Post-COVID Resilience for Urban Food Provisioning Systems – The case of Villa Maria del Triunfo, Lima, Peru

A dissertation submitted in partial fulfilment of the requirements for the MSc Urban Development Planning

10, 209 words

Leila GANGUIN CHAUDHURI

Supervisor: Azadeh Mashayekhi

Msc Urban Development Planning

Development Planning Unit, University College London

15th September 2021

Acknowledgments

I would like to express my most sincere gratitude to my supervisor Azadeh Mashayekhi who encouraged me every step of the way, helped me open my mind and shape my thoughts with her insightful input and support. I must offer my thanks to all the Urban Development Planning tutors I've had throughout the year who contributed to my progress, especially Daniel Oviedo, Jordana Ramalho, Dana Sousa-Limbu, Barbara Lipietz, Ruth Mcleod, Tim Wikson, Thaisa Comelli, Jorge Fiori and Camilla Cocina. My appreciation also goes to the tutors in my optional modules that have inspired the topic of my dissertation including, Yves Cabannes, Cassidy Johnson, Robert Biel and Alban Hasson. Another special thanks to all my classmates for being great colleagues, allowing us to grow together as a beautiful team. Finally, I would like to thank UCL for working hard on making this difficult year as enjoyable as possible.

Abstract

Since the beginning of the pandemic many flaws in the way cities around the world function were made visible and the FAO identified the urban food provisioning system as one of these (Khim, 2020). COVID-19 is far from being the first biological hazard but in current times it is the first that has gravely affected all stages of the food system including, production, processing, packaging, distribution, retail, and consumption. More frequent climatic hazards have been studied and addressed through disaster risk reduction usually at the level of agricultural production such as unpredictable and extreme weather leading to failed harvests. Therefore, this paper combines the fields of disaster risk reduction and food system planning to build back better after the COVID-19 biological hazard in developing cities such as Lima, Peru and more particularly in the middle-low to low-income district of Villa Maria del Triunfo. This combination is based on the idea that disasters can be defined as the impact of a hazard on a human system which can be a food system and that literature in both fields mention resilience as a key concept to build back better. Throughout the case study assessing pre-disposing disaster risk to COVID-19 in the food system shed light on the unequal exposure, vulnerability, and capacity to act to disaster risk in Lima. It also created space to look at international examples of post-disaster recovery strategies in food systems of other cities and the Food and Agriculture Organisation's most recent resilience framework called the City-Region Food system. The strategies suggested for the case of Villa Maria del Triunfo are transferable to cities that have similar issues but on the other hand they are also largely dependent on the will of cities and their actors to act on these matters. Thus, this paper can be seen as advocating for the implementation of food systems planning in disaster risk reduction as an important step for urban development.

Key words: disaster risk reduction / urban food provisioning systems / resilience / hazard / exposure / vulnerability / capacity to act / city-region food systems

Table of Contents

List of Tables

List of illustrations

Abbreviations

ANAP	National Farmers' Association
CC	Climate Change
CEPLAN	National Centre for Strategic Planning
CENEPRED	National Centre of Estimation, Prevention and Reduction of risk for Disasters
CRFS	City-Region Food System
DRA	Disaster Risk Assessment
DRR	Disaster Risk Reduction
FAO	Food and Agriculture Organisation
FS	Food System
FSP	Food System Planning
MINAGRI	Ministry of agriculture and irrigation
NGO	Non-Governmental Organisation
UA	Urban Agriculture
UN	United Nations
UNALM	National University of Agriculture La Molina
VMT	Villa Maria del Triunfo

Post-COVID Resilience for Urban Food Provisioning Systems – The case of Villa Maria del Triunfo, Lima, Peru

Introduction

In 2018, 55% of the world's population lived in urban areas and it is projected that by 2050 68% of the population will be urban (UN, 2018). These trends are largely characterised by rural exodus since cities are increasingly seen as hubs of economic opportunity. However, cities have also become hubs of malnutrition and food insecurity as global hunger is growing and cities hold the 'majority of overweight adults and one in three stunted children' (Tacoli, 2019). The urban dwellers that find themselves in situations of food insecurity are repeatedly lower-middle- and low-income residents. Nonetheless, an IIED study found that these household's food security is also affected by non-income related factors since the more food insecure residents of Bangalore, for instance, 'are also those who lack access to piped water, adequate housing and are often recent migrants to the city with limited support networks' (2019). The assimilation of unequal access to food and other basic needs such as shelter and water in cities portrays the city, with its public and private sectors, as an actor whose duty is to provide these for its dwellers; meaning that people are relatively dependent on external sources for their basic needs. Despite the small percentage of urban agriculture in cities around the world Jensen and Orfila suggested that to 'meet basic daily needs, modern cities almost exclusively rely on imports of resources' (2021). Thus, these imports either come from the city-region, from within the country's borders or from global trade, which the city and its networks has relative control over. These include the processes of production, processing, packaging, distribution to sites of retail for consumption, which define a food provisioning system (Tendall, 2015, page 18). Thus, residents are more dependent on what the city has to offer, which is simultaneously becoming more dependent on global trade making the chain from production to consumption much longer, reliant on other regions and the risks that come with them. Furthermore, most of the time urbanisation grows faster than food systems can adapt. Suppose people move into the furthest suburb of a city, the more people do this, the less the city's planning for access to basic needs can keep up the pace. Moreover, in developing cities, these residents often live informally/without secure land tenure as the cost of living for new urban dwellers is too high, making official powers even less likely to intervene. Considering the centrality of city governance, the import of food, and rapid uncontrolled urbanisation for provision of food the *first research question* will focus on why and how shortening food system circuits can create a better food system.

The issues linked to the previous, became more evident as COVID-19 hit and figures showed that the pandemic 'may add between 83 to 132 million people to the total number of undernourished people in the world in 2020' (Khim, 2020: 2). These numbers are supported by the failure of food systems 'provoked by labour disruptions and logistics leading to empty supermarket shelves and crops rotting in fields' (Jensen and Orfila, 2021). Although the pandemic has hit all food systems, it has not hit people

equally since the Food and Agriculture Organisation (FAO) noted that the differentiated impacts will more strongly affect the most vulnerable (2020). In Lima, the capital of Peru, it was '14% of households that could not access protein foods such as meat, fish, and eggs in the first week of lockdown' (Zarate, 2020). A variety of factors defined these limitations in Lima, but the previous analysis of the urban food provisioning system shows similarities to these factors. For instance, Lima has moved towards global trade for imported foods since it has become the US's 3rd largest export market for its processed foods in 2019 (Food Export USA, 2019). It is also fast-growing city that has doubled since the 1990s from 5million to 10million inhabitants in 2021 meaning that its urban planning in terms of the food provisioning system might not have grown simultaneously (Macrotrends, 2021). On a district level the differentiated impact of these processes can also be seen as malnutrition, and lack of access to food is much worse in places such as the district of Villa Maria del Triunfo (VMT), where 23% of children under eight years old were already suffering from chronic malnutrition according to the last census (Vigo, 2013). Therefore, as a biological hazard, COVID-19 did not only create more food insecurity it exposed existing disparities in the food system. These facts and figures put a *second research question* into light, on how COVID-19 exacerbated unequal access to food in cities, particularly in districts such as VMT, Lima and a subsequent question on the pre-existing drivers of hunger in these hubs.

Since the occurrence of this biological hazard, scholars such as Jensen and Orfila along with the FAO have posed the question of resilience of city's food systems (2021). The concept of resilience is increasingly relevant today because it is starting to be widely accepted that climate related or biological hazards will continue to occur and multiply due to climate change and our use of the environment. It is also a complementary concept to sustainability which is meant to 'preserve the capacity of a system to function in the future, which is also one of the conditions of maintaining resilience. However, resilience implies the capacity to continue providing a function over time despite disturbances, and this forms an essential part of what enables sustainability' (Tendall, 2015, page 18). Therefore, using resilience as a guiding concept for the urban food provisioning system is interesting because it englobes both the concepts of mitigation to limit hazards on the long run and adaptation, which accepts that disturbances will occur. The concept of resilience is also central to the field of disaster risk reduction (DRR), which has become an official government institution in countries like Peru. DRR frames resilience as the management of risk experienced by people or system's exposure, vulnerability, and capacity to act to a certain hazard/disturbance (UNDRR, 2019). This means that creating resilience through the management of risk experienced by a system such as urban food provisioning could be integrated into disaster risk reduction; bringing us to our *third research question* which aims to assess how disaster risk reduction can help build a resilient food system.

Considering the centrality of food to human survival and the current threat posed by multiplying hazards, arguing that 'COVID-19's impact on access to food has exposed flaws in food system planning demonstrating the need for city's food provisioning system to become part of DRR' is relevant today more than ever. To further understand the multiple concepts cited previously the literature review will provide a more detailed analysis of disaster risk reduction, and an illustration of its implementation in the case of

Peru. It will then portray how the DRR framework can be used as an analytical tool to understand the impacts of COVID-19 on food system planning. Finally, it will look at the FAOs most recent framework for food system resilience englobing all the previous concepts. To answer the research questions with a concrete illustration, the case study will look at disaster risk within the processes of production, processing, packaging, distribution, retail, and consumption that provide Villa Maria del Triunfo district of Lima, Peru to assess how to build resilience in this microcosm.

I. Literature review / theoretical and analytical framework

1.1 The disaster risk assessment

As climate change is increasing the frequency of extreme hazards such as hurricanes, floods, droughts, pandemics and many others, disaster risk assessments (DRA) have been gaining popularity mainly within NGOs and governments for 'prevention, mitigation, preparedness, and response' (UNDRR, 2019). In fact, following the Hyogo framework for disaster risk reduction in 2005 the United Nations for DRR published the Sendai Framework for DRR in 2015. In it, its first priority was 'understanding disaster risk', which is an assessment of risk according to four dimensions including, hazard, exposure, vulnerability, and capacity to act. Within the Sendai framework there are three other priorities comprising, strengthening disaster risk governance, investing in DRR for resilience and finally enhancing disaster preparedness to build back better. Nonetheless, this paper will focus on priority one, which is defined in more detail in Table 1 below.

Disaster risk	The potential loss of life, injury or destroyed or damaged assets which could occur to a system, society, or a community in a specific period, determined probabilistically as a function of hazard, exposure, vulnerability, and capacity
Hazard	A process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, social and economic disruption, or environmental degradation
Exposure	The situation of people, infrastructure, housing production capacities and other tangible human assets located in hazard-prone areas
Vulnerability	The conditions determined by physical, social, economic, and environmental factors or processes which increase the susceptibility of an individual, a community, assets, or systems to the impacts of hazards
Capacity to Act	The combination of all strengths, attributes, and resources available within an organisation, community, or society to manage and reduce disaster risks and strengthen resilience

Table 1: UNDRR Framework for Disaster Risk Assessment (UNDRR, 2015)

The characteristics of each dimension hint to the need to collect qualitative and quantitative information from many aspects of a society in a determined location, which could be a country, city, district, or a settlement. However, it remains an assessment of potential loss and damage which requires a calculation of the four dimensions visible in figure 1 below.

