Converting underused mobility infrastructure to vibrant spaces of social cohesion and Security.

Placing street markets in Beirut City

Master thesis by Julien Bitar

Converting underused mobility infrastructure to vibrant spaces of social cohesion and security: Placing street markets in Beirut City

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Abstract

Beirut is Lebanon's densest city with very few unbuilt plots. Additionally, it is a car based city, where transportation is exclusive to private automobiles, hence most of the public space in the city is dedicated to vehicles.

This generates a great deal of car pressure on the public space, especially since there are no proper public transport network in the city. However, this situation is not permanent, and the city will eventually adopt a public mobility strategy, as the public is insisting on this demand nowadays.

On the other hand, most of the Urban blocks in Beirut are considered relatively small, creating more streets than usual or needed, from which, some are insignificant to the mobility network in the city. That being said, Public spaces such as streets, can be rethought of, and transformed from car infrastructure to pedestrian spaces, for an optimal use of space in dense cities such as Beirut.

These spaces could host functions the city needs today more than ever such as markets and public pedestrian areas. This aligns perfectly with the sever economic crises Lebanon is going through, where people are losing their jobs and all type of goods are becoming unattainable.

Today, people need access to affordable goods, adopt a new way of trading, and for this they need suitable spaces, most importantly free outdoor spaces in urban/dense areas.

Therefore my research question would be: how can underused mobility infrastructure host vibrant spaces of social cohesion and security? The idea behind this thesis is to build up a rational system that allows to assign functions such as markets and pedestrian areas to certain streets which can be closed down to cars. or where car access is reconsidered. This system is based on several parameters, such as parking availability, width and length of the street to properly accommodate markets, uninterrupted flow of goods and waste to and out of the city without adding congestion, and most importantly how to least affect the traffic flow and centrality in the city.

I will be using parametric tools to be able to test the pressure on the current street network, choose streets which would not affect the mobility network, set the mentioned parameters to filter out the streets which fulfill the criteria.

The expected outcome would be a set of streets fitting the criteria successfully to be used for markets/trading spaces as well as pedestrian area, making the city more livable.

Key words

Beirut / Public space / Street network

Public market / interactive spaces

Food security /Centrality / Accessibility

Economic crises / Import / Export

Structure

Introduction

The thesis starts by introducing Beirut as a city, it's context, a brief history of the city while going through the urbanization event and its consequence on population distribution and urban density.

In the second chapter, the urban form is explained more thoroughly from a spatial and urban perspective, to have a better holistic understanding of the city's potential and situation.

This thesis will tackle a financial and economic crises Lebanon is going through, it is considered to be the cruelest the country has ever seen. One of the many implications of this struggle would be, unfordable food as well as any kind of product imported to the country in the past. Moreover, The theory behind the thesis is to create spaces such as markets, where people can get fresh food for cheaper prices, and used products which will be very difficult to import to the country in the next five years at best.

Thus the targeted city in this Thesis will be Beirut, thus the generated method and approach could be used in any other city after some adaptation.

Nevertheless, the areas of trade and retail would have to physically be placed on a piece of land in the city, and since Beirut's land ownership is limited to streets, one park, one sea side promenade, and a couple of small gardens then it is best to leave the existing pedestrian spaces intact and convert vehicle infrastructure to street markets.

Furthermore, two type of markets will be developed, fixed food markets, and temporary markets such as flea and bartering markets, where once markets are not active the streets could be turned into shares streets or pedestrian areas (depending on the context).

Nevertheless, placing these markets is the main challenge in this exercise, and as a way to move forward, a list of parameters are set, such as closeness to parking spaces, proximity to bus stops, existing public spaces and of course the main food sources etc...

All these parameters are active and changeable once an estimation of the traffic situation is done, so that the chosen streets for conversion will not affect the global mobility flow.

As a final result, a parametric tool would be generated, allowing users to assign streets which do not interrupt the traffic flow and which fulfill the defined criteria, as potential street markets, making the targeted city a more livable, sustainable and affordable place.

1.Beirut the City

Introduction to Beirut city

Beirut, like any other city in the world is a result of continual overlapping sequences of complex layers; whether they are social, political, economic, religious, ethnic... However what distinguishes Beirut from other cities is its old history of civilization, which dates back to 5000 years ago, the different eras which ruled the city with the traces they left behind, and the rich cultural mix Beirut currently host.

Nonetheless, urban planning in Beirut is not any different from this odd elements mixture, this explains the urban form which may seem unfamiliar to western cities, as well to Arabic cities. Beirut within its Arabic context was known after the second world war as Paris of the middle east, this is mainly because of the French mandate/occupation but also because of all the cultures that occupied the city, leaving each time a new perception of the city.

On the other hand Lebanon's climate played a major role In promoting the city to all the world, especially with all four seasons, Lebanon was able to host visitors from all over the world, all year long. Tourist and visitors participated in shaping the cities and defining its cultural identity. This applies specifically to Beirut as it was the most Vibrant city throughout Lebanon's history.

Since Beirut is the capital of the country, and one the first cities to develop due to its proximity with the sea, it includes a great deal of spatial representation of different urban planning traces. Hence, there are many significant urban ele-

ments throughout the country, but in this thesis, I will be mainly focus on Lebanon's capital.

Lebanon is situated on the Mediterranean cost, with a surface of 10452 sqkm. To the north and east, Lebanon borders with Syria, to the south with Israel/Palestine with whom there is no diplomatic relations of any kind, meaning the borders are closed and are under the surveillance of the United nations peace corps.

fig 01: Lebanon regional map
by the author

History of the city:

As mentioned previously, Lebanon has gone through many phases throughout history and Beirut has witnessed most of them. Some left bigger spatial impacts than others on the city, but one way or another, this heterogeneity blend is what defines Beirut today.

Beirut dates back all the way back to 1000 B.C., when it was a flourishing Phoenician city alongside the east of the Mediterranean *(new Internationalist, 1994)*.

Back then, the city was known for its expertise in numbers and trade. The core of these activities relied on the strategic location of the city, besides the Mediterranean.

In later centuries, Beirut was under Persian conquer, then by the Romans, going through the Ottoman period, falling under the French mandate, to eventually reaching independence.

Finally, in 1943, Lebanon got its own independence, hence the Lebanese republic. The French mandate influenced deeply the urban planning in the city, public spaces and Boulevards in Beirut got more attention and centrality, Haussmann's design consisted of roads which intersects at monumental landmarks, this was the core of the French master plan for Beirut. While the Lebanese republic area was known for the economic bloom leaving a great trace through its architecture and modern heritage.

Of course all this ended with the start of the civil war which had major destruction impact on the city.
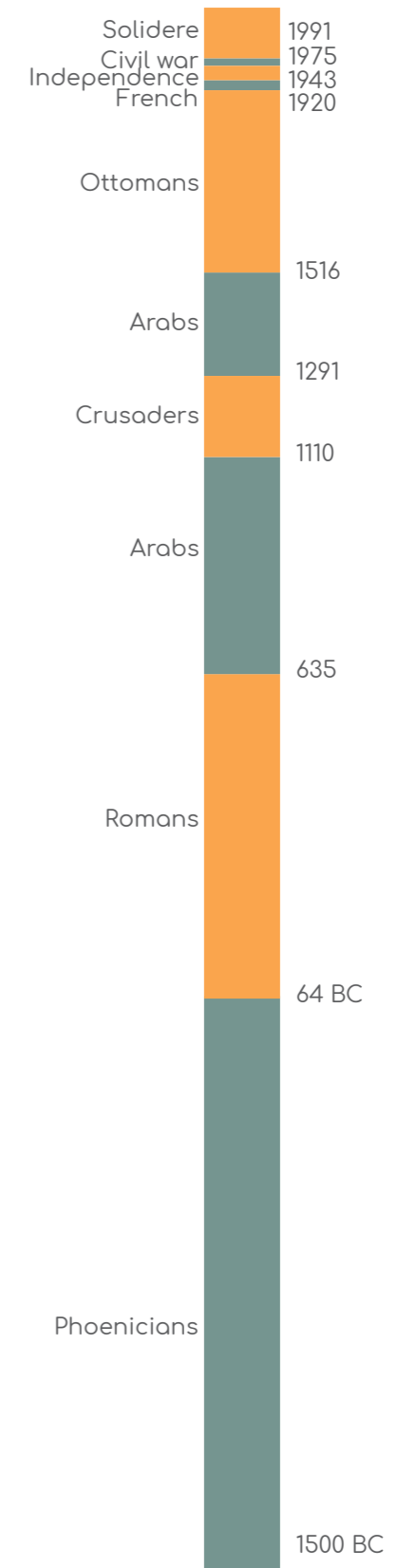

fig 02: Lebanon history timeline
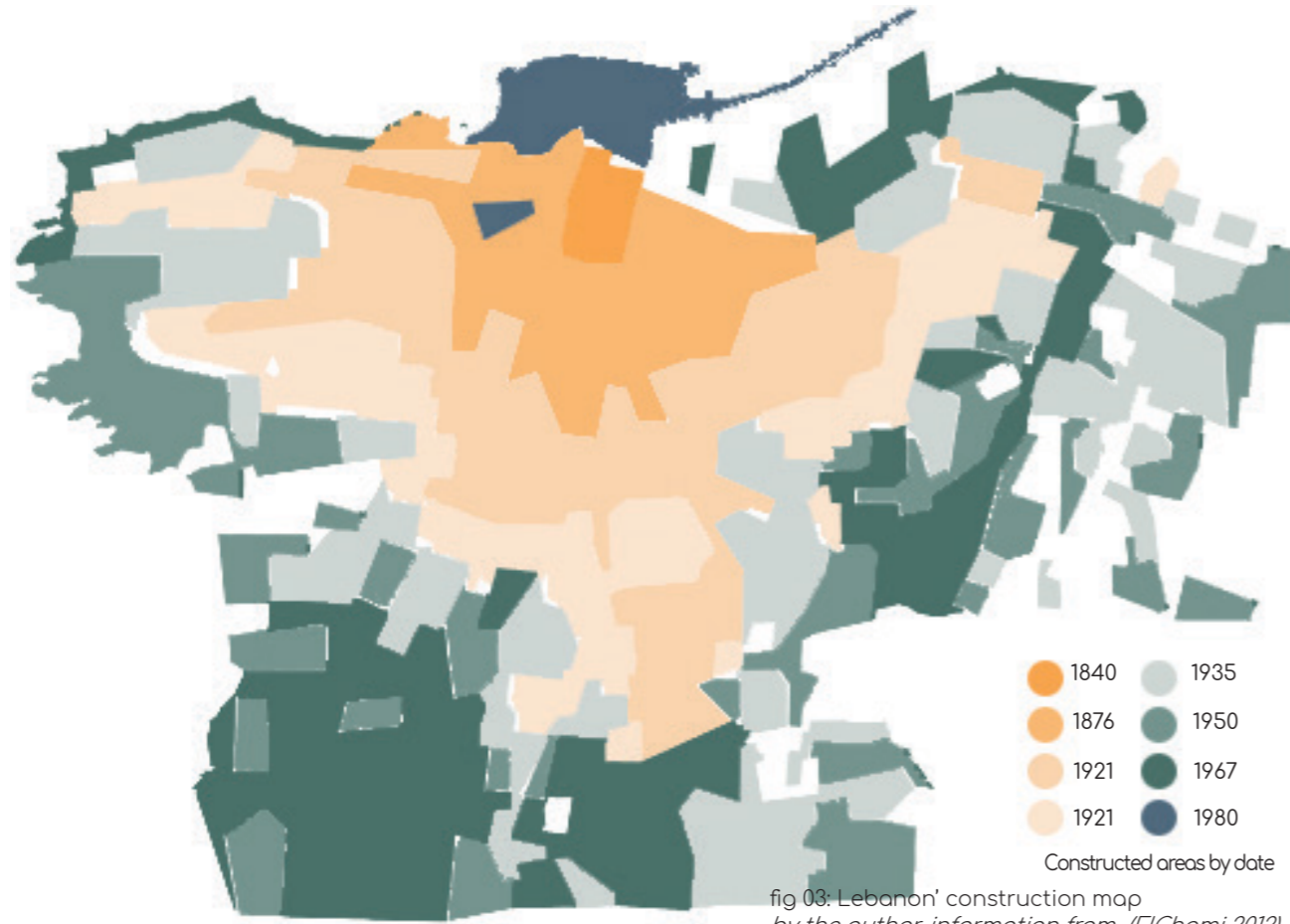*by the author, information from (ElChami 2012)*

	1840		1935
	1876		1950
	1921		1967
	1921		1980

Constructed areas by date

fig 03: Lebanon' construction map
by the author, information from (ElChami 2012)

(2000-2013)

	No. of Projects
Wider Ashrafieh	**405**
Ashrafieh	275
Medawar	28
Rmeil	102
Mazraa	**353**
Moussaitbeh	**330**
Wider Ras Beirut	**244**
Ras Beirut	191
Ain El-Mreisseh	53
BCD & Vicinity	**228**
Zokak El-Blat	40
Saifi	39
Minet El-Hosn	82
Port	19
Bachoura	48

fig 04: New project location
Source: Gebara, Khechen Marot, 2016)

	Total BUA
Wider Ashrafieh	**2,687,417**
Ashrafieh	1,965,142
Medawar	238,937
Rmeil	483,338
BCD & Vicinity	**2,271,532**
Zokak El-Blat	238,818
Saifi	371,576
Minet El-Hosn	1,189,465
Port	118,916
Bachoura	352,757
Moussaitbeh	**1,913,870**
Wider Ras Beirut	**1,769,415**
Ras Beirut	1,263,037
Ain El-Mreisseh	506,378
Mazraa	**1,247,008**

Built-Up Area per Project	
0 - 20,000 m2	1,455
20,000 - 50,000 m2	81
>50,000	24

BUILT-UP AREA PER PROJECT

- 0 - 20,000 m²
- 20,000 - 50,000 m³
- >50,000 m³

TOPOGRAPHY

fig 05: Size of new project location
Source: Gebara, Khechen Marot, 2016

Once the war ended, the reconstruction process took off, leading to Beirut city which is today the densest city as well as the Capital of the country.

Recent urbanization

To have a better understanding of the actual urban fabric of the city, one can look closely into the time of post and pre- civil war. This is an interesting era to observe as urbanization took place quite remarkably. After the independence and during the so called Beirut's golden age, the city's population grew by four folds, reaching in 1975 half of the Lebanese population.

According to Bourgey *(Bourgey, 1985).* Once the war and its ripple effect calmed down, reconstruction of torn down neighborhoods started, as well the construction of new suburbs. This construction boom reached its peak around the year 2000, when foreign investors as well as the capable Lebanese diaspora invested in the construction sector. Moreover, just like any other growing city, Beirut was and is always in a horizontal and vertical expansion process, the map below illustrates this progression on the horizontal level, in other terms the acquired land for construction.
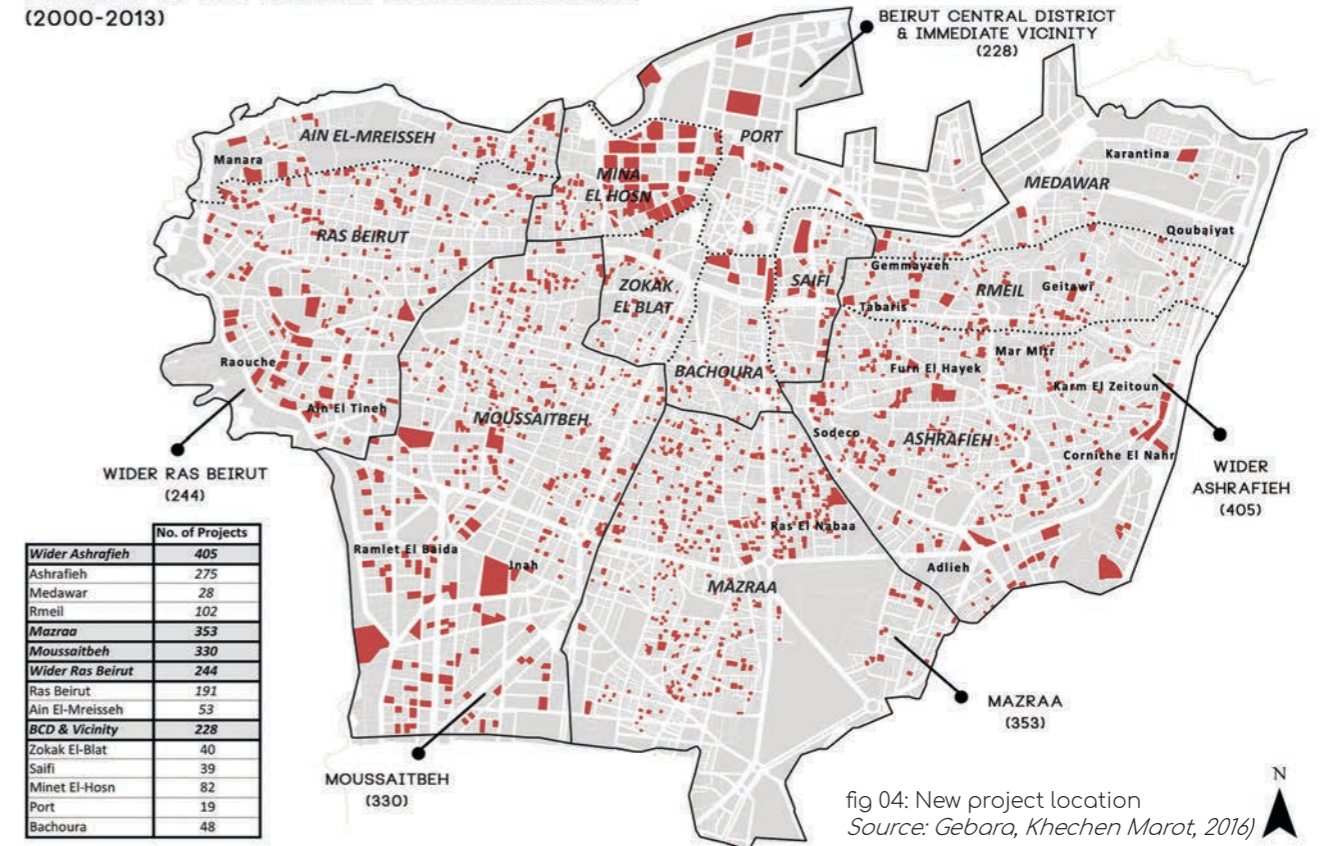
The projects are not only numerous but also quite dense, comparing to the existing urban form back during the construction time. Here is a map which demonstrates the constructed projects in terms of built area.

Population and density repartition

This pattern of land consumption and building construction come as a consequence to several policies such as centralized administration and neglecting rural development for decades.
This made Beirut the most attractive city not only for what it has to offer but also for people who have no another option.
Beirut city remained an attractive place to study, live and work due it's centrality on one hand, while being home to most of Governmental institutions, central administrations, business hubs, universities, museums, embassies and so on …
The centralized public administration of all personal paper work also reinforced this pressure on Beirut, in other words, all Lebanese citizens have to go through administrations located in the Beirut city to get most required paperwork of any kind done.
Therefore, Beirut witnessed a radical urbanization, and pressure of daily visitors. Although Beirut city, some would say is denser than most cities in the world but this falls within the municipality's effort to distribute the density through a zoning master plan of the area, where zoning regulation consist of building and construction norms with margins of GSI and FSI.

Obviously, the city center is the densest zone, and the further plots are from the center the sparser they are. Withal, according to Lebanese construction regulation, a construction permit exceeding the allowed local regulations can be approved by the national urban planning bureau if the project proves to have public benefits. This, in addition to old constructions might explain irregularities observed in the city's urban form.

Here is a table and map of the administrative borders of Beirut as well as the allowed GSI and FSI per zone.

Zone number	Constructible parcel	GSI	FSI
1	100	1	6
2	100	0.7	5
3	120	0.6	4
4	150	0.4	3.5
5	250	0.5	2.5
6	200	0.7	3
7	100	0.3	0.3
8	750/1200	0.4	0.9/2
9	-	0.3	-
10	-	0.2	0.2/1

Even-hough the built density range known as the zoning schedule defines bounds of density, yet the higher council of urban planning can give exceptions to some projects if they prove to fulfill some criteria or present proof that the project if beneficial on a bigger scale. This issue always launches a big dis-

fig 06: Beirut zoning map
made by Author

cussion among professionals, as sometimes projects are given 10x and 20x times more density margin, yet their benefits are quite insignificant compared to the negative impact the building creates on a neighborhood and area scale, whether it was in terms of urban scale, street alignment, street life, congestion during rush hours, shadowing buildings and public spaces. Beirut is not the only urbanized area in the country, however it is the densest of them all, mainly for the reasons listed above. The difference between Beirut and the second urbanized city in terms of urbanization rate is quite big. Measuring urban density is spatially feasible by using GSI, FSI and OSR param-

eters, but, then again these figures relate directly with population count eventually, or otherly known as residents in the city. This particular data is always a chance for debate in Lebanon as the last official census was done in 1932. Lebanese authorities try to avoid doing such national counts for political/religious reasons. During this census Lebanon's population was around 875 000 people. Nevertheless, in July 2019 an informal census was made indicating that the Lebanese population is around 5.5 million people *(Ramadan, 2018)* plus the registered and unregistered foreign residents and refugees which are estimated to round out to 2 million people.

Urbanization in Lebanese cities

fig 07: Urbanization ratio
Source: (Faour 2015)

● 1963   ● 1954

● 2005

This is quite a remarkable population increase and causes more shock since there was no other population count 60 years ago, however out of these 7.5 million resident in the country 2 million live within the border of Greater Beirut *(Moualef 2020)* which makes Beirut not only the densest city but also a relatively dense city worldwide.

fig 08: Urbanized Beirut
Source: (Mrad 2020)

2.Food and goods

Import and export

Lebanon is by definition an Arabic country, located on the Mediterranean, however the lifestyle and everyday products of most Lebanese people do not resemble in any kind its middle eastern and Arabic geographical context.
This is partially due to the massive good and products which are imported yearly to the country, mainly from the west.

This import consists of all types of goods, primary materials, clothing furniture, food and so on …
Unfortunately, from an economic point of view, the past couple of years held a great gap between the values of imports and exports, which means that as a country, Lebanon is purchasing products much more than he is selling.
This graph can illustrate this growing
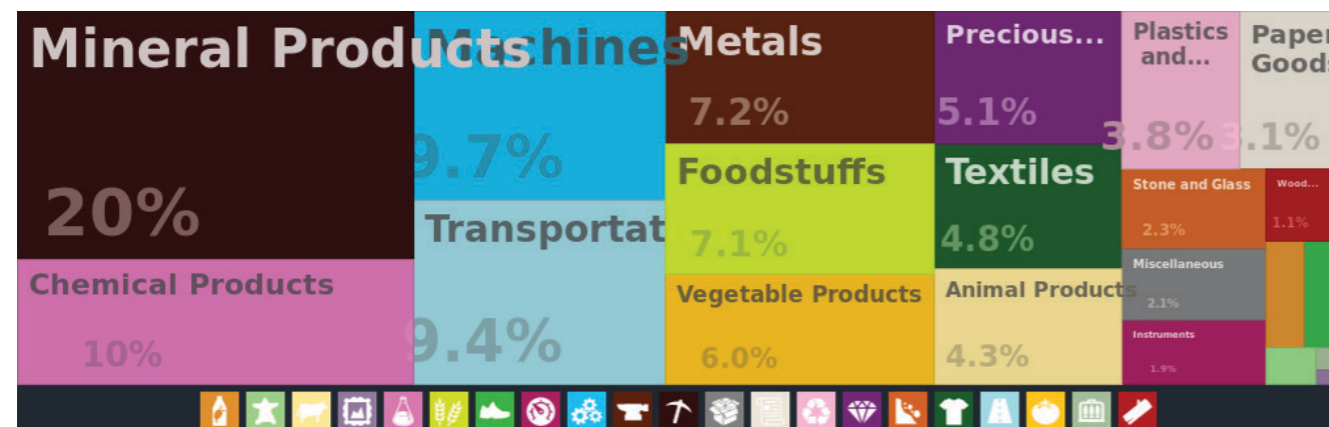
fig 09: Lebanon's product import
Source: (OEC 2017)

Import value in $
Export value in $
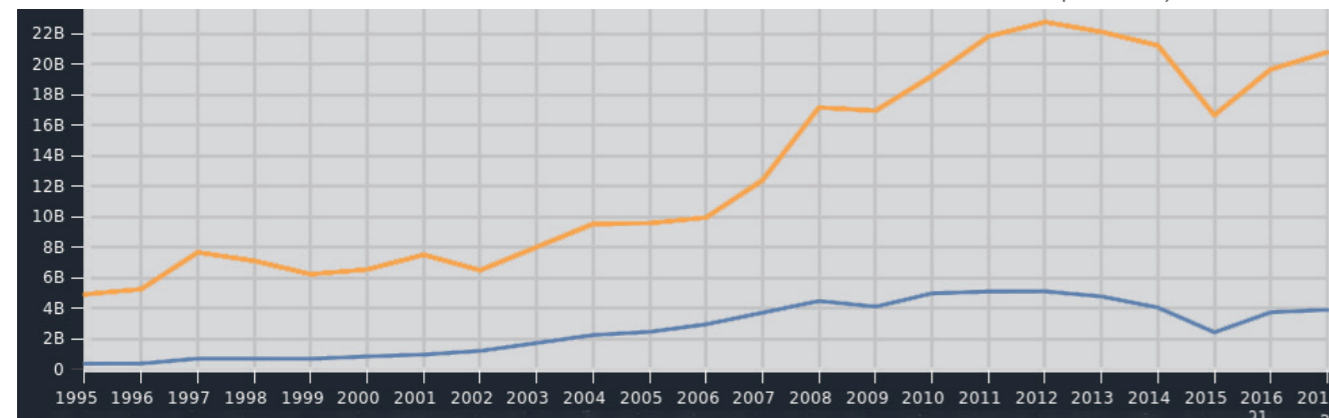
fig 10:Import/export values
Source: (OEC 2017)

In 2017, 20% of the imports to Lebanon were vegetables, fruits, meats and their products, which round up to almost to 4.5 billion in US $.

Imported Food related items

Total amount of Import
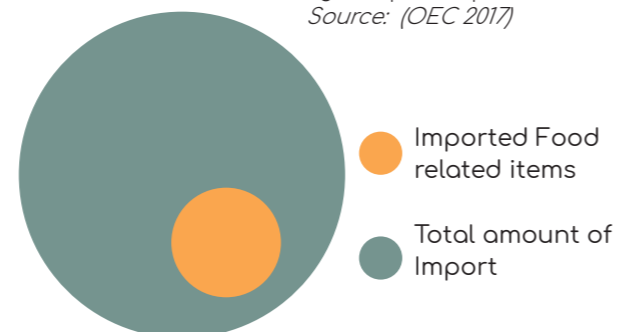
Experts and politicians say that in 2019 this number is much higher, thus precise studies and data are not publicly available.
After observing these figures, it is fair to say that Lebanon's food security counts massively on imported goods, and at any certain moment, shall this import be interrupted food accessibility is greatly threatened.

Economic crisis of 2019

Lebanese markets has always relied on two currencies in any kind of trading activities, the American dollar ($) and the Lebanese pound (LBP). The market never favored one currency on the other since the rate and value of the LBP has been always officially fixed for past decades in a way that 1$ = 1515 LBP, this has been done through financial policies set and executed by the Central Lebanese Bank.
Nonetheless, all this stable economic ground changed ever since October 2019, leaving the currency no longer fixed and bouncing daily, reaching sometimes 10000 LBP for 1 USD, which is 7 times the original value.
On the other side, Banks in Lebanon has stopped in 2020 to deliver bank notes in American dollars despite the fact that some account holders have account in US dollars, leaving the markets flooded with only LBP which has witness a great deal of devaluation.
At first sight this economic crisis might seem something any country could go through and get over it by simple measures following a holistic financial and

economic action plan, however in Lebanon, this might not be the case, since the country's industry, agriculture and consumer's behavior depend greatly on imported goods and resources.

Accessibility to food

According to a study done by the UN regarding food security, in 2016 when Lebanon was far away from this economic and financial crisis, around 35% of the country was within a margin of moderate food insecurity. This number is of course outdated as studies have not yet been done on the effect of the current crisis. Nevertheless, this number is much higher today, one can draw a similar conclusion when observing numbers of welfare aid requests the Government is receiving during the month of March and April 2020, which is around 300 000 request and still counting, according to the Minister of social affairs, noting that only one family member is allowed to apply for such support systems, and all employees of the public sector are deprived from this social support.
These figures can shed some light on how critical securing food can be, especially while the Government is financially incapable to greatly intervene because of the massive debts and currency drop. Food security, being the most fragile aspect of this crises, but of course this fallout affects all type of goods and products.
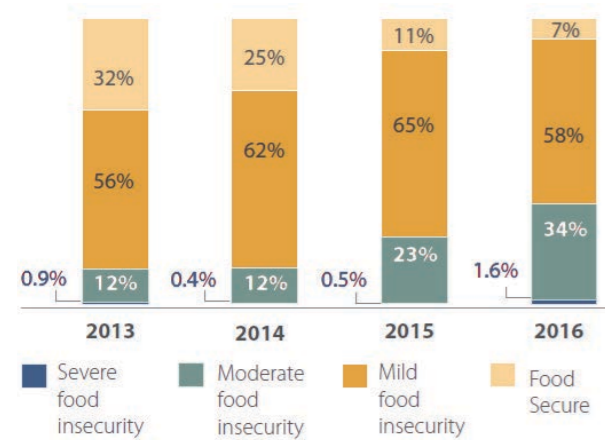
fig 10:Food security
Source: (United nations2017)

That is to say that obviously food security is no longer just a minor threat to the Lebanese community but rather a serious problematic leaving a big social class unprotected.

Not only but also the difficulty to import any type goods is much harder than before, and maybe impossible given that traders no longer are able to get bank notes of US dollars which is their only mean to pay off their shipping and product fees.

This situation leaves Lebanon with no other option than to rethink its food security strategy and adopt a sustainable plan where self-sufficiency is at the core of its action plan.

During this Crisis all the attention is at farmers, the food chain and subsistence agriculture which the Lebanese community has shown great interest in, this is clearly visible through virtual social platforms where people are sharing their urban gardening experience and limited knowledge in the field, also through the sale of agriculture supply store which has been witnessing an interesting spike, despite the financial crisis.

This great pro-active attitude will serve the overall wellbeing of the country, at least until the situation is taken care of on an official/national scale, but for it to be more efficient it needs great deal of organization and framework.

Especially when it comes to farmers promoting their products and goods since the agriculture lands are not so close to the city but could be easily connected.

Not only but also, products such as furniture and imported items are getting more inaccessible for the middle and lower class. This asks for unfamiliar measures to the Lebanese community such as communal ownership or sharing items on one hand and starting to think about buying used products.

This was never the case for the Lebanese people as their currency was always fixed and so they never felt the need to buy a used item except for cars.

It was always affordable to buy a new item right from the store, which is most probably imported.

Be that as it may, the Lebanese community has shown interest in gardening and agriculture, whether it was subsistence agriculture or traditional farming, the current situation has pushed the Lebanese community to change its habits and lifestyle. Hence, the community and the city today are both ready and eager to host public spaces of exchange and trade, where products are attainable in affordable prices, and people can benefit from second hand items that are still in good condition.

fig 10: Beirut alleys
Source: Mrad 2020

3. The urban form

Urban form

Following a spatial administrative approach, a city's urban form can be summed up by geometrical compositions of urban blocks and plots on one hand, by built and unbuilt space on the other. Beirut's urban fabric includes many organic traces and shapes, and this is due to the historical era and different urban design schools mentioned earlier. Moreover Beirut has many newly built areas, whether it was reclaimed land by the sea or redesigned wiped out neighborhoods in the post war period.

