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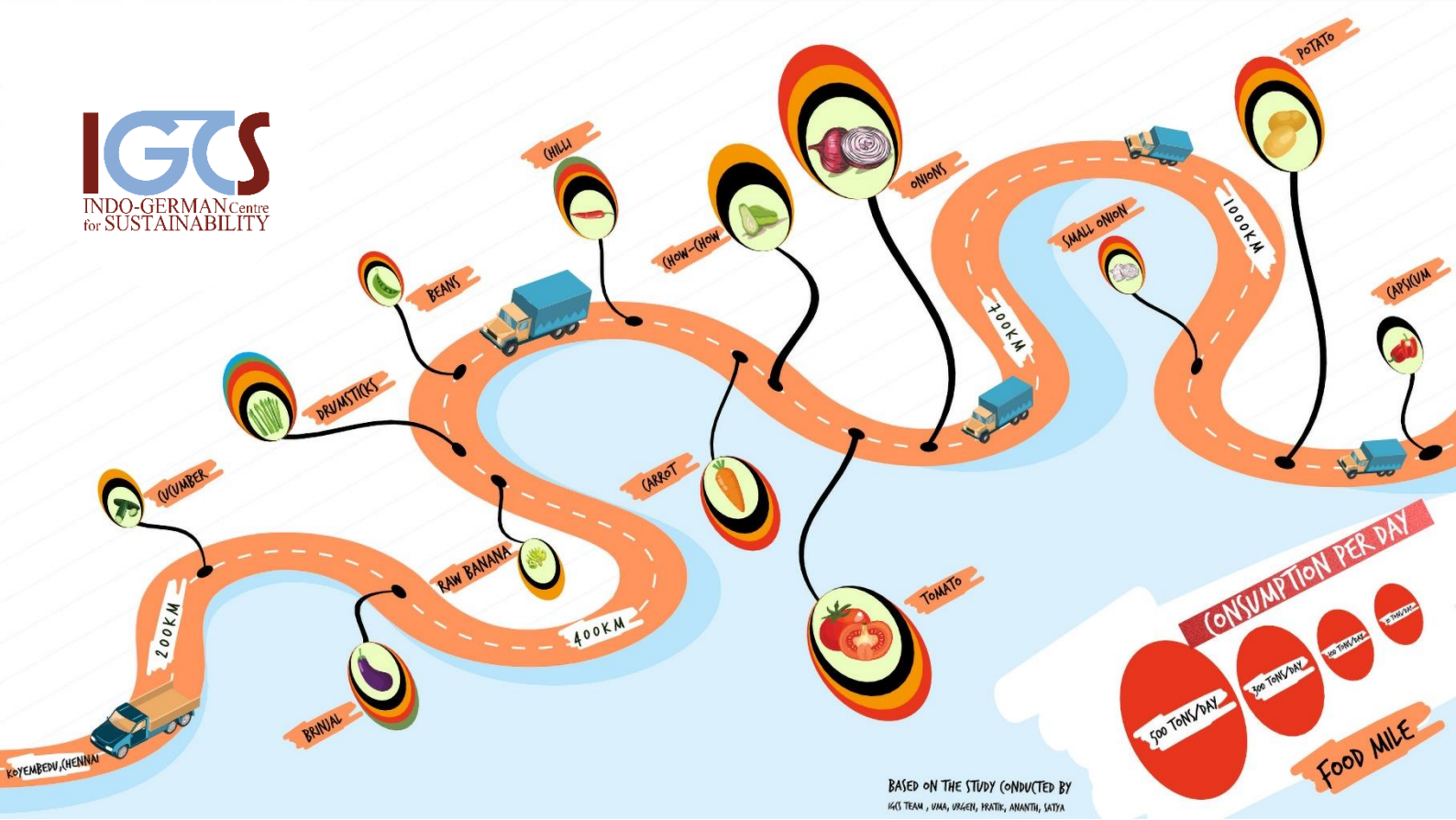
Towards a Sustainable Transformation of the Food System in the Chennai Region

Peter Volz and Christoph Woiwode



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Introduction

The pandemic has virtually changed and affected all spheres of people's lives around the globe with unprecedented consequences and impact. It is apparent that in the food sector, localisation and regionalisation of production and consumption by way of (peri-)urban agriculture, terrace/rooftop gardening and farming would increase people's and systems resilience with respect to food security and sovereignty (Anderson et al. 2020, World Bank 2013). For example, the largest wholesale vegetable Market in Chennai, which is the distribution centre for the entire city, was shut down early during the pandemic after becoming a hotspot, raising questions of decentralising such markets across the city (Lakshmi and Narayanan 2020). Consequently, there are numerous implications of this pandemic for sustainability science and agro-food systems (European Commission 2020a and 2020b, Future Earth 2020, Schneidewind and Fischedick 2020). In times of disaster, already vulnerable communities are highly risk prone to food insecurity. Recent studies by the Madras Institute of Development Studies in Chennai (Malaiarasan 2020), the 2020 Report on Global Food Security and

Vegetable and herbal garden in a shelterless home for girls, set up with mobile gardening kits with the support of Chennai Resilience Centre (photo: C. Woiwode)

Nutrition (FAO et al. 2020), and the Rockefeller Foundation (2020) highlight the critical situation in Tamil Nadu, globally and the USA respectively.

The aim of this research brief is to provide information regarding the design of the food system supplying Chennai, and the challenges and potentials to sustainable food system transformation. It starts with an introduction to the geographic and socio-economic situation before moving on to an analysis of the actors, locations and fabric of the food system. A final section proposes a number of recommendations derived from the analysis. This document is based on semi-structured interviews with 52 people, from farmer to researcher, from food initiative or business to policy maker, from food processor to restaurant owner, from seed producer to consumer (Annexe 1). In this way, insights about the issue of food system transformation were gained from various angles.

Definitions of key terms

A food system "refers to the web of actors, processes, and interactions involved in growing, processing, distributing, consuming, and disposing of foods, from the provision of inputs and farmer training, to product packaging and marketing, to waste recycling (IPES 2015).

A holistic food systems lens "is concerned with how these processes interact with one another, and with the environmental, social, political and economic context (Ericksen et al., 2014).

A sustainable food system is seen to be as "one that delivers food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generation is not compromised" (FAO 2021).

Food sovereignty "is the right of people to define their own food, agriculture, livestock and fisheries systems and policies" (Nyeleni ECA 2021).

Agroecology refers to a scientific discipline, agricultural practice, and political or social movement (Wezel, Bellon, Dore et al. 2009) dealing with "the ecology of food systems" (Francis 2003).

The most straightforward **definition of urban gardening or urban agriculture** is "growing plants or livestock within and around cities". The way urban or peri-urban is defined strictly depends on the context. (Taguchi and Santini, FAO 2019).

The size and complexity of the city region food system and the relatively new engagement of Chennai's stakeholders to transform it on a *systemic* level clearly provides limits to the depth of this 3-month long study. It cannot provide a plan for implementation because the required research (e.g. availability and productivity of urban land, suitability of farming model, foodshed analysis), agency (unclear policy objectives, trajectories and motivation of the institutional stakeholders in charge) and structures (e.g. something like a food policy council) are not there yet, despite a large number of very good and dedicated initiatives.

When talking more generally about feeding megacities it can be stated that there is a wide understanding that these are not sustainable in themselves as they have lost the link to the land, consume lots of fertile soil and are characterized by high levels of pollution, a fast pace of life, a focus on material acquisition and in many cases a CO2-intense lifestyle. Therefore, feeding such huge and growing "monstrosities" (Kumarappa in Bandhu 2021) in a sustainable way has its contradictions. However, there are clear benefits of putting urban and peri-urban farming and urban gardening on the agenda as "food is an effective entry point to improve a city's resilience, impacting many other urban issues such as transportation, health, land use and waste management" (RUAF, 2021). Interestingly, in the Indian context Tier 2 cities were often seen as more suited for such transformative action (interviews Ayer, Gunasekar 2021).

> "Unrecognized slums risk eviction anytime, so there is little agriculture or gardening. However, kitchen gardens are popular"
>
> (interview Peters 2021)

> "Food is an effective entry point to improve a city's resilience, impacting many other urban issues such as transportation, health, land use and waste management"
>
> (RUAF, 2021)

Chennai Context: Urbanisation

Chennai is governed by the Greater Chennai Corporation and the Chennai Metropolitan Development Agency (CMDA), besides many other specialised agencies. CMDA is a nodal planning agency of Chennai in the state of Tamil Nadu. It is responsible for planning and development of the Chennai Metropolitan Area, which is spread over an area of 1,189 km² covering the Chennai district and parts of Tiruvallur, Chengalpattu and Kanchipuram districts. For this purpose, CMDA has prepared a Master Plan which designates the land use permissible in every part of the Chennai Metropolitan Area, comprising the local bodies of Chennai city as Municipal Corporation, 8 Municipalities as second tier cities, 11 Town Panchayats as third tier cities and covering 179 rural villages. Some of these local bodies are reclassified at times for administrative reasons to accommodate rapid population growth. Thus, recently the government of Tamil Nadu approved

certain municipalities to the municipal corporation category. In addition, the Government of Tamil Nadu also plans to expand the planning boundary region for Chennai to 8878 km2 to include the neighbouring districts Kancheepuram, Chengalpattu and parts of Vellore. The number of inhabitants for the Chennai Corporation is currently 9.72 million people (2021), for the Chennai Metropolitan Area 11.98 million (data by IITM, Peri-Cene Project, 2021; Fig. 1). The Tamil Nadu state has a strong influence on policies through its departments and the central state as well through the appointment of district collectors.