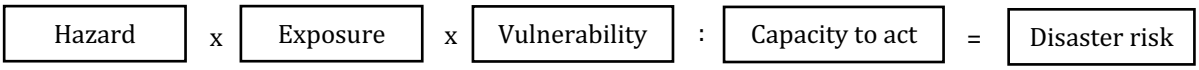


Figure 1: Calculation of a disaster risk assessment (UNDRR, 2019)

Obtaining knowledge on the components of DRA is vital to understand the drivers of risk which can simultaneously help pinpoint strategies according to the *hazards, exposure, vulnerabilities, and capacity to act* observed. These strategies can then be scaled up to form *resilience* against risk drivers, which is the end goal of DRR. It is defined as:

'The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt, transform, and recover from effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management.' (Disaster Risk Reduction in Cities, Johnson, 2020)

1.2 Disaster risk reduction in Peru

To further understand how this paper will use the disaster risk assessment framework, an overview of how it has and is being used in the context of Peru will firstly be done. Peru's disaster risk initiatives have been implemented at multiple levels of society since the Hyogo international framework in 2005 and the earthquake in Pisco in 2007: 'Public sector agencies, along with donors and the international development community, became increasingly concerned about the impact of a potential earthquake and subsequent tsunami in Lima' (ELLA, 2012). After conducting in depth Disaster Risk Assessments, they found that a magnitude over 8 earthquake on the Richter scale could destroy 2.5 million houses and take 50, 000 lives (ELLA, 2012:3). Therefore, the national government created the National Centre of Estimation, Prevention and Reduction of risk for Disasters (CENEPRED) in 2011 mandating that all public institutions from all levels of government must integrate DRM in their planning processes (OECD, 2020). On their website you can find a map of Peru (see Appendix 1) classified per region with 'evaluation of risk for disasters' whereby the papers published on Lima are based on risk related to either earthquakes, floods, or debris flows and published by the municipal districts as stated by national law (CENEPRED, 2019). For instance, the municipal district of San Juan de Miraflores published a paper from 2018 on 'Reducing risk in vulnerable areas of Pamplona Alta, district of San Juan de Miraflores, province of Lima' (Gallo Marcas, 2018). It includes the analysis of different categories of risk drivers as you can observe in Table 2, but it also has an in-depth scientific analysis of climatic hazards that frequently hits that region (see Appendix 2).

Social exposure	Social resilience	Social fragility	Economic fragility	Economic resilience	Physical exposure	Physical fragility	Physical resilience
Age group vulnerabilities	Perception of risk, attitude to risk, population training in DRM, information channels for DRM,	Ownership status, affiliation to health insurance, educational level of the head of household, average monthly household income	Economically active unemployed population, institutional organisation and training, main occupation of the head of household	Percentage of enterprises with few employees	Location of buildings	Construction material of buildings, state of conservation of buildings, age of buildings, elevation configuration of buildings, topography of the land, foundation or base, base land, type of roofing, non-structural elements, dwellings with access to drinking water	Compliance with building codes, dwellings complying with building reinforcement measures, state of the building, exposure component analysis, social exposure

Table 2: Disaster risk assessment of areas in Pamplona Alta, San Juan de Miraflores, Lima (Gallo Marcas, 2018: 69-98)

CENEPRED's framework for disaster risk reduction is embedded in all levels of governance. Moreover, its strategies are multi-sectoral as they engage with climate change (CC) mitigation on the national level since their last publication for 2020 to 2022 commits to 'reforestation and protection of the watershed, protection of ecosystems, installation of the services of protection against floods on both banks of the Chancay-Huaral river' (Chavarria Oria, Aguado Galvez, 2020: 109). They have also worked on projects with the Ministry of Agriculture and Irrigation (MINGARI) to provide DRR on national production (Tasso et al., 2012). Despite a multiplicity of national initiatives NGOs have also played a part in integrating bottom-up approaches in Lima. cLima sin riesgo for instance, has implemented community mapping of risk and community savings groups, which has contributed to the empowerment of people to scale up their resilience simultaneously considering the vulnerabilities that might not be observable from the government or private sector's standpoint (cLima sin riesgo, 2015).

Although these are just a few examples of Peru's commitment to DRR they demonstrate an important alignment with strategic actors as coordination between different organisations are essential for good governance. In fact, just three years before the creation of CENEPRED, the national Ministry for the Environment and the National Centre for Strategic Planning (*CEPLAN*) were created in 2008, and the World Bank characterised them as 'two events, that will help make the country more disaster resilient' (World Bank, 2012: 213). To summarise Peru's engagement in DRR figure 2 demonstrates the key actors involved in its governance:

Figure 2: Key actors in Peru's disaster risk reduction governance, CENEPRED

1.3 The Disaster Risk Assessment as an analytical tool to understand the food system during COVID-19

CENEPRED's work on the food system has looked at disasters affecting production from a climatic standpoint as the work it has conducted with the ministry of agriculture and irrigation is focused on the risks related to hazards such as floods or earthquakes on agricultural production (Tasso et al., 2012). In fact, it was noticed by de Zeeuw and Deschel that 'agricultural production is largely negatively affected by climate change but, on the other hand, it also contributes to climate change by emitting GHG. This implies that agriculture can also contribute to climate change mitigation" (2015: 12). Although this statement mentions the worsening impacts of CC it includes the notion of disasters since they can be defined as the impact of a climate-related hazards provoked by CC on a human system such as agricultural production. De Zeeuw and Dreschel also noted that the main resources responsible for the previous paradox are fuel, water, and land, which are not reserved to agricultural production, but the entire urban food provisioning system which relies heavily on them for the processes of production, processing, packaging, distribution, retail, and consumption.

Firstly, the use of fossil fuels is growing due to worldwide urbanisation as the distance between food production and food consumption gets wider but also due to cooking processes and increasing demand of industrialised processed foodstuffs. Secondly, as developing cities grow to consume more like western cities it is said that 'if the entire world population were to adopt a Western-style diet, 75% more water would be necessary for agriculture and this could imply that the world runs out of freshwater' (de Zeuuw and Dreschel, 2015: 11). The last resource mentioned is land and the growing demand for it for a multiplicity of activities ranging from food retail buildings to production of biofuels, which puts pressure on its ecosystems. These different uses of resources throughout the food provisioning system highly contribute to the increase of disaster risk in terms CC related hazards that in turn affect the food system. Thus, addressing risk associated to food system planning FSP could be directly assessed through a DRA including production to consumption related risk and not solely production as CENEPRED has focused on.

Although the food system and DRR are closely intertwined in terms of climatic hazards, the pandemic has also 'clearly shown the systemic nature of risk caused by a biological hazard' (Khim, 2020: 2). In fact, Khim observed that people were majorly affected by food system damage as 'food supply and demand, and indirectly through decreases in purchasing power, capacity to produce and distribute food, and the intensification of care tasks, had differentiated impacts and more strongly affected the most vulnerable and food insecure populations' (Khim, 2020:2). In places like Lima worrisome news headings stated 'mas miedo al hambre que al virus' meaning 'more scared of hunger than the virus' (Zarate 2020) along many other articles describing how people mainly in the suburbs of Lima had to resort to creating common food pots where official 'ollas communes'/ 'soup kitchens' closed (Hartley, 2008). The disproportionate impact of COVID-19 on food systems of certain regions in Lima can then be associated to multiple risk factors which could also be assessed through a DRA. Even more so, because FSP is a system, COVID-19 is a hazard and disaster risk is defined as 'the potential loss of or damage of assets which could occur to a system in a

specific period, determined probabilistically as a function of hazard, exposure, vulnerability, and capacity to act' (UNDRR, 2019).

Thus, in the case study, looking at the impact of COVID-19 on Villa Maria del Triunfo's food provisioning system will integrate the risks in the processes of production, processing, packaging, distribution, retail, and consumption. Within these processes there are three forms of production, on the macro level it includes imports and exports, at the miso level, national agricultural production, and at the micro level, local urban agriculture. Secondly, food distribution involves the processes of international, national production and urban agriculture products reaching various types of retail outlets, but also the distribution of these outlets. Thirdly, consumption of food integrates the processes of storage, cooking, and ingestion at the household and individual level. Finally, analysing the existing strategies to address the risks associated to the previous will help assess how to expand capacity to act and create food system resilience.

1.4 Expanding capacity to act through the concept of food system resilience

After a disaster risk assessment, CENEPRED would look at how to build resilience in the context of DRR. Thus, the merging of DRR and food system planning (FSP) in the analysis calls for a look at literature on food system resilience. Similarly to DRR's definition of resilience, the Johns Hopkins centre for a liveable future defined FSP resilience as 'ensuring a secure food supply for the future by preparing for and responding to crises that disrupt food security for their residents' (2021). Moreover, the latest framework developed on food system resilience was translated into a 'city-region food system' (CRFS) by the FAO which integrates 'the understanding of the interactions and knock-on effects between impacts at any one stage in the food value chains, as well as how the food system as a whole is impacted by events within anyone of its subsystems' (Carucci et al., 2019). Here, the processes in the urban food provisioning system and disaster risk are included and represent well the merge between DRR and FSP to build FSP resilience. CRFS further bases itself on three approaches, multisectoral, territorial and multi-level governance visible in Table 3.

Multi-sectoral approach	Territoriality	Multi-level governance
Including the food chain from producer to consumer as well as environmental, economic, institutional, and social relate-aspects. All of these elements are affected by climate shocks and stresses.	The city-region referring to a larger urban centre or several small urban centres and their surrounding areas, including peri-urban and rural hinterland. The term 'city-region' refers not only to megacities and the immediate proximate rural and	Given its multidimensional link with environment, public health and the economy, to achieve food and nutrition security, it requires joint collaboration among government, civil society and private sector and it needs integrated multi-level

	agricultural areas surrounding them, but also small-scale producers and their agricultural value chains to urban centre and markets in developing countries.	governance involving national, regional, municipal, as well as rural.

Table 3: Three approaches of the City-Region Food System (FAO, 2021)

This framework is a helpful guide to building food system resilience encountering the needed aspects of mitigation, adaptation, governance, unequal access to food, sustainability and DRR by planning for food system failure recovery. It has been implemented in cities such as Quito in Ecuador, Medellin in Colombia, Belo Horizonte in Brazil amongst others. Whilst the local DR assessments of these cities are also categorised by production to consumption, they do not integrate COVID-19 as a hazard and point of departure for analysis, which will help this paper illustrate the needs that have become prevalent today. Therefore, using CRFS's three approaches of territoriality, multi-sector approach, and multi-level governance, solely as inspiration to create strategies for a resilient food provisioning system for VMT will be more appropriate. Keeping in mind the context of COVID-19 expanding the capacity to act in the case study will also be developed with strategies used in other post-COVID and post-crisis environments.

