact all active economic sectors and systems in a country and not only agriculture and food systems.

Analysis

The indicators have been chosen to cover both the supply[317] and demand[318] side governances as without one aspect the integration of policies and programs into agricultural and nutrition interventions will end-up unsuccessful.

In a highly corrupted country such as Lebanon, moving toward inclusion, transparency, and accountability in national and local governments is highly challenged by those in power who will resist changes that threaten the status quo. Hence, this shows the importance of working on the demand side governance and put the Civil Society and people at the center of our work and plans.

Without good institutions, good governance cannot be reached; Good governance requires accountability, which necessitates effective Monitoring and Evaluation. The use of supreme audit institutions has been an important factor in tracking progress and ensuring efficient use of resources across all levels of government. Hence, the departments and institutions are as important as the policy itself.

As per the FAO: "Global governance of food security refers to a mechanism that facilitates debate, convergence of views and coordination of actions to improve food security at global but also at regional and national levels. In order to make substantial and rapid progress towards global food security, coherence and convergence are fundamental elements among policies and programmes of countries, donors and other stakeholders when addressing the underlying causes of hunger and, the recognition of the human rights dimensions of food security". In addition to the importance of policies and programmes, more actions are needed on a national level to improve the governance.

For this analysis, we will refer to The Good Governance Barometer (GGB)[319] universal criteria using our context specific local indicators. The universal criteria of good governance are defined as:

- Effectiveness: Leadership, Satisfaction with Services, Decision and Information, Financial Management, Vision and Plan.

[317] Refers to the ability of a government to implement policies and services that effectively respond to the needs of the citizens and stakeholders within agricultural and nutrition value chains.
[318] Refers to the institutions and mechanisms through which agriculture and nutrition value chains frame and articulate their concerns to government representatives, exercise their legal parts/rights, participate in political processes, and hold government accountable.
[319] Guide to the Good Governance Barometer, FHI 360

- Rule of Law: Incidence of Corruption, Citizen's Access to Justice, Existence of Legal Framework, Effectiveness of Legal Framework.
- Accountability: Integrity, Government Responsiveness, Resources, Checks and Balances, Transparency.
- Equity: Opportunity for Livelihoods, Access to Resources, Access to Power, Access to Basic Services, Legal Framework.
- Participation: Civic Engagement, Citizen Engagement, Institutional Framework.

All the five criteria are equally important to achieve good governance, hence, the image below is improvised to be linked further to the action plan:

If the index is between:

- 0 and 0.25: The Governance and Institutions status is very bad. Then, all the five criteria mentioned above should be analyzed and be included in an action plan including short, medium- and long-term interventions.
- 0.25 and 0.5: The Governance and Institutions status is moderately bad. Then, all the five criteria mentioned above should be analyzed and be included in an action plan including short, medium- and long-term interventions.
- 0.5 and 0.75: The Governance and Institutions status is moderately good. Then, an analysis should be done to find out what criteria out of five are not performing well. Once the criteria are defined (could be one or two), then an action plan can be set.
- 0.75 and 1: The Governance and Institutions status is very good. Then, an on-going analysis should be done to make sure the long-term policies and action plans won't be impacting the index in light of any global and national change.

In Lebanon, as mentioned above, the final indicator before the Syrian crisis was **0.362477525** and after **0.345338667** which means that **the Governance and Institutions Index is moderately**

bad close to the very bad status. Hence, all five criteria need to be revised and included in an action plan as the below. The burden of the Syria crisis and the high influx of refugees has put a lot of pressure on the already vulnerable government agencies and institutions who have fewer resources and capacity to deal with such displacement. As per the UNDP, individual and institutional vulnerabilities are consistently and rapidly deteriorating in Lebanon. However, the Lebanon Crisis Response Plan formed from international donors, ministries, UN agencies and INGOs, are inventing in institution and quality of services for a one main goal to support the poor Lebanese and Syrians living in country.

Action plan

The action plan will be influenced by the "Food Sovereignty concept" where we will highlight the importance of expanding citizen participation and gender inclusion in the co-production of knowledge, policies, and institutions for the democratic governance of food systems and the territories they are embedded in[320].

The action plan will be covering all the five criteria and the indicators relevant to the Lebanese context and its Food System as per our own previous analysis. The recommendations below are only related to the agricultural institutions and governance as the whole system in country is not part of our recommendations, it needs more political and governance experts and needs a lot of action plans to be able to improve.

Term	**Aspects**	**Action Plan**
Short-Term	- Institutions effectiveness through decision and information	-An independent Food Safety board should be formed, responsible to coordinate the activities amongst the agencies in the food chain (Indicator 2). A bi-yearly meeting should take place between these agencies to revise general aspects and inform the public through a national report.
	- Effectiveness through satisfaction with services	- A specific budget should be designated to support the ministries and their agencies to computerize systems and upgrade laboratories. The computerized systems will improve the effectiveness of the services delivered, generate data and ease data analysis, and reduce the bureaucratic and time-consuming administrative procedures; the laboratories will mainly be used for micro-biological tests with minimal fees for small-scale farmers in Lebanon. "the public administration capacity is often a constraint for policy coordination and coherence".

[320] One of the four dimensions of the food sovereignty concept.

	- Accountability through integrity and transparency	- The formation of an Agricultural Supreme Audit Institution is important to track progress over the food chains and ensure efficient use of resources across all levels of the main agencies. More broadly, Monitoring and Evaluation Systems have improved accountability while increasing coordination and coherence across the agencies.
	- Participation through agricultural stakeholders' participation	- The first thing that the government can start doing is to listen to the citizens, agricultural value chains actors and civic societies. A "complaint and feedback mechanisms" through a hotline number for agricultural stakeholders and all citizens should be in place as the beginning of analyzing the needs and challenges to inform policies and decisions later. The government can collaborate with CAS (Central Administration of Statistics) to produce a yearly report for all complaints/challenges, present it to other NGOs and private sector actors and work upon addressing the issues through policies and programmes.
Medium-Term	- Effectiveness through vision and plans	- In the situation where the government lack the resources to provide key agricultural services for target populations, partnerships with a variety of non-governmental actors at global, national and local levels have proven a relevant avenue both for enabling achievement of "Development goals" and "improving governance through its capacity building".
	- Improve policy coordination	- All formed boards such as the Food Safety Board, ministries, private sectors and UN agencies should collaborate in an organized manner for an improved policy coordination. The working Group should be led by the Ministry of Agriculture. The policy coherence and coordination is important for development policy in general especially in resources-constrained contexts.
	- Improve participation through food production and processing policy meetings at area level	- A participatory approach through roundtables in all areas to share the voices of agricultural stakeholders is a necessity to inform policies. In collaboration with the Chambers of Commerce in all areas, LARI can take the lead bi-yearly to produce policy briefs, inform the higher government and other national and international audiences.

Long-Term	- Equity through decentralization	- Decentralization is a necessity and a critical mechanism for engaging communities and ensuring more transparent governance. The government should be able to serve and understand population from a close proximity. The Ministry of Agriculture in Lebanon should re-assess the role of each agency outside the capital, assess its needs and work on empowering these agencies financially and through decision making. Educating and empowering the ministries and agencies/institutions staff should be one of the main steps towards strong, decision-maker agencies. - Empowering the Municipalities in Lebanon is a long-term action that the civic society should also be part of as municipalities in Lebanon are linked to political groups. The municipalities also as institutions need to be empowered financially through "Local Economic Development Plans" including agriculture mainly in rural areas.

Environmental Practices, Food Safety and Nutrition and Natural Resources Capital

Objective: In this study, we will identify the importance of the environmental practices, the food safety aspects and the natural resources status in maintaining the resiliency and the sustainability of the food systems. Understanding the scope of the problem related to these aspects is essential to show the high risks that can be put on people' health in the short, medium and long run and not only on the food system by itself.

Abstract:

With growing academic recognition of environmental degradation and loss of biodiversity, as well as a dramatically increasing body of evidence of the unsustainable nature of agriculture as it is currently practiced in many parts of the world, renewed attention has been directed to sustainability in all its forms, including healthy diets. The alarming pace of food biodiversity loss and ecosystem degradation, and their impact on poverty and health makes a compelling case for re-examining food-agricultural systems and diets.

To address also the food and nutrition needs of a richer and more urbanized growing world population, while preserving natural and productive resources, food systems have to undergo radical transformations towards more efficiency in the use of resources and more efficiency in applying sustainable environmental practices.

In this analysis, we will define the indicators related to 3 sub-pillars: Environmental Practices, Food Safety and Natural Resources, and analyse each separately. The indicators have been

chosen from a pool of indicators, they are the most relevant to the Lebanese context and the food system. Once the indicators are analysed, we will highlight the link between the three sub-pillars– considering the Lebanese context – by creating the final composite index; the index will be created and compared to before and after the Syrian Crisis to perceive the sustainability and resiliency of the system and how it reacted to the shock.

Introduction:

For too long now, the issue of food security has focused on the quantity of food with very little or no attention given to the quality of food. FAO data show that one billion people suffer from hunger, while even more people are overweight or obese. In both groups, there is a high prevalence of micro-nutrient malnutrition. Improving nutrition through better balanced nutritious diets can also reduce the ecological impact of dietary choices. Therefore, a shift to more sustainable diets would trigger upstream effects on the food production (e.g. diversification), processing chain and food consumption[321].

As per the FAO and Biodiversity International' symposium[322], the "*Sustainable diets are those diets with low environmental impacts which contribute to food and nutrition security and to healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy; while optimizing natural and human resources*". Nutrition and biodiversity are central to sustainable development: minimizing environmental degradation and biodiversity loss are interlinked with food safety and better diets. Furthermore, a healthy natural environment is essential to sustaining the agricultural sector and produce safe food. However, agricultural policies and practices also play an increasingly influential role in sustaining a healthy natural environment: inappropriate agricultural practices and land use have a negative impact on natural resources, such as pollution of soil, water and air, fragmentation of habitats and loss of wildlife; the final results will be harming the environment and its natural resources, production of unsafe food which will affect the health of people and the export to international markets, increase in food loss and eventually unstable food prices.

From a policy perspective, in January 2000, the European Commission published the policy document "Indicators for the Integration of Environmental Concerns into the Common Agricultural Policy", which identified a set of agri-environmental indicators to serve the following purposes:

- Provide information on the state of the environment in agriculture
- Understand and monitor the linkages between agricultural practices and their effects on environment

[321] Sustainable diets and biodiversity, directions and solutions for policy, research and action. FAO and Biodiversity International, November 2010.
[322] Ibid

- Provide contextual information, particularly concerning the diversity of the EU's agri-ecosystems
- Assess the extent to which agricultural and rural development policies promote environment friendly farming activities and sustainable agriculture
- Inform the global assessment process of agricultural sustainability

In Lebanon, the National Council for Scientific Research (CNRS), monitored the status of land degradation in Lebanon in 2012 for the main reasons below[323]:

Natural:

- Rugged topography with 64% of territory having complex landform with sloping and steep slopes.
- Old deforestation
- Poor drainage
- Weak lithology
- Heavy rainfall.

All these factor cause: • Flash floods • Erosion • Mass movements and landslides

Human induced:

- Forest fires
- Chaotic urban sprawl amplifies the negative impact of deforestation.
- Inappropriate irrigation practices and fertilizer application secondary soil salinization.
- Improper practices also lead to deterioration of groundwater quality and soil contamination hazards.

Hence, in this study and taking into consideration all of the above, a new framework has been designed to address the main interlinkages between the environment and agriculture, in addition to the inclusion of safety aspects affecting the health of people to ensure a good representation of the "sustainable diet" concept (e.g. number of people with access to safe water, etc.).

A- Natural Resources

1- Land

1-1- Land structure – Arable land

Agricultural land is defined as the land area that is either arable, under permanent crops, or under permanent pastures. Arable land includes land under temporary crops such as cereals, temporary

[323] http://www.fao.org/fileadmin/user_upload/GSP/docs/Presentation_NEMA_Inception/Francis_Lebanon.pdf

meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow.

The tables below represent the basic land data:

General Data		
Sq.km		ha = sq.km*100
Total land area (estimation)	10,400	1,040,000 ha
Urban land area (estimation)	2,317.5	231,750 ha ≈ 22.2% of total area
Rural land area (estimation)	8,081.99	809,199 ha ≈ 77.8% of total area

Source: World Bank data 2010

Land agricultural characteristics	**Number estimation**[324]
Agricultural land (% of land area)	Roughly 64.32% (till 2016); 658,000 ha *Before the Syrian crisis the value was 62 and 63%*
Agricultural irrigated land (% of total agricultural land)	Roughly 20.33% (till 2007)
Arable land (% of land area)	Roughly 12.093% (till 2015); 132,000 ha
Land under cereal production (ha)	57,198 ha (2016);
Permanent crops (% of land area)	12,317% (2016); 128,096 ha
Forest area (% of land area)	13,43% (2016)

Source: World Bank Data; web portal

Moreover, Lebanon is one of the most urbanized countries in both the world and the Arab region, with 87% of its population of 4 million living in urban areas and the majority - estimated at 64% - residing in the metropolitan areas of Beirut and Tripoli. Urban expansion in Lebanon is concentrated in and around the main coastal cities (Beirut, Tripoli, Saida and Tyre), between secondary cities and in the form of informal areas on the belts of cities[325].

Value: minimum (0), Maximum (74%), Value before crisis (11.144%), Value after crisis (12.093%)

Source: Qualitative data

Analysis:

The top three countries with the most arable lands are Bangladesh (59.6%), Denmark (56,6%) and Ukraine (56.6%) compared to (12.093%)[326] in Lebanon. A country that has a small

[324] Knoema.com, world data atlas, Lebanon.
[325] Lebanon – Urban issues, UN Habitat, https://unhabitat.org/lebanon-urban-issues
[326] World Bank data, web portal

percentage of arable land is a country that cannot grow crops and depends on the import of food which will further harm its economy. Arable land is a necessity for countries working towards their food security.

Lebanon, the small country, is mostly mountainous with only two agricultural areas making the availability of arable land difficult. In addition, the population growth – including refugees – and the high costs of houses (the real estate sector) made people urbanizing the agricultural lands. One a second hand, the Syrian crisis did not affect drastically the land characteristics (almost same % of arable land before and after the crisis).

Improving the arable land in Lebanon and finding solutions to increase its percentage – considering its small size and mountainous characteristics – is by empowering the agricultural sector such as the real estate and improve the irrigation system to make the remaining agricultural lands arable.

Based on literature, and considering the percentages of the countries with the highest arable lands, an ideal scenario is where a country has a high percentage of arable land and feeding its economy from agriculture. The split on Likert scale will be:

Based on the countries with most arable lands, the maximum value will be set as 74% a number that Bangladesh reached in the 1988 based on the analysis of the World Bank data. Hence, the minimum will be as Zero the worst value since the country with no arable lands cannot grow crops and will rely heavily on food imports (case of Greenland as per the World Bank data). Lebanon will have a value of 12.093% in 2015 as per the World Bank and 11.144% in 2010 before the Syrian Crisis. Hence, there is no available data showing the link between the influx of refugees and the slight increase in arable lands in Lebanon. However, as per the field interviews, we can conclude that the Syrians – specifically in rural Lebanon – have been investing in abandoned lands where they live in tents and produce mainly vegetables (green leaves were the main products that farmers mentioned as it is less costly than citrus and other crops). This fact might justify the increase in the percentage of arable lands.

1-2- Quality of Soil

The soils of Lebanon are typically Mediterranean, generally calcareous except for the sandy soils formed on the basal cretaceous strata of the Akkar Plain and the alluvial soils of central and western Bekaa Valley.

The uncontrolled usage of pesticides and fertilizers, besides killing harmful bacterial insects, kills also useful bacteria, birds, and plants, leading to decomposition and sterility of the soil. The cheap chemicals and their unrestricted use demonstrate the lack of awareness amongst all parties whether importers of chemicals, distributors, and farmers. Pesticides pollution, urbanization, deforestation, urbanites, fertilizers and insecticides, exert huge negative impact on agricultural life and soil degradation, poisoning it. Furthermore, farmers often irrigate with contaminated water, especially in the summer month to offset water shortages. The greatest danger lies in the

applied pesticides and fertilizers that comprise nitrates. Agriculture will not then be the only victim of soil pollution. A great number of mammals, fish, birds, even wild life, and rare aromatic and medicinal plants would be damaged and suffer extinction. Lebanon hosts over 600 wild plants species[327]. Furthermore, the illegal hunting tools used such as led pallets, poison the soil reaching the underground fresh water and contaminating it. In the rivers, illegal overfishing is practiced through dynamite and small size trawling nets threatening the life of many fish species. It also damages the natural habitat urbanization has not yet claimed and abused[328].

