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Designing metropolitan food reserve portfolios for urban food resilience: A policy-design case from Surabaya, Indonesia

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Abstract

Urban food resilience is often treated as a question of agricultural production, staple stock availability, or emergency food aid. Such interpretations are useful but incomplete for dense metropolitan regions whose food security depends on household coping capacities, neighborhood retail systems, civic redistribution networks, market information, municipal logistics, and inter-regional procurement. This article develops a qualitative policy-design case study of Surabaya, Indonesia, to examine how metropolitan food reserves can be planned beyond conventional stockholding. Using a documentary archive consisting of a 2022 food-reserve focus group discussion report, presentation materials, coordination notes, food-station and food-bank models, local food-security mapping, and urban baseline records, the study codes stakeholder inputs by problem domain, actor mandate, reserve function, spatial scale, and implementation risk. The analysis shows that Surabaya's favorable food-security classification coexists with structural dependence on external supply, limited urban agricultural land, long market chains, food-quality concerns, storage and budget risks, and fragmented reserve governance. Rather than treating sustainable home-food garden areas, women's farmer groups, family welfare and empowerment groups, city food units, food banks, food stations/municipally owned food enterprises, and inter-regional procurement as separate alternatives, the article reconstructs them as a collaborative food reserve portfolio. The contribution is conceptual and policy-design oriented: it reframes urban food reserves as a multi-scalar governance architecture composed of material stocks, social provisioning, surplus redistribution, city-region logistics, rules, data, and emergency capacities. The model is best read as a pilotable planning framework, not as evidence of program impact, and is intended to help planners translate fragmented food-security instruments into coordinated, monitorable resilience functions.

Keywords: city-region food systems, collaborative governance, food reserves, metropolitan planning, urban food resilience

1. Introduction

Food has become a central urban planning question. The issue is not new: planning scholars have long argued that food systems shape land use, distribution infrastructure, public markets, neighbourhood access, waste flows and public health while remaining peripheral to the formal planning field (Pothukuchi & Kaufman, 2000; Satterthwaite et al., 2010; Battersby, 2013; Morgan, 2015). What has changed is the intensity with which food access is now exposed to climate disturbance, price volatility, logistical disruption, public-health emergencies, uneven purchasing power and metropolitan demand growth. Cities concentrate food demand and vulnerability, but they also concentrate institutions, retail networks, waste streams, social assistance mechanisms and public decision-making capacities. Urban food resilience therefore depends not only on food availability, but on how cities organise the conditions under which food remains accessible, affordable, safe and socially legitimate during disturbance (Ericksen, 2008).

In many metropolitan regions, food security is still interpreted through aggregate availability or the existence of public staple stocks. This interpretation is necessary but insufficient. A city may

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appear secure in a composite food-security map while still depending on external supply territories, long distribution chains, weak household purchasing power, poorly coordinated relief systems and avoidable food loss or waste. A sectoral view also produces a false choice among agricultural production, public procurement, food donation, urban farming, retail support and market monitoring. These instruments do not perform the same function. They operate at different spatial scales, involve different institutional carriers and address different kinds of vulnerability. The planning problem is therefore not simply how much food is stored, but how reserve capacity is distributed, activated and governed across households, neighbourhoods, markets, civic organisations and city-regional logistics.

This gap has two consequences for urban planning. First, food reserves are often treated as an emergency-management problem rather than as a spatial-institutional planning issue. Second, aggregate food-security indicators can conceal the uneven ways in which households experience food insecurity. A municipal stock may exist while some groups face weak access, poor information, low trust in distributed food, limited purchasing power or distance from reliable retail channels. Planning must therefore connect reserve capacity with the spatial organisation of markets, communities, storage, transport, digital information and public assistance (Cohen & Garrett, 2010).

The challenge is particularly visible in metropolitan cities of the Global South. These cities are neither self-sufficient food territories nor passive endpoints of national food chains. They are organised through wholesale markets, warehouses, informal retail, digital platforms, public agencies, social assistance, household coping practices and inter-regional procurement. Their food resilience depends on the ability of public, private and civic actors to absorb disturbance, adapt routines and preserve food entitlements under uncertainty (Béné, 2020; Tendall et al., 2015). Recent urban food governance scholarship has moved beyond food as a private consumption matter and has emphasised place, time, relations, diversity and power in the governance of urban food systems (Moragues-Faus et al., 2024).

Surabaya, Indonesia, offers an instrumental case for developing this argument. The documentary archive used in this study records that the city's 2024 food-security mapping classified all 154 urban villages, or kelurahan, as Priority 6, the most favourable local category (Dinas Ketahanan Pangan dan Pertanian Kota Surabaya, 2024). This indicates strong aggregate food-security performance. Yet the same archive describes a metropolitan dilemma: Surabaya is primarily a consuming city, its agricultural land is limited, and much of its food availability depends on producing regions outside the municipal boundary. This is not a contradiction. It is the precise urban planning paradox that aggregate indicators can hide: a city may be food secure in static classification while still requiring a reserve system capable of governing flows, access, price risk and emergency capacities across scales.

The Surabaya archive contains a 2022 focus group discussion (FGD) report, presentation and discussion materials, coordination notes, a food-station note, a food-bank-and-investment-system model, a document on community empowerment for food-reserve strengthening and local food-security mapping records. These materials document stakeholder problem statements from public procurement, market management, economic, cooperative, community and food-rescue actors. They also document proposed instruments such as urban farming, Sustainable Home-Food Garden Areas (KRPL), One Area One Product, household diversification, Women's Farmer Groups (KWT), Family Welfare and Empowerment groups (PKK), City Food Units (UPK), a food bank and a Food Station or municipally owned food enterprise (BUMD Pangan).

This article reconstructs that agenda as a collaborative food reserve portfolio. The term portfolio is used as an analytical concept, not merely as a metaphor. It refers to a multi-layered governance architecture that distributes reserve functions across different spatial scales, institutional carriers, temporalities and risk domains. Unlike conventional reserve models centred on commodity stockholding, the portfolio approach treats reserve capacity as a combination of material buffers, household provisioning, community retail mechanisms, surplus redistribution, market intelligence,

legal rules, financing mechanisms and emergency activation protocols. The research question is: how can a metropolitan food-reserve model be designed as an urban-regional planning portfolio rather than as a single stockholding programme?

The article contributes to urbanism and territorial planning in three ways. First, it reframes food reserves as a planning object composed of stocks, flows, rules, data and socio-institutional capacities. Second, it shows why urban farming, food donation, neighbourhood retail and Food Station mechanisms should be treated as differentiated resilience layers rather than as substitutes for city-region logistics. Third, it translates stakeholder-defined instruments into a pilotable planning architecture with implementation requirements and monitoring indicators. The contribution is analytical rather than impact-evaluative: the article does not claim that the proposed portfolio has already improved food security, but explains how a city can convert fragmented reserve ideas into a coherent, testable urban-regional strategy.

2. From Stockholding to Collaborative Reserve Portfolios

2.1. Urban Food Reserves as Spatial-Institutional Infrastructure

Urban food systems are infrastructures of everyday life, even when they are not formally recognised as infrastructure in statutory planning. Roads, wholesale markets, wet markets, warehouses, retailers, informal vendors, school food systems, social-assistance channels, kitchens, household storage, food banks and waste-recovery networks all mediate food access. Urban planning often regulates some of these spaces indirectly, while food as a system remains fragmented across agencies responsible for agriculture, trade, public works, health, social affairs, cooperatives, emergency response and environmental management. This fragmentation weakens the capacity of cities to anticipate food-related shocks and to link long-term planning with emergency response (Haysom, 2015; Moragues-Faus & Battersby, 2021; Candel, 2014; Sonnino, 2016).