Methodology and research limitations

The research for this dissertation relies almost entirely on secondary resources written in English and in Spanish ranging from academic papers, news articles, books, government publications, census data, websites, and YouTube videos. While a lot of research has been conducted on the topic of food and disaster risk reduction in general, in Lima and VMT, the centrality of COVID-19 as a point of departure for this paper limits the scope of research considering its recent occurrence. However, it also leaves room to hypothesize on what could be done to build back better with lessons from international examples and strategic frameworks. Furthermore, this paper sets out to look at food system planning in cities through a disaster risk assessment lens, which has not been engaged with in the past although there is a multiplicity of research on agriculture and DRR and urban agriculture as a DRR strategy in cities. Another limitations is that data on VMT dates to earlier 2000s but it was chosen as a microcosm because COVID-19 had an important impact on its food provisioning system, which can demonstrate why FSP should be integrated to DRR governance. Moreover, VMT's pre-disposing conditions to hazard, vulnerability and exposure are not only present in other districts of Lima but also in many other cities around the world, which makes its capacity to act adaptable to international strategies. Finally, since my level in Spanish is intermediate and many resources found are in Spanish it is possible that I was not able to capture the whole essence of the papers.

II. Case study of Villa Maria del Triunfo, Lima, Peru

To introduce the case of VMT some background information succeeds. VMT is in the Southern Cone of Lima located between the start of the Andes Mountains and the plateau that covers most of Lima (Meus, 2021: 66) as you can see in the Figure 3 and 4 below.

Figure 3: Villa Maria del Triunfo (Delgado, 2020)

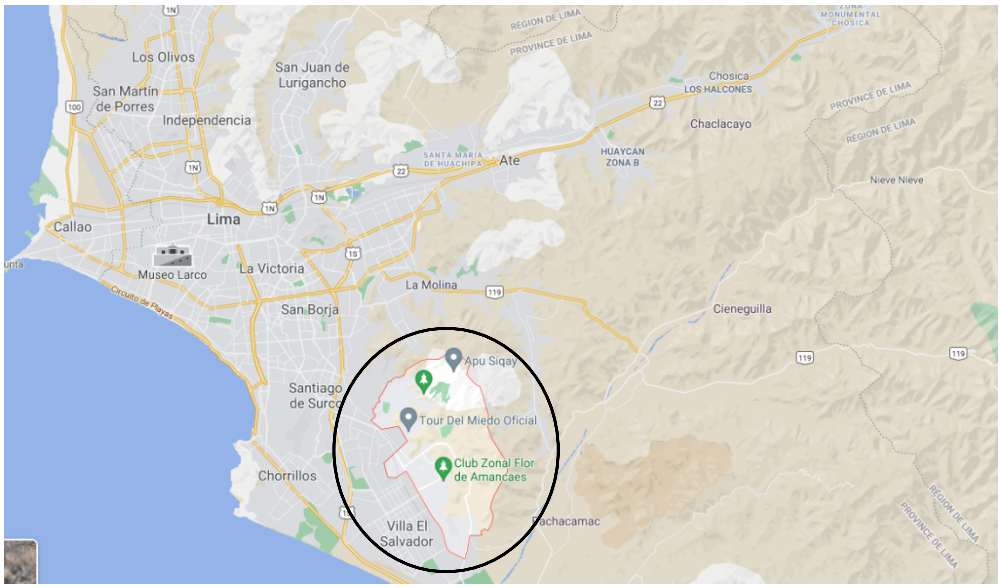


Figure 4: Map of Villa Maria del Triunfo, Lima, Peru (Google maps, 2021)

This district was formed organically through rural migration and was made official in 1961 although 80% of inhabitants were still living informally and in slum like conditions in the 1990s and 30% in 2017 (Meus, 2021: 66). Moreover, according to 2010 report 23% of children under eight years old in VMT suffered from chronic malnutrition (Vigo, 2013). In the last census data, the socio-economic profile of VMT was comprised of '30.5% of unskilled labourers, agricultural labourers; of these 8.3% domestic workers and 6.2% street vendors. 21.9% of the registered population are skilled workers in personal services" (Gobierno Peruano, 2017: 9). Overall, VMT is middle low to low-income district that expands east into hills of the Andes where the landscape is increasingly unforgiving, 'acquired illegally, managed by local leaders and corrupted members of the district municipality' (Meus, 2020: 66). Thus, for the case study of VMT, Lima, Peru the DRA framework will be used to analyse the risks linked to the COVID-19 biological hazard, exposure, vulnerability, and the capacity to act within each of the processes of production, processing, and packaging, then distribution and retail and finally consumption, provisioning VMT.

2.1 Production, processing, and packaging

In the food system there are three forms of production, on the macro level it includes imports and exports, at the miso level, national agricultural production, and at the micro level, local urban agriculture. Throughout the first part national production and the import-export market's risk will be discussed through their *vulnerability, exposure, and capacity to act* regarding COVID-19 as a primary hazard. The same will then be done for VMT's urban agriculture.

National production and the import-export market: vulnerability, exposure, and capacity to act

Peruvian's main dietary habits are composed of chicken, milk, rice, sugar, and potatoes (Oxford Business Group, 2021) of which, according to the OECD, Peru is the 40th largest exporter and 47th largest importer of rice in the world. It is also the 73rd largest exporter and 61st largest importer of poultry (OEC, 2019). These figures seem contradictory, but they could be explained by Peru's increasing imports of processed and packaged foods including processed dairy products, prepared and preserved meats, dog and cat food, chocolate, and confectionary products, amongst others. This is also evident as Peru's imports from the US grew by 18% in the year 2019 becoming the US's 3rd largest export market (Food Export USA, 2019). Peru also imports 77% of its total milk consumption (USDA Foreign Agriculture Service, 2019) and most of its sugar confectionary (Trendeconomy, 2020). However, it is also the biggest producer of potatoes in Latin America (Andina, 2021) and has a growing international export market of fruits and vegetables mainly composed of asparagus, berries, avocado, and other Andean species (Oxford Business Group, 2021). These patterns of trade are largely dictated by geopolitical trends as Peru's first four trading partners are largely distant but geopolitically strategic, including China, the United States (US), South Korea and Switzerland. Its three next partners involving Brazil, Mexico, and Argentina are more geographically strategic (World Bank, 2021).

During COVID-19's first lockdowns and physical distancing there were labour shortages in food and agriculture, whereby crops could not be harvested, processed, transported, or stored in time (Blay-Palmer et al., 2021:5). As agriculture accounts for 6% of Peru's GDP but 27% of national employment these impacts hit its economy and the labour involved (World Bank, 2019). However, for Peru's import economy this meant a loss of food products and subsequent gouging prices. In terms of *vulnerability*, defined in DRR as a physical process that increases an asset's susceptibility to a hazard; Peru has augmented its susceptibility to food insecurity by shifting toward an export agriculture and increasing imports of processed foods composed of multiple, often imported, ingredients which are then assembled in one location and exported to other countries. This highly complex physical process / chain of production, processing, packaging, and export is highly *vulnerable* because if there is one failed harvest of a certain component of processed food it affects the whole process. Moreover, creating more dependence on imported foods multiplies risk linked to *exposure* as they become attached to other regions around the world that face uncontrollable risks from the standpoint of Peru. In this, *exposure* is the situation of production capacities of human assets, such as food, in a hazard prone area. For instance, since this system of production is linked to a variety of regions it is also exposed to different types of climatic and biological hazards ranging from floods, droughts, hurricanes, locust invasions and other pests as climate change is worsening. The factors of exposure multiplied with those of vulnerability that were identified have demonstrated how immense the fluctuation of food prices linked to the increasing scope of dependence to imported foods is during times like COVID-19.

For this, the Peruvian government has demonstrated its *capacity to act* by investing in plant breeding of quinoa, maize, tubers, rice, and sugarcane, which is mainly carried out by the Universidad Nacional Agraria La Molina (UNALM) and Instituto Nacional de Investigacion Agraria (INIA) to increase variety of local produce (FAO, 2021). In terms of adhesion to international strategies, they have been involved with the Institute for Food and Agricultural Development since 2018, which has pushed for support of small-scale rural or urban farmer's integration in South to South and Triangular Cooperation for technical knowledge transfer to scale up production, all with focus on gender equality, community-based development, and sustainability (IFAD, 2018). Nevertheless, these strategies are all quite recent and their impact has yet to be observed in a significant manner.

Urban Agriculture (UA) in VMT: vulnerability, exposure, and capacity to act

On the regional and district level production has taken the form of urban and peri-urban agriculture and has been practiced in Lima since the 1950s by rural migrants whose products would be sold by corner shops, municipal markets, stands, and street vendors (Cabannes, et al., 2018). However, UA was not regulated until 2005 when an official Urban Agriculture Office was created along with urban farming schools and community kitchens (Cabannes, et al., 2018: 123). In 2011, only three years after the creation of the national Ministry for the Environment and Susana Villaran's term as mayor of Lima, UA was urged in a project called Mi Huerta as a 'strategy to advance social inclusion, gender equity, job creation, food security, community participation, environmental protection and the combatting of poverty' (Cabannes,

et al., 2018:122). Furthermore, in 2016, the scholar Leloup stated that 68% of coriander production, 67% of turnips, 56% of Swiss Chard, other leaf vegetables and 31 out of 37 vegetables sold in the markets are grown in Lima (2016:7). These advances and investment in an urban agricultural system created a basis for local food production however research conducted by UCL and cLima sin Riesgo found that urban agriculture in VMT and other districts have now deteriorated since the end of mayor Susana's term in 2015 (ESD Overseas Alliance, UCL, 2017). Therefore, UA's leading *vulnerability* is regional and district governance which has historically had a 'laissez-faire' attitude in urban affairs (Fernandez-Maldonado, 2019: 371). Land use is the district's responsibility and projects like Mi Huerta that extended along multiple districts met its demise with the general instability of administrations whereby projects are often abandoned when a change of leader occurs (Leloup, 2016).

Although VMT was the first district to institutionally implement UA with 145 community gardens and 570 urban farmers (see Figure 5), Cabannes also acknowledged 'that 60% plots in Lima measure less than 1 hectare and that there is no great evidence that UA is a solution for supplying large quantities' (2018:121-123). Thus, during the outbreak of COVID-19 and the food insecurity it brought, UA was not able to relieve most of the missing calories in people's diets. In fact, UA could have played a bigger role but *exposure* to climatic events, uncontrolled urbanisation and land speculation increasing the value of land rapidly, of 50% between 2012-2013 for instance, had already shrunk urban agricultural land to 125 square km by 2015 (FAO, 2015). Therefore, an official local governance push for urban agriculture as a strategic activity remains unstable as it is today NGOs such as cLima sin Riesgo, SUCO, and research centres that can only maintain it on a small-scale (FAO, 2015). UA's capacity to act remains in the hands of NGOs whereby official local governance should have the responsibility to push for it as it is the only institution that can coordinate all districts and their land use.