Housing space and prices has become a major concern in Chennai. The real estate sector has a significant influence on Chennai's spatial development, and it is also a main player in social housing schemes. Marginalised, vulnerable communities have been evicted and shifted out of the city to peri-urban and rural settlements into high-rise buildings with little infrastructure potentially leading to ghettoisation. The population living in slums in Chennai is estimated to be 30-35% of the population (interview Peters 2021). The last government census is from 2011 and found 27-30%, but the study was criticised for flaws like not counting in migrant labourers and shelterless.

Furthermore, according to Peters (interview 2021) the situation has worsened since then. Most if not all of these marginalised communities are being stigmatised, hence ideas such as establishing organic food supplies with an own brand name could become a gamechanger. There is also a huge potential of using the labour force for this to provide additional income and livelihoods opportunities.

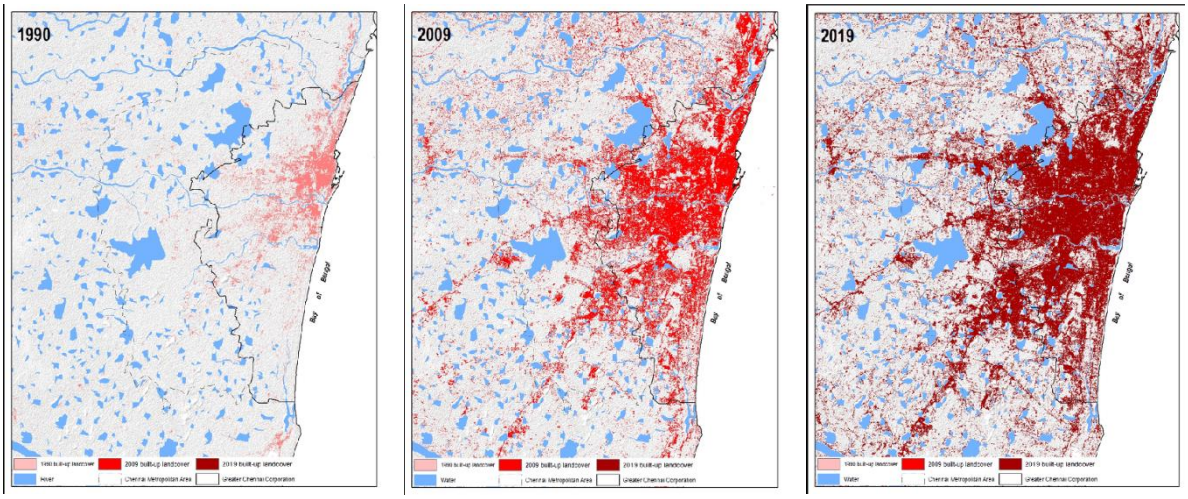

Figure 1: Growth of Chennai 1990, 2009, 2019 (Pericene Project, Ramachandran, 2020)

Tamil Nadu is highly urbanised compared to other Indian states with 48% of the population living in urban areas. According to Ramachandran (IGCS Peri-Cene Project, E-mail-exchange 2021), there is no significant farmland to be found within the city limits, i.e. the older corporation boundaries before 2011. This is remarkably different to other cities in the global South, such as Nairobi, Lima or even Bengaluru (Worldbank 2013). The increase of the city population and land use changes have led to the loss of agricultural land of approx. 2,50,576 hectares for the period 2008-2017, which accounts for 42.64% of total land use conversion in Chennai (Fig. 3). This is 0.25 percent of the total land in the CMA excluding Chennai Corporation-city limits (Ayyangar et al. 2019). This number seems to be quite low and it might be that the large land conversion in the Chennai peri-urban growth area – GCC and CMA combined – took place before 2008, since the 1990s. The low profitability of farmland compared to the (often illegal) conversion to highly valuable housing land has changed the landscape and the social composition, especially along the main highways (e.g. IT corridor along the OMR, Industrial corridor NH4 towards Bengaluru). If agriculture land is not used for five years it can be converted in other ways, and this conversion rate has been growing significantly (interview Mohankumar 2021). According to researchers at IGCS (Peri-Cene Project 2021), the Chennai Region (CMDA) has 1892 km2 land potentially available for farming (incl. waterspread areas). Informal agricultural production is undertaken on some of such non-designated land already now, which is viewed as a potential to develop further in the future

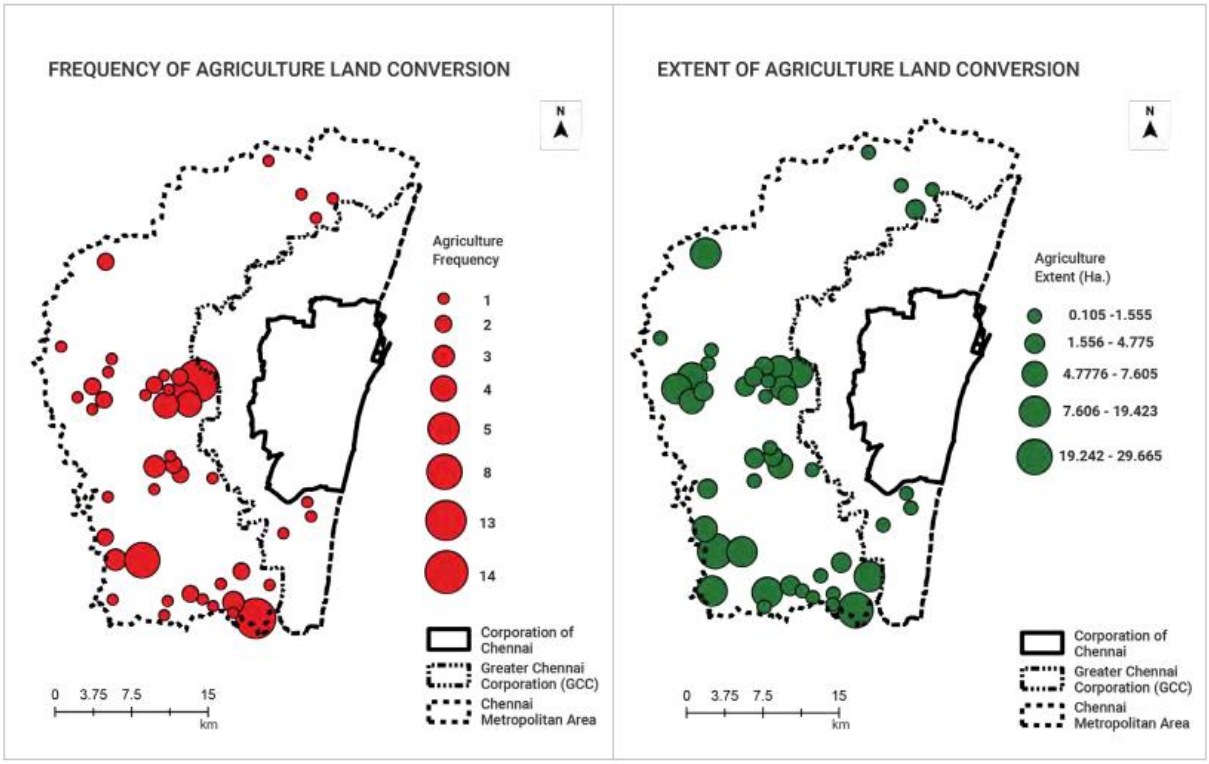

Figure 2: Agriculture Land Conversion (Roy et al. 2018)

Chennai context: Salient features of the peri-urban area

The districts Chengalpattu, Kanchipuram and Thiruvallur are surrounding the Chennai district. Agriculture is still the predominant sector in terms of landuse although lower than in other districts (Fig. 3). The soil is often of poor quality, characterised by less water than in other parts of Tamil Nadu while the building of a new port and other infrastructure projects has increased industrialisation rapidly especially since the mid 1990s.

Around the city the land is still being used for farming, mainly for paddy cultivation, horticulture, as well as large poultry production in the peri-urban area (Data by IITM, Peri-Cene Project, 2021):

1 The Chennai Basin hinterland region, predominantly in Kanchipuram, and Thiruvallur is dominated by grain (paddy) production.

2 Most of the broiler poultry that is supplied to Chennai are produced in the Vellore district and Villupuram.

3 Vegetables, mainly Green Vegetables (leafy Vegetables), are grown in the peripheries of Chennai (Redhills), and Vellore district.

