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Research article

Food system transitions in Vietnam: The case of pork and vegetable networks

Quoc Nguyen-Minh [a,*], Heleen Prins [a], Peter Oosterveer [a], Inge D. Brouwer [b], Raffaele Vignola [c]

[a] Environmental Policy Group, Wageningen University, Postbus 8130, 6700 EW Wageningen, the Netherlands
[b] Division of Human Nutrition, Wageningen University, P.O. Box 17, 6700 AA, Wageningen, the Netherlands
[c] Water Systems and Global Change Group, Wageningen University, P.O Box 47, 6700 AA, Wageningen, the Netherlands

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ABSTRACT

Vietnamese food systems have experienced a transition process since the late 1980s *Đổi mới* reforms. This paper examines the historical and ongoing transitions of pork and vegetable networks, using the Multi-Level Perspective (MLP), the Multi-Pattern Approach (MPA) and insights from food systems research. Our findings show that there was a shift from collective and self-subsistent farming to commercial small-scale farming in the late 1980s, and a rapid institutionalisation of smallholders and wet markets in the early 1990s. We argue that the current slow transition of the smallholder food regime towards improved food safety and standardisation has been locked in by the strong alignments of actors, practices and cultural values that support small-scale, fragmented production and distribution. The study suggests that those practices, values, and the needs and interests of smallholder producers and food consumers should be carefully considered when implementing transition agendas toward food safety, security, and sustainability.

1. Introduction

Vietnamese food systems have changed significantly over the last fifty years. After the reunification of North and South Vietnam in 1975, a period of more than ten years of centrally planned economic policies followed. In 1986, the country momentously embraced a market and trade liberalisation policy. These economic reforms of the late-1980s (known as *Đổi mới*) initiated a long-term transition process concerning food production and consumption as well as their drivers and outcomes. Today, Vietnamese food systems are faced with a critical challenge: they need to produce sufficient and healthy food for a growing and increasingly wealthy and urbanized population while mitigating adverse environmental impacts and addressing food safety concerns. This is especially important since Vietnam signed the Sustainable Development Goals (SDGs) in 2015, including SDG2 which calls to improve food and nutrition security and promote sustainable agriculture. Lessons from previous transition experiences may inform this transformation process.

Historical transitions of food systems in Vietnam have received considerable academic attention, concerning the trends in specific food commodities (Hoi et al., 2009; Lebel et al., 2002; Niimi et al., 2004), and the impacts of retail modernisation on smallholder farmers and urban consumers (Cadilhon et al., 2006; Wertheim-Heck et al., 2015). Such studies have connected the dynamics of specific food system components with macro-level global or national settings and micro-level everyday situations. However, there are

* Corresponding author.
E-mail address: quoc.nguyen@wur.nl (Q. Nguyen-Minh).

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currently no studies analysing the cross-level transition dynamics in food systems.

Hence, this study aims to document, characterise and discuss the multi-level transition dynamics of Vietnamese food systems. It builds on the conceptual framework of *socio-technical transition* (Markard et al., 2012) combining historical accounts of completed transitions and an analysis of the patterns, drivers, and lock-ins of ongoing transitions to learn what may shape the directionality of future transitions (Arapostathis and Pearson, 2019; Arranz, 2017). In food systems research, such a combined approach helps comprehend alternative scenarios for future food systems and propose coordinated actions to navigate transition pathways towards enhanced food security, safety, and sustainability (Brooks and Place, 2019).

Food systems refer to all elements and activities related to the production, storage, processing, distribution, consumption, and disposal of food and the socio-economic, health, and environmental outcomes (Ericksen, 2008; HLPE, 2017). In the current study, this framework is applied to study two important fresh food supply chains: pork and vegetables. This selection is based on the Vietnamese people's preference for these fresh products, as well as their significant nutritional and food safety implications. Both the pork and vegetable sectors have experienced rapid growth since the 1990s (Johnson et al., 2008; Ma and Lapar, 2014) but are still struggling with food safety risks, including pesticide overuse for vegetables and microbial contamination for pork (Hoi et al., 2016; Sinh et al., 2016).

This study seeks to answer the question: *"What are the key drivers and issues that characterise the historical and ongoing transitions of fresh pork and vegetables in Vietnamese food systems?"* In answering this question, we start by elaborating on the theoretical background (Section 2), continuing in Section 3 by presenting the methodology used in this study. In Section 4, we show the dynamics of food system components across multiple levels in different periods in order to examine the drivers and patterns of these transitions. We then reflect in Section 5 on several key characteristics of the transition process of Vietnamese food systems and the prospects of steering their transitions towards sustainability goals.

2. Theoretical background

2.1. The multi-level perspective in food system transitions

This study utilises the transition theory and in particular the Multi-Level Perspective (MLP, see Table 1 for a list of acronyms) framework to analyse food system changes and their drivers. Transition theories utilise interpretations and learning when addressing the compound, interrelated dynamics of socio-technical systems (STS). Originally used to denote the interactions between people and technologies in workplace settings, the concept of STS is expanded to refer to all interlinked elements - social-economic, physical, technical, cultural and cognitive – to fulfil certain societal functions like transport, energy, and food supply (Geels, 2004; Hinrichs, 2014). The MLP framework states that transitions in socio-technical systems occur as a result of complex dynamics within and between niches, regimes, and socio-technical landscapes (Geels, 2011).

A *regime* is the dominant and incumbent part of the STS - a coherent and dynamically stable configuration of elements that fulfil most related societal functions. *Niches* are less stable and coherent, unable to play a major role, and led by smaller networks of actors, but they have the potential to innovate, develop and transform a system (Holtz et al., 2008; Smith and Raven, 2012). Nonetheless, in many socio-technical systems including food systems, there is no clear separation between the two levels (Karanikolas et al., 2014). Some authors thus propose a hybrid category – *niche-regimes* – to denote empowered niches which contribute significantly to fulfilling societal functioning but cannot replace the dominant regime yet (Grin et al., 2010). Still, regime, niche-regimes and niches are embedded in broader, macro-level *socio-technical landscapes*, referring to the 'exogenous' factors and trends that are beyond the direct control of the regime and niche actors.

A regime is characterised by lock-ins and path-dependence, as mainstream actors prefer existing patterns in production and

Table 1
List of abbreviations.

Acronym	Full name	Acronym	Full name
ADDA	Agricultural Development Denmark Asia	ICT	Information and communication technology
AFTA	ASEAN Free Trade Area	IFOAM	International Federation of Organic Agriculture Movements
APEC	Asia-Pacific Economic Cooperation	ILRI	International Livestock Research Institute
ASEAN	Association of Southeast Asian Nations	MARD	Ministry of Agriculture and Rural Development
ASF	African swine fever	MDGs	Millennium Development Goals
CAC	Codex Alimentarius Commission	MOH	Ministry of Health
CIAT	International center for Tropical Agriculture	MONRE	Ministry of Natural Resources and Environment
CIDSE	Coopération Internationale pour le Développement et la Solidarité	NAFIQAD	The National Agro-Forestry-Fisheries Quality Assurance Department
FAO	Food and Agriculture Organization	NGOs	Non-governmental organisations
GAP	Good Agricultural Practices	OECD	Organisation for Economic Co-operation and Development
GDP	Gross Domestic Product	PRISMA-Scr	Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews
GSO	General Statistics Office	VFA	Vietnam Food Administration
HACCP	Hazard and Critical Control Points	VOAA	Vietnam Organic Agriculture Association
HLPE	High Level Panel of Experts on Food Security and Nutrition	WTO	World Trade Organisation

consumption and resist radical novelties (Geels, 2004). Transitions only arise when the regime is destabilised by internal tensions within the regime, through external pressure from landscape movements and niche activities, or a combination of the two (Frantzeskaki and de Haan, 2009). These situations of instability create 'windows of opportunity' for niches to gain power, making them competitive enough to rival or even replace the regime (*fit-and-conform*) or diffuse and facilitate the restructuring of the regime in favour of the niche (*stretch-and-transform*) (Smith and Raven, 2012).

Four pathways that a transition process can follow based on the timing and nature of interactions among various dynamics across levels are described (Geels and Schot, 2007): transformation, de-alignment and re-alignment, technological substitution, and reconfiguration. However, this classification requires a clear temporal demarcation of transitions, i.e., to specify when a transition begins and ends; and not every transition can fit into a certain type of pathway. (Geels et al., 2016) note that pathways are only 'ideal types' and 'not deterministic', so transitions can shift between pathways depending on how regime actors perceive and respond to local problems.

Therefore, we adopt the Multi-Pattern Approach (MPA) to analyse the transition process. The MPA, proposed by de Haan and Rogers (2019), is not separate from the MLP but a complementary approach to analysing transition pathways. It provides a tool to break down pathways into (sequences of) *patterns*, defined as ideal-typical types of system change. Patterns can be used to characterize changes in regimes, niches, and niche-regimes, which the MPA mutually regards as 'constellations' (Hans de Haan and Rotmans, 2011). Under the specific local *conditions* of societal needs and constraints, constellations can follow three patterns: (i) *adaptation*: adjust its functioning through adoption, re-organising or phasing out, (ii) *empowerment*: emerge, gain power, and proliferate, (iii) *intervention*: adapt or empower due to the interference of external agents outside of the system (e.g., supranational or national policies). The usage of MPA is justified by its flexibility to systematically unfold the complex, interrelated transition dynamics and the driving societal conditions, without the obligation to temporally demarcate and classify the whole transition process. Nonetheless, the pathways can still be delineated if a confluence of patterns is found when mapping the storylines (de Haan and Rogers, 2019).