Finally, land pollution, better known as trash, is a major problem in Lebanon. In total there are 9 sanitary landfills, 3 of which are operational, 3 are constructed and the rest planned or under construction. Experts say it contains industrial as well as domestic waste. As per Greenpeace, there's certainly a huge scope for toxic heavy metals, toxic pollutants like household chemicals, that are mobilized into the marine environment and lands.

Value: minimum (0), Maximum (1), Value before crisis (0.602), Value after crisis (0.602)

Source: Qualitative data

Analysis:

Chemical properties – sample taken from two areas in Lebanon, one in North Lebanon (Menjez Municipality) and one in Mount Lebanon (Jabal Moussa), the soil properties have been tested by the Lebanese Agricultural Research Institute (LARI):

	Minimal Value	Maximum Value	Unit	Current Value	Standard Current Value	Weight	Final Value
PH	0	8	No unit	7.05	0.88	0.18	0.1584
Organic matter[329]	0	8	Percentage	3.325	0.42	0.18	0.0756
Electrical conductivity (EC)[330]	0	148	MilliSiemens per meter mS/m	108.75	0.36	0.16	0.0576
Total nitrate in soil	0.1	0.407	Percentage	0.306	0.67	0.16	0.1072
Exchangeable P2O5	15	607.63	Ppm	225.245	0.65	0.16	0.104
Exchangeable K2O	400	1654.17	Ppm	880.893	0.62	0.16	0.0992
						1	**0.602**

[327] The Environment in Education: Pesticides in Lebanon, Akl Kayrou, Issam Atala, 2015

[328] Ibid

[329] Soil with close to 50% clay may need around 6% organic matter. The clay content of the soil samples in Lebanon ranged between 16-70% so the ideal % of organic matter range between 3 to 7%.

[330] Optimal EC levels in the soil therefore range from 110-570 milliSiemens per meter (mS/m). Too low EC levels indicate low available nutrients, and too high EC levels indicate an excess of nutrients.

**Standard Current Value= (value - minimal value)/ (Maximal value - Minimal value) *Index= ∑Final Value *Final Value = Standard Current Value*Weight*

As per the table above, the final index is 0.602 which is considered good comparing the current value to the maximum and minimum of zero. We considered mainly the chemical properties of the soil in this case as it is our main source when analyzing the soil pollution. It is estimated that the value will decrease with time as described above as a reason for the aggressive usage of pesticides and waste landfills. Hence, soil conservation practices[331] are tools the farmer can use to prevent soil degradation and build organic matter. These practices that include: crop rotation, reduced tillage, mulching, cover cropping and cross-slope farming, are not well practiced in Lebanon where farmers lack awareness and technical skills.

1-3- Land Degradation and Conservation

This indicator reflects the importance of land conservation from a physical point of view to complement the chemical one mentioned above. As addressed, several natural and human-induced factors contributed to land degradation in the country. The status of Lebanon's landcover/land-use has been characterized by a continuous change over the last decades[332]. More specifically, the natural and built environments have been continuously affected by the lack of land management plans and/or inadequate urban regulations. This contributed to unplanned urban sprawl at the expense of natural landscapes[333].

As per the Lebanon Final National Report on Land Degradation Neutrality Target Setting Programme done in February 2018 using a comparative analysis between the year 2000 and 2010, the country had losses in vegetative covers, namely forests, grassland, and cropland as per the figure below:

[331] Soil conservation is the prevention of loss of the top most layer of the soil from erosion or prevention of reduced fertility caused by over usage, acidification, salinization or other chemical soil contamination.

[332] First National Report on Land Degradation Neutrality, UNCCD
[333] Ibid

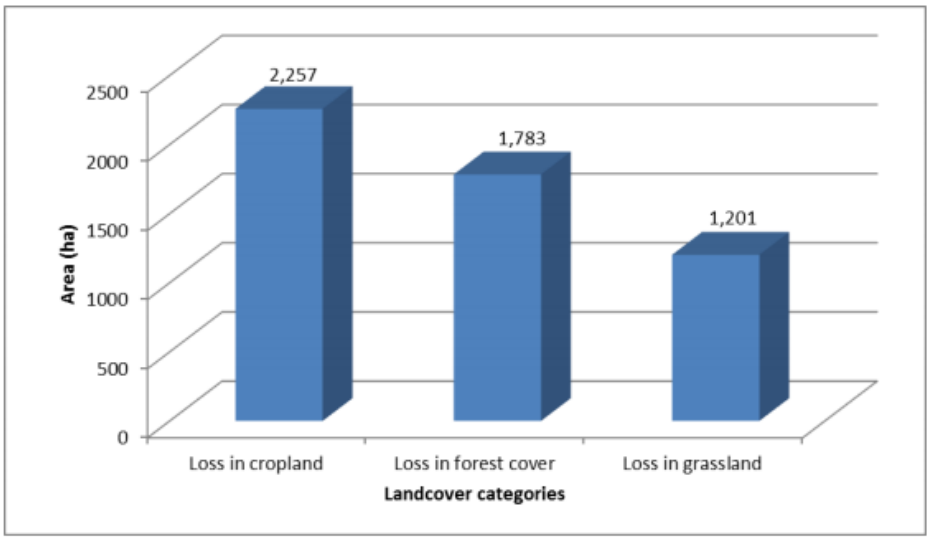


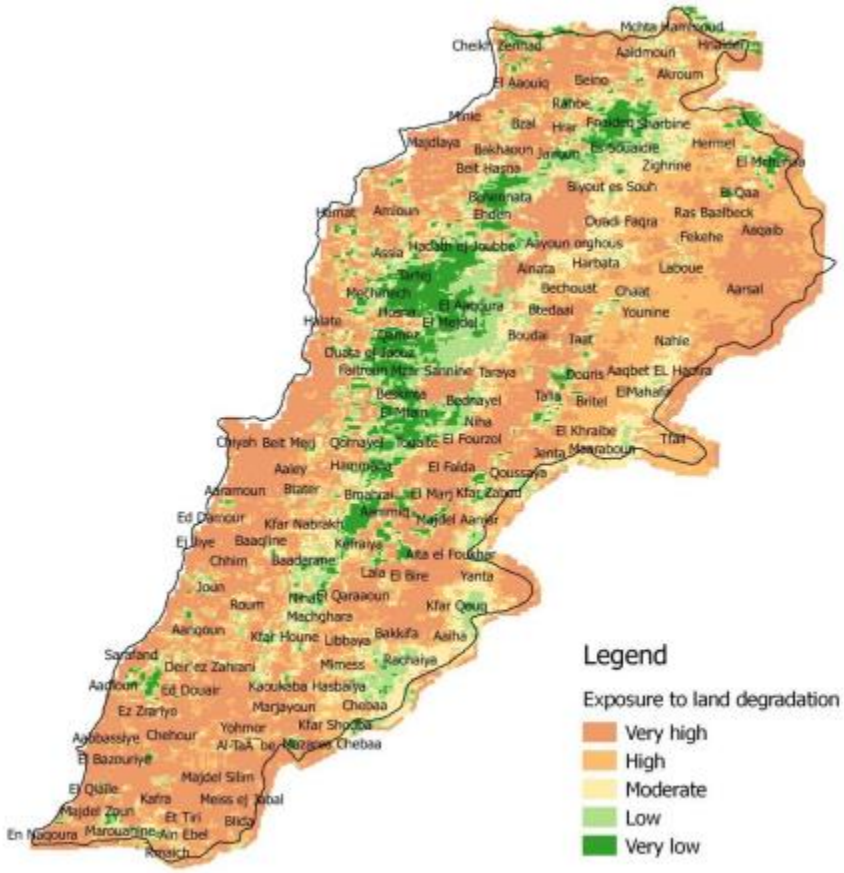
Figure 5:Comparative Analysis

In addition, five classes of exposure to land degradation were produced[334]:

- Very low exposure (>857 Kg C/m2)
- Low exposure (593 Kg C/m2 to 857 Kg C/m2 inclusive)
- Moderate exposure (362 Kg C/m2 to 593 Kg C/m2 inclusive)
- High exposure (90 kg C/m2 to 362 Kg C/m2 inclusive)
- Very high exposure (<= 90 Kg C/m2)

A map of exposure to land degradation showing the spatial distribution of the five classes was generated:

[334] Final National Report on Land Degradation Neutrality Target Setting Programme, February 2018



Value: minimum (0), Maximum (7), Value before crisis (2), Value after crisis (2)

Source: Qualitative data

Analysis:

As per the figures above, many constraints and issues are affecting the lands in Lebanon and the exposure to land degradation is relatively high except in the high mountains were the population is very low. Qualitatively analysing the facts and linking them to the exposure to land degradation, the scale is as:

% of exposure	**Likert**
100%	0 (the lowest)
Very high (80%)	1
High 60%	2
Moderate 40%	3
Low 20%	4
Very low 10%	5

Almost Zero 5%	6
Zero 0%	7

The more percent of land exposed to degradation, the low the number is on Likert Scale; as per the map, the percentage is around 60% which is high and reflected at (2) as per the Likert Scale.

Furthermore, Lebanon's environmental assessment of the Syrian conflict (MOE/EU/UNDP, 2014) documented facts in relevance to possible impact on land resources: Syrian refugees who live in ITSs occupy more land than those who live outside ITSs; tents cannot grow vertically and must also comply with UNHCR specifications related to inter-tent spacing. The largest concentration of Informal Tented Settlements (ITSs) are located in the Beqaa (712 ITS) followed by Akkar (300), which represent Lebanon's largest agricultural regions[335]. As the number of Syrian Refugees continues to rise, further ITSs growth will inevitably encroach on agricultural lands and put those lands out of production, unless agricultural lands are designated by the Government of Lebanon (GOL) as exclusion zones. However, considering all these facts, the value will remain the same as before the crisis which is 2 on Likert Scale unless the ITSs of refugees take additional 20% of land which is very difficult to happens.

2- Water

2-1- Water Quantity

Water is one of Lebanon's most precious resources. There are 267 public wells which are operated by the Water Establishments and are used within the public supply network. In comparison, there are 42,824 privately owned wells, of which around 51% are illegally drilled[336]. Many activities affect the water cycle (deforestation, dams, irrigation, drainage canals) thereby altering the conditions for water replenishment. For example, soil erosion (soil acts as a sponge) and the loss of plant cover (plants intercept rainfall) diminish groundwater recharge. Continued soil erosion and loss of plant cover (including forests), will lead to scarcer water resources and poorer water quality[337].

Facts about the water sector in Lebanon:

- Demand: 60% agriculture, 29% domestic,11% domestic[338].
- Renewable internal freshwater resources per capita (cubic meters): 766m³/per[339] in 2014.
- Level of water stress: freshwater withdrawal as a proportion of available freshwater resources: Lebanon ranked #3 worldwide for water stress – 4.82 over 5[340].
- Infrastructure: old or outdated in some areas and poorly maintained.

[335] Lebanon Environmental Assessment of the Syrian Conflict & Priority Interventions, September 2014, UNDP
[336] Ministry of Energy and Water 2010 report
[337] Lebanon State of the Environment Report Ministry of Environment/LEDO
[338] Climate Change and the Environment in the Arab World Program, AUB
[339] World Bank Data portal
[340] World Resources Institute's Aqueduct Water Risk Atlas

Data on water use in Lebanon are contradictory. Official estimates put total water use in 2010 at 1.59 billion m3, including 0.27 billion m3 (17%) from public wells for drinking water supply. In 2005, the FAO estimated water withdrawal was at 1.31 billion m3 or about 63% of economically exploitable water resources.

Value: minimum (0), Maximum (5), Value before crisis (3.8), Value after crisis (4.82)

Source: Qualitative data

Analysis:

Analysing the quantity of water indicator will be considering the level of water stress in the country. Lebanon has ranked the third water stressed country[341] in the world with a score of 4.82 over 5[342]. Water use in agriculture represents around 60% of water consumption in Lebanon (as above) which is considered the most water-demanding sector; Lebanon needs to make every drop of water go further in its food systems. Farmers can use seeds that require less water and improve their irrigation techniques by using precision watering rather than flooding their fields. Financiers can provide capital for water productivity investments, while engineers can develop technologies that improve efficiency in agriculture. And consumers can reduce food loss and waste, which uses one-quarter of all agricultural water.

Back to the water stress index, the worst country in the world is Qatar with a 4.97 over 5 and the best is Paraguay with 0.01[343] – Considering 0 the minimum and 5 the maximum. To calculate the index, the value after the Syrian crisis is 4.82 (as the data is for 2019).

If we compare the results since 2011, we spot an increase of (6%) yearly in water stress in an average water year at the national level that masks hot spots of water scarcity at the local geography[344]. Before the Syrian conflict, Lebanon was the 28 most water-stressed country in the world[345]; using the same index scale in 2019, the 28th level means that the index in the country was around 3.8 over 5 before the Syrian crisis. With more than one million refugees in country starting 2011, while domestic water use increased by 20%, we find that refugees' water use is only 10% of agricultural water use in summer. We also show that interventions to rehabilitate the water networks can reduce water stress to better than pre-conflict levels (3% less stress)[346].

After: (value - minimal value)/(Maximal value - Minimal value) = 4.82/5=0.964

Before: (value - minimal value)/(Maximal value - Minimal value) = 3.8/5=0.76

However, since the scenario shows that 0 is the most favourable value and 5 is the worst, the value of "After" should be less than the value of "Before" the crisis. Hence, the final number will be as:

[341] A region is said to be under 'water stress' when the demand for water there exceeds the available volume or when poor quality restricts use.
[342] https://www.statista.com/statistics/1097524/water-stress-levels-by-country/
[343] Ibid
[344] Refugees, water balance, and water stress: Lessons learned from Lebanon, Springer link, 2019
[345] Ibid
[346] Ibid

Final value = 1-initial value

Value final after= 1-0.964= 0.036

Value final before = 1-0.76= 0.24

2-2- Water Quality

Water pollution is a major problem in Lebanon, which is has been exacerbated lately. Various factors are responsible for water pollution in the country. – Untreated Sewage: considered one of the most contaminants of water sources; according to a study, around 70% of all fresh water sources were exposed to untreated sewage from various homes and business premises[347]. – Industrial effluent into the sea: the seawater in Lebanon has a high incidence of chemical contamination. More so, a recent study concluded that plastic contaminants were encountered under water of the Lebanese shore. In addition, disposed oil from ships and wastes are also part of the causes of water pollution in Lebanon[348]. – Agrochemicals: Another source of water pollution in Lebanon is the use of fertilizers and pesticides. Farmers in Lebanon use pesticides and fertilizers without conformity with government regulation. At a point, the government was able to put in place an effective protocol to curb the abuse of fertilizers and pesticides. However, Government efforts to regulate agricultural activities to prevent pollution suffered serious setbacks. – Improper disposal of solid waste: Another cause of water pollution in Lebanon is that solid waste are improperly disposed into water sources. This occurrence prompted Lebanon's Ministry of Environment to issue a waste management directive putting an end to the use of incineration. This is because when solid wastes are incinerated, the particles remaining are carried by flood to contaminate fresh water sources when heavy rain falls. – Landfilling: Landfilling is another cause of water pollution in Lebanon. Lebanon produces over 150 tons of waste daily. One of the usual ways of disposing this waste is by land filling them. The consequence of this is that when rain falls, the liquid part of the waste is carried by flood to cause pollution of fresh water sources.

Historically, the government of Lebanon took several steps and instituted numerous reforms to fight water pollution. Because of the political situation, these reforms were never instituted.

Value: minimum (0), Maximum (100%), Value before crisis (70.78%), Value after crisis (78.78%)

Source: Qualitative data

[347] Advanced BMI, Weight Loss Clinic, water pollution in Lebanon, 2016
[348] Ibid

Analysis:

Based on the latest data, the water pollution in Lebanon is 78.78%[349] where it is considered high and very critical. Poor quality water can be responsible for slow growth, poor aesthetic quality of the crop and, in some cases, can result in the gradual death of the plants.