This explains the diverse shapes and sizes of urban blocks, as the city is built and designed on a plot level rather than a block level, meaning ownership is totally individual/private, and so the concept of communal ownership or shared space is not common in the city. For instance the effect of such policies would be that each car must every single plot, whereas if the city was thought from a block level infrastructure space will definitely reduce. Also, as a results of set GSI and FSI, Beirut's urban form has the following appearance.
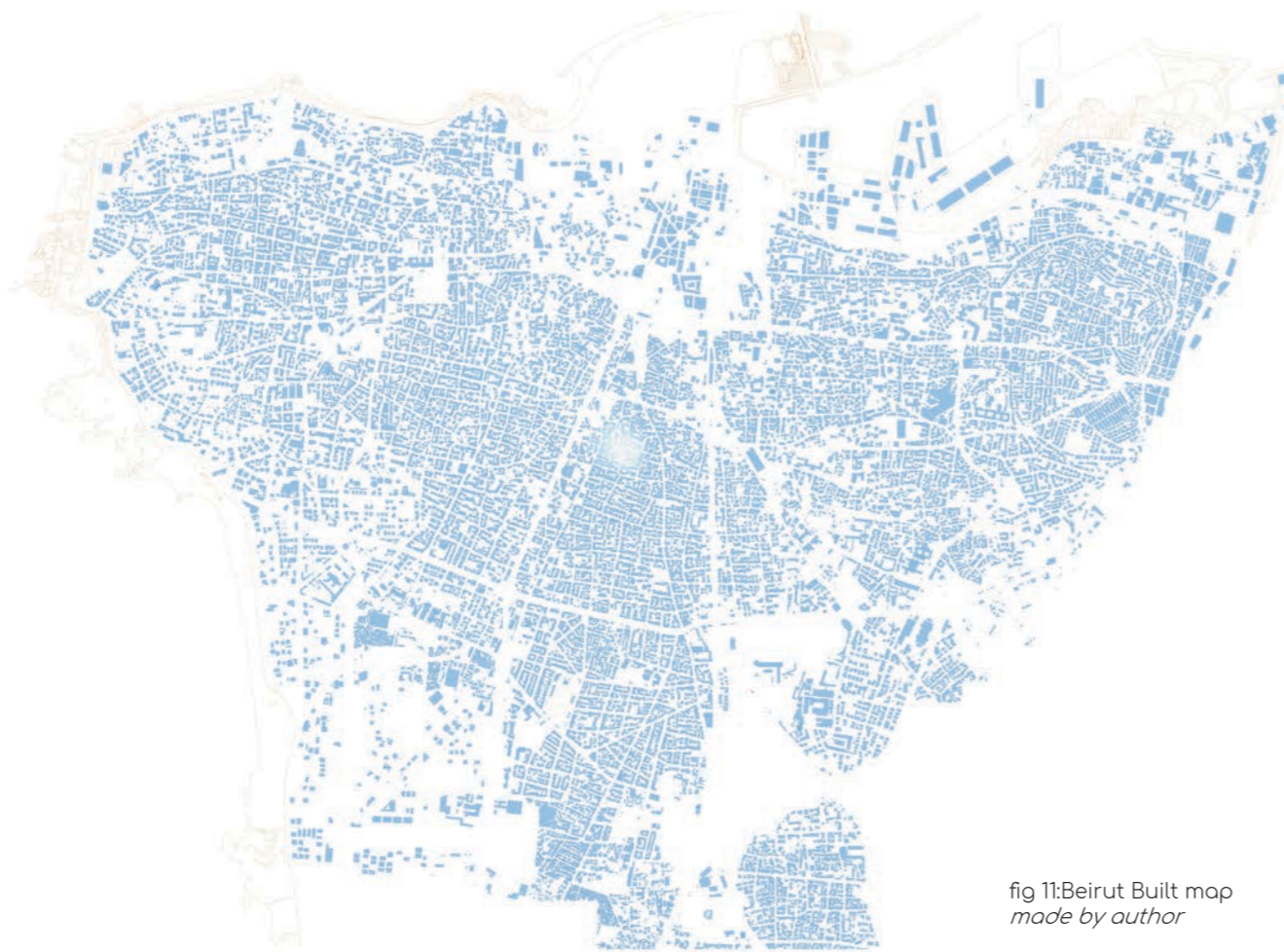
fig 11: Beirut Built map
made by author

Street network

Another result would be related to the street network, where it tends to have a larger number of streets than usual and urban blocks are smaller than urban planner prefer them to be for more compactness and optimal use of land. Beirut city is Lebanon's densest city, in terms of built density therefore population wise as well, and this creates a great pressure on the public space in the city, whether it's from the residents, or from commuters since a lot of people commute daily to Beirut for work or heading to public administration. As a matter of fact, the policy of centralized administration that Governments has been adopting for past decades has added up a lot of pressure on city from non-residents as most of the legal/official documents otherly known as personal official paper work are requested and done personally in Beirut.

Besides, Beirut lacks greatly a proper public or common transport network, some public buses do exists and they circulate without committing to a specific schedule, and most importantly without proper bus stops. Unfortunately, one could say that Beirut barely has any public transport.

Furthermore, a study done by the world Bank in 2017 confirms this, the study elaborates how 80% of the Lebanese community prefers to use a private car when moving around Beirut, leaving 20% to buses and taxis *(Anas, De Sarkar, Abou Zeid, Govinda Timilsina, Nakat 2017)*.

Once this changes and the city acknowledge a sustainable common or public transport strategy, car ownership and dependency will definitely decrease, hence the pressure on the street network.
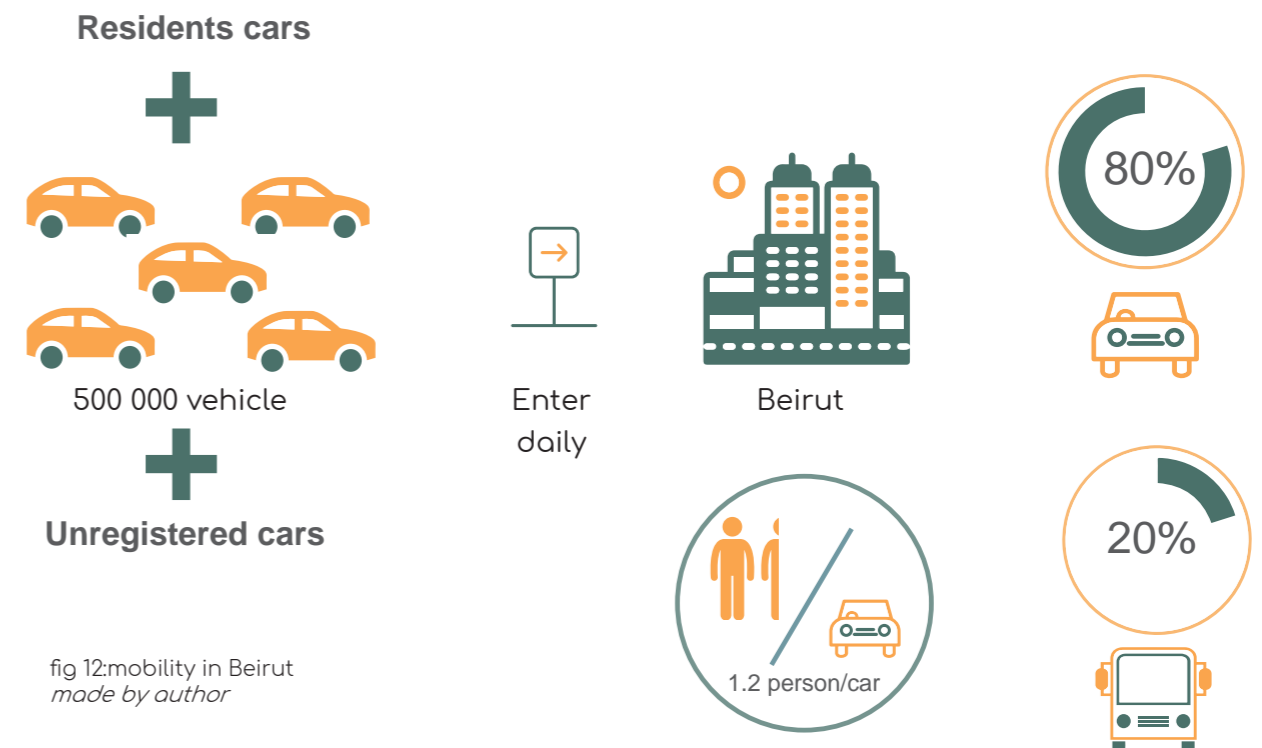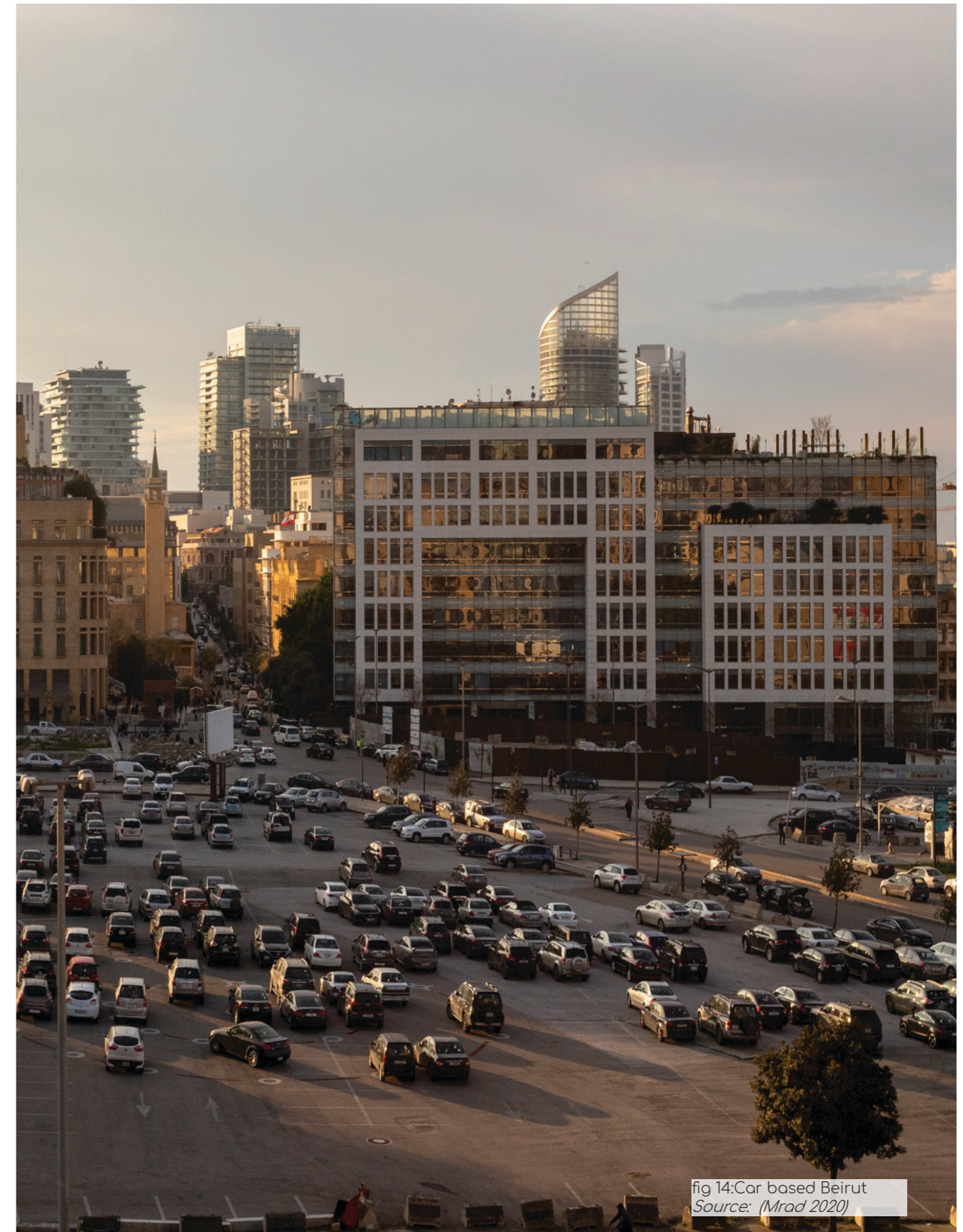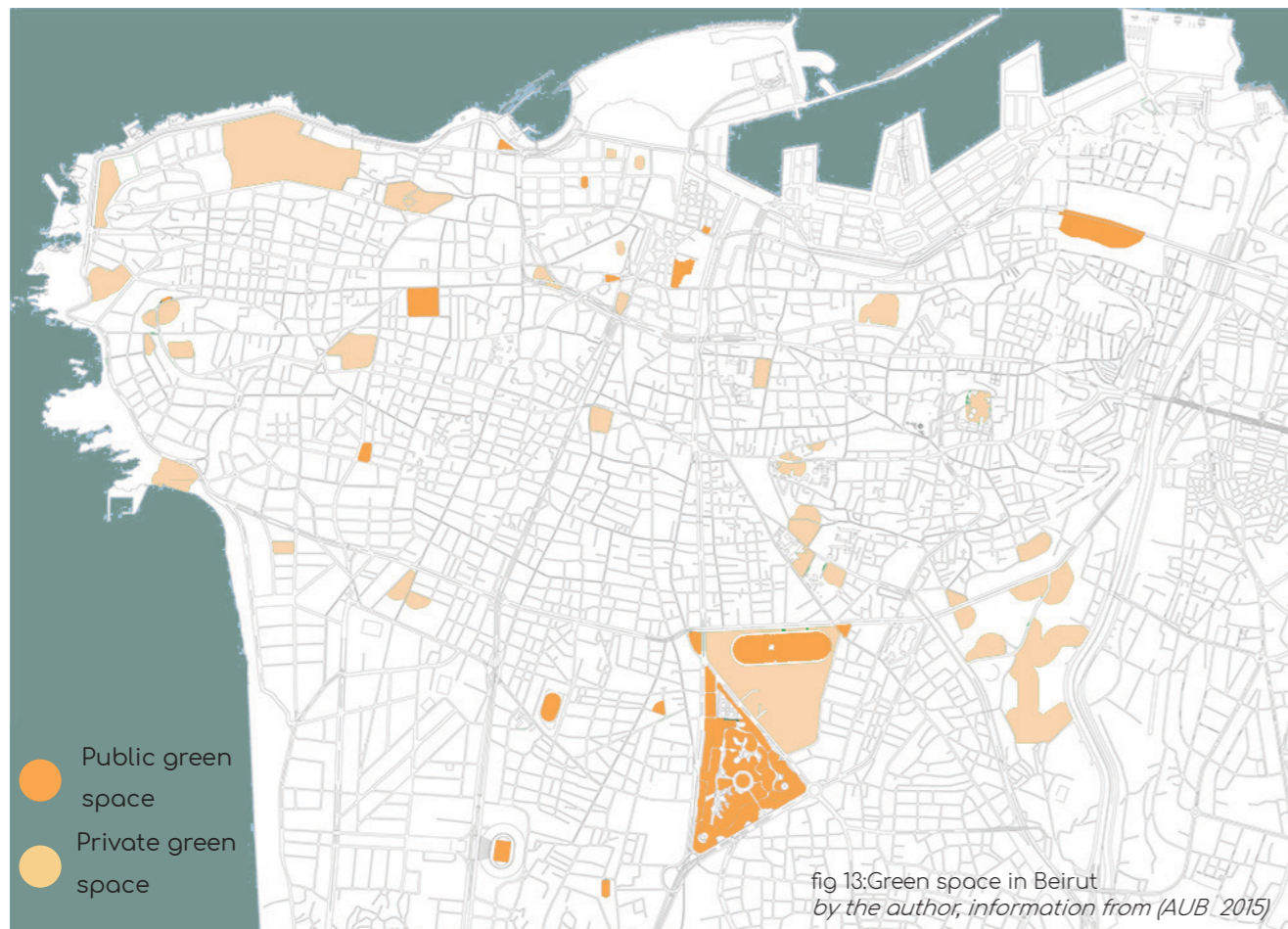

fig 12: mobility in Beirut
made by author

All this pressure is not permanent as eventually a sustainable public transport will take place, and so whether decreasing the number of cars entering Beirut or increasing the number of passengers per vehicle, the need and role for car streets won't be the same.

Public Space

In the meantime, any intervention needing a physical space or land has to either be placed in the very few pedestrian spaces in the city, by buying off a private piece of land (which is not common for political reasons) or exploring wider ranges of public space, meaning looking into the city's street network.

The street network ownership clearly is public like most cities yet public spaces in Beirut city are mainly exclusive to streets and very limited pedestrian spaces such as the seaside promenade, a couple of small gardens and the closed Beirut green park. Neighborhoods, residents as well as visitors do not have enough access to pedestrian public spaces. The map below can illustrate the privately and public owned green areas, and as one can see public green and/or pedestrian areas must be increased, and this is one of the issues which this thesis will tackle to reach a more livable city.

Public green space

Private green space

fig 13:Green space in Beirut
by the author, information from (AUB. 2015)

fig 14:Car based Beirut
Source: (Mrad 2020)

3

4.Role of Markets

Market as social-economic spaces.

Markets have always been a primary source of food and products to people, whether they are living in rural or urban areas, and just like any other asset in the urban realm, markets have evolved, developed and mutated, yet they still all fulfill the same basic role of providing goods, from the people to people.

Markets by definition are spaces where goods are offered for a reasonable price, usually cheaper than stores and supermarkets, moreover the goods in case of markets of edible products, the goods usually are fresher since storage is not that common nor needed in most markets.

Furthermore, markets are considered to be urban drivers in city, as they represent vibrant spaces with sociological and economic values, and its mainly a healthy accurate balance between these two that produces a successful functioning public market.

Project for public space (PPS), consider markets to have a role beyond trade and commerce, in a research about the impacts markets have on their communities PPS elaborates to list 6 major benefits of public markets in cities *(Project for Public Spaces, 2003)*

1- Provide Economic Opportunity
2- Link Urban & Rural Economies
3- Bring Together Diverse People
4- Promote Public Health
5- Create Active Public Space
6- Renew Downtowns & Neighborhoods

-Apparently public markets have a great deal of benefits to the city and the na-tional scale as well; Linking urban and rural economies is of course a goal in itself, but creating these one to one connections, between rural farmers and urban residents can have also healthy impacts, such as promoting internal/rural tourism, where people have the curiosity to visit these places once they go personally to purchase the food coming from those areas.

- Not only but also, on the touristic impact, markets can serve as magnets for tourist, many cities in the world such as Barcelona, Amsterdam and Berlin, have famous markets which became later on popular touristic destinations, this also falls within the umbrella of the benefits of local economy.

-Another impact worth highlighting, is the vibrant street life public markets create, where different social classes blend and meet. These inclusive spaces are vital to a city's growth as social cohesion becomes more probable and is given higher chances to succeed. The synergy generated in these spaces is an interesting social happening which could generate a diverse range of economic opportunities.

-Economically speaking, markets are always good and affordable businesses, especially for beginners, as they need a very small capital, and sometimes none (besides the sold product of course). This is always the case with vendors in properly functioning public markets, and as an outcome this financial cycle of profit boosts an upward mobility for the vendors, allowing them to improve their living conditions, their business or maybe afford taking leisure time.

Whether it was a daily or weekly market, vendors tend to experience this upward mobility, which can also effect the purchasing experience of buyers when the business and the product is refined or improved in terms of quality and or quantity.

Vendors in public markets, tend to be from a specific low income social class, this pushes them to promote their product in a certain competitive pricing system, which is usually affordable for buyers, who could also be a low income resident in the city's market. The fact that the market is open and the stalls are installed next to each other, gives the chance for vendors to observe each other's price, leading to a more competitive market, hence a better accessibility to affordable goods for the lower social class. Nevertheless, some markets are regulated by the municipality, meaning a municipal clerk is always checking If the pricing is within the allowed profit range set by the municipality.

All this affordable cycle of buying and selling creates a kind of social safety net for the lower class, where vendors are profiting from small incomes and buyers have access to affordable goods, particularly food.

Public markets in dense cities are actually a great gentrification brake tool, as they allow the lower class to maintain a certain affordable threshold while living in the city which is probably their workplace as well. Moreover, dense cities usually witness pressure on housing and this creates an ascending frequency rate in rents of houses and retail space, that have inevitable impact on the price of goods, especially food, and so public markets can sometimes be one of the only affordable retail space of edible products.

Affordable cities and access to food are major urban livability indicator of the city, not to mention the exclusive purchasing experience public markets can offer.

Cities with low income individuals or families can benefits greatly from public markets, while public markets create some job opportunities, they can also motivate the low income social class to start up a small part time business of their own, or grab some part time jobs opportunities the market and vendors need.

While traditional fixed public markets are rich of benefits on the urban scale, weekly or monthly flea markets are also a good idea for the city, where products are given a second life to be used, this falls within a circular approach where products are used and reused to their fullest potential to extend their lifecycle. Rather, these kinds of market also offer almost the same benefits as regular market from an urban and sociological impact, and definitely on the economic aspect as well, even if it was in a smaller intensity.

Thus, flea markets offer a chance to be a secondary income source for all the society, especially the ones in need, since this low income social class can practice a regular job with a fixed schedule while occupying a kiosk in a flea market of one day per month or week, to secure an additional revenue. These kind of markets also carry out an upward mobility for vendors, while giving a chance for people

who cannot afford buying new product such as furniture, clothing, stationary, books or electronics ...

In modern urban societies, mainly ran by capitalists, barter market aims to show the implied status of money as a man-made social construct *(the awesome foundation 2016)* it confirms the theory that people have interesting skills that should not be waged to a certain currency value. Barter markets are like any other type of markets where good and services are offered, yet the action of offering a certain currency, or money is not possible, but people have to offer their own goods, products or services in exchange for other goods, products and services. Besides, this type of markets favor individual initiatives and connections which have of course great social value, but also the fact that money is no longer the used currency, frees up the market from any unstable financial crisis, and can to some extend isolate and fortify the community against upcoming threats.

Withal, when money is left out of the trading system, bartering stimulates individuals living in cities to experiment and develop their skills and use this market to expose and discover other talents or skills and maybe think of a creative combination of different skills and goods to reach innovative kind of goods which could be useful to the society.

In short, there are various type of markets, although most of them carry great benefits for the city, the community and the economy, yet they all enhance each sector from a different angle and in different frequencies. Not only but also, for

these markets to function successfully, they must be places in their correct context, with the appropriate infrastructure, while making sure the markets are supported to financially sustain themselves on the long run.

Towards successful urban markets

Speaking about markets and their importance is without doubt a great way to bring back to life these urban commons, and with Lebanon current situation it goes even more without saying the compatibility in terms of what markets have to offer alongside the city's needs and struggles. Doubtlessly, urban markets, like any other element of the urban realm could be a great added value to its context when functioning well, yet it could also be a tremendous waste of funds, space, effort and most importantly time. Moreover, a city's behavior is complex science and the best to understand such a discipline is to observe and draw some conclusions, some urban planning schools such as the City of Amsterdam is a big fan of the learning by doing method. This bring up one of the most important struggles, thus the question of: What makes a functioning market?

The street plans cooperative, an urban planning, design, and research-advocacy firm based in the US works internationally on a research project called: Mercado, lessons learned from 20 markets across south America. The researchers have chosen 20 successful markets across south of America, these markets belong to cities with different, shapes, location,

sized, densities. Not only but also, the markets are different as well on many aspects, such as sold goods, market size, its layout.

All of these 20 markets have proven their success throughout the years, and despite the fact that they belong to different culture and aspects, yet according to the study they all share some characteristic which can be called characteristic of success (*The street plans cooperative 2014).*

These "success factors" deserve some recognition of some kind in the context of the relatively recent North American public market renaissance. According to the author these observations can provide inspiration and, eventually push readers to think about how to help markets continue to prosper.

The document highlights as research conclusions 10 points as the strongest success factors for markets.

1- full-day hours of operation

Most of the studied markets open all day along, even though the idea of full day hours' might sound expensive for vendors, yet the stall owners have argued that the long hours have payed-off, especially in areas where markets were centrally located and grouped into few compact markets, instead of sprawled vendors across the city.

Markets placed in residential neighborhoods and in busy mixed use spots in the city also have proven to be quite busy enough for vendors to have a good selling day, most of these market were place within walkable distances of public spac-

es, transportation hubs, housing areas, convenient stores and restaurants. They are all positioned to keep the selling activity going during the day as well as the night, all week long.

2- Accessibility and central location:

Obviously, the location of a market is a main condition for a functioning market. Vibrant makers remain vibrant only when the vendors and shoppers are given workable options for moving products in or out. If the market is too far from the next transit stop or parking space, shoppers will hesitate to visit it or to purchase more items. All studied markets were located in a busy neighborhood with a accessibility to a public transit and/or private parking space.

3-Protection from elements

The observations made on the physical shape of markets concluded that most the them offer shelter for both shoppers and vendors in rainy and sunny days for a comfortable shopping experience.

4-Navigable aisles

Aisles have to be wide enough to accommodate people moving around as well people who are standing in front of a stall.

5- Broad selection of goods

It is important to note that the markets in this study various products within each goods category.

6- Affordability

One of the biggest success factors for market is to be affordable, therefore accessible to all community and social classes. Studied markets have shown to be much cheaper than supermarkets, and in case prices of goods were higher

than stores, it would be for their superior quality and the limited attainability, for instance *bio* products and handmade items.

7- Safety

All 20 the markets gave an impression of safety, in other terms even though markets are crowded places with quick pedestrian movement sometimes, yet pick pocketing remain to be a common in most markets. This threat can be addressed by better control of the markets through defining entrances and exiting points and by the presence of official security forces.

8-Multi level vending

It goes without saying that the more options available in a market, the more people it could attract, in other terms healthy markets welcome all types of investors and vendors, whether they want to rent and set up a flashy stall or can only afford to display their goods on a desk or table.

9-Seating and prepared food

Vibrant markets mostly have this in common, as people tend to stay more therefore shop more in pleasant places they feel comfortable in. Urban furniture such as seating benches, Food and beverages can boost this impression, pushing people to enjoy their time in the market and stay for a longer time.

10-Integration of public spaces and pedestrian streets.

A great number of markets have been found to be more attractive when associated with a pedestrian street, or a small public space like public square. This improves walkability of the market while leaving space for socializing and cultural activities.

In such cases, market create a sense of community therefore people who visit this space tend to linger even more.

Markets enhancing a resilient Beirut.

In light of current events in Lebanon, the country is facing a great threat to all kinds of social safety nets. In May 2020, Lebanon witnessed its first hunger protest, although Lebanese activists have always protested against corruption, fighting for public transport, and a transparent Government, hunger protests were never observed before. Prime Minister, Hassan Diab, publicly announced that by the end of 2020 over half of the Lebanese people will no longer have proper access to food *(The Washington post 2020)*.

This is quite alarming, especially since the Central Bank is exclusively pumping U.S. Dollars to only supply the import of Gas, Fuel, wheat and medical supplies including medications, leaving out all the food and other sector unattended.

This leaves no other option for the Government but to encourage and support local industries and agriculture on a national scale to reach an acceptable level of self-sufficiency, and once this is done Lebanon will no longer be hostage of import and foreign currencies. Yet, this according to the Government will be at best, a 5-year exercise, but until then Lebanon has to get through this tough period and the only way of doing so is by maximizing and extending the life cycle of what we have in terms of imported products, and

make edible products grown in Lebanon as affordable and accessible as possible. Setting up markets in Lebanon can offer a great deal of relief to the community.

-Flea markets on one hand, can help people sell functioning products they don't need to someone who does for affordable prices. Beirut city is a convenient host to such markets as a lot of people move temporary to the city for education, a job opportunity or simply to experience the city life. This quick variation in residents can generate a need to sell or buy items frequently, service flea markets can offer.

-Barter markets can stimulate people with no income to develop their skills and use them as a currency to afford daily needs. Although this is a very unfamiliar commerce method to the Lebanese community and maybe even to most communities, but it might be the only tool for people to access goods. Particularly, after the biggest unemployment wave Lebanon has witnessed, starting by the uprising events of October 2019, to the currency drop and lack of the US dollars bank notes, to the recent lock-down Covid-19 has caused. Moreover, one must note that outbreak measure taken in Lebanon are quite sever and long lasting lock-down measures seeing as the medical sector possess a limited amount of Intensive care units and is not prepared for pandemics nor big amount of daily patients.

This sever lock-down has rushed the economic and financial deterioration.

- Finally and most importantly, food markets in Lebanon can address the most

serious issue threatening the city and the country, food safety. With the great shrinkage of imported goods, the food sector is definitely affected, and so public food markets can intervene and offer themselves as a public platform for farmers to promote their products instead of supermarkets, in a more competitive framework. Simultaneously, buyers will have the chance to shop from a variety of fresher products for more affordable prices. These markets can include livestock, vegetables, fruits as well cereals and any kind of processed food or dairy products.

Since these markets need more preparation and study than temporary markets (flea and barter markets) one must understand the spatial dimension of the food cycle, from the farmer to the consumer.

All these markets, once taking place in Beirut city will make the city more affordable in terms of daily needs and consumption ,livable and more resilient.

In addition, markets, especially food markets will create a spatial platform for consumers to attain fresh goods in an easier and more affordable way, creating additional demand pressure on the agriculture sector hence pushing people to invest and dive in this national turn over.

As a direct consequence of this ascending demand on food, the agriculture areas as known as the highlands and the rural areas will witness a great wave of residents come back, they are residents who left in earlier times due to the lack of job opportunities, leading also to reducing the density pressure on major cities

in Lebanon.

Though this urban rural migration would be a new phenomenon to Lebanon, it is interesting to re-introduce the agriculture land as new economy and opportunity generator for the local communities as well as assuring food security for major cities, and eventually as an export asset falling within national economic strategies.

Food cycle in Lebanon

Lebanon is considered to be an agricultural country by excellence,at least in terms of potential. The topography, the type of soil, the 4 seasons and the sun all year long, these factors favor agriculture and stimulate farmers and agronomists to invest in this sector and grow crops. Nevertheless, governments in the last decades did not invest in this sector, they focused their investments and support to the service and hospitality sectors, such as banks, real estate, trade,hotels, resorts, restaurants and so on... Leaving out industry and agriculture.

In 2005, the government issued a document called the Physical master plan of the Lebanese territory, otherly known as the SDATL document. This document studies all different sectors in the city from a spatial and urban perspective.

This map illustrates which areas are best for agriculture, yet, at the time being, not all of these areas are purely agriculture, towns and agglomerations can be found. According to the ministry of agriculture, 63% of Lebanon's surface is usable for agriculture, yet only 22% is actually plant-

ed. This is something cause by rural urban migration caused by urbanization, where job opportunities were no longer available in the rural areas, but only in the city.

In 1950, 68% of the people lived in rural areas, whereas in 2005 this number dropped to 11% *(Akiki, 2019)* and in 2020 of course this number is expected to be even lower The current Government has decided to change its policies towards framers and agriculture, since there is no other option left for the country but to grow its own food.

Usually the food cycle in Lebanon works as following, Livestock, cereals, vegetables and fruits are grown in agriculture areas, harvested and collected, then transported to the wholesale markets in the suburbs of main cities, and then from there transported to supermarkets and small grocery stores, to be eventually bought and consumed by the people.