Food-system resilience literature provides a broad but useful vocabulary for this problem. Resilience is not simply the ability to return to a pre-shock condition. In food systems, it refers to the capacity of actors, infrastructures and institutions to maintain sufficient, appropriate and accessible food over time while adapting to disturbance (Tendall et al., 2015). In metropolitan contexts, this capacity is multi-scalar: it includes household coping, neighbourhood access points, city-level price and stock monitoring, and regional supply-chain reliability. Urban planning matters because these capacities have spatial locations, institutional boundaries and resource requirements.

A resilience perspective also changes the meaning of reserve capacity. A reserve is not only a physical stock that waits for a crisis; it is a set of options that can be activated under different conditions. Some options are material, such as stored rice, alternative suppliers, household gardens or refrigerated redistribution. Others are institutional, such as procurement rules, donor agreements, budget procedures, monitoring dashboards and quality standards. Others are social, such as the capacity of women's groups, neighbourhood shops, NGOs and youth organisations to mobilise and coordinate. Urban planning can connect these options because it works at the intersection of space, institutions, infrastructure and public purpose.

2.2. City-Region Food Systems and the Limits of Municipal Self-Sufficiency

The city-region food system approach reinforces this view by treating the city and its surrounding production, distribution and ecological territories as one functional food system (FAO, 2023; Krähmer et al., 2024). From this perspective, the question is not whether a dense metropolitan city can become food self-sufficient within its administrative boundary. The more defensible question is how the city can build redundancy, diversity, equity and adaptability into flows that connect households, neighbourhood institutions, retailers, civic redistribution networks, municipal agencies and inter-regional suppliers.

This territorial interpretation is especially important when food planning is discussed in relation to reserves. A city-region reserve system cannot be reduced to whatever is located inside the city. It depends on procurement routes, supplier diversity, wholesale and retail nodes, market information, storage rotation and the ability to prioritise vulnerable residents when normal market access weakens. The portfolio model developed here therefore treats the administrative boundary as a governance boundary rather than as the boundary of the food system itself (Sonnino et al., 2019).

Urban agriculture must be positioned carefully within this architecture. It can improve food literacy, household coping, community participation and access to some fresh foods, especially when it uses home yards, hydroponics, aquaponics, verticulture and wall gardening. However, systematic reviews caution against overstating urban agriculture as a city-scale supply solution in low-income and land-constrained settings (Poulsen et al., 2015; Zezza & Tasciotti, 2010). Within a metropolitan reserve portfolio, urban farming is therefore best interpreted as a household and neighbourhood resilience layer, not as a substitute for logistics, procurement, warehousing or regional supply coordination.

2.3. Collaborative Governance and Portfolio Thinking

Food surplus redistribution raises a different planning issue. Food banks, food-rescue organizations and near-expiry food redistribution can reduce avoidable food waste while increasing emergency access, but they also require strict attention to safety, traceability, dignity and targeting (Lambie-Mumford, 2013; Papargyropoulou et al., 2014; Schneider, 2013; Tarasuk & Eakin, 2005). In planning terms, surplus redistribution is not merely charity. It is a governed flow of edible resources through donor agreements, sorting spaces, cold-chain decisions, transport routes, beneficiary identification and accountability rules (Mourad, 2016; United Nations Environment Programme, 2024).

Collaborative governance provides the institutional lens. Food resilience cannot be produced by a single agency because food systems connect procurement, markets, social welfare, small enterprises, women's groups, NGOs, hotels, restaurants, street vendors, supermarkets and regional suppliers (Horst, 2017; Vara-Sánchez et al., 2021). Collaborative governance theory emphasizes joint problem definition, shared rules, facilitative leadership, trust-building and iterative monitoring (Ansell & Gash, 2008; Emerson et al., 2012). The Surabaya case extends this logic to food-reserve strategy by asking how different reserve functions can be distributed across actors without pretending that mandate automatically equals capacity.

Portfolio thinking adds a stricter analytical layer to collaborative governance. Collaboration often becomes a general normative term, implying that actors should cooperate because cooperation is desirable. The portfolio approach asks a more demanding set of questions: which actor contributes which function, at which scale, under which rule, with which risk and which indicator? It prevents collaboration from becoming a loose list of stakeholders and prevents a single instrument from being overburdened with expectations (Luger et al., 2025; Manderbach et al., 2025). Refer to Table 1, four principles guide the reconstruction in this article: functional differentiation, scalar distribution, temporal layering and governance accountability.

Table 1 Analytical Principles of a Collaborative Food Reserve Portfolio

Principle	Analytical meaning	Implication for Surabaya
Functional differentiation	Reserve capacity is produced by different functions: provisioning, retail access, redistribution, logistics, information and rule-setting.	KRPL, UPK, food banks and Food Station/BUMD Pangan should not be ranked as substitutes; they should be assigned distinct reserve functions.
Scalar distribution	Reserve functions operate across household, neighbourhood, civic, market, municipal and city-regional scales.	Household gardens and women's groups support coping capacity, while Food Station and procurement mechanisms address city-region flows.

Principle	Analytical meaning	Implication for Surabaya
Temporal layering	Some capacities are routine, some are standby, and some are activated during disruption.	Food literacy and retail bookkeeping are continuous; donor networks and emergency distribution require activation protocols; warehousing and supplier contracts require long-term investment.
Governance accountability	Reserve capacity depends on rules, data, budgets, quality standards, monitoring and responsibility.	The portfolio requires legal clarity, food-safety SOPs, stock-rotation rules, beneficiary targeting and a monitoring dashboard.

Source: Authors' conceptual synthesis based on the documentary archive and urban food governance literature.

3. Methodology

3.1. Research Design and Case Logic

This study uses a qualitative policy-design case approach. It does not claim to be a transcript-based ethnography, survey or quantitative impact evaluation. Instead, it treats FGD reports, coordination notes and technical materials as a documentary archive that records how local actors understood the food-reserve problem and assembled candidate instruments. The analytical task is to reconstruct the implicit planning logic, make the evidence boundary transparent and convert the policy materials into a conceptually coherent urban-regional model (Chambers, 1994).

Surabaya is used as an instrumental case rather than as a statistically representative case. The city combines three features that matter for metropolitan food governance: favourable aggregate food-security classification, limited local production capacity and dependence on regional supply chains. These conditions are common in large cities whose food security depends on city-region flows. The case is valuable not because it proves that one model will work everywhere, but because it clarifies how reserve functions can be distributed across household, community, market, civic and municipal layers. The article therefore offers analytical generalisation rather than statistical generalization.

3.2. Documentary Sources and Evidence Boundary

The analysis draws on an expanded documentary archive supplied by the authors. The archive includes the main FGD report, presentation materials, meeting notes, written suggestions from the facilitation team, a food-station note, a food-bank-and-investment-system model, a document on empowerment for food-reserve strengthening and the local 2024 food-security mapping record. These materials are treated as empirical data rather than as bibliographic literature. Unpublished local institutional documents are therefore described as documentary sources but are not listed in the reference list. The scholarly framing is built from peer-reviewed journal articles and policy-planning literature on urban food governance, food-system resilience, participatory policy design, urban agriculture and food surplus redistribution (Table 2 details the documentary sources and their analytical use).