In applying the MLP in food system research, one of the major challenges is how to unpack the components of food system regimes in the context of transitions, given the complexity of the structure and the multiplicity of functions of food systems (Karanikolas et al., 2014). Here we apply Gaitán-Cremaschi et al. (2019), who distinguish three regime/niche components: (i) agricultural production systems, (ii) value chain systems, and (iii) support structures. We find this framework valuable for its systemic categorisation of food production and supply chains; however, it lacks an adequate consideration of consumer behaviours and diets which play an essential role in shaping downstream food systems (Spaargaren et al., 2012).

2.2. Analytical framework

For our analytical framework (Fig. 1), we combine MLP and MPA with the conceptual framework of food systems, inspired by HLPE (2017) and Gaitán-Cremaschi et al. (2019). We used the term 'food networks' to denote the regime/niche part as the main unit of analysis, which constitute the entire food systems but can only be responsible for parts of their functions. Food networks[1] are composed of four major components: (i) food production, (ii) food distribution, (iii) food consumption, and (iv) support structures, although not all niches and niche-regimes comprise all four components. Even being placed in the same position, niches differ from the dominant regime, depending on the stability and size of the food network, and on whether their key role is to satisfy the majority of societal demands (regime) or to nurture innovations (niches).

Support structures encompass institutions, organizations, and programmes that underpin domestic food activities but sometimes they overlap with landscape factors (e.g., authorities and governance) (Schot and Kanger, 2018). The framework also integrates the *conditions* for change (drivers), *patterns* of change and food system *outcomes*, as proposed by MPA, to explain the trajectories that food systems go through. This is based on the assumption that change and stability in regimes/niches always involve the agency of actors (Grin et al., 2011), and that their dynamics increase when incumbent regimes lose their capabilities to fulfil societal needs and overcome constraints. Conditions for change are influenced by feedback from food system outcomes through changes in socio-cultural, economic and environmental landscapes, as well as political and institutional responses (Ericksen, 2008; HLPE, 2017). To address societal needs and constraints, the regime/niche dynamics can unfold along with three possible and mutually exclusive patterns, namely: *adaptation, empowerment*, and *intervention*. Lastly, the study briefly examines evidence of changes in food system outcomes, e.g., food/nutrition security and health (including food safety), socio-economic welfare (smallholder inclusion) and environmental wellbeing, through the lens of achieving the SDG2 goals, to further understand societal conditions for transitions.

3. Methodology

Our research is qualitative as we document and synthesise how the dynamics of Vietnamese food system components, landscapes, and outcomes, are interpreted by experts, key informants, and scientific literature. We use the conceptual framework, presented in Section 2.2, to conduct data collection and analysis, which consists of several steps as presented in Fig. 2.

A scoping literature review was carried out on multiple aspects of agri-food transitions, using PRISMA-ScR (Tricco et al., 2018). We also included grey literature and non-academic sources using Google Search. Statistical information on food production, export and

[1] 'Food network' was used instead of the MPA term 'constellation', which is not familiar to food studies. In using the term 'food network' to denote niches or regimes, we do not specifically refer to "alternative food networks" studies but to the broader agri-food literature that also uses the term like 'urban/rural food networks' or 'local food networks'.

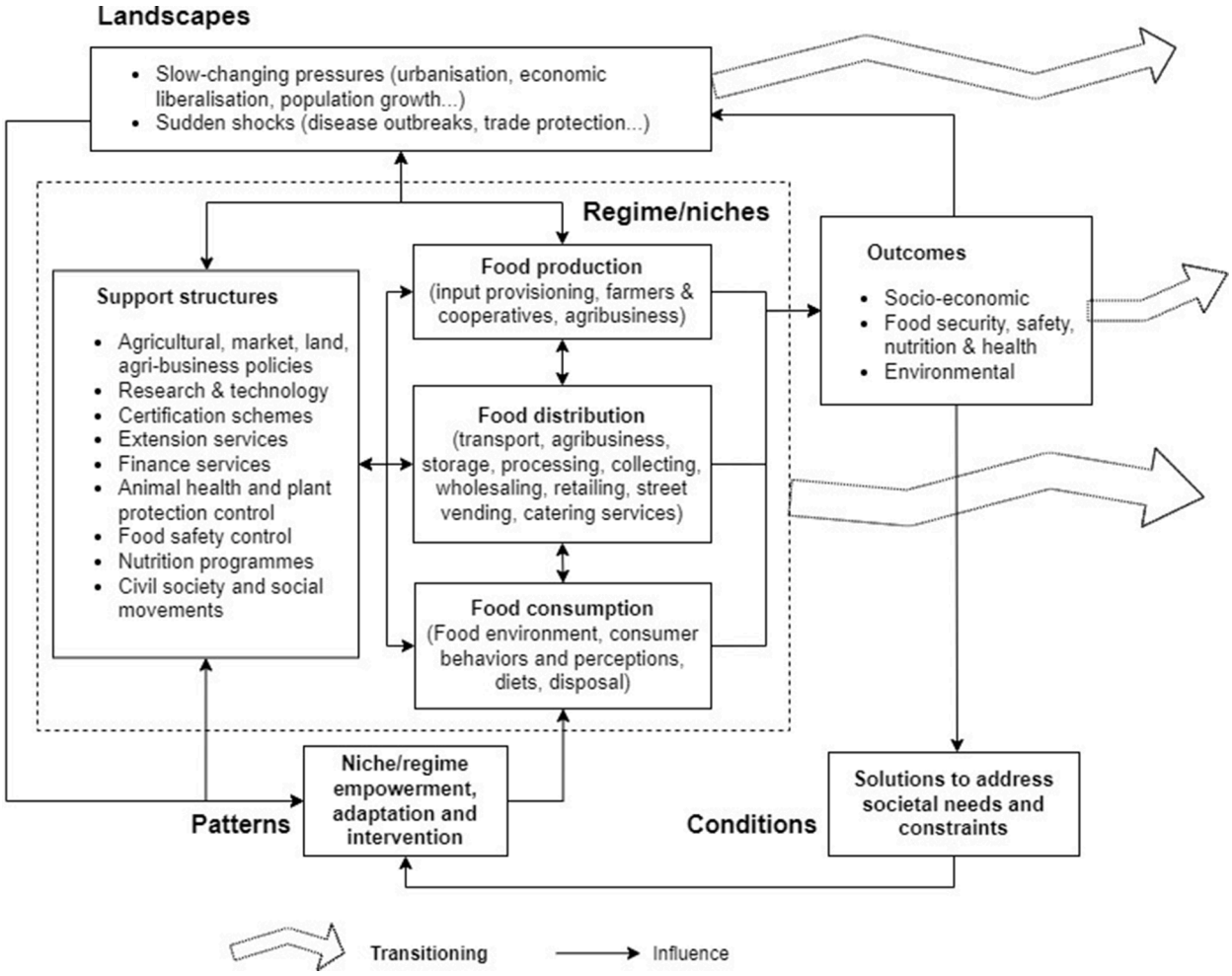

Fig. 1. Analytical framework.

import, was retrieved from the databases of FAOSTAT (2020), GSO (2020) and MARD (2020) (accessed in May 2020). Legislative and normative documents were searched in the Ministry of Justice database (vbpl.vn), based on the references from the included studies.

We included only documents in English or Vietnamese that contain references to dynamics in (pork and vegetable) food system components with broader discussions of socio-economic, political, and technological settings (i.e., excluding those focussing only on technical aspects). Two authors independently conducted the steps of screening and data charting.

In addition to the scoping review, the study also included in-depth interviews with four experts and six key informants to collect further qualitative data about the food system dynamics. Experts include those with at least ten years of direct experience in the pork and vegetable supply chains. The key informants comprised cooperative leaders, wholesalers, and farmers. CIAT and ILRI's networks in Vietnam supported the selection of interviewees (See Annex 1).

After the data collection, the study followed the steps of MPA analysis shown in Fig. 2. Firstly, the boundaries of the studied system were delineated and its components were identified and characterized. Next, the charting form and interview transcripts were analysed to identify the dynamics of the food networks and their associated landscapes. Some key trends, as referenced in the literature (Béné et al., 2019; Kearney, 2010; Swinnen and Maertens, 2007) characterise these dynamics, which we also mapped in a timeline to identify the major phases of the transition process. We hence reflected on the conditions and patterns of change in each phase. Finally, we discussed the pathways of food systems transitions in Vietnam and the implications for sustainability. The results were validated through discussion with our local partners (CIAT & ILRI) as well as three stakeholder workshops, comprising experts and practitioners in agri-food, retailing and nutrition in Vietnam (see Annex 2). We revised our findings based on the comments from the participants.