Figure 5: Urban garden, Machu Picchu, in Villa Maria del Triunfo, Lima (Cabannes et al., 2018: 122)

2.2 Distribution and retail

Food *distribution* involves the processes of international, national production and urban agriculture products reaching various types of *retail* outlets, but also the distribution of these outlets. To calculate the risk associated to the processes of distribution and retail, analysis of their symbiotic *vulnerability, exposure, and capacity to act* will be conducted with a brief comparison of VMT to the upper middle to high income district of La Molina demonstrating related socio-economic vulnerabilities.

Vulnerability and exposure

The rough history of the relations between the districts of La Molina and VMT are physically visible through a ten-foot-high wall topped with barbed wire separating them (see Figure 6), put up by Juan Carlos Zurek the Mayor of La Molina in 2010, who did not appreciate the rapid expansion of the shanty towns of VMT (Vigo, 2013).

Figure 6: The wall dividing Villa Maria del Triunfo and La Molina (Van Eertern, 2017)

This 'testament of Lima's economic disparity' as Janetsky (2019) put it, is unfortunately not the only physical proof of disparity in Lima. In fact, despite the smaller size of La Molina it has eight supermarkets of the three main chains of Peru (USDA Foreign Agriculture Service, 2019: 5) including, four Wongs, three Tottus's and one Metro as you can see in figure 7 below.

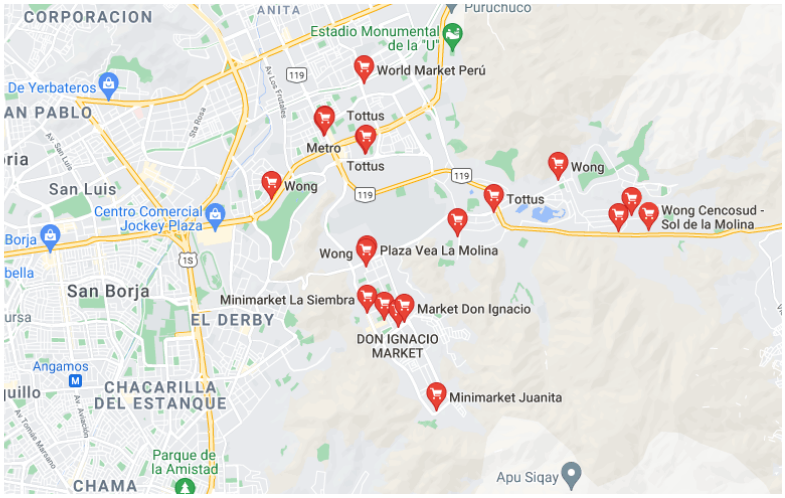


Figure 7: Supermarkets in la Molina (Google Maps, 2021)

On the other hand, VMT does not have one single supermarket of the three main chains according to the same google maps search visible in figure 8 (Google maps, 2021). Instead, VMT mainly has bodegas, which are small often family run corner shops and traditional markets noticeable in figure 8, 9 and 10.

Figure 8: Supermarkets in Villa Maria del Triunfo (Google maps, 2021)

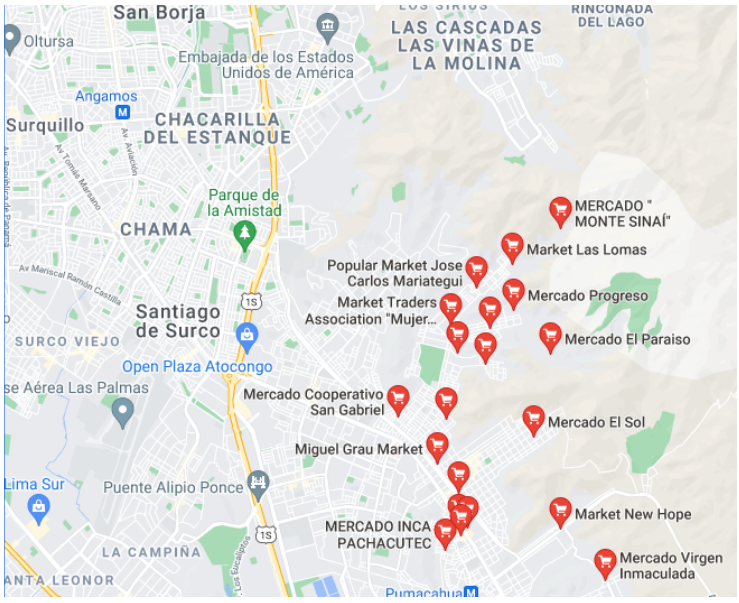


Figure 9: Traditional market in Villa Maria del Triunfo (Google maps, 2021)

Figure 10: Traditional market New Hope in Villa Maria del Triunfo (Google maps, 2021)

In these, food from urban or peri-urban agriculture is often sold. In terms of *vulnerability*, as noted previously, urban, and peri-urban agriculture do not produce sufficient quantities, thus leaving a gap in variety of produce sold in the markets. To fill this gap uncontrolled contraband products of the informal economy are sold in informal outlets, which are *exposed* to poor storage conditions, use of contaminated water, and create additional congestion, so air pollution (FAO, 2003). Moreover, Leloup stated that due to a lack of opportunities to learn marketing strategies the producers that sell their produce informally often go through wholesale middlemen. She states that these farmers could profit more from their proximity to cities by cutting out middlemen further reducing market prices and increasing their own income (2016: 8). These informal processes were further fuelled during lockdown as there was new demand for special

certificates complying with handling and distancing thereby increasing safety risks of food quality (Blay-Palmer et al., 2021:5).

Conversely, in La Molina the main source of foodstuffs are supermarkets, which are the primary receivers of diverse and sanitarily controlled imported and processed foods. Also, large-scale national production of Peruvian staple crops such as coffee, potatoes, avocado, asparagus amongst others, dictated by official global trade measures. Although these supermarkets were affected by price gouging and product halts at borders the quantities and varieties of produce sold was not as severely affected as measures to deal with new certificates are more financially manageable by large-scale production firms. These differences in processes of distribution of production and retail outlets are widely defined by socio-economic inequalities/*vulnerabilities,* which affect access to sufficient foodstuffs in times like COVID-19.

Regarding *exposure*, since VMT is located between the start of the Andes Mountains and the plateau covering most Lima, some communities live in extremely steep areas (Meus, 2021: 66) as you can see in Figure 11. For these, public transport is not well developed and so access to food outlets other than bodegas is an even bigger challenge. For instance, in the community of Vallecito Alto in VMT the only bus that connects it to the city is a 45min walk from the highest point of the neighbourhood at 400m above sea level (Meus, 2021:66). Therefore, going to outlets other than proximity bodegas or possible markets, is near impossible as carrying groceries uphill for 40min is extremely tiresome and most roads have not been maintained since the 1980s, which becomes a health risk but also prevents the transport of food to possible upper hill retail outlets. Some of the habitants even conduct road repair themselves due to the lack of urban planning and official governance in VMT and other shanty towns (Meus, 2021:68). Consequently, this left more people at risk of getting COVID-19 as dense communities must purchase their food in the same small bodegas or overcrowded markets, which offer limited choice of products due to the vulnerabilities within processes of distribution further impacting people's dietary health.

Figure 11: Highest point of Villa Maria del Triunfo at 400m above sea level (Google maps, 2021)

Capacity to act

The *vulnerability* that the distribution and retail segments of the food system face in VMT are highly linked to socioeconomic disparity, supermarket's prices, and the private sector's land speculation of certain areas over others giving people access to different types of production in different retail outlets. The people of VMT being closer to traditional markets and bodegas have less variety and are more exposed to dietary deficiencies whereby COVID-19 has further endangered their food security. The *exposure* in VMT, is mainly linked to the geographical landscape and its insufficient urban planning limiting people's physical access to varied types of outlets. Conversely, capacity to act has been translated through the investment $46,3 billion USD in transport infrastructure by the Peruvian government since the outbreak of COVID-19 (International trade Administration, 2020) and other programs connecting markets in districts such as VMT to agricultural regions of Junin, Apurimac and Ayacucho to sell their products such as tubers, vegetables, and meats (MIDAGRI, 2021). Finally, food distributions were organised by some NGOs and churches such as the San Gabriel church of Villa Casuarinas in VMT since 50% of the government food baskets did not reach their destinations (Iglesia de Jesucristo, 2021) (Saludconlupa, 2021). These programs demonstrate the Peruvian's civil society and government's *capacity to act* on its food system processes of distribution and retail as COVID-19 demonstrated its weaknesses.

2.3 Consumption

Consumption of food integrates the processes of storage, cooking, and ingestion at the household and individual level, which will be assessed through its vulnerabilities, exposure, and capacity to act. The data on this matter, however, is from early 2000s and no recent census has been conducted as this very data was used in the latest Institutional Operation Plan of the local government of Villa Maria del Triunfo in December 2017 (Gobierno Peruano, 2017).

Vulnerability and exposure

Within the segment of consumption three *vulnerabilities* with related *exposure* are observable through lack of, refrigerators, appropriate cooking fuel and access to water. With food bought in proximity bodegas or traditional markets only four out ten households of VMT had a refrigerator to store it (Instituto Nacional de Estadistica e Informatica, 2005: 65). This figure from 2005 is today supported by the article stating that half of all Peruvians do not have a refrigerator (Zarate, 2020). Moreover, as lockdown was pronounced March 16th and the summer months in Lima are from December to April *exposure* to weather varying from twenty to thirty degrees Celsius did not allow preservation of some food longer than a few hours to a day (Weather Spark, 2021). This means that during this time many residents of VMT had to go out every day to buy products such as meat, vegetables, and dairy if they could afford them. It also worsened infection rates and put many residents of poorer districts such as VMT out of work due to COVID infections, ingestion of non-preserved food and general lockdown measures further

worsening sufficient consumption of food and a diversified diet. These material conditions are determined by socio-economic factors of *vulnerability* and have increased risk of food insecurity during COVID 19.

Also due to socioeconomic disparity, 19.6% people in VMT used kerosene liquid as a cooking fuel and 3.2% used wood in 2005 (Instituto Nacional de Estadistica e Informatica, 2005: 65). Furthermore, Zarate mentioned that during lockdown one of the poorest north-eastern district of Comas (see map in Appendix 3) that initially used firewood had to use debris such as 'beds' to burn as a cooking fuel (2020). Thus, the use of kerosene and the aggravated use of debris as cooking fuels by households initially using firewood in VMT *exposed* them to more polluted air and so increased risk of respiratory diseases. This factor is not directly related to food security, but it is a health risk that can prevent youth from finishing their studies, working, or dying prematurely which has a direct impact on ability to purchase for sufficient and varied diets.

Furthermore, in 2005 14.5% of VMT used one public standpipe and in extremely poor households 19.3% used informal forms of water supply (Instituto Nacional de Estadistica e Informatica, 2005: 65). As noted previously the geography of VMT expands uphill so not only would getting water require a hard travel up and down people were once again obliged to expose themselves to COVID-19 or risk not having enough water for individual hydration and expose the household to uncleaned foods and hands that can engender food poisoning.