The study applies a conservative evidentiary strategy. It uses only information present in the supplied documents or in official secondary sources. It does not invent FGD participant numbers, verbatim quotations, survey results, production volumes, food-waste quantities, warehouse capacity, GIS measurements or financial estimates. Where the documents identify a need for such information, the article treats it as a baseline data requirement rather than as an existing finding. This protects the validity of the paper and prevents the policy model from being overstated.

To support international readability, Indonesian acronyms are retained only after functional translation. KRPL refers to Kawasan Rumah Pangan Lestari, rendered as Sustainable Home-Food Garden Areas; KWT refers to *Kelompok Wanita Tani*, rendered as Women's Farmer Groups; PKK

refers to *Pemberdayaan dan Kesejahteraan Keluarga*, rendered as Family Welfare and Empowerment groups; BUMD refers to Badan Usaha Milik Daerah, rendered as a municipally owned or regional-owned enterprise; UPK refers to Unit Pangan Kota, rendered as City Food Unit; PSPK refers to *Pusat Stabilisasi Pangan Kota*, rendered as Urban Food Stabilization Centre. Other local terms are translated by function: RT/RW as neighbourhood associations, PKL as informal street-food vendors, *toko kelontong* as neighbourhood grocery stores, *tabungan pangan* as food-savings accounts and *lumbung pangan* as community food barns or local food granaries.

Table 2 Documentary Sources and Analytical Use

Documentary source	Key information extracted	Analytical use
Main FGD report, 2022	Stakeholder list, proposed models, integrated collaborative food-reserve model and recommended pilot at urban-village scale.	Primary evidence for the original policy design and stakeholder-defined agenda.
FGD presentation and discussion materials, 2022	Reserve functions, strategic steps, participatory appraisal logic, stakeholder analysis, beneficiary assessment and model options.	Reconstruction of method logic and reserve-function categories.
Meeting suggestions, 21 September 2022	Empowerment of PKK/KWT; Food Station as BUMD Pangan; food bank sources from hotels, restaurants, informal vendors, events and near-expiry food.	Strengthening of implementation chronology and institutional design.
Food Station note, 2022	Distribution, sales, warehousing, warehouse receipt, retail services, transport, buffer stock, electronic trade and market information.	Clarification of city logistics and price-stabilisation functions.
Food Bank and Investment System model, 2022	PSPK, Garda Pangan, Bulog, unused food sources, neighbourhood grocery stores, food-savings accounts, processing and emergency distribution.	Clarification of surplus redistribution and community-retail layers.
Coordination notes, 2022	Limited public stock, risk of stored-rice deterioration, budget absorption issues, lack of warehouse, need for baseline data and vulnerability maps.	Identification of implementation risks and baseline data requirements.
Local food-security mapping and urban baseline records	Urban-village-level food-security classification, metropolitan food-system profile and contextual baseline.	Contextual updating and external validation of the case setting.

Source: Authors' reconstruction based on the documentary archive.

3.3. Coding Procedure and Analytical Reconstruction

The analysis proceeded through five steps. First, stakeholder statements and documentary entries were coded by actor and problem domain. Second, each proposed model was reclassified by its primary reserve function: production, diversification, retail saving, surplus redistribution, logistics, market information or governance. Third, the intervention scale of each model was identified as household, neighbourhood, market, civic, municipal or city-regional. Fourth, implementation risks were extracted from the coordination notes and written suggestions. Fifth, the resulting model was interpreted against the literature on food-system resilience, collaborative governance, urban food planning and participatory appraisal.

The coding was deductive-inductive. Deductive categories were derived from food-system resilience and collaborative governance literature, especially the distinction among stocks, flows, institutions, information and adaptive capacities. Inductive codes were generated from the documentary archive, including land limitation, rice dependence, surplus food, food-quality perception, retail saving, stock deterioration, warehouse absence, budget uncertainty and baseline-

data needs. According to Table 3, the final codebook was organized around five dimensions: problem domain, actor mandate, reserve function, spatial scale and implementation risk.

Because the archive does not contain full transcripts, the article does not report individual quotations or attribute personal views. Instead, it reconstructs institutional problem framings and planning functions. This evidence boundary is central to the validity of the article: the findings show how the documentary archive can be organized into a coherent policy-design model, not how individual participants experienced the FGD process.

Table 3 Coding Framework and Evidence-Trace Examples

Coding dimension	Guiding question	Example documentary signal	Analytical output
Problem domain	What vulnerability or constraint is identified?	Limited agricultural land; long market chains; stored-rice deterioration; weak baseline data.	Map of land, access, price, storage, budget, quality, waste and coordination concerns.
Actor mandate	Which institution or community actor is positioned to respond?	Bulog, market agency, economic affairs office, PKK/KWT, Garda Pangan, food-security authority and university facilitators.	Stakeholder-function matrix that distinguishes mandate from capacity.
Reserve function	What kind of reserve capacity does the instrument create?	KRPL as household provisioning; UPK as retail saving; food bank as surplus redistribution; Food Station as logistics and market information.	Classification into provisioning, diversification, retail access, redistribution, logistics and governance.
Spatial scale	Where does the mechanism operate?	Home yards and neighbourhood associations; local shops; city logistics; inter-regional suppliers.	Household, neighbourhood, market, civic, municipal and city-regional layers.
Implementation risk	What could prevent operationalisation?	Food-safety risk, unclear budget rules, warehouse absence, weak bookkeeping, unpaid women's labour, absence of vulnerability map.	Design requirements rather than solved problems.

Source: Authors' reconstruction based on the documentary archive.

3.4. Trustworthiness, Ethics and Permissions

Credibility was strengthened through triangulation across multiple internal documents, official municipal data and peer-reviewed literature. Dependability was addressed by using explicit coding dimensions rather than a loose narrative summary. Confirmability was addressed by distinguishing among documented stakeholder inputs, interpretive reconstruction and policy-design recommendations. Transferability was addressed by presenting Surabaya as a metropolitan case whose relevance lies in external supply dependence and multi-actor governance rather than in a unique local feature.

The documentary archive used in this study does not contain participant-level personal data and the article does not report identifiable individual statements. The analysis reports institutional roles and policy ideas rather than personal views. Because the archive includes unpublished institutional materials, the authors should retain written permission or institutional authorization for the use of these materials in scholarly publication and provide the relevant approval statement according to the target journal's requirements. If full transcripts, interviews or identifiable stakeholder data are added in later revisions, institutional ethics clearance, informed consent, anonymization and data-retention protocols should be reported explicitly.

The GIS component was used as spatial evidence rather than as decorative mapping. The FSVA composite map and the food-provisioning infrastructure map were read together to identify a planning paradox: all urban villages are classified as food secure at the composite level, but several neighbourhoods show weaker ratios of food-provisioning facilities relative to households. This spatial divergence supports the article's argument that reserve planning should move beyond aggregate food-security status and target differentiated household, neighbourhood, market and logistics functions.

Three rules governed this integration. First, quantitative indicators were used only where the source, unit and year were clear. Second, derived indicators, such as estimated rice demand, were explicitly labelled as estimates rather than official food-balance figures. Third, unavailable or incomplete variables, especially city-level warehouse capacity and farmer profit-loss accounts, were treated as data gaps and converted into monitoring requirements for the proposed reserve portfolio.