This of course is convenient since people visit the supermarket and get their hands on all their needs from one specific place, yet this long process is not so sustainable and phases can be cut out, leaving the final prices of goods lower than the current price, and much fresher goods. (See schematic below)

Hence, if markets are properly installed, some farmers can still rely on the current system, but other farmers will prefer to directly transport their goods from the farm to the public market, where people can purchase it directly and create a new relationship between the farmers and the urban residents.

The thesis aims to cut short and food

from the farmers straight to the communities.

Some people complain sometime about fruit and vegetables prices, blaming farmers for raising their prices, while farmers also complain about not being able to make a proper profit out of their business , leaving the biggest chunk of the profit to the middle men, the wholesale dealers.

In other words most of the profit is considered easy money with no main investment besides the cost of market rent, food trucks maintenance, and fuel.

Wholesale markets

Agricultural land

Green path: traditional process

Black path: suggested process

Community

fig 14:Food process
Made *by the author*

Retail stores

34

35
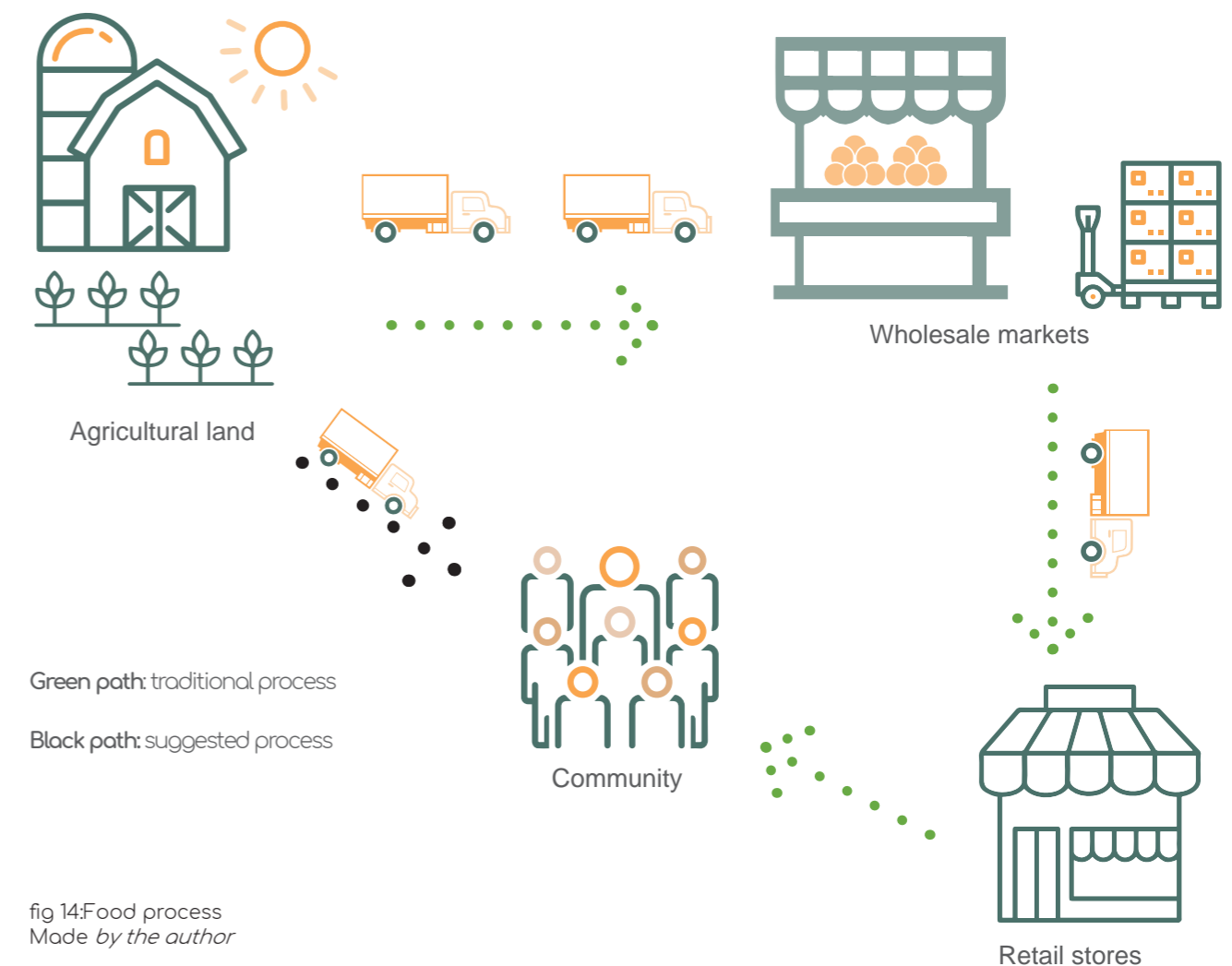
Reaching food security.

Lebanon is a country with a Mediter-
ranean weather, however the country's
geography and terrain topology allows
different micro weather conditions, ones
that could vary from one area to another
during the same day. Mountains, valleys,
coast cities,green fields, Lebanon has it
all, and this a great asset to reach a com-
plete agriculture calendar, producing all
kinds of food almost all year long.
Even though Baalbek and Bekaa (East of
Beirut) have the biggest field crops and
they produce the bigger part of total
crops production all year long, yet due
to it's morphology and weather it could
not produce all crops all year long. Some
fruits and vegetables could be found all
year long yet, most of these goods they
don't come all year long from the source,
for instance in winter, onions are plant-
ed on the coast, while in summer they
are planted in highlands. On the oth-
er hand, most farmers tend to change
therefore Beirut needs to rely on all ag-
ricultural lands to be able to reach self
sufficiency in terms of food and nutrition.
Moreover, permanent agriculture is a

main pillar of the Lebanese agriculture
sector, yet temporary agriculture, know as
seasonal agriculture is also a significant
asset to the sector. This aligns perfectly
with Lebanese diverse weather, hence in
a way most products could be planted in
Lebanon, somewhere, sometime.
As seen on the map, all Lebanese farmers,
regardless of their location, have both
temporary and permanent agriculture.
Farmers in Lebanon do this as a safety
measure and to efficiently use land to its
fullest potential. Having that said, in a
scenario where Beirut city wants to reach
the threshold of social security, by hav-
ing a proper nutrition stock (fruits, vege-
tables and cereals) then the city must be
able to welcome goods coming from all
three main agriculture areas, the north,
the south and the Bekaa valley.
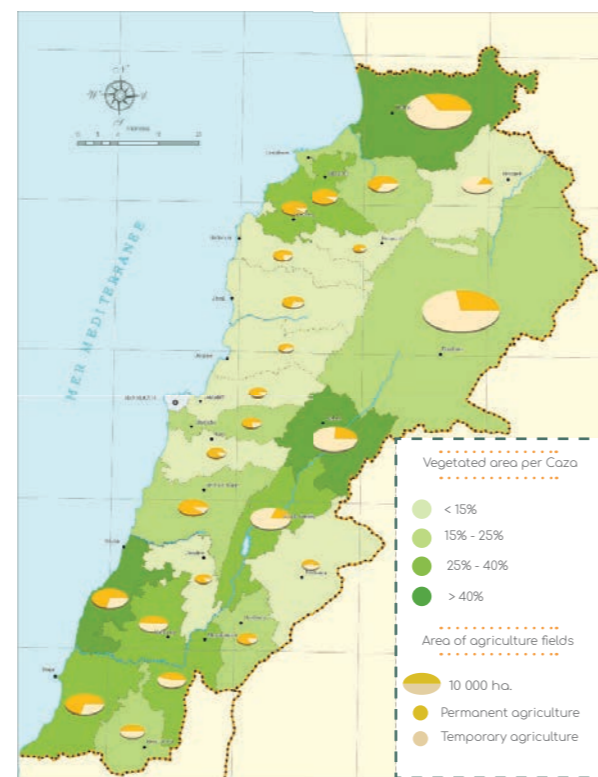
Lebanon's topography is quite diverse,
however when it comes to agriculture
lands the north and the south have to
some extend some resemblance. When
observing the topography map, the north
and the south have both vast coastal
surfaces which is where most of the ag-
riculture is located as well as highlands
and mountains, wheile in Bekaa, it is more
of a valley, hence the agriculture is usual-
ly different there.
Consequently, the best combination of
food source would be Bekaa and north,
or Bekaa and south, in this logic a mar-
keting supplied by one of these two op-
tions would have
On the map to right, the three section
traces are located respectively to the
north, in the Bekaa valley and the south.

fig 17:Agriculture map of Lebanon
Source: (IDAL 2017)

fig 15:Cultivated land by Mohafaza
Source: (IDAL 2017)
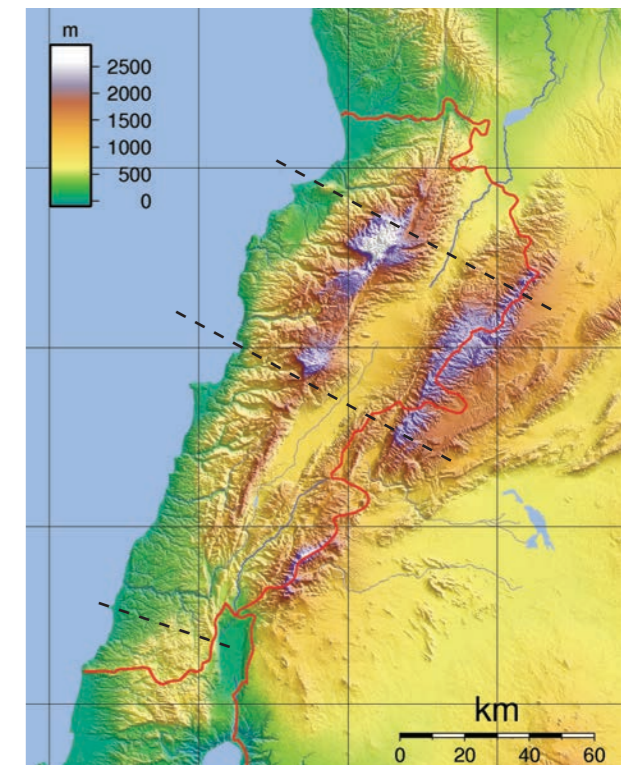
fig 16:Agriculture map of Lebanon
Source: (IDAL 2017)
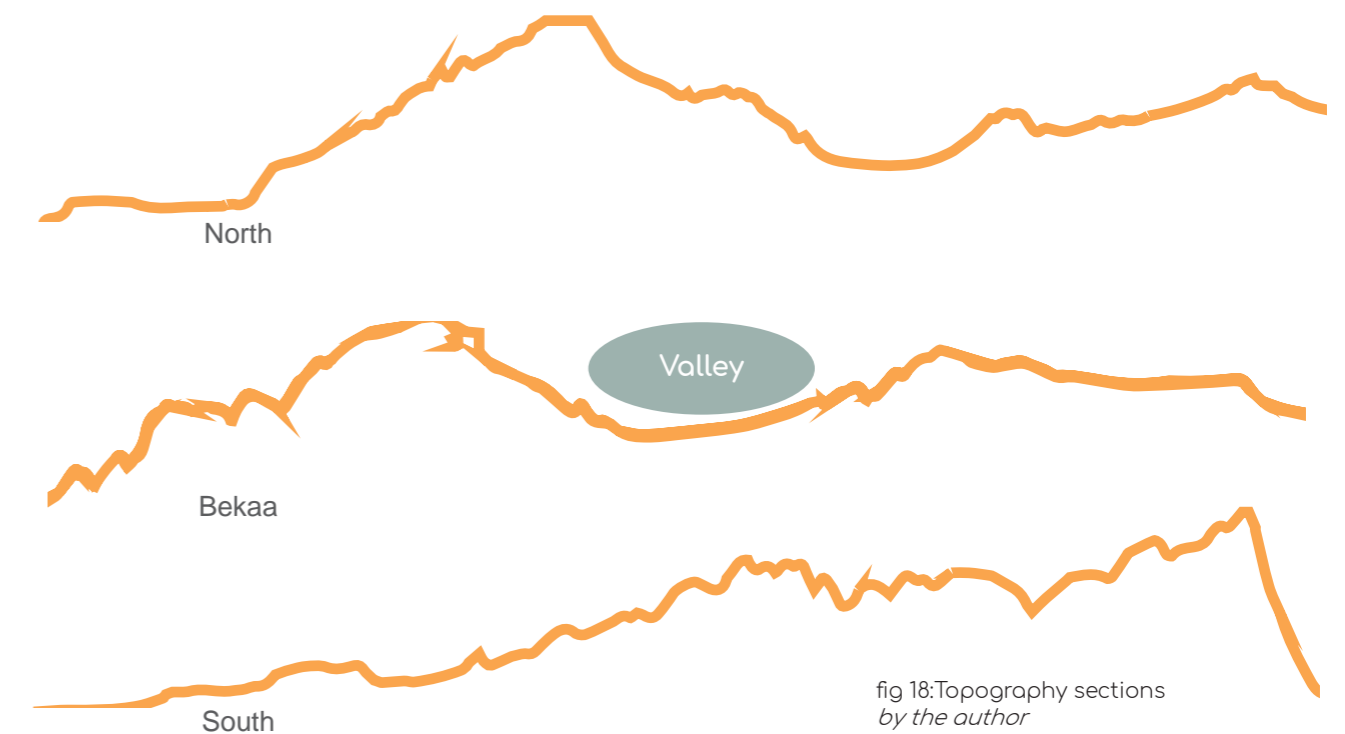
fig 18:Topography sections
by the author

To the left, is a national map of the coun-
try, explaining how food could enter the
capital, from agriculture lands in the
north, south and the Bekaa Valley. In the
bottom is a zoomed in observation about
the highways which are or could be used
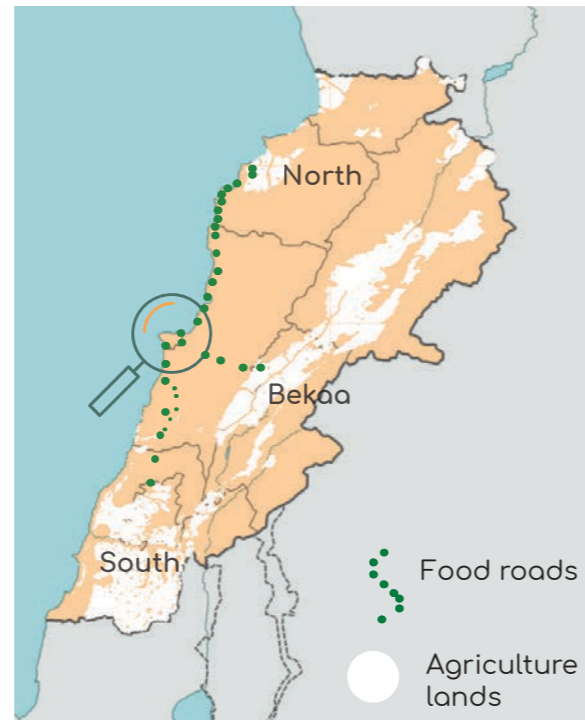to transport food directly from the whole
sale

North

Bekaa

South

Food roads

Agriculture
lands

fig 19:National agriculture land
by author with information from
Source: (SDATL 2005)

north

Bekaa

south
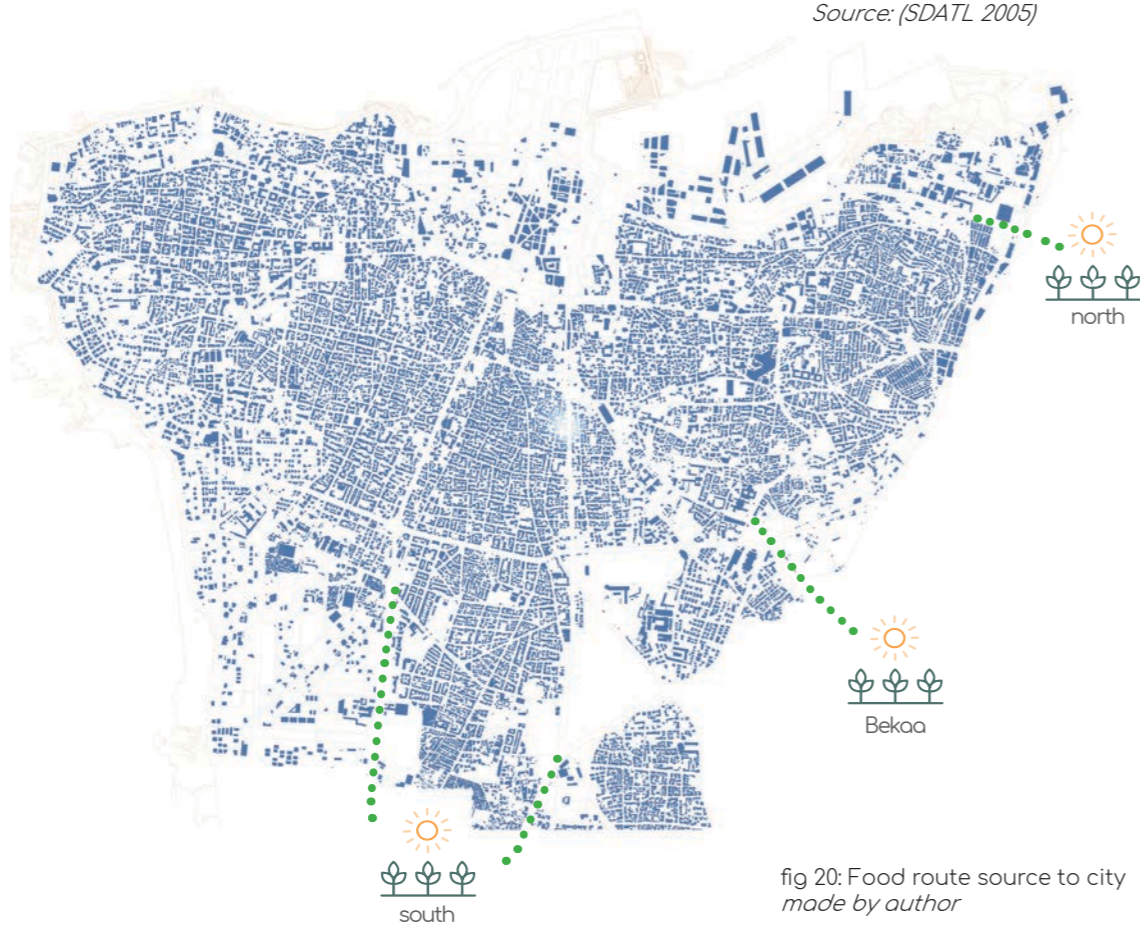
fig 20: Food route source to city
made by author

fig 21: Bekaa Cultivated
Source: Hajjar 2019

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5.Methodology and results

Streets as the spaces

Since Lebanon is going through a great crisis, throughout which different types of public market are needed, the question remains about their strategical placement.

In an ideal situation where a City decides to set up a public market, an urban analysis is needed and multiple factors must be taken into account to place the markets strategically such as: proximity to public transport network, uninterrupted access of goods and smooth waste exhaust, assets and the lands the city owns, financial capital of the municipality and its capability of purchasing or tendering new pieces of land, and if a plot must be bought, the size of the plot or even block with it's context must be also taken into consideration as well. These factors are the main ones, but since markets are context specific in most cases, additional factors may appear while some might fade out. All these factors will most probably overlap at some point, and here the idea becomes a question of priorities and capabilities to choose which criteria to fulfill first. This, alongside the whole process result in, strategically placed public markets, serving the surrounding neighborhoods and making the city more affordable, ergo livable.

In a nutshell, placing markets in cities is a challenging task, and when the City owns a fair amount of land surface, or when it is capable of purchasing privately owned plots to set up market, there would be of course a broader range of choices, therefore extra opportunities for a functioning

and healthy market. Another factor for placing markets would be the availability of people focused public space in the city and the options of the market placing market process to be part of a broader integrated methodology.

Unfortunately, in the case of Beirut city, the capital has barely any people focused public space, mainly one seaside boulevard, one park and a pair of small gardens which need massive maintenance and are closed most of the times, while squares or public plazas are used as roundabout or streets extensions. On the other hand, purchasing a plot of land to make it a public space is something out of question, especially during these difficult times, where every penny should be spent on primary needs lacking the city such as re-establishing proper urban infrastructure, particularly a sustainable public or common transportation strategy, or a healthy waste management strategy, even the maintenance of existing public space in terms of lighting, furniture, safety and so on ....

These circumstances leave the city with the option of either using the very few existing pedestrian's areas which might not be optimal in terms of strategical positioning, or rethinking the street network and questioning its potential beyond being exclusively car infrastructure.

After the invention of automobiles, new types of streets such highways, freeways and high speed lanes started to appear, and with time, car focused streets invaded cities and their suburbs reaching a point where streets became exclusively associated with cars only.

"A Street is not just a street" *(Benfield 2013)*, this expression stands for itself, as streets at some point should no longer be perceived as car automobile infrastructure, their potential is extremely beyond just that. According to Benfield, Streets come in various categories, some which are vital to the greater mobility scale where the city is not a destination but also an interesting interactive transit area. He argues that these kind of streets should stay streets for automobiles, but the internal street within the neighborhoods of the city should be fair streets and spatially accommodate all users, from pedestrians, to cyclist, trees and eventually automobiles.

Streets have developed and evolved to become socially inclusive spaces, these experiments have proven their success in major cities in Europe such as Berlin, Amsterdam, and Paris, whether streets were converted to pure pedestrian spaces or shared spaces where the car become the guest and the existing lanes would be slow traffic only, giving the pedestrian a safer experience.

Although streets are only one of the urban commons yet they are the main reflection of the city's urban wellbeing, the covid-19 lock-down period where social distancing must be practice and car traffic was reduced, streets have a lot to offer and they have to do much more than before *(NACTO 2020)*. Streets will host sanitation stands and medical support stations, queuing and waiting areas and all that while respecting the implemented

fig 22: Empty streets
Source: Mrad 2019

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physical distancing standards. Although the covid-19 situation is a temporary situation, yet the imposed procedures taken in cities all over the world, not only in Lebanon to prevent the spread of virus, helped people rediscover the potential of streets, and rethinking them as places which are not only for cars, this observation is at the best during strict lockdowns, when driving vehicles was not permitted unless for emergencies or specific personnel.

This can raise the question of streets in Beirut and their potential when/if the city shifts from a private car based city to a city holding a sustainable mobility strategy where people are no longer car reliant. Some public spaces experts go further in exploring this theory and push to making streets proper public spaces, *Gil Peñalosa* is a great believer in this experimental exercise, he describes streets as family members of parks, meaning by this that any activity happening in parks could probably happen on a street or a sidewalk *(PPS 2015). Peñalosa* elaborates by explaining how liberal approaches to streets activity should be, particularly street vending, to eventually reaching vibrant streets that could be the most interesting urban common within communities.

Furthermore, similar experimentations are ideal for dense cities like Beirut, where streets are mainly car oriented and pedestrians can't find enough space dedicated for them, while having barely any access to public spaces such as parks and squares.

Photos of the main public spaces in Beirut city.

Beirut Park

fig 23: Horsh Beirut
Source: Great runs

Beirut seaside boulevard

fig 24: The Corniche
Source: Khalifeh 2011

Renee Mouawad Garden

fig 25: Sanayeh Garden
Source: ZMK landscape architects 2016

The method in theory

When it comes to strategically placing elements in a city, they must follow a rational logic allowing them to function correctly within a certain context. This logic consist a list of parameters based on data structures, which forms together criteria threshold. Only once this phase is completed, streets can be converted to markets based on the study results. In this thesis a parameter list is considered, as a first and common step there is a street network performance test, and later the criteria are divided into two categories, for the fixed markets as well as the temporary markets. Below is the structure:

A-Testing the street network.

B-Food market:
1-Streets long enough to host a market
2-Streets with proximity to parking space
3- Integrated public transportation network
4- uninterrupted access from food source
5- La0nd use of the existing structures and underground parking.

C-Temporary markets/ Pedestrian streets:
1-Streets big enough to host a temporary market
2-Street far from existing green or public spaces.
3-Street within a walkable range of parking lots.
4- Proximity to sub-centers in the city.

A- Testing the street network.

This phase is mainly dedicated to testing the traffic and congestion on the streets. First, to be able to properly test the traffic system in Beirut, one can rely on intelligent traffic monitoring systems or softwares. This is something usually available in municipalities or ministry of traffic and transportation, and even in specialized traffic and mobility firms.
These systems can observe data related to streets, knots, roundabouts, highways ... and highlight the ones that witness the heaviest traffic flow during the day. These streets or mobility elements are usually the most important ones as people tend to use them the most, for being the shortest, easiest or most convenient or interesting route to get from point A to point B in the city.
This comes either by daily practice through trying different trajectory and then choosing the shortest or most convenient one, or through mobile application such as Google maps that can give you the shortest path from a precise location to a destination.
On the other hand, while some streets are quite busy during the day and night, some streets are relatively calm and do not contribute to the daily congestion scene, in other words, if these streets would not exist, this would a cause an insignificant consequence on the city's daily mobility routine, therefore one could say that closing down these streets or shifting them from car streets to places where the cars are not allowed or cannot exceed a certain speed limit is quite fea-

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sible, following this logic.
B-For fixed markets:

B1-Streets with a minimum
length

As mentioned earlier, throughout the study of commons between 20 successful market in south America, the bigger the market the better, of course while keeping the space walkable. Street markets usually impose a fixed layout to the market, linear market, especially if the streets are not wide enough, (street width would be maximum 12 meters in Beirut) which means that the only way to expand the market is linearly, hence making the market longer. After Observing the average street length in Beirut city street network, a well defined range could be a set parameter, on one hand to keep this number within the margin of the existing streets width, and to have enough stalls installed to push the market up and running.

B2- Streets with proximity to
parking space

The future markets should promote themselves as a convenient space by being close or having a certain proximity to parking space. The parking space would definitely be a parking facility, however it could also serve as an unloading space in early mornings before the opening hours, as well as a loading space after hours and during waste collection, if the street market infrastructure and width would not allow this. In addition this

space could be used as parking space for residents who might loose their usual parking spots after changes that might happen to the street network.
Therefore having a parking space nearby would definitely help the market function smoothly and attract more people.

B3- Integrated public
transportation network.

Accessibility has to be covered to a certain extent, and although transit stops should be at the core focus of the criteria, yet in car based and dense cities where spatially, only the street network could host functions and events , the approach is more of what streets could offer rather than what is the best optimal place to a market. Therefore, connections with public transport transit is definitely a success factor, hence walkable distances could vary from one city to anther based on the urban form of the city, the culture of the people, and weather conditions.

B4- Uninterrupted flow of
goods from source.

As an additional parameter, streets which will host food markets, should have an easy access to roads coming from the agriculture areas, without being additional burden to the city. Cities that are car dependent, suffer enough from congestion already, and street markets should cause the most minimal pressure possible on the street network. Therefore, big food trucks should avoid going into the city's internal grid network and limit

their movement to the main highways to minimize the congestion they create as much as possible. Another way around this would be to oblige food delivery truck to stick to a specific schedule where they have full access to the city. In other words foodtrucks could wonder all around the city, in and out from 5 am till 6 am, and after that they have to exit, to re-enter only between 19:00 and 20:00 to pick up leftovers and waste. Not only but also, storage facilities could be used to avoid the picking up process, in this way food could be stored in or near the market.

B5- Land-use of existing buildings
and underground parking.

To ideally wrap the street selection process, the land use and architecture of buildings must be taken into account. This kind of data platform could include all sort of physical specification i.e. if which buildings are residential or office buildings, or what kind of plinth exist in the existing built structure in the city, is it retail and if so what kind of retail, is it *Horeca* related or not, exit and entrance of buildings as well as of underground parking and whether they exist or not ...
For example, a fixed food market could not be located on a street where all buildings have underground parking is the parking land-use is preserved. However this is different for the case of temporary markets and shared streets, as they are more flexible in their performance towards automobiles.
As a final step, a centrality study is made again to compare between the best com-

bination of streets, in a way allowing the tool user to define which combination of closed streets would affect the city's spatial centrality.

C-For temporary markets:
C1-Streets with a certain length

For Temporary markets, street length can be much more flexible, this comes as a consequence for the uncertainty temporary markets hold, in terms of frequency and in terms of retail intensity. Furthermore, after assessing the street network and seeing the average street length one can set a flexible threshold for these temporary markets, since they function as people focused streets when markets are not installed, and if during market days the street has proven to be smaller than needed, the market could always be shifted to a bigger one meeting the same criteria while leaving the current street as a pocket public space for the neighborhood, or another option would be to allocate multiple streets to be transformed and flea markets could occur simultaneously on different streets. This way a great public space network is set, out of which some streets are chosen to hold temporary markets following a certain schedule and even rotation system targeting most neighborhoods in the city.

C2- Streets distant from
existing public spaces.

When the chosen streets are not hosting temporary markets, they will act as

pedestrian spaces the city is in need of, and since this action plan is dedicated to dense cities with not enough parks and public spaces, it would best to spread new ones to neighborhoods where public space do not exist. In this way the city can offer the residents minimal accessibility to publics spaces across its territory, in a decentralize and rational manner, promoting spatial social justice, on the other hand these spaces could also have a certain distance from each other and not only from existing public spaces.

C3-Streets with a walkable distance from parking spaces

While some dense cities remain car dependent, accommodating people's choice of transportation is a must for a destination to be vibrant, people should be comfortable and free to choose the means of transport they prefer. In that case, parking facility should be available for market visitors as long as the general city policy is to remain car welcoming. Besides, temporary markets such as flea and bartering markets often display element such as furniture, garden or balcony elements, second hand mechanics etc ... Objects of that kind are physically bigger than displayed items in food markets, therefore proximity to parking space is important for people planning to visit the market, and purchasing big or multiple items from there. For people who own a private, being able to park it easily can be extremely useful once planning to purchase furniture. In cities were public transport is not so organized this

is even more important and some would say inevitable.

C4- Proximity to sub-centers in the city.

Although main cities act as a whole and usually have one main downtown or center, yet cities such as Beirut have also developed vibrant sub centers alongside downtown, where mixed use functions take place, and would often be people's daily or weekly destination.
These areas are famous usually for their cheaper rent when compared to the downtown, as well as their fresh impression since it would be a center in the making.
To give an extra push for these markets to function properly, assigning markets and public spaces to these which has some proximity to sub centers in the city would be a good way to attract people to the market and to activate the public space when markets are inactive.