Finally, due to all the above-mentioned pre-disposing risk factors leading to food insecurity and lack of variety 43.5% of Peruvian children under 3 suffer from anaemia and 26% from stunting made worse by COVID-19. These, are the most vulnerable people of Peru and so, include a percentage of the inhabitants of VMT (World Food Programme, 2019).

Capacity to act

The risk associated to exposure and vulnerability for the people of VMT's food consumption's during COVID-19 integrates multiple factors from storage, cooking to ingestion. Mainly health risks associated to increased exposure to food poisoning, respiratory diseases and restrictive diets were identified as aggravated by COVID-19 but predisposed by general living conditions. To remedy to these issues, Lima has used 'Ollas Comunnes' which are soup kitchens for a long time and today there are a total of '13.664 soup kitchen's integrated into the Midis Food Supplementation Program. Another 3.354 registered in the municipalities of Lima and Callao that feed a quarter of a million mouths' (Zarate, 2020). Although these should provide relief of household food insecurity through their distribution of two meals a day it played out differently during COVID 19. In fact, many Ollas Communes closed during quarantine due to their exposure to hundreds of people so instead people resorted to creating more Common Pots which is the same as a soup kitchen but without formal recognition or investment from the government. In fact, a common pot in the district of Comas asked to become an official soup kitchen during COVID-19 but were

refused the title due to a lack of budget (Zarate, 2020). Although they had limited support from the government private donations and civil society organisation contributed to the creation of '1.300 communal pots in 33 districts, which fed 129.661' (Saludconlupa, 2021). However, now that Ollas Communes have reopened a noticeable shift has appeared as reliance on common pots has risen. Furthermore, ollas communes are experiencing a lack of budget and resources from the government which is engendering a lack of water, food and firewood making it incredibly difficult for ones like la Milagrosa in VMT to serve the 140 families it usually does (Saludconlupa, 2021). Therefore, community solutions to sufficient food consumption through common pots is increasing but in terms of household and individual consumption on their capacity to store, use safe and enough cooking fuel, water and foodstuffs has not been addressed much or at all by different authorities after the COVID 19 crisis.

2.4 Expanding capacity to act in VMT, Lima, Peru

By building on international cases from Latin America that use the City-Region Food System (CRFS) framework or other post crisis strategies, suggestions are made below on those that can be used to push towards a resilient food provisioning system, which would have the potential to ensure food security in the microcosm of VMT.

Production, processing, and packaging: expanding its capacity to act

As noted in the part on distribution and retail the international and national processes of production which reach Lima's supermarkets are not present in VMT instead its people are primary receivers of uncontrolled informal food and urban and peri-urban agriculture. While these can be reformed (see following) the agricultural import-export market of Peru, which wealthier districts profit from could also be redirected. According to the city region concept this would mean the part of the export-led large-scale national production of fruits and vegetables, tubers, rice, and maize could be redirected to markets in districts such as VMT instead of it being exported and processed abroad in complicated chains. However, to achieve this would mean re-coordinating national food production chains for coordination between "local, provincial and national governments which is still a challenge in Quito" for instance (Dubelling et al., 2017: 10). In Peru, connecting these would equally be a challenge as even the synchronization between districts for urban agriculture was a relative failure due to administrative instability. However, insight from the case of Medellin which successfully facilitated the connection between the municipality of Medellin, the Metropolitan area of Aburra and the regional government of Antioquia contributed to:

1. Supporting regional value chains and linking these to local food demand, thereby enhancing agricultural production and promoting sustainable and innovative production in the district of Medellin
2. Improving access and availability of safe and diverse food products for city region dwellers by strengthening the food supply and distribution system (Dubbeling, 2017: 8).

As well as connecting different levels of government for re-direction of production like in Medellin, ensuring its increase, sustainability, fairness, and efficiency also called for the need to support the primary producers, small, medium, and large-scale farmers. For instance, during the food crisis in Cuba they used the National Farmers' Association (ANAP) to create a sense of unity where all farmers were registered and represented, to enter the Campesino-to-Campesino agroecology movement, which is a knowledge transfer platform (Rosset et al., 2011: 169). In Peru, this process could scale up its sustainable practices, amplify the voices of producers and give access to more foodstuffs in districts such as VMT.

In terms of urban and peri-urban agriculture the municipal government of Lima as well as district governments attempted to push for it, but the main issue was the lack of continuity between administrations, land speculation and grabbing. In places like VMT this is important because many people live informally and do not own any land. For UA, Cuba's primary strategy was to distribute land rights to 45, 800 people and thereby created 26, 000 urban gardens producing 540, 000 tonnes of fruit and vegetables (Wright, 2012). As well as this, they distributed the land into Basic Units of Cooperative Production Cooperatives (UBPC), which would have an effect of unifying production standards and amplify the voices of urban farmers to create longevity of their activities themselves (Spencer, 2016). For the case of Peru, civil society cooperatives are still lacking as they are mainly NGOs and Research Centres that lead UA. Therefore, the kind of governance that was implemented in Cuba to ensure longevity and community solidarity for UA could be an important strategy in VMT to multiply sources of food production.

Distribution and Retail: expanding its capacity to act

The distribution and retail corresponding to VMT is characterised by a total absence of supermarkets, informal channels of food supply and urban/peri-urban agriculture sold in bodegas and markets. Moreover, due to the lack of mobility within VMT food distribution is limited. The coordination of the Ministry of Agriculture and Rural Affairs, the Ministry of Transport, and the Ministry of Public Security in multiple countries during the first lockdown shed light on the importance of the links they have to ensure effective logistics for agricultural products and materials (Fan, 2021: 4). In Peru, this alliance would contribute a great deal to the existing recent investment in transport infrastructure by combining it with routes connecting communities with retail outlets, warehouses, and national production. In fact, the existence of warehouses along the way and solid roads are extremely important, as according to Zeeuw and Drechsel "poor transport infrastructure between the city and the countryside, together with a lack of cool storage, are the main causes of food losses" (2015: 9). On the district level, as mentioned previously, the urban planning of VMT's road infrastructure is lacking and so initiatives such as cLima sin Riesgo that work on disaster risk reduction in Peru, using mapping exercises for community building and advocacy could be used (cLima sin Riesgo, 2015). In this case, community mapping for the distribution and retail of food would be beneficial to determine locations of vulnerability and so, strategic points of retail and routes to connect them. Although cLima sin Riesgo is a community-based NGO its model's goal is to scale

up to district and municipal governance levels, which could be successfully applicable for the previous strategy.

These strategies would be ideal to create resilience in the long term, but food relief plans also need to be developed as food system resilience still englobes possibilities of failure. For this, two strategies including ration systems and food banks are often used. In the case of the Cuban food crisis, its communist system controlled equitable distribution of food channelled from farmer's production and imported food to outlets that rationed fruit, vegetables, rice, poultry, milk, and cooking oil (Fernandez, 2018). According to the data this system had large success as dependence to it dropped from 40/60% in 1996 to 10% in 1999 (Wright, 2012). Conversely, in Quito, Ecuador, the private sector along with the Food Bank of Quito and humanitarian aid organisations used centralized warehouses for direct distribution of food packages during lockdown (Blay-Palmer, 2021). Although Peru had humanitarian food distributions many government ration packages never made it to destination and larger official coping mechanisms such as the previous ones are needed especially in places like VMT where people are not always on the lists to benefit from help. With stronger governance and data gathering these systems have a chance of creating more equal access to food aid and foodstuff in times of shock.

Finally, another issue remains because many of the food supply chains that feed VMT are informal so connecting them through official governance would not be feasible since information on them is not collected. Moreover, informal food chains provide great relief and compensation especially in times of crisis so efforts in trying to dissolve them should not be a priority. Instead, the FAO set some ideas on how to accompany the informal sector to ensure its safety and efficiency additionally to connecting formal routes better (see Table 4).

Identifying informal activities, operators and consumer practices in the purchase of food products: - Training local government staff in these same matters - Encouraging the formation of groups and associations of informal operators and/or reinforcing those already existing	Inform operators of their rights and obligations, and brief them on existing programmes of action
Sustaining meaningful dialogue with their representatives who must be invited to participate in the formulation of the programmes of action that affect them	Provide information and training on food hygiene, safety and nutritional quality
Facilitating the reporting by private sector food supply and distribution operatives of illegal practices among police officers and market authorities (through, for example, a "complaints" window) and by ensuring that such violations are actively pursued	Provide information and training on marketing and sales technique

Better understand informal activities and operators so as to better identify their problems and needs	Provide training on practices that add value to production (processing, marketing techniques)
Integrate into land occupancy planning: - The demand for land for urban and peri-urban food production -The existence of informal markets, including in outlying urban areas	Act through informal vendors' associations when delivering information and/or training in order to bolster membership

Table 4: FAO strategies to support informal food chains (FAO, 2003: 6)

Consumption: expanding capacity to act

The storage, cooking, and ingestion of food in VMT affects people's health mainly because of the lack of refrigerators, and the use of unsafe cooking fuel and water. To remedy to this, the existing strategies and the proposed ones should have a beneficial impact on accessibility to foodstuffs and its variety. However, until there is proper urban planning and aid, the storage, cooking, and ingestion of food in VMT can be dealt with at the community level. Taking inspiration from the NGO ArkomJatim in Indonesia (2021) their community-based initiatives have helped scale-up the community's capacity to act through collective empowerment. Lima and VMT's civil society's capacity to act through its Common Pots during COVID-19 has been noted by international papers and reviews as remarkable for its organisation. Since community organisation is the basis for expanding civil society's capacity to act and different parts of Lima have proven their solidarity, harnessing it to scale it up has a strong point of departure. In the shanty town of Dupak Magersari, Surabaya, Indonesia, their first activities involved mapping similarly to cLima sin Riesgo's in the pursuit of solidifying a sense of community. Through this exercise they were able to find common needs and create a community development fund to tend to them. The fund consisted of a metal can in which each household would put around 2000Rp which would be collected every Sunday. In Dupak Magersari, the short-term impact of this strategy is the purchase of objects such as garbage cans, plants, and composting tools. In VMT, this could be translated to the purchase of cooking fuel and foodstuffs for Common Pots and the most vulnerable households. On the long-term, the community of Dupak Magersari hope to scale-up by getting a loan from a bank to invest in bigger community projects. In VMT this kind of strategy could be dedicated to initiatives linked to better storage of food and access to water for enhanced consumption.

Conclusion

Since most of the world's population lives in cities and this ratio is continuing to grow, focus on its overall function has become a primary concern. When shocks like COVID-19 occur, cities are particularly vulnerable because of its high contagion rate due to their important density. However, it is also systems such as the urban food provisioning system that are severely affected during disturbances like these and in general times of shock. This was the starting point of the research as the fields of disaster risk reduction and food system planning met through the biological hazard of COVID-19. It allowed to look at the processes of production, processing, packaging, retail, distribution, and consumption through their exposure, vulnerability, and capacity to act to risk posed by the pandemic. To illustrate it, the case of VMT, Lima, Peru was deemed appropriate since Peru was one of the hardest hit countries by the pandemic, it is also known to be a very unequal city in terms of living conditions and VMT is a middle low to low-income district of the capital. The findings put forward showed relative capacity to act on making the food system more resilient but also high risks linked to hazard, exposure, and vulnerability.

