

A tale of two networks: Market formation on the Cambodia–Vietnam frontier

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Although South-East Asia's trading networks have existed for millennia, recent decades have seen markets dramatically intensify in the region's frontiers, bringing social and environmental upheaval. Within political ecology, such transitions are framed as frontier incorporation into global capitalism – a process that has been ongoing since European colonisation. This paper, however, responds to recent calls for commodity network studies to better account for specific material and social variances in “actually existing capitalism.” My analysis focuses on Mondulhiri province in north-eastern Cambodia, where a boom in cassava cultivation has produced two distinct commodity networks. The first network supplies dried cassava chips to trans-border markets that serve bioethanol and livestock production. The second network supplies fresh cassava to Vietnamese starch and processed food factories. In order to understand why two market networks have evolved from one crop, I analyse the social, material and spatial relationships in each network. Comparative analysis shows that both networks involve land and labour commodification and respond to global demand. Yet subtle geographical variations in transport networks, migration patterns and the availability of uncleared land, support dried cassava production in some areas and fresh cassava in others. The cassava case shows that although frontier markets are propelled by globally connected processes of commodification, they ultimately take form through co-productive networks that mould to and shape frontier landscapes. Furthermore, market networks are not only mobilised, but also can be demobilised by environmental, economic and social pressures – a point that frontier incorporation perspectives may overlook. The paper therefore argues for an understanding of frontier geographies as dynamic and constitutive in market formation.

KEYWORDS

Cambodia, cassava, frontier, hybrid methodology, market formation, Vietnam

1 | INTRODUCTION

South-East Asia's trading networks have existed for millennia (Piper et al., 2017; Stuart-Fox, 2003). Yet, in recent decades, markets have dramatically intensified in the region's “frontiers” through the rapid acceleration of resource extraction and commodification (Rasmussen & Lund, 2018). The resulting social and environmental upheavals call for a deeper understanding of frontier markets and their transformative effects. Although global capitalism relies on resource commodification

in frontiers (Harvey, 2007; Rasmussen & Lund, 2018), the specific trajectories of frontier market formation are far from uniform (Hudson, 2016). Supplementing critical understandings of frontier commodification with the socio-technical analytics of Science and Technology Studies (STS), this paper asks why and how different market trajectories can emerge from specific frontier landscapes.

Within a broad understanding of markets as physical and institutional spaces for commodity exchange (Black et al., 2017), this empirically based analysis of market formation speaks to two key literatures. The first, grounded in critical political economy, explains frontier markets as peripheral spaces of incorporation into global markets (Watts, 2012) that catalyse differentiated agrarian change and entrench structural inequality (Harvey, 2007). The second body of scholarship, based in STS, views markets as social constructs that take form through social relationships, knowledge about market processes, and related practices (Callon, 2006). I argue that both perspectives contribute distinct and complementary insights on market formation (Castree, 2002). The first explains *why* markets form within historical and systemic conjunctures (Li, 2014), and the second speaks to *how* they evolve and mould to nature and society in diverse contexts (Hudson, 2016; Lockie, 2006).

I use a hybrid approach to study a decade-long boom in the cultivation of industrial cassava (*Manihot esculenta*, also known as bitter cassava). This development has brought large tracts of the Cambodia–Vietnam border region under small-holder cassava cultivation to supply Vietnamese processing industries. Field research found that cassava produced in this region was drawn into two distinctive trading networks: the first for dried cassava chips and the second for fresh cassava tubers. This paper examines why these distinct networks formed from the same crop, and the implications for our conceptualisation of frontier markets.

My investigation is presented in four sections. The first section synthesises concepts and themes from agrarian political economy and STS that are pertinent to the study of frontier markets. The second section presents my research methodology and introduces the case study. The third section analyses dried and fresh cassava networks in the Cambodian border province of Monduliri in relation to commodification processes and socio-material networks. The fourth section synthesises key insights on the co-productive nature of frontier markets. The paper shows that frontier markets are propelled by global capital but take diverse forms through disparate networks that both mould to and shape – or co-produce – frontier landscapes. These networks are dynamic and prone to disruption, calling for a relational and dynamic understanding of frontier markets.

2 | CONCEPTUALISING MARKET FORMATION IN FRONTIERS

In the broadest sense, markets are an arena where we exchange goods and services for money (Mayhew, 2015). Geographers have pursued two main approaches to studying markets and their effects, which are surveyed below. The first draws on Marxist political economy to study the unequal structural and geographical dimensions of global capital. The second uses socio-technical or relational approaches to study markets as diverse configurations of “people, things, and socio-technical devices” (Mayhew, 2015). Some scholars see insurmountable epistemological and ontological differences between these perspectives (Hornborg, 2017; Lave, 2015). Others, however, work productively across these spheres to gain new insights on the functioning of commodity markets (Castree, 2002; Rocheleau, 2015; Tsing, 2015; Vandergeest, 2008). This paper joins recent efforts to bridge structural and relational approaches in order to gain novel insights on frontier markets.