4. Results: Vietnamese food system transitions (1975–2019)

Demarcation: The study analyses the two separate yet overlapping systems of fresh pork and vegetables in Vietnam. The temporal boundary is from the reunification of Vietnam in 1975 to the present (2019). The spatial limitation is the territory of Vietnam, although

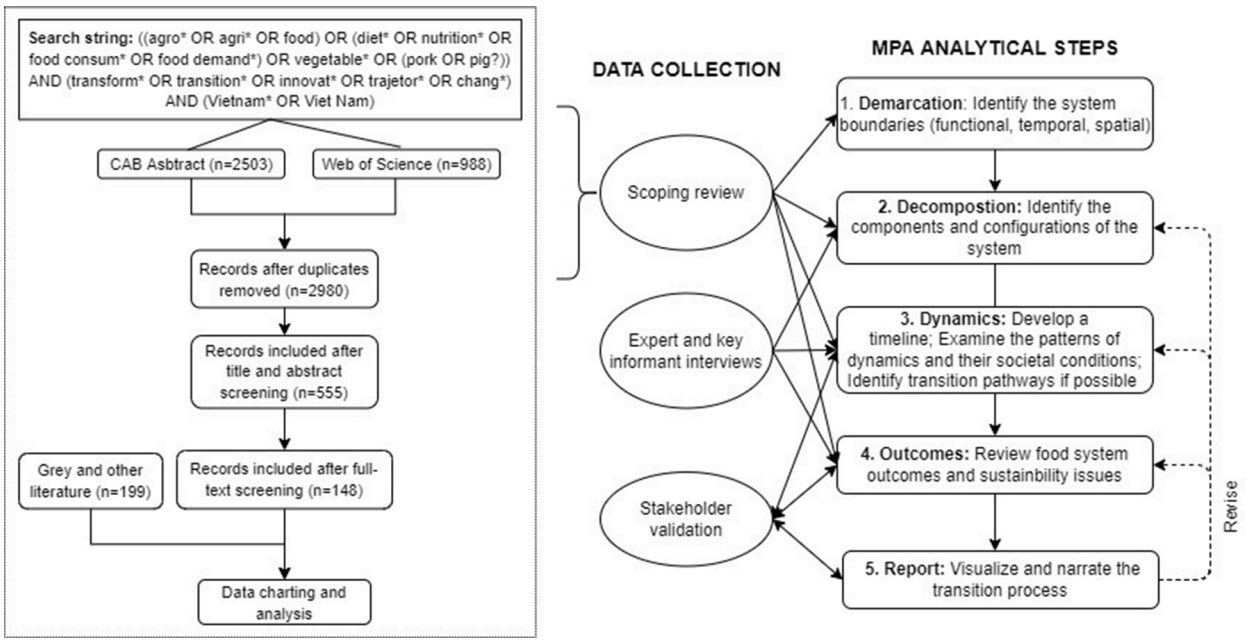

Fig. 2. Steps of data collection and analysis.

Annex 1
List of key informants and experts.

No	Code	Organization and position	Date interviewed
01	E1	Bac Tom safe food chain - Director	2019–11–04
02	E2	Vietnam Academy of Agricultural Sciences (VAAS) – Vice Director	2019–12–02
03	E3	Vietnam Organic Agriculture Association (VOAA) – Head of PGS Coordinating Committee	2019–12–13
04	E4	ILRI East and Southeast Asia regional office - Specialist	2019–11–15
05	P1	Tang My (Nam Hong) Safe Vegetable Cooperative – Director, farmer	2019–11–19
06	P2	Son Du (Nguyen Khe) Safe Vegetable Cooperative – Director, farmer	2019–11–01
07	P3	Son Du Cooperative – Director	2019–11–01
08	P4	Vegetable wholesaler at Long Bien market, Hanoi	2019–12–06
09	P5	Organic vegetable producer in Son Tay, Hanoi	2019–12–09
10	E5	Dong Anh Plant Protection Agency – Vice Director	2019–12–15

Annex 2
List of stakeholder validation workshops and discussions.

Name of workshop	Participants	Date organized
MALICA PhD Day	15 persons, including peer PhDs and experts within MALICA network	2020–09–30
Cau Giay Validation Workshop	Around 25 persons, including officials and stakeholders in agri-food, market, health and other fields in Cau Giay, Hanoi	2020–10–24
Dong Anh Validation Workshop	Around 30 persons, including officials and stakeholders in agri-food, market, health and other fields in Dong Anh, Hanoi	2020–12–10

the focus is on major production and consumption areas in large deltas rather than the non-representative areas like remote mountains or islands. Functionally, the two systems include all actors, infrastructures, institutions, and organizations related to the provisioning of pork and vegetables. The two systems are separate in terms of production networks (with farmers being increasingly professionalised to produce single commodity type), but overlap in components like distribution networks (e.g., wet markets and supermarkets) or support structures (e.g., extension agencies).

Decomposition: Based on the scoping reviews and expert interviews, we identified several food networks that constitute the pork and vegetable systems and characterized their institutional arrangements (see Annex 3). In each network, the actors can adopt a variety of solutions – technological or institutional measures – to address societal needs and constraints. Improvements in the technology of breeding, feeding, disease prevention, and waste management (for pork), or seeding, fertilization, plant protection, or soil restoration (for vegetables) could be introduced and implemented in many networks to different extents. Innovations can also involve shifts in

organizational and cultural aspects, for example, the Integrated Pest Management (IPM) approach in vegetable production or all-in/all-out pig production. The information from Annex 3 can be used to illustrate the emergence and change of those networks over time, as elaborated in the next section.

Transition dynamics: In this part, we explain the main dynamics in food system components that took place between 1975 and 2019. Based on significant landscape and policy developments, we roughly split the transitions into three major phases: 1975–1992, 1993–2008, and 2009–2019. However, the distinction between the phases is not clear-cut, owing to the delayed effects of policy implementation and the gradual co-evolution of socio-economic and technological institutions.

Overall, both systems experience a continuous increase in production (except pork production in 2019). However, there are fluctuations in growth rates: vegetable production increased by 3.2% in phase one, 8% in phase two, and 4.2% in phase three (Fig. 3).

Annex 3

Food networks in transitioning Vietnamese pork and vegetable systems.

Networks	Composition	Institutional characteristics & aims	Solutions
Pre-1993 systems			
Collective systems	Agricultural cooperatives, supply/marketing cooperatives, state farms, state trading agencies	A network of state-controlled agencies and farmer organizations that nearly monopolize the production and trade of some agri-food products, to modernize agricultural production.	Large-scale farms; Central planning; Mechanization
Small-scale private systems	Household farms (5% of total cooperative land); informal and formal markets; Local experiments of 'household contracts'	Family farming and private trading with the aim to improve food quantity and income (after fulfilling state quotas);	
Support structures			
Public	Extension services; Credit services; Research institutes and universities; Food safety, animal health and plant health management departments;	A network of state-controlled institutions, providing a wide range of agricultural services yet focusing more on food production technology transfer.	Enhanced breeds and seed varieties; Improved food safety, plant protection and veterinarian measures; IPM protocol;
Private	Informal and private credit networks; Private extension services; Non-government organizations;	Agricultural services provided by private sector, focusing more on marketing information, microcredit and animal nutrition; NGO works in cooperation with the government;	Rural microcredit; Improved fertilization and feeding technologies; IPM protocol;
Production systems			
Conventional vegetable	Smallholder farmers	Farmers with small landholdings, producing uncertified vegetables for both subsistence and commercial purposes	Enhanced seed varieties; Improved fertilization and feeding technologies; Soil remediation; Crop rotation; Mechanization;
Safe vegetable	Smallholder farmers; Safe vegetable cooperatives;	Small-scale farmers located in designated safe production zones in peri-urban areas, organized into safe vegetable cooperatives; Some have contracts with supermarkets, catering services and speciality shops	Safe production zones; Safe certification schemes (RAT, VietGAP); IPM class; Bio-pesticides; Soil remediation; Crop rotation;
Organic vegetable	Organic vegetable farmers and cooperatives; Private organic farms;	Vegetable producers focusing on producing organic products with assistance from NGOs like ADDA & VOAA, some have contracts with speciality shop chains; Export-oriented enterprise-owned farms;	Biological pest control; Organic manure; Organic certification schemes (PGS)
Small & medium-scale pork	Small farms; Semi-commercial private farms;	Pig producers with small to medium-size herds (less than 100 fatteners); very few have contracts;	Enhanced breeds; Improved veterinarian measures; Improved housing & feeding facilities; Biosecurity measures; Biogas tanks; VAC system;
Large-scale pork	Commercial private farms;	Large-scale farms (> 100 fatteners), some having supplying contracts with supermarkets and intermediaries;	Mechanized facilities; Industrial housing & feeding; Strict biosecurity protocols (all-in, all-out); Enhanced breeds; Waste management system;
Distribution systems			
Small-scale processing	Small-scale slaughterers	Providing products to mostly rural markets, with little or no regulations on food safety	
Medium & large-scale processing	Concentrated medium & large-scale slaughterhouses; export companies;	Providing products to urban markets, with stricter controls on food safety, disease prevention, and waste management;	Mechanization; Disease-preventing facilities and protocols; Hygiene system; Waste management; HACCP;
Traditional supplying	Collectors; Traders; Wholesalers; Wet market retailers; Street vendors;	Networks of distributors that provide products to traditional markets throughout the country	Improved food safety control;
Modern supplying	Supermarkets; Convenience stores;	Modern retail formats, including both foreign-owned and domestic chains, located in mainly urban and peri-urban areas	Domestic and international food safety certification; Vertically integrated farms; Distribution centres; Cold storage; Online marketing;
Speciality supplying	Safe or organic specialty shops, including online shops	Chains of shops focusing on safe or organic food, mostly in urban areas	Safe & organic certification schemes; Online marketing;

Average annual growth figures for pork are around 7.1%, 7.6% and 2.6% over the three phases, respectively (FAOSTAT, 2020; MARD, 2020). The development of both systems is associated with structural changes in production and distribution networks shown in Annex 3, under the influences of major landscape changes. We present further details of these dynamics below.