4 Locally grown fruits come from the Hinterland regions like Kanchipuram, Thiruvallur, and Vellore.

The following amounts of production were recorded accordingly:

415,302 tons of grains	Kanchipuram District *(year 2015 – 2016)*
333,203 tons of grains	Thiruvallur District *(year 2015 – 2016)*
10,000 tons/month of Chicken	Vellore district & Villipuram District
150 tons/day of fruits	Kanchipuram, Thiruvallur, and Vellore District

The fishing industry close to Chennai, especially the rapidly growing industrial shrimp farming, threatens and ruins coastal mangrove forests, is highly polluting and affects livelihoods of small local fishing communities outside of the aquaculture economy negatively. These communities have been neglected for decades and the *peramboke* (form of commons land) has shrunk. Large infrastructure projects, such as power plants and harbours, as well as dumping of waste from cities and chemical plants have significantly disturbed the natural environment particularly in the northern part of the Chennai metropolitan region.

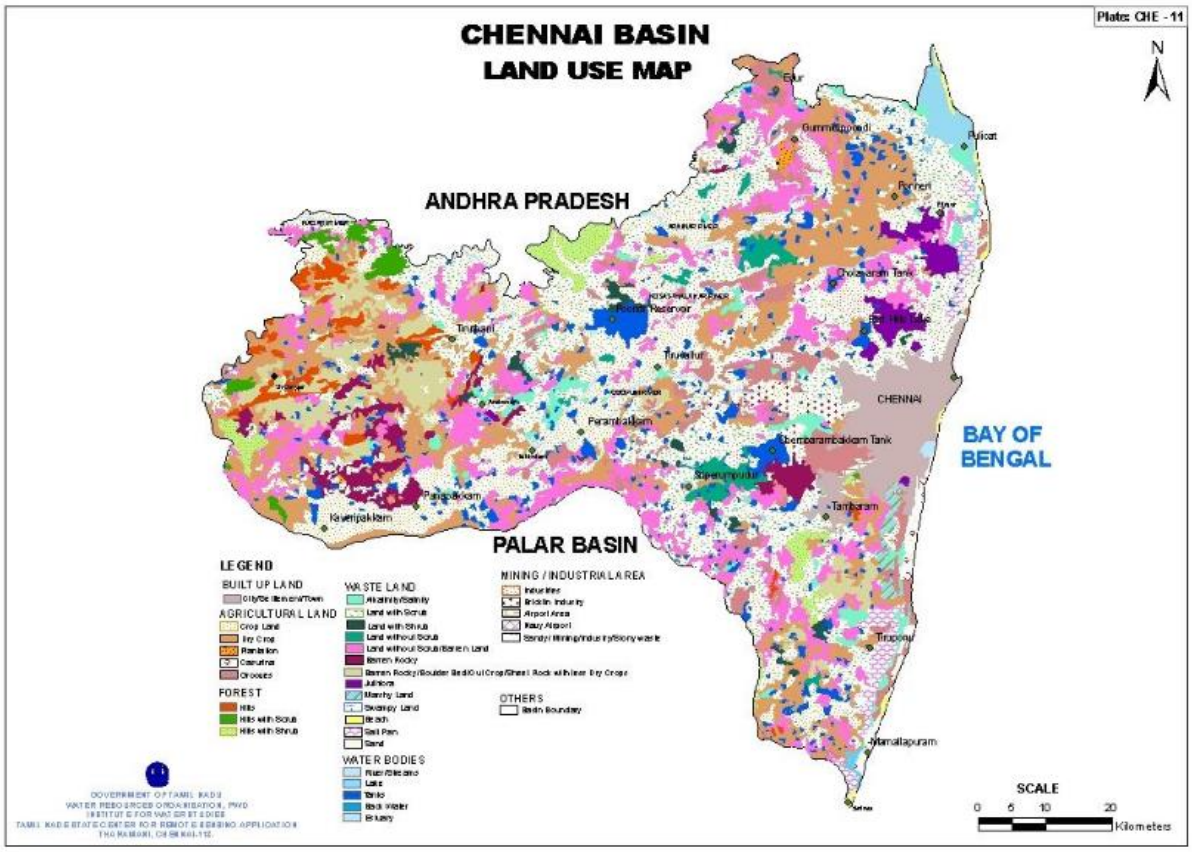

Figure 3: Land use in the Chennai Basin (National Water Mission 2019)

Tamil Nadu context: Agriculture

In Tamil Nadu there are particular areas for certain crops (Table 1). Turmeric is grown strongly around Ellore. Vegetables, tea and coffee come from the hills (Ooty etc.) while paddy is grown wherever there is enough water. The "rice bowl" is therefore located in the South, in the Cauvery delta (interview Renuka 2021). The Cauvery delta zone is also where the cash crops are grown (e.g. sugarcane, plantain, cotton). Tamil Nadu is a major fruit growing region as 10% of all fruits produced in India come from here, especially bananas and mangoes but also papaya, pineapple, guava, citrus and grapes (AgriFarming 2021). Major crops are rice and various types of millets (jowar, bajra, ragi). Rubber, coconut, flowers, spices, oilseeds and pulses are also produced in a significant number (AgriFarming 2021).

Organic soil matter level in Tamil Nadu lies at 0.68%, which seems better than in other states, yet still quite low (interview Ismail 2021). Red soils are most prominent, covering 2/3 of the land of Tamil Nadu (National Water Mission, 2019). Fertile alluvial soils can be found along the rivers and in plain coastal zones. Sodic soils are more susceptible to clay dispersion and surface sealing, which generate runoff flow and subsequently lead to elevated levels of soil erosion, a serious problem from the crop production point of view. Saline soils exist close to Chennai at the Coromandel coast, these soils are insufficient for farming.

Table 1: Overview of vegetable production, Tamil Nadu (AgriFarming 2021)

S. NO	Name of the Crop	Area (Hectare)	Production (metric ton)	Productivity (metric ton/hectare)	Major Vegetable Growing Districts
1	Tapioca	89,609	28,62,135	31.94	Villupuram, Dharmapuri, Namakkal, Salem, and Erode
2	Onion	28,357	3,04,246	10.73	Perambalur, Dindigul, Tiruchirapalli, Namakkal, and Tirunelveli
3	Tomato	29,078	8,87,080	30.51	Dharmapuri, Salem, Krishnagiri, Dindigul, and Coimbatore
4	Brinjal	15,084	3,02,408	20.05	Dharmapuri, Salem, Dindigul, Vellore, and Krishnagiri
5	Ladies Finger	11,824	1,24,887	10.56	Dharmapuri, Salem, Dindigul, Tiruvallur, and Tiruvannamalai
6	Beans	8,672	1,61,998	18.68	Dindigul, Krishnagiri, Vellore, Theni, and Erode
7	Carrot	3,742	1,07,423	28.70	Dindigul, The Nilgiris, and Krishnagiri
8	Potato	3,506	67,663	19.30	Erode, Dindigul, Krishnagiri Nilgiris, and Tiruppur
9	Bitter gourd	2,922	66,371	22.71	Dharmapuri, Coimbatore, Salem, Dindigul, and Cuddalore
10	Leafy Vegetable Plants	2,732	51,339	18.79	Salem, Tiruvallur and Dharmapuri

Generally speaking, agriculture is still largely small scale with 93% of the farms being small and marginal (AgriFarming 2021). The average size of the land holding in the state of Tamil Nadu is 0.75 ha, less than the average size of land holding in India (1,08 ha). Agriculture is the principal source of livelihood for more than 40 percent of the population of this State (Tamil Nadu Gov 2014). Some of the interviewees (Krishna, Dangel, De Clerk), pointed out that not all farmers actually have a farming heritage being connected to the land. Some have been allocated the land but are actually opportunistic enough to switch profession, or sell the land and leave the rural areas altogether.

The Tamil Nadu state government approved a new budget to improve soil quality (interview Ismail 2021). This new government was generally seen as following more ambitious agricultural goals, e.g. one aim is to increase non-chemical farming by 10% each year (interview Ismail 2021).

The Tamil Nadu millet mission was set up in 2021 to promote the wider use of drought resistant and nutritious millet varieties that do not depend on irrigation.

These varieties will be accessible through ration shops as well, although to what extent is not clear as yet. If this engagement results in long term improvements of sustainability will have to be seen. Public procurement for organic food and traditional varieties of rice and millets is not a focus as yet.

The situation of small farmers is complicated; incomes from farming are low due to the high capital costs of seeds, chemical fertilisers and herbicides as well as fuel. Due to low prices paid by middlemen, many farmers are indebted, have several jobs and eventually recommend their children not to continue with farming. Only the keeping of livestock for milk, eggs, meat and manure provides somewhat better income. In rural areas market access, fair price and storing capacities are a serious issue, especially when the monoculture model is followed focusing on a few crops only (interview Tamilselvan 2021). As a result, an issue that was frequently mentioned in interviews is the lack of agriculture labour (interviews Tomassen, Dangel, Renuka 2021).