Based on the study "Effect of Irrigation Water Quality on the Microbial Contamination of Fresh Vegetables in the Bekaa Valley, Lebanon" done in 2018 by Dr. Amal Mcheik et al: A total of 33 vegetable samples and 38 water samples were collected from 5 villages of the Bekaa valley. The 38 water samples include 33 well water samples taken from the same places where the vegetable samples were taken and 5 water samples taken from the Litani River[350] passing through the 5 villages. All the vegetable samples taken were irrigated from well waters located near the Litani River and passing through the five villages. The microbiological analysis of the well water samples indicated that all the samples taken from the 5 sites were contaminated with total coliforms and most of them were contaminated with faecal coliforms, E. coli and S.aureus. At Deir Zanoun, about 92.4% of the well water samples were contaminated with faecal coliforms and 78.7% were contaminated with S.aureus. as a result, the primary source of contamination of vegetables is from irrigated water. But also, many sources of contamination may be responsible including "daefacation" from humans and animals on marginal lands around the farms and from the application of fresh poultry manure on farm plots.

When it comes to water quality and the impact of the high number of refugees in Lebanon, the main concern comes from the increased pollution from wastewater (WW) discharges. Given the lack of accurate data, it is difficult to determine the fate of the incremental WW generated by the refugees in the various Lebanese regions. However, as only eight percent of the WW generated at the national level is treated and the remaining is discharged into open lands or in watercourses, it is expected that similar trends would apply to the WW generated by the refugees. Hence, as per literature, there is no data confirming the exact percentage of water pollution before the crisis, we will estimate an increase of 8% in water pollution and so the number is *70.78%*.

After: (value - minimal value)/(Maximal value - Minimal value) = 78.78/100=0.7878

Before: (value - minimal value)/(Maximal value - Minimal value) = 70.78/100=0.7078

However, since the scenario shows that 0 is the most favourable value and 100 is the worst, the value of "After" should be less than the value of "Before" the crisis. Hence, the final number will be as:

Final value = 1-initial value

Value final after= 1-0.7878= 0.2122

Value final before = 1-0.7078= 0.2922

[349] https://www.numbeo.com/pollution/country_result.jsp?country=Lebanon

[350] The Litani River, the largest river in Lebanon. The river rises in the fertile Beqaa Valley, west of Baalbek, and empties into the Mediterranean Sea north of Tyre.

3- Air

3-1- Air Quality

Air pollution is the introduction of chemicals, particular matters, or biological materials that cause harm of discomfort to humans and other living organisms, and damages the natural environment into the atmosphere.

Air pollution places a major burden on world health. In many places, including cities but also in rural areas, exposure to air pollution is the main environmental threat to health and kills an estimated seven million people worldwide every year[351]. Not only does exposure to air pollution affect the health of the world's people, it also carries huge economic costs and represents a drag on development, particularly for low- and middle-income countries. Air pollution injury to plants can be evident in several ways. Injury to foliage may be visible in a short time and appear as necrotic lesions (dead tissue), or it can develop slowly as a yellowing or chlorosis of the leaf. There may be a reduction in growth of various portions of a plant. Plants may be killed outright, but they usually do not succumb until they have suffered recurrent injury.

Value: minimum (0), Maximum (7), Value before crisis (3.5), Value after crisis (3.5)
Source: Qualitative data

Analysis:
Air pollution is a huge mess in Lebanon that is causing damages to people's safety and earth's climate also. As per the World Bank data:

- PM2.5[352] Air pollution, mean annual exposure (micrograms per cubic meter): 30.621 mg/m3. The maximum country is Nepal with 100/10 and the lowest are Finland, Canada, Sweden and Iceland with 6 over 100[353].
- % of population exposed to levels exceeding WHO interim target: 99.5% of the population in 2017
- Agricultural methane emissions (thousand metric tons of CO2 equivalent): 275 tons of CO2 (2008 last value)

The guideline set by the World Health Organization (WHO): PM2.5 Air pollution, mean annual exposure (micrograms per cubic meter) is that annual mean concentrations should not exceed 10 micrograms per cubic meter, representing the lower range over which adverse health effects have been observed. Just 24 countries have less than or equal to 10 micrograms per cubic meter.

[351] Air Pollution, World Health Organization
[352] Fine particulate matter (PM2.5) is an air pollutant that is a concern for people's health when levels in air are high. PM2.5 are tiny particles in the air that reduce visibility and cause the air to appear hazy when levels are elevated.

[353] The World Bank also calculates the percentage of population exposed to levels exceeding WHO guidline value. However, this is not what we need to look a only as the pollution from the mean annual exposure can be linked plant injuries.

Lebanon has a value of around 30 over 10 for the last 7 years (30.621 in 2017 and 30.892 in 2010)[354]. Hence, the numbers cannot be calculated based on our standard formula; to do so, the values will be reflected into the Likert Scale.

mg/m3	**Likert**
100	0 (the lowest and worst)
Very high 80	1
High 60	2
Moderate 40	3
Low 20	4
Very low 10	5
Almost Zero 5	6
Zero 0	7 Ideal

Based on the improvised reflection and considering Lebanon data, the value of Lebanon will be 3.5 (as both values "30" are between 20 to 40).

After: (value - minimal value)/(Maximal value - Minimal value) = 3.5/7=0.5

Before: (value - minimal value)/(Maximal value - Minimal value) = 3.5/7=0.5

B- Food Safety and Nutrition Aspects

4- Population data[355]

These aspects are all related to the health of people resulting from the use of safe food and water. Including them in our index is important to show how at risk are people are to food insecurity if a shock occurred. Water is important for food security, which is defined as the regular access of people to enough high-quality food to lead active, healthy lives. This is especially true in developing countries. People who have better access to water tend to have lower levels of undernourishment. The FAO indicators are the main indicators representing the "utilization" pillar of the food security. They are directly linked to the food safety of people from a water aspect.

4-1 Percentage of population using safely managed drinking water services

Before the crisis – 2011 data: 46.6%

After the crisis – 2016 data (latest): 47.7%

[354] World Bank Data, Web portal
[355] All Data from FAO Web portal

Before: (value - minimal value)/(Maximal value - Minimal value) = 46.6/100=0.466

After: (value - minimal value)/(Maximal value - Minimal value) = 47.7/100=0.477

4-2 Percentage of population using at least basic drinking water services

Before the crisis – 2011 data: 90.4%
After the crisis – 2016 data (latest): 92.6%

Before: (value - minimal value)/(Maximal value - Minimal value) = 90.4/100=0.904

After: (value - minimal value)/(Maximal value - Minimal value) = 92.6/100=0.926

4-3 Percentage of population using safely managed sanitation services

Before the crisis – 2011 data: 19.9%
After the crisis – 2016 data (latest): 21.5%

Before: (value - minimal value)/(Maximal value - Minimal value) = 19.9/100=0.199

After: (value - minimal value)/(Maximal value - Minimal value) = 21.5/100=0.215

4-4 Prevalence of obesity in the adult population (18 years and older)

Before the crisis – 2011 data: 26.7%[356]
After the crisis – 2016 data (latest): 30.84%[357]

Before: (value - minimal value)/(Maximal value - Minimal value) = 26.7/100=0.267

After: (value - minimal value)/(Maximal value - Minimal value) = 30.84/100=0.3084

However, since the scenario shows that 0 is the most favourable value and 100 is the worst, the value of "After" should be less than the value of "Before" the crisis. Hence, the final number will be as:

Final value = 1-initial value

Value final before= 1-0.267= 0.733

Value final after = 1-0.3084= 0.6916

4-5 Prevalence of anaemia among women of reproductive age (15-49 years)

Before the crisis – 2011 data: 27.15%[358]

[356] Average value calculated from FAO excel file from the year of 2000 till 2011 for Lebanese only.
[357] Average value calculated from FAO excel file from the year of 2012 till 2016 for Lebanese only.
[358] Average value calculated from FAO excel file from the year of 2000 till 2011 for Lebanese only.

After the crisis – 2016 data (latest): 29.48%[359]

Before: (value - minimal value)/(Maximal value - Minimal value) = 27.15/100=0.2715

After: (value - minimal value)/(Maximal value - Minimal value) = 29.48/100=0.2948

However, since the scenario shows that 0 is the most favourable value and 100 is the worst, the value of "After" should be less than the value of "Before" the crisis. Hence, the final number will be as:

Final value = 1-initial value

Value final before= 1-0.2715= 0.7285

Value final after = 1-0.2948= 0.7052

5- Food safety procedures in industry

Food and beverages processing is the flagship of manufacturing industries: it employs the largest industrial work force; it produces the largest share of industrial output and accounts for the largest portion of industrial value added and the largest portion of exports; it has the highest gross fixed capital formation and has accumulated the largest total fixed assets; and it is the country's most successful import substituting manufacturing activity[360]. Weighty as the sector may be in our economy, it is only through adherence to international safety and quality standards that its competitiveness will be sustained[361].

One of serious weaknesses undermining the Food and Beverages (F&B) sector in Lebanon is that "most local production is not compliant with international standards and use improper practices such as the excessive use of pesticides and herbicides. These practices affect the quality of production and lead to exports being denied access to US, EU and other export markets".

The last 100 recorded cases where exports were denied access to US markets revealed that violations fell into two broad categories: a. Violations that corrupt food safety and quality, such as the presence of unacceptable levels of pesticide residues, toxic levels of bacteria, or the use of unsafe colour additives, or products that are plainly described as "filthy". b. Violations that are less hazardous to health, but nonetheless cause exports to be denied access, such as labelling, misbranding and administrative infringements[362].

In January 2011, the MoA and the Ministry of Industry (MoI) jointly issued regulation number 950/1 requiring food and beverages manufacturing establishments to register with the Ministry of Agriculture, and subsequently go through an inspection designed to ascertain compliance with

[359] Average value calculated from FAO excel file from the year of 2012 till 2016 for Lebanese only.
[360] THE IMPACT OF MINISTERIAL DECISION 950/1 ON FOOD AND BEVERAGES PRODUCERS IN LEBANON, USAID, Chamber of Commerce Industry and Agriculture
[361] Ibid
[362] Ibid

health and technical standards. The regulation's conditions relate to food safety, pollution control, worker hygiene, and more generally, systematic control over all areas and nexuses in production lines and processes. These conditions are in harmony with international practices and guidelines. Factory premises, equipment and infrastructure are to be subjected to inspection and so is the whole production process, including the quality of raw materials and additives used, worker hygiene, packaging, labelling, and storage. Product testing is to be made regularly to determine conformity with national standards and with export market requirements. Environmental safety requirements such as those related to waste management and disposal take part of the conditions that should be met for registration. The decision states that non-compliant factories are allowed a grace period of three months to carry out the required corrective measures. Compliant factories will be assigned a health registration number, a pre-condition for selling on the local market and for the issuance of health certificates for exports.

In 2015, another food safety law has been issued by the parliament in November, to control the food safety of firms and cooperatives.

Value: minimum (0), Maximum (7), Value before crisis (2), Value after crisis (2)

Source: Quantitative data

Analysis:

There are five ministries in Lebanon responsible for food safety: Ministry of Tourism, Ministry of Agriculture (MoA), Ministry of Economy and Trade, Ministry of Industry and the Ministry of Environment. Each ministry will send its own inspectors who will check the formal firms and cooperatives involved in the F&B production by having an industrial license and some for the restaurants. Here comes the issue of the informal businesses and firms who exists in Lebanon; however, the MoA has made it clear from the outset that the stipulations of decision 950/1 will apply to all F&B producers irrespective of whether or not they have an industrial license from the MoI. The formal firms have to renew each year their permit which means the ministry' inspectors each year will double check their food safety standards.

As per the feedback from meetings with food safety experts, the inspectors need to be empowered so they can do their job correctly. Some of them are doing fine and others involved in bribery where they take money to write a wrong report, in addition that the inspectors' number is low and not covering correctly all the firms.

As per the above and since the country is doing bad when it comes to food safety in industry, qualitatively the number is 2 on Likert scale before and after the crisis as the crisis did not affect the system: 7 =Excellent, 6=Very good, 5=good, 4= moderately good, 3=moderately bad, 2= bad, 1= very bad, 0=Worst.

6- Quality of storage and distribution of food

In line with the Good Storage & Distribution Practices of Pharmaceutical Products project that has brought core improvements at the level of the Lebanese pharmaceutical warehouses, the MoPH launched in 2017 through its Quality Assurance of Pharmaceutical Products program, the

Good Storage & Distribution Practices of Food Supplements guideline[363]. The adequate storage and distribution of Food Supplements are a crucial activity to maintain their quality and integrity, to protect consumers from potential health risks and to ensure that they are not provided with misleading information. However, this program did not cover the food and distribution of food in general in Lebanon and the process is not monitored at all.

In November 2014, the Lebanese public has been overwhelmed with the latest food contamination scandal when the Minister of Public Health publicized a list of restaurants, supermarkets and other food provider services that did not meet the ministry's food regulation standards with some products testing positive for salmonella, E. coli, and obligate aerobes. Most contaminations were attributed to general lack of hygiene standards from employees handling the food and polluted storage areas.

Hence, the only good storage in Lebanon for fresh food are area based cold storages and not accessible for all farmers. When, the distribution takes place, some are transported into cars with cold storages mainly meat and chicken and others no such as vegetables.

Value: minimum (0), Maximum (7), Value before crisis (2), Value after crisis (2)
Source: Qualitative data
Analysis:
"Proper food storage helps to preserve the quality and nutritional value of the foods you purchase, and also helps make the most of your food dollar by preventing spoilage. Additionally, proper food storage can help prevent foodborne illnesses caused by harmful bacteria."

As per the above, the situation of the storages mainly in quantity and quality is bad and as per Likert Scale is 2 over 7[364]. In Lebanon there is no guidelines for good storages of food which will put the majority of food under the risk of the growth of the mold and production of aflatoxins at different storage conditions.

7- Good Agricultural Practices (GAPs)

GAP, as defined by FAO, are a "collection of principles to apply for on-farm production and postproduction processes, resulting in safe and healthy food and non-food agricultural products, while taking into account economic, social and environmental sustainability."

Many importing countries as well as domestic buyers, especially organized retailers, are requiring producers to implement GAP as a prerequisite for procurement to ensure the quality and safety of their produce. In addition, implementing GAP also helps promote sustainable agriculture and contributes to meeting national and international environmental and social developmental objectives. It has been documented that implementation of GAP encourages promotion of the optimum use of resources such as pesticides, fertilizers, and water, and eco-

[363] Ministry of Health
[364] 7 =Excellent, 6=Very good, 5=good, 4= moderately good, 3=moderately bad, 2= bad, 1= very bad, 0=Worst.

friendly agriculture. Its social dimension would be to protect the agricultural workers' health from improper use of chemicals and pesticides[365].

Lebanon does not have a specific policy on the implementation of GAPs. However, since 2010 the concept was addressed in several policy papers, some measures have been implemented and projects were developed locally[366]. In order to have concerned people able to adopt GAP, agriculture sector in Lebanon shall standardize agricultural techniques, aiming at helping Lebanese fruits and vegetables enhancing local and foreign market access. Some big farmers and cooperatives already have Global Gap[367] in Lebanon. Some others are willing to get Global GAP, however they are facing some difficulties such as investment, short delays of land renting time and discrepancies in the yields from year to year[368].

Hence, the Ministry of Agriculture (MoA) has recognized the importance of GAPs where it highlighted in its strategy for 2015-2019 the following: (a) Promoting Good Agricultural Practices through the support of organic farming and obtaining quality certificates, (b) Identification of quality certificate requirements and conditions (Expert for 3 months), (c) Training of inspectors and extension agents (50 person for 5 days), (d) Training of farmers (6 sessions per year in each Regional Service), (e) Incentives for organic and farmers lined in the quality programme (100 FARMERS).