4.1. 1975–1992: from collective to small-scale farming

4.1.1. Landscape policies of collectivisation and de-collectivisation

Following the reunification of Vietnam, the government enacted a five-year economic plan to expand the centrally planned economy (Selden et al., 2006; Watts, 1998) (Fig. 4). This led to the process of agricultural ***collectivisation*** when cooperatives were amalgamated and enlarged in the North and established step-by-step in the South, evolving from solidary teams to full cooperatives. The government supported the transformation of agri-food systems from small-scale to large-scale, mechanized farms while monopolizing food distribution and trade. However, the collectivisation and mechanization strategy did not succeed, mainly because of resistance and reluctance in the Southern provinces (Dang, 2018) and the decline of imported agri-inputs from the Soviet Union (Takeshima et al., 2018).

Local experiments of ***de-collectivisation*** occurred in the North long before the reunification, with cooperatives sub-contracting pig or rice farming to households in the 1960s and 1970s (mostly without government approvals). In the early 1980s, the poor performance of collectives contributed to widespread food shortages, compelling the government to support liberalisation (Sepehri and Akram-Lodhi, 2006). This led to the introduction of 'household production contracts' in 1981, partly devolving production responsibilities to individual households (Kerkvliet, 1995). In the late 1980s, more comprehensive reforms were launched, including a new land policy (Resolution 10) in 1988 that eventually allowed land allocation for household uses. The weakening of state procurement and pricing policies in 1987 and its final abolition in 1989 boosted the commoditisation of food. These were accompanied by a series of broader reforms on domestic and foreign investment, private enterprises, taxes and finance (See Van Arkadie, 2003), the resumption of diplomatic relations with China and Western countries, and the collapse of the Soviet bloc (Fig. 4).

4.1.2. Collective and small-scale systems: seeds of change

Under the two macro-policies of collectivisation and de-collectivisation, this phase witnessed the evolution of two main systems – the ***collective system*** and the ***small-scale private system*** – in opposing directions (Fig. 4). The collective systems expanded between 1975 and 1981, yet underwent significant adjustments in 1981 and 1988, and finally collapsed around 1992. Meanwhile, small-scale *private systems* were discouraged between 1975 and 1981, then steadily gained power and ended up dominating the agri-food sector in the early 1990s. In the early 1990s, ***there was a (technological) substitution from collective to individual farming***, owing to the rapid decline and collapse of agricultural cooperative networks.

For pork and vegetables, the small-scale private production system remained firmly despite the government unfavourable policies (Lemke and Zárate, 2008). Since vegetables accounted for a large part of the daily food consumption; they were grown in home gardens

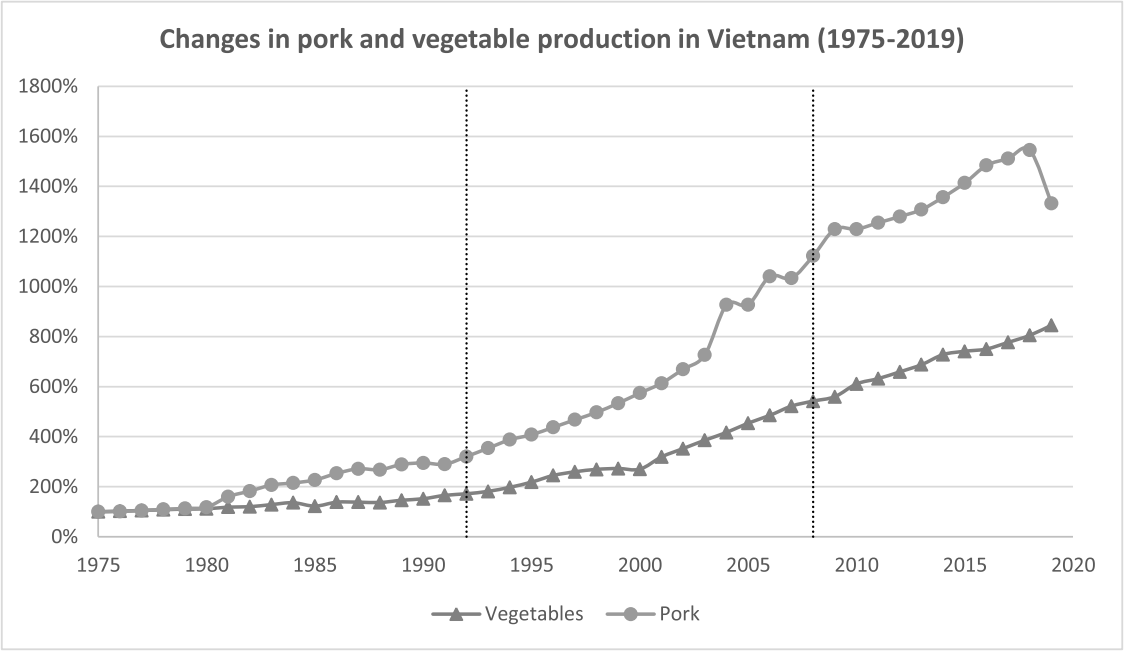

Fig. 3. Changes in pork and vegetable production in Vietnam (FAOSTAT, 2020; GSO, 2020; MARD, 2020). The dotted lines represent the demarcation between the three transition phase, i.e., 1975–1992, 1993–2008, and 2009–2019.

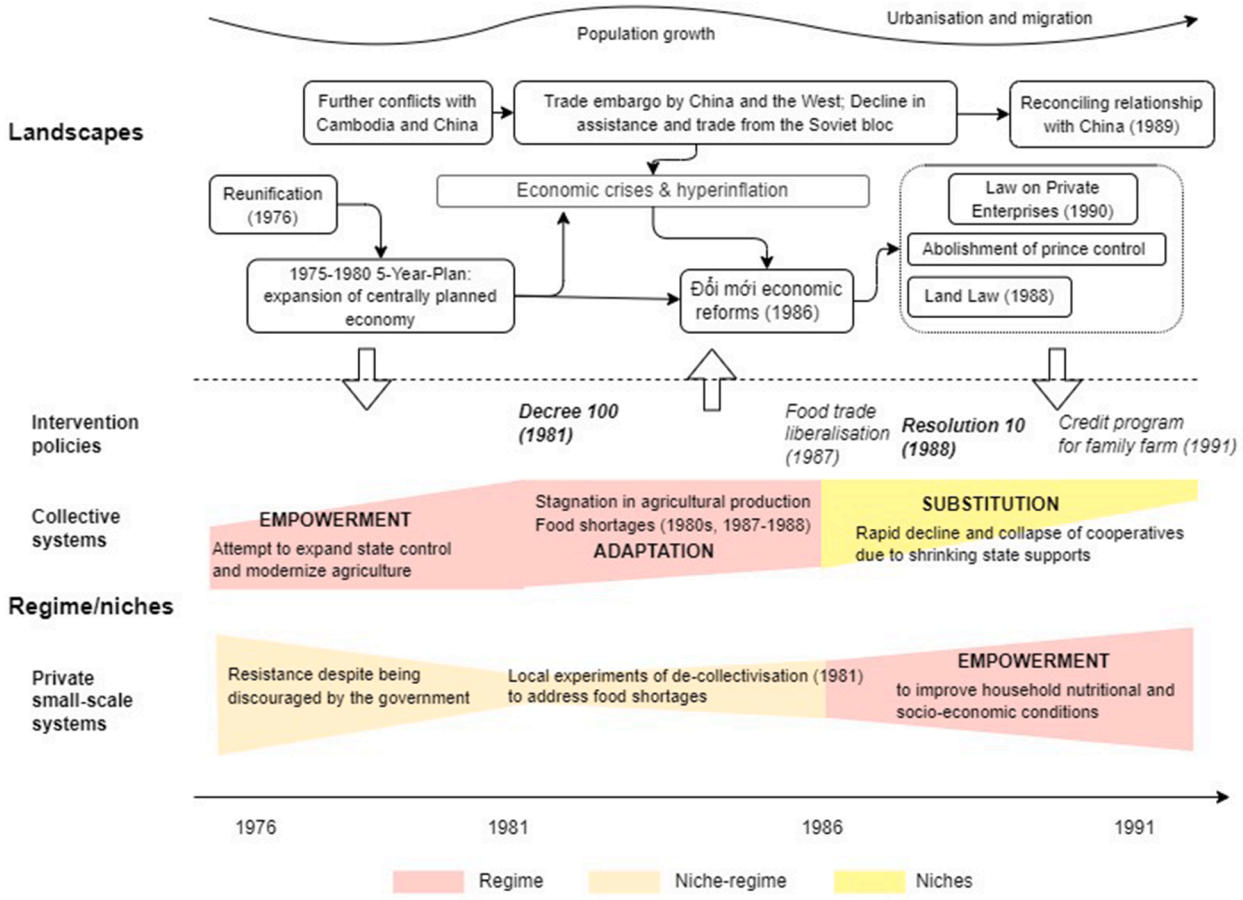

Fig. 4. The transition process of Vietnamese food systems in 1975–1992. Each block represents a food network; the change in size denotes its decrease or increase in market share. Patterns of change are capitalized with explanations of the conditions that the patterns address.

or on special plots for household use (less than 5% of cooperative land), mostly for self-sufficiency (Raymond, 2008). Numerous households also raised pigs at home for private use, but under obligatory state procurement quota (reportedly 50 kg pig live weight per capita) (Lemke and Zárate, 2008). Due to the erosion in the role of state trading agencies, many farmers preferred to sell higher-quality pigs through the informal market, while retaining only inferior-quality pigs for compulsory state procurement (Vu, 2003). The remarkable continued small-scale household production of pork and vegetables facilitated a rapid expansion of the market for these products in the late-1980s (Sikor and Vi, 2005).