Water (scarcity and flooding) is increasingly an issue in Tamil Nadu (interview Philip 2021). Yet water-intensive cash crops such as rice, sugarcane and plantain are still widespread. Historically, agriculture systems evolved complementary to the water systems (tanks, water reservoirs) (interview Mohankumar 2021). With the continuous reduction of agricultural land, large parts of the water saving systems also fell into disuse. This situation still resonates in the current water problems of Chennai.

Despite the obvious advantages for the environment, organic agriculture is limited in India and in Tamil Nadu. A figure of 3% is given for Tamil Nadu and India (Sharma interview 2021) but it is contested. There are questions regarding the definition of organic agriculture: on the one hand, there are certified farmers, whereas on the other hand there are those who operate without chemicals because of lack of money (natural farming) or, because they follow a traditional system (interview John 2021). In Andhra Pradesh state, since 2017 the zero budget natural farming (ZBNF) approach has been strongly promoted and supported by the government (Bharucha 2020, Gupta et al. 2020). Naidu (interview 2021) from the Jattu Trust who is involved in the implementation of the ZBNF observes improvement in net income in all crops as well as the rise of consumer awareness. However, there are also challenges, mainly that there is not enough cattle available to produce natural fertilisers, as well as issues related to the steady funding and policy support.

> "Even though demand for other cereals, such as finger millet, is increasing due to changes in the urban diet, farmers prefer not to cultivate these crops on a large scale as they are labour intensive and therefore vulnerable to the acute labour shortage that exists in peri-urban and rural areas. Modern technologies, such as transplanting and harvesting machines, are being widely used as a substitute for labour in paddy-rice cultivation, but technology appropriate to non-paddy crops has not yet been developed on a large scale."
>
> (IGCS, Peri-Cene Project, 2021)

Consumers: Consumption Changes and Action

Consumption patterns have become a serious concern where citizens in rural and urban areas display increased unhealthy "snacking" and "junk food" consumption including softdrinks (interview Janu 2021). In many more affluent households where women have also become part of the work force, food preparation is changing from freshly made daily meals towards more convenient ways, which has increased demand for packaged food items and ready-made meals. Recently, the increase in fuel prices (among other factors) have increased the food prices. Meat consumption, especially for broiler chicken, has increased over the last decade (interview Murali 2021, see also Government of Tamil Nadu 2011). To promote responsible healthy consumer behaviour is seen as crucial by many people interviewed (Ismail, Janu, John, Selvam interview 2021).

A food transformation movement emphasising non-toxic organic production and traditional food had started in Tamil Nadu already in the 1980s with the farmer, scientist and campaigner Namalvar and his organisation Vanagam being a key figure in this. There were many small initiatives emerging all over Tamil Nadu (Gunasekar interview 2021). Even now, many people interviewed referred to his influence (Thilak, David, Azhagan interviews 2021). His ideas were taken forward in Chennai after 2007, when a younger generation, many of them coming from the IT sector and/or returning from work abroad came together to start new structures to link farmers and prosumers with organic food, such as Re-store, the Organic Farmers Market and other initiatives. Financial sustainability has been an issue for some of the emerging organic businesses, while some initiatives rely on a lean infrastructure supported by volunteers. These initiated the societal discourse about healthy food and agriculture. Activist structures involving volunteers emerged (15 Organic Farmers Markets all over Chennai) as well as commercial organic shops (about 300 before the Covid pandemic). For the activists, the priority were environmental concerns, followed by the livelihoods of farmers and a third priority related to healthy and safe food. In contrast, for the consumers it was the other way around (interview Sayanan 2021).

> "That's why restore (shop) was born, through restore we talked – because 'we lost it all'. Lost the farmers, lost our health, lost culture of food, disconnect of nature, livelihood was lost, chain stores everywhere, small shops are gone. You wouldn't know if you spend 100 Rs how much will come to the farmer"
>
> (Sayanan, 2021)

> "There is no proper civil society narrative in Tamil Nadu and no common push, which is a very big problem."
>
> (Gunasekar, 2021)

Now it is time for the next step in the development of the organic food and farming movement. Also, there is no proper institutional support which has to change (Gunasekar interview 2021). Efforts for a platform like a "food policy council" have not been taken up yet, but the need for a common civil society narrative in Tamil Nadu regarding food and farming has been identified.

The idea of a "food policy council" to bring together the stakeholders from field to plate has been resonating with grassroot activists, researchers and farmers interviewed, yet often with some understanding of being aware of potential issues that might stop the success of such an approach. Gunasekar sees that it has not come yet simply due to the lack of effort and the bandwidth of the people. The importance is to have professional staff to work on the core issues like logistics between farmers and consumers and to provide an anchoring group (interview Gunasekar 2021). Gopalan (interview 2021) had experience of being involved in a food policy council in Toronto. She stated that the caste mentality of Indians somewhat limits the success of these approaches in India. Sayanan (interview 2021) though believes that the concept of a food policy council can work, and that any type of discussion and bringing people of all classes together is useful. However, he argues that there will be different narratives: while a large scale farmer will talk of big things, the food transformation movement wants it small-scale.

There is a network of small and often organic retailers called Sopra in Tamil Nadu, there are several (often informal)

Founder of Mannvasani, promoting organic food products and cooking workshops reviving traditional, healthy recipes (photo: P. Volz)

Community Supported Agriculture projects, there are farmer cooperatives and government cooperatives, there are farmer producer organisations (FPOs) and there are farmers collaborating to sell as an association. However, there is a need for consumer-driven cooperatives (interview Gunasekar 2021). It was pointed out to create a space for the food transformation movement and make it being heard before the big players (Amazon has been entering the organic food market) are absorbing the positive moves made by the new Tamil Nadu government regarding advancing organic farming. Creating a workshop space to advance these ideas in a participatory way with professional moderation from within the movement is seen as crucial for the organic movement in Tamil Nadu (interview Gunasekar 2021).

The Regional Food System of Chennai

Similar to the watershed, the regional food system that supplies Chennai spreads across several states including Andhra Pradesh and Karnataka. Compared to food supply in German cities, there still seems to be a somewhat more localised food system in place, less dependent on supermarkets. However, it is clear that the food system has been changing rapidly for some time resulting in increasing food miles. Supply of food comes mainly from India which includes the mentioned Southern states (plus Kerala) and also the rest of the country, even North Eastern states (rice from Assam). Additionally, there are imported goods from abroad like apples from New Zealand, USA or China.

The Urban Design Collective (UDC, Mohankumar, Rajalingam 2020) mapped an overview outlining the origin of most vegetable items and grains analysing "Who Feeds Chennai?". In their study, prepared during the beginning of the Covid pandemic, the authors outlined the supply chains before and during Covid (Fig. 4). It was inspired by the response of government, businesses and civil society to Covid and the closure of the Koyambeedu wholesale market when the question "How do we get our food?" became a crucial issue. Taking it further, the sustainability and resilience of the food system came under scrutiny. UDC proposes for Chennai to become a food smart city by using spaces for community *thottams* (farms on vacant land, residual or public) and *mottamadi thottams* (rooftop farms on all kinds of public or private buildings that are suitable for that).

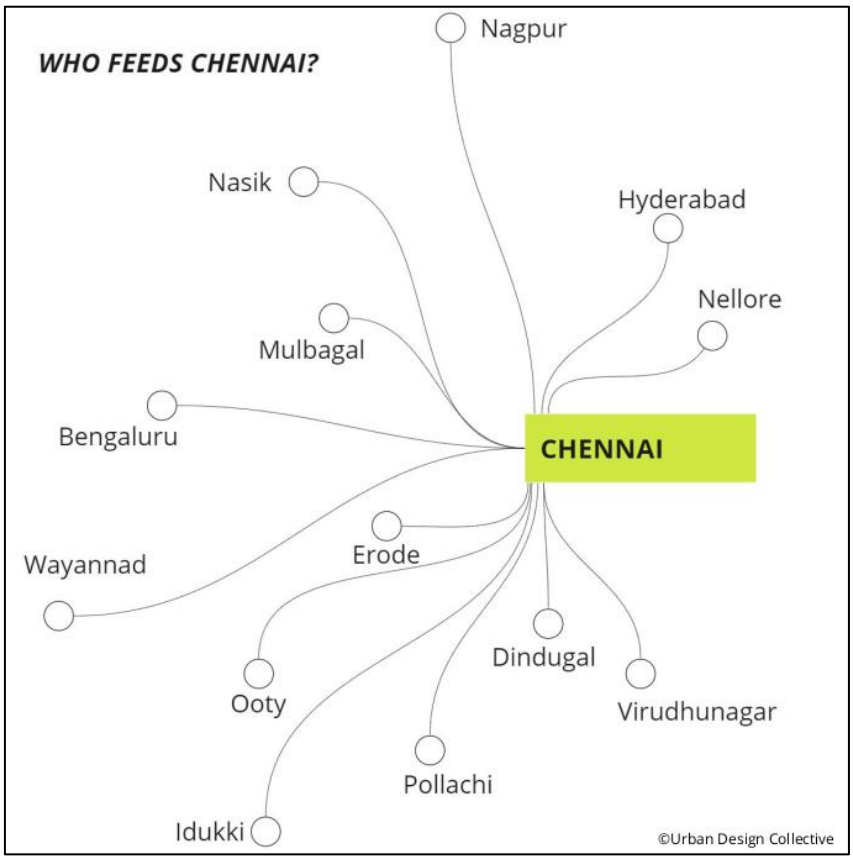

Figure 4: Who feeds Chennai? (Urban design Collective Chennai, 2021)