2.1 | Frontiers as sites of capital incorporation

Although trade in valued items dates back to prehistory, Marxist scholars distinguish these exchanges from the post-colonial markets that tied commodity production and exchange to global capitalism (Nevins & Peluso, 2008). The colonisation of South-East Asia and other parts of the world served the development of global markets and capital (Nevins & Peluso, 2008). Commodity extraction and production required new modes of territorialisation that proscribed local access to land and natural resources (Vandergeest & Peluso, 1995). Colonial institutions and territorial infrastructures facilitated rapid growth in the extraction and circulation of commodities, capital, money, and people through rural spaces (Brenner, 1999). Colonisation was therefore a distinct moment of rapid market growth. These transitions remain prominent in contemporary resource frontiers (Nevins & Peluso, 2008).

A substantial literature on agrarian political economy shows that local engagement with global markets has dispossessed many, while benefitting a well-resourced and well-connected elite (Harvey, 2007; Nevins & Peluso, 2008). Most recently, the intensification of land transformations and market development by a flood of international investment, known as the “global land grab,” has fuelled rural dispossession and elite accumulation (Schoenberger et al., 2017). In South-East Asia,

farmers with relatively small, family-based land holdings (smallholders) are still significant producers in agricultural commodity markets (Rigg et al., 2016). Growing opportunities for mobility and off-farm income have typically broadened and supplemented agrarian livelihoods (Kelly et al., 2001; Rigg, 2006). In some places, these patterns reflect “de-agrarianisation,” where smallholders leave farming altogether (Bryceson, 1996). In frontier areas of Cambodia, however, migration from more populous provinces continues to drive smallholder agriculture (Diepart, 2016; Hecht et al., 2015). Ethnic minority populations in this region have juggled mixed forms of market engagement, involving commercial crops as well as subsistence production (Turner et al., 2015). Over time, with in-migration and the opening of new agro-industries, these communities may tip towards greater reliance on the sale of labour and commodity production (Akram-Lodhi & Kay, 2009; Li, 2014). A growing reliance on markets and cash incomes also appears to be connected to emerging cycles of debt (Gerber, 2014). This literature maps out the interconnected nature of global to local processes of market formation, and the differentiated outcomes that markets often produce.

Resource frontiers are often marked as active sites of market development. In political ecology, the analytic of “frontier” is applied to peripheral spaces of capital incorporation, where processes of accumulation and dispossession are in play (Watts, 2012, p. 440). In this view, frontiers are cast as spaces that may be continually “reinvented” as new resources are discovered, gain value and are commodified (Rasmussen & Lund, 2018; Watts, 2012). This reflects an understanding of frontier landscapes as resource assemblages, waiting to be dismembered for resource extraction (Watts, 2012). Yet, such landscapes also frame the available resources and opportunities and have the potential to be “lively actors” in market formation (Tsing, 2003, p. 5100). Relational green Marxism takes this notion further to understand society and nature as mutually constitutive, which blurs a firm distinction between political economy and socio-technical or relational perspectives (Castree, 2002). Building on these perspectives, the cassava case discussed here takes us from an extractivist view of frontiers to an understanding of frontier geographies as constitutive in market formation.

2.2 | Sociotechnical perspectives on frontier markets

From the STS perspective, market formation involves new ways of thinking about and enacting social relations, cultures and relationships to nature. Society and nature in turn exert an influence on the specific trajectories that markets follow, in a recursive process of “co-production” (Jasanoff, 2004). Viewing markets through the lens of socio-technology opens up analytical possibilities in relation to how knowledge is taken up and practised, to ultimately explain the disparate ways in which markets can mould to frontier landscapes. Callon (1998) adds that the economy itself is an artefact of the discipline of economics, a construct through which we understand and organise the world. Through an STS lens, markets are socially constructed, and incorporate knowledge, discourses and practices that are performed at an individual, organisational and societal level (Callon, 1998).

The performance of markets is therefore ongoing and may have inherent elements of instability (Berndt & Boeckler, 2009, p. 544). In the STS literature, this instability is discussed as dissonance or, in Callon's words, “misfires,” referring to tensions within market processes that have a constitutive or productive power (2010, p. 167). For example, major fluctuations in demand and price, or dramatic shifts in social relations, may on the one hand promote market formation or on the other may destabilise or “disarticulate” commodity networks (Berndt & Boeckler, 2009, p. 544). Understanding the existence and effects of dissonance within ostensibly hegemonic systems such as global markets and capitalism can reveal potential spaces for agency and change.