4.2. 1993–2008: institutionalisation and dominance of smallholders

4.2.1. Landscapes and support structures for the new regime

With the collapse of numerous cooperatives in the early 1990s, small-scale farming and its associated distribution networks (see Annex 3) quickly emerged to become the regime. Their emergence was reinforced by landscape movements, macroeconomic policies and state support structures.

4.2.1.1. Landscapes. Population growth, economic development and urbanization significantly boosted the production of pork and vegetables (Fig. 5). With the rising living standards, urban consumers not only bought more pork and vegetable products (rather than producing by themselves) but also demanded higher-quality food with year-round availability (Ho et al., 2003). Urbanisation also prompted the consolidation of production areas, especially for vegetables. To provide vegetables to the growing urban population, the state endorsed the establishment of 'vegetable belts' in peri-urban zones near large cities (van den Berg et al., 2003).

4.2.1.2. Land and trade liberalisation policies. New state policies and institutions supported agricultural commoditisation in the 1990s (Fig. 5). Particularly, the 1993 Land Law effectively finalised the shift from collective to smallholder dominance by redistributing arable lands equally to rural households and granting them long-term use rights (Do and Iyer, 2008). However, to restrict land accumulation, region-specific ceilings were placed on individual landholdings, e.g., a maximum of 3 ha per farm in the Red River

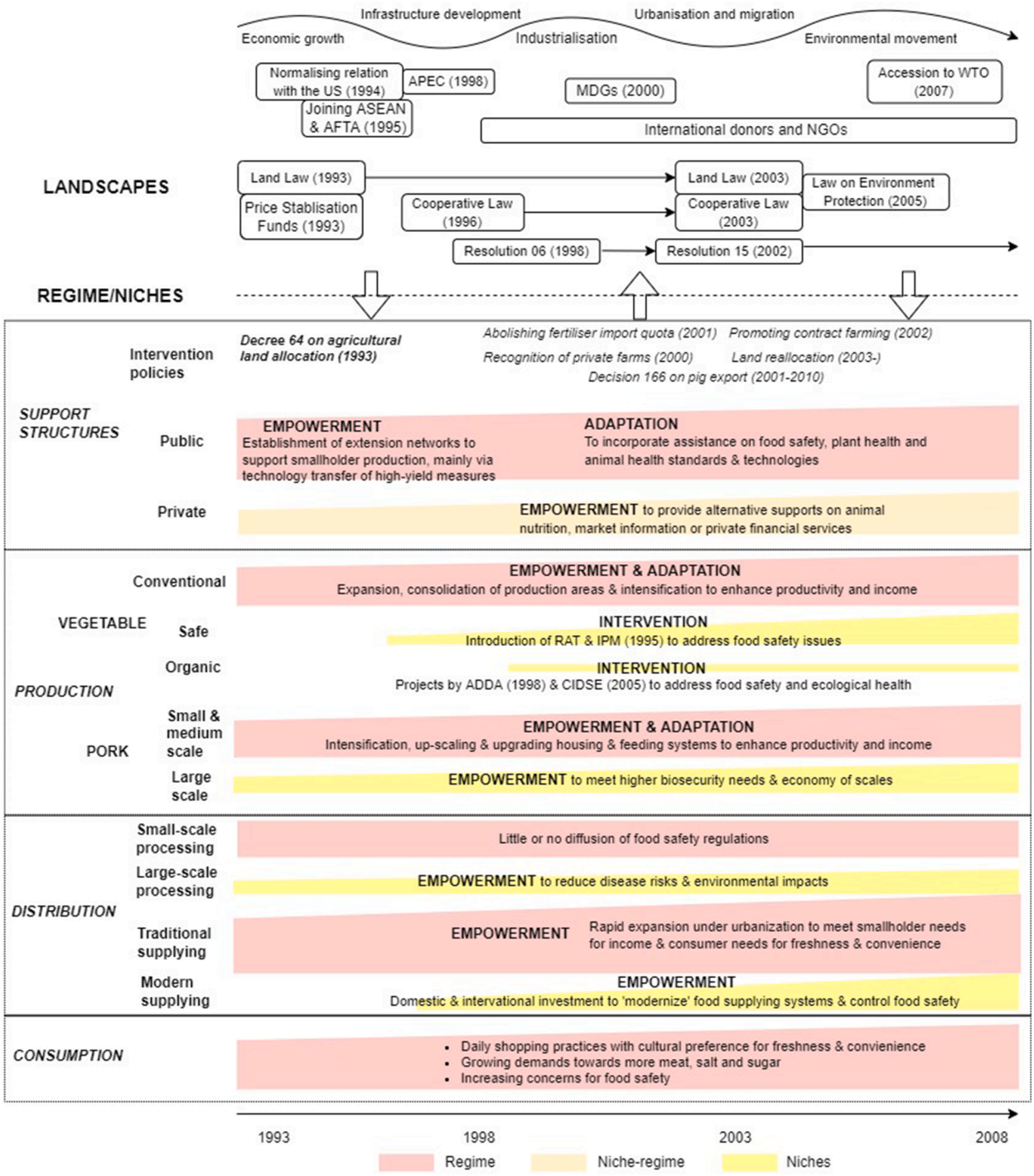

Fig. 5. The transition process of Vietnamese pork and vegetable systems in 1993–2008. Each block represents a food network; the change in the size denotes its decrease or increase in market share. Patterns of change are capitalized with explanations of the conditions that the patterns address.

Delta. This ideal of equitable land distribution led to problems of land fragmentation, limiting prospects for enhancing productivity and efficiency (To et al., 2019).

Trade liberalisation enabled the rise of inputs used for intensification purposes. From 1997 to 2001, the country gradually abolished fertiliser import quotas and removed tariffs for most agricultural inputs, especially when joining the ASEAN Free Trade Area in 1995 and the WTO in 2007 (OECD, 2015).

4.2.1.3. Public and private support structures. ***State support structures*** for extension, research, credit, animal health and plant protection services were established or restructured at the beginning of this phase. Notably, vegetable and pork farmers benefited from programmes for improving genetic sources of seeds and livestock breeds, which were provided at subsidised rates (Nga et al., 2014; OECD, 2015). The state programmes focused on demonstrating and transferring high-yield technologies while paying insufficient attention to market linkages and communication (Moustier et al., 2003). This top-down approach to technology transfer is supply-driven, relying on the monolithic structure of the public system and has limited outreach among underprivileged households (Dalsgaard et al., 2005; Linh, 2001).

Although state agencies dominated the support structure, the ***informal and private support structures*** played an increasing role in providing services. Private and civil actors like international NGOs, enterprises, and informal local groups, offered services and assistance in marketing information, microcredit, and animal nutrition, which public extension agencies often disregarded (Moustier et al., 2003).

4.2.2. Food production: accelerating intensification

The empowerment of small-scale, conventional vegetable and pork production (Fig. 5) was accompanied by accelerating intensification. With the growing market demands and enhanced access to technologies, producers switched from subsistence to commercial farming, expanding cultivated areas and pig quantity (FAOSTAT, 2020), as well as employing measures to maximise productivity.

Conventional vegetable producers changed their cropping patterns from rice/maize-vegetable crop rotation to year-round vegetable production (Everaarts et al., 2008). Vegetable producers also ramp up the use of fertilizers and pesticides. Pesticide usage in Vietnam increased from 15,000 to 76,000 tonnes between 1991 and 2007, and vegetable production scored the highest in pesticide use: 5.52 kg ha^{-1} compared to 3.34 kg ha^{-1} for rice and 0.88 kg ha^{-1} for other annual crops (Hoi et al., 2009).

Small-scale pork producers expanded pig herds and adopted advanced breeding, housing and feeding protocols. The limited local availability of raw materials, especially protein-rich ingredients, propelled the increase in using imported industrial feeds, dominantly provided by foreign feed companies (Lemke et al., 2008). Some producers adopted the traditional VAC model, which integrates pig rearing, crop cultivation and fish production to recycle pig manure; or installed biogas tanks. A pork niche of ***large-scale and registered farms*** started to proliferate in the 2000s. This niche received government support not only because of their modern facilities and stricter biosecurity adoption but also their capacity to establish formal contracts with intermediaries and supermarkets (Costales et al., 2006).