Food miles have been analysed by an IGCS team at the IIT Madras in an (unpublished) study in 2020 and 2021 based on interviews with stakeholders mainly at Koyambeedu market. The origin of vegetables, fruits, grains and poultry as well as the respective supply chains were analysed. "The organization for vegetable-transportion is handled by various traders within the Koyambeedu market, and most of these traders have a union in terms of administration. Small local farmers who are not connected to any of the middle men or a trader make their travel as far as approx. 200 kms to reach Koyembeedu or the primary markets to sell their local fresh produce"; and vegetables travel often "over 1000 kms from the north" (Peri-Cene Project 2021, see title image). Greens are majorly produced from peripheries of Chennai and other adjoining districts.

In a study by Boyer et al. (2019), that compares the diets, food miles, and environmental sustainability of urban food systems of nine Indian cities, it is remarkable to note that Chennai accounts for the highest number of food miles (1,137 km/Mg). The supply chain data for food is based on a GoI-commissioned multimodal freight survey. An overview of consumption patterns is also provided by this study (Fig. 5; Annex 2). Generally speaking, international imports and processed food play a minor role in the Indian food supply compared to other countries (FAO 2017b).

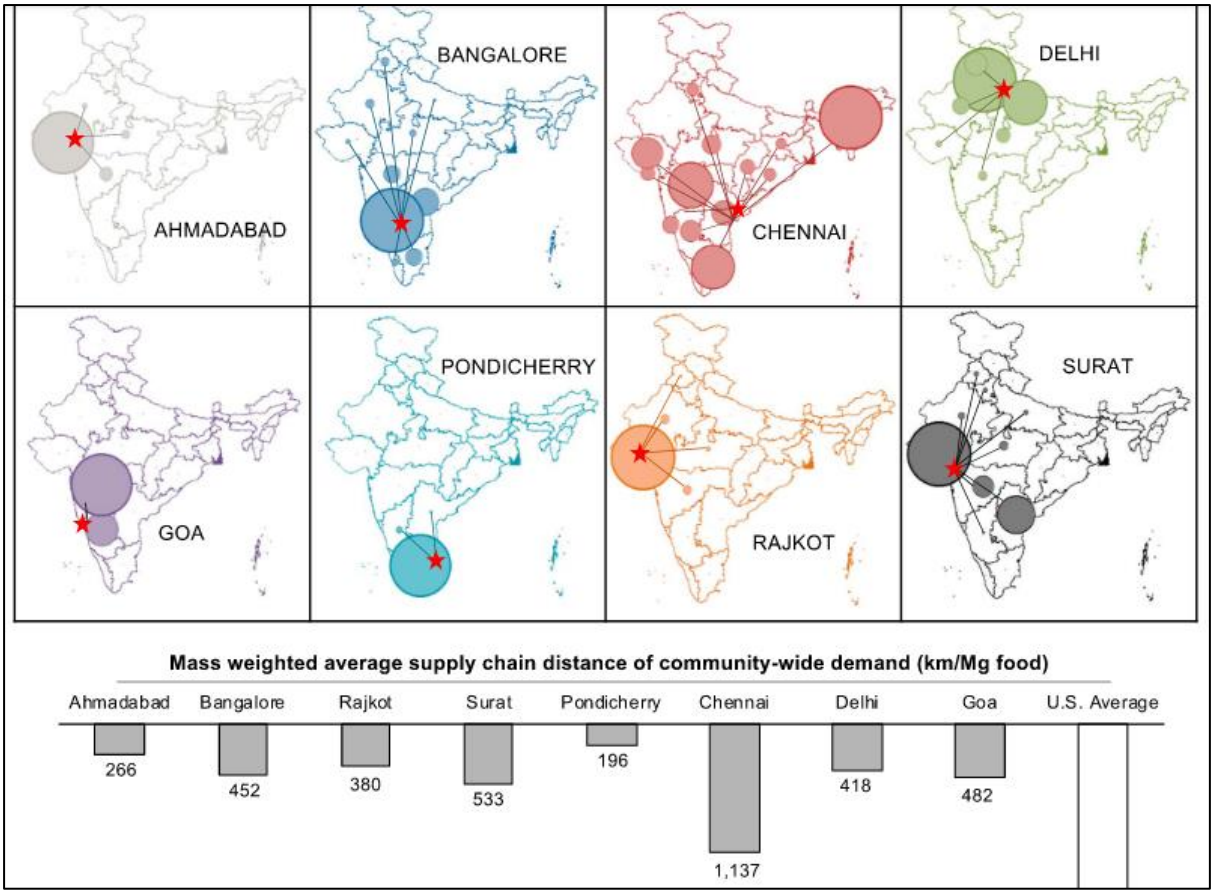

Figure 5: Food Miles of Indian Cities (Boyer et al. 2019)

Construction site for green open space with playground and redesign of the metro buildings Kasturba Nagar/Thiruvanmyur, which includes first of its kind 'Nutrigardens', implemented by Chennai Smart City Project and facilitated by M S Swaminathan Research Foundation (photo: C. Woiwode)

Food System Infrastructure

The central point for food distribution (fruit, vegetables, grains, spices) is Koyambeedu market located in north-central Chennai, which is supposedly one of the largest wholesale markets in Asia (Market Mechanism Commitee 2019). It has remarkably little storing (or even cold storing) capacity. The bulk of the produce, including perishable items like tomatoes, is sold directly. Mohankumar (interview 2021) points out that many vegetables are picked early and sprayed to preserve them longer in the absence of cool storage.

Another large wholesale market close to Chennai is in Solai, Velachery (a neighbourhood in Chennai), which functions for meat trading (interview Murali 2021). Generally, the meat is traded in a less centralised way (interview Mohankumar 2021) with especially poultry being delivered directly to the shops. Poultry is the most popular meat and comes in great quantities from Tamil Nadu and the other southern states. Some traders in Tamil Nadu provide entrepreneurs which have land, with equipment, chicks and market the meat through their own channels. Mutton (second in popularity) is often transported 2000 km or even more from states as far as Andhra Pradesh, Rajasthan and Maharashtra. Beef comes usually from Kerala.

For fish, the largest wholesale market in Chennai is Kasimedu. There are also many other smaller markets and vendors. Because the cold storage chain has improved, fish is not only coming from the Coromandel coast but from other coasts as well (interview Murali 2021).

Chennai gets fruits prominently from Tamil Nadu, Karnataka, Kerala, Andhra Pradesh, Telangana, and Maharashtra. Koyambeedu is again the centre for logistics and "caters to various fruit wholesalers/ retailers in markets located at a radius of 100 km" (Peri-Cene Project 2021). Looking at rice, wheat and pulses the study finds that "Chennai procures its rice mainly from the other states of India" and "brokers act as the middleman between the producers or farmers (Andhra Pradesh, Haryana, Delhi, West Bengal) and mill owners in Chennai (Redhills, Vannarpettai, Tondiarpet etc)", which "supply it to various retailers in the market". The majority of wheat supplying Chennai "is procured from Punjab, Madhya Pradesh and Uttar Pradesh" while "the distribution channel for wheat is similar to that of rice" (Peri-Cene Project 2021).

According to the Peri-urban study Chennai gets pulses not only locally but also from other states of India (Delhi, Haryana, Punjab and Madhya Pradesh) and imports from US, Canada, Russia, Australia, Mozambique.

Processing is an issue regarding to traditional varieties of rice (where bran is not removed) and millets, for large-scale mills do not have the required technology. There are various traditional ways of processing (puffed rice e.g.) that should be shared and being made available to the farmers (interview Gunasekar 2021).