Market
All week
Temporary
Centrality Test
Street width
Proximity to public space
Proximity to sub-centers
Proximity to Parking space
Proximity to Bus Stops
Uninterrupted flow of goods
Underground parking
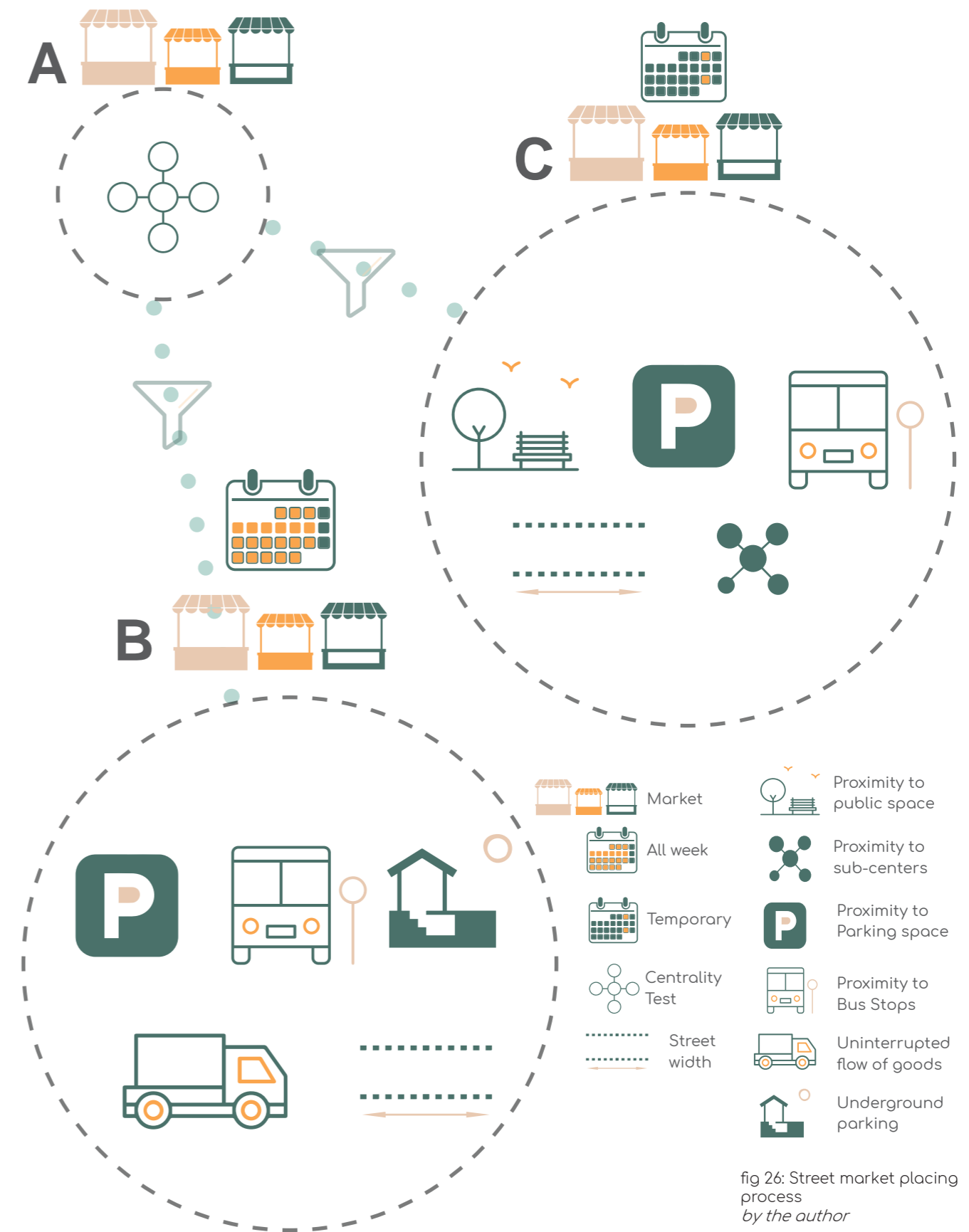
fig 26: Street market placing process
by the author

Parametric implementation

Available data

All the theory and proposed parameters mentioned in the earlier chapter, could be implemented in a case where all kinds of data and resources are available, however in the case of this master thesis specifically and given its time frame, and particularly in the Lebanese context where most data is collected by the private sector and is not published, the approach for executing the thesis theory calls for some modifications.

-For instance, there is no actual data, map or document listing the existing buildings, their land use, nor whether the building has an underground parking or not. Hence, to acquire this kind of data, a field survey can be done, in other terms a group of people can walk along all the city's streets and take notes about buildings size,stories, and basements availability, digitize it and introduce it to the current data base in the thesis. However, within the time frame and resources of the thesis, this is not actually possible, therefore the parameter concerned with underground parking, building's and plinth's land-use will be left out of the simulation. Nonetheless it could be added later on at any point once made available. Moreover, data concerning the parking spots all over the city was collected manually using a satellite image from Google maps, hence all public underground parkings are left out of the calculations, in addition to new parking lots which did not exist once the observed photo was captured.

-Furthermore, the main basis of the study

is the street network, this geometry is quite complex as it contains different layers such as tunnels, roads and bridges which could overlap in one or many spots. Since a detailed scientific traffic study cannot be made at this point, one of the alternative would be parametric tools which can give an impression about the potential of the street network based purely on the geometry. To be able to use this alternative method properly some simplifications to the street network's geometry must be made in order to reduce its complexity so that it is usable with parametric tools. Thus this does not mean that the method cannot incorporate complex streets networks, but within the time frame and resources of this thesis a simple geometry is better fitting. Finally to start all this rational process, the firsts step is to assess the current street network, which is again not available to the public, thus it is possible that some private traffic firms/engineers have run some studies and stimulations, however all related results are still till this day unaccessible nor published. Nevertheless, many other alternative can be used to generate an estimation which might not be as accurate and realistic as a traffic study, but could serve the purpose of this thesis to some extend.

-Public transport in Beirut is still far from being sustainable, transportation is either through privately owned cars, .small buses, or through the public buses which do not commit to any kind of schedule nor Bus stops. This sector was extremely neglected over the past few years and even decades, as a result Beirut turned into

a car based city, the same goes for the whole country actually since transportation in Beirut as chaotic as it seems is actually much better than other cities/towns. *Yallabus* is a group of students who came up with an idea to map the stops where Buses pick up passengers usually and gather the routes as well in one document. In this thesis the Bus stops location are taken from the YallaBus map.

Currently, Lebanon only relies, on cars, mini-Buses and buses for transportation, however if there was any new implementation in the future, it shall be introduced to this methodology, offering a updated map of proposed street markets.

On the other hand, if public markets where to take place in the city, public transport networks would build on top of the place's attractivity, leading to a more integrated and inclusive performance.

2.Applied methods

To avoid discarding this whole thesis because of lack of data, specifically the street network performance part. The chosen/adopted alternative would be geometrically testing the centrality of the street network. In other terms the street network will be considered a simple abstract geometry
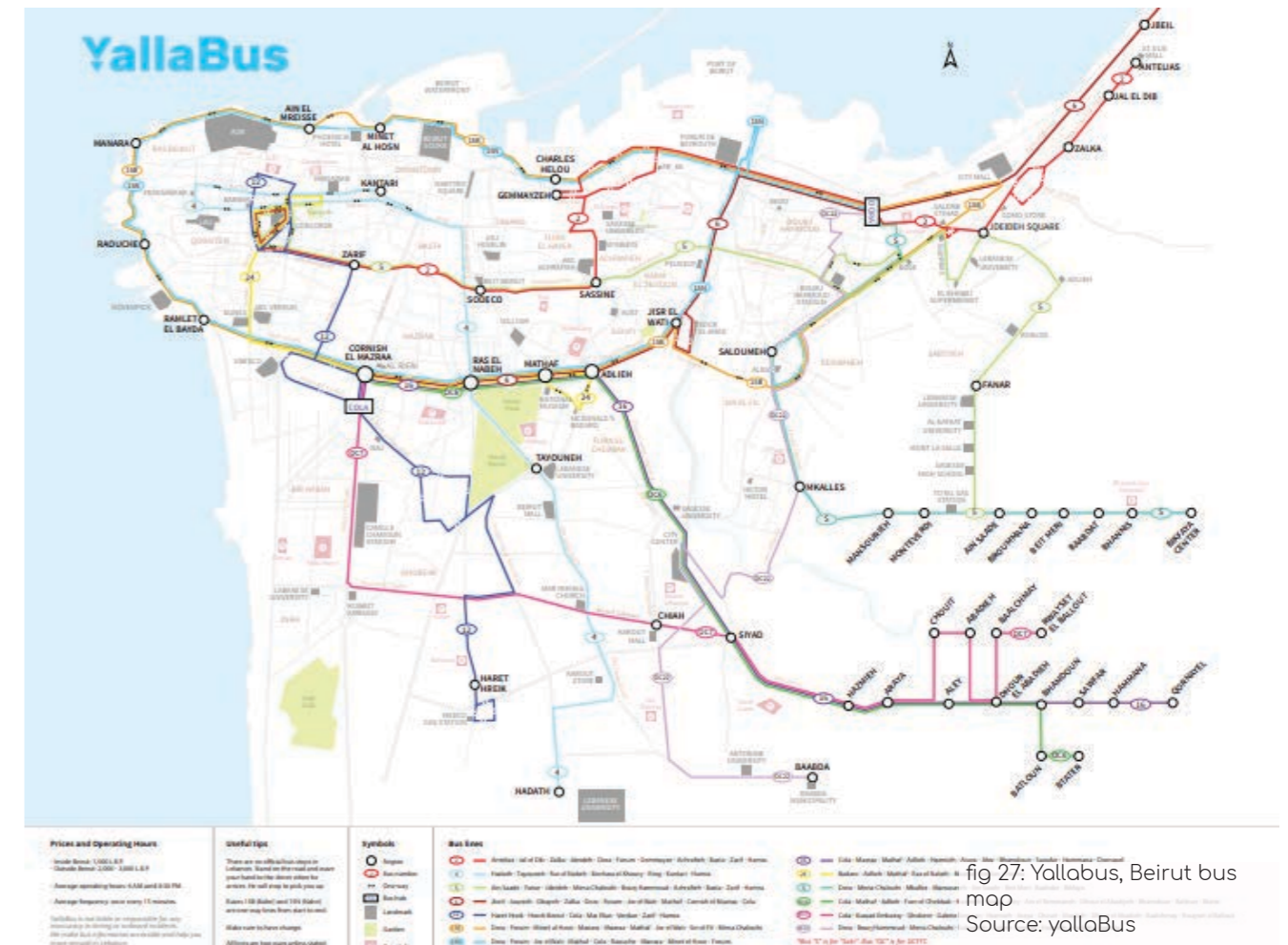

fig 27: Yallabus, Beirut bus map
Source: yallaBus

with no precise relation to any spatial and realistic dimensions. Hence, the result would be the potential centrality of the street network, and whether this is coherent with the actual traffic situation is irrelevant in this thesis at this point. In the following chapters of the thesis two new terminologies are introduced, Betweenness centrality and closeness centrality.

What do they mean and how are they calculated?

To start, the current street network is simplified and turned into a plane geometry formed by connecting lines, clearly each line is a representation of the connection between two points. In this exercise, a new segment must be defined at every intersection. Now once all this geometry is prepared the actual centrality test can be performed.

In a nutshell *Centrality* , is how elements are related and or connected to each other(Schneider, 2019).The main idea is to compute relationships between different elements, (in the case of street network the elements are the nodes of these segments) while highlighting the different importance of these connections. Moreover, different type of centrality exist as follows:

-Betweenness centrality: Calculates the shortest path from all nodes to all other nodes and highlights the nodes which are crossed the most. Therefore this kind of centrality test points out the most important to the least imported nodes in terms of connectivity   using descending values .

Closeness centrality: Defines for each node the distance to all other nodes in the street network. The street with the highest and shortest connections to all other nodes is the street with the highest closeness centrality value. In addition to these measurement concepts, two scales can be used, the global scale, meaning all the street network is considered, meaning from all streets to all
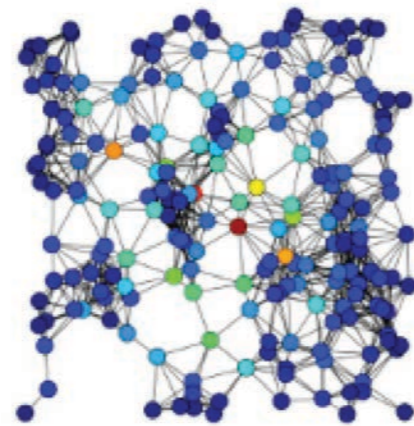
Betweenness centrality:
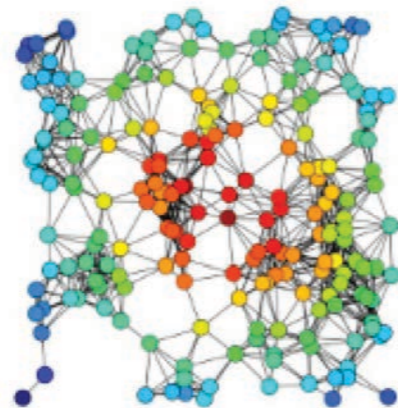
Closeness centrality:

fig 29: Centrality
Source: Wikipedia Centrality

streets,(destinations and origins) or radius based on a metrical value such as 800 meter, in the case only destinations within this radius are considered, this is called local scale.

Having defined the adopted streets network analysis, and knowing that the adopted streets network is only a geometrical representation of the city's grid, the result would be a rough output showing the spatial potential of the street network layout. Another thing worth highlighting would be that these kind of approaches give results based on pure data, however the actual behavior of the traffic flow could be extremely different, for instance if a road is not pleasant to drive through to reach a certain destination due to maintenance work or many speed bumps, people will not use it, even if its quicker to reach from a metric dimension point of view. This kind of details any many more are discarded in this thesis for simplicity and feasibility reasons.

5

Fuzzy Logic

Throughout history humans have judged statements as true,false or something in between, however for traditional computers they usual react by data classified as 1 and 0. This is called binary logic, and in science this would be the most adopted logic, either something is or isn't. Traditional binary logic gives a very crisp output, such as firm yes or no, day or night, wrong or right, black or white, and so on … However this crisp attitude is not always the best answer, especially in the modern world where opportunities and choices rise everyday, sometimes significant scenarios and answers can hide in between the 0 and 1, the grey area, which is where the Fuzzy logic exists and comes in handy.

World renowned scientist, *Lotfi Zadeh* was the first person ever to introduce the concept of fuzzy Logic to the modern world in the 60's.

Despite the recent discovery and labeling of the term, yet this approach existed thousand of years ago, and far from being considered a break through. Humans have this reasoning method by nature and use in daily life, but integrating this mindset to a computer or machine was challenging. The architecture of this method goes as the following:

First a domain must be set, in this case the street length, or more precisely whether the street is long or not for example. In binary logic a street is either long or not long, however in Fuzzy logic, a membership defines whether the item belongs or not, and if it does, to what degree of membership, having 0 as not belonging and 1 as fully belonging. Between 0 and 1 is a list of belonging values, for instance a street having a value of 0.7 belongs more to the domain meaning is longer than a street having 0.3 as a value, and so on … *(Tutorials point 2020)*

Furthermore this degree of membership

follows a concrete mathematical logic, hence, the calculation theory of the fuzzy logic:

A crisp input is the start, for instance a street length of 80 meters, at first the fuzzifier transforms this into a fuzzy value following the rules which are a definition of what is long and what is not and the categories in between, if a street is below 50 it is definitely not long, if its 100 meters and above it is definitely long if its 75 it is long. After this, the logic calculates the new value based on the rules by deffuzifying the results in a way that 75 meters becomes 0.5 instead of 1 (true), so in a way is it half true and not completely true, hence the half value. Eventually after deffuzification the output would be crisp again, just like traditional binary logic but instead of an ultimate 0 or 1, it presents a numerical value in between.
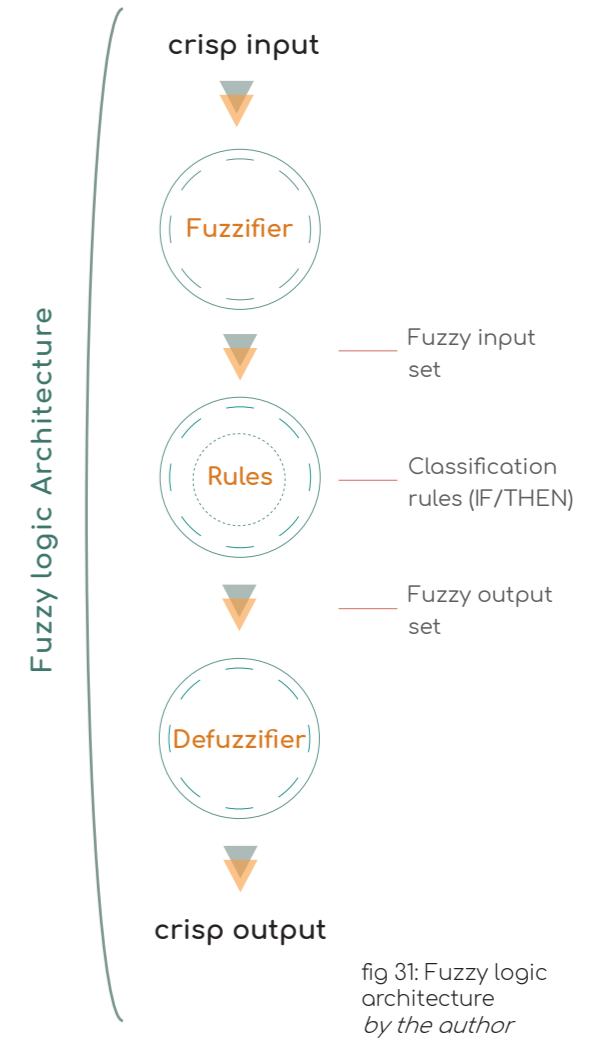
fig 31: Fuzzy logic architecture
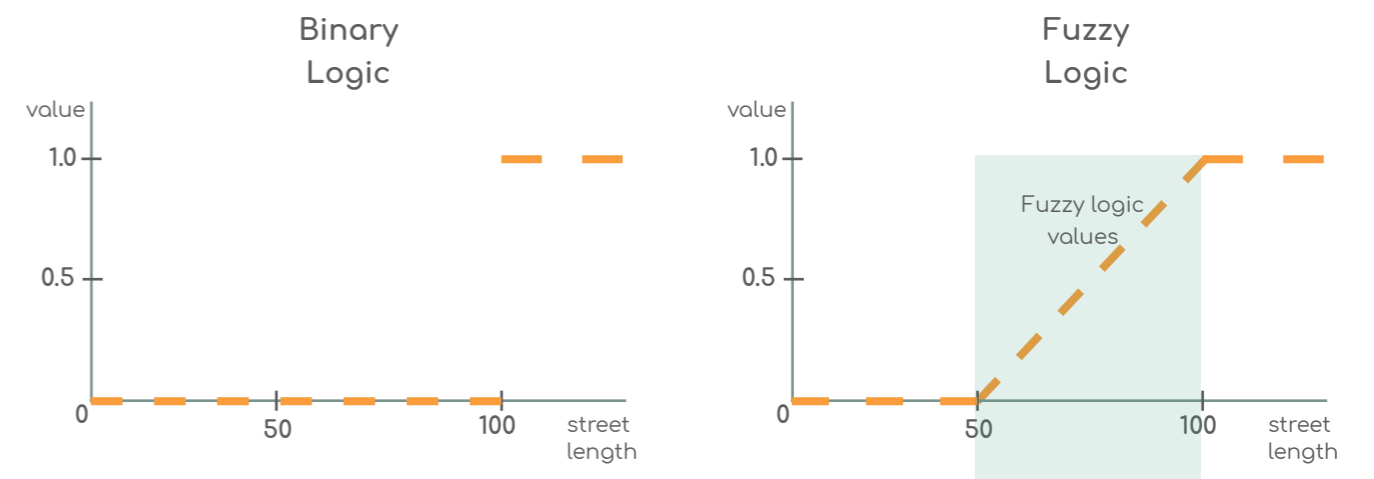*by the author*
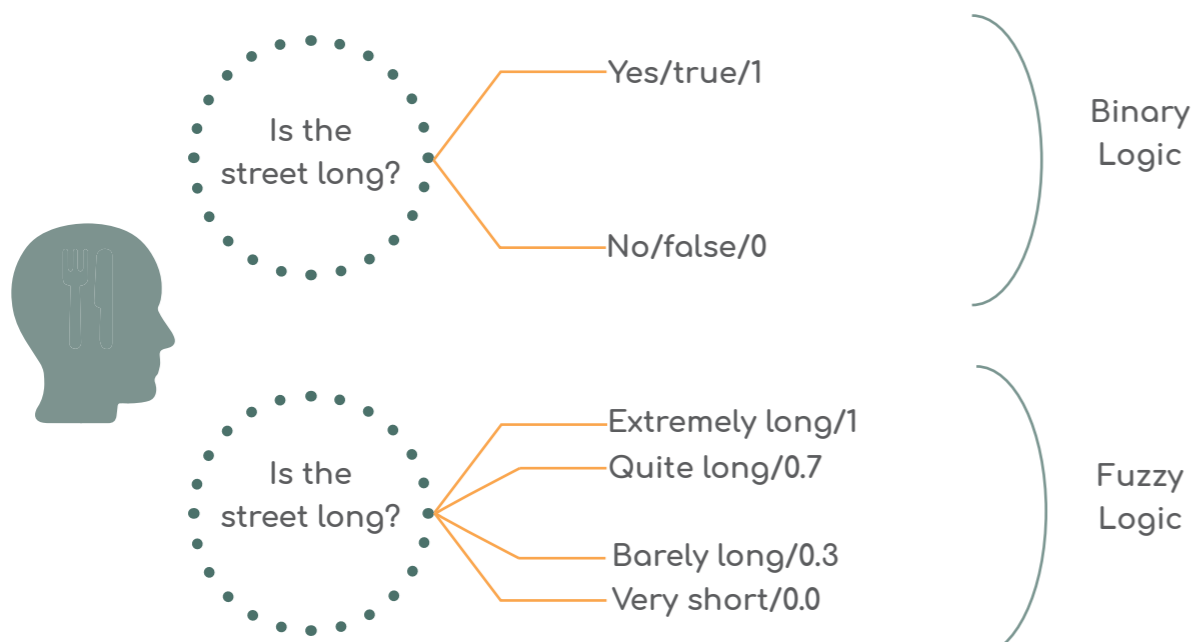
fig 30: Fuzzy logic logic
by the author

fig 32: Logic values
by the author

Projection of Theory.

In the previous chapter the theory about selecting streets to convert to market was explained in an abstract context however in the following segment, the theory will be tackled from a more technical and specific dimension. The sole purpose of this is to address the local issue of one of Beirut's urban commons, streets. Nonetheless, by using parametric tool, this thesis can become more sustainable through not only creating a tool which fulfill this thesis purpose, but as a flexible tool for future use in different cities. As a result any value or given data can be at any time modified, hence a new result based on the last modification. Moreover all this is a data driven study, and while most of the needed data is compensated by acceptable alternatives then it is fair to say that the results might not be fully coherent with the reality of Beirut's urban condition but rather a rough estimation of the direction things could go, as well a functional parametric tool All parametric implementation are done using the software of Rhino and Grasshopper plug-in, some of the analysis done in the thesis is based on tools existing in the decoding spaces toolbox (check reference list), especially all centrality related studies, whether it was Betweeness centrality or closeness centrality.

Note: In the upcoming maps, a gradient illustration color will be used , and so values which 0 and above will be light blue, values being 0.5 are orange and values of 1 and below are colored in dark red.

Global betweenness centrality test:

This test is straight forward yet its output is quite complex, betweenness centrality considers that everyone is traveling from everywhere to everywhere within Beirut city and the result would be a map which shows a gradient result of most used streets and least used streets. This test stands on spatial and geometrical hypothesis, therefore even if some resemblance exists with the current actual centrality condition, this test only pres-

ents the spatial potential of the street network geometry. A more realistic result can contribute to more accurate results in the future.

Color code:

least central — most central
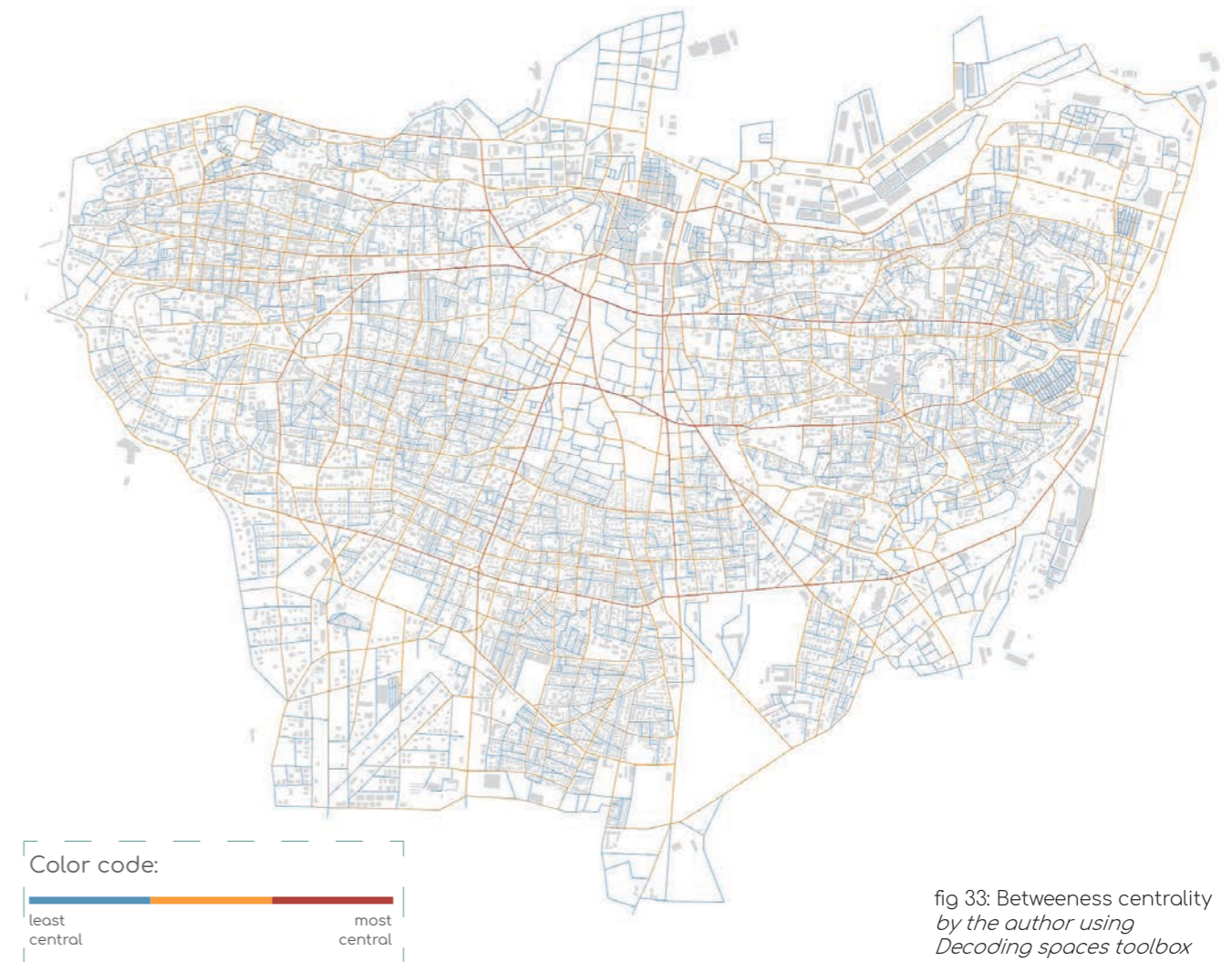
fig 33: Betweeness centrality
by the author using
Decoding spaces toolbox

Fixed Food markets

Here all street values in terms of performance are bound between 0 and 1, using Binary logic only streets having values less than 0.4 will undergo the upcoming, tests and classifications, to have a better overview of streets suitability for each parameter. Binary logic is only used in this phase of filtering and this is only for simplicity reasons as computing all the street network each time or introducing fuzzy values here will make the upcoming results too complex to obtain, in terms of parametric testing.

However, ideally it is better to have started and finished all the exercise using the same logic.
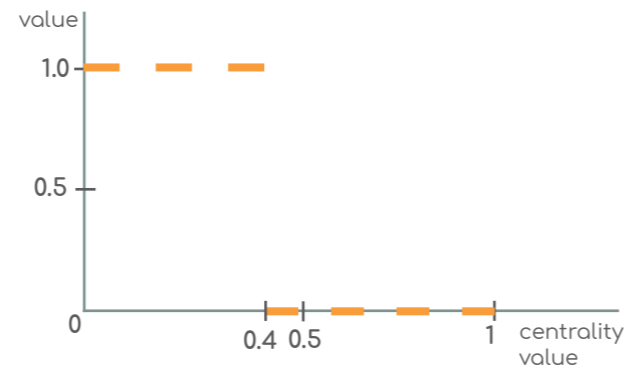
Streets with a minimum length

Streets in Beirut are most of the times narrow, therefor if transformed to street-markets, the only possible market layout would be a linear one, hence the longer the street is the more stalls are installed. In this case street that are less than 80 meters long are discarded. Street which have length between 80 and 100 are considered yet with a suitability value of less than 1, and street that are 100 meters and longer have a full value of 1.

fig 34: Betweeness centrality
by the author using
Decoding spaces toolbox

Color code:

Central Roads — Less central roads

fig 34: Street length map
by the author

Color code:

Short roads — Long roads

Streets with proximity to parking space

Parking spots are always important in urban markets, especially when the city is car based. In addition, The internal narrow streets of Beirut make it difficult for food/waste trucks to circulate and maneuver, therefore they need a dedicated open space to load and unload. This is why proximity is significant, therefore the short distance between the market and the parking lot, any street having a parking further than 200 meters is discarded from the study.

In addition this parking space is used as a small compensation for residents who might affected by any intervention.
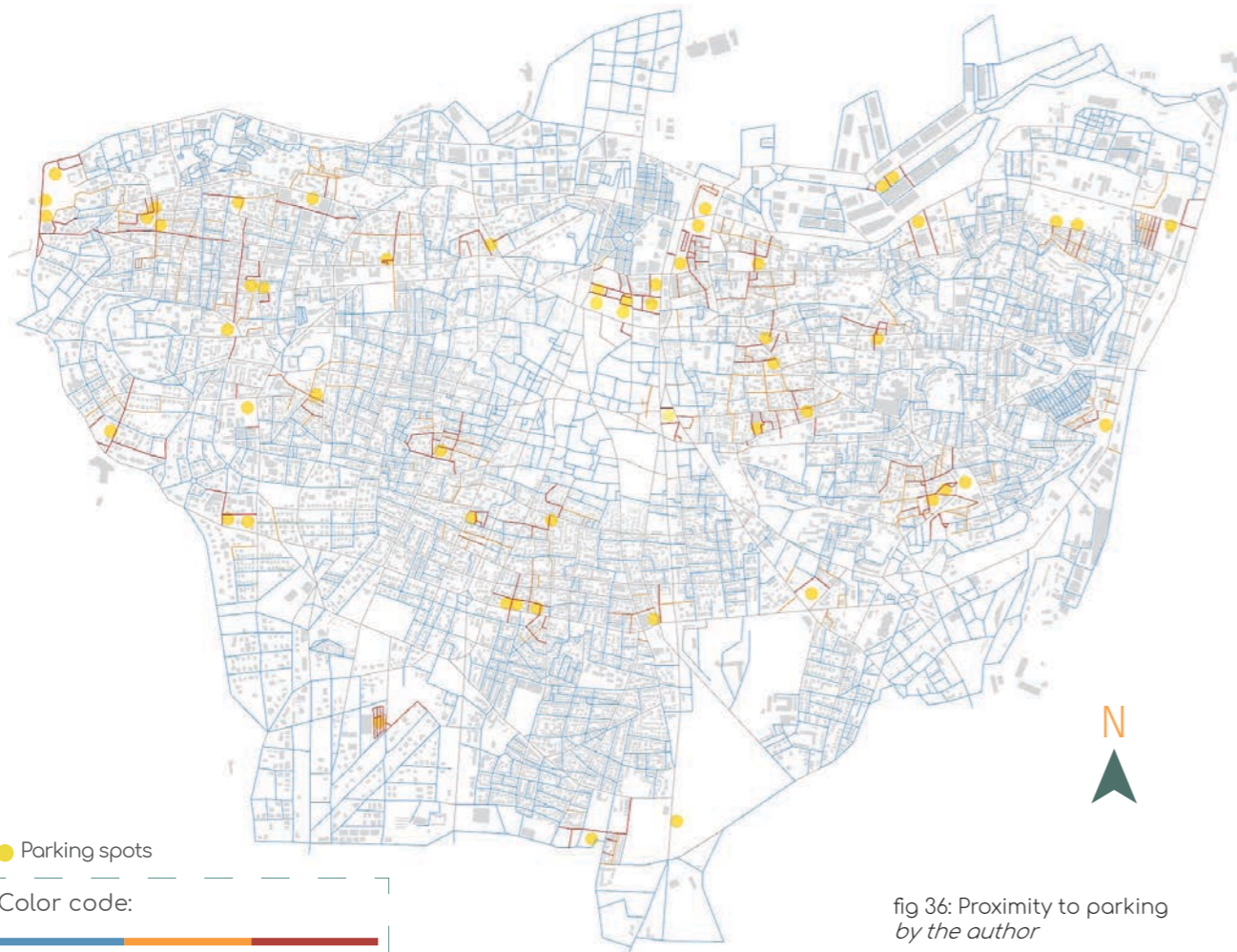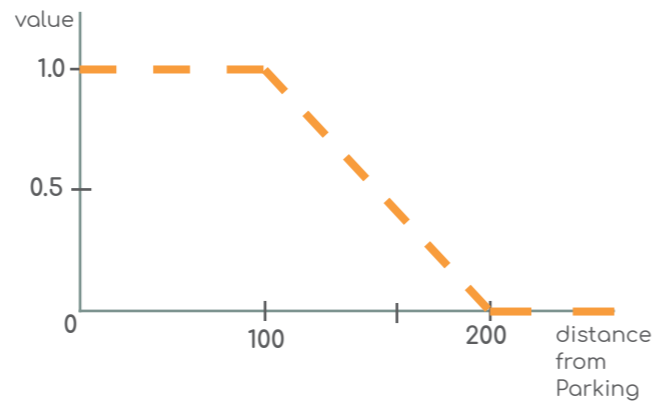
Integrated public transportation network.