4.2.3. Food distribution: the dominance of traditional markets

Along with the strong institutionalisation of smallholder producers, their associated distribution networks (***traditional supplying***) have also been empowered (Fig. 5). The number of wet markets in Vietnam doubled from around 4000 in 1993 to 8300 in 2003 (Maruyama and Trung, 2012). The number of mobile vendors also increased (e.g., from 2100 to 5600 in 2004–2006 according to a survey in Hanoi), engaging mostly female migrants from rural/peri-urban areas (Moustier et al., 2008).

Urbanization reinforced such empowerment of traditional markets. New urban settlers did not change their food consumption practices but were attached to their traditional practices of daily shopping for fresh food (van Wijk et al., 2006). Traditional markets not only scored better on prices and convenience but were also able to offer food with better appearance and freshness, seen by many consumers as primary criteria for ensuring food safety (Cadilhon et al., 2006). There was also a nutrition transition towards enhanced meat intake, recognised as the *'meatification'* of food production and consumption (Hansen, 2018).

4.2.4. Pressures and interventions for food safety and modernisation

In the late 1990s, multiple food safety scandals erupted, leading to widespread public concerns (Figuié et al., 2019). This compelled interventions by the government and NGOs. At the national level, the government started to adapt their support structures to also integrate food safety training, especially via the Integrated Pest Management (IPM) programme. Vietnam Food Administration (VFA), the first central agency for food control, was established in 1999 (World Bank, 2006). International standards and protocols such as HACCP, GAP or Sanitary and Phytosanitary measures (SPS), were introduced after Vietnam's entry into CAC (1994) and WTO (Ho and Dao, 2005; McLeod et al., 2004).

This resulted in the establishment of two vegetable niches, namely ***safe production*** and ***organic production***, in the mid-1990s. In 1995, MARD launched the 'safe vegetables' (RAT) programme, which established safe vegetable production areas in peri-urban zones of large cities. Safe vegetable farmers have to comply with specific production protocols based on the IPM approach, requiring controlled use of pesticides and fertilisers, and irrigation from non-polluted water sources. A certification scheme ("safe vegetable" or RAT) was developed, although this certifies all vegetables in designated 'safe zones' rather than farming procedures per se. In addition to safe production, organic vegetable production was introduced by international NGOs like CIDSE (1998) and ADDA (2004).

In addition, the niche of ***modern retail systems*** received government support, by fast-tracking plans for supermarket development, upgrading formal marketplaces, and eliminating informal markets, while prohibiting street vending activities (Gerber et al., 2014). This retail modernisation policy was rooted in the notion that modern retail outlets could more effectively control food safety and facilitate the creation of 'modern' and 'civilised' lifestyles (Wertheim-Heck et al., 2015). Supermarkets rapidly expanded from one in 1993 to over 400 in 2007; yet with the dominance of traditional markets, their share in the fresh food supply remained small, accounting for only 1–2% by 2004 (Figuié and Moustier, 2009).

4.3. 2008 to present: ongoing transition for food safety and modernity

4.3.1. Shifting approaches in policies and support structures

A new phase of transition seemed to start in 2008, marked by Vietnam's accession to WTO (2007) and the introduction of VietGAP

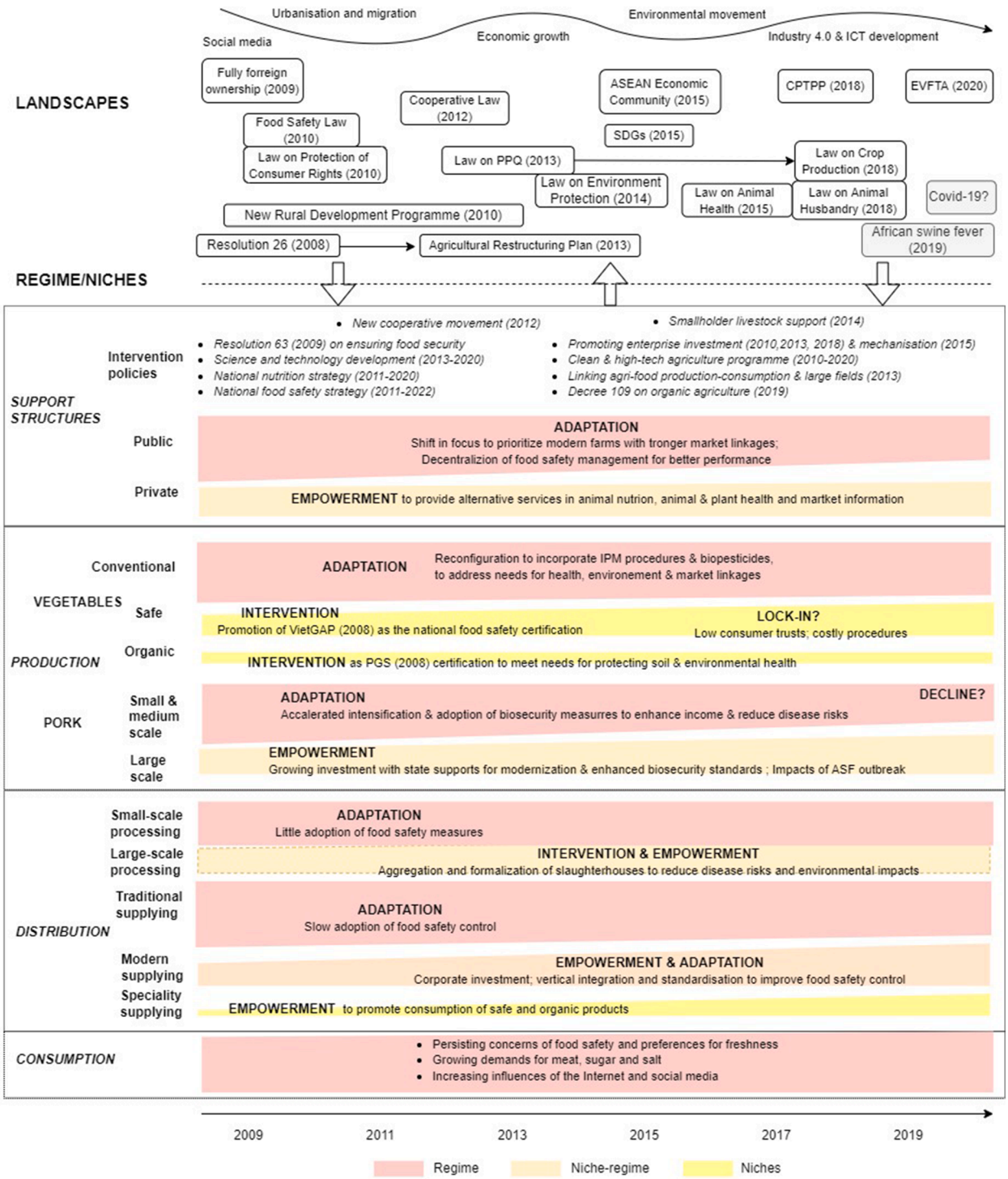

Fig. 6. The transition process of Vietnamese pork and vegetable systems from 2008 to the present. Each block represents a food network; the change in the size denotes its decrease or increase in market share. Patterns of change are capitalized with explanations of the conditions that the patterns address.

(2008) and the Food Safety Law (2010) (Fig. 6). They created the legislative foundation for tightening food control and surveillance and induced standardising and formalising production and distribution protocols.

Economic growth, urban development, international integration, and the growing public concerns for food safety and the environment continued to be the main *landscape drivers* in this phase. New factors such as social media and the development of ICT brought new marketing opportunities and stimulate adaptations of both producers and distributors.

Another keystone programme - *Agricultural Restructuring Plan* (ARP) – was promulgated in 2013. The plan outlined a strategic shift in agricultural development approaches from emphasising production to a focus on 'enabling market responsiveness and sustainability' (World Bank, 2016). Following the ARP, new policies were issued (Fig. 6) to encourage private and public cooperation in modernising agri-food supply chains, favouring large-scale and high-tech production by applying contractual arrangements.

Support structures were also adapted to promote functional and fiscal responsibility. For instance, Food Safety Management Authorities are now established to be solely in charge of provincial controls on food safety, and stations of plant protection, animal health and extension services were merged into Agricultural Service Centres. New models of cooperatives and farmer organisations gained state endorsement as key intermediaries for facilitating the transformation by enhancing value addition and building market linkages (Loc and Hang, 2016).

4.3.2. *Food production: diffusion of food safety and biosecurity measures*

As shown in Fig. 6, ***small-scale & conventional pork and vegetable production*** remained the dominant regimes. Intensification and concentration are still the major trends. *Vegetable production* is more and more agglomerated due to urban and industrial development: 75% of vegetable producers are now concentrated in peri-urban zones (Khue et al., 2016). To adapt to the decreasing farmlands, pesticides continue to be used excessively: a 10-year study shows that pesticide use amplified by 1.9–2.5 times between 2002 and 2012 (Hoi et al., 2016). For *pork production*, intensification accelerates due to thriving demand and technological advances. Pig farm sizes continued to grow significantly, with the share of farms having 20 or more fatteners growing from 1.75% to 23.06% in 2006–2016 (GSO, 2016).