A further contribution of the socio-technology lens is its attention to the mechanisms and relationships that translate new practices and knowledge to different settings. Actor-network theory's (ANT) foundational concept of “translation” is particularly useful here (Callon, 1986; Latour, 2005). Translation speaks to the role of knowledge, relationships and practices that are needed to *enrol* disparate human and non-human actants¹ in emerging markets. The approach also considers how networks are *mobilised* to sustain the production and reproduction of markets over time (Callon, 1986). Less attention is given to network disruptions, however. This is an important gap, as Bair et al. (2013) observe, because market networks can also experience frictions or “disarticulate.” Building on their work, I adapt Callon's phrasing to call the fracture and falling apart of markets due to dissonant conditions “demobilisation.”

Science and Technology Studies' post-human analytics are controversial from the perspective of critical scholars, who argue that attention to material agency diverts attention from the social relations and exploitation on which capitalism rests (Hornborg, 2017). Scholars such as Hornborg (2017) and Lave (2015) therefore see an ontological binary between political-economic and socio-technical approaches. However, within ANT, material agency is studied for its relational significance rather than as an inherent quality of material objects. Attention to the relationships between human and material entities such as cassava, land, roads, and country borders helps us to move beyond the notion of frontier landscapes as

passive assemblages, and to grasp the specific mechanisms through which commodity networks “co-produce” society and nature (Latour, 1993; Jasanoff, 2004; see also political ecologists Rocheleau, 2015; McElwee, 2016). In STS, questions of power are central rather than diminished, to understand negotiations between various forms of knowledge, expertise, and technical praxis (Jasanoff, 2004, p. 4).

2.3 | A hybrid approach to markets

There is growing interest in hybrid approaches that work across these structural and relational spheres (Castree, 2002; Hudson, 2016; Mitchell, 2008). Both are significant for a comprehensive understanding of market formation, in what Hudson calls a coming together of bottom-up/micro and top-down/macro scales of analysis (2016). He therefore calls for more experimentation with hybrid methodologies.

Commodity network studies are an important sphere for the development and testing of hybrid approaches. A growing body of work questions the sole focus in commodity chain studies on understanding the sequences and processes that bring goods and services from peripheral frontiers to global markets (Bair, 2009, p. 2). Vandergeest et al. (2015), for instance, highlight the importance of governance modalities in shaping commodity networks for sustainable seafood certification, through new assemblages of space, objects, subjects, and expertise. Bair and Werner (2011) show that markets rest not only on the incorporation of new frontiers, but also historical and spatial processes of accumulation, disinvestment, and dispossession – or “disarticulations” – that collectively produce the uneven geographies of markets. Berndt and Boeckler (2011), drawing on Callon (1998) and others, bring performativity into the study of commodity networks, to understand the practices and constructions that underpin globally connected markets.

As Hudson (2016) argues, it is through this kind of integration that “actually existing capitalism” can be better understood. In other words, hybrid approaches can allow us to understand how specific geographies can actively translate structural influences in distinctive ways (Brenner & Theodore, 2002). This has important implications for our thinking about markets. It opens the potential to examine different causal processes in markets, and to study commodities as arenas of technology and cultural production that interact in complex ways with processes of capitalist expansion (Tsing, 2015).

Drawing on these ideas, my hybrid approach first considers the formation of frontier markets in the context of commodification and connection to global markets. Second, drawing on STS perspectives, the network heuristic is used to study how structural influences take form locally through material and social relationships and practices. Within this second theme, I draw on the notions of enrolment and mobilisation (see above) to assess how human and material actants are brought into market-oriented production and how markets are sustained over time. A critical factor in my case study is the productive role of “misfires” or “disarticulation” (Bair et al., 2013). In particular, I examine the pressures imposed by factors such as volatility in price and demand, which can cause farmers to switch crops and join different market networks, or else drive them further into debt.

3 | CASE STUDY OVERVIEW AND RESEARCH METHODOLOGY

Borders often promote trading opportunities, as they divide spaces with differential resources and market opportunities (Walther, 2015). This is also true of the Cambodia–Vietnam border region, where the flow of commodities from Cambodia to Vietnam has intensified over the last decade with Vietnam's economic reconstruction after the Indochina war (see Section 3.1). While the border has been central to market formation, the region is also examined as a frontier – a transitional space between cultures, land uses, territories, and degrees of state presence, and where the exploitation of natural resources feeds market formation (Hall, 2011).