Value: minimum (0), Maximum (7), Value before crisis (1), Value after crisis (1)
Source: Qualitative data

Analysis:
The implementation of GAP concepts and principles in Lebanon had a good start; the success depends on the further work to be done:

- Increase vulgarization of GAP concepts and principles through trainings and distribution of guides.
- Breeding materials must be certified
- Availability of varieties complying with production requirements
- For certified productions, transplants or rootstocks must be certified Educators/Extension Agents/Controllers Continuous and scheduled trainings
- GAPs must be enforced complying with sometimes different local, regional and national guidelines.
- Retailer Price oriented not always willing to afford extra costs for better productions
- Certification bodies Uniform the rules among different certification bodies

[365] http://www.fao.org/3/a-i6677e.pdf
[366] https://www.unescwa.org/sites/www.unescwa.org/files/events/files/session_3_-_3_lebanon_-_mhanna.pdf
[367] Global GAP is an independent, voluntary system to ensure food safety for primary agricultural production. GLOBALGAP standard was originally called EUREPGAP in 1997 as an initiative of the Working Group retail chains are members of the organization EUREP (Euro-Retailer Produce Working Group) to develop common procedures and a uniform standard for Good Agricultural Practices GAP (Good Agricultural Practice) and provide food safety.
[368] GAP in Lebanon, ESCWA and FAO.

- Final product must meet consumer expectations Vision and Strategy of MoA At 2 levels Enhancing the general GAP in the Lebanese agri-food sector, and the strategy is to go towards national GAP approach implementation for the benefit of the domestic consumers (with priorities, i.e. to tackle the most critical points). Another goal is to enhance the produce export to specific countries (including Arab countries), and the strategy is to go towards adopting and implementing GAPs according to a certification process.

Considering the above, the concept of GAP started to be familiar amongst farmers and key stakeholders; the concept has been recognized by the Ministry of Agriculture and some steps has been implemented. However, to consider the country doing well, at least 80% of farmers are aware and apply the concepts of GAPs which is not the case in Lebanon.

Some big farmers already have the Global GAP in Lebanon in addition to two certification bodies: ACERTA LEBANON and Control Union (Middle East). There is no data showing the percentage of farmers having the certificate or applying the GAPs even if they are familiar with, however this can be estimated to 10% based on qualitative analysis and field interviews.

% of farmers	**Likert**
0 to 5%	0 (the lowest)
5 to 10%	1
10 to 25%	2
25% to 45%	3
50%	4
50 to 60%	5
60 to 80%	6
80% plus	7

Before: (value - minimal value)/(Maximal value - Minimal value) = 1/7=0.1428

After: (value - minimal value)/(Maximal value - Minimal value) = 1/7=0.1428

C- Environmental Practices

8- Climate change adaptation - Technology capability and suitability

Agriculture is confronted to produce more marketable products under unpredictable climate conditions. Adaptation to climate change is crucial not only to support the livelihood of rural populations and to sustain the viability of the agriculture sector, but also to maintain a tolerable level of food security.

Agriculture in Lebanon is one of the most vulnerable sectors to climate change due to the limited availability of water and land resources and the pressure exerted by population growth and urbanization.
Higher temperature, reduced precipitation and high evapotranspiration will decrease soil moisture and increase aridity thus affecting the overall agricultural yield of crops. Lebanese agriculture may indeed experience a decrease in productivity for most of the crops and fruit trees targeting mostly wheat, tomatoes, cherries, apples, olives and grapes[369].

As per the Ministry of Environment (MoE), many adaptation measures, such as the adoption of more drought and heat-resistant species, change planting dates and cropping patterns can reduce the impacts of climate change and increase the resilience of the agricultural sector. Adaptation technologies in most cases are a combination of hard and soft technologies. Conservation agriculture[370], good agricultural practices[371] and range of adapted varieties and rootstocks[372] have been selected as priority adaptation technologies in Lebanon based on their economic viability (capital and operational cost, importance of economic impact), environmental reliability (improvement of resilience to climate change and technology suitability and capability) and social readiness (human and information requirement, social suitability for Lebanon). As a result, agricultural revenues can be increased by USD 119 million by shifting to conservation agriculture, planting heat and water-resistant crop and adopting good agricultural practices, in addition to protecting the livelihoods of thousands of families that rely on agriculture as a source of living.

Value: minimum (0), Maximum (7), Value before crisis (2), Value after crisis (2)
Source: Qualitative data
Analysis:
UNDP has been a key partner in assisting Lebanon to assess its greenhouse gas emissions and duly reporting to the UN Framework Convention on Climate Change. With the generous support of numerous donors, projects have also analysed the impact of climate change on Lebanon's environment and economy in order to prioritise interventions and integrate climate action into the national agenda. UNDP has also implemented interventions on the ground not only to mitigate the effects of climate change but also to protect local communities from its impact. This series of publications records the progress of several climate-related activities led by the Ministry of Environment which UNDP Lebanon has managed and supported during the past few years. These reports provide Lebanon with a technically sound solid basis for designing climate related actions and support the integration of climate change considerations into relevant social, economic and environmental policies.

[369] Ministry of Environment, Agriculture sector.
[370] Minimal tillage with conservation of crop residues to conserve both water and organic matter. This method has a direct benefit for farmers including the increase in income due to savings in the cost of production.
[371] Or the "Risk coping production systems" which includes field operations related to plantation scheme management, fertilization management, pesticides management and harvesting.
[372] This technology embeds the replacement of actual seeds and seedlings produced locally or imported, by appropriate adapted varieties and rootstocks to future climate.

Moreover, in Lebanon many plans and strategies we can rely on such as: The National Biodiversity Strategy and Action Plan (NBSAP), National Renewable Energy Action Plan for the Republic of Lebanon (NREAP 2016-2020), National Council for the Environment (NCE) reports, National Forest Plan (NFP) 2015 and Ministry of Agriculture Strategy 2015. When it comes to the implementation, the country is not doing so good compared to the strategies put in place; people should be more aware of the impact and the seriousness of climate change. Plus, the government must work more on the implementation of the adaptation technologies and not keeping them ink on papers.

Inputs from the field visits: "Farmers always used water from artesian wells to irrigate their farms in Lebanon. But climate change has made such farming more difficult. December, January and February are usually Lebanon's wettest months. It's a crucial time for farmers, since rainfall and snowfall renew the water levels in their wells. Wells are not being recharged as they once were, forcing farmers to pump deeper and deeper. This is risky, as it not only means exploiting groundwater faster than it is being renewed, but also risks digging too deep and introducing saltwater into the wells. Hence, Lebanese farmers fight climate change – by adapting if they are supported by initiatives like UNDP or others such as: rainwater harvesting systems that sit on the top of greenhouses".

As per the above, the governmental entities did recognize the issue of the climate change and it was included in plans and reports. Hence, the ministries with some support from UN agencies and local organizations started piloting projects for climate change adaptation. However, the adaptation is not only the solution as some initiatives should reduce the impact and the plans should be more taken into actions. The country is not doing well when it come to implementing big projects, awareness to citizens, support to the agricultural and transportation sectors and more. Forest fires are still erupting in country each year and getting worst, the dis-organized transportation sector is neglected, industries not being compliant to norms, the high and almost only usage of fossil fuel instead of renewable energy and more. As a conclusion, the CO2 emission is the result of all non-environmental actions. To refer to global data, as per the World Bank, the CO2 emission for Lebanon is 24,796 kt (kiloton) in 2016 where the highest country is China scoring 9,893,038 kt and the lowest is Tuvalu with 11 kt.

Based on both qualitative and qualitative analysis, the country still has a long way to go to improve its climate change adaptation and mitigation measures. The citizens behavior plays an essential role and based on the field interviews and as a Lebanese living for more than 30 years in Lebanon, I can tell that the citizens are not aware of the impact of climate change, pollution and more.

As the situation is bad, the score for both before and after the crisis is 2 on Likert scale[373].

[373] Likert Scale: 7 =Excellent, 6=Very good, 5=good, 4= moderately good, 3=moderately bad, 2= bad, 1= very bad, 0=Worst.

9- Communication and level of commitment to UNFCCC

The Ministry of Environment (MoE) is the main national coordinator for climate change and the UNFCCC focal point. The MoE is responsible for the coordination, compilation and submission of national communications, Biennial Update Reports (BUR) and related GHG inventories. The Climate Change Coordinating Committee (CCCC), led by the MoE, in cooperation with the focal points located at the line ministries, government agencies, private sector and academic institutions, oversee the implementation of all climate change activities as well as climate mainstreaming. The Ministry also chairs the National Council for the Environment (NCE) which is composed of official representatives from 7 ministries (the Ministry of 53 USAID (2016)). The NCE is mandated to approve environmental policies and strategies and integrate environmental concept, including climate change issues, into national development plans.

The Environmental Protection Law (law no. 444/2002) is the overarching legal instrument for environmental protection and management in Lebanon. With respect to climate change, apart from law 359/1994 and law 738/2006 relating to the ratification of the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol (KP), no major legislation (e.g. climate change policy) directly addresses climate change in Lebanon55.

However, a number of regulations have addressed issues that could be linked to climate change, such as the reduction of air pollution from transport (law 341/2001), the reduction of energy import by developing local energy including renewable energies (Council of Ministers, decision no. 13/2004), energy efficiency standards and labels, tax incentives on green products as well as large scale renewable energy industries (decree 167 under Law 444) and other decisions relating to the ratification of conventions such as the United Nations (UN) Convention on Biodiversity or the UN Convention to Combat Desertification. Lebanon has set a target towards land neutrality by 2030 under the United Nations Convention to Combat Desertification. The Paris Agreement was signed by Lebanon in April 2016; ratification is still awaiting approval by the Lebanese Parliament after having been approved by the relevant parliamentarian committees. Lebanon submitted its Intended Nationally Determined Contribution (INDC) in 2015 but has as yet not submitted its First NDC. It has submitted First (1999), Second (2011) and Third National Communication (2016) and two Biennial Update reports (2015; 2017) to the UNFCCC.

With this INDC, the government of Lebanon strives to both build resilience and improve adaptation as it lowers emissions, and therefore take advantage of the synergies between adaptation and mitigation.

An example from the “Lebanon’s Third Biennial Update Report to the UNFCCC”:

	Water resources Overarching objective: Increase water availability and improve water usage to decrease the sector's vulnerability to climate change impacts by: • Improving water security such as through increasing artificial recharge of groundwater aquifers and increasing surface storage dams and hill lakes. • Optimizing the use of the current water resources through the rehabilitation of the existing network and the installation of water meters. • Increasing wastewater collection and treatment. • Increasing water reuse, especially after wastewater treatment. • Improving water efficiency and decrease water loss in irrigation.
Adaptation targets	**Biodiversity** Overarching objective: By 2030, adaptation plans for ecosystems vulnerable to climate change have been developed and implemented. This will be achieved by: • Conducting needs assessment and defining pilot national monitoring sites and species. Coastal zones are considered a priority. • Designing and implementing pilot action plans. **Agriculture and Forestry** Overarching objective: Towards sustainably managed forest resources, safeguarded ecological integrity, and economic and social development for the benefit of present and future generations. This will be achieved through the implementation of the National Forest Programme including, among others: • Raising tree nurseries' productivity. • Planting of trees. • Implementing the forest fire fighting strategy. • Rehabilitating irrigation canals. • Promoting Good Agricultural Practices through the support of organic farming and obtaining quality certificates. • Applying forest integrated pest management. • Developing an early warning system for agricultural pests and climatic conditions.

Table 90: Lebanon's Nationally Determined Contribution

Unconditional Target[1]	• A GHG emission reduction of 15% compared to the Business-As-Usual (BAU) scenario in 2030. • 15% of the power and heat demand in 2030 is generated by renewable energy sources. • A 3% reduction in power demand through energy-efficiency measures in 2030 compared to the demand under the Business-As-Usual scenario. The unconditional mitigation scenario includes the impacts of mitigation actions which Lebanon is able to implement without additional international support.
Conditional Target	• A GHG emission reduction of 30% compared to the BAU scenario in 2030. • 20% of the power and heat demand in 2030 is generated by renewable energy sources. • A 10% reduction in power demand through energy-efficiency in 2030 compared to the demand under the BAU scenario. The conditional mitigation scenario covers the mitigation actions under the unconditional scenario, as well as further mitigation actions which can be implemented upon the provision of additional international support.
Implementation Period	2020-2030
Sectoral coverage	The NDC covers the following IPCC sectors: Energy, industrial processes and other product use, agriculture, land-use, land-use change and forestry, and waste.
Coverage of greenhouse gases	The following gases are covered: CO_2, CH_4, and N_2O. Fluorinated greenhouse gases (HFCs, PFCs and SF_6) play a limited role in Lebanon's overall GHG emissions. Furthermore, they have not been assessed at the level of detail required to estimate their emissions with the necessary accuracy needed to include them in the GHG inventory. Such assessments are currently being undertaken. Lebanon plans to include emissions from fluorinated GHGs in an updated version of its NDC.

Value: minimum (0), Maximum (7), Value before crisis (5), Value after crisis (5)

Source: Qualitative data

Analysis:

Since Lebanon submitted its reports to the UNFCCC, this shows that the country is committed to do effort in reducing the negative impact on the environment. The country is, however, not able to provide the resources necessary to implement these strategies completely on its own. International support is required to fully implement and track the existing adaptation and mitigation strategies and to further mainstream adaptation and mitigation throughout the economy[374].

The score will increase when Lebanon submitted the final NDC and not the intended one only. However, the implementation of the commitments is not measured under this indicator and could not be measured before few years from the submission of reports.

As background, in December 1994, Lebanon ratified the United Nations Framework Convention on Climate Change (UNFCCC) and has since been involved in various activities aimed at spreading climate change awareness in the country, reducing national greenhouse gas (GHG) emissions, developing measures to reduce adverse impacts on environmental, economic and social systems, building institutional capacity and mainstreaming climate change into the different policies. These activities were undertaken and monitored through a platform, the Climate Change Coordinating Committee (CCCC), led by the Ministry of Environment and in cooperation with its various focal points located at the line ministries, government agencies, private sector and academic institutions[375].

Based on that, the country is heading forward with reports submission, and is good and scoring 5 on Likert Scale[376].

Before and after: (value - minimal value)/(Maximal value - Minimal value) = 5/7=0.714

10- Risk of natural disasters and National Response Plan (NRP)

Lebanon is challenged by multiple natural hazards, including flooding, drought, earthquakes and associated tsunamis. The country experiences one to two cases of flooding annually, a number that is likely to rise with climate change.

Lebanon is subjected to a range of natural hazards. The largest, single, natural disaster threat is that of a severe earthquake, possibly with an associated tsunami. In addition, frequent smaller-scale disasters include floods, forest fires, landslides and drought. The vulnerability of the Lebanese population to disasters is compounded by the following factors: a) lack of capacity of government ministries in peripheral regions; b) haphazard housing and uncontrolled urban expansion; and c) lack of enforcement of building codes and lack of regulation of land use. The fundamental challenge of effective disaster preparedness in Lebanon is the lack of a national

[374] https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Lebanon%20First/Republic%20of%20Lebanon%20-%20INDC%20-%20September%202015.pdf
[375] Ibid
[376] Likert Scale: 7 =Excellent, 6=Very good, 5=good, 4= moderately good, 3=moderately bad, 2= bad, 1= very bad, 0=Worst.

disaster management plan and strategy. Furthermore, an official national authority developing Disaster Risk Reduction (DRR) initiatives and establishing linkages with respective ministries is lacking. In Lebanon most resources are directed at relief, rehabilitation and reconstruction efforts, and not enough at DRR. However, the recurring mild earthquakes in the south of the country over the last few years have prompted both internal and external pressure for the establishment of a new mechanism for disaster risk reduction to be located in the Office of the Prime Minister.

Value: minimum (0), Maximum (7), Value before crisis (3), Value after crisis (3)

Source: Qualitative data

Analysis:

Occurrence per year	**Likert**
Never	0 (the lowest)
Once moderate	1
Once severe	2
Twice moderate	3
Twice severe	4
Three moderate	5
Three severe	6
More than three	7

Lebanon is not an exception as it is also subjected to earthquakes, floods and forest fires which threaten lives, livelihoods, homes, basic social services and community infrastructure. In 2012, a first national strategy has been implemented with the assistance of UNDRR, and in 2018 the decision was taken to develop this strategy and present it to the Council of ministers[377]. At the sectoral level, several ministries and key agencies have integrated disaster risk considerations into sustainable development and have been supported to develop their response plans in line with the National Response Plan (NRP) including the Ministry of Education (MEHE), Ministry of Social Affairs (MoSA), Ministry of Agriculture (MoA) and the airports[378]. Hence, The CNRS with close cooperation of Ministries of Agriculture and Environment in addition to the Civil Defense and active NGOs including AFDC established maps on a national scale related to forest fire prone areas.