Firstly, it was demonstrated that Lima was increasingly dependent on imported foods. In times of COVID, it augmented exposure to other region's variabilities and the process of importing processed foods instead of national produce increased vulnerability to failure in the long chain of production, processing, and packaging. Additionally, the existence of UA in VMT to have direct access to produce in general and in times of shock has been reducing as urban governance can be unstable. UA is also exposed to the competition over land for speculation, uncontrolled urbanisation, and climatic events, which has largely shrunk its size and capacity of production. For retail and distribution, a comparison between the district of La Molina and VMT was undertaken. This reinforced the notion of inequality in Lima as it was made evident that higher income districts were more planned for food distribution by the city's actors. La Molina receives the main products from global trade and produce from national production through official major supermarkets whereas VMT had none. VMT's main vulnerability is its dependence on unsafe informal food and insufficient quantities of UA in bodegas or traditional markets. Its geography and location did not permit easy access to the few retail outlets or the distribution of food to them as roads were uncared for by official governance. During COVID-19 this was made evident as people in districts such as VMT had the highest death rate as overcrowded markets and bodegas were the main places of contagion (Development workshop, UCL, 2020). Finally, the processes of consumption including storage, cooking and ingestion were exposed to multiple health risks because of socio-economic vulnerability, preventing many people from having refrigerators, appropriate cooking fuel and access to safe water. In times of COVID these predisposing conditions were made more obvious as people had to venture out every day to get these resources, once again increasing the rate of contagion.

Although the urban food provisioning system of VMT's disaster risk is important it has engaged in multiple projects to expand its capacity to act, and this paper has provided some extra input thanks to

international examples of implementation of the FAO's CRFS project and other post-crisis strategies. These included the reorientation of the export-import market along the lines of governance of the city-region in Medellin and the Cuban system for UA to sustain itself through Basic Unit Cooperatives. The coordination of civil society, ministry of transport, agriculture, public security, and community mapping of vulnerable areas to provide retail of food was proposed in addition to the existing investment in transport infrastructure to connect sites of production, storage, and retail better. This mapping exercise could then contribute to ensuring no one is left out of food aid schemes or creation ration system in times of crisis. Then, following the FAO's guidelines on supporting the controversial topic of informal food channels for more security was advised. Finally, community saving schemes to empower communities to save together to contribute to better their living conditions as a group has been a widely used strategy and could help people in VMT on the topic of food security.

Nonetheless, throughout this research a main challenge related to the difficulties associated to governance has reoccurred in every part. For production, the increase of dependence on global trade for the international export of Peruvian agriculture and import of processed food revealed a 'laissez-faire' approach left in the hands of global capitalism rather than national control. UA also had hardship expanding as unstable local governance and lack of continuity shrunk its production capacities. Then, inexistent routes or transport infrastructure in bad conditions between production and retail in areas such as VMT demonstrated a lack of general urban planning. Finally, in terms of consumption, the resort of civil society to the creation of common pots and the absence of government investment in them showed that it is not a priority. Although this paper has suggested strategies to remedy to these issues, they can only be successful if urban governance is willing to invest in them. You may ask yourself why governance is so important for these matters and the answer is subjective. As urbanisation is moving at lightning speed the government apparatus is engrained as institutions in society. It has the connections and strategic partners to coordinate this fast-moving environment, which needs to be constantly addressed. Although there are many issues linked to corruption and instability within governance, strategies of decentralisation can aim to ensure more bottom-up mechanisms. These can sometimes be translated in the division of planning into provincial, regional, municipal and district levels with efficient reporting systems that can include community budgeting groups for instance.

This is important for the topic of food system resilience because the needs of the population are central to food security and can be implemented through government action. Thus, its integration in a decentralised government apparatus should be immediate. Furthermore, its incorporation in the institution of DRR as suggested in the introduction is considered more appropriate because in the case of Peru for instance CENEPRED is already a well ingrained institution on all stages of governance from national to district levels (see 1.2). It also combines the concepts of resilience, planning, agriculture, sustainability, risk, and many others as it has strategic partnerships with multiple areas of government, NGOs, and the private sector. As you can see in figure 2 and 12 below, integrating food system resilience as a sector of DRR in Peru would bring together some additional important actors to CENEPRED.

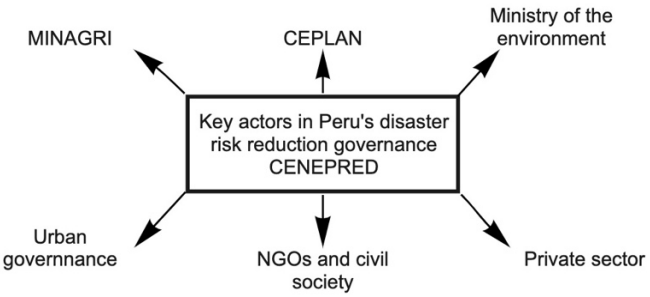


Figure 2: Key actors in Peru's disaster risk reduction governance, CENEPRED

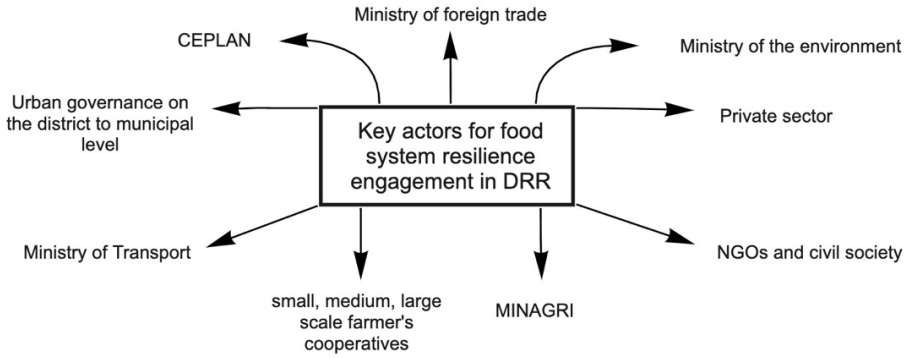


Figure 12: Key actors for food system resilience engagement in DRR

The coordination of the actors in figure 12 in any city could be extremely powerful as the food system from production to consumption contributes to the increase of hazards provoked by climate change and our use of the environment as mentioned in part 1.3. If this coordination were to become a main driver of urban development, it could not only reinforce food security for all but reduce the impacts of climate change and thereby increase sustainability in cities around the world.

Bibliography

ArkomJatim. 2021. Presentation Dupak Magersari Kampung. UCL.

Andina, 2021. *Peru exports 500 tons of native potatoes a year*. [online] Andina.pe. Available at: <https://andina.pe/ingles/noticia-peru-exports-500-tons-of-native-potatoes-a-year-711730.aspx> [Accessed 2021].

Blay-Palmer, A.; Santini, G.; Halliday, J.; Malec, R.; Carey, J.; Keller, L.; Ni, J.; Taguchi, M.; van Veenhuizen, R. City Region Food Systems: Building Resilience to COVID-19 and Other Shocks. Sustainability 2021, 13, 1325. Available at : https://doi.org/10.3390/su13031325 [Accessed 2021].

Cabannes, Y. and Marocchino, C. (eds). 2018. *Integrating Food into Urban Planning*. London, UCL Press; Rome, FAO. Available at: https://doi.org/10.14324/111. 9781787353763

Carucci, M., Malec, R. and Santini, G., 2019. *Beyond Urban: City-Region Food Systems for Resilient and Sustainable Development - Urbanet*. [online] Urbanet. Available at: <https://www.urbanet.info/beyond-urban-city-region-food-systems/> [Accessed 2021].

CENEPRED, 2019. *Centro Nacional de Estimación, Prevención y Reducción del Riesgo de Desastres - CENEPRED*. [online] Gob.pe. Available at: <https://www.gob.pe/cenepred> [Accessed 2021].
cLima sin Riesgo. 2015. cLima sin Riesgo (online). Available at: https://climasinriesgo.net/ [Accessed 2021].

D.M. Tendall, J. Joerin, B. Kopainsky, P. Edwards, A. Shreck, Q.B. Le, P. Kruetli, M. Grant, J. 2015. *Food system resilience: Defining the concept*. Global Food Security. **6,** 17-23. Available at: ISSN 2211-9124 [Accessed 2021].

Delgado, A., 2021. *Lomas de Villa Maria del Triunfo*. [image] Available at: <https://www.google.com/maps/place/Villa+Mar%C3%ADa+del+Triunfo,+P%C3%A9rou/@-12.1377361,-76.922532,3a,75y,90t/data=!3m8!1e2!3m6!1sAF1QipMlItRE4Upuzvg2-2Zb1921sArpKgA5Y_dqhixw!2e10!3e12!6shttps:%2F%2Flh5.googleusercontent.com%2Fp%2FAF1QipMlItRE4Upuzvg2-2Zb1921sArpKgA5Y_dqhixw%3Dw203-h152-k-no!7i3648!8i2736!4m5!3m4!1s0x9105b92b9e02c189:0x4e31ea20f4c5e783!8m2!3d-12.1675125!4d-76.9201161> [Accessed 2021].

Development workshop, 2020. University College of London.

Disaster Risk Reduction in Cities. Johnson, C. 2020. Unit 3. University College of London.

Dubbeling, M., Santini, G., Renting, H., Taguchi, M., Lançon, L., Zuluaga, J., de Paoli, L., Rodriguez, A. and Andino, V., 2017. *Assessing and Planning Sustainable City Region Food Systems: Insights from Two Latin American Cities*. Sustainability. [online] Available at: <https://ruaf.org/assets/2019/11/Assessing-and-Planning-Sustainable-City-Region-Food-Systems.pdf> [Accessed 2021].

ESD Overseas Learning Alliances, 2021. *ESD Overseas Learning Alliances*. [online] The Bartlett Development Planning Unit. Available at: <https://www.ucl.ac.uk/bartlett/development/esd-overseas-learning-alliances> [Accessed 2021].

Evidence and lessons from Latin America (ELLA). 2012. *Pushing through reform: Lima's Disaster Risk Management Strategy*. UK Government publishing. Available at: https://assets.publishing.service.gov.uk/media/57a08a07e5274a31e00003ae/130404_ENV_DisRisManCit_BRIEF3.pdf [Accessed 2021].

FAO, 2003. *The informal food sector, municipal support policies for operators*. [online] Rome: FAO. Available at: <http://www.fao.org/3/y4312e/y4312e.pdf> [Accessed 2021].

FAO, 2015. Urban and peri-urban agriculture in Latin America and the Caribbean – Growing greener cities. Available at: **http://www.fao.org/ag/agp/greenercities/en/ggclac/lima.html** [Accessed 2021].