However, some adaptations regarding food safety have also taken root in *vegetable production*. The usage of high-toxicity pesticides is now prohibited and producers are switching to using biological pesticides owing to the increased market availability of bio-pesticide products (Schreinemachers et al., 2017). Our interviews with cooperative leaders and producers reveal that principles and procedures of IPM, which were introduced in the niche of safe vegetable production, are now widely diffused among conventional producers. Even if the products are not certified as 'safe', numerous producers have gradually adopted IPM measures thanks to their concerns for their own health and the environment (Interview P1 & P2, 2019). This suggests a forthcoming ***reconfiguration*** to incorporate food safety practices and standards into the small-scale regime.

The growing acceptance of food safety protocols, nevertheless, did not entail the rapid adoption of domestic and global safety certifications. Since 2008, both niches of ***safe and organic food*** have developed separate certification schemes: the national state-sponsored VietGAP for safe food and the community-based, peer-assessed PGS for organic products (see summary in Annex 4). Despite the active promotion of the government and NGOs (e.g., VOAA), the two certification niches only grew slowly: by 2016, only 22 ha of vegetables are PGS-certified and less than 1.1% of vegetable inputs are VietGAP-certified (Pham and Dao, 2016).

In *pork production*, biosecurity measures started to be widely adopted, especially after the ASF pandemic in 2019. To avoid disease transmission, all producers have installed biosecurity facilities and embraced disease-prevention practices. However, with lower technical and financial capacity to adopt strict biosecurity standards, the small-scale producers suffer the largest loss, while the modern, large-scale producers will be less affected, and may even benefit from gaining market shares (Ngoc Que et al., 2020). Empowered by the ASF shock and state policies that favour large-scale modern farms, ***large-scale pork production*** is now a niche-regime. Meanwhile, multiple smallholders have decided to either downscale or quit production under the competitive pressures of large-scale farms (Interview E4, 2019). One could expect a ***technological institution*** from small-scale to high-biosecurity and

Annex 4

Comparing three niches of safe vegetables (RAT certificate), organic vegetables (PGS) and VietGAP-certified vegetables (Adapted from (Pham and Dao, 2016) and (GSO, 2016)).

	Safe vegetable (RAT)	Organic (PGS)	VietGAP
Starting year	1995	2008	2008
Voluntary	Yes	Yes	Yes
Certified by	Third-party sponsored by local governments (Plant Protection Department)	Peer farmers and other stakeholders under the supervision of the PGS Coordination Committee	Third-party sponsored by the government
Initiated by	MARD & Provincial governments	ADDA & Farmers' Union	MARD
Traceability	No	Yes	Yes
HACCP	No	Yes	Yes
IFOAM	No	Yes	No
Type of products	Vegetables, fruits, tea	Agricultural & livestock products	Agricultural, livestock & fishery products
Scale of vegetable production	No nationwide data. 30% of the vegetable area in Hanoi and HCMC.	Only 22 ha in 2015	1.1% of total vegetable output (GSO, 2016).
Distribution network	Wholesale markets, wet markets, safe vegetable shops, catering services	Safe & organic vegetable shops	Supermarkets, safe vegetable shops, catering services

high-tech large-scale commercial farms, but this prediction requires further investigation.

4.3.3. Food distribution: retail modernisation and standardisation

While traditional supplying still dominates food distribution, the network of ***modern supplying*** has become a niche-regime in the current phase (Fig. 6). After Vietnam entered the WTO, the retailing sector was opened to 100% foreign ownership in 2009, enabling the penetration of international brands in Vietnamese food distribution (Maruyama and Trung, 2012). The amount of supermarkets and department stores doubled, while the number of traditional markets has reduced slightly after peaking in 2015 (Fig. 7). Convenience stores also flourished, growing from around 1000 in 2013 to more than 4000 outlets in 2019 (USDA, 2020). Vertical integration also accelerates, for example, conglomerates like Vingroup or Masan Group established new brands of fresh products (USDA, 2020).

Retail modernization has an effect on stimulating small-scale producers to embrace safety and quality certificates. Increasingly they tend to avoid purchasing non-certified products, while still employing modern logistics facilities and internal control systems to reduce safety risks. Nonetheless, new certification schemes with stricter standards (e.g., VietGAP) face challenges from high production costs and cumbersome procedures (Hoang, 2020; Pham, 2017) as well as low consumer familiarity (My et al., 2017; Ngo et al., 2019). There is also the question of smallholder inclusiveness: high requirements and unfair terms hinder small-size producers from building long-term contracts with modern retailers (Moustier and Loc, 2015).

Besides, several niches have ascended to support the distribution of safe food. In the 2000s, safe vegetable cooperatives opened special stalls within formal wet markets, enabling direct sales between producers and consumers. Such stalls declined in the late 2000s due to low trust among traditional consumers (Wertheim-Heck and Spaargaren, 2016). The niche of ***specialty shopping***, however, was revitalized in the early 2010s with the emergence of many small-sized retail chains focusing on certified safe or organic products (BacTom, Soi Bien, etc.). These chains target younger and more tech-savvy consumers, actively employing online marketing via Facebook and other platforms to expand their niche market (Kim Dang et al., 2018).

Overall, consumers still have limited trust in certificates and standardised retail channels and continue to rely on personalised relations with traditional retailers, reproduced via their daily shopping practices. Despite their concerns for food safety, consumers still prioritize other factors like convenience, affordability, and the diversity of fresh food products (Lapar et al., 2009; Wertheim-Heck et al., 2014). However, this can be changed in the future owing to the stronger penetration of large firms into retailing sectors and the growing urban, young and affluent middle-class (Ehlert and Faltmann, 2019).

5. Discussion

5.1. Use of MPA & MLP in transition pathway analysis

In this paper, we apply the MPA and MLP to examine the transition process of Vietnamese pork and vegetable systems. After the demarcation and decomposition of the system into specific components (food networks), MPA provides a rigorous method to systematically analyse the non-linear dynamics by dissecting time-bound changes of such networks. The emerged patterns of changes were then further explained in detail by connecting with the landscape movements, intervention policies, and socio-technical innovations (see Solutions column in Annex 3).

The results demonstrate the benefits of the MPA in supporting MLP analysis in short periods without the need for a complete transition from one regime to another. The MPA is instrumental in identifying 'transition pathways' if some indications of such

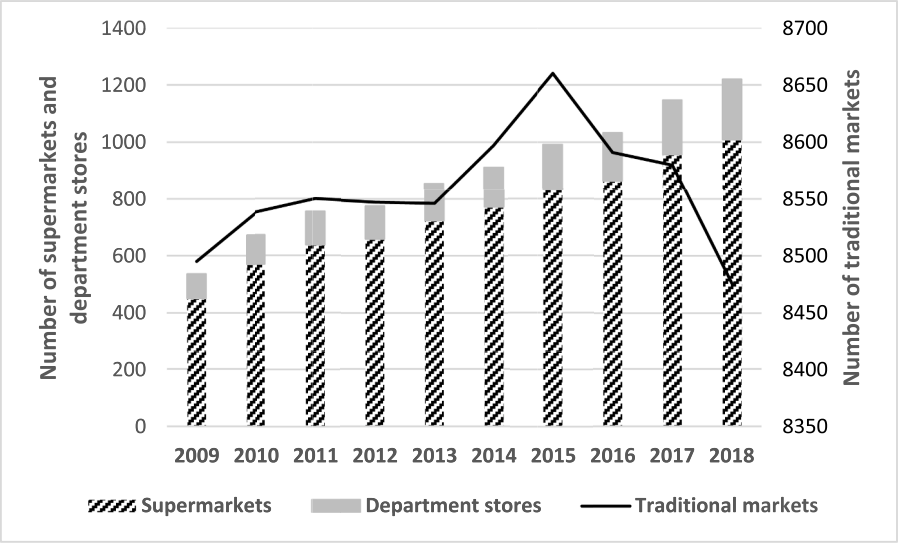

Fig. 7. Number of supermarkets, department stores, and traditional markets in Vietnam in 2009–2018 (GSO, 2020).

pathways are recognised. In our case study, we identified a *substitution* from collectives to family farms from 1975 to 1993. While there has been no regime shift since the 1990s, one could expect a forthcoming *technological substitution* from small-scale pork farms to high-biosecurity large-scale farms, and a *reconfiguration* of small-scale vegetable systems to integrate food safety innovations.

However, the MPA must be applied with caution. The use of MPA seems not to be necessary for multiple case studies where transition pathways are clear-cut and undisputed. MPA is more appropriate for examining multi-component systems with highly nonlinear transition processes, when the ideal types of transition pathways are not easily identified and proved. Moreover, the MPA assumes the agency of key actors in enacting changes to meet societal needs. This is easier to demonstrate in technology-led systems like water management (de Haan and Rogers, 2019); yet in other systems like food, one cannot neglect diverse informal actors with different interests, expectations, resources and levels of involvement (Grin et al., 2011; Smith et al., 2005). The explanation (and prediction) of transition pathways will have to incorporate different storylines from various actors and components, yet it could lead to difficulties in arranging the 'messy' narratives.