Table 2: Overview of Stakeholders by sector, type and model/organisation

Sector	Type	Model/Organisation
Producer	Farmer	Subsistence Direct Marketing Farmer Producer Organisation Sell to Middlemen Cooperatives Contracted by Supermarket
	Organic Farmer	Sell to Organic shops "IT" niche farmer Direct Marketing/Community Supported Agriculture
	Fisherfolk	Direct Cooperative Commercial
	Estates	Coffee Tea Rubber
Processor	Food processing	Traditional Cottage industry Mills Slaughterhouses (AgriHind e.g.) Industrial
	Trading	Cooperatives Brokers to Mill Owners

Middlemen	Logistics	Brokers to Vendors Brokers to Hotel and Shops etc Commercial
	KOYAMBEEDU MARKET (managed by Market Management Committee)	
Retail and Distribution	(Corner)Shops Supermarket Wholesale Ration Shops Direct Marketing	Street Vendors Family Businesses Chains Wholesalers Food Cooperative India IT Food Suppliers e-thotam
Nutrition	Restaurants Canteens School meals	Schools Street Vendors Family Businesses Farmer restaurant Restaurant Chains Online Food Delivery Temples, Mosques, Churches
Administration and Policy	National Regional Municipal PVS International	Tamil Nadu Civil Supplies Lmt The Food Corporation of India Public Distribution System GoI Ministry of Agriculture Warehousing corporation Tamil Nadu Civil Supplies Lmt Civil Supplies and Public Distribution Department Agriculture Department Woman's Development Department Skills Department Horticulture Department District Collectors Chennai Metropolitan Development Authority (Land Use Zoning, Masterplan) Greater Chennai Corporation CMDA Chennai Smart City Chennai Resilience Centre Chennai Urban Horticulture Initiative
Civil Society	NGOs	OFM CIKS PGS Council Rooftop gardening movement in Chennai Sunday gatherings
Research	State National Private	Universities, e.g. IITM (Peri-urban) M S Swaminathan Research Foundation BERAS

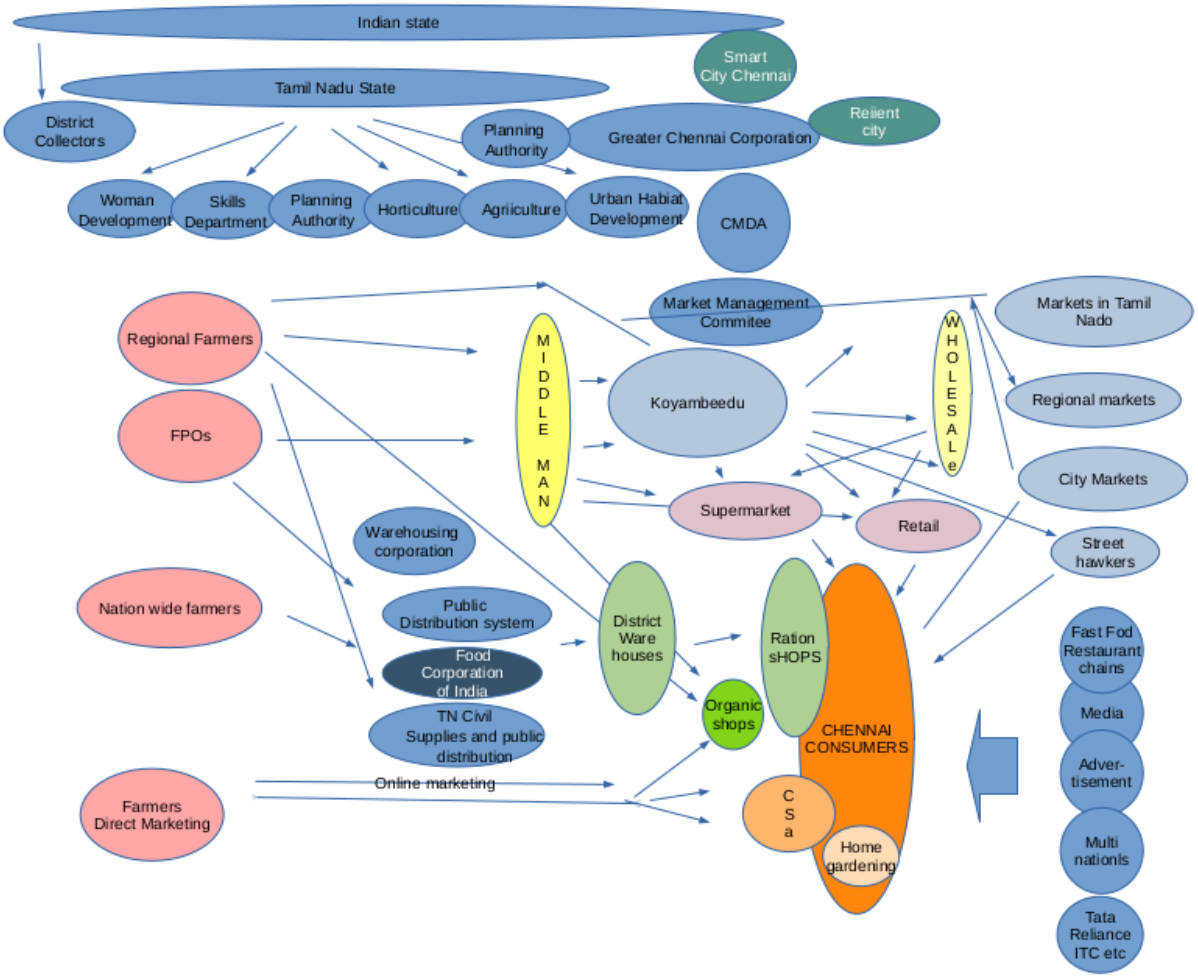

Figure 6: Mapping of Stakeholders

The Food System of Chennai is characterised by relatively strong government intervention, e.g. through provisioning of school meals and the Public Distribution System (PDS) which is supplying subsidised food via Fair Price shops (Ration shops) and other general shops (*Anna unawagga*) with basic dry products (rice, lentils, sugar, oils, flour, etc). The supplies are sourced from (state and central) government channels through a warehouse distribution system on district level. What kind of food is subsidised and the quality offered (mainly carbohydrates with low nutrition, e.g. polished rice compared to millets) is subject to criticism and debate. Other state departments of Tamil Nadu are directly or indirectly involved in the food system through regulations and policies but also programs. The Tamil Nadu planning committee has advocates of organic agriculture on board, which has strategic importance.

National and international business-chain supermarkets and restaurants are increasingly a challenge for family-run enterprises (e.g. corner shops) which are however, much more prominent than in other parts of the world. The informal sector plays a considerable role in selling food and cooking it (street vendors). At the same time, the improved cooling chain and logistics have led to the food system being supplied more on a national level instead of the local surroundings. This corresponds with other (more globalised) eating habits.

Compared to other cities, e.g. in Africa, urban farming is quite low (see IWMI 2003), especially since land value has increased considerably and tolerance for marginalised people living on land close to waterways and other areas considered wasteland is low. They are constantly threatened by eviction.

For an overview of stakeholders by sector and type refer to Table 2 and a stakeholder map to Fig. 6.

Institutional setup

The institutional setup is highly important to consider, as strong government participation and intervention along the whole value chain can be observed, visible for instance in subsidies from the seed up to when the food reaches one's plate. Central and State government policies play an important role in framing the entire value chain. As policy analyst Sankaranarayan (interview 2021) pointed out, a policy change to make the food system healthier, more just, participatory, and more local is ideally the way forward, yet there are multiple barriers. Some such barriers are caused by structures created since the green revolution (interview Nair 2021). Barriers that are entrenched in the existing food production system, like subsidies for fertilisers and electricity, but also the role of agricultural extension services. But there are more issues. Inconsistent policy making and implementation means that whatever positive change has been initiated such as promoting of millet production may be at risk of being arrested due to political changes during the course of implementation. Sankaranarayan (interview 2021) points out that the policy approach in India is normally not system oriented, but rather people oriented, in the sense that there is no system to back the activities properly. As a result, frequently positive approaches fail or are watered down. Therefore, it depends largely on the agenda of the people who are in power, which often this can be very erratic. Hence the success of particular projects depends on the kind of leadership to sustain that program. Consequently, even if there is a policy on paper, translating it on to the ground is a very different thing. This is valid for both the central and the state government percolating even down to the district level (Sankaranarayan interview 2021). Local governance exists but it is very fragmented. This poses a significant challenge for replicating and upscaling of successful projects.

While an increasing interest is noted in taking up organic farming and consumption of such produce, the organic farming movement appears splintered and agents are disconnected, hence there is a need for better networking and communication among these stakeholders for systemic, transformative change (interviews with Gunasekar, Ismail, Selvan, John 2021).

Agro forest system outside Chennai, Tamizh Nilam (photo: P. Volz)

Potentials for new urban and peri-urban landuse towards farming/gardening

As mentioned earlier, UDC proposes for Chennai to become a food smart city by using spaces for community *thottams* (farms on vacant lands, residual or public) and *mottamadi thottams* (rooftop farms on all kinds of public or private buildings that are suitable for that). This idea was also mentioned by Resilient City Chennai (interview Mohan 2021) and by Nair (interview 2021). In a similar vein, researchers of IGCS's Peri-Cene Project propose farming projects on 'wasteland', i.e. unused spaces next to waterbodies which are seasonally flooded or waterlogged. IRCDUC are also about to start a community garden by using a plot of government owned land in a slum resettlement area (Perumbakkam) with marginalised communities. UDC point to the land resource management in the city, especially the open space regulation as part of the development control regulations that obliges 10% of the entire property to be allocated as public thoroughfare/right of way, maintained by the owner but open to public use. This land often remains unutilised. Parks, public vacant land and other buffer zones can also be tapped for

community farming. It is estimated that 10-15% of consumption needs may be supplied by these approaches. In support of this, UDC are ready to take their preliminary study further with more research to gather more quantitative data.