[377] Interview notes from Ziad Chahine in 2019, the Head of head of the Risk Management Unit affiliated to the Prime Minister's office.

[378] National progress report on the implementation of the Hyogo Framework for Action (2013-2015)

Final score:

Considering the occurrence of natural disasters in Lebanon, the major disasters are considered very low which is twice and is basically moderate such as floods scoring 3 on Likert Scale. The floods in Lebanon are mainly affecting the roads and the agricultural lands on the coastal areas.

In addition, since the country is planning to improve its National Response plan with the support of UNDRR and governmental bodies are aware of its importance, this means that country is moving forward on the right path. However, during the floods caused by rain, the country has not be able to respond quickly, no measures has been taken to improve its infrastructure from a year to another. The country has never faced a natural disaster where the government had to evacuate, but since the actions seen were not trustworthy on small scale and moderate disasters then the country is not able to respond efficiently to more severe situations.

The final score to be given for the indicators is based on the occurrence of disasters. Before and after: (value - minimal value)/(Maximal value - Minimal value) = 3/7=0.428

11- Environmental awareness and people' behaviour

Changing our own lifestyles and reconnecting our values with the biosphere is crucial to combat climate change and limit its detrimental effects on our lives and planet. The importance of human behavior and attitudes to our environmental future is not a new idea. It is this connection between human decisions and environmental outcomes. There is no doubt that investment in and protection of the environment will require human choices, and some changes in human behavior. Just as we track trends in species loss and forest cover as key environmental indicators, we need to pay attention to trends in human behaviors and attitudes as the ultimate drivers of global change[379].

The environmental problems in the shape of global warming, air pollution, noise and loss of diversity brings back the fundamental root cause as human behaviour (Vlek and Steg, 2007).

Value: minimum (0), Maximum (7), Value before crisis (1), Value after crisis (1)

Source: Qualitative data

Analysis:

Lebanon is suffering from human disturbance and destruction of the environment. Many Lebanese are more concerned with immediate political and economic problems than long-term environmental stewardship.

At school, students are not being taught about the importance of recycling and the environment in general, no bins to separate waste are available on the streets, Lebanese pollute the forests, throw waste out of the windows, do not initiate any household's level recycling, and they kill animals without considering the ecosystem mainly birds.

[379] Human Behavior and Attitudes Effect our Environmental Future, February 2008, The Ocean Project

Few campaigns were launched to raise environmental awareness; however, no serious impact was detected further. The main solution in addition to the awareness are laws who penalise people when they do any harm to the environment. Although Lebanon's judiciary system is not specialized in environmental matters, it has in recent years acquired resources to investigate and arbitrate environmental issues more effectively. The judiciary system, consisting of judges and prosecutors, helps stop or curtail environmental abuses and crimes around the country provided that such abuses and crimes are detected and reported. The judiciary system is critical to enforcing environmental laws and regulations and policies[380].

To score the indicator, and since it relies on human behaviours towards the environment and the social traditions, qualitatively, the score in Lebanon will be very low. On Likert Scale, the number will be 1 instead of zero considering the new awareness campaigns and the percentage of educated youth aiming to promote the importance of protecting nature and its resources.

Before and after: (value - minimal value)/(Maximal value - Minimal value) = 1/7=0.142

12- Cross-cutting policies/ environmental governance[381]

The ability of the Ministry of Environment in Lebanon and other line ministries and intergovernmental agencies to enforce environmental regulations is weak382. Environmental governance does not improve markedly. Key environmental laws and decrees (environmental prosecutor, environmental police, environmental impact assessment, environmental fund, etc.) are either approved/ enacted but not implemented or have yet to be approved/enacted. The Parliamentarian Committee for Environment convenes irregularly, to respond to emerging issues and priorities (waste management contracts, spills, pollution, fires, etc.) but their work is often blurred by other national issues gripping the country (privatization, oil exploration, security, etc.).

Stop-and-go work planning by the MOE is affected by ministerial cabinet reshuffles and the National Environmental Action Plan does not crystallize. Patron-client relationships prevail in many sectors including construction, energy and industry. Leading public research organizations (IRI, LARI, NCSR, TEDO, LCEC, etc.) as well private environmental institutions located on university campuses (AUB, UOB, USJ, USEK, etc.) continue their work as usual, subject to funding availability and research priorities, with little interagency cooperation. Lebanon has so called regional Industrial Permitting Committees (including MOI, MOE, MOPH and MOPWT-Urban Planning) and Health Councils at the Mohafaza level. The Health Councils comprise the Governor as well as representatives from the ministries of Environment, Public Health, Industry, and Urban Planning. At the syndicate level, the Order of Engineers and Architects and the

[380] https://www.undp.org/content/dam/lebanon/docs/Energy%20and%20Environment/Publications/SOER_en.pdf
[381] Environmental governance refers to the processes of decision-making involved in controlling and managing the environment and natural resources. Principles such as inclusivity, representation, accountability, efficiency, and effectiveness, as well as social equity and justice, are the foundations of good governance. Source: SOER, Department of Environmental Affairs, Republic of South Africa. http://soer.deat.gov.za/27.html
[382] http://www.undp.org.lb/communication/publications/downloads/SOER_en.pdf

Syndicate of Lawyers have dedicated environmental committees. Collectively, these councils and committees help mainstream the environment in all sectors of the economy. On the party level, Lebanon has two political parties dedicated to the environment. The Green Party of Lebanon was established in 2004 followed by the Lebanese Environmental Party in 2005[383].

Synergies among research organizations are only partially explored and pursued. Research and Development (R&D) is not always in sync with national environmental priorities. Access to environmental funding continues to depend on the goodwill of international development organizations and multilateral trust funds while the Government of Lebanon is unable or unwilling to divert and /or spend more resources on the environment.

Value: minimum (0), Maximum (7), Value before crisis (3), Value after crisis (3)
Source: Qualitative data
Analysis:
Although there has been commendable progress in many areas over the last decade, trends do not indicate a sustainable future for Lebanon without strong political will to further integrate environmental considerations across all sectors. It is crucial for politicians, policy makers, decisionmakers at both the national and local levels, entrepreneurs, academics, journalists and citizens alike to be aware of the necessity to change our development approach to one that will safeguard Lebanon's future generations[384]. For the progress and linking the policies to the national reports (see Indicator 9), the score will be 3 on Likert Scale.

Before and after: (value - minimal value)/(Maximal value - Minimal value) = 3/7=0.428

13- Environmental performance Index[385]

The 2016 Environmental Performance index highlights the country's performance on high priority issues in the areas of (i) protection of human health and (ii) protection of ecosystems. These two objectives are further divided into nine issue categories that span high- priority environmental policy issues, including air quality, forests, fisheries, and climate and energy, among others.

The Environmental Performance Index (EPI) indicators are calculated using a "proximity to- target" methodology, which assesses how close each country is to an identified target (international treaties, scientific thresholds, high performance benchmarks, etc.). hence, the index includes some indicators not mentioned in our index such as the biodiversity and habitat, fisheries and energy.

Value: minimum (0), Maximum (100), Value before crisis (57.9), Value after crisis (69.14)
Source: Qualitative data

[383] https://www.undp.org/content/dam/lebanon/docs/Energy%20and%20Environment/Publications/SOER_en.pdf
[384] Robert Watkins UNDP Resident Representative June 2011
[385] http://www.databank.com.lb/docs/Environmental%20Performance%20Index%202016.pdf

Analysis:
Lebanon has an overall EPI of 69.14 (2016), ranking at 94 in a pool of 180 rated countries. Regionally, it positions itself at rank 9 out of the 19 countries rated in the MENA region, overall performing better than some of these countries. Although at higher score compared to 2014, it loses 3 places on the overall ranking testifying to a slower progress on addressing environmental performance objectives. It is worthwhile noting that a number of changes and improvements have been introduced in the production of 2016 EPI invalidating any trend and progress analysis. Furthermore, the results are not a fully comprehensive picture of national performance, mainly due to data gaps for a number of key environmental issues, requiring Lebanon, among other countries, to improve its understanding of environmental quality.

Before: (value - minimal value)/(Maximal value - Minimal value) = 57.9/100=0.579

After: (value - minimal value)/(Maximal value - Minimal value) = 69.14/100=0.6914

14- Food Loss Levels

An unacceptably high proportion of food is lost along the supply chain, amounting to over 400 billion USD a year[386] – a comparable value to some national and regional economic stimulus packages in the wake of the coronavirus pandemic: While it is not yet possible to estimate the percentage of food wasted at the retail and consumption stage, FAO has generated modelled estimates of food losses across the main regions of the world based on a limited pool of available national data. Based on these estimates, the percentage of food lost after harvest on farm and at the transport, storage, processing and wholesale stages stands at 13.8 percent globally.

Causes of food loss and waste differ widely along the food supply chain. Important causes of on-farm losses include[387]:

- inadequate harvesting time
- climatic conditions
- non-efficient practices applied at harvest and handling
- and challenges in marketing produce

Significant losses are caused by inadequate transportation infrastructure and storage conditions as well as decisions made at earlier stages of the supply chain, which predispose products to a shorter shelf life. Adequate cold storage, in particular, can be crucial to prevent quantitative and qualitative food losses.

While food waste occurs across the whole food chain, around 35% is generated at the consumer level, driven largely by consumers' values, behaviors, and attitudes[388]. Studies on waste at the

[386] SDG Progress Report 2020, FAO
[387] Ibid
[388] Bond et. al. (2013). Food waste within global food systems. A Global Food Security Report.

consumer stage are mostly done in high-income countries; they indicate that waste levels are high for all types of food, but particularly for highly perishable foods such as animal products and fruits and vegetables[389].

Value: minimum (0), Maximum (80), Value before crisis (50), Value after crisis (50)
Source: Qualitative data

Analysis:
For instance, in Lebanon, food waste constitutes more than 50% of the total household solid waste[390], with a recent survey revealing that 42% of Lebanese households throw away at least 250 g of consumable food each week[391]. An additional source of food waste in Lebanon is leftovers on customers' plates, or what is typically referred to as plate waste. In fact, it is estimated that 3 out of 9 plates served in Lebanese restaurants end up being wasted[392].

In Lebanon there is a considerable lack of data about food waste. Essential information such as causes, volumes, use and reuse are missing, as are other details that fuel the problem. For this reason, we will calculate the index based on the "Households Food Waste Generation" and not the entire food chain.

The most favorable percentage of households' food waste is 0% and the worst in 80% considering that no household waste 100% of the food they buy or cook. In Lebanon, as mentioned above, the value is 50% which is alarming and considered really high. "the Syria Crisis did not affect the consumer behaviour and their waste generation".

The consumer behavior is an essential area to study when addressing the food waste and awareness ais required. Hence, more social initiatives are needed to reuse the food waste and support the food insecure population. It is very important to conduct preliminary studies to establish a baseline for food waste quantities/volumes, causes and factors affecting its generation in Lebanon. This will help develop further research aimed at developing solutions to mitigate negative environmental effects, create sustainable solutions by diverting food waste away from landfills, and to develop policies aimed at addressing the problem.

Before and after: (value - minimal value)/(Maximal value - Minimal value) = 50/80= 0.625

However, since the scenario shows that 0 is the most favourable value and 80 is the worst, the value of "After" should be less than the value of "Before" the crisis. Hence, the final number will be as:

Final value = 1-initial value

[389] SDG Progress Report 2020, FAO
[390] Ministry of Environment, Nationally Appropriate Mitigation Action in Lebanon's Municipal Solid Waste Sector Report. Retrieved from http://climatechange.moe.gov.lb/waste.
[391] Charbel, L., Capone, R., Grizi, L., Debs, P., Khalife, D., & Bilali, H. E. (2016). Preliminary insights on household food wastage in Lebanon. Journal of Food Security, 4(6), 131-137.
[392] Retrieved from http://foodblessed.org/MaBadda2iste7a/.

Value final after and before = 1-0.625= 0.375

15- Water-Energy-Food Nexus Practices

As per the FAO, the Water-Energy-Food Nexus has emerged as a useful concept to describe and address the complex and interrelated nature of our global resource systems, on which we depend to achieve different social, economic and environmental goals. In practical terms, it presents a conceptual approach to better understand and systematically analyze the interactions between the natural environment and human activities, and to work towards a more coordinated management and use of natural resources across sectors and scales. This can help us to identify and manage trade-offs and to build synergies through our responses, allowing for more integrated and cost-effective planning, decision-making, implementation, monitoring and evaluation.

A Nexus approach helps us to better understand the complex and dynamic interrelationships between water, energy and food, so that we can use and manage our limited resources sustainably. It forces us to think of the impacts a decision in one sector can have not only on that sector, but on others. Anticipating potential trade-offs and synergies, we can then design, appraise and prioritize response options that are viable across different sectors.

Value: minimum (0), Maximum (7), Value before crisis (3), Value after crisis (3)

Source: Qualitative data

Analysis:

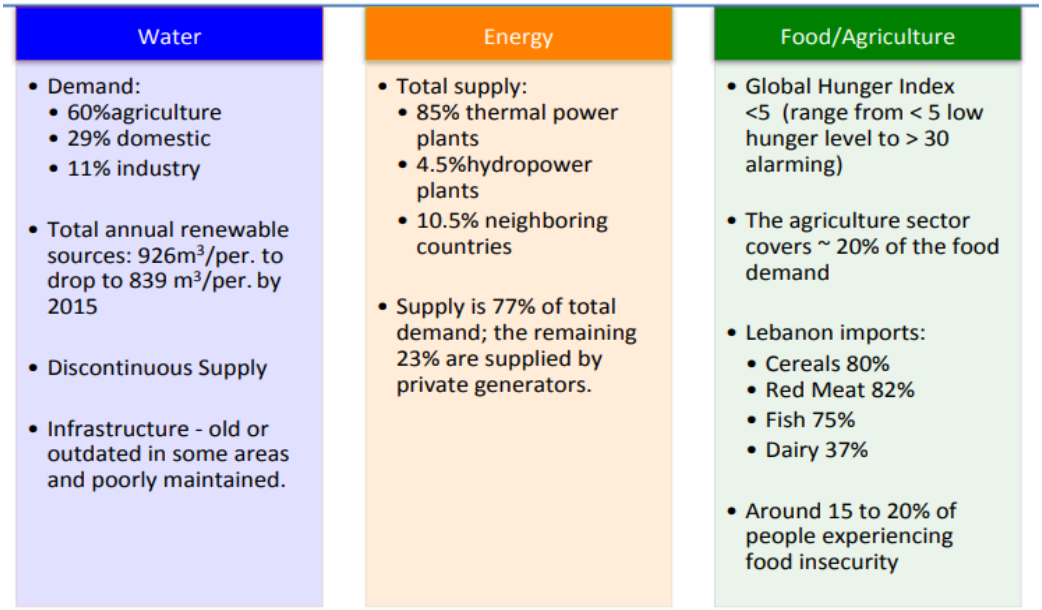
Lebanon is facing water and energy shortages and imports more than 80% of its food needs. These are further aggravated by climate change impacts, high population densities and rapid urbanization rates, influx of war refugees, and sectoral mismanagement.

The energy sector in Lebanon is able to meet 77% of the total demand with the remaining 33% being provided by private generators on local levels. Only 4.5% of energy in Lebanon is generated by hydropower plants while 95% is generated by thermal plants[393]. At the moment, 14% (220 million m3) of the stored water in the Qaroun Dam is being exploited for water supply and irrigation and the rest is used to generate electricity[394]. There are 267 public wells which are operated by the Water Establishments and are used within the public supply network. In comparison, there are 42,824 privately owned wells, of which around 51% are illegally drilled[395].