Public markets are usually attractive spots in cities, especially if they are placed correctly and offer diverse range of goods targeting most social classes. For this, public markets need to be well connected to the public transport network. In this simulation the markets are imagined to be walkable from the stops, taking no more than 10 minutes there for ideally markets should stay within this limit, it would be around 750 meters as a maximum but ideally 500 meters.

● Parking spots

Color code:

far from Parking — close to Parking

fig 36: Proximity to parking
by the author

● Bus stops

Color code:

far from Bus — close to Bus
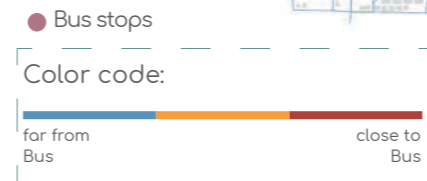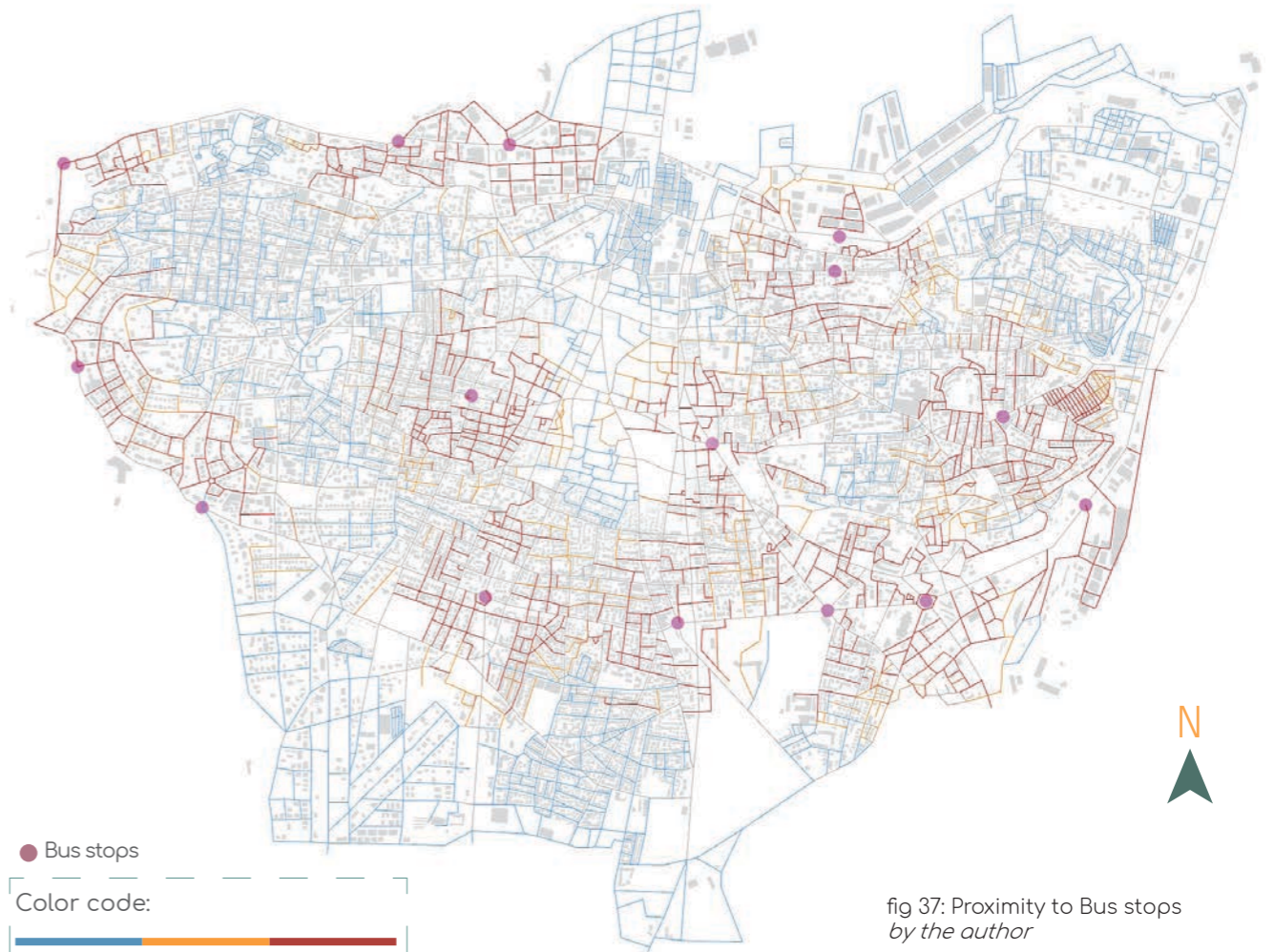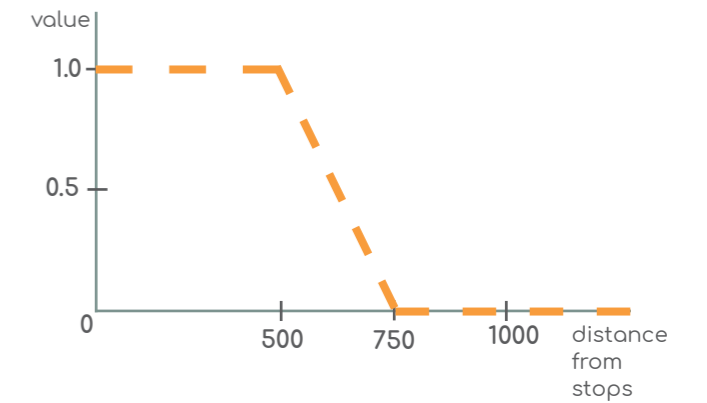
fig 37: Proximity to Bus stops
by the author

Uninterrupted flow of goods from source (East market).

Two markets are needed in Beirut, one market in the East supplied with goods from Bekaa and the north, while the other market supplied from Bekaa and the south. With this logic, the food coming from the North and Bekaa would ideally go to a market placed in between the two sources. Food trucks create congestion in cities, especially since they arrive early in the morning (rush hour) therefore it is better for these trucks to drive as least as possible in the city. In this case a max-

imum route of 2.5 kilometers is allowed, from the midpoint of the route connecting food sources.
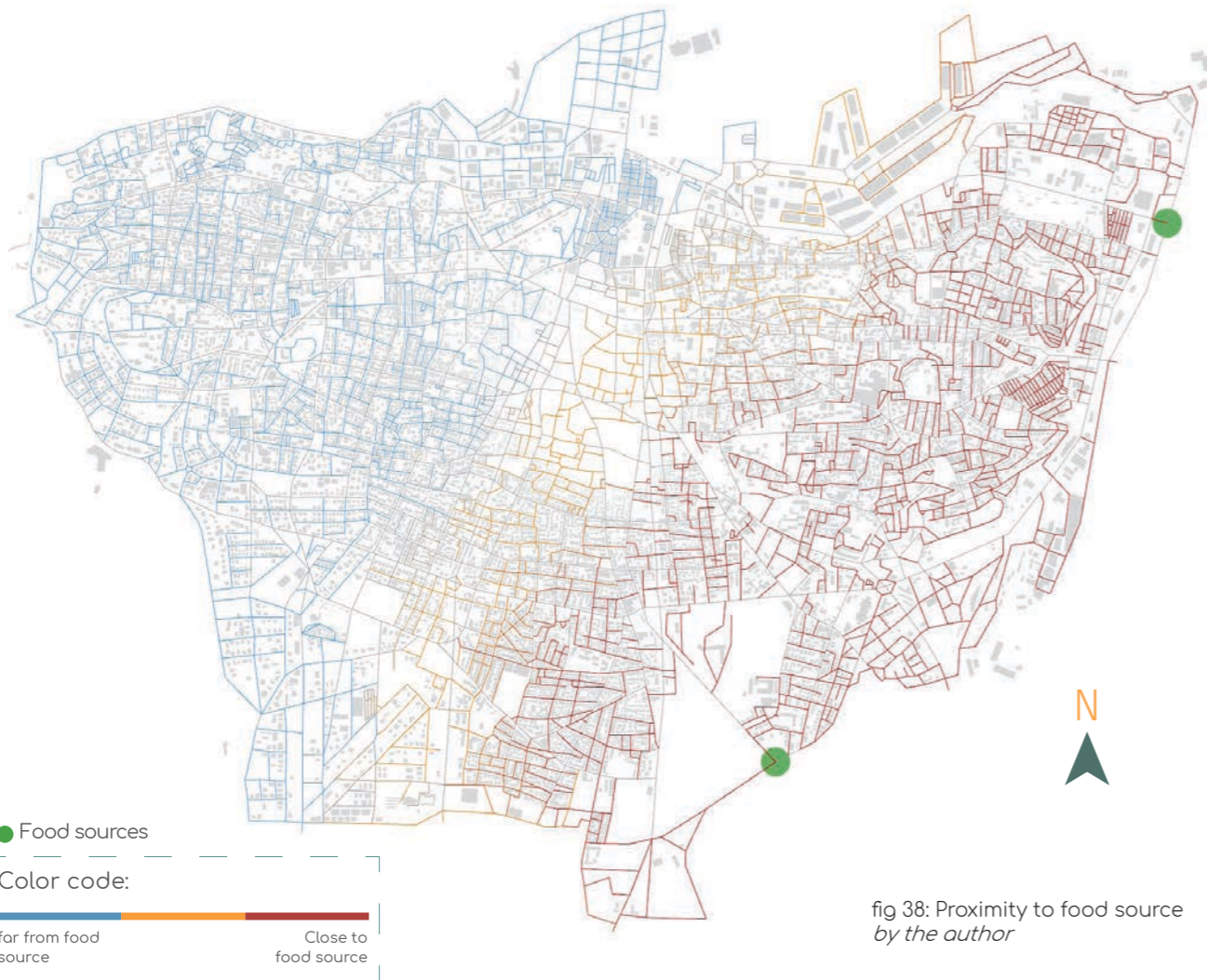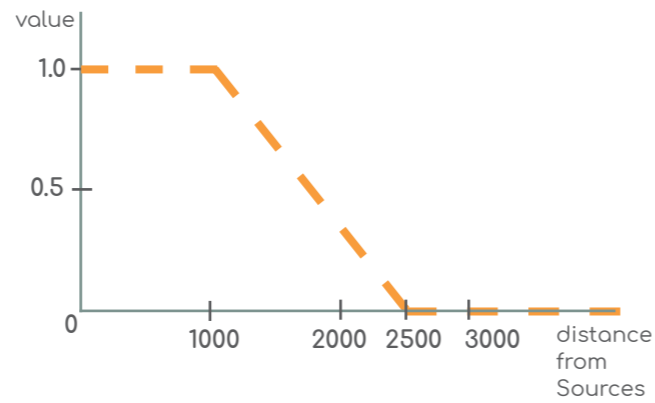
Overlaying the results (East market)

After generating street maps with their suitability scores, to have a final illustration mapping all the acceptable values based on the different parameters. The final goal is to have Bus stops, parking spaces, streets length and accessibility to food, listed one map, and as a result, all the values from these parameters are mixed and transformed to one value. Moreover to explain this mathematically, every street having a value of zero in any of the previous parameters is kicked

out of the simulation, and only the streets with values above zero are kept in. Then all values of each street is added up and redivided by the mass edition of parameters, in this case, its divided by 4. ergo a new value for each streets is assigned. This mathematical equation takes place while taking into consideration all parameters having equal ratios to each other. In other words, all parameters are treated equally and have the same priority. Shall this change, the parameter is given a different and value, and the number used to divided the sum of values is changed accordingly.
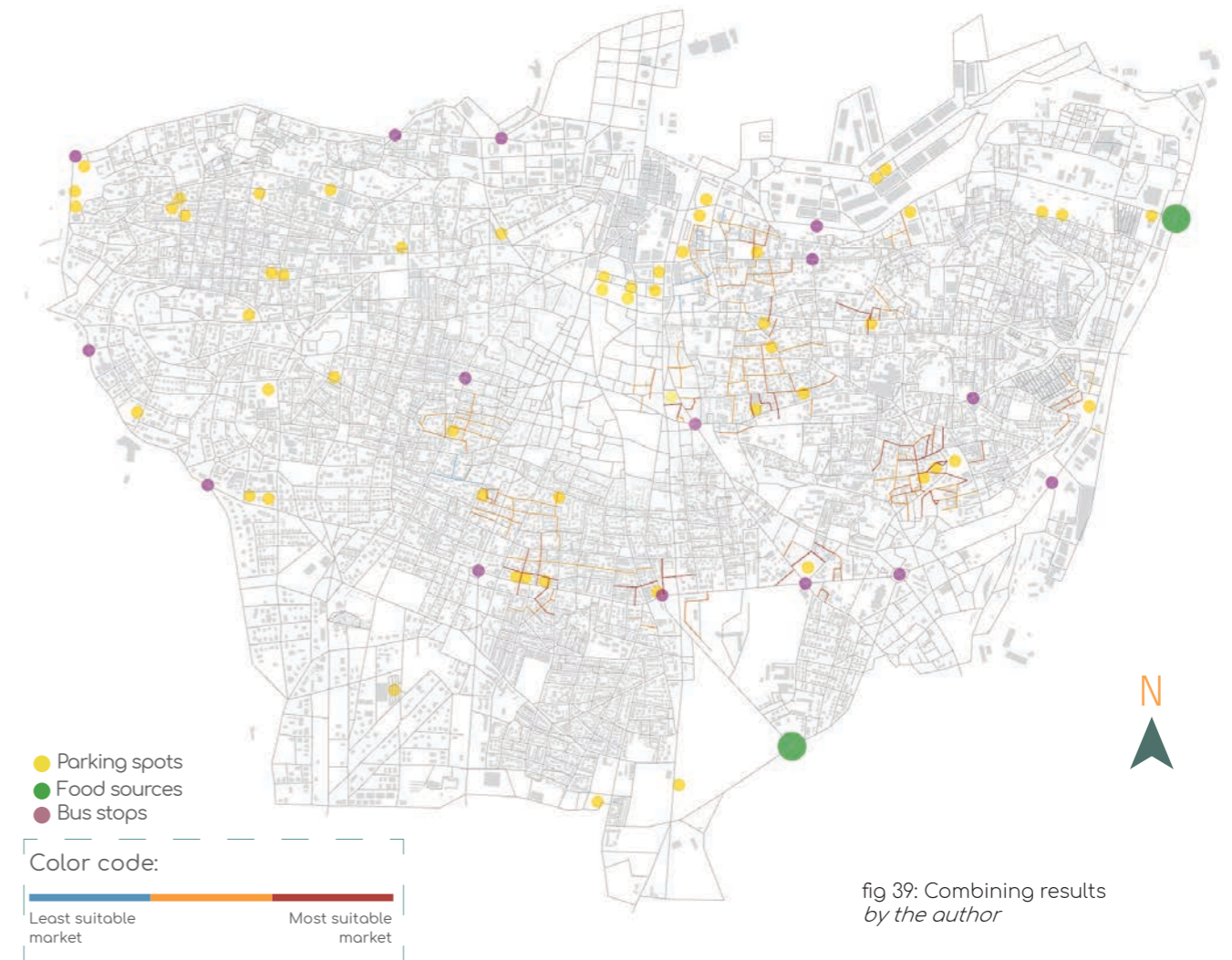

● Food sources

Color code:

far from food source → Close to food source

fig 38: Proximity to food source
by the author

● Parking spots
● Food sources
● Bus stops

Color code:

Least suitable market → Most suitable market

fig 39: Combining results
by the author

Uninterrupted flow of
goods from source (**West market**).

Food supplied by the south has two means of getting to the city, which are central and heavy traffic highways, thus geometrically, the main food source would be considered as a midpoint of a route linking all three food sources(2 from south+ 1 from Bekaa) .
Again from this point, all routes defined between 0 and maximum 2.5 kilometers is possible with of course decreasing suitability values.
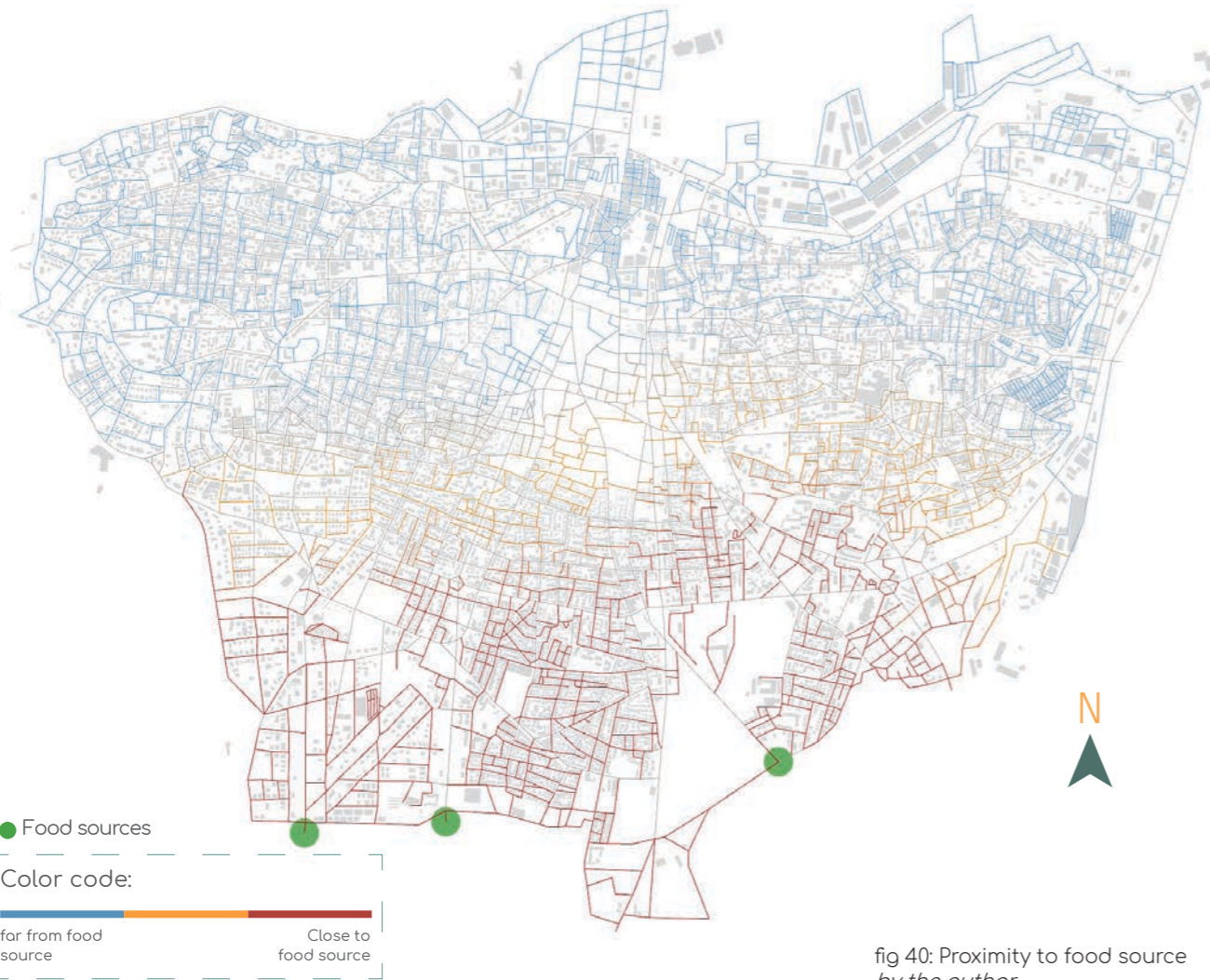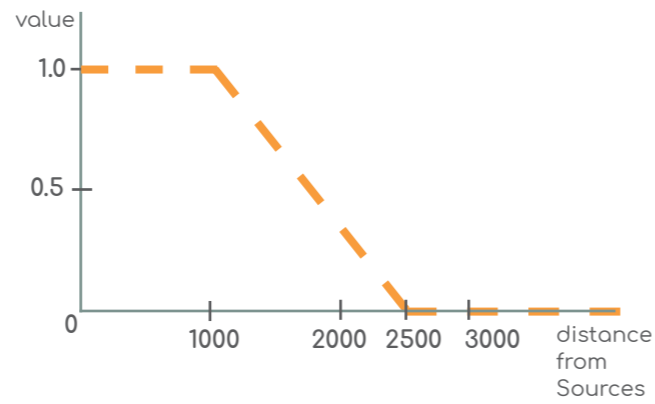
value

1.0

0.5

0

1000 2000 2500 3000   distance
from
Sources

Overlaying the results
(West market)

Overlaying all the results, but taking into account food sources from Bekaa and the south to strategically define the western market location.
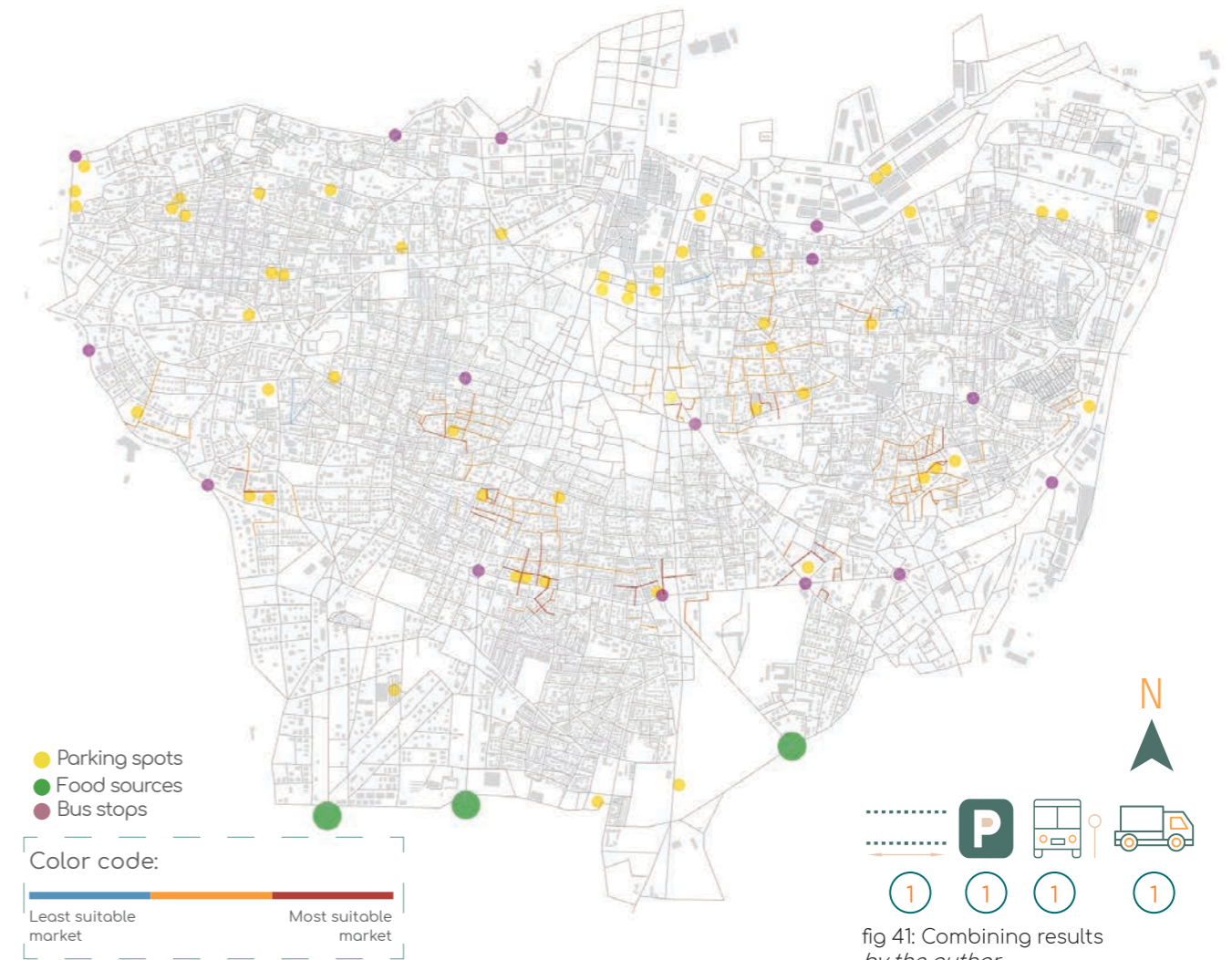

● Food sources

Color code:

for from food source ———————————— Close to food source

fig 40: Proximity to food source
by the author

● Parking spots
● Food sources
● Bus stops

Color code:

Least suitable market ———————————— Most suitable market

fig 41: Combining results
by the author

5

Adaptable tool

The generated tool assist users to strategically place markets within a city is based on data an hypothesis, however this can be modified at any instant for one or more parameters. In case of placing a food market in a city where accessibility to food is the minor concern, while street length, parking, and bus stops are major concerns, the assigned ratio that was 1 in the previous simulation gets downsized to 0.1, meaning
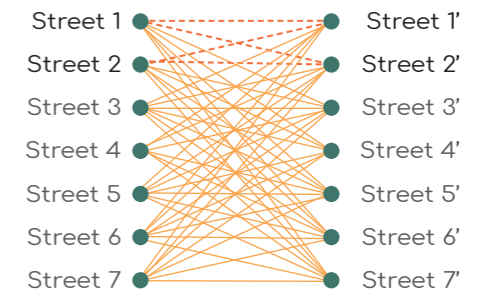
this parameter decreases 90% of its influence. Hence the remaining parameters become dominant parameters leading to a different result. This is useful since all cities are in constant development, and adaptation in the urban realm is inevitable. Nevertheless, in this thesis all parameters are and will be treated equally, they all have the same score and value, 1.
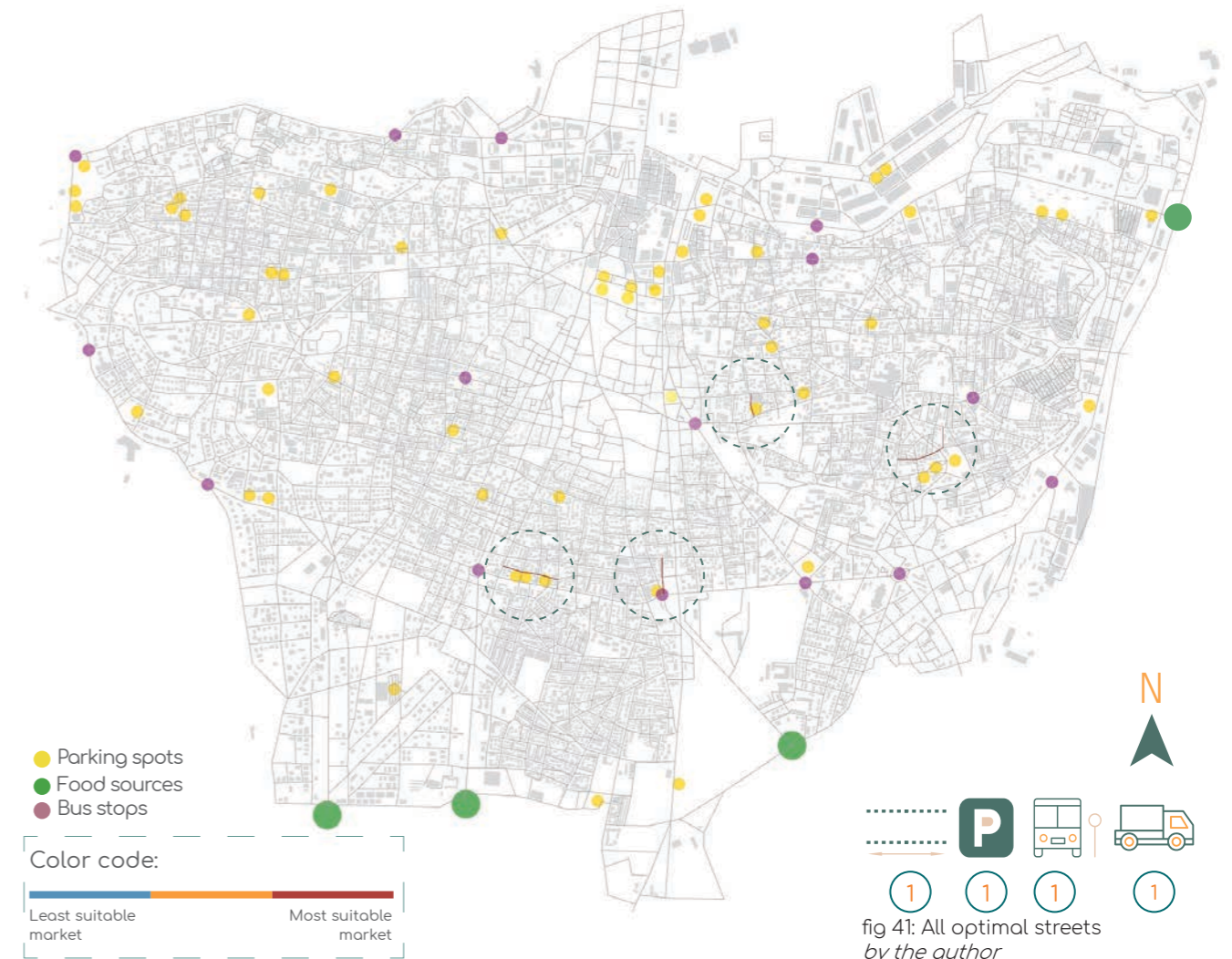Below is a map showing different results when changing ratios.
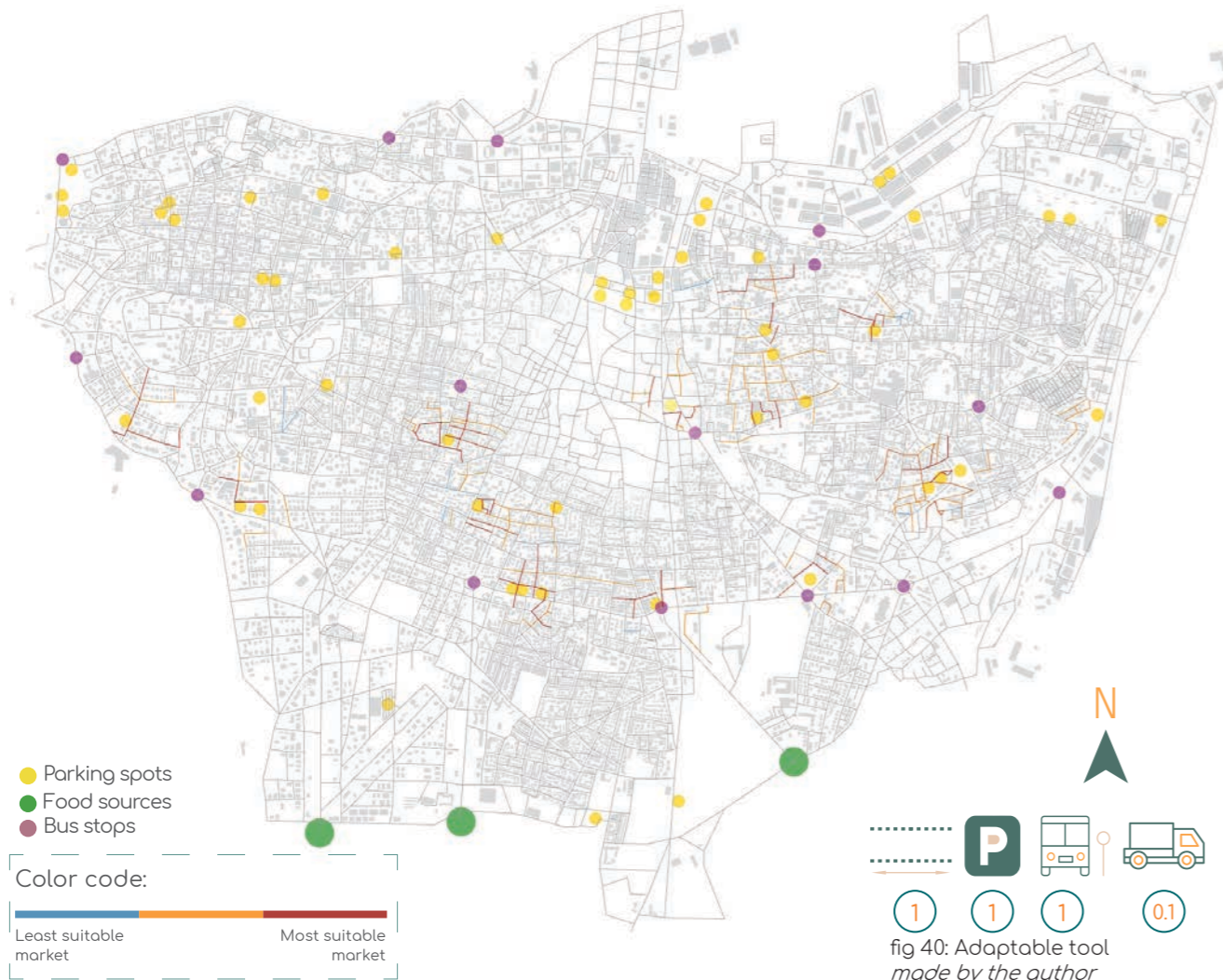
Eventually, the final aim of this thesis is to strategically place 2 markets in Beirut city, and so far there are multiple options which have proven to fulfill all the required criteria. Nevertheless, the question remains on how to choose 1 market for each areas of Beirut, knowing that there are multiple candidates? One way could would be to create a list of possible 2 street combination (1 east and 1 west), remove them from the street network, test the effect they cause and choose the option which affect the current performance of the street network the least. The possible options would be S1S1',S1S2',S1S3'