To address the risk that the documentary reconstruction could appear empirically thin, the revised analysis incorporated official secondary statistics as contextual triangulation. The additional data were used to strengthen the case logic, not to claim program impact. The sources included BPS agricultural statistics, Surabaya Food Security and Vulnerability Atlas (FSVA) maps, Satu Data Surabaya sectoral statistics, municipal price and cheap-market reports, Bulog/SPHP distribution information, and publicly available information on food-related enterprises.

3.5. Secondary Statistical and GIS Evidence

Where official city-level balances were unavailable, the article reports bounded proxy calculations rather than unsupported claims. The rice-demand and local rice-equivalent estimates are therefore presented as NBM-style approximations, while farmer profit-loss accounts, actor-level marketing margins, official commodity balances and facility-level warehouse registers are treated as baseline data requirements for future pilot implementation. This evidentiary boundary is retained throughout the results and discussion sections.

Secondary statistical and GIS-ready evidence was used to strengthen the case logic without changing the study into a quantitative impact evaluation. The analysis incorporated official data on population, rice consumption, paddy harvested area, productivity, paddy production, warehouse capacity, public stock, stabilization program, retail-price observations and sectoral food-system records. These sources were used to contextualize the documentary findings and to test whether the proposed reserve portfolio was consistent with Surabaya's status as a large consuming metropolis.

4. Results

4.1. A Favourable Food-Security Classification with Hidden Systemic Exposure

The first result is a food-security paradox. Surabaya's 2024 food-security mapping classified all 154 urban villages as Priority 6, the most favourable category in the local classification. This suggests strong aggregate performance. However, the FGD materials repeatedly describe Surabaya as a consuming city whose food availability is still obtained from food-producing regions. Resilience therefore cannot be inferred from aggregate classification alone. A city can be food secure in a composite mapping exercise while remaining exposed to inter-regional supply disruption, price volatility, retail bottlenecks and uneven household access.

The archive sharpens this paradox by documenting vulnerabilities that are not captured by a favourable aggregate category. Stakeholders identified shrinking agricultural land, long market chains, underused home yards, low diversification of local food products, limited public understanding of food quality and persistent dependence on rice. Coordination notes further identified limited public stock, possible deterioration of stored rice, weak budget absorption, lack

of warehouse capacity and the need for better baseline data. These points shift the analytical focus from how much food is stored to how reserve capacity is governed through planning institutions.

The distinction is important. The archive does not support an alarmist claim that Surabaya is generally food insecure. It does support a more precise claim: the city's reserve strategy must address vulnerabilities that are not visible in aggregate classification. The question is not whether Surabaya currently lacks food, but whether its reserve governance is robust enough to manage future disruption, price movement, quality concerns and unequal access (As outlined in Table 4).

Table 4 Documented Vulnerabilities and Reserve-Design İmplications

Documented issue	Evidence from the archive	Design implication
Limited local production base	Urban land is increasingly narrow and Surabaya depends on food-producing areas outside the city.	Urban agriculture should be treated as a household-resilience layer, not as a claim of city self-sufficiency.
Long market chain and price risk	Stakeholders noted potential price increases due to excessive market-chain length.	Food Station/BUMD Pangan should coordinate suppliers, market data, distribution and price responsiveness.
Food-quality and targeting concerns	Market actors noted public perceptions of poor-quality distributed rice and the need for better targeting.	Reserve governance needs quality assurance, communication and beneficiary targeting.
Storage and budget risk	Coordination notes mention limited stock, deteriorating stored rice, contingency-budget logic and lack of warehouse.	The reserve strategy needs stock rotation, procurement rules, legal clarity and financing design.
Avoidable surplus food	Food-bank materials identify hotels, restaurants, informal vendors, community events, supermarkets and near-expiry food as potential sources.	Surplus redistribution should be incorporated with food-safety SOPs, traceability and dignity-based targeting.
Missing baseline data	Coordination notes list needs for data on business actors, production capacity, land, enterprise types and vulnerability maps.	Pilot implementation must begin with baseline mapping before scaling.

Source: Authors' reconstruction based on the documentary archive.

4.2. Stakeholder Problem Framings and Governance Functions

The stakeholder materials show that the food-reserve issue was understood differently by different actor groups. Bulog, Indonesia's public logistics agency, emphasized shrinking agricultural land, coverage of vulnerable areas, non-rice alternatives, subsidised access and the risk of staple-stock deterioration. Market-management actors focused on public perceptions of rice quality, education about food suitability and accurate targeting. Economic and cooperative actors emphasized household production, diversification, price monitoring, warehousing, supply-chain shortening and local retail. Garda Pangan and related civic actors highlighted edible surplus, near-expiry food, platform-based redistribution, frozen-food potential and collaboration with youth organizations, small shops and community groups.

This diversity of problem framing is analytically valuable. Actors were not merely proposing separate projects; they were diagnosing different parts of the metropolitan food system. Procurement actors saw the risk of staple availability and subsidy. Market actors saw problems of trust, quality and targeting. Community actors saw household capacity and diversification. Civic food-rescue actors saw surplus and redistribution. Economic and cooperative actors saw retail, warehousing and local enterprise. A planning portfolio becomes necessary precisely because these diagnoses cannot be merged into one instrument without losing their functional specificity.

Written suggestions from the facilitation team added two institutional directions. First, PKK, KWT and households should be empowered to manage home yards and available agricultural land through KRPL, hydroponics, aquaponics, verticulture and wall gardening. Second, a Food Station should be developed as a municipally owned food enterprise to accommodate multiple food

sources, prioritize residents with access difficulties and function as a city food stabilizer. These suggestions do not provide a finished policy design; they identify complementary governance layers (Table 5).

Table 5 Stakeholder Framing, Portfolio Function and Risk if Isolated

Actor or actor group	Problem signal	Function in the portfolio	Risk if isolated
Bulog	Limited urban production, vulnerable residents, non-rice alternatives, subsidised food and staple-stock deterioration.	Buffer-stock interface, public procurement support and staple-price stabilisation.	System remains staple-centred and may neglect fresh food, household behaviour and stock-rotation risk.
Market-management actors	Perceived low quality of distributed rice, need for education and accurate targeting.	Quality communication, market monitoring and retail-channel coordination.	Assistance may fail if households do not trust product quality or targeting.
Municipal economic affairs actors	Household reserve through home yards or hydroponics, diversification, price and distribution monitoring, cooperation with producing areas.	City-region supply coordination and household provisioning agenda.	Household initiatives may be disconnected from market and logistics systems.
Cooperative and MSME actors	Price and stock monitoring, warehouse monitoring, local granaries and difficult agreements between shops and farmers.	Community enterprise, retail saving, processing and market-linkage support.	Local initiatives may fail without bookkeeping, contracts and accountability.
PKK, KWT and households	Home-yard food gardens, KRPL, local processing, food literacy and women's roles in household food management.	Micro-production, diversification, processing and household resilience.	Risk of romanticising unpaid domestic and women's labour.
Garda Pangan and civic actors	Edible surplus from cafés, restaurants, hotels, informal vendors, community events, supermarkets and near-expiry products.	Food bank, surplus rescue, emergency redistribution and platform coordination.	Food-safety and dignity risks if redistribution is not governed.
University facilitators and municipal food-security authority	Technical design, facilitation, pilot strategy and updated potential mapping.	Knowledge brokerage, evaluation and governance facilitation.	Model may remain a report unless converted into a pilot with measurable indicators.

Source: Authors' reconstruction based on the documentary archive.