The country's WEF overview is as below[396]:

[393] Ministry of Energy and Water, 2010a
[394] Ibid
[395] Ibid
[396] Retrieved from the Climate Change and the Environment in the Arab World Program, AUB

I – Lebanon Overview



The hidden interlinkage between the three nexus pillars is the amount of energy consumed to pump this water for which there are no official values. In terms of its relation to agriculture, 50% of irrigated lands rely on groundwater[397]. Nearly 50% of irrigated lands are surface irrigated, with the remaining 50% divided among 30% sprinklers and 20% drip[398]. Implications of such methods of irrigation are a tradeoff between water consumption and the use of energy: the energy intensive methods save water, whereas water intensive ones use up very little energy (traditional irrigation methods).

The contribution of the agriculture sector to the water sector is reflected in the negative context of pollution and its use of nearly 60% of available freshwater. The use of pesticides and fertilizers with little compliance to environmental and public health norms, has led to the pollution of water bodies[399].

Even though physical interlinkages between the WEF resources in Lebanon exist, it is clear that they are not planned in the most efficient manner. The main problem in Lebanon remains the mismanagement and the governance of these sectors[400].

The budget in the Ministry of Agriculture (MoA) is very small Less than 1%. Therefore, the Ministry cannot provide for the needs of farmers. The Ministry distributes annually "200,000 to 250,000 olive trees that do not need irrigation. The Ministry relies on implementing pools to harvest and provide water. The Ministry also works on foreign-funded projects related to the

[397] MoA, FAO, & Cooperation Italienne, 2012
[398] MoA et al., 2012
[399] MoE/UNDP/ECODIT, 2011
[400] Lebanese Transparency Association, 2009

issue of irrigation, and the Ministry annually" distributes irrigation units to farmers. In addition, the Ministry organizes vocational training seminars for agricultural school students, in order to encourage the idea of an agricultural guide. She emphasized here that strengthening agricultural extension is "important" to prevent the wasteful use of water in agriculture[401].

As for the improvement of water reuse for agriculture, the MoA has conducted experiments related to this subject through external financing development projects such as the last plant project in coordination with the FAO, where rules and specifications have been developed for the use of the ENPI CBC med Program within the 2007 ACCBAT wastewater system for agricultural irrigation, And the 2013 project, on the Ablah refinery. Good to mention, the microbial quality of the irrigation water is critical because water contaminated with animal or human wastes can introduce pathogens into produce during pre-harvest and post-harvest.

Table: National Public stakeholders that affect the WEF nexus in Lebanon[402]

	State agency	Mandate	Other key public stakeholders	Relevant national strategies
	Ministry of Energy and Water *For Water:* Water Establishments (WEs)	Producing national water policies and strategies, national scale studies, overseeing and monitoring the Wes, licencing wells, assisting in the licencing of mines and quarries, designing, building and implementing major water facilities. System operation and maintenance implement the national water plan	Ministry of Economy and Trade (MoET) Ministry of public health Ministry of Finance	National Energy Efficiency Action Plan National Water Sector Strategy released by the Ministry of Energy and Water in 2010 Electricity Policy paper

[401] محضر الجلسة الأولى: المياه والغذاء- Orders of Engineers
[402] WEF Nexus: An outlook on public institutions in the Arab World

Lebanon	Litany River Authority	and the national wastewater plan, irrigation plans, water quality		Ministry of Agriculture Strategy 2015-2019
	<u>For Energy:</u>	Planning and operating		
	Electricité du Liban	Setting the policies for the sector and developing the master plan, proposing comprehensive rules to regulate the services, proposing draft laws and decrees, proposing public safety conditions and environmental conditions and technical specifications.		
	Ministry of Agriculture	Handles 90% of the generation, transmission, and distribution of electricity.		
	Ministry of Environment	Producing agriculture policies, responsible for crops and animal resources, rural development and natural resources.		
		Point of reference for all environmental regulations and		

		policies, and controls pollution across all different sectors.		

As per the information above, the situation in Lebanon is still considered moderately[403] bad as more cooperation between ministries regarding programmes, plans and policies are needed.

Hence, the state adopts a vision for the formula of forming Lebanese society: Create a sustainable development plan; Defining the policy of supervising the implementation of projects; Adopting the principle of accounting; Converting agricultural irrigation methods from traction to modern methods, and seeking to introduce incentives for farmers. In addition, developing a national plan to maintain and expand irrigated agricultural areas, and to introduce new varieties suitable for climate change is a must alongside establishing rainwater harvesting ponds for agricultural irrigation and development of work on the green project.

Before and after: (value - minimal value)/(Maximal value - Minimal value) = 3/7= 0.428

Environmental Practices, Food Safety and Natural Resources Index –Annex 3 attached to this study

For each indicator: Ind1 = (Value – Min Value)/ (Max Value – Min Value).
Weight has been divided equally for all indicators while calculating the final capital index:

$$Capital\ Index = (Indicator1)^{w1} * (Indicator2)^{w2} * \ (indicator\ m)^{wm}$$
$$= \prod_{i=1}^{m} (Indicator\ i)^{\ wi}$$

For this capital, we will be dividing the index into 3, for each of the pillars– the data are copied from the Annex 3:

Indicator	**Weight**	**Value before crisis**	**Value after crisis**	**Final Value = Value^ weight**	
				Before	**After**
Natural Resources (NR)					
Land Structure - Arable Lands	0.166666667	0.1505	0.1634	0.72932777	0.739393012

[403] 7 =Excellent, 6=Very good, 5=good, 4= moderately good, 3=moderately bad, 2= bad, 1= very bad, 0=Worst.

Quality of Soil	0.166666667	0.602	0.602	0.918895409	0.918895409
Land Degradation and Conservation	0.166666667	0.2857	0.2857	0.811555777	0.811555777
Water Quantity	0.166666667	0.24	0.036	0.788318781	0.574623986
Water Quality	0.166666667	0.2922	0.2122	0.814604307	0.772308646
Air Quality	0.166666667	0.5	0.5	0.890898718	0.890898718
Index NR	**1**			**0.311160252**	**0.218003155**
Food Safety and Nutrition (FSN)					
Percentage of population using safely managed drinking water services (Percent)	0.125	0.466	0.477	0.908967258	0.911622
Percentage of population using at least basic drinking water services (percent)	0.125	0.904	0.926	0.987463505	0.990435899
Percentage of population using safely managed sanitation services (Percent)	0.125	0.199	0.215	0.817253209	0.825191617
Prevalence of obesity in the adult population (18 years and older)	0.125	0.733	0.6916	0.961917879	0.954952727
Prevalence of anaemia among women of reproductive age (15-49 years)	0.125	0.7285	0.7052	0.961177718	0.957280116
Food safety procedures in industry	0.125	0.2857	0.2857	0.855044623	0.855044623
Quality of storages and distribution of food	0.125	0.2857	0.2857	0.855044623	0.855044623
Good Agricultural Practices	0.125	0.1428	0.1428	0.784045066	0.784045066
Index FS	**1**			**0.388764146**	**0.390423073**
Environmental Practices (EP)					

Climate change adaptation - Technology capability and suitability	0.125	0.2857	0.2857	0.855044623	0.855044623
Communication and level of commitment to UNFCCC	0.125	0.714	0.714	0.958765232	0.958765232
Risk of natural disasters and National Response Plan (NRP)	0.125	0.428	0.428	0.899353587	0.899353587
Environmental awareness and people' behaviour	0.125	0.142	0.142	0.783494664	0.783494664
Cross-cutting policies/ environmental governance	0.125	0.428	0.428	0.899353587	0.899353587
Environmental Performance Index	0.125	0.579	0.6914	0.933974073	0.954918203
Food Loss Levels	0.125	0.375	0.375	0.884614204	0.884614204
Water-Energy-Food Nexus Practices	0.125	0.428	0.428	0.899353587	0.899353587
Index EP	**1**			**0.386026609**	**0.394683157**

$$Capital\ Index = (Indicator1)^{w1} * (Indicator2)^{w2} * (indicator\ m)^{wm}$$
$$= \prod_{i=1}^{m} (Indicator\ i)^{wi}$$

Indexes	**Weight**	**Before crisis Index**	**After crisis Index**	**Final Value Before = Value^ weight**	**Final Value Before = Value^ weight**
Index NR	0.333333333	0.31116025	0.21800315	0.677633246	0.601849069
Index FSN	0.333333333	0.38876415	0.39042307	0.729841804	0.730878453
Index EP	0.333333333	0.38602661	0.39468316	0.728124672	0.733527158
Final capital Index	**1**			**0.36010503**	**0.322662838**

The final Capital Index before the Syrian Crisis **0.36010503**

The final Capital Index after the Syrian Crisis = **0.322662838**

Conclusion:

Globalization, increased competition, better consumer awareness, and rising demands, are the main reasons encouraging the production of safe and healthy food. In times of growing competition for customers, ensuring the health safety of the product produced follows not only from the need to meet legal requirements, but must be a crucial element in the marketing strategy of the company. However, it requires continuous monitoring of every stage of production, at all levels of the food chain, from primary production through processing and distribution, to the date of purchase by the consumer. On a second hand, in times of growing competition and demand, there is increasing competition for natural resources such as water, energy, agriculture, fisheries, livestock, forestry, mining, transport and other sectors with unpredictable impacts for livelihoods and the environment (FAO 2011c).

Climate variability and extremes are undermining all dimensions of food security: food availability (with losses in productivity that undermine food production and increase food imports); food access (causing spikes in food prices and volatility, especially following climate extremes, income loss for those who depend on agriculture); food utilization and food safety (worsened or reduced dietary consumption, reduced quality and safety of food because of crop contamination, outbreaks of pests and diseases because of rainfall intensity or changes in temperature[404].

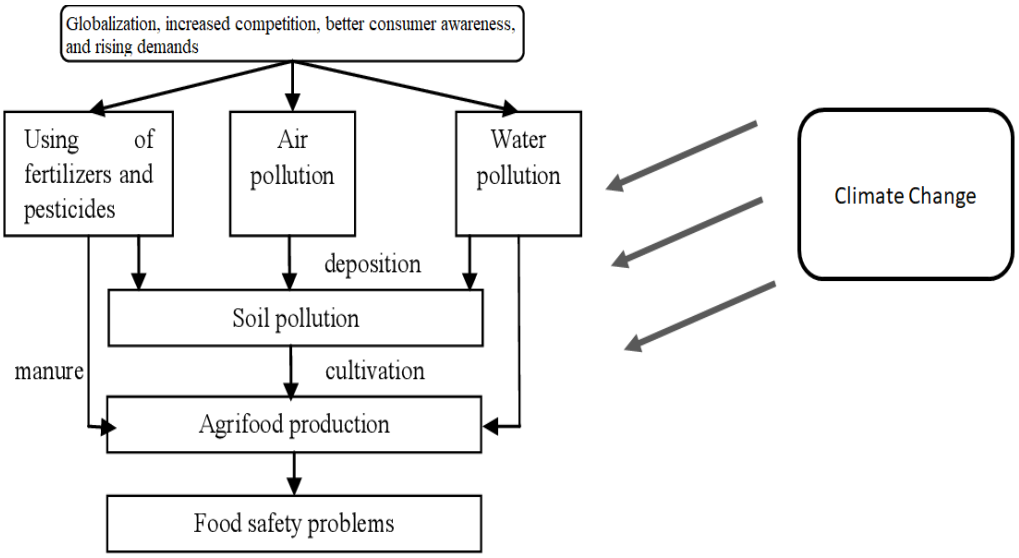
Changes in climate heavily impact nutrition through impaired nutrient quality and dietary diversity of foods produced and consumed; impacts on water and sanitation, with their implications for patterns of health risks and disease; and changes in maternal and child care and breastfeeding[405]. More erratic rainfall and higher temperatures along with other extreme events affect the quality and safety of food. Changing climate conditions and extremes such as temperature and humidity can lead to increased contamination of water and food. Even increased contamination of water used for irrigation can affect the safety of crops and animals that consume them, as well as the resulting food output. Unsafe water and food create a vicious cycle of diarrhea and malnutrition, threatening the nutritional status of the most vulnerable. Furthermore, climate extremes often directly affect human health through changes in temperature and precipitation and natural hazards. These increase the risk of disease, which further compromises food security and nutrition. Disease interferes with the body´s ability to absorb nutrients, which can negatively affect the nutritional status of adults and children.

[404] State of Food Security and Nutrition, FAO, 2018
[405] Ibid

During the passage of food from the natural environment to the table, pollution becomes an aspect of the consumption behaviors of earth, water and air and the plants and animals that rely on them for growth. Hence, what the planet consumes we consume.

Food production – even for healthy food - cause air pollution through the intensification process, use of machineries, greenhouses gas emission and more; hereafter, agricultural is considered the single largest contributor of ammonia pollution as well as emitting other nitrogen compounds[406]. Equally, there is increasing evidence that food production is also threatened by air pollution. Ozone precursor emissions (nitrogen oxides and volatile organic compounds) are of particular concern for global food security as these compounds react to form ground-level ozone. This, in turn, penetrates into the plant structure and impairs its ability to develop. Ozone was estimated to cause relative global crop losses for soy 6-16%, wheat 7-12% and maize 3-5%[407]. At a European level, a study in 2000 of the economic losses due to the impact of ozone on 23 crops amounted to 6.7 billion Euros[408]. Although agricultural pesticide use has allowed for increased production of food and fiber at a lower cost, widespread use of pesticides in a variety of crops increases the likelihood of negative impacts on the environment. Same for water pollution considered as the most sensitive natural resources; water quality is a vitally important pre-harvest factor for preventing foodborne contamination during food production. When a contaminant[409] reaches pollutant levels, it leads to the degradation of water, soil, air, or habitat and to potential consequences on human health.

As a summary:



[406] Air pollution and food production, UNECE, SDGs
[407] Air pollution and food production, UNECE, SDGs
[408] Ibid
[409] include nutrients (i.e., nitrogen and phosphorus), pesticides, pharmaceuticals, pathogens, gases and inhalants (i.e., ammonia, nitrogen oxide, methane, odors, and fine particulate matter, or PM), and soil sediment (including the chemicals and organisms it may contain).

Analysis

As the interlinkages are clear, no specific global framework will be used for this analysis. However, relying on the main indicators mentioned above, the three main criteria will be as:

- Natural Resources preserved and respected: healthy air and water quality, land availability and nutritious soil quality, usage of Good Agricultural Practices.

- Food Safety and Nutrition are adequate: people have access to healthy and nutritious food, clean water, absence of food contamination, industrial monitoring, reduced food loss

- Environmental Practices applied: Good environmental practices, support adaptation and mitigation measures to climate change.

All the three sub-pillars are equally important; hence, the image below is improvised to be linked further to the action plan:

If the index is between:

- 0 and 0.25: The NR/FSN/EP status is very bad. Then, all the three criteria mentioned above should be analyzed and be included in an action plan including short, medium- and long-term interventions.
- 0.25 and 0.5: The NR/FSN/EP status is moderately bad. Then, all the three criteria mentioned above should be analyzed and be included in an action plan including short, medium- and long-term interventions.

- 0.5 and 0.75: The NR/FSN/EP status is moderately good. Then, an analysis should be done to find out what criteria out of three are not performing well. Once the criteria are defined (could be one or two), then an action plan can be set.
- 0.75 and 1: The NR/FSN/EP status is very good. Then, an on-going analysis should be done to make sure the long-term policies and action plans won't be impacting the index in light of any global and national change.

In Lebanon, as mentioned above, the final indicator before the Syrian crisis was **0.36010503** and after **0.322662838** which means that **the Natural Resources, Food Safety and Nutrition and Environmental Practices Index is moderately bad close to the very bad status.** For some indicators the situation in Lebanon can be very bad as per the analysis above for each indicator and an in-depth revision should take place the soonest. Hence, all three criteria need to be revised and included in an action plan as the below. The burden of the Syria crisis and the high influx of refugees has put a lot of pressure on the already scarce natural resources.

Action plan

Term	**Aspects/criteria of intervention**	**Action Plan**
Short-Term	- Natural Resources preserved and respected	- A committee led by the Ministry of Agricultural, formed from microbiological experts to assess the current status of soil, water and air specifically in agricultural areas and produce a brief and recommendations to the specific audience. The brief should take place bi-yearly. Highly contaminated areas should be identified and treated the soonest to avoid food contamination and health problems. - The ministry of Agriculture and Environment should coordinate together and produce a short-term plan to improve the status of the natural resources. - LARI from the Ministry of Agriculture should present the status of the laboratories where the natural resources are being tested. In case of rehabilitation and equipment support, the Ministry can fund.
	- Food Safety and Nutrition are adequate	- A group of controllers should be rotating and checking the status of all food industries. These controllers should have the authority to close industries not abiding by the food laws published by ministries. In addition, these controllers should be coordinating with the committee mentioned above to control the contamination of raw food.