Markets in West   Markets in east

Street 1 ● ---- ● Street 1'
Street 2 ● ---- ● Street 2'
Street 3 ●   ● Street 3'
Street 4 ●   ● Street 4'
Street 5 ●   ● Street 5'
Street 6 ●   ● Street 6'
Street 7 ●   ● Street 7'

,S1S4',S1S5',S1S6',S1S7', and then S2S1',S2S2' ... and so on. For simplicity/feasibility reasons this exercise will be tested only on 4 streets with the highest scores (2 from each list)

Parking spots
Food sources
Bus stops

Color code:

Least suitable market   Most suitable market

1   1   1   0.1

fig 40: Adaptable tool
made by the author

Parking spots
Food sources
Bus stops

Color code:

Least suitable market   Most suitable market

1   1   1   1

fig 41: All optimal streets
by the author

Comparing Closeness

Centrality tests are useful for comparing the effect of removing roads from the street network, or more specifically closing it down to automobiles. However, while Betweenness centrality revealed data about how important a street is, closeness centrality offers insight about how central a street to all other streets is. Closeness centrality can be performed on a global as well as on a radius based scale, yet the global scale will be used here to maintain the same logic used with Betweenness. Furthermore, even if closeness centrali-

ty only gives a predication about street centrality based purely on the geometry and landscape of the street layout, yet when modified it could reveal the effect of this change. In other terms, comparing closeness centralities could offer an idea about how would the new proposal perform, will the so called city center or centers remain as central as before ? And what about the centrality values streets held before and after all modifications? Below is the main map, without removing any street segment, and so in the following exercise the results of the four possible outcomes (S1S1', S1S2', S2S1' and S2S2')
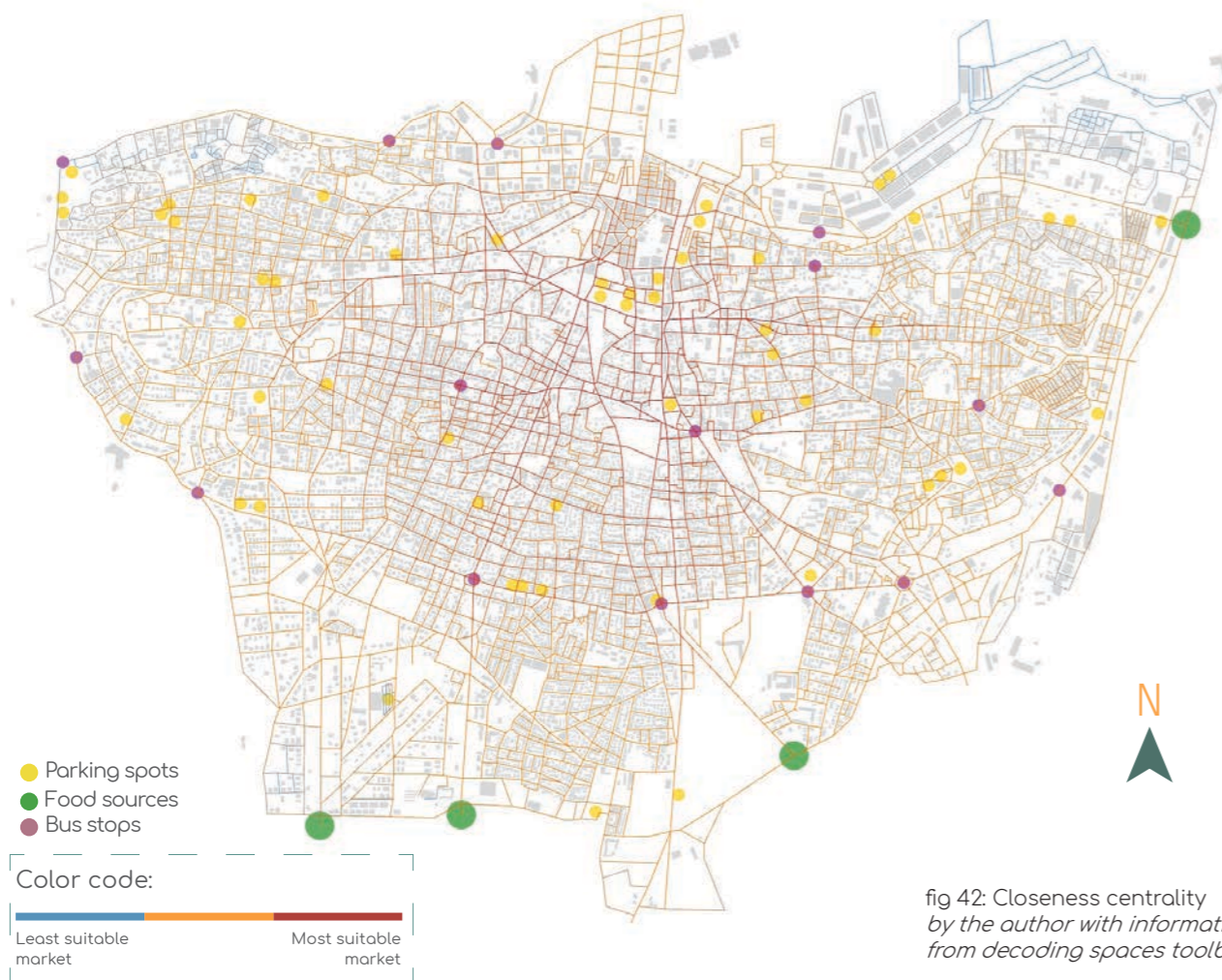
are compared to this result. In each scenario, two streets are kept and two other are removed.

When performing a centrality test using parametric tools such as the present case, a map showing colorful segment would be one of the outcomes. This map comes as a result, and as a graphical representation of centrality values, the higher the difference between values, the greater the color contrast would be on the colored map. When comparing the four scenarios, it is not possible to rely only on the graphical representations since its not an accurate, nor a scientific method, while sometimes the difference might not be visible to the naked eye, hence a more sensitive method is put in place. The four possible outcomes are compared as follows:

Each street value in the four scenarios is compared to the current street value, and the difference is kept as a variation value, once all the variation values of all streets are collected, the values are added to reach one value. The same goes for the remaining three outputs and then the total variation values are compared to each other, and the lowest value is the most suitable for this test, if the aim is to not disturb the street network performance in terms of centrality as much as possible.

Beirut's street network geometry holds: 6950 street segment, and each segment obtains a centrality value varying from 0 to 1, hence for each segment the variation value is something between 0 and 1. The sum of all variation values for each scenario is the some of all these variations defined as numerical values between 0 and 1.

This is to give an impression about the importance and scale of the variation values in each scenario.

fig 42: Closeness centrality
*by the author with information
from decoding spaces toolbox*

- ● Parking spots
- ● Food sources
- ● Bus stops

Color code:

Least suitable market   Most suitable market

N

variation
value

1246

N

variation
value

1250

N

fig 43: Closeness centrality comparaison
*by the author with information from de-
coding spaces toolbox*

lowest
value

variation
value

1242

N

variation
value

1252

5

Least disturbing option

The combination of the two streets in red have proven to affect the least the current spatial centrality revealed by a global closeness centrality test. These two markets have quick access to bus stops and parking spaces, they are also central in terms of food accessibility which will lead to an uninterrupted supply and waste exhaust. While being of course long enough to host physically as much stalls as possible, therefor theoretically these two streets are the optimal location for setting up fixed markets.

Results observation

For the western market, one can notice that the market's location is not exactly equidistant from all food sources, the reason behind such a result would be the great distance between bus stops and parking lots in most of the times (except the street market), as they are not adjacent in most of the times.
The same goes for the eastern market whereas the market is more or less central in terms of distance between food sources, but could be considered far from the food sources. This is mainly because of
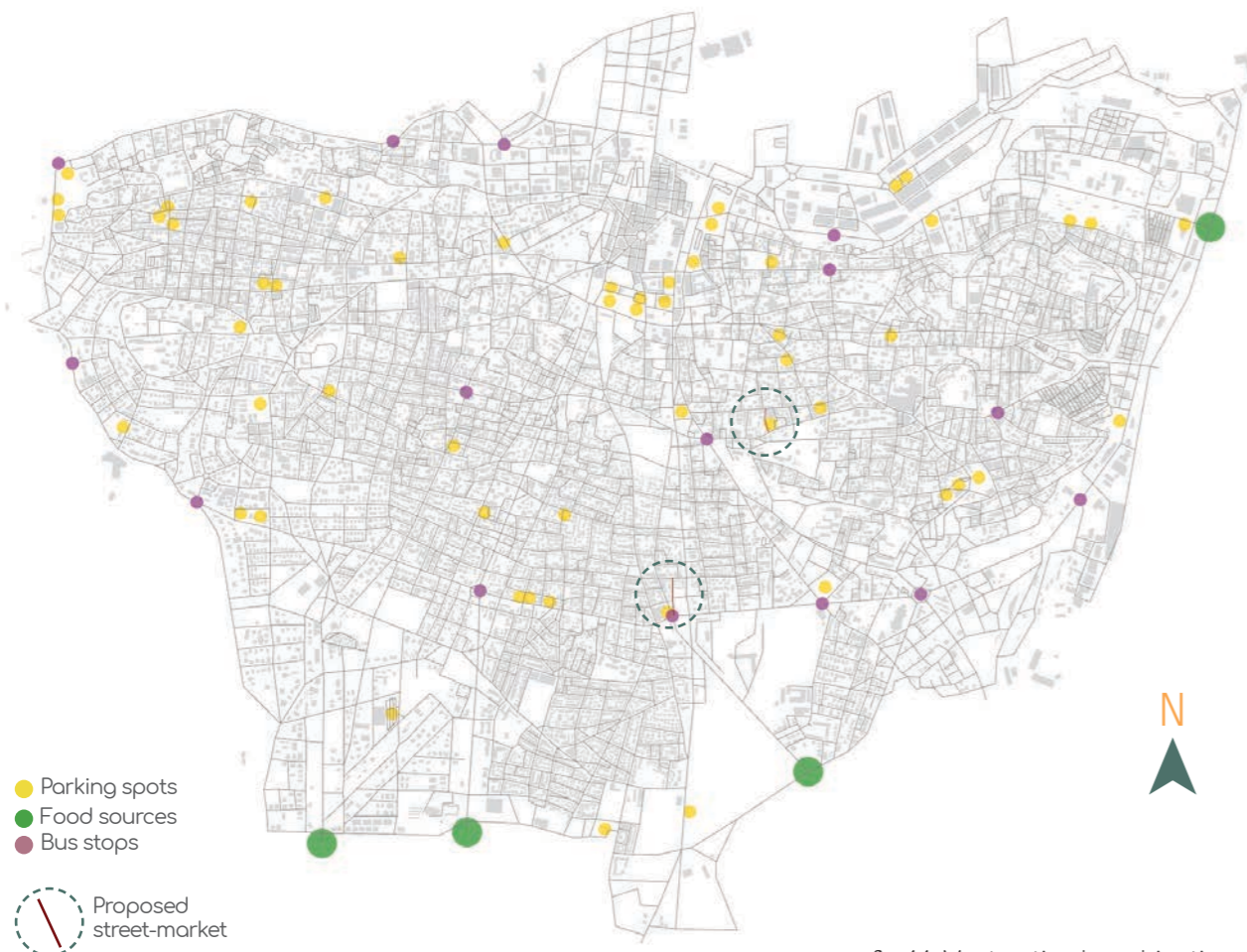
the distribution of Bus stops, which are apparently not enough nor fairly distributed across the city(according to the used data). In case bus stops numbers are reconsidered they could offer more opportunities for markets to perform better within the urban context. For instance if bus stops existed in peripheral areas in Beirut, markets could have been placed in much closer proximity to food sources, meaning food trucks would spend less time in congestion between automobiles during rush hours.
The same logic could apply for parking spaces, yet adding parking lots in the city is not quite wise in capitals nowadays, especially when major cities of the world are reducing car access and parking spots within its administrative borders. Furthermore, setting up markets within a smooth and quick reach from food sources, is a wise decision, yet one must also consider and question what would happen to areas further than 2.5 kilometers from food sources (maximum threshold used for fuzzy logic calculation). These areas are either bound to not having affordable food and goods, or a new alternative for food supply must be thought of. For instance the city could benefit from its proximity to the sea, and from the existing commercial dock to assure supplies by sea from the north side of the city, or rethink the service schedule of food trucks, whereas they are allowed to enter and exit enter before rush hour starts (check map of uninterrupted flow of goods) this was the proximity to food sources is no longer an issue and instead of 2 markets, its possible to have 3 which

could be enough to cover all neighborhoods of the city within a walkable distance. In this case, the priority goes to bus stops, and parking lot which could offer together different results if discarding the distance from food sources. This would also be possible within the potential of the developed tool (check adaptable tool map).
Moreover, food markets should also follow a certain pattern of distribution, in a way that they are not in proximity to each other, so that the biggest number of neighborhoods could benefit from services these markets offer (check map of variation value:1250). Nonetheless these results are taking into consideration a certain amount of data, and the more developed the data the better the results would be.
Such observations are useful for future optimization phases which can not be covered within the time frame of this thesis, they could also be useful for rethinking the overall performance of urban elements in the city in order to reach eventually an better integrated urban performance plan of the city.

● Parking spots
● Food sources
● Bus stops

⊘ Proposed street-market

N

fig 44: Most optimal combination
Made *by the author*

5

Street observation:

This street is currently used as a one way street with one lane of side parking, it is also the entrance to several urban structures.

Some of these buildings are modern buildings from 50's and 60's having a couple of stories, meaning they are quite simple in terms of architecture. While other structures are more recent, or are in the process of construction. These new buildings will probably have much more floors,bigger surfaces, multiple underground parkings. If these streets are converted to food markets, residents of these buildings will no loner have free and unrestricted access to their buildings by automobiles. As an alternative these underground parking could be tendered and used by the farmers as storage facilities to reduce commuting and transportation cost.

This would come as a financial compensation for investors who built these low and high rise constructions. Parking spaces located on the side of street can be replaced with the parking lots near the street market, also this would be a good opportunity to reduce parking spots in the city

Eastern market
view 1

fig 45: Street view 1
Source: Daou 2020

Eastern market
view 2

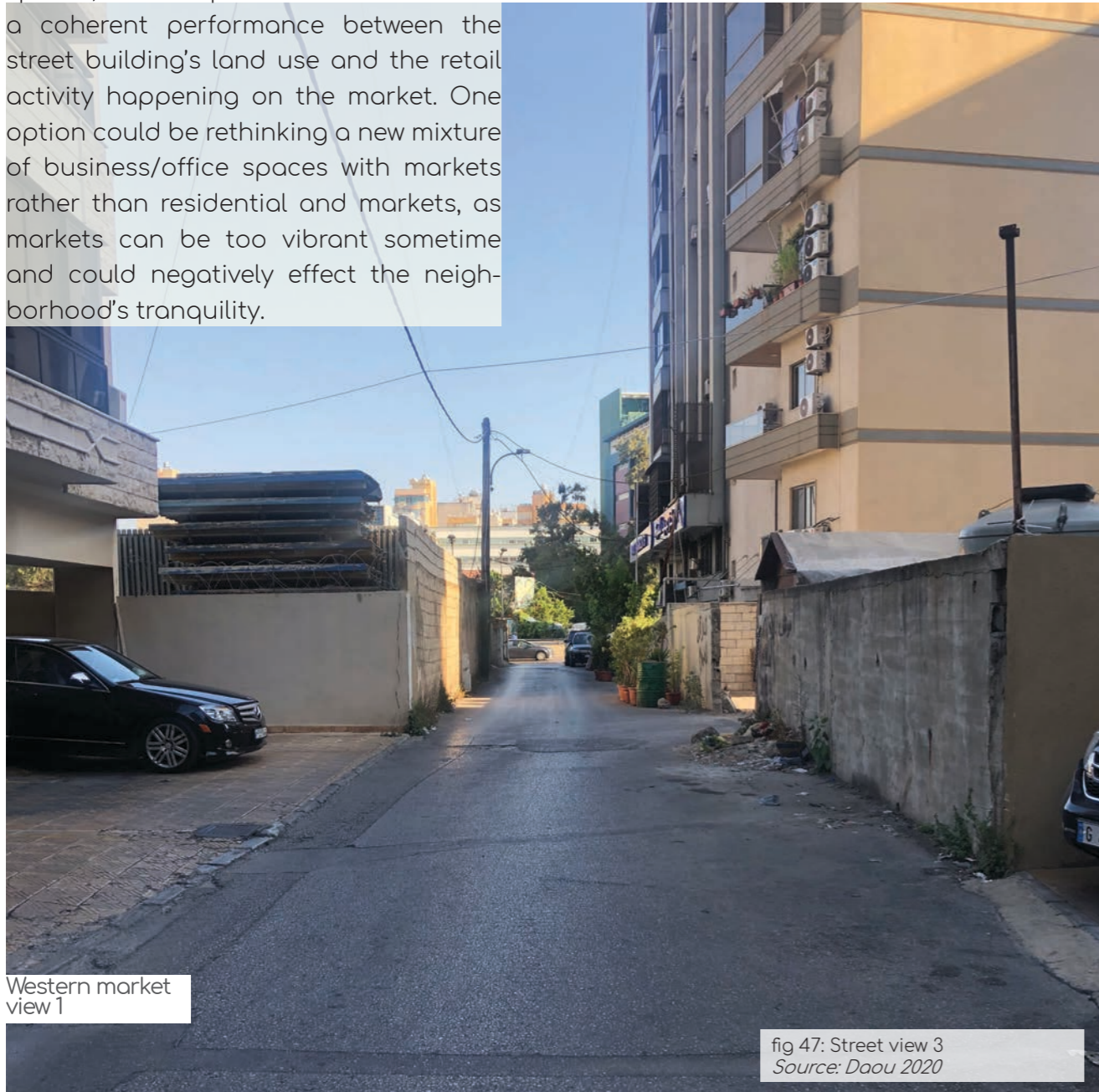fig 46: Street view 2
Source: Daou 2020

Street observation:

This street has obviously a different layout whereas ground floor space in buildings is used for parking spaces, with mid-rise residential buildings.

Here street life is not really active, since most of the plinth is either closed by blind walls, or used as private parking spaces, and this pushes to rethink about a coherent performance between the street building's land use and the retail activity happening on the market. One option could be rethinking a new mixture of business/office spaces with markets rather than residential and markets, as markets can be too vibrant sometime and could negatively effect the neighborhood's tranquility.

Street width is also a vital element in successful markets, perhaps defining a minimum street length would serve as a success boost factor for markets.

These street observation are not fixed as each time the variant and parameters change, the observations change, however it is useful to take into consideration all notes for future optimization phases and better data collection.

Western market view 1

fig 47: Street view 3
Source: Daou 2020
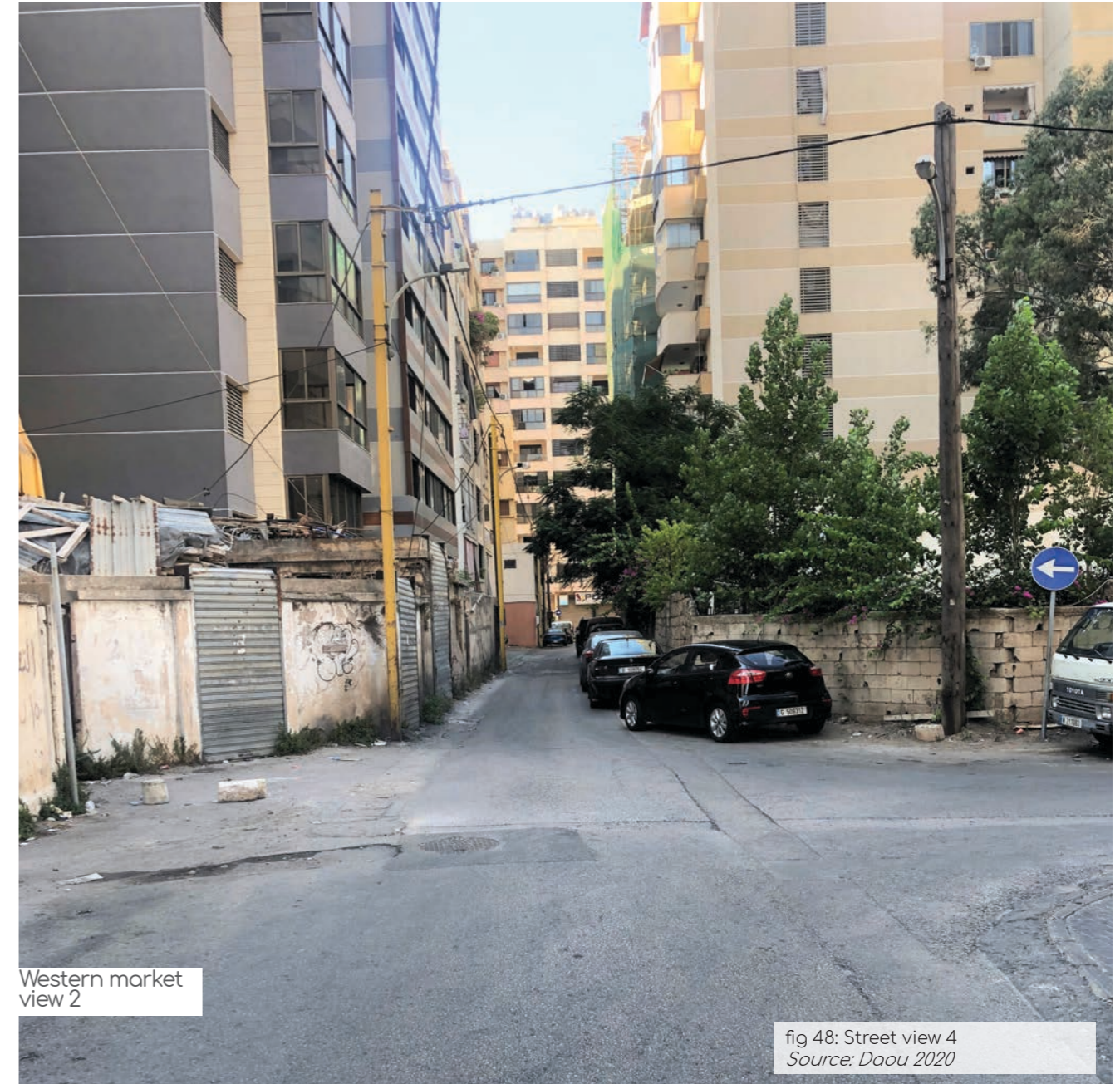
Western market view 2

fig 48: Street view 4
Source: Daou 2020

5

Temporary markets
Betweeness centrality

Temporary markets are clearly temporary functions, yet the space hosting these markets can be transformed to people focused streets and or even proper public spaces. While shared streets are considered to be both, people oriented spaces and vehicle infrastructure yet these kind of streets could not be counted during rush hours, but rather could be used for simple purposes such as entrances and exists; service roads and emergency access. For this reason it is better to trans-

form streets which are not significant to the city's traffic flow. Here Binary logic is being used again for the same reasons of simplicity in the previous logic. Streets with centrality values lower than 0.4 will be used in further tests(Global Betweenness centrality).

Streets with minimum
length

Even-though public space don't have a standard size for it to exist, yet temporary markets do, its is preferable for temporary markets to be big since usually markets happening on a weekly or monthly basis needs a sufficient area surface. Flea markets happening on street market will have to be installed in a linear layout, therefore streets above 80 meters should offer enough stalls, however preferably above 100 meters would be more

spacious and would give more space for people to showcase their goods leading to higher chances of success for the event/market.
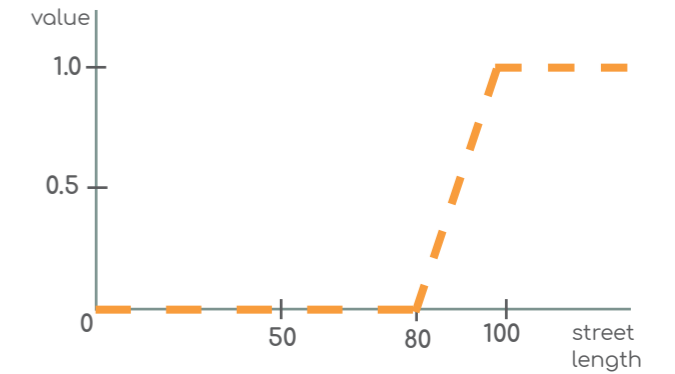

Color code:

none   most central
central streets   streets

fig 49: Betweeness centrality map
made by the author with information from decodig spaces toolbox

Color code:

shorter   longer
streets   streets

fig 50: Street length map
by the author

5

Proximity to parking lots

P

Flea market and bartering markets are a new urban concept within the Lebanese community, this interesting idea might attract a lot of people out of curiosity, on top of being a vital need given the current circumstances, especially for people living in the suburbs and outside the capital.

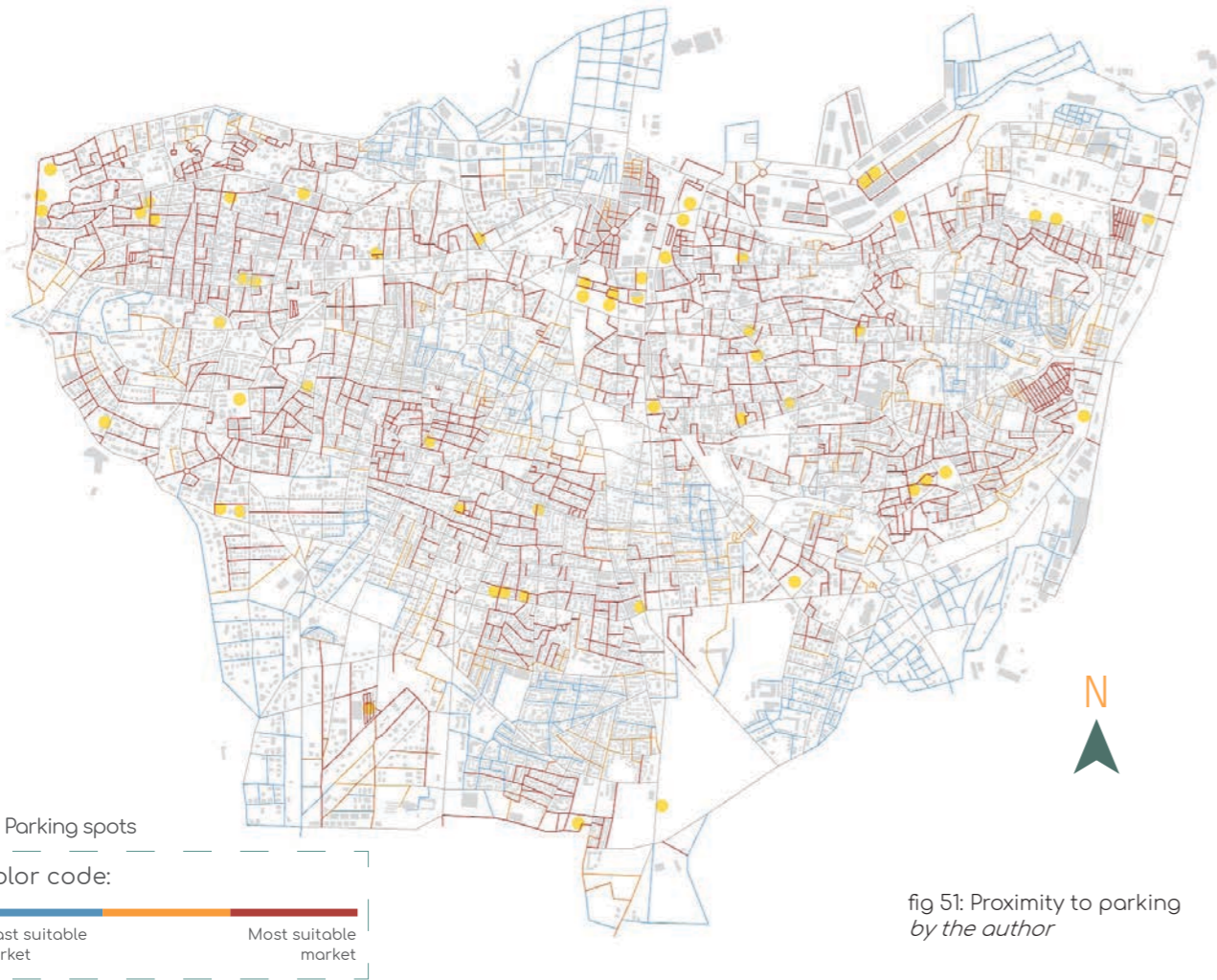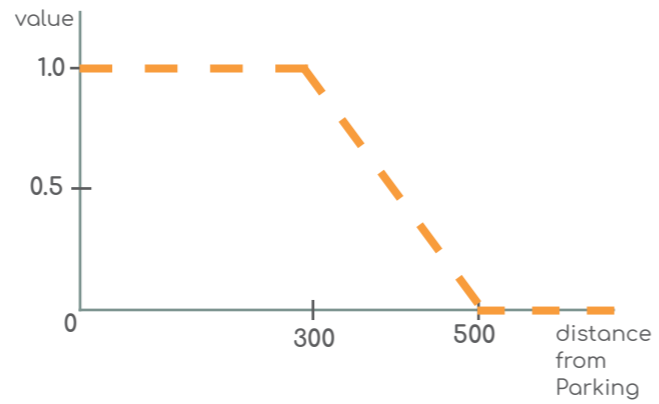A market with a walkable distance from a parking space would give a success boost to the market. The distance is not obligatory small since it is not needed for technical issues (loading unloading), yet it should be easily walkable.