Data for this analysis come from a four-year study of cross-border trading networks along the Cambodia–Vietnam borderland (see Figure 1; ARC FT130101495, 2014–2018). This project aimed to understand the formation of frontier markets, the role of systemic factors in facilitating new markets, as well as key actors, their trading networks, and practices. An earlier three-year project on land use change in Mondulhiri also gathered relevant data (ARC DP120100270, 2012–2014). Taken together, these two projects have enabled a detailed study of this region, including a total of 20 months of field research over six years (2012–2018). This effort has produced a rich empirical dataset from three main sources. The first body of data, which is the primary source for this paper, includes semi-structured interviews and repeat interviews with some 300 informants (including farmers, middle-men, traders, officials from different levels of government, factory owners, and border-checkpoint personnel, among others). The interviews broadly addressed the different categories of actors and relationships that enabled the production and trade of cassava and other key commodities from Cambodia to Vietnam.

Interviews were supplemented with participant observation on farms, trading hubs, and border checkpoints. Second, the project included a household survey in the Cambodian provinces of Mondulkiri and Tbong Khmum (2016, $n = 220$ households). The third dataset, on the history of trade and land use in this border region, was compiled from French colonial correspondence and reports held at the Archives Nationales d'Outre-Mer in Aix-en-Provence and the Vietnamese National Archives II in Ho Chi Minh City.

Although my research has covered several study sites along this border, this paper focuses on commodity networks that reach from Cambodia's Mondulkiri province to the Vietnamese provinces of Binh Phuoc and Tay Ninh. My field research aimed to understand the drivers and transformative outcomes of agricultural commodity booms, notably timber and the key crops of cassava and rubber. When fieldwork uncovered two distinct trading networks for dried and fresh cassava, this provided the opportunity to examine why farmers specialised in one or the other crop. This paper reports on my comparative analysis of the two networks and the insights that it provides on the geography of frontier markets.

My analysis of human and material actants and relationships here draws primarily on interviews, field observations, and secondary sources. I analysed this narrative data with NVivo to identify various categories of human and non-human actants and patterns of interaction between them. Elsewhere, I have analysed actants and their relationships with quantitative social network analysis, to understand the role and influence of state actors (Mahanty, 2018). In this paper, however, my analysis is qualitative and focuses on each cassava network's actants and geography.