4.3. Alternative Instruments as Differentiated Reserve Functions

Based on Table 6, the original materials presented several models: urban farming through KRPL, One Area One Product, household diversification, KWT-led strengthening, UPK, food bank and Food Station. A weak interpretation would ask which model is best. The stronger interpretation is functional. Each instrument creates a different type of reserve capacity and operates at a different scale. The strategic task is therefore not model selection in isolation, but portfolio assembly.

The archive provides several important details. The City Food Unit (UPK) is not simply a shop; it is a neighbourhood retail-saving mechanism in which small shops record food savings associated with transactions. The food bank model is not only charity; it links unused food sources, near-expiry products, processing, rapid distribution, neighbourhood grocery stores and the Urban Food Stabilization Centre. The Food Station is not merely a warehouse; the food-station note describes distribution, sales, warehousing, warehouse receipts, retail services, transportation, buffer stock, electronic food trade, quality standardization and market information.

These details show why a standard food-security program would be too narrow. UPK introduces a micro-financial and retail dimension. Food bank arrangements introduce circularity and

emergency redistribution. Food Station/BUMD Pangan introduces logistics, market intelligence and procurement. KRPL and women- and family-welfare group activities introduce household production, literacy and social organization. The policy challenge is therefore not a shortage of ideas, but the absence of an organizing framework that clarifies complementarities, responsibilities and thresholds for implementation.

Table 6 Functional Appraisal of Food-Reserve Instruments

Instrument	Primary reserve function	Main strength	Main limitation or risk
Urban farming / KRPL	Household micro-production and food literacy.	Builds coping capacity, fresh-food access and participation through home yards, hydroponics, aquaponics, verticulture and wall gardening.	Scale is limited; it cannot replace regional supply.
One Area One Product at neighbourhood scale	Neighbourhood commodity organisation and local diversity.	Can organise diverse commodities across neighbourhoods if adapted from rural OAOP logic.	Weak if treated as a city reserve strategy by itself.
Food diversification	Reduced dependence on rice and broader consumption practices.	Supports stability when rice prices rise and links food security with behaviour change.	Requires sustained education, acceptance and household-level adoption.
KWT/PKK processing and local food store	Women's group-led processing, seedling support and value addition.	Converts home-yard output and local potential into household income and processed products.	May burden women unless incentives, market links and labour recognition are provided.
City Food Unit (UPK)	Community retail saving and affordability support.	Connects local shops, bookkeeping and food saving for periods of scarcity or price increase.	Requires transparent accounting, trust and oversight.
Food bank / PSPK	Emergency redistribution of edible surplus and near-expiry food.	Reduces avoidable food waste while reaching access-constrained households rapidly.	Requires food-safety SOPs, traceability, dignity and targeting protocols.
Food Station / BUMD Pangan	City logistics, procurement, storage, market information and price stabilisation.	Can coordinate inter-regional suppliers, online food markets, quality standards and buffer-stock functions.	Capital-intensive and legally complex; needs procurement, warehousing and governance clarity.

Source: Authors' reconstruction based on the documentary archive.

4.4. Reconstructed Collaborative Food Reserve Portfolio

The reconstructed model is the collaborative food reserve portfolio. It has four operational layers and one governance core. The household reserve layer includes KRPL, KWT/PKK action, hydroponics, aquaponics, verticulture and wall gardening. The community and retail layer includes food diversification, KWT/PKK processing, local food shops and UPK saving. The surplus redistribution layer includes food-bank-style collection from hotels, restaurants, informal vendors, supermarkets, minimarkets and community events, supported by Garda Pangan, youth groups, PKK, KWT and other civic actors. The city logistics layer includes Food Station/BUMD Pangan, inter-regional supply coordination, warehousing, procurement, online markets and price information. The governance core links these layers through baseline mapping, rules, budgets, monitoring and evaluation.

The model's central insight is that resilience requires alignment across layers. Household gardens may increase coping capacity, but they need seedling support, knowledge, group organization and links to food literacy. KWT/PKK processing can add value, but products require

quality standards, packaging, retail access and MSME support. Food banks can redistribute edible surplus, but they need safety protocols, donor agreements and beneficiary targeting rules. Food Station/BUMD Pangan can stabilize flows, but it needs supplier contracts, warehouse strategy, data and financing. The portfolio therefore treats collaboration not as a slogan but as an operational strategic architecture (Table 7).

This architecture also clarifies the temporal dimension of resilience. Some functions are continuous, such as household food literacy, garden maintenance, retail bookkeeping and price monitoring. Others are episodic, such as emergency distribution or rapid activation of donor networks. Others require long-term investment, such as warehousing, supplier contracts, information platforms and institutional mandates. Planning failure occurs when these temporalities are confused: for example, when a training activity is treated as a permanent reserve, or when a warehouse is created without stock-rotation rules and demand information (Figure 1).

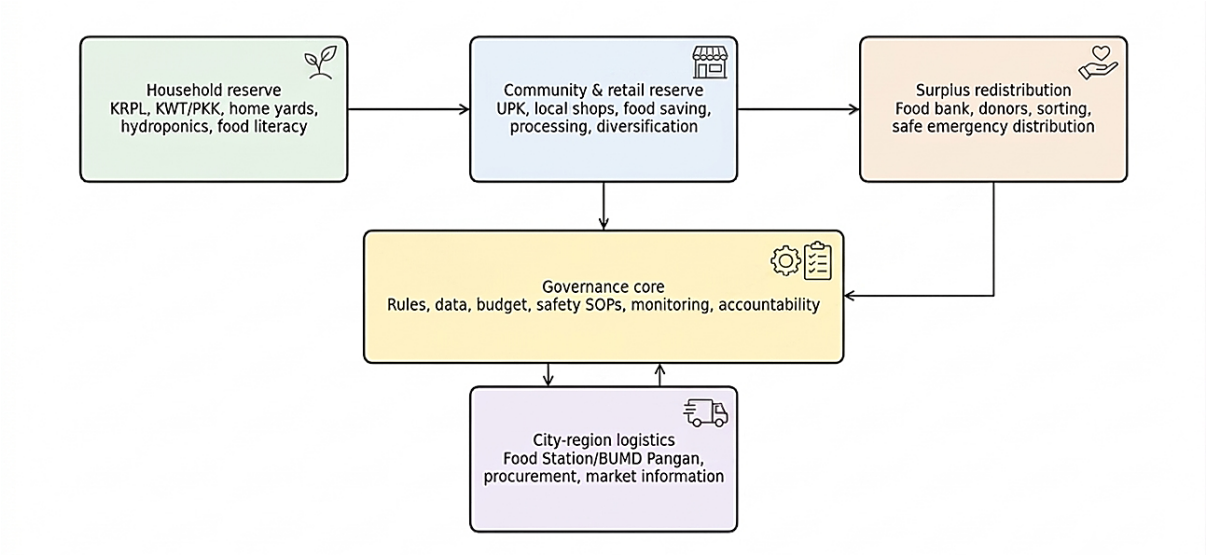

Figure 1 Collaborative food reserve portfolio for metropolitan food resilience

Source: Authors' elaboration based on the documentary archive.