FAO, 2021. *Getting Prepared | Food for the cities programme | Food and Agriculture Organization of the United Nations*. [online] Fao.org. Available at: <http://www.fao.org/in-action/food-for-cities-programme/toolkit/getting-prepared/en/> [Accessed 2021].

Fan, S., Teng, P., Chew, P., Smith, G., Copeland, L., 2021. Food system resilience and COVID-19 – Lessons from the Asian experience, Global Food Security, **28**. Available at: https://doi.org/10.1016/j.gfs.2021.100501. [Accessed 2021].

Fernandez, M. et al. 2018. New opportunities, new challenges: Harnessing Cuba's advances in agroecology and sustainable agriculture in the context of changing relations with the United States. Elem Sci Anth, 6: 76. Available at DOI: https://doi.org/10.1525/elementa.337 [Accessed 2021].

Fernández-Maldonado, A. 2019. Unboxing the Black Box of Peruvian Planning, Planning Practice & Research, 34:4, 368-386. Available at : 10.1080/02697459.2019.1618596 [Accessed 2021].

Food Export USA, 2019. *Peru Country Profile*. [online] Foodexport.org. Available at: <https://www.foodexport.org/export-insights/market-and-country-profiles/peru-country-profile> [Accessed 2021].

Gallo Marcas, C. M. 2018. *Evaluacion del riesgo de desastres de la nueva riconada : Pamplona Alta, Distrito de San Juan de Miraflores*. Municipalidad distrital de San Juan de Miraflores. Available at : https://sigrid.cenepred.gob.pe/sigridv3/storage/biblioteca//7827_evaluacion-del-riesgo-de-desastres-de-la-nueva-rinconada-pamplona-alta-san-juan-de-miraflores-provincia-y-departamento-de-lima.pdf [Accessed 2021].

Gobierno Peruano, 2017. *Plan Operativo Institucional 2018*. Gobierno Local de Villa Maria del Triunfo: A Trabajar Juntos.

Google Maps, 2021. Highest point of Villa Maria del Triunfo at 400m above sea level. [image] Available at : https://www.google.com/maps?q=Highest+point+of+Villa+Maria+del+Triunfo+at+400m+above+sea+level.&source=lmns&bih=722&biw=957&hl=fr&sa=X&ved=2ahUKEwiHi8yUiPfyAhVBihoKHcAtC8EQ_AUoAXoECAEQAQ

Google Maps, 2021. *Map of Villa Maria del Triunfo*. [image] Available at: <https://www.google.com/maps/place/Villa+Mar%C3%ADa+del+Triunfo,+P%C3%A9rou/@-12.1742696,-76.9586904,13z/data=!3m1!4b1!4m5!3m4!1s0x9105b92b9e02c189:0x4e31ea20f4c5e783!8m2!3d-12.1675125!4d-76.9201161> [Accessed 2021].

Google Maps, 2021. *Retail outlets in Villa Maria del Triunfo*. [image] Available at: https://www.google.com/search?q=supermarkets+in+villa+maria+del+triunfo&tbm=lcl&sxsrf=AOaemvI0dbJMBZc2b-V_2wD8ZNFcE9py4Q%3A1631367519989&ei=X7E8Yan-O-SDhbIPlf6HmAQ&oq=supermarkets+in+villa+maria+del+triunfo&gs_l=psy-ab.3..35i39k1.90820.96018.0.96232.37.35.0.0.0.0.186.3852.8j24.32.0....0...1c.1.64.psy-

ab..6.31.3714...0i22i30k1j0i22i10i30k1j0i203k1.0.cmKINxkLDto#rlfi=hd:;si:;mv:[[-12.138653099999999,-76.9040964],[-12.2186135,-76.9531078]];tbs:lrf:!1m4!1u3!2m2!3m1!1e1!1m4!1u2!2m2!2m1!1e1!2m1!1e2!2m1!1e3!3sIAE,lf:1,lf_ui:10 [Accessed 2021].

Google Maps, 2021. *Supermarkets in La Molina*. [image] Available at: https://www.google.com/search?tbs=lf:1,lf_ui:10&tbm=lcl&sxsrf=AOaemvJZRqf3mLQye59Sqtkgucmlk61gMw:1631367511202&q=supermarkets+in+la+molina+lima&rflfq=1&num=10&ved=2ahUKEwiz3oLIhffyAhXCSPEDHefFDG0QtgN6BAgHEAQ#rlfi=hd:;si:;mv:[[-12.057664899999999,-76.8980529],[-12.119173,-76.9796647]];tbs:lrf:!1m4!1u3!2m2!3m1!1e1!1m4!1u2!2m2!2m1!1e1!2m1!1e2!2m1!1e3!3sIAE,lf:1,lf_ui:10 [Accessed 2021].

Google Maps, 2021. Traditional market New Hope in Villa Maria del Triunfo. [image] Available at: https://www.google.com/search?q=Traditional+Markets+in+Villa+Maria+del+Triunfo&tbm=lcl&sxsrf=AOaemvK47PGGfUDQW5wWA2iwmJEjQqaFcA%3A1631367652141&ei=5LE8Yd2LCIGC8gLGm4G4CQ&oq=Traditional+Markets+in+Villa+Maria+del+Triunfo&gs_l=psy-ab.3..33i22i29i30k1.55767.57762.0.58248.2.2.0.0.0.0.115.214.1j1.2.0....0...1c.1.64.psy-ab..0.1.115....0.QQIg6TwzE5w#rlfi=hd:;si:;mv:[[-11.937318,-76.92591560000001],[-12.2198119,-77.06346529999999]];tbs:lrf:!1m4!1u3!2m2!3m1!1e1!1m4!1u2!2m2!2m1!1e1!2m1!1e2!2m1!1e3!3sIAE,lf:1,lf_ui:1

Google Maps, 2021. *Traditional markets in Villa Maria del Triunfo*. [image] Available at: https://www.google.com/search?q=Traditional+market+in+Villa+Maria+del+Triunfo+&tbm=lcl&sxsrf=AOaemvJRLpy1hFwAkB4MdesQ2WZXF_fkpQ%3A1631367618743&ei=wrE8YYvdLIvJgAax5rCYDw&oq=Traditional+market+in+Villa+Maria+del+Triunfo+&gs_l=psy-ab.3..33i22i29i30k1.28976.28976.0.29118.1.1.0.0.0.0.132.132.0j1.1.0....0...1c.1.64.psy-ab..0.1.131....0.0Tc8y0A9aF8#rlfi=hd:;si:;mv:[[-11.937318,-76.92591560000001],[-12.2198119,-77.06346529999999]];tbs:lrf:!1m4!1u3!2m2!3m1!1e1!1m4!1u2!2m2!2m1!1e1!2m1!1e2!2m1!1e3!3sIAE,lf:1,lf_ui:1 [Accessed 2021].

Hartley, P., 2008. *Lima's community-organised soup kitchens are a lifeline during COVID-19*. [online] International Institute for Environment and Development. Available at: <https://www.iied.org/limas-community-organised-soup-kitchens-are-lifeline-during-covid-19> [Accessed 2021]. https://doi.org/10.1016/j.gfs.2015.08.001 [Accessed 2021].

Iglesia de Jesucristo, 2021. *Iglesia dona alimentos en una de las regiones más afectadas por el COVID-19*. [online] noticias.laiglesiadejesucristo.org. Available at: <https://noticias.laiglesiadejesucristo.org/articulo/iglesia-dona-alimentos-en-una-de-las-regiones-m-aacute-s-afectadas-por-el-covid-19> [Accessed 2021].

IFAD, 2018. *Republic of Peru: Country Strategic Opportunities Programme 2019-2024*. [online] Available at: <https://webapps.ifad.org/members/eb/125/docs/EB-2018-125-R-27.pdf?attach=1> [Accessed 2021].

International Trade Administration, 2020. *Peru - Infrastructure Development*. [online] International Trade Administration | Trade.gov. Available at: <https://www.trade.gov/country-commercial-guides/peru-infrastructure-development> [Accessed 2021].

Instituto Nacional de Estadistica e Informatica, 2005. *Villa Maria del Triunfo, perfil sociodemografico de las poblaciones en riesgo*. [online] Lima: Direccion ejecutiva de indicadores sociales. Available at: <https://www.trabajo.gob.pe/archivos/file/estadisticas/peel/estadisticas/PROPOLI_VILLA_MARIA_DEL_TRIUNFO.pdf> [Accessed 2021].

Janetsky, M., 2019. *Lima's 'Wall of Shame' and the Art of Building Barriers*. [online] The Atlantic. Available at: <https://www.theatlantic.com/international/archive/2019/09/peru-lima-wall/597085/> [Accessed 2021].

Jensen, P.D., Orfila, C. 2021. *Mapping the production-consumption gap of an urban food system: an empirical case study of food security and resilience* (online). Food Sec. **13,** 551–570. Available at: https://doi.org/10.1007/s12571-021-01142-2 [Accessed 2021].

John Hopskins Center, 2021. *Food System Resilience*. [online] Center for a Livable Future. Available at: <https://clf.jhsph.edu/projects/food-system-resilience> [Accessed 2021].

Khim, W. 2020. *Disaster risk reduction in times of COVID-19: What have we learned*? Food and Agriculture Organization of the United Nations. Available at: http://www.fao.org/publications/card/fr/c/CB0748EN/ [Accessed 2021].

Leloup, H. 2016. Proximity Agriculture in Lima: Is a fairer production system emerging for producers and consumers? Justice spatiale - Spatial justice, Université Paris Ouest Nanterre La Défense, UMR LAVUE 7218, Laboratoire Mosaïques, Food justice and agriculture, 9. Available at : http://www.jssj.org/article/lagriculture-de-proximite-a-lima-vers-un-systeme-productif-plus-justepour-les-producteurs-et-les-consommateurs/.

Macrotrends, 2021. *Lima, Peru Metro Area Population 1950-2021*. [online] Macrotrends.net. Available at: <https://www.macrotrends.net/cities/22078/lima/population#:~:text=The%20current%20metro%20area%20population,a%201.58%25%20increase%20from%202018> [Accessed 2021].
Meus, M., 2021. *Urban Densification of Informal Settlement in Lima, Peru - Study Case of Vallecito Alto in Lima, Peru*. [online] Liège: Université de Liège, p.66. Available at: <http://hdl.handle.net/2268.2/11212> [Accessed 2021].

MIDAGRI, 2021. *Villa María del Triunfo: vuelven los Mercados Midagri solidarios con precios sociales para familias de zonas vulnerables*. [online] Gob.pe. Available at: <https://www.gob.pe/institucion/agrorural/noticias/345273-villa-maria-del-triunfo-vuelven-los-mercados-midagri-solidarios-con-precios-sociales-para-familias-de-zonas-vulnerables> [Accessed 2021].

OEC, 2021. *Poultry Meat in Peru | OEC*. [online] OEC - The Observatory of Economic Complexity. Available at: <https://oec.world/en/profile/bilateral-product/poultry-meat/reporter/per> [Accessed 2021].
OECD, 2020. *Home*. [online] Oecd-ilibrary.org. Available at: <https://www.oecd-ilibrary.org/sites/36d1a985-en/index.html?itemId=/content/component/36d1a985-en> [Accessed 2021].