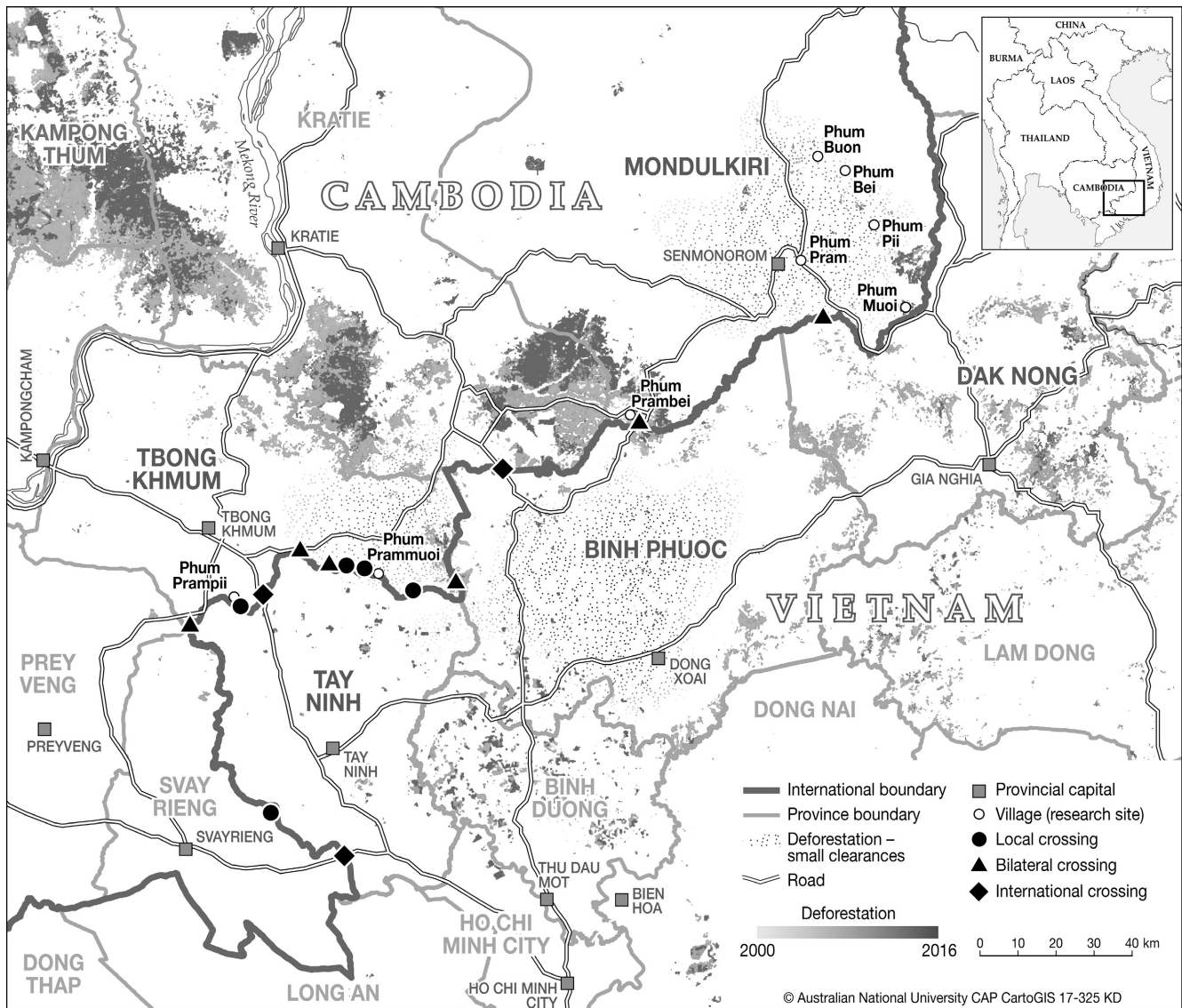


FIGURE 1 Study sites in Cambodia and Vietnam.
 Source of deforestation data: Hansen et al. (2013), updated 2016

4 | COMPARING NETWORKS FOR CASSAVA CHIPS AND CASSAVA TUBERS

Introduced to South-East Asia in the 18th century, cassava was an established domestic crop by the late 19th century (Onwueme, 2002). The industrial variety of cassava grown today is different to this earlier edible variety and was developed for its high yield and starch content during the 1970s (Smith et al., 2018). Global demand for industrial cassava took off in the 1970s, initially driven by European markets and, later, China. This section looks at how these markets have taken form on the Cambodia–Vietnam frontier. First, it examines the history of market formation, and its connections to colonisation and the post-war political economy of Cambodia and Vietnam, when the two countries opened up to international investment, industrial development, and land commodification. The second section outlines the actants, relationships, and practices that have respectively mobilised the network for dried cassava and the network for fresh cassava tubers. The third section discusses the key factors that are causing these networks to “demobilise” over time. The analysis identifies the main factors that produced these distinct networks and assesses their transformative effects.

4.1 | Market formation during and after colonisation

By the time France established its colony of Cochinchina in 1864 (now Vietnam) and its Cambodian protectorate in 1863, a vast array of trade and social networks already traversed the region (Piper et al., 2017; Stuart-Fox, 2003). China and Vietnam were already important players in the extraction of timber and other natural resources from Cambodia (Cooke, 2004). The French colonial government increased agricultural exports, initially targeting Asian and later European markets (Brocheux & Hémerly, 2009). Similar to other colonial rulers, the French introduced new actors, territorial regimes, governance arrangements, and trading institutions.

Strategies to promote trade with east Asia produced dramatic growth in Indochinese exports in the late 19th and early 20th centuries and made Indochina (incorporating Vietnam, Cambodia, and later Laos) France's most profitable colony (Brocheux & Hémerly, 2009, p. 175). Rice was the first major export to east Asia, with about 1.3 million tons exported in 1919 (Brocheux & Hémerly, 2009, p. 123). Trade also involved the exploitation of tropical natural resources, especially timber (Chandler, 2008, p. 172), and the development of agro-industrial crops, namely rubber, tea, and coffee (Brocheux & Hémerly, 2009). Between 1913 and 1929, agro-industries were expanded by private French and Belgian investors, who were allocated an estimated 610,000 hectares of land by 1937 (Brocheux & Hémerly, 2009, p. 126). The French state supported these export industries with land grants, basic facilities, and infrastructure such as irrigation, rail, roads, and ports (Aso, 2018). However, road networks in Monduliri remained relatively undeveloped until well into the 20th century. This restricted access by lowland farmers and, until recently, left the province with a predominantly ethnic minority population.

After independence from the French was achieved in Cambodia (1953) and Vietnam (1954), the border region was shaped by successive conflicts up until the 1980s. The independence struggle of the first Indochina war (1946–1954) was followed by the second Indochina war between North and South Vietnam with American involvement (1950s–1975). The border region occupied a strategic position as a passageway for Vietnamese troops and arms along the Ho Chi Minh trail. When the Democratic Kampuchea (Khmer Rouge) regime subsequently claimed power in Cambodia from 1975 to 1979, the eastern border was plagued by massacres and bombings and ultimately became the entry point for Vietnamese troops who overthrew the Khmer Rouge in 1979. The Vietnamese then occupied Cambodia for a decade (1979–1989) (see Taylor (2013) on Vietnam and Chandler (2008) on Cambodia). The movement of people and goods between the two countries was severely constrained during these periods of active conflict, a point that was recalled by many older informants who participated in this research. Starting with timber, cross-border commodity flows recommenced in the mid-1980s and then grew from the 1990s along the eastern and western borders (Le Billon, 2002).