Gunasekar notices a hype around urban Miyawaki forests. In his opinion though, ideas for more productive food forests should be explored. Also, the peri-urban areas, especially Kanchipuram and Thiruvallur, have still a significant farming sector. There is a need to tap into that to create the direct marketing links to support the remaining agricultural activities as the pressure of land conversion increases.

Sayanan (2021) opines that such efforts in an urban context are only economically viable for food production and not farming. According to him, commercial farming will not work in an urban context. However, self-catering, e.g. for schools and hospitals, is important. Education for city people, so they can relate to agriculture and nutrition, is equally Important.

Recommendations

For several reasons, Tamil Nadu is well suited for an agroecological transformation compared to other regions in India (interviews John and Sayanan 2021). The soil provides fertile agricultural land in many parts of the state, there is still considerable diversity in the agrarian structure and there is interest in organic agriculture amongst farmers and citizens since Namalvar started his activities in the 1980s across Tamil Nadu. With the neighbouring Andhra Pradesh state there is a pioneer in ZBNF that can spur further motivation, competition and hopefully exchange and cooperation. Tamil Nadu has a proud food culture and a very healthy millet based dietary heritage that has already been re-activated in recent years, but still there is huge potential to develop this further more strategically.

Vannagam Farm started by Namalvar (photo: P. Volz)

The city of Chennai has been recognised by the experts interviewed (interviews Mohan, Reddy, Cherubal 2021) as one of the more transformative cities in India. It hosts internationally co-funded projects like Chennai Smart City, Resilient Chennai and the Indo-German Center for Sustainability. It is the first big city in India that has a resilience strategy and a well educated population with high literacy levels.

Following, we present detailed policy recommendations addressing the stakeholders such as the Tamil Nadu state government, the Chennai corporation, the local Chennai urban and the rural district governments as well as NGOs, businesses

along the production-supply-consumption chain of added-value and farmers. Apparently, there are no one-size fits all solutions or silver bullets, nor will top-down and linear approaches suffice as we deal with complex interdependent socio-economic, ecological and political systems. In the past and in other locations, such approaches have proven to be of limited use. Instead, we outline pathways structured along research and analysis activities, and proposed action. Obviously, there are overlaps indicating links between the various recommendations. We furthermore set preconditions for each recommendation to contextualise them and add the scale: a micro-level addresses individuals and small-scale interactions, the meso-level refers to the study of groups, whereas the macro-level examines the political-administrative environment and culture. Finally, we prioritise the recommendations.

Overview of Recommendations

1. Design an **Agro-ecological, Adaptive Pathway** for the entire Chennai metropolitan region
2. Establish **Agroecological Transformation Labs** in the Chennai Region
3. **Protection of farmland** and creating of perspectives for farmers through fair prices **as well as shift towards sustainable farming practices** as key of the resilience of a food system
4. **Conduct a Foodshed Study that** analyses the potential of a city region to feed itself
5. **Encourage better interdepartmental cooperation** in the city administration **and stronger cohesion of policies**
6. **Become involved with global networks on sustainable urban and peri-urban agriculture**
7. **Push for an organic and other non-conventional farming policy** on state level **and support for (direct) marketing**
8. **Increase consumer awareness and highlight health benefits**

Detailed recommendations

1. At the meta-level, we propose the design of an **agroecological adaptive development pathway** as sketched by IGCS's Pericene Research Project for the Chennai Metroregion (https://periurban.iitm.ac.in/project-pericene.html) to generate a synergistic vision for a longer term, visionary transformation process towards sustainable peri/urban agriculture and a more resilient food system (Mangnus et al. 2019). Building on the stakeholder mapping outlined before, this would entail the formation of a network of multiple and diverse stakeholders to investigate and assess the potentials, and propose a strategic approach by initiating a process for a possible 'Regional Food Council' as a platform for exchange, visioning (e.g. Food Strategy) and projects. In Chennai the level of urban farming activities is relatively low compared to other cities in Africa or Latin America. This should be the motivation to start a deeper engagement with the Chennai region food system. The institutionalisation of an entity dedicated to steer the food system with funding, staff and a mandate is important.
Concrete action: -How this platform is designed and especially how it relates to the institutional arrangement of the city (incl. a person in charge with clear mandate) has to be developed in a **series of workshops** using professional moderation with innovative group work tools and a clearly designed participatory framework. A **reach-out campaign** has to be done in time before the events, contacting all relevant stakeholders. -This structured process should ideally be managed by a **core group** drawn from the active stakeholders that is equipped with financial and institutional support for the work, materials etc. -Idenifying government/administrative partners for addressing food system transformation (Albi John, Vikram Kapoor, Sultan Ismail etc). -Think about a person for the coordination of this process, incl. funding and a legal structure for it (SVP?).
Scale: Macro
Type: Analytical/research
Precondition: Funding, openness of partners to cooperate, support of city representatives, committed core group members. Great opportunity for donors and the city institutions to support democratic participation and civil engagement.
Prioritisation: high

2. Establish **Agroecological Transformation Labs** in the Chennai Region. With the support of existing initiatives and stakeholders from government, civil society, and the business sector, we propose to set up a number of transdisciplinary real-world or living labs as spaces of learning and experimentation with potential innovative socio-technical solutions. Such spaces will allow to incubate, prototype and test novel approaches in demonstration

and lighthouse projects, supplemented by action research to ensure continuous feedback, improvement and adaptive changes. Successful techniques and approaches can then be upscaled, replicated and distributed, thus accelerating the transformative process (Laborgne et al. 2021). The first trasformation labs should be done in the city center, in peri-urban spaces and at the border of the city.
Concrete action: The creation of urban farming (*makkel thottams*) along the waterways of Chennai (commons/*Paromboke* land) involving urban poor women through the Womens' Development Cooperation shall be explored. This could become a comprehensive approach using Urban Employment Guarantee scheme/ National urban livelihoods program as a vehicle. These ideas need however, to be tested in action research settings (urban food lab). The already existing offer by Smart City (Cherubal) to set something up should be folllowed-up involving interested stakeholders. The M S Swaminathan Research Foundation (MSSRF) may be further consulted regarding their experience of the existing Nutri-Garden along the Buckingham canal. On a private property level, an exploration study regarding the use of available land (10% public use of sites plus rooftop) and the management for it should be conducted incl. the assessment of greywater use (see Hyderabad declaration). It should be assessed, whether trained external labour (through agencies) or domestic labour training for garden management is more feasible. A real-world-lab may be set up as well. The creation of an already envisaged peri-urban community garden and potentially food processing project in Perumbakkam, should be undertaken in a real world lab involving IGCS/IITM and IRCDUC. The development of a social enterprise (legal form to be defined) with own brand supplying fresh vegetable and processed goods could function as a showcase to other similar activities. Social dynamics and the set-up as well as marketing channels can be explored in the real-world-lab. The organic transformation and common marketing of a group of existing farmers in the area of Pandeshwaram should be undertaken in a real-world-lab approach. This can be a precedent for a improved income through better marketing and the valorisation of close farming structures to Chennai. Especially direct marketing (Community Supported Agriculture) should be explored. Peri-urban farmland can be protected if the farmers are linked to Chennai and their contribution is more visible. This includes proper communication.
Scale: Micro and Meso
Type: Action
Precondition: Funding application, identification of stakeholders, preliminary research,
Prioritisation: high

3. Protection of farmland and creating of a perspective for farmers through fair prices **and a shift towards sustainable production practices** is key to the resilience of a food system. Above all, existing agricultural land in and around Chennai should be protected better, saving it from conversion to development land. This measure will have multiple benefits even beyond just providing food for the city, but also as open land contributing to a) groundwater recharge, b) flood prevention/mitigation, c) maintenance and purpose of irrigation tanks, d) the micro climate, among others.
Concrete action: First, this can be achieved through the strengthening of the existing land protection committee (interview Selvam 2021) and new regulatory requirements directly at the registry level (interview Mohan, Vijay 2021). Second, urban and peri-urban farmers of Chennai should be supported to continue farming and to make the step towards this through market access, training and certification (Participatory guarantee systems are a group based process recognised by IFOAM; they are well suited to have low cost certification and to build networks of trust between farmers and consumers). Links to the real-world lab in Pandeshwaram should be made.
Scale: Meta
Type: Analytical/research
Precondition: Identification of researchers to undertake a study and follow up through a workshop with relevant authorities.
Prioritisation: medium