Lastly, we reflect on the applicability of MLP & MPA in studying transitions in the global South, including Vietnam and many lower and middle-income countries (LMICs). Many authors have questioned whether or not the concepts and frameworks of transition theory – mainly developed in Western contexts - can be useful to address nuances in settings of developing countries, for example, the informality of regime or social injustices (Ghosh et al., 2021; U. E. Hansen et al., 2018; Ramos-Mejía et al., 2018). Our case study of Vietnamese food transitions can offer insights to enrich this discussion. The utilization of concepts like niches, regime, landscapes, or the 'pathway' terms like technical substitution, as discussed in the next section, did not totally fit the particular institutional and socio-cultural conditions of Vietnam. For instance, the substitution in the early 1990s was not exactly led by technological innovations but mainly by a governance and organizational shift (though there were advances in the adoption of agricultural technology). The presumption about incumbent/regime actors as coherent, dominating and resisting radical change (Holtz et al., 2008; Turnheim and Sovacool, 2019) should be reconsidered in the case of the smallholder-led regime. The regime in our case is heterogeneous and composed of different segments and institutions (mainly informal) with various levels of adaptation to technological changes. In that light, future transition studies should seek to reconceptualize their concepts and frameworks to encompass diverse contexts of LMICs. Nonetheless, our study still considers transition theory and its concepts and ideas invaluable and necessary. While there can be different approaches from other disciplines (e.g., political economy or anthropology) to study changes in Vietnamese agri-food systems, transition theory is a uniquely powerful tool to explore the co-evolutionary and interdependent nature of food actors and institutions across levels.

5.2. Characterizing Vietnamese food system transitions

In this part, we return to the research question on the key drivers and issues that characterize the transitions of Vietnamese food systems. We further discuss several points that were highlighted in previous literature on transitions in food systems (Hebinck et al., 2021) and developing countries (Wieczorek, 2018). Three major insights are drawn from our analysis that help understand the transition process in the case study.

5.2.1. Technological and social innovations

The examination of solutions and their connections to the patterns reconfirms the shared importance of both socio-institutional and technological factors in shaping transitions (Smith et al., 2010). Unlike many other studies on historical transitions (Geels, 2005; Karltorp and Sandén, 2012; Turnheim and Geels, 2012), the transition process in this case was not led by the development of some breakthrough technologies. Multiple innovations listed in Annex 3 are cumulative improvements in breeding, seeding, feeding, fertilization, and plant or animal health protection technologies. Some are the rediscovery and diffusion of 'old ideas', e.g., traditional know-how of crop rotation, soil remediation and organic fertilization promoted via the IPM programme. The transition process, furthermore, involves different mechanisms of social innovations (Bock, 2012; Wittmayer et al., 2020), when food actors actively adopt and adapt innovations in social, organizational and cultural aspects to address normative societal concerns. One prominent example of the co-determining roles of both technological and non-technological innovations for food system changes is the case of bio-pesticides in vegetable production. The development of the biopesticide market in the late 2010s reinforced the wider diffusion of safety practices (introduced in the late 1990s). Nonetheless, there will be no transition in production practices without associated changes in law enforcement (on the use and sale of high-toxicity pesticides), organization (reformed cooperative models), or cultural meanings (awareness about their impacts).

5.2.2. Path dependency and developmental state

The study results add to the findings of previous studies that underscore governance and institutions as the driving factors of food system transitions (Kuokkanen et al., 2017; Schiller et al., 2020; van Gameren et al., 2015). The described transition process and their outcomes can be better understood via two main concepts. First, *path dependency* has a critical role in shaping the process. The rapid collapse of cooperatives and institutionalization of the smallholder regime in the early 1990s led to the widespread fragmentation of food production and distribution, which became a lock-in mechanism for adopting food control or certifications. The smallholders lack both the motivations and capacities to pursue formal contracts and certifications, especially in the regime where interpersonal relationships and informal institutions dominate (Hoang, 2020).

Second, as a *developmental state*, Vietnam has shown a strong commitment to international trade integration and economic development, while maintaining its long-lasting legacy of authoritative administration (Fritz and Menocal, 2007). Nonetheless, their primarily supply-driven, top-down approach and the inadequate participation of civil society have shown mixed performance,

especially in food safety control (Pham and Dinh, 2020; World Bank, 2017). Unlike some examples of transitions in other developmental states (Rock et al., 2009), the government did not establish a strong institutional setting for promoting public-private coordination in addressing food safety issues – perhaps except for the market development of bio-pesticides.

5.2.3. Stability and changes of smallholder-based regimes

The study found remarkable stability in both smallholder-dominated regimes of pork and vegetables. This can be explained via three main mechanisms: (i) the crucial role of informal rules, norms, and cultural preferences (daily shopping for fresh food) in shaping consumer and supplier behaviours (Wieczorek, 2018), (ii) the inertia in distribution systems (influenced by low consumer acceptability) deters the comprehensive reconfiguration or transformation of production systems, and (iii) smallholders also adopt cautious yet flexible strategies in adapting to the context of constant changes and market insecurity: retaining the traditional low-risk small-sized production models or migrating to find other incomes (e.g., retailers) in cities, rather than embracing modern or alternative models.

However, the contrasting of the two systems in later phases also shows different levels of destabilization, as well as varying levels of success among niches. While safe and organic vegetables are still small niches, large-scale farming and modern pork supply chains have developed into niche-regimes. This can be attributed not only to the intrinsic characteristics of each sector (i.e., the importance of processing in pork supply chains and the dependence on labour and land access in vegetable production) but also to the impacts of landscape shocks. The disruption caused by the ASF outbreak in 2019 appears to have had transformative impacts on the pork supply chain, while this is not the case for many food safety scandals in the vegetable chain.

5.3. Implications and trade-offs for agri-food sustainability goals

In the analysis, we found major implications for food security, food safety and smallholder welfare in the transition pathways of Vietnamese food systems. The substitution from collective to smallholder systems in the early 1990s coincided with the change in focus from ensuring food security to enhancing income and productivity. In the late 1990s, government policies shifted their focus from productivity to food safety and value chain upgrading, yet this policy shift did not align with opportune changes in production and consumption patterns.

Nutritional and environmental issues are regularly mentioned yet have little impact on the decisions of food system actors. While state and non-state agencies have started to pay more attention to nutritional problems (child malnutrition, micronutrient deficiency, obesity and non-communicable diseases), there are only a few initiatives that integrate nutritional goals into agri-food development (Raneri et al., 2019). Considering the insufficient intake of vegetables and the excessive consumption of red meat (compared to the GBD health recommendations), the governance of upcoming agri-food transitions should integrate the goal of promoting more balanced diets. Nonetheless, the challenge is in addressing the trade-offs between this goal and the interests of small-scale and large-scale pork producers and distributors, as well as the legitimate needs of the poor, undernourished population to consume more protein-rich sources.

In their study on agricultural modernization in Vietnam, Fortier and Tran (2013) argued that the Vietnamese food systems have been locked in by 'technological path dependencies' that prioritize high-energy and high-input technologies. This might be partially correct, considering the rapid growth of large-scale pork production and the rapid retail modernization, however, there are still different pathways that Vietnamese food systems can follow. The smallholder-led production and distribution networks can be reconfigured into alternative food systems with more balanced diets, less ecological impact, and a fairer distribution of benefits and responsibilities among food stakeholders (El Bilali et al., 2018). To navigate the ongoing transition process towards more sustainable goals, decision-makers must address the diverse practices, attitudes, and motivations of various stakeholders. A national agenda of modernization or sustainable development (i.e., SDGs) will not succeed if the local implementation does not thoroughly consider traditional practices, cultural norms and values, and the needs and expectations of myriad food actors, including poor consumers and smallholder producers.

6. Conclusion

The study has examined the transitional process of Vietnamese pork and vegetable food systems. We identified the substitution from collective to smallholder farming in the late 1980s, the rapid domination and empowerment of small-scale food systems in the 1990s, and the multiple adaptations for addressing food safety and productivity issues afterwards. We expect a reconfiguration of vegetable systems to incorporate food safety protocols, and a technological substitution from small-scale to large-scale and high-biosecurity pork production in the future. Nonetheless, the directionality and pace of such transitions still require further investigation. Future research should explore the practices and perceptions regarding sustainability transitions of various food actors at different levels (regime, niche, landscape, intermediaries) and components (production, distribution, consumption, support). One should consider the compound interactions of niche/regime dynamics with landscape movements of urbanisation, modernisation, and globalisation, as well as between the issues of food safety, food and nutritional security, and smallholder well-being. It is crucial to learn about different strategies and struggles and identify coordination mechanisms for co-building futures towards safe, nutritious, and sustainable food systems.

CRediT authorship contribution statement

Quoc Nguyen-Minh: Conceptualization, Methodology, Investigation, Data curation, Visualization, Writing – original draft. **Heleen Prins:** Investigation, Data curation, Writing – review & editing. **Peter Oosterveer:** Conceptualization, Supervision, Writing – review & editing. **Inge D. Brouwer:** Methodology, Supervision, Writing – review & editing. **Raffaele Vignola:** Supervision, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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