The current wave of agricultural commodity production in Monduliri, in which cassava has been a crucial pioneer crop, came with economic liberalisation in the two countries. Vietnam's *Đổi Mới* (economic renovation) reforms of 1986 brought rapid industrial growth, financed by joint ventures with foreign investors. Food processing industries were an important component, accounting for about 20% of Vietnam's GDP in 2016 (Do, 2016). The demand for raw inputs, including cassava, far exceeded domestic agricultural production capacity, yet international demand steadily increased with China's emergence as a major global buyer in the early 2000s. These developments positioned Vietnam as an important processing centre for agricultural products such as cassava, but processing industries depended on raw materials from Cambodia, which came in increasing volumes from 2005 onwards (FAOSTAT, 2017). The province of Tay Ninh became Vietnam's

main centre for starch processing, with 67 starch factories in 2014 (Government Official, Tay Ninh Department of Natural Resources and Environment, Interview, 13 April 2015). These factories produced over one million tons of refined starch in that year, primarily for export (Government Official, Tay Ninh Department of Industry and Trade, Interview, 13 April 2015).

In Cambodia, the formalisation of land holdings also served the espoused developmental goals of the government. The government's "Rectangular Strategy" has emphasised stable land tenure as an essential precondition to boost agricultural production and domestic value addition (Royal Government of Cambodia, 2004, 2013). Only through these measures, according to the strategy, could the government "eliminate illegal and anarchic land grabbing, and prevent misuse of land acquisition and landholding of concessions for speculative purposes or without any productive purpose" (Royal Government of Cambodia, 2013, para. 62). With donor support, the 2001 Land Law attempted systematic land registration to promote tenure security, land markets, and investment. However, titling was never completed because of the fluidity and movement in rural areas in the post-conflict period, particularly rural-rural migration to new frontiers such as Mondulkiri (Diepart, 2015).

After 2010, many rural people still lacked secure land access and were agitating to achieve this. Direct appeals to government elites – even the Prime Minister – were common, as illustrated in this story from a resident of Phum Buon in Mondulkiri, about local protests when state agencies attempted to restrict settlement in forests by new migrants:

In 2009, two houses were burned by the Forest Administration. Then we heard that Prime Minister Hun Sen was coming to Phum Prambei [a nearby village], so we wrote a protest letter to him. After that, the Prime Minister's son came to visit our village and saw that many people were already living here ... Although the authorities wanted us to move to another place near the Vietnam border, we were able to stay here because the land there was no good. (Farmer, Phum Buon, Interview, 20 February 2016)

With this story, the informant was demonstrating the capacity of villagers to engage with and pressure political elites in support of their desires for land and security. Pressure on the government was primarily triggered by large-scale agro-industrial concessions, where land conflicts between companies and farmers were routine (Grimsditch & Schoenberger, 2015). These developments, along with competition from a viable opposition party in the lead up to the 2013 national elections, led to a new policy intervention that ran from 2012 until the 2013 national election known as "Order 01." Teams of university students, working closely with state officials, were deployed across the country to measure farms, map boundaries, and title smallholdings of up to five hectares. In Phum Pii, Phum Bei, Phum Buon, Phum Pram, and Phum Prambei, many newly cleared lands were titled during this process. Household survey data showed that, in 2016, 65% of respondents gained titles for residential lands and 33% for their farmlands. The policy also had important anticipatory effects, producing a flurry of land clearing, small-scale land-grabbing, and planting of cassava to demonstrate active use ahead of the arrival of titling teams. Despite these efforts, some of this purposefully cleared land was not titled (Mahanty & Milne, 2016).

This brief history shows that a conjuncture of political and economic developments from the local to the global scale have driven the development of agricultural commodity production in Mondulkiri and processing industries in Vietnam. The formation of cassava markets here is relatively recent, as colonial agro-industrial interventions initially centred on lowland border areas to the south. It was the post-war reconstruction period that propelled market formation in Mondulkiri, as Vietnamese industries developed, and rural migration grew in Cambodia, alongside the government's land reforms. Although the post-war political economy has propelled agricultural markets, a host of more nuanced actors and factors underpin the growth of specific commodity networks, which I discuss next.

4.2 | One crop, two networks: Cassava chips and cassava tubers

Mondulkiri's differentiated geography was crucial in producing two distinct cassava networks for cassava chips and tubers (see Figure 2). The upland areas of Mondulkiri, where cassava gained ground as a crop of choice for new lowland migrants, was best suited for cassava chip production. For fresh cassava, transport time was critical as it needed to reach processing factories within 1–2 days or starch levels deteriorated. These conditions only existed in the more established farming areas of lowland Mondulkiri. Among my field sites, lowland Phum Prambei was the only one producing fresh cassava, while the rest (Phum Muoi, Phum Pii, Phum Bei, Phum Buon, and Phum Pram), located in upland Mondulkiri, solely produced chips.