Integrated public transport network

A distance of 750 meters, which is equivalent to a 10 minute walk, is the furthest distance a person would have to walk from the bus stop to a market or public space. This ratio makes the market more attractive and stimulate the activation of public spaces as well. Public spaces are great once active and have people but could be unsafe spaces when empty, hence the importance of easily accessible temporary markets/public spaces.
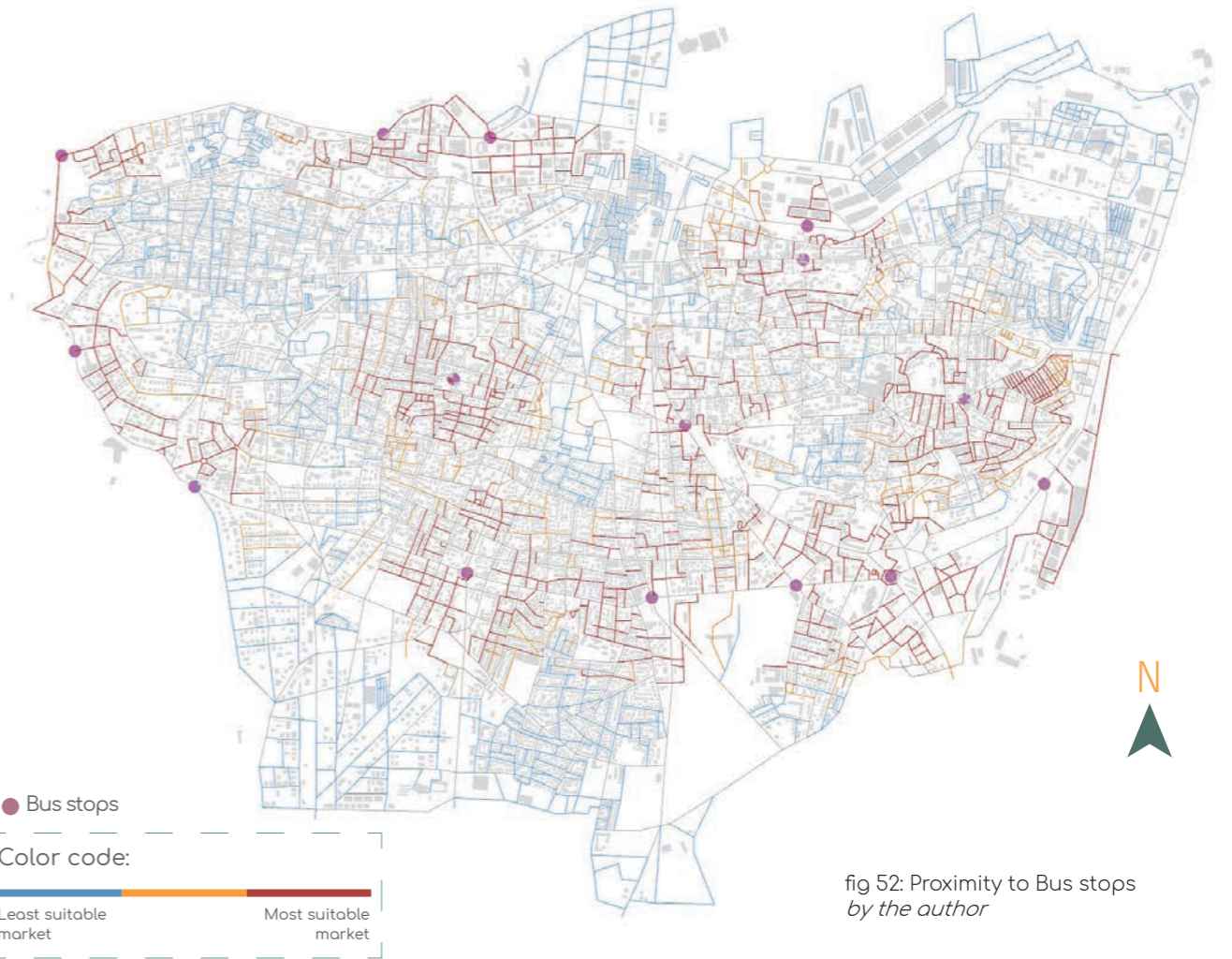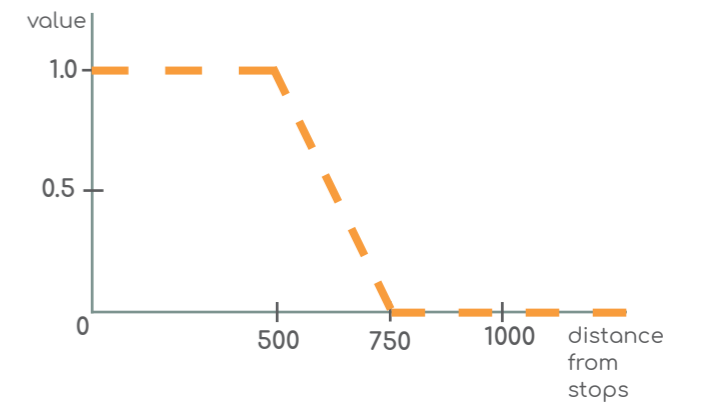
● Parking spots

Color code:

Least suitable market   Most suitable market

fig 51: Proximity to parking
by the author

● Bus stops

Color code:

Least suitable market   Most suitable market

fig 52: Proximity to Bus stops
by the author

5

Distance from existing public spaces

These temporary markets will act as people oriented public spaces, when markets are inactive. And since Beirut suffers from lack of public space then it makes sense to place the new public spaces in a distant way from existing public spaces. This would help create some sort of spatial justice in the city, where the accessibility to public space granted to as much people as possible. The proposed public spaces are set in

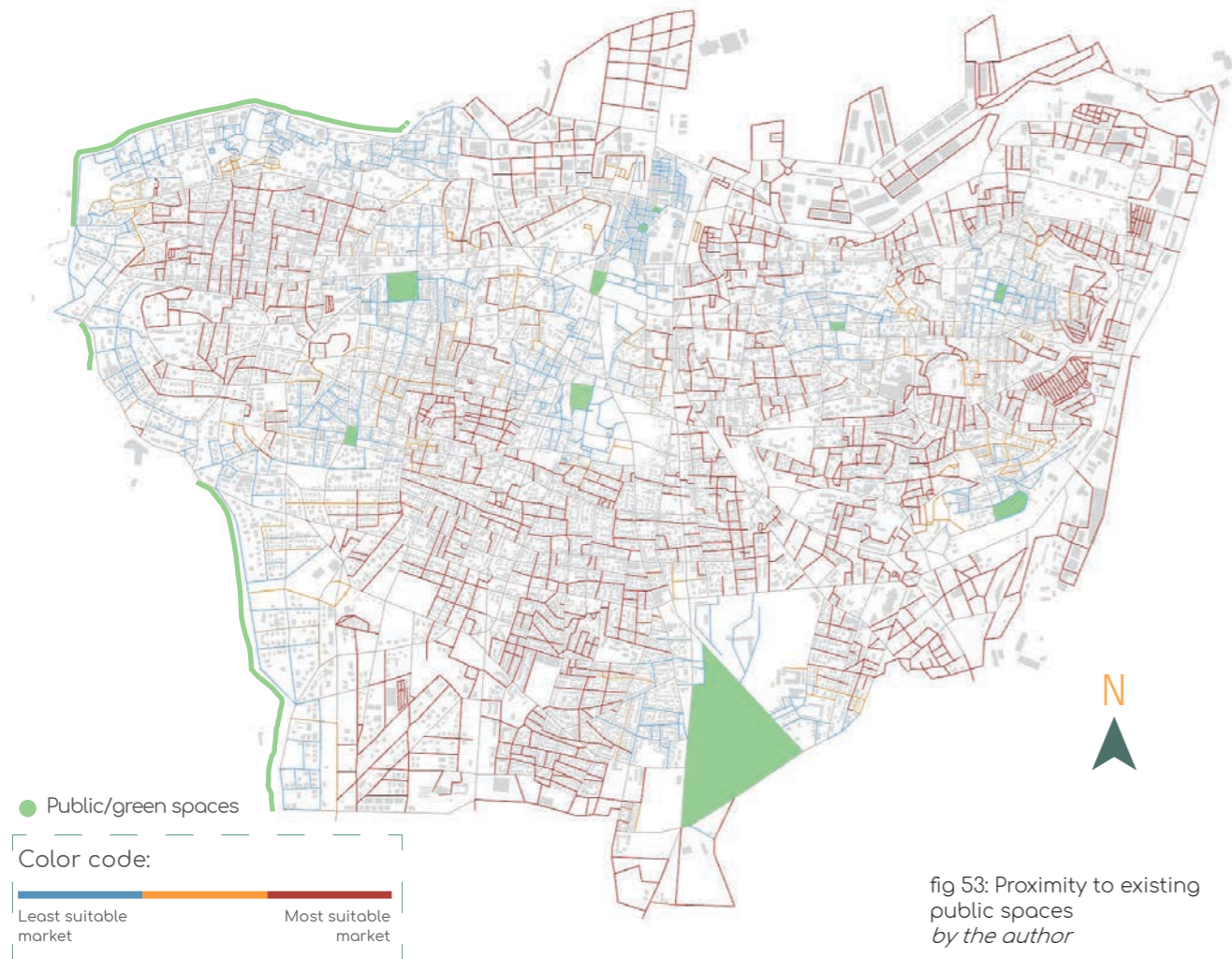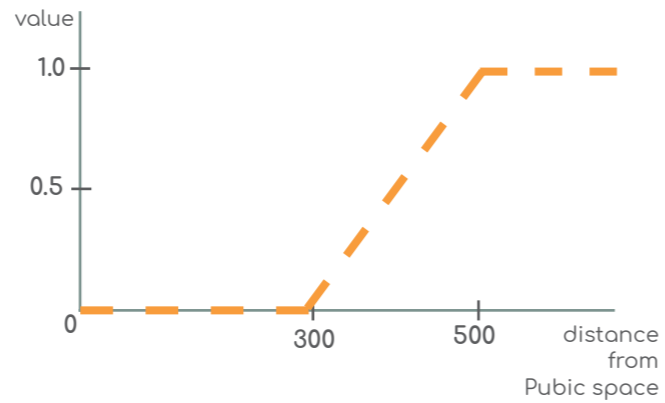a way to be at least 300 meters far from existing one, and preferable 500 meters and above.

Radius based closeness centrality

In this thesis placing markets is a question of suitability based on certain data and parameters, a great factor to consider would be activating the public spaces once markets are not installed, and attracting more people when they are. Moreover, closeness centrality gives insight about the sub centers of the city that usually attract people, hence as mentioned earlier this is just from a spatial point of view and purely based on the

street network geometry. To be able to locate sub centers and not just one center, a radius of 800 meters is set, this helps in finding multiple central zones in the city, while traveling 800 meters from each node in all direction. As a results while following this logic, streets that are the most central would define the city's sub-centers around them.
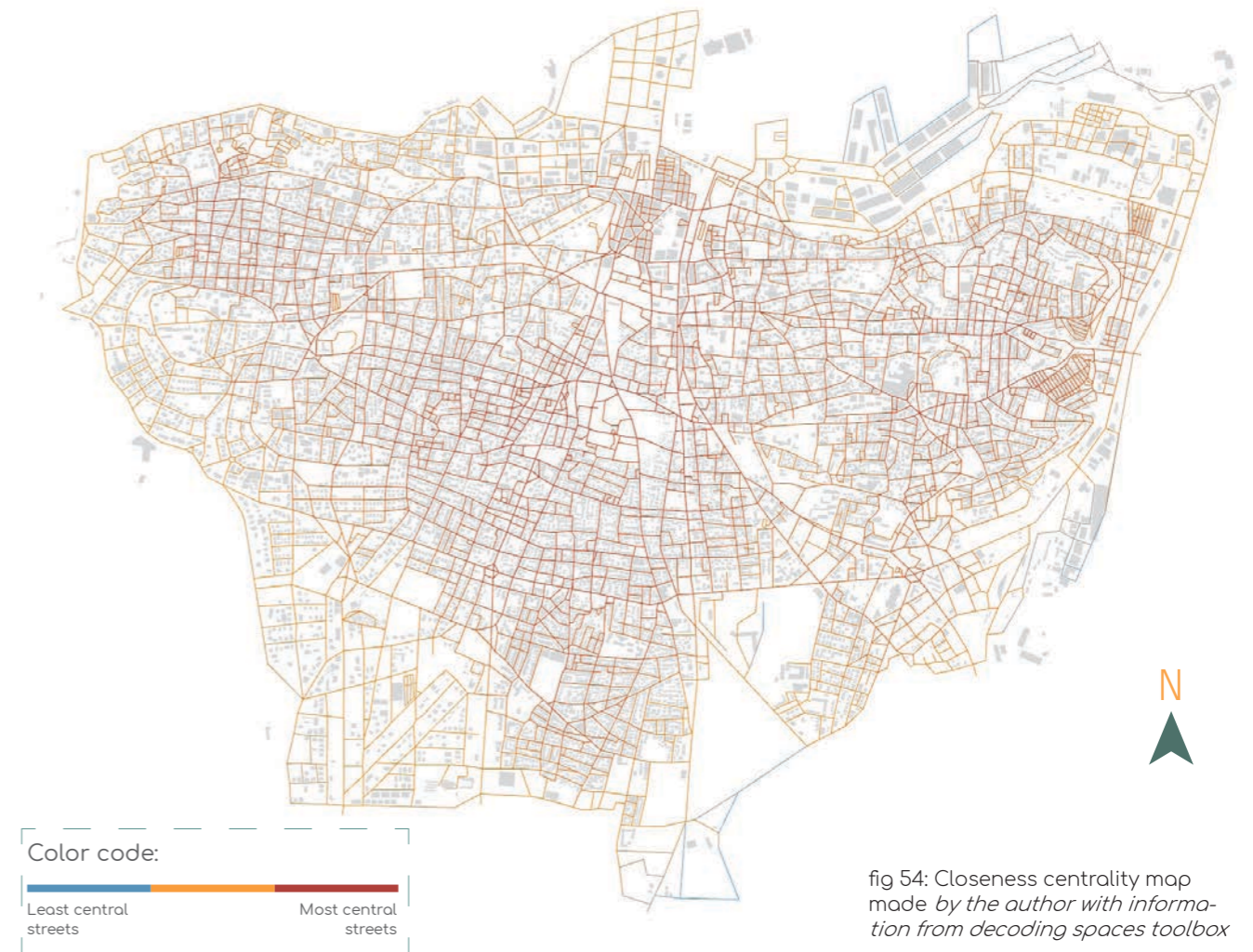
Public/green spaces

Color code:

Least suitable market   Most suitable market

fig 53: Proximity to existing public spaces
by the author

Color code:

Least central streets   Most central streets

fig 54: Closeness centrality map made *by the author with information from decoding spaces toolbox*

5

To make the content more graphically readable, below are the most central street when putting the street network to a 800m radius based closeness centrality visually, while highlighting only streets with values on 0.8 and higher. This threshold will be used to filter out all the streets which has a smaller centrality value, using traditional binary logic.

Ideally, fuzzy logics with a threshold is favorable to follow the same coherent work flow, yet again for feasibility and simulation reasons the number of computed streets must be drastically lowered to obtain an actual output. It goes without saying that using better computing tools one can adopt fuzzy logic in all this tool, however given the used resources in this thesis, adaptation is needed.
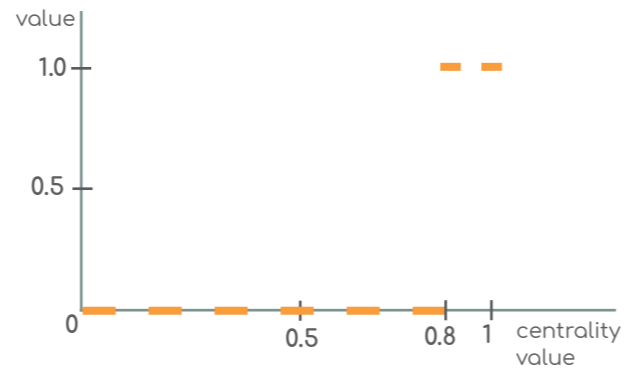

Proximity to sub-centers

Similar to the previous parameters, closeness centrality comes as a parameter following the fuzzy logic concept. Here all potential markets are preferable to be within a distance not exceeding 600 meters from attractive spots in the city. It is preferable for public space to be in close proximity to attractive places, as people attract people,considering the initial area more or less active. Usually sub centers are places with retail activity and office space, this boosts the success rate of a public space as well as a market.
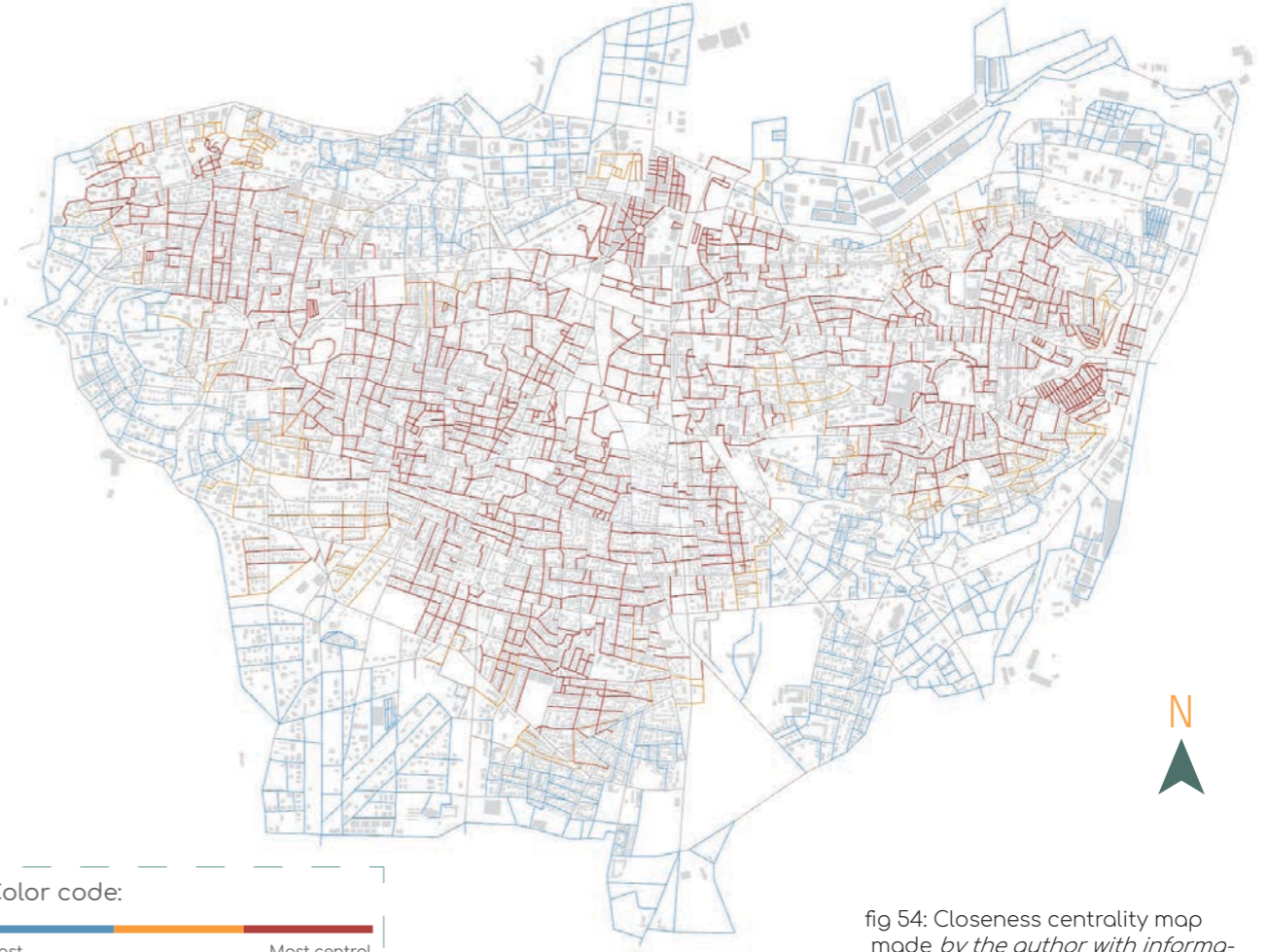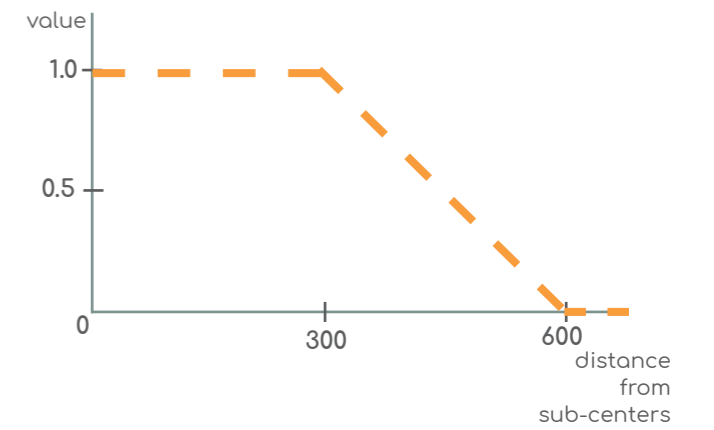

Color code:

none central streets — most central streets

fig 55: most central streets
by the author

Color code:

least central streets — Most central streets

fig 54: Closeness centrality map made *by the author with information from decoding spaces toolbox*
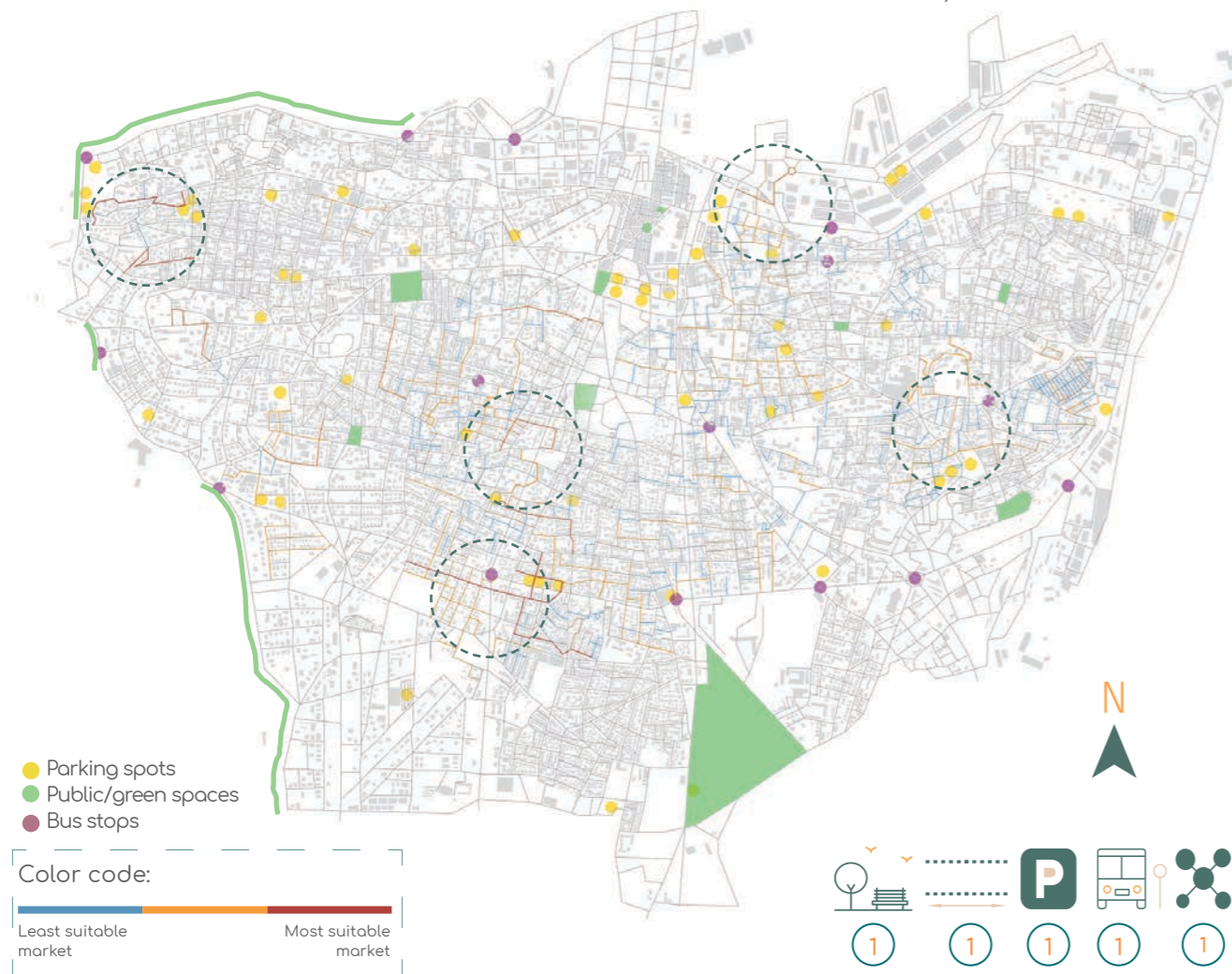
5

Overlaying the results

Using the fuzzy logic concept once more, this time to overlap and summarize all values streets have gained in previous parameters. Once this is done, a new set of values is generated as represented in the map below, however just like the fixed food market process, this representation offers results while treating all parameters equally, and not prioritizing one parameter on the other.

Although the red dark street are located only in 2 main areas, yet other streets in lighter colors, are streets holding smaller values that could also be considered valid candidates since they fulfill all previous criteria, just in a lower intensity . Any choice from this street list is theoretically a good choice for a temporary market and public space, given the available data and selected parameters.

fig 56: most suitable streets for conversion.
by the author

N

Parking spots
Public/green spaces
Bus stops

Color code:

Least suitable market   Most suitable market

Results observation

Temporary markets can play a great role in cities, the fact that their function is on a weekly/monthly basis is quite interesting in terms of attraction, unlike fixed food market which can be considered also to some extend monotone, yet their distribution can be codependent on multiple factor such as the ones used in this exercise. The fact that these spaces are placed within proximity of sub-center of the city will promote their activity, in a way it is a marketing strategy to attract people and to stimulate people to stay longer in these centers. Moreover, results displayed on this map are a gradient of suitable streets distributed in different areas in the city, and this is mainly since many parts of city seems spatially central within the used closeness centrality radius, so here choices are more open and flexible than fixed markets since these interventions could be considered very light in terms of street performance disturbance.

On the other hand, while these streets will witness massive retail activity whether from second hand goods or from bartering trade, they will also have a secondary function of being people focused public spaces.

Here the picture becomes broader since Beirut city greatly lacks open public space, and as shown in the map, there are various potential streets for temporary markets, when it comes to locating them on a micro-scale, the issue is rather a political decision about the role of public spaces and their performance. in

Beirut. For instance, one could suggest to transform most of these potential streets to people focused public space, in a way that people have access to them within a maximum walk of 800 meters, ergo each household can reach an open public space if walking 800 meters or less. As a result, a new network of open public space distributed all over the city of Beirut would be ready to welcome residents as well as visitors, it consists from purely pedestrian areas, shared streets areas or scheduled service roads, as well as exclusive use of space for residents, meaning that only residents living on that streets are allowed to enter it by automobile. As follows, temporary markets could also not have a fixed location following the highest suitability value, but rather managed by a central division such as the municipality of comity of traders. It is possible and could be a better idea to set up a monthly or yearly schedule where bartering and flea markets are given a time (weekly or monthly) and a specific location (different street each time) from this newly established public spaces network. This rotating shift schedule can promote social justice in a way that people from different social classes are gathering in different areas each time. Since the list is quite big, one can transform most of them based on the suggested radius to public spaces, while creating a new sublist of streets with high proximity to sub-centers in the city and use them as rotating locations for temporary markets.

5

Street observation:

These markets are temporary ones, holding light/dis-mountable structures, this allows markets to be installed and adapt more or less to any existing street layout. However since these markets are public spaces, yet the better way to describe these spaces would be pedestrian areas which could function as temporary markets sometimes. In this street, parked cars on public domain streets should be relocated to the nearest parking area, while keeping cars in privately owned parking as they do not interfere with the street performance.

The Plinth here is quite remarkable since most buildings have plinths, these plinths will become more attractive once these areas are turned to proper public space , which will increase their revenues as well as property value.