		- In order to have concerned people able to adopt GAP, agriculture sector in Lebanon shall standardize agricultural techniques, aiming at helping Lebanese fruits and vegetables enhancing local and foreign market access.
	- Environmental Practices applied	- In addition to the National Report submitted to the UNCCC, the main sources of harmful gas emission such as the transportation sector should be identified. The assessment should be led by the Ministry of Environment as a first step.
Medium-Term	- Natural Resources preserved and respected	- Once the status of the main resources is assessed and testes, the Ministry of Agriculture should develop a detailed plan on how to reduce the levels of pollutions in each resource. In case of incapability, the Ministry should do a partnership with interested UN agencies such as UNDP and other NGOs the Private Sector. - The Waste issue in Lebanon contaminating the soil and underground water should be solved by re-introduced more sustainable waste management practices. - On-going control of the usage of pesticides and insecticides. - Interventions should take place by the municipalities to rehabilitate the water networks and this should be set as priority for their development plans.
	- Food Safety and Nutrition are adequate	- after the assessment of industries and for the medium-term, food in storages and on the shelves should be assessed. A sample from the food can be taken and tested. All the data should be shared by the consumers to improve the accountability and knowledge of consumers and reduce the health risks. - Inspections on Storages and transportation cars
	- Environmental Practices applied	- More environmental awareness to students and citizens through ads and Social Media. - At the sectoral level, several ministries and key agencies have integrated disaster risk considerations into sustainable development and developing their response plans - An in-depth study regarding the food loss throughout the whole value chain. Significant losses are caused by inadequate transportation infrastructure and storage conditions as well as decisions made at earlier stages of the supply chain, which predispose products to a shorter shelf life. Adequate cold storage, in particular, can be crucial to prevent quantitative and qualitative food losses.

Long-Term	- Natural Resources preserved and respected	- Improving the arable land in Lebanon and finding solutions to increase its percentage – considering its small size and mountainous characteristics – is by empowering the agricultural sector such as the real estate and improve the irrigation system to make the remaining agricultural lands arable. - Agricultural lands are designated by the Government of Lebanon (GOL) as exclusion zones. - Treated Sewage Systems. This should also be done through the municipalities as a priority too as the sewage systems are considered as the main polluter to the ground water.
	- Food Safety and Nutrition are adequate	- Policy development on the implementation of GAPs. - Tests on the imported food and not only the exported ones as this is crucial for the safety and health of the citizens. The imported routes should be well defined and samples from the imported food should be studied in areas' laboratories.
	- Environmental Practices applied	- Adoption of more drought and heat-resistant species. - Change planting dates and cropping patterns. - Usage of adaptation technologies such as: Conservation agriculture, good agricultural practices and range of adapted varieties and rootstocks have been selected as priority adaptation technologies in Lebanon based on their economic viability.

Final Analysis – the Overall Index

Literature Review – "Development and Food Security Global Indexes"

According to Sen, "An adequate conception of development must go much beyond the accumulation of wealth and the growth of national product and other income-related variables, without ignoring the importance of economic growth, we must look well beyond it" (Sen, 1999, p.14). From Sen's perspective, it can be understood that development is essentially concerned with not only the wealth but also the enhancement it does to people's life (Acuna-Alfaro, 2006). Consequently, a new view of development has emerged which Todaro (1997) describes as a multidimensional process involving major structural changes in social, attitudes, and national institutions, as well as the acceleration of economic growth, the reduction of inequality and the eradication of poverty. The assessment on these existing indicators can give insights in developing more comprehensive and holistic development indicators in the future. Many studies have been conducted to identify the indicators that represent the development level of a country. In the meantime, many researchers have come up with variety of development indices to rank the countries according to their national performance.

The measurement of development or poverty as multidimensional phenomena is very difficult because there are many theoretical, methodological and empirical problems. The literature of composite indicators offers a wide variety of aggregation methods, all having pros and cons. The shift from a single dimension to multiple dimensions, by enlarging and enriching the scope of the analysis, represents an important theoretical progress and has some relevant advantages in terms of policy. However, notwithstanding those benefits, the multidimensionality makes the measurement and evaluation of development and poverty more difficult[410]. In fact, while measuring and assessing a given single dimension can be done with a single indicator, multiple dimensions require a set of various indicators. This multiplicity implies a number of theoretical and statistical problems, especially when we need to make comparisons over time and/or space.

In general, most of the existing development indices have been criticized with regard to poor data, incorrect choice of indicators, involvement of only a few dimensions of the broader concept of development, lack of consideration on non-material aspects and poor specification of the development framework[411]. Therefore, a comprehensive development index needs to be developed to measure a more holistic approach of development[412].

There are three main components of sustainability according to Gilbert, Stevenson, Girardet and Stren (1996) which are environmental, social and economic sustainability. In a nutshell, although the existing development frameworks and indices seem insufficient to accurately measure development in its comprehensive sense, it could still provide valuable insights to provide a better alternative to the existing development indices. All the advantages and limitations will help to direct to developing a better index which is more comprehensive and integrated. We have

[410] The indicators and indices od development, Afeez Salami et al, July 2017
[411] Ibid
[412] Ibid

to take what is common and good among the indices from these three frameworks and add indicators on any missing important aspects in order to develop a better development index.

The Global Food Security Index (GFSI) and Food Sovereignty

During the past decades, there has been much debate on food security. A variety of indicators have been proposed in order to establish which countries are in need of improved food security status[413]. The heterogeneity of existing indicators and the lack of consensus on how to compare and rank countries have motivated international organizations to build composite indexes to synthesize the information[414]. The process of building composite indexes involves multiple choices that influence the outcome. Several measures of food insecurity, whether at the household or at the national level, have been introduced during the past two or three decades. Some concentrate on the determinants of food security while other emphasize more the consequences of food insecurity.

The Global Food Security Index considers the core issues of affordability, availability, and quality across a set of 113 countries. The index is a dynamic quantitative and qualitative scoring model, constructed from 28 unique indicators, that measures these drivers of food security across both developing and developed countries. The overall goal of the study is to assess which countries are most and least vulnerable to food insecurity through the categories of Affordability, Availability, and Quality and Safety[415]. The affordability indicators assume that all people are consumers. In reality, most of the food insecure people are mainly producers and only partially consumers buying food on the market[416]. The availability indicators contain the supply of food and food aid. A supply indicator tells us little about whether people have access to supplies – and whether this supply has replaced local produce (as food aid often does), and is sustainable or leads to sustainable solutions, as it should under the definition of food security. The indicators that are related to public expenditure for R&D fail to investigate what is this expenditure/infrastructure and how this is related to food insecurity[417]. This is why before assessing the food security index of a country, we should assess mainly the status of the food and agricultural systems in order to develop policies that solve the fundamental issues.

Hence, over the last two decades, the concept of food sovereignty has rapidly moved from the margins to more center stage in international discussions on food security and development. The Food Sovereignty Movement is based upon personal ethics about sustainable food production[418]. Food sovereignty' places emphasis on the right of individuals and communities to define the processes that regulate their own food systems, from production to consumption. It questions power imbalances in the food system – from the global to the intra-household level – with a

[413] On the Composite Indicators for Food Security: Decisions Matter!, Fabio Gaetano Santeramo, 2015
[414] Ibid
[415] The Global Food Security Index, The Economists
[416] NEW GLOBAL FOOD SECURITY INDEX IGNORES KEY ISSUES, MAY LEAD TO WRONG POLICIES, Food Governance
[417] Ibid
[418] Food Sovereignty, Science Direct

particular focus on how global systems support resource-intensive farming thereby hindering the ability of resource-poor farmers, particularly from the Global South, to support their livelihoods through agriculture[419]. Food sovereignty remains pertinent today; is evident in many aspects of daily social, cultural, and physical life; and counters the colonial pasts that have long devastated communities (McMichael, 2014).

The "Food Sustainability and Agricultural Development Index"

A major breakthrough in the thinking about Food and Agricultural systems should take place which will eventually lead to a re-definition of both systems from ones that focus solely on the food security to ones in which the fruits of strong systems benefit the population in terms of higher economic growth levels, literacy rates and education levels, better health and nutrition, higher levels of social cohesion and social skills, and more equality: "people who are food secure and live within a strong food and agricultural systems tend to be more educated, enjoy a decent standard of living and contribute directly to the development of their countries".

Our work complements numerous calls to convert the analysis of the current food and agricultural systems from an industrialized, consolidated systems approach into one considering the socioeconomic, agro-ecological principles and food citizenship. Our main contribution is in developing a new composite index, applied in a country with a weak data environment, as a sign that no indicator should be left behind if no data is available. In this research we propose harnessing the socioeconomic, ecological, environmental, food safety, governance and institutions capitals to measure and reform the food and agricultural systems in a country into what we refer to as sustainable and developed systems. Moreover, new indicators have been selected for this study, which will open doors for future researchers to select one indicator and extend it.

Sustainability is the challenge of our time (Sachs, 2015). By seeking to achieve dynamic and simultaneous harmony among ecological subsystems (environmental sustainability), social subsystems (social sustainability), and economic subsystems (economic sustainability), sustainability is inherently complex, multi-dimensional, and embedded with trade-offs among multiple sustainability dimensions (Wu, 2013). However, as the public's desire for more sustainability grows stronger (Kates and Clark, 1999; Kates et al., 2001), so does the need to accurately assess the sustainability of our societies (Böhringer and Jochem, 2007), which is no easy task. To capture the complexity of sustainability, sustainability assessments often require the integration of multiple indicators to form composite indices (Özdemir et al., 2011; Wu and Wu, 2012)

The provocative questions that might be raised are: to what extent are analysts able to synthesize a complex phenomenon such food security by mean of a single composite indicator? And how should governments interpret the message that existing food security indicators convey? We took the suggestions from many experts that when proposing new composite indexes, "the United

[419] Ibid

Nations, international agencies, academics, and researchers, must pay careful attention to emphasizing the algorithm implemented to transform raw data into a single index and be aware of the implications that each method conveys. Without transparency on the steps followed to build the index, no judgment or comparison with existing indicators can be made. As some example shows, the political and practical implications of each choice made are very relevant."

Sustainable food and agricultural systems – The framework for analysis

Ian Scoones, in his work "Sustainable Rural Livelihoods _ A framework for analysis", outlined a framework for analyzing sustainable livelihoods where he showed how, in different contexts, sustainable livelihoods are achieved through access to a range of livelihoods resources (natural, economic, human and social capital) which are combined in the pursuit of different livelihood strategies (agricultural intensification or extensification, livelihoods diversification and migration). Scoones posed a key question to be asked in any analysis of sustainable livelihoods:

"Given a particular ***context***, what combination of ***livelihood resources*** result in the ability to follow what combination of ***livelihoods strategies*** with what ***outcomes***?"

Scoones framework can be applied at a range of different scales – from individuals to nation – where sustainable livelihoods outcomes are assessed at different levels.

Hence, our framework of analysis is influenced by Scoones approach where we will pose a different question to analyze sustainable food and agricultural systems:

"Given a particular ***index***, what combination of ***capitals*** result in the ability to follow what combination of ***capitals' strategies*** in order to reach to ultimate ***outcome***?"

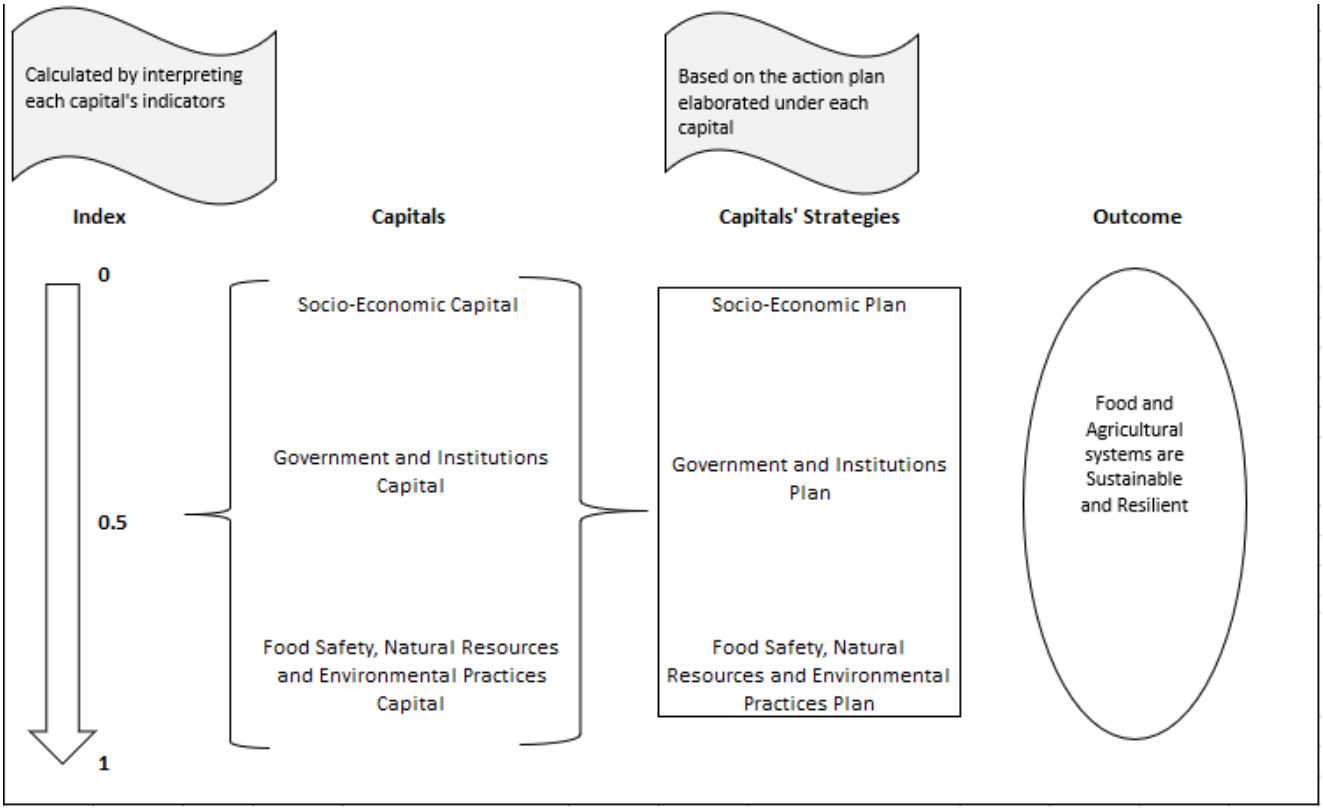


Figure 6: Framework for Analysis

Based on the framework, four main scenarios arise:

- Scenario 1: Index ≤ 0.25
- Scenario 2: $0.25 \leq$ Index ≤ 0.5
- Scenario 3: $0.5 \leq$ Index ≤ 0.75
- Scenario 4: Index ≥ 0.75

Scenario	Description	Combination of Capital	Strategy
Index ≤ 0.25	Country is performing very bad, based on reasons identified during analysis of indicators.	In most cases and depending on each country in such case the combination should take place for the three capitals together	Follow the three developed action plans

0.25 ≤ Index ≤ 0.5	Country performing moderately bad; the majority of indicators have a low value and performing badly.	In most cases and depending on each country in such case the combination should take place for the three capitals together	Follow the three developed action plans
0.5 ≤ Index ≤ 0.75	Country performing moderately good; the majority of indicators have a high value and performing well.	Depending on each country, the combination of 2 capitals or 3 can take place	Work on the lowest indicators
Index ≥ 0.75	Country is performing good on the vast majority of indicators.	Depending on each country, the lowest capital can be prioritized	Work on the lowest indicators

Lebanon Final Index

$$Final\ Index = (Capital\ Ind\ 1)^{w1} * (Capital\ Ind\ 2)^{w2} * (Capital\ Ind\ m)^{wm}$$
$$= \prod_{i=1}^{m} (Capital\ Ind\ i)^{wi}$$

Refer to Annex 4:

Capital	Weight	Before Crisis	After Crisis	Final Index Before	Final Index After
Socio-Economic	0.333333333	0.377594013	0.294863581	0.72278373	0.665590393
Governance and Institutions	0.333333333	0.362477525	0.345338667	0.71300684	0.701587328
Food Safety, Natural Resources and Environmental Practices	0.333333333	0.36010503	0.322662838	0.71144784	0.685882385
TOTAL	**1**			**0.36664446**	**0.32028635**

Sensitivity analysis

Sensitivity analysis examines how changes in the assumptions of an index model affect its predictions. By definition, an index model is a simplified mathematical representation of a complex interaction of variables, and as such is built upon certain assumptions. These assumptions, which include the structural specification of the model and the values of its parameters, are made to best approximate the phenomenon the model attempts to capture. At the same time, however, a model's assumptions are typically subject to uncertainty and error. For example, variables' current values often are not known with precision, and their future values may change. A properly designed sensitivity analysis can be a powerful modeling tool that contributes to an understanding of the relationships between the assumptions of an index model and its results. Moreover, such an analysis can help validate the model's predictions even given uncertainty about its assumptions. An incorrectly designed sensitivity analysis, however, can be used to support a flawed model and can lead to wrong conclusions. Accordingly, it is essential to design this analysis carefully.