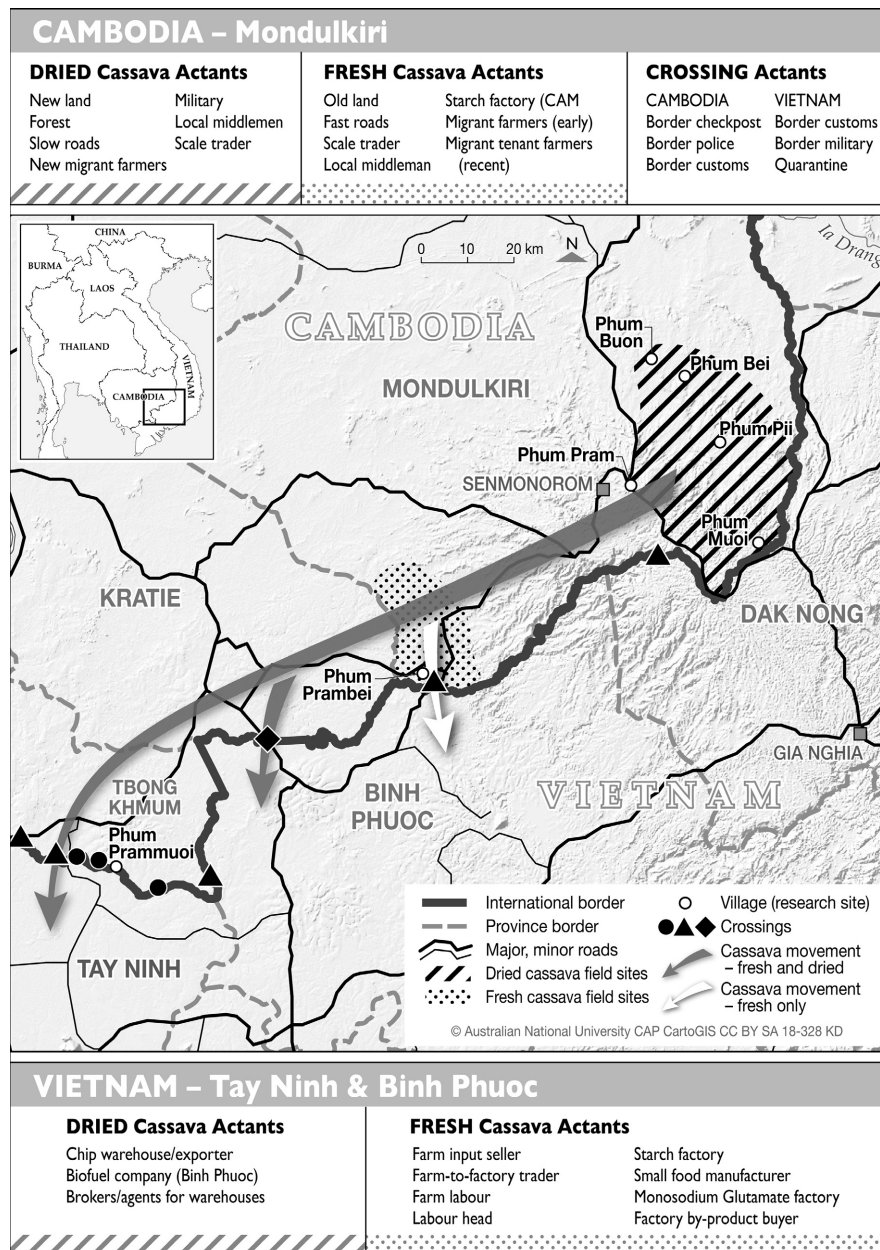


FIGURE 2 The geography of dried and fresh cassava in Mondulkiri.

Note: For legibility, only a subset of the actants discussed in the text appears in Figure 2

4.2.1 | Mobilising cassava

Vietnamese cassava research centres developed and disseminated the industrial cassava cultivars now grown in Cambodia and Vietnam. As global starch markets grew, crop scientists promoted cassava as a cultivar suited to poor farmers due to its ease of cultivation and low investment needs (Vietnamese cassava scientist, Interview, 12 April 2015). Although scientists were instrumental in developing new varieties and cultivation techniques, the crop's dissemination to Cambodia occurred through Vietnamese traders. Traders first brought cassava to Phum Prambei around 2005. They advised farmers on how to cultivate the cassava stems that they supplied, promising to return at the end of their first few growing seasons to buy their harvest (Focus Group Discussion, Phum Prambei, 11 December 2013). The crop was then quickly disseminated through farmer networks, first gaining a foothold in lowland Mondulkiri and gradually spreading to upland areas as migration opened up new lands for farming (see below).