Oria, C., Galvez, A. 2020. Plan de prevencion y reduccion de riesgos de deasastres 2020-2022. Available at : http://sigrid.cenepred.gob.pe/sigridv3/storage/biblioteca//10479_plan-de-prevencion-y-reduccion-de-riesgos-de-desastres-de-la-region-lima-2020-2022.pdf [Accessed 2021].

Oxford Business Group, 2021. *Agricultural exports on the rise in Peru*. [online] Oxford Business Group. Available at: <https://oxfordbusinessgroup.com/overview/fresh-horizons-agricultural-exports-are-taking-place-traditional-foreign-currency-earners> [Accessed 2021].

Rosset, P., Braulio Machín Sosa, B., Jaime, A. & Lozano, D., 2011. *The Campesino-to-Campesino agroecology movement of ANAP in Cuba: social process methodology in the construction of sustainable peasant agriculture and food sovereignty*, The Journal of Peasant Studies, 38:1, 161-191, Available at: DOI: 10.1080/03066150.2010.538584 [Accessed 2021].

Salud con lupa, 2021. *Sobrevivir con una comida al día*. [online] Salud con lupa. Available at: <https://saludconlupa.com/noticias/sobrevivir-con-una-comida-al-dia/> [Accessed 2021].

Spencer, L. 2016. *Urban Agriculture in Cuba: Alternative legal Structures, crisis and change*. In: Singh, V., ed. Balanced Urban Development: Options and Strategies for Liveable Cities (online). Water Science and Technology Library: Springer Open. Pp. 343-354. Available from DOI: 10.1007/978-3-319-28112-4

Tacoli, C., 2019. *Urban food insecurity and malnutrition are about more than just food*. [online] International Institute for Environment and Development. Available at: <https://www.iied.org/urban-food-insecurity-malnutrition-are-about-more-just-food> [Accessed 2021].

Tasso, O., La Serna, M., Piccardo, J., Quiroz, R., Farfan, A. and Preissing, J., 2012. *PLAN DE GESTIÓN DE RIESGOS Y ADAPTACIÓN AL CAMBIO CLIMÁTICO EN EL SECTOR AGRARIO PERÍODO 2012-2021*. [online] Lima: Plan de Gestión de Riesgos y Adaptación al Cambio Climático en el Sector Agrario. Available at: <http://extwprlegs1.fao.org/docs/pdf/per115365.pdf> [Accessed 2021].

Trend Economy, 2020. *Peru | Imports and Exports | World | Sugar confectionery (including white chocolate), not containing cocoa | Value (US$) and Value Growth, YoY (%) | 2008 - 2019*. [online] Trendeconomy.com. Available at: <https://trendeconomy.com/data/h2/Peru/1704> [Accessed 2021].

Un.org. 2018. *68% of the world population projected to live in urban areas by 2050, says UN | UN DESA | United Nations Department of Economic and Social Affairs*. [online] Available at: <https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html> [Accessed 2021].

United Nations Office for Disaster Risk Reduction (2015), *Sendai Framework for Disaster Risk Reduction 2015-2030 (online)*. Japan: United Nations. Available at: https://www.preventionweb.net/files/43291_sendaiframeworkfordrren.pdf [Accessed 2021].

United Nations Office for Disaster Risk Reduction. 2019. Global Assessment Report on Disaster Risk Reduction. Available at: https://www.undrr.org/publication/global-assessment-report-disaster-risk-reduction-2019 [Accessed 2021].

USDA Foreign Agriculture Sevice, 2019. *An overview of Peru's dairy sector*. Global Agriculture Information Network. [online] Available at: <http://agriexchange.apeda.gov.in/MarketReport/Reports/Dairy_Update_Lima_Peru_4-15-2019.pdf> [Accessed 2021].

Van Eertern, 2017. *Peru: Rich and poor in Lima divided by 'wall of shame' | DW | 10.05.2017*. [online] DW.COM. Available at: <https://www.dw.com/en/peru-rich-and-poor-in-lima-divided-by-wall-of-shame/a-38780025> [Accessed 2021].

Vigo, M., 2013. *Hill-Climbing Commuters Decry a Proposed Border Fence in Their Path – The Informal City Dialogues*. [online] Nextcity.org. Available at: <https://nextcity.org/informalcity/entry/hill-climbing-commuters-decry-a-proposed-border-fence-in-their-path> [Accessed 2021].

Weather Spark, 2021. *Lima Climate, Weather By Month, Average Temperature (Lima, New York, United States) - Weather Spark*. [online] Weatherspark.com. Available at: <https://weatherspark.com/y/21212/Average-Weather-in-Lima-New-York-United-States-Year-Round> [Accessed 2021].

World Bank, 2021. *Agriculture, forestry, and fishing, value added (% of GDP) - Peru | Data*. [online] Data.worldbank.org. Available at: <https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS?end=2019&locations=PE&start=2019&view=bar> [Accessed 2021].

World Bank, 2021. *Peru Trade | WITS Data*. [online] Wits.worldbank.org. Available at: <https://wits.worldbank.org/countrysnapshot/en/PER> [Accessed 2021].

World Bank. 2012. Disaster Risk Management in Latin America and the Caribbean Region : GFDRR Country Notes. Washington, DC. © World Bank. Available at : https://openknowledge.worldbank.org/handle/10986/27336 License: CC BY 3.0 IGO [Accessed 2021].

World Food Programme, 2019. *The Peru Paradox: Malnutrition in a gastronomic hub | World Food Programme*. [online] Wfp.org. Available at: <https://www.wfp.org/stories/peru-paradox-malnutrition-gastronomic-hub> [Accessed 2021].

Wright, J., 2020. *The little-studied success story of post-crisis food security in Cuba: does lack of international interest signify lack of political will?.* International Journal of Cuban Studies (online), **4**(2), pp. 130-153, *Pluto Journals*. Available from: https://www.jstor.org/stable/41945973 [Accessed 2021].

Zarate, J., 2020. *"Más miedo al hambre que al virus" | IDL Reporteros*. [online] IDL Reporteros | Unidad de periodismo de investigación. Available at: <https://www.idl-reporteros.pe/mas-miedo-al-hambre-que-al-virus/> [Accessed 2021].

Zeeuw, H., Drechsel, P. 2015. Cities and Agriculture: Developing Resilient Urban Food Systems. United Kingdom: Routledge. [Accessed 2021].

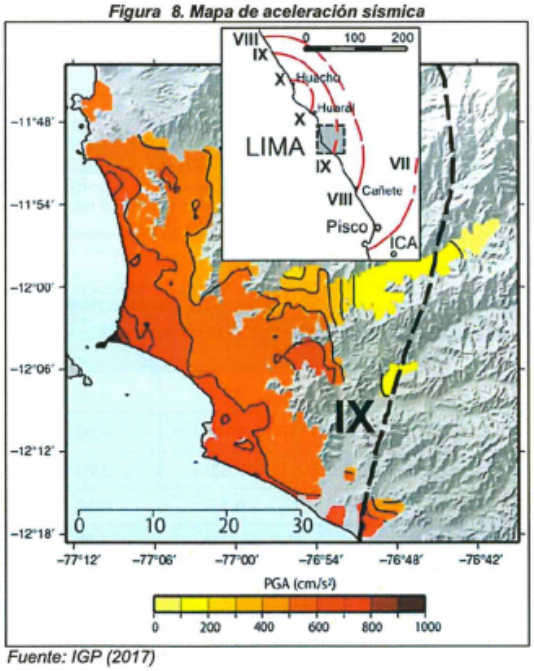
Appendixes

Appendix 1- Evaluation of risks of disasters
Source: SIGRID, 2019. / *SIGRID*. [online] Sigrid.cenepred.gob.pe. Available at: <https://sigrid.cenepred.gob.pe/sigridv3/evar> [Accessed 2021].

Appendix 2 – Methodology of data

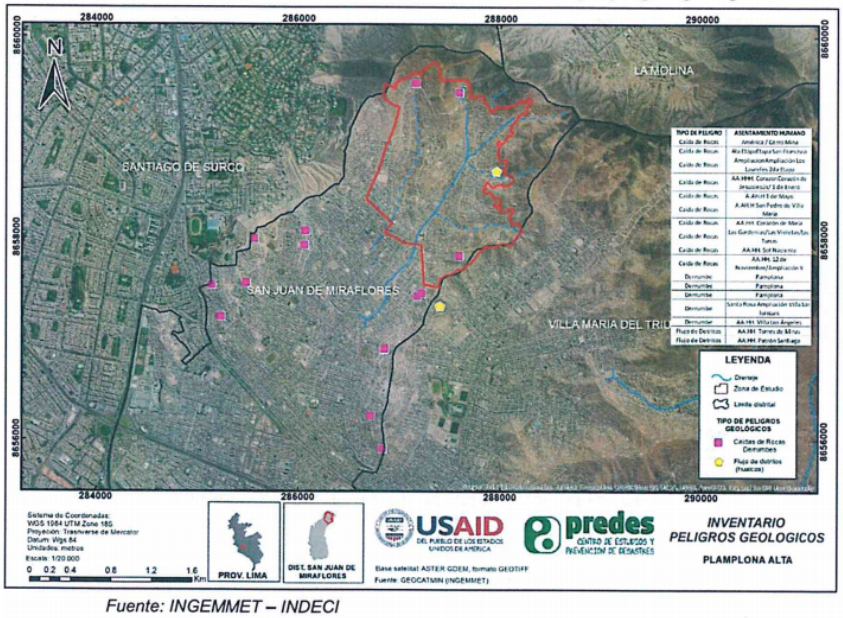
Source: Gallo Marcas, C. M. 2018. *Evaluacion del riesgo de desastres de la nueva riconada : Pamplona Alta, Distrito de San Juan de Miraflores*. Municipalidad distrital de San Juan de Miraflores. Available at : https://sigrid.cenepred.gob.pe/sigridv3/storage/biblioteca//7827_evaluacion-del-riesgo-de-desastres-de-la-nueva-rinconada-pamplona-alta-san-juan-de-miraflores-provincia-y-departamento-de-lima.pdf [Accessed 2021].

Figura 8. Mapa de aceleración sísmica



Fuente: IGP (2017)

Figura 7. Emergencias en el distrito de San Juan de Miraflores por peligros geológicos.



Fuente: INGEMMET – INDECI

Translation:

Title: Emergencies in the district of San Juan de Miraflores with geological dangers

Drainage flow

Zone of study

District line

Rock falls and debris flows

Appendix 3 – District of Comas, Lima, Peru

Source: Google Maps, 2021. District of Las Comas. [image] Available at : https://www.google.com/maps/place/Comas,+P%C3%A9rou/@-11.9325314,-77.0662679,13z/data=!3m1!4b1!4m5!3m4!1s0x9105d06992e815e3:0x18573d7c2751ddb!8m2!3d-11.9150865!4d-77.0478482 [Accessed 2021].