Because index models are complex and frequently consist of many interrelated variables, it may be appropriate to test the effects of changing more than one variable at a time. In these circumstances, understanding the relationships among variables is important for designing a sensitivity analysis because, if variables are correlated, a change to one variable is likely to be accompanied by changes to one or more other variables.

When correctly designed, a sensitivity analysis is a valuable modeling tool because it may provide information on the robustness of a model's predictions. That information can help validate an index model in the presence of uncertainty. Conducting sensitivity analysis provides a number of benefits for decision-makers. First, it acts as an in-depth study of all the variables. Because it's more in-depth, the predictions may be far more reliable. Secondly, it allows decision-makers to identify where they can make improvements in the future.

In this study, we created four scenarios for the analysis to be compared with the baseline:

- scenario 1: keep only the indicators who have changed after the Syrian crisis and remove others.

- scenario 2: give higher weight for indicators who have changed after the Syrian crisis but keep the others with lower weight.

- scenario 3: give the indicators which has the higher number of indicators a higher score.

- scenario 4: give each capital in the final analysis a different weight based on the number of indicators.

Refer to Annex 5:

Capital		Socio-Economic	Governance and Institutions	Food Safety, Natural Resources and Environmental Practices	Final index
Baseline	Before S. c.	0.378	0.362	0.360	0.367
	After S. c.	0.295	0.345	0.323	0.320
Scenario 1	Before S. c.	0.404	0.365	0.409	0.381
	After S. c.	0.284	0.389	0.343	0.321
Scenario 2	Before S. c.	0.309	0.356	0.356	0.340
	After S. c.	0.272	0.347	0.354	0.322
Scenario 3	Before S. c.	0.399	0.334	0.355	0.362
	After S. c.	0.338	0.339	0.310	0.329
Scenario 4	Before S. c.				0.364
	After S. c.				0.332

Based on the sensitivity analysis presented in the Annex 5 attached to the thesis and synthetized in the above table, we can conclude the below:

- result scenario 1 (sc 1): *"keep only the indicators who have changed after the Syrian crisis and remove others."*

Under this scenario all the index values calculated before the Syrian crisis increased their value, while after this event the index for the Socio-Economic capital decreases and the overall index remains rather stable. As a consequence, the variation after/before for the Socio-Economic capital goes from -21.9% in the baseline scenario to -29.9% in scenario 1; the same values are -4.7% and +1.3% for the Governance and Institutions capital, -10.4% and -16.1% for the Food Safety, Natural Resources and Environmental Practices capital, -12.6 and -15.9% for overall index. The inverse variation for the Governance and Institutions capital confirms the reduced significance of this component considering the short period of analysis. The overall index variation under this scenario confirms that using only the indicators which showed a variation over the period analyzed, a more dynamic version of our model can be obtained.

- result scenario 2 (sc2): "*give higher weight for indicators who have changed after the Syrian crisis but keep the others with lower weight."*

As indicators are normalized, therefore their values are comprised between 0 and 1, applying geometric weights one obtains a results such as the higher is the weight, the lower is the results. Therefore, in order to reduce the impact of indicators stable before and after the Syrian crisis (static indicators), their weight must be increased. Our choice has been to halve the weights of indicators which value changed over the analyzed period (dynamic indicators), calculating afterwards the (equal) weights of static indicators so that the adding-to-1 condition could be maintained. Our expectation has been to obtain intermediate results between the baseline (equal

impact of all indicators) and the scenario 1 (no impact of static indicators), while indeed the variations of all the capital indices, as well as the overall index, are constantly lower than both the previous findings. The variations are -12.1% for the Socio-Economic capital, -2,4% for the Governance and Institutions capital, -0.4% for the Food Safety, Natural Resources and Environmental Practices capital and -5.1% for overall index. Therefore, while the baseline and scenario 1 could be considered as polar situations between which an intermediate solution should be found, selecting intermediate weights as in scenario 2 appears not to be the good way.

- result scenario 3 (sc3): *"give the aspects having the higher number of indicators within each capital a higher score."*

The weight of the aspects has been calculated based on the number of indicators. First of all, each aspect had a provisional weight equal to 1/n, with n = the number of indicators referring to it, thereafter the weights have been reevaluated in order to keep the adding-to-1 condition. The idea underlying this scenario is that the higher the number of indicators referring to aspect, the more consistent can be assumed its impact on the index. Results indicated in Annex 5 and synthetized in the above table show that for all the capitals but the Food Safety, Natural Resources and Environmental Practices one, the index variation before and after the Syrian crisis is lower than the baseline. While the variation concerning the Governance and Institutions capital index, equal to +1,3%, can be considered as non-significant, for the same reasons as in scenario 1, the reduction (compared to the baseline) of the Socio-Economic capital impact, (-15.3%), not appearing for the Food Safety, Natural Resources and Environmental Practices capital (-12,6%) suggests that there is, in the first case, a compensation effect among the indicators, which is emphasized by the different weights attributed to aspects with a very diversified number of indicators (31 vs 10). Opposite, this emphasis on compensation does not appear in the case of the Food Safety, Natural Resources and Environmental Practices capital, where ethe number of indicators is much more balanced (6, 8 and 8 for the three aspects).

- result scenario 4 (sc4): *"give each capital at the final analysis a different weight based on the number of indicators."*

The same way of calculating the weights applied in the scenario 3, has been applied to the scenario 4, but this way has been applied to each whole capital instead of the individual aspects referring to it. Therefore the indices referred to the three capitals do not vary compared to the baseline, only the way they are combined changes. The variation of the overall index before and after the Syrian crisis is lower than the baseline and all the other scenarios but the N. 2 (-8,7), again supporting the hypothesis of a compensation effect.

Conclusion

Findings' meaning

Applying the framework of analysis, our index for both before and after the crisis is between 0.25 and 0.5 close to the lower limit of 0.25 (0.3666 and 0.3202) which indicates that the country is performing moderately bad and at risk – if no interventions are applied – the system will be performing very bad under any new shock: the Syrian crisis has decreased the index by 0.046358107 with its indirect effects on the all the capitals. The crisis is in a neighboring country and not in Lebanon directly which means that any external shock is able to reduce the index by 0.046358107 (around 0.05), and since the country is situated in a hostile region than the likelihood of the occurrence is high. We can conclude that if an internal shock occurs in Lebanon than the probability of the index reduction will be 0.1 (double as the 0.05) as the majority of the impact is direct/internal and not from a neighboring country: assuming that the in-country shock has a double impact on the situation.

What we can highlight by this reduction that the food system in Lebanon is not resilient, and based on the framework for analysis all the action plans developed under each capital should be considered and applied. A country performing moderately bad for this index means that the food security and safety of people is at risk and no quick reforms might lead to the ultimate consequence, which is hunger.

In addition to the risks clarified within the chapters under each indicator, what the final numbers (before the Syrian crisis 0.36664446 and after the Syrian crisis 0.32028635) mean for Lebanon – in the near and far future – if no quick reforms and interventions take place?

- The wealth and level of income for rural communities will be at risk, hence risking the food security of people and further creating more social tension. The broader indicators of quality of life such as the freedom of choice to pursue taste and the well-being of workers and farmers will be impacted.
- Concerns associated with the socio-economic indicators analyzed, will decrease drastically the motivation to remain and enter the agricultural sector risking the whole sector future.
- More than 80% of agricultural workers are foreign born (mainly Syrian) with no legal contracts to protect them, leaving them vulnerable to exploitation. The agricultural labor market should be more considered by the Labor Law in Lebanon were labors should be covered by the national social security (access to health care); in such case, youth in rural areas will be motivated to work or invest.
- Globalization and the monopoly of input supply have been beneficial for large agribusiness firms. This concentration of input firm is leading to shifts in market power and affecting the distribution of economic returns among food chain actors (small farmers, cooperatives, MSMEs and more).

- Arrangements between large food processing and manufacturing companies and small-scale farmers and companies is low. These arrangements are important and should be widely initiated; The benefit of this arrangement is that it alleviates the farmer's risk of not finding a market and of not knowing what the price will be at harvest time. It also can provide an opportunity to hedge against price declines in case of unforeseen market circumstances (where the likelihood is high in Lebanon).
- - The "distribution" subsector of the food system provides the transportation and warehousing of food and agricultural products between the other sectors. It involves warehousing, trucking and other transportation, and procurement services. This sector is critical to the availability of food in remote areas and in cities far from production location. In Lebanon, the informality and the weak infrastructure of this subsector is not only threatening the availability of food but also the quality of food delivered.
- - Agricultural lands in Lebanon are being converted and degraded, with disastrous effects on human health and the environment. In the absence of serious and imminent change, the next generation will inherit a country with no agricultural lands and/or lands that has been damaged and plundered, and many will suffer from hunger, malnutrition.
- - Between 2015 and 2019, Lebanon imported about three million tons of food products each year to meet the demand on the domestic market. Less than 20 percent of the consumption needs of cereals was covered by local production. Hence, if the country is highly dependent on export and the global commodity prices. In case of any global shock or bordure closure no food available will be in the Lebanese market except locally produced vegetables and for a short time.

As per the findings and consequences showing that the country is performing very bad and the food security of people is at risk, in 2020 – after the data was collected for this study – Lebanon was and is still going through an economic crisis and a major COVID-19 outbreak. The latest 2020 data was not incorporated in this study since the data needed was collected before these crises, also, due to the uncertainty of the situation and the future; however, this example can back-up our findings that the country is at risk if any additional shock occurs.

Summary of the current situation (from media and publications available online):

<u>Crisis background:</u>

Way before the coronavirus pandemic at the start of this year, Lebanon seemed to be headed for a crash. At the start of October 2019, a shortage of foreign currency led to the Lebanese pound losing value against the dollar on a newly emerged black market for the first time in two decades. When importers of wheat and fuel demanded to be paid in dollars, unions called strikes. In mid-October, the government proposed new taxes on tobacco, petrol, and voice calls via messaging services such as WhatsApp to drum up more revenue, but a backlash and country wide protest forced the government to cancel the new taxation plans. However, the debacle unleashed a surge of discontent that had been simmering in Lebanon for years. Tens of thousands of Lebanese took to the streets, leading to the resignation of Western-backed Prime Minister Saad Hariri and his

unity government. In the wake of the first Covid-19 deaths and a surge in infections, a lockdown was imposed in mid-March to curb the spread of the disease. On the one hand, it forced anti-government protesters off the streets, but on the other, it made the economic crisis much worse and exposed the inadequacies of Lebanon's social welfare system. By the time the coronavirus restrictions began to be lifted in May, the prices of some foodstuffs had doubled and Mr. Diab (the Prime Minister in charge) warned that Lebanon was at risk of a "major food crisis". "Many Lebanese have already stopped buying meat, fruits and vegetables, and may soon find it difficult to afford even bread," he wrote in the Washington Post.

Consequences:

- As Lebanon weathers through an economic crisis and COVID-19 outbreak, food insecurity has become a major concern across media headlines and in society. More stories are surfacing on how many families can no longer afford to meet their food needs, raising questions on the future of Lebanon's fragile food sector.
- Food availability derives from domestic production or from imports, with Lebanon relying heavily on the latter as a net food importer. The recent scarcity of US dollars and capital control measures have put food availability at risk as food importers have been facing increasing obstacles to make payments on the international market.
- This high inflation of food prices, unprecedented in Lebanon in the last ten years, is strongly correlated to the unofficial devaluation of the Lebanese lira against the US dollar, which made food imports more expensive and also more difficult to get due to capital control measures. Food price inflation combined with inflation affecting non-food products and services, and with loss of income resulting from rising unemployment and salary cuts, has undoubtedly and drastically reduced Lebanese households' ability to afford adequate and sufficient food, especially for the poorest and most vulnerable.

Finally, Lebanon is facing a period of many unknowns, yet in the current state of emergency at national and global levels the provision of enough food at affordable prices for all Lebanon's residents, including refugees and migrant workers, must be secured. Failing this, the country's food security situation will rapidly deteriorate, both in terms of food availability and access to food. Considering the hypothesis mentioned above: "if an internal shock occurs in Lebanon than the probability of the index reduction will be 0.1 (double as the 0.05) as the majority of the impact is direct/internal and not from a neighboring country: assuming that the in-country shock has a double impact on the situation." Then, we totally assume that the current index will be around 0.2 maximum showing that the country is performing very bad – which is backed-up by all the current 2020 facts stated above.

Empowering the agricultural and food system is a must and if it was done before, less people will be at risk of malnutrition and no burden on the Central Bank to pay its final remaining savings on securing food to citizens.

Research Implications

The first major practical contribution of this thesis is that the majority of information related to the agricultural and food system in Lebanon was collected and available to the public. Hence, future researchers can pick one indicator and work on it accordingly for a more in-depth analysis.

The new index methodology we have developed give the decision-makers a new tool "influenced by existing methods" to analyze the situation – in a country where no data exists, and no index can be applied – to find solutions and improve the food and agricultural systems. One of the limits of our study was the lack of data, however, we did not let aside any indicator we found relevant and we made sure to get as much as qualitative data from field interviews and analyze them.

The sensitivity analysis suggest that the baseline solution adopted (uniform geometric weights for the indicators into the aspects, for the aspects into the different capitals and for the capitals into the overall index) can be compared with the one where only the "dynamic" indicators (those varying their value before and after the Syrian crisis) have an impact, which results in a more sensitive scenario; while the attempts to vary the impacts based on the number of indicators doesn't show significant results, possibly due to a compensation effect among indicators and/or aspects. However, in the baseline scenario, the variation of the overall index falling into the range of the partial indices referring to the different capitals, and quite close to the highest of them, indicate the absence of compensation effects between the different capitals, therefore allowing to analyze them separately.

The action plans and the findings of the study will be presented to the ministries. While delivering the results, a meeting with the "Ministers' Consultants" will take place to explain the research, its methodology and its importance. In addition, we will push for the index to be adapted by a governmental entity (either a ministry or institution such as the Economic and Social Council); if the government did not accept the adoption, we will be asking international organizations, UN agencies and universities in country to adopt it.

It is important to note that at the beginning of this research and before the data collection, a call has been conducted between us and the "The Economists Group" – the journal responsible of the yearly publishing of "Global Food Security Index"; during the call the experts showed a high interest in collaborating and they stated that they were not able to calculate the "GFSI" for Lebanon for two main reasons: lack of data and government support. Now, we will request a new call with "The Economists Group" to rediscuss further actions since the majority of data has been collected.

Finally, the limitations related to the development of the index in general come with the methods used to develop the index such as setting weights to aggregate variables, number of indicators, interference and more. In this thesis, we used the equal weight method for all variables as a start. This method is considered as an advantage for an index with a high number of indicators (in this case it is equal to 72); by this method, the main advantage is namely, that a debate over the

inclusion of variables, that is, which variables are important, can be conducted on a more basic level than a discussion that centers around the choice of numerical weights. However, more research shall be devoted in future to the optimization of the weighting system, which is often an issue in aggregative systems. Since the variables are often proxies of real phenomena and not measurements in themselves, it is more consistent to treat them as statistical objects that are not subject to further subjective numerical interpretation.

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