Table 7 Architecture of the Collaborative Food Reserve Portfolio

Layer	Main actors	Core mechanisms	Indicators for pilot monitoring
Household reserve	KWT, PKK, households, extension officers and municipal facilitators.	KRPL, seed support, hydroponics, aquaponics, verticulture, wall gardening and food-literacy training.	Active households; garden continuity; small-produce volume; household dietary diversity.
Community and retail reserve	PKK, KWT, MSME/UMKM agency, neighbourhood grocery stores and local enterprises.	Food diversification, KRPL processing, local product development, UPK food-saving and local shop bookkeeping.	Number of products; food-saving accounts; sales value; transparent bookkeeping; non-rice consumption.
Surplus redistribution	Garda Pangan, hotels, restaurants, informal vendors, supermarkets, minimarkets, youth groups, PKK/KWT and social agencies.	Collection of edible surplus and near-expiry food, sorting, processing, rapid distribution and beneficiary targeting.	Safe food volume; donors registered; beneficiaries reached; compliance with food-safety SOPs.
City logistics and market information	Municipal food authority, Food Station/BUMD Pangan, procurement actor, market agency, cooperative/MSME agency, regional suppliers and retailers.	Procurement, warehousing, stock rotation, supplier coordination, online market, price information and quality standards.	Stock days; supplier diversity; price responsiveness; warehouse use; procurement transparency.

Layer	Main actors	Core mechanisms	Indicators for pilot monitoring
Governance core	Municipal task force, university facilitation team, relevant agencies and community representatives.	Baseline mapping, legal rules, budget design, data dashboard, participatory monitoring and periodic evaluation.	Updated food-provider database; vulnerability map; meeting frequency; decision log; budget realisation.

Source: Authors' reconstruction based on the documentary archive.

4.5. Quantitative Food-Balance, Stock, Market and GIS Evidence

The strengthened secondary evidence turns the Surabaya case from a purely documentary policy-design reconstruction into a data-anchored reserve-planning case. BPS recorded Surabaya's 2024 paddy harvested area at 1,321.75 ha, productivity at 55.54 quintals/ha and paddy production at 7,340.42 ton of dry unhusked paddy (GKG) (Badan Pusat Statistik Provinsi Jawa Timur, 2025). Using the BPS 2024 rice-consumption entry for Kota Surabaya of approximately 1.413 kg/capita/week (Badan Pusat Statistik, 2026) and the 2024 registered population of 3,018,022 people (Badan Pusat Statistik Kota Surabaya, 2025), annual household rice demand can be approximated at 221,752 ton. Applying a conservative NBM-style conversion to local paddy output--deducting 7.3% for seed, feed, non-food use and loss and then applying a 64.02% GKG-to-rice conversion--local rice-equivalent output is only about 4,356 ton. This proxy balance suggests that local rice production covers roughly 2.0% of estimated household rice consumption, leaving an indicative supply gap of about 217,396 ton that must be met through inter-regional flows.

The stock and warehouse evidence reinforces the same argument. The National Food Agency reported that *Perum Bulog* Surabaya had warehouse capacity of 200,000 ton, with 25,582 ton of rice in stock for Cadangan Beras Pemerintah (CBP), SPHP and food assistance as of 15 October 2024 (Badan Pangan Nasional, 2024a, 2024b, 2024c). SPHP realization through Bulog Kanca Surabaya reached 15,853 ton, including 6,460 ton for Kota Surabaya. By May 2026, the Ministry of Agriculture reported that Bulog had rented two additional warehouses at Romokalisari II with combined capacity of 8,000 ton (Kementerian Pertanian Republik Indonesia, 2026), already filled with 7,610 ton of rice; the same report stated that the earlier 200,000-tonne Surabaya capacity had been reported full. These figures show why reserve planning cannot treat warehouse capacity as a static number. Capacity, utilization, stock age, ownership status and location must be recorded as time-stamped GIS attributes.

The farmer-profit and market-margin evidence must be handled more cautiously. No official open Surabaya dataset was found that reports per-hectare profit-loss accounts for paddy farmers or actor-disaggregated marketing margins from farmer, collector, miller, wholesaler and retailer. The manuscript therefore uses only bounded proxy calculations. With 2024 productivity of 5,554 kg GKG/ha and the 2024 HPP for GKG at the milling level of Rp7,300/kg (Badan Pangan Nasional, 2024d; Badan Pemeriksa Keuangan Republik Indonesia, 2024), the gross paddy value is approximately Rp40.54 million/ha before production costs. This is not farmer profit. Net profit-loss can only be calculated after observing seed, fertilizer, pesticide, labor, machinery, irrigation, land rent, post-harvest, transport, credit and marketing costs. Similarly, the policy price spread between the HPP rice price at Bulog warehouse and retail/HET prices can show the stabilization corridor, but it cannot replace a complete margin study. The 2024 HET for medium rice in Java was Rp12,500/kg, while NFA observations at Pasar Nambangan Surabaya recorded medium rice around Rp12,100-Rp12,200/kg and premium rice below Rp15,000/kg. Against the HPP rice-at-Bulog-warehouse benchmark of Rp11,000/kg, this indicates a rough warehouse-to-retail policy spread of Rp1,100-Rp1,500/kg for medium rice, not a decomposed marketing margin.

The NBM and GIS evidence also need explicit boundary control. Public sources confirm that NBM is the appropriate framework for measuring food availability, utilization and per-capita availability, and that regional NBM can use national conversion coefficients when local coefficients are

unavailable. However, an official, complete Surabaya NBM table with commodity-by-commodity supply, use and per-capita availability was not publicly accessible during this revision. The article therefore reports a rice-only NBM-style proxy while identifying the official Surabaya NBM as a necessary data input before pilot implementation. Satu Data Surabaya and sectoral statistical reports already provide GIS-ready production, harvested-area, irrigation and food-system datasets, including 2023 paddy harvested area of 1,090.74 ha and paddy production of 7,150.76 ton in the municipal sectoral statistics (Satu Data Surabaya, 2024a, 2024b, 2026). These datasets should be geocoded by *kecamatan*/urban-village and linked with warehouse, market, food-bank, donor and vulnerable-household layers (Table 8).

Table 8 Quantitative Evidence Matrix for Strengthening the Surabaya Reserve-Portfolio Case

Indicator domain	Evidence added to case	Implication for reserve-portfolio design	Source basis
Population and rice demand	Registered population in 2024: 3,018,022 people. BPS rice-consumption entry for Kota Surabaya: approximately 1.413 kg/capita/week. Estimated annual household rice demand: about 221,752 tonnes.	The reserve system must be designed for a large consuming metropolis, not for a self-sufficient production territory.	BPS Kota Surabaya; BPS consumption table; authors' calculation
Local paddy supply and rice equivalent	2024 paddy harvested area: 1,321.75 ha; productivity: 55.54 quintals/ha; production: 7,340.42 tonnes GKG. NBM-style rice-equivalent output after deductions and conversion: about 4,356 tonnes.	Local paddy production can support only a small share of rice consumption; urban agriculture cannot substitute for inter-regional supply coordination.	BPS Jawa Timur; NBM conversion guidance; authors' calculation
Rice demand-supply proxy	Estimated household rice demand: 221,752 tonnes/year; local rice-equivalent output: 4,356 tonnes/year; indicative gap: 217,396 tonnes/year; local cover ratio: about 2.0%.	Food Station/BUMD Pangan, supplier contracts, market intelligence and emergency procurement are central rather than optional.	Authors' NBM-style proxy calculation
Warehouse capacity and public stock	Bulog Surabaya warehouse capacity was reported at 200,000 tonnes; stock on 15 Oct 2024 was 25,582 tonnes of rice. SPHP realisation by Bulog Kanca Surabaya was 15,853 tonnes, including 6,460 tonnes for Kota Surabaya.	The city already uses stabilisation channels, but these need to be linked with stock-age, capacity and location monitoring.	National Food Agency/Bulog, 2024
Location-specific warehouse evidence	In May 2026, two rented Romokalisari II warehouses had combined capacity of 8,000 tonnes and were filled with 7,610 tonnes; each rented warehouse was reported at 4,000 tonnes. A complete public, location-by-location Bulog warehouse register for Surabaya was not found.	The pilot should request official facility-level data: warehouse name, address/coordinates, ownership/rental status, capacity, utilisation, commodity, stock age and quality status.	Ministry of Agriculture, 2026; data-gap control
Farmer gross value and profit-loss boundary	Using productivity of 5,554 kg GKG/ha and HPP GKG at mill of Rp7,300/kg, gross paddy value is approximately Rp40.54 million/ha before costs. No official Surabaya farm profit-loss account was found.	The paper should not claim farmer profit or loss. A farm-enterprise baseline survey is required before evaluating welfare effects.	BPS Jawa Timur; Perbadan 4/2024; authors' calculation