The streets will also be a great use for the residents, kids can safely play and use the streets, while people can enjoy walks and exercise recreational activities when markets are inactive. In a way, this network of temporary street could act as a series of pocket public/green spaces.
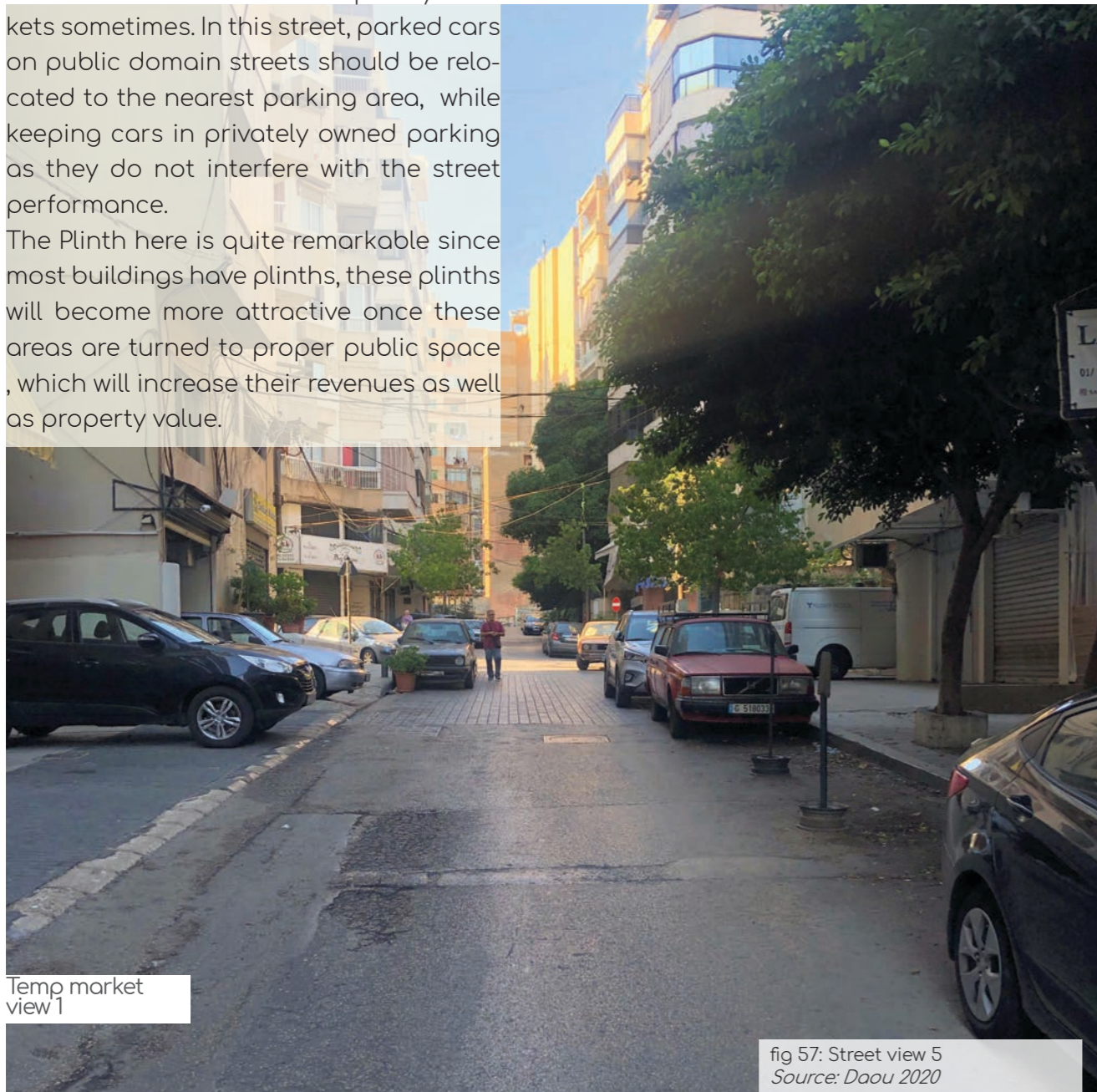
Temp market
view 1

fig 57: Street view 5
Source: Daou 2020

Temp market
view 2
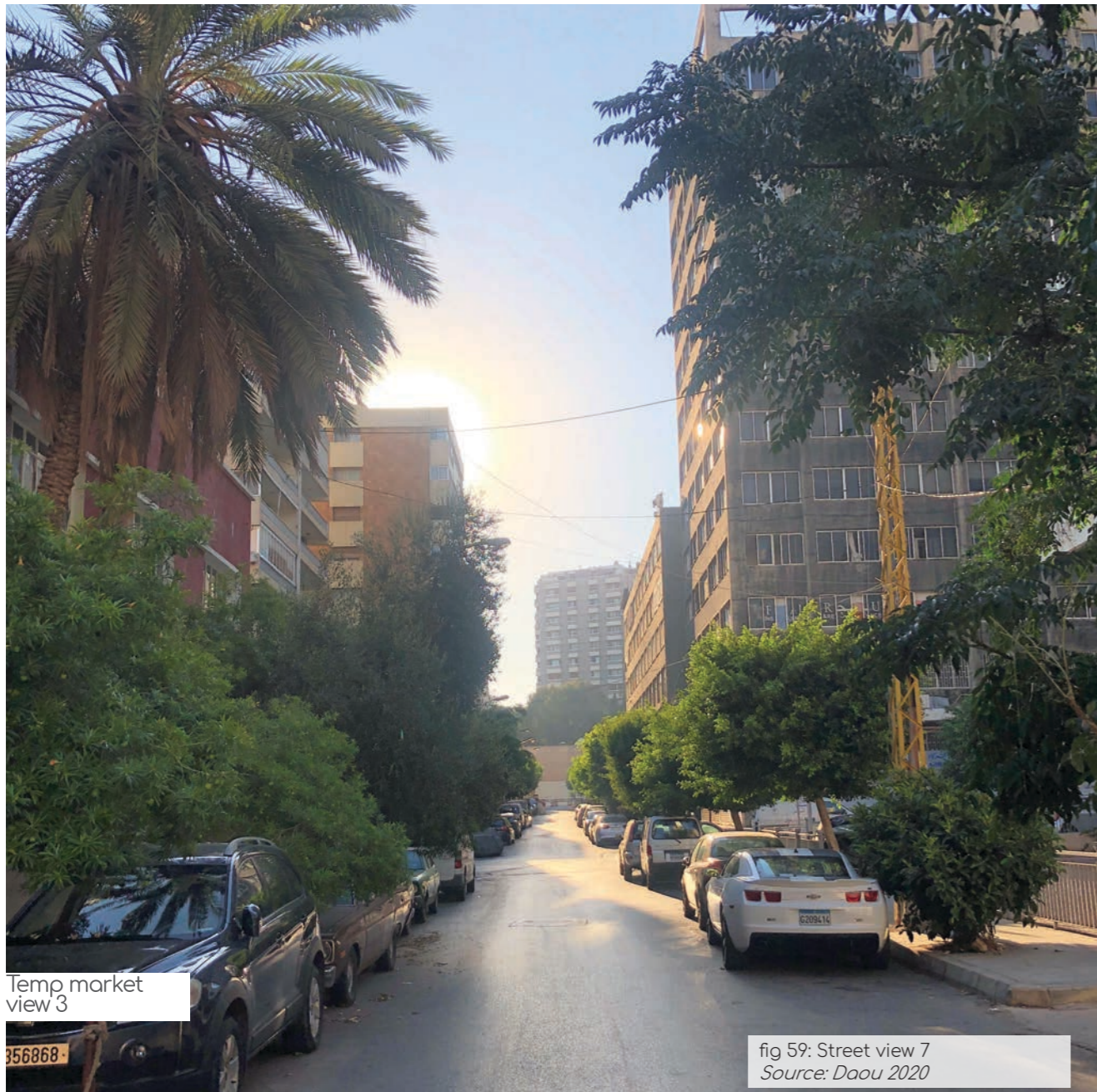
fig 58: Street view 6
Source: Daou 2020

5

Street observation:

Greenery is a key element in successful public spaces, it makes it more pleasant, attractive and even healthier. It would be good to take this into consideration and integrate the existing green network in the simulation for future optimization phases.

Temp market
view 3

fig 59: Street view 7
Source: Daou 2020

Adaptable tool:

Since this tool is flexible enough to allow some modification, changing the parameters value can create new/different opportunities. For instance, if the bus stop parameter value is set to zero, new potential streets appear in a new area, they might lower suitability values but they are of course valid enough to succeed theoretically. I this scenario more neighborhoods could benefit from the transformed streets.
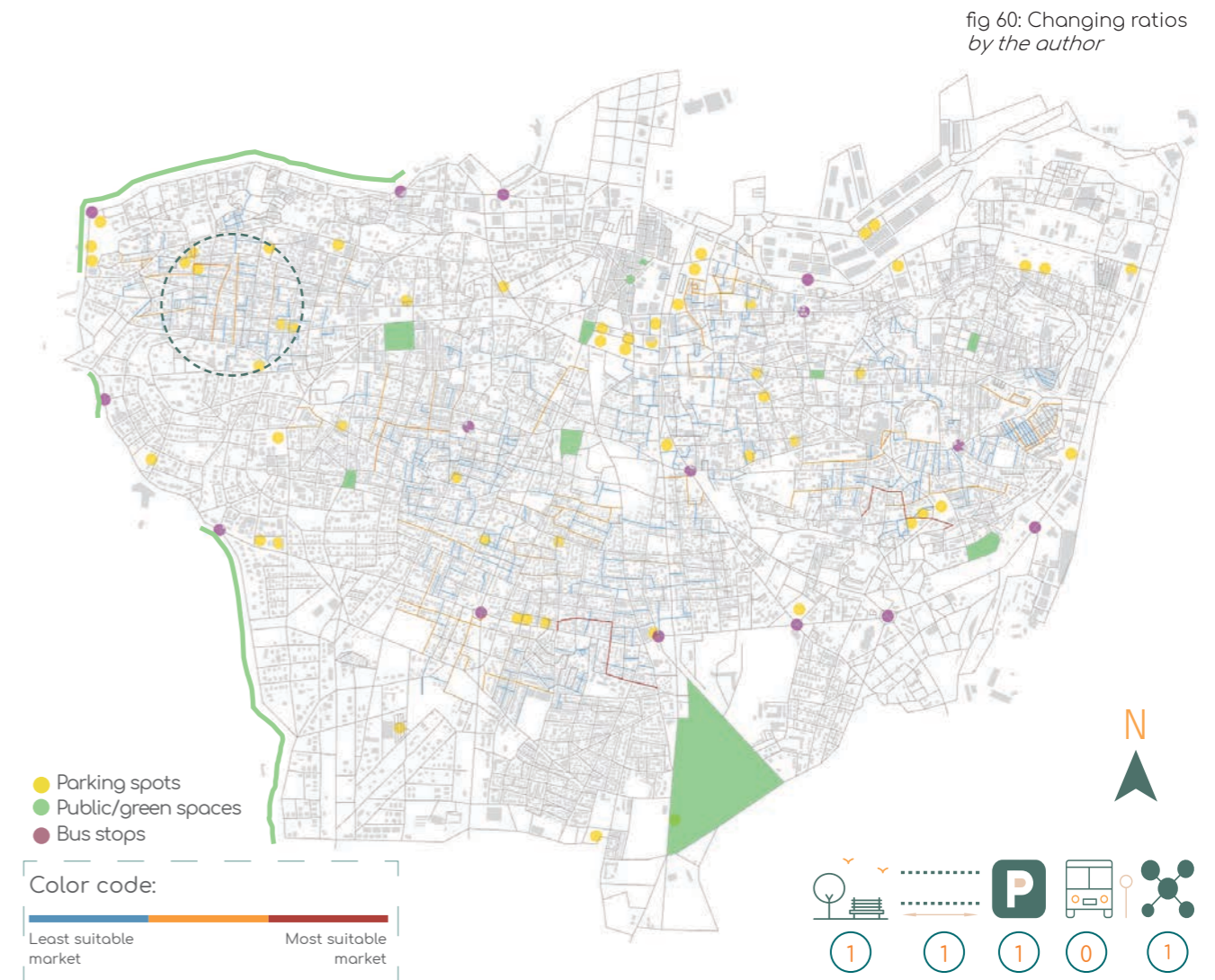
fig 60: Changing ratios
by the author

● Parking spots
● Public/green spaces
● Bus stops

Color code:

Least suitable
market

Most suitable
market

N

5

6.Discussion & outlook

Spatial potential awaiting Beirut.

When searching for a city or any area via *Google maps* application, if users have settings by default, the application tend to reveal some informative content beyond its basic purpose, a navigation tool. Google maps tend to highlight interesting areas, that attract people, cars and has to some extend a vibrant impression. How does google maps aquire this kind of information is not really the main point in this thesis rather just seeing where do people go in Beirut city on a regular basis, what areas are considered interesting.

In the map below, Google maps highlight these so called interesting/vibrant areas in light yellow while regular areas are left light grey, and dark pink is for hospitals.
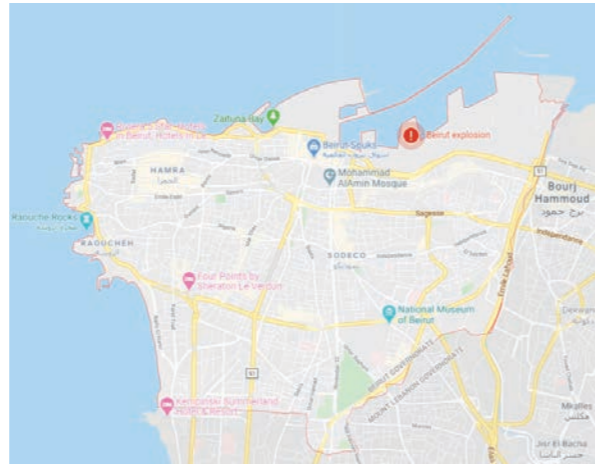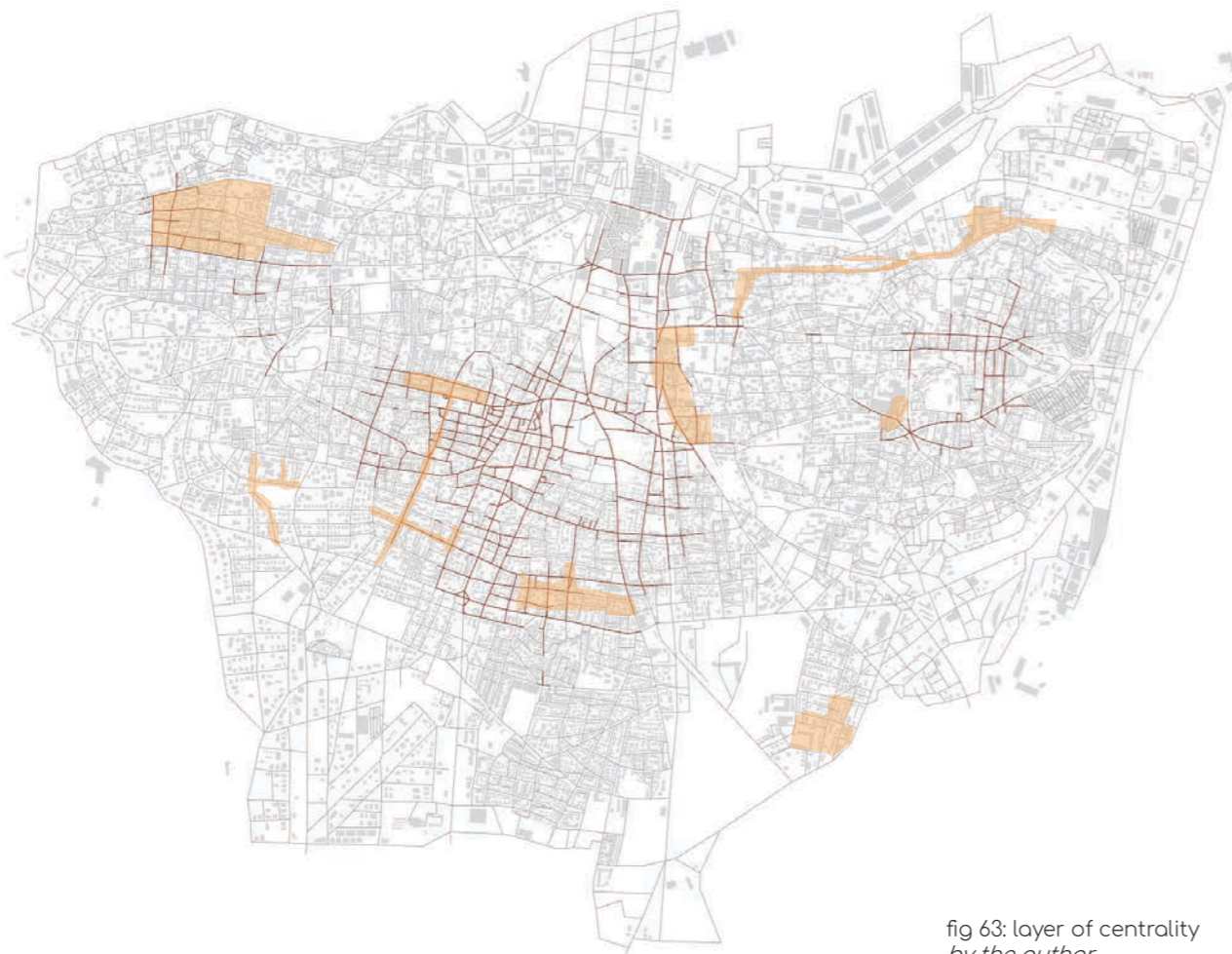
fig 61: Beirut map
Source: Google maps

fig 63: layer of centrality
by the author

As a second step, it would be interesting to overlay these areas, with the sub-centers that were found in the local closeness centrality test with a radius of 800 meters. The idea behind this exercise is to observe is the spatial central areas are used and if they match with the current attractive spots in the city. After this observation one can have an estimation of whether the used method aligns with the reality, and if there are more sub-center which will emerge in the future of the city, and this is actually the main idea, in the light of tragic events of the 4th of October where an explosion massively destroyed great areas of the city. Hence, having more answers and a better understanding of the city, can push decision makers and stake holders to rethink the future structure, its mobility plan as well as its overall density potential.

The bigger map, shows in dark red the so called central street (check previous local closeness centrality map) and the light orange patches highlight the current interesting spots in the city.

At first sight, it is interesting to see that most of the orange patches aligns with the centrality test, while the three patches which do not overlap might have several reasons concerning the studied area during the simulation (only Beirut and not the surrounding). Or the area could simply be interesting and vibrant while note being geometrically central, however er these areas eventually are central.

While most of the orange patches overlay with central streets, yet a lot of central streets are not considered as interesting spots according to Google maps, mean-

ing that these streets have geometrically unattained potential. Furthermore, this potential tackles many aspect of the city performance, whether it was stations for public markets, future bus or public transport stops, new green pocket areas and so on...
Another aspect which could be rethought of would be land-use of new constructed areas, especially after the event of the 4th of august where reconstructing areas is inevitable.

Tool optimization.

After generating all kinds of informative and analytical maps in the different simulations, and observing the results physically from a street scale, and finally drawing appropriate conclusions, it might a good time to make some suggestions for future simulations to have a more optimized tool, hence optimized results. As a commons suggestion, for both fixed markets, temporary, markets as well as public spaces, is data availability and data accuracy. Since all simulation based tools relies on data, then obviously the more/better data one have, the more accurate and correct the results would be.
For the fixed food markets:
Include, land-use data, architecture typology, plinth availability as well land use. This is quite significant for logistic reasons as entrance to underground can act as a bless or curse in case it is overlooked. A good idea would be underground parking which do not appear on satellite maps and therefore could greatly change all results once integrated in the data base.

6

Introduce street width as a parameter, integrate a new simulation the two street markets to be distance from each other. Introduce closeness centrality in earlier phases to be able to locate how many markets are needed based on a certain walkable radius, in a city like Beirut maybe 3 or 4 are needed, and not just two.
For temporary markets:

To start with, it is important the plinth land-use to be integrate here as well, this would be optimal for the local economy if a coherent combination of product oriented flea markets or even bartering markets with existing retail activity. Integrate building typology to assure a certain amount of people flow, allowing the public space to activity most times of the day.
Public space can be categorized into local use and regional use(public spaces that all the city could benefit from and not only the surrounding community), in a way that the local might be integrated into the bigger proposed public spaces network and could perform as whole in terms of biodiversity, green layer, urban gardening and so on... Whereas regional public spaces can be combined for a bigger plan where Beirut has actually enough greenery and enough parks.
Integrate street typologies (shared street, pedestrian areas, scheduled service roads.)when the tool is taking a further step in placing the temporary markets.
Endless optimization phases can be made to any rational process and so at any point there will be room for im-

provement. Nevertheless, this thesis shed some light on some areas where the city can work on to reach better performance in all its urban aspects. Obviously , the economic benefits of markets are great and this will also improve the livability in the city, however mobility in the city is extremely overlooked, most neighborhoods are not walkable from the very few bus stops which exists and if the used data is missing, then this does not justify the unorganized public transport sector. In the end how can people benefit from a bus stop if they don't where is it, when is the Bus reaching and where is going.
Another fragile aspect of the city is accessibility to public spaces and specifically public green areas. Beirut should rethink its ecological well being and integrate this in future construction projects. The events of the 4th of August are quite horrible to follow, and the bigger consequences are yet to come, thus in all reconstruction projects one can find a small silver lining, a chance to rethink the city, its performance and what life quality will residents have.

Overall conclusion.

Markets have always been a significant element in the urban realm, yet when put in the Lebanese context they become one of the only possible solutions to the country's current crisis, or at least during the transition phase before reaching social security. It is relevant to point out that all numbers and figures describing the economic and social difficulties in the coun-

try has escalated by the time the current chapter is written, this is to highlight the urgency of a sustainable action plan. Whether it was food markets which can deliver affordable and fresh food from farmers to directly to consumers without passing by very few wholesale traders who are making major profits just by being intermediate people between farmers and people, whereas when adopting markets, farmers could make more profits which can be reinvested in their business to improve it and enlarge it in terms of quality and quantity. Or, through flea markets that give a second life to previously imported unused products which will no longer be available in Lebanese communities in the future, or through bartering markets that can promote developing new skills and stop depending on financial currencies, which are part of the greater financial crisis happening in the country. All these type of markets could introduce a virtual safety net for threatened social classes who are growing weekly, while introducing affordable goods and products in the city would increase livability factors on a broader scale for all social classes in the city. On the other hand these temporary markets (flea and bartering) would act as public spaces in the city, which is something the city greatly lacks. The importance of public space in cities are endless, yet in Beirut's context it would be first to spread open spaces all over the city, reducing the heavy impact of density, giving place for more social justice through allowing people to exercise activities in the city free of charge for a more inclusive urban future.

The challenge remain in strategically positioning these markets. For the fixed markets, two are needed, one supplying from Bekaa and the north, while the other from the south and Bekaa. Moreover, following the final generated gradient map of of markets suitability, having fulfilled all required criteria with different values, two streets which can hold fixed food markets are found, and then a open space network is established, a network that can hold temporary markets on weekly basis, each week located in a different area.
For fixed market affecting the traffic, even after both simulation of Betweenness and closeness centrality to minimize the damage on the traffic flow, they will still cause kind of a shock for people in the city, especially when these kind of interventions are not quite common yet in Lebanese cities. Closing down roads in residential neighborhoods might be manageable if alternatives are considered from a traffic flow vantage point, hence when combining the vibrant retail activity that is happening on the street with the characteristic of a residential street, it might be wiser to combine this function with office space, where as offices don't need the same quite and tranquility residential areas do while keeping them in walkable reach from residential quarters, because eventually its the resident who are the loyal customers of these markets. While on the other hand considering the plinth's function might also contribute in shaping better markets, for markets will attract people and it is better not to place food markets on streets with plinth consisted of restaurant and

6

street food shops. The whole idea of introducing markets was to make the city more livable, one vital element of livable cities are local economies. Hence building's land use is significant factor which needs to be considered(this type of data is not public and maybe not even generated/collected properly).

While staying in the fixed markets concerns, underground parking can be a great issue/opportunity for the markets, whereas they can be a great obstacle despite the market's strategical location, since residents have the right to access their underground parking and might even legally own a parking space there. When they could also solve a great solution for food storage and could be quite cost/time efficient. This kind of approach is part of a greater vision where the city decides to adopt a new policy for transportation, a policy that motivates people to give up their private cars.

In general, most types of markets are well connected to the public transport system, yet as seen in the previous results, areas which do not have bus stops are in a way deprived from these active spaces, therefore they would lose access or easy access to these spaces as well as their benefits. Whereas if a proper public transport strategy is adopted, cities not only would have good connections but also all destinations in the city, particularly markets and public spaces would be easily accessible. This function both ways as people make markets more successful and functional, and functioning markets make the city more livable. If Beirut city reconsiders its policy towards

automobiles, and if one day the policy goes towards being less car dependent, this also would reduce the importance of parking need in the simulation,therefore more areas could have good opportunities to markets and public spaces. Public transport network has proven its utility through this exercise, especially from a social justice standard, people living anywhere in the city have the right to a minimum access to open public spaces, markets, and recreational areas. Again, land use data comes as great asset here. For instance it's important to have enough people when creating public spaces, in other words, streets which are transformed to public spaces, should have a minimum density threshold and be able to keep this activity of people going and coming to keep the street safe and active, especially if the streets has no active plinth and is pure residential.

Land use and building density is important information which should be added to the required data for an optimal positioning of public space.

Meanwhile, the central and northern wester part of the city has to be reconsidered when establishing markets and public spaces, at the moment people living their head to the sea side boulevard since its the available public space there but it is not the ideal local public space as it is used more as a national/touristic destination, for event and sports mainly. Whereas they should have public spaces around their neighborhoods to create communal connections and meet neighbors. These residents have only expensive stores and supermarkets to shop

from, whereas markets could now be a great escape for them. However also for markets, placing them there is quite challenging considering the great distance from food sources, even the southern one which are relatively closer. This issue calls for a new approach where the sea port could be used somehow, or food trucks must have some priority and a schedule to be able to enter easily that part of the city.

Going back to the main research question about how can underused mobility infrastructure host vibrant spaces of social cohesion and security, the answer relies in understanding how the street network performs, define all the necessary and related element of the urban realm, from logistics to accessibility, to attraction motivators, to people's behavior and security, introduce them all to a rational functioning processing system, and then rethink the outputs for further optimization. Markets haver proven their role in cities all over the world, yet when introduced in Lebanese context it is useful to customized such an intervention. As a result a list of street This is mainly the focus this thesis orbited around, yet missing and unavailable data proved to be a great obstacle to similar project. Not only missing data but unprocessed data can cripple a similar process, therefore one important success key for any future intervention in the urban context would be the data collection/availability. In addition to the data driven process, and the spatial dimension of similar project, one must work on a social point of view for good integration of such spaces.

This is quite significant for a functioning market as it needs to be socially acceptable for people to go and purchase used items. At the moment this means of purchasing is limited to only the poor and the low social class, yet for a better inclusive market, flea markets should be able to target all kinds of social classes. This can only be done after some awareness campaign and cultural acceptance.

Final statement

City planning is always considered a complex field, where it is still developing and most practitioners learn as they perform. Sometimes learned lessons in cities can come at a great cost. Especially when traditional top to bottom methods are used, whereas in this century a more agile attitude is convenient, especially when integrated into the process so it becomes self developing. It is in times like these when parametric tools come quite efficient, when a quick reconstruction is needed, field hospitals must be urgently placed, public transport routes modified, and rubble gathering points needs to be defined.

Introducing street markets in Beirut city is quite a great achievement to both the city and the residents, and it is something today the city needs more than ever, especially after August 2020. But what is equally important is to reconsider what does the city know about itself, how developed and advance is its database, and once improved how could it be useful for future planning.

6

Dear Beirut,

It was heart breaking seeing what happened to you last week, my beloved city . Seeing your people turn homeless, all the de-molished buildings,the damaged homes, the lost heritage, and most importantly ,all the innocent victims who passed away and who might be till this day missing. I can't even imagine how diffi-cult it was for their families nor can I describe how difficult this year has been to all the Lebanese people.
Whether it was during my visits to Lebanon or while watching the news when abroad, it was very hard to keep going and work on a thesis directly related to you . This was extremely de-mota-vating and stopped me from progressing for quite a while.
Things never got better, not before I realized that you are mine, you are mine as much as you belong to any other person who was lucky to experience your version of life.
Even though what happened, what might happen, is not my, nor our fault as Lebanese, but it is definitely our responsibility to get back up, help you get back up and rebuild, this time not only rebuild a city, but a better, inclusive, happier, safe space. I wish for my thesis to be part of that story.
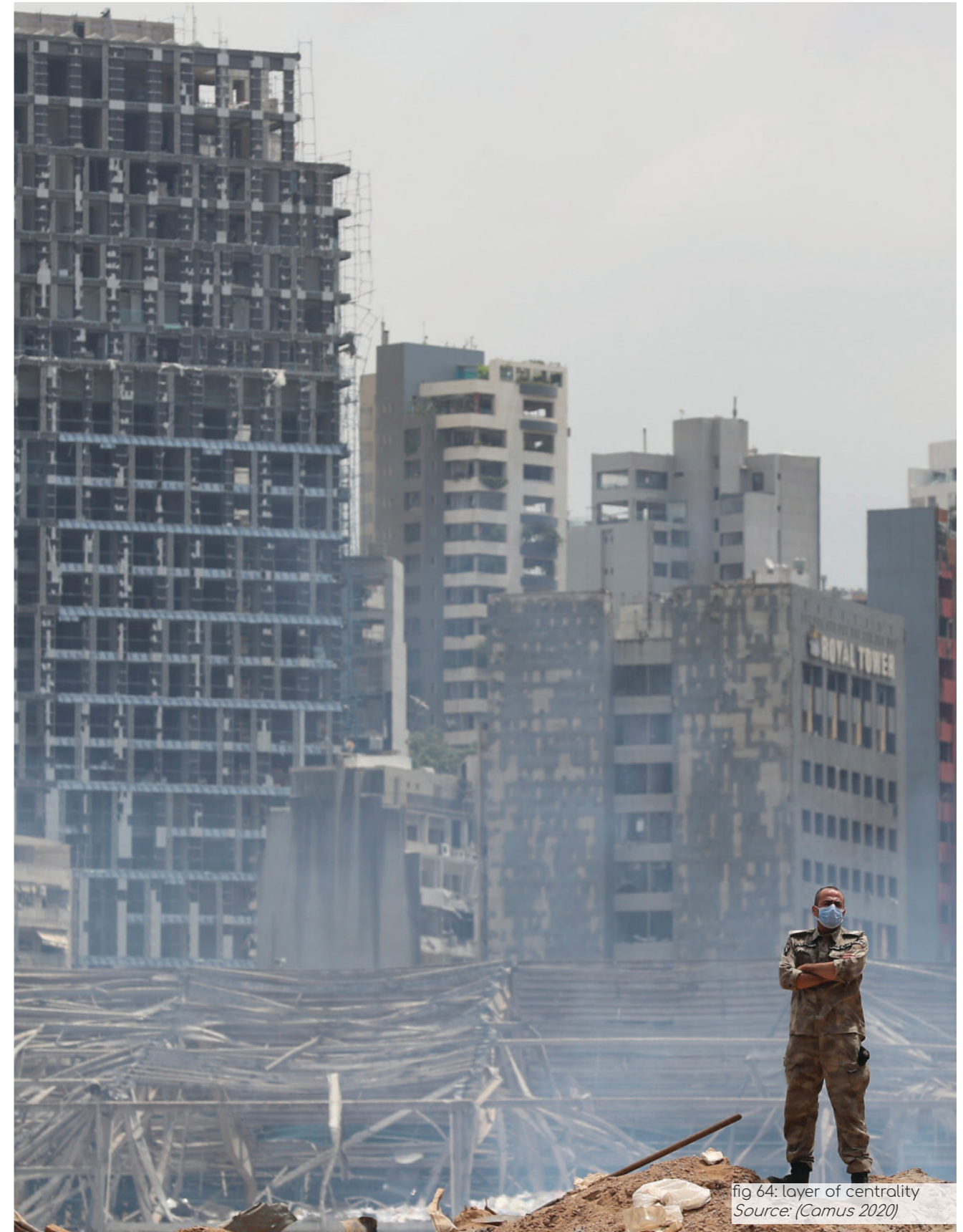
Sincerely, Julien
Weimar, 8/8/2020

fig 64: layer of centrality
Source: (Camus 2020)

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