4. A Foodshed study analyses the potential of a city region to feed itself. A methodology by the German research institute ZALF exists in order to establish the data based on geographic, agrarian and consumer numbers. This aids policy makers in understanding regional resilience, potential food supply and food sovereignty of their region.
Concrete action: Arrange a suitable German or Indian Master Student to undertake a 3-4 months study for data collection and develop a Chennai region foodshed analysis. The ZALF are interested to cooperate in this endeavor. Funding could be requested from IGCS. Arrange a PhD scholarship in Cooperation with ZALF and IGCS and IITM to further develop the foodshed model to agroecological farming, urban and periurban farming as well as informal farming in Chennai region. A scholarship could be requested by DAAD. The German Justus Liebig University Giessen and the Albert Ludwig University Freiburg may be considered for such collaboration. The ZALF have already indicated their interest for such a cooperation.
Scale: Meta
Type: Analytical/research
Precondition: Cooperation with ZALF. Identification of research student to undertake the study.
Prioritisation: high

5. Encourage better interdepartmental cooperation in the city administration **and stronger cohesion of policies**. Woman Development Department, Skills Department, Chennai Metropolitan Development Authority (Land Use Zoning, Masterplan), Greater Chennai Corporation, Chennai Horticulture Department as well as Agriculture department, Koyambeedu Market Management Commitee, Food Corporation of India, Public distribution system, Warehousing corporation, Civil Supplies and public distribution department should cooperate along this transsectoral issue. Mindfullness should be addressed.
Concrete action: A detailed assessments of the power relations, the knowledge politics and the political economy of the Chennai food system is required to identify the leverage points. The responsibilities, potentials for cooperation and communication structures of the administration should be analysed and a workshop should be conducted communicating the results. A big criticism was the often plain technocratic approach to implementing useful policies. This leads to the recommendation that mindfullness training should be offered to the administration in order to understand the importance of their work. For governance integration and cohesive policy there is a need for a policy note. For policy implementation there should be a steady focus and no abrupt shifts.
Scale: Mesa and Meta
Type: Analytical/research
Precondition: Chennai Resilience Centre and Smart City should be involved in this action, since it was stipulated in the resilience strategy to foster stronger administrative cooperation.
Prioritisation: low/medium

6. Become involved with global networks on sustainable urban and peri-urban agriculture.
Concrete action: Get connected with RUAF, they offer services like City Region Food System Assessment, Policy Advice and Training. They have experience in India. There are also useful guidelines from RUAF (A menu of actions to shape urban food environments for improved nutrition (2019), and – together with FAO – a City Region Food System Toolkit (2017a). Other international organisations like IPES (What makes urban food policy happen? 2017) have inspiring guidelines as well. Consider a membership in the network of Asian Local Governments for Organic Agriculture (ALOGA) and ICLEI (cities for sustainability).

Scale: Mesa and Meta
Type: Analytical/research and action
Precondition: Sensitise the decision makers at city and state level administration to inform themselves regarding these options.
Prioritisation: medium

7. Push for an organic and other non-conventional farming policy on state level and support of (direct) marketing of organic/natural produce in Tamil Nadu. Co-create an ecosystem of support.
Concrete action: Develop a policy for organic agriculture, farmer empowerment and healthy traditional grains. Supporting direct marketing structures (markets, storage, logistics) like Community Supported Agriculture models through training, coordination and provision of spaces for pick up (combined with cultural events). Support the spread of Participatory Guarantee System (PGS) certification. Support more organic food into the public distribution system. Change subsidies towards traditional nutritious crops, healthy food. The cooperative model in the milk sector (Amul and Arvind) already collect from small farmers, this is a long-standing and largescale approach that should be explored for vegetables and fruits as well. A new scheme in Tamil Nadu enabling solar power generation on farmland for the grid has shown, that 20.000 Rs extra income for each farmer can be realised per year (interview 2021). These kinds of extra incomes should be explored further. An issue was that many farmers were not aware of these opportunities to cross-support their farming.
Scale: Mesa and Meta
Type: Analytical/research and action
Precondition: Sensitise the decision makers at city and state level administration to inform themselves regarding these options.
Prioritisation: medium/high

8. Increase consumer awareness, highlighting the health benefits.
Concrete action: Schools should provide food education. Start a consumer targeted media campaign for organic and healthy food. Support community gardening by providing spaces, training and instructions to set up household manure cooperations. Support the creation of urban food forests.
Scale: Mesa and Meta
Type: Analytical/research and action
Precondition: Sensitise the decision makers at city and state level administration to inform themselves regarding these options.
Prioritisation: medium

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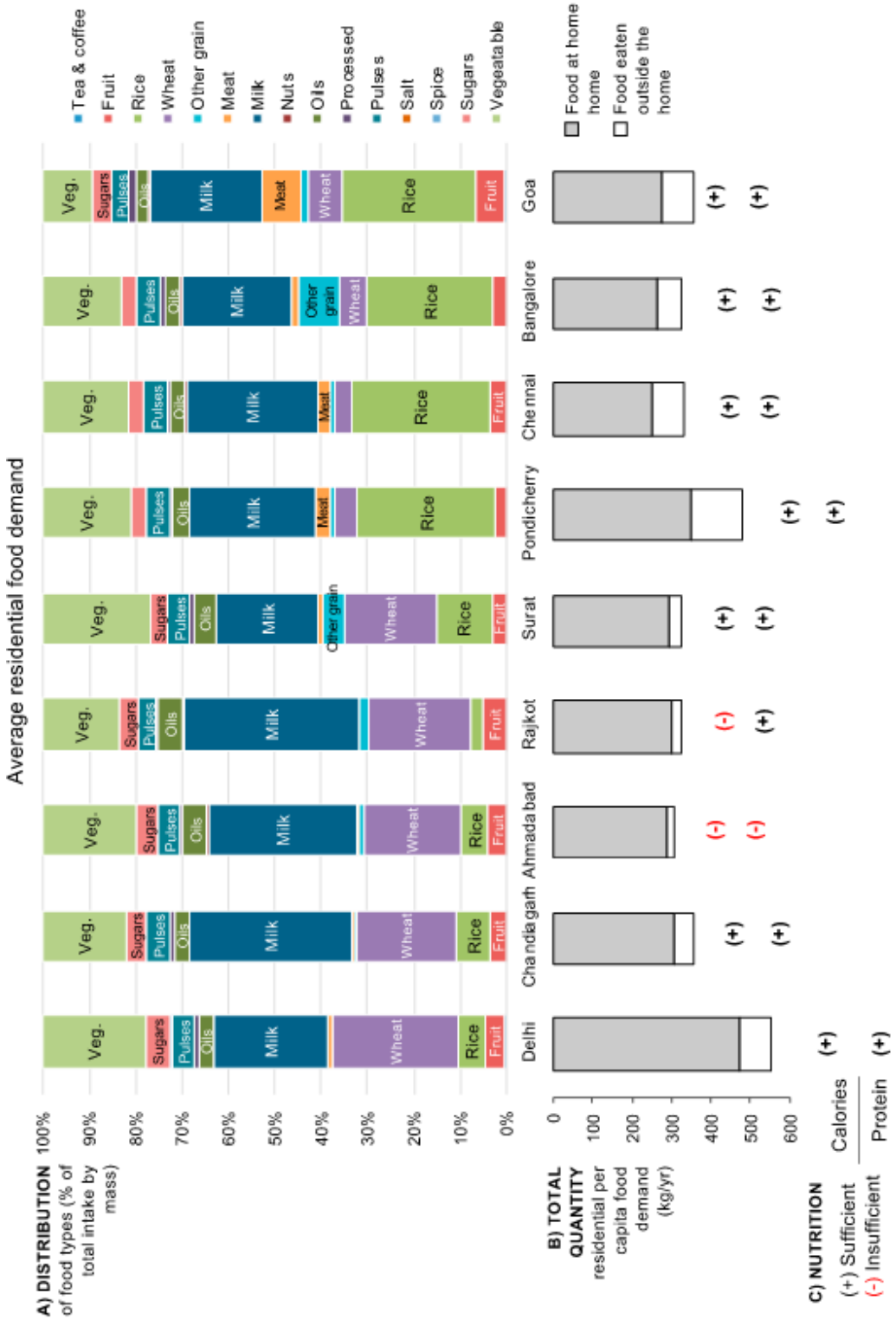
Annex

1 - Overview of Interviews conducted in Nov/Dec 2021

2 - Average residential food demand and food miles (Boyer et al. 2019)


Average residential food demand
A) DISTRIBUTION of food types (% of total intake by mass)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Veg.
Sugars
Pulses
Oils
Milk
Wheat
Rice
Fruit
Other grain
Meat
Tea & coffee
Nuts
Processed
Salt
Spice
B) TOTAL QUANTITY residential per capita food demand (kg/yr)
0
100
200
300
400
500
600
Food at home
Food eaten outside the home
Delhi
Chandigarh
Ahmadabad
Rajkot
Surat
Pondicherry
Chennai
Bangalore
Goa
(+)
(-)
C) NUTRITION
(+) Sufficient
(-) Insufficient
Calories
Protein