Indicator domain	Evidence added to case	Implication for reserve-portfolio design	Source basis
Market-margin proxy	HPP rice at Bulog warehouse: Rp11,000/kg. 2024 HET medium rice for Java: Rp12,500/kg. NFA observed medium rice at Pasar Nambangan Surabaya at about Rp12,100-Rp12,200/kg. Proxy warehouse-to-retail policy spread: roughly Rp1,100-Rp1,500/kg.	The spread indicates the policy stabilisation corridor but not a complete margin by actor. A market-chain survey is still required.	Perbadan 4/2024; NFA HET and market observation
GIS-ready production and land data	Satu Data Surabaya and sectoral reports provide paddy harvested area, production, irrigation and food-system datasets, including 2023 paddy harvested area of 1,090.74 ha and paddy production of 7,150.76 tonnes.	A GIS reserve dashboard should overlay production nodes, market nodes, warehouses, donor sources, vulnerable households and distribution routes.	Satu Data Surabaya; DKPP sectoral statistics
Official NBM demand-supply gap	Official Surabaya NBM tables were not publicly accessible during revision, although NBM is the proper framework for commodity availability, use and per-capita availability.	The manuscript uses a rice-only NBM-style proxy and identifies the official NBM as a mandatory pre-pilot dataset.	NBM guidance; DKPP data-function evidence; evidence-gap control

Source: Authors' synthesis from BPS, DKPP Kota Surabaya, Satu Data Surabaya, National Food Agency/Bulog, Ministry of Agriculture, BPK/JDIH regulatory records and authors' calculations. Demand, local rice-equivalent output, gross paddy value and price-spread values are transparent proxies; they should be replaced by official Surabaya NBM, farm enterprise budgets and actor-level market-margin data when those datasets are obtained.

For future implementation, the Food Station/BUMD Pangan layer should therefore maintain a GIS-linked dashboard with at least twelve fields: commodity stock by warehouse and date, warehouse capacity and utilization, stock age and quality status, supplier origin, procurement price, wholesale price, retail price, household vulnerability, food-retail density, donor and food-bank sources, local production nodes and emergency distribution routes. The dashboard should distinguish verified administrative data from proxy estimates so that reserve decisions remain auditable.

This evidence matrix strengthens the article but also clarifies the remaining evidence boundary. The data now substantiate Surabaya's local-production deficit, external-supply dependence, stock-distribution scale and warehouse-capacity dynamics. At the same time, the requested variables that remain incomplete in public sources--farm profit-loss, complete actor-level marketing margins, location-by-location official warehouse capacity and complete Surabaya NBM demand-supply balances--are converted into a mandatory baseline package for the pilot, rather than being hidden or replaced by unsupported claims.

5. Discussion

5.1. Theoretical Contribution: Reserves as Urban-Regional Governance Architecture

The Surabaya case supports a shift from reserve stock to reserve strategy. In conventional policy language, reserves are often associated with stored staple commodities. This remains important, especially for rice. However, the Surabaya archive shows that the practical vulnerabilities of a metropolitan food system are wider: limited land, price instability, long supply chains, household access, weak diversification, quality perception, surplus food, budget rules, warehousing and data gaps. A reserve system that responds only by holding staple stock would address only part of the problem. Urban food reserves should therefore be understood as an institutional-spatial system linking emergency readiness with everyday access.

This argument adds to urban food governance literature by making reserve capacity operational. Much resilience literature remains conceptual, while much urban food policy literature focuses on councils, networks or strategies. The Surabaya case sits between these discussions. It asks how a city can translate broad resilience principles into a sequence of instruments that can be piloted at urban-village scale. The result is not a universal recipe but an operational grammar: identify the vulnerability, locate the spatial scale, assign a reserve function, define the actor configuration, specify the operational risk and select a monitoring indicator.

The portfolio concept is the main theoretical contribution. Its value lies in four moves. First, it differentiates reserve functions instead of treating all food-security instruments as equivalent. Second, it distributes these functions across household, neighbourhood, civic, municipal and city-region scales. Third, it recognizes that routine, standby and emergency capacities require different rules and investments. Fourth, it makes accountability central through data, safety protocols, budgets, legal mandates and monitoring. These moves transform food reserves from a commodity-stock question into a governance architecture.

5.2. Urban Agriculture, Food Banks and Food Station as Complementary Layers

A key implication is the careful positioning of urban agriculture. The archive rightly places KRPL, KWT, PKK and home-yard food production at the centre of household resilience. These activities can increase food literacy, fresh-food access, social participation and productive use of limited household space. However, a strong urban-planning argument must avoid the self-sufficiency illusion. Urban agriculture in a dense, externally dependent city cannot secure metropolitan food availability by itself. Its value lies in household-level and neighbourhood-level resilience, not in replacing city-regional supply chains.

A second implication is the differentiation among Food Station, food bank and UPK. These three instruments are often discussed separately or rhetorically merged under food-security programming. In the Surabaya portfolio, they perform different forms of access governance. The food bank responds to avoidable surplus and immediate access constraints. The Food Station responds to city logistics, market information, procurement and price stabilisation. UPK responds to household affordability and community retail through food-saving mechanisms. Their complementarity clarifies why a portfolio is preferable to a single model.

The portfolio also exposes implementation risks that should not be hidden. Food banks can improve emergency redistribution, but they must not become unsafe or undignified charity. Food Stations can stabilize supply, but they may become capital-heavy institutions without clear procurement and stock-rotation rules. UPK can increase affordability, but it depends on trustworthy bookkeeping and shop-level accountability. Women's groups can strengthen household resilience, but they should not be treated as an invisible labor reserve. A serious planning model must therefore include protocols, incentives, data systems and monitoring indicators.

5.3. City-Region Planning and Policy Transfer

The city-region dimension is especially important. Surabaya's reserve problem cannot be solved within the administrative boundary of the city. Food Station/BUMD Pangan is strongest when interpreted as a mechanism for organising regional supply, supplier diversity, quality standards, price information and emergency procurement. This makes the model relevant to urban and regional planning: food resilience is produced through the link among household practices, neighbourhood institutions, city logistics and regional production networks. A Food Station without city-region supplier coordination is only a facility; a food bank without neighbourhood targeting and safety rules is only charity; KRPL without links to retail, processing and dietary change is only a garden programme.