Mondulkiri's differentiated road infrastructure was an important influence on cassava markets – a pattern that is well documented in the development literature (Dalakoglou & Harvey, 2012; Harvey & Knox, 2012). In lowland Mondulkiri, Chinese and Asian Development Bank (ADB) finance progressively upgraded the road infrastructure from the early 2000s (Chan, 2017; Hughes & Un, 2011). This produced a lowland road system of sealed or packed dirt roads that could support large trucks and enabled tubers to be rapidly transported to factories over the border. In contrast, villages in upland Mondulkiri were served by tracks that were only navigable by motorbike or the hardest cars and trucks (see Figure 3). The ability of dried cassava to be transported after weeks of storage made it suitable for these relatively remote localities.

A second crucial difference was the timing of migration and land clearance in dried and fresh cassava production areas. Lowland Mondulkiri's ease of access made it the first part of the province to be settled during post-conflict migration. This commenced in the early 2000s and intensified – alongside cassava markets – from 2005 onwards (Focus Group Discussion, Phum Prambei, 11 December 2013). By 2016, the population in lowland Phum Prambei was dominated by established migrant farmers whose land holdings were more than five years old. The remaining population was comprised of smaller numbers of Bunong and Stieng² families and new migrants. These different patterns of settlement and land availability contrasted with the chip network's reliance on forest, freshly cleared lands, and new migration. Accessible lowland forests diminished by 2013, and only elites with government networks could secure land in any remaining forests and afford the labour required to clear it (Mahanty & Milne, 2016). Landholdings were also locked in during 2013 due to the government's rapid land-titling scheme (see Section 3.1). With little scope to claim land in lowland Mondulkiri, new migrants instead moved on to upland locations or worked as day labourers for established landowners. Thus, the fresh cassava network is characterised by a settled agricultural landscape and relatively good roads.

The demography of chip-producing areas, such as Phum Buon and Phum Pii, reflected a later migratory surge (Focus Group Discussion, Phum Buon, 10 February 2016; Hamlet leader, Phum Pii, Interview, 26 January 2016). In Phum Pii, the allocation of several land concessions brought a major influx of workers, which boosted the slow drift of migrants that had already commenced around 2005. In Phum Buon, migration occurred from 2007 onwards. An estimated 80% of farmers in that village had seized and cleared the land themselves, while newer arrivals (around 20%, but rapidly increasing in ratio) had to buy land from migrants who arrived before them (Focus Group Discussion, Phum Buon, 10 February 2016). Unlike the Bunong, whose adoption of cash crops required farmers to switch away from upland rice cultivation, migrants would produce agricultural commodities from the start, sell their labour, or set up trading businesses (Focus Group Discussions: Phum Bei, 10 February 2016; Phum Pram, 11 February 2016).

Cassava's ease of cultivation on newly cleared lands made this crop central to land-claiming processes and therefore landscape change in this border region. New migrants continued to clear land in remote areas of Mondulkiri during 2016 and 2017 (shown as “small clearances” in Figure 1). The nexus between upland cassava chips, land clearance, and land claiming also brought local state actors into the network, particularly village and commune officials. New migrants routinely had to seek the approval of these local officials in order to clear and occupy land. During Order 01, local authorities



Well-connected Phum Prambei



Road to Phum Pii

FIGURE 3 Roads: (a) well-connected Phum Prambei; (b) road to Phum Pii.

Source: Author

also verified and approved the land measurements and ownership status, usually demonstrated by active cultivation, that were needed for land titling. In this way, dried cassava emerged from and contributed to interactions between forests, new migrants, state actors, and newly cleared lands. In both the dried and fresh cassava networks, district, commune, and village officials mediated land access networks and authorised land titles. These relationships tied cassava cultivation to land use change, which was historical in fresh cassava areas and ongoing in dried cassava areas.

Subtle differences in available infrastructure, biophysical characteristics, and migration patterns thus helped to mobilise two distinctive networks for fresh and dried cassava. At the same time, cassava has served an important role in land claiming and clearance. The nature of this border landscape helped to constitute cassava networks, while being simultaneously transformed by them.

4.2.2 | Circulation networks

The production of fresh and dried cassava targeted different end uses. After being cut and sun-dried, the more highly priced semi-dried cassava chips could be stored for several months. The chips were then shipped for livestock feed and ethanol production to Chinese and Vietnamese buyers. In contrast, Vietnamese processing factories were the main users of fresh cassava tubers. Some were used to make noodles and processed food for Vietnamese markets, but most were processed into refined starch, glucose, and monosodium glutamate (MSG). These derivative products were exported to China or other Asian countries for use in processed foods, paper production, and pharmaceuticals, among other things.

Although Vietnamese traders figured in the dried cassava network, their arrangements for buying and