For policy transfer, the portfolio should be read as a design logic rather than as a fixed institutional recipe. Other metropolitan cities may not have the same organisations, food-rescue networks or community structures, but they can still use the same diagnostic sequence: identify

the food-system vulnerability, locate the spatial scale, assign a reserve function, define the actor configuration, specify the operational risk and select a monitoring indicator. This is the broader planning value of the Surabaya case. It transforms a local FGD archive into a generalisable way of thinking about metropolitan food reserves without detaching the model from its empirical origin.

5.4. Implementation Roadmap Before Scaling

The coordination notes make clear that implementation should not begin with a city-wide launch. Several prerequisites are unresolved. The city needs data on agricultural, fisheries and livestock business actors, their production capacity, enterprise types, remaining agricultural land and food-vulnerability mapping. It also needs clarity on how contingency budgets can be translated into reserve operations, whether warehouses are required, how stored staples will be rotated before quality deteriorates and what legal relationships govern the use of municipal or former village land for community food programmes.

The Food Station/BUMD Pangan planning document also requires institutional realism. A municipal food enterprise may stabilise prices and organise suppliers, but only if its mandate is clear: whether it will buy, store, distribute, provide market information, run online retail, support MSME products, manage quality standards or coordinate emergency reserves. Without such clarity, the Food Station risks becoming an expensive warehouse or an underused online platform. Similarly, the food bank layer must be governed through food-safety SOPs, donor agreements, cold-chain considerations and dignity-based beneficiary targeting.

The recommended sequence begins with baseline and institutional design, moves to an urban-village pilot, then consolidates linkages with Food Station/BUMD Pangan and MSME support (Pemerintah Kota Surabaya, 2024a, 2024b, 2024c) before any city-wide scaling (Table 9). This staged approach is consistent with the article's conservative evidence boundary. The model is not yet an impact evaluation. It is a strategic proposition that should be tested through participation, safety, affordability, stock rotation, data updating and equitable access indicators.

Table 9 Pilot Roadmap and Monitoring Indicators

Phase	Priority action	Decision gate	Core indicators
0-6 months: baseline and institutional design	Create food-resilience task force; map KRPL/KWT/PKK, markets, retailers, donors, vulnerable households, business actors, land and production capacity.	Pilot urban village selected and institutional roles agreed.	Baseline food-diversity data; food-provider database; vulnerability map; donor list; legal and budget notes.
6-18 months: urban-village pilot	Implement KRPL support, diversification training, UPK bookkeeping, donor registration, food-safety SOPs and limited Food Station linkage.	Evidence of participation, safe handling, transparent accounting and data use.	Active households; food-saving accounts; safe food redistributed; beneficiaries reached; price-monitoring entries.
18-36 months: consolidation	Connect pilots to BUMD/Food Station functions, MSME support, supplier coordination, market information and periodic monitoring.	Functions continue beyond training events and are financially traceable.	Supplier diversity; stock rotation; enterprise sales; reduced avoidable food waste; budget realisation.
Beyond 36 months: scale-up	Institutionalise financing, dashboard reporting, legal agreements, inter-regional procurement and participatory evaluation.	Model embedded in municipal planning and budget cycles.	Stock days; affordability index; dashboard updating frequency; equity of access; audit results.

Source: Authors' reconstruction based on the documentary archive.

6. Limitations and Future Research

This study has five limitations. First, the documentary archive does not provide full FGD transcripts, participant-level data or verbatim quotations, so the analysis reconstructs institutional problem framings rather than individual narratives. Second, although the revision adds production, consumption, stock, warehouse and GIS-ready secondary data, several variables requested for a full economic reserve assessment remain unavailable in open public sources: official Surabaya NBM commodity balances, location-by-location warehouse capacity and utilisation, farmer profit-loss accounts and complete actor-level market margins. Third, the rice-balance, gross paddy value and price-spread figures are transparent proxies, not substitutes for official NBM, farm-enterprise budgets or marketing-margin surveys. Fourth, the spatial dimension is still partly conceptual because the manuscript does not yet include a geocoded GIS layer of markets, warehouses, donor sources, supplier corridors and vulnerable households. Fifth, the use of unpublished institutional materials requires careful documentation of institutional permission before journal submission.

Future research should therefore proceed in two stages. The first stage should compile a baseline dataset from DKPP, Bulog Kanca Surabaya, BPS, Satu Data Surabaya, market authorities and food-bank actors, covering commodity stock, warehouse coordinates and capacity, farm enterprise budgets, market-chain margins, official NBM tables, food-waste flows and vulnerable-household locations. The second stage should test the portfolio through mixed methods: spatial food-access mapping, Delphi or analytic hierarchy process prioritization, pilot evaluation of KRPL-UPK-food-bank-Food Station linkages, cost-benefit analysis under disruption scenarios and governance research on accountability when a Food Station/BUMD Pangan operates across procurement, market stabilization and commercial retail functions.

7. Conclusions

This article has reconstructed a Surabaya FGD-based planning archive into a collaborative food reserve portfolio for metropolitan food resilience. The central argument is that urban food reserves should not be reduced to stored staple commodities. In a dense and externally dependent city, reserve capacity also includes household provisioning, community diversification, local retail saving, surplus-food redistribution, city logistics, regional supplier coordination, food-safety protocols, data systems and financing rules. These capacities must be planned as complementary layers rather than as competing alternatives.

The documentary archive sharpens the model in three ways. First, it shows that the Food Station idea was intended not merely as a storehouse but as a possible municipally owned food enterprise and stabilisation instrument. Second, it shows that food-bank functions can draw on underused food sources from restaurants, hotels, small vendors, supermarkets, minimarkets and social events, provided safety and dignity are protected. Third, it shows that implementation requires a stronger baseline: data on business actors, production capacity, land, vulnerability, potential donors, legal arrangements and budget mechanisms.

The final model should therefore be piloted rather than immediately scaled city-wide. An urban-village pilot can test whether KRPL initiatives, KWT initiatives, UPK food-saving, food-bank redistribution and Food Station linkages can operate together under one monitoring framework. If the pilot demonstrates participation, safety, affordability, stock rotation, data updating and equitable access, Surabaya would have a stronger basis for institutionalizing metropolitan food-reserve governance. The broader lesson is that urban food resilience is best governed as a collaborative portfolio of complementary capacities, not as a single program, warehouse or charity mechanism.

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CRediT Authorship Contribution Statement

Medea Ramadhani Utomo: Conceptualization, methodology, investigation, data analysis, visualization, writing - original draft, and writing - review and editing. Yayuk Yuliati: Conceptualization, supervision, methodology, validation, and writing - review and editing. All authors approved the final version of the manuscript and agreed to be accountable for the integrity of the work.

Declaration of Competing Interest

The authors declared that this study has received no financial support. No conflict of interest was declared by the authors.

Data Availability

The documentary archive analyzed in this study consists of unpublished institutional materials and is not publicly deposited. Public secondary data used for contextual strengthening are available from BPS, Satu Data Surabaya, DKPP Kota Surabaya, Badan Pangan Nasional, Bulog-related official releases and the Ministry of Agriculture. Derived proxy calculations are reported transparently in the manuscript and should be replaced with official Surabaya NBM, farm profit-loss, market-margin and warehouse-register datasets when the relevant agencies provide them.

Ethics Committee Approval and Legal Public/Private Permissions

This article analyses a documentary policy-design archive and reports no identifiable participant-level personal data. Legal public/private permission for the use of unpublished institutional materials should be documented in the submission package and provided to the journal where required.

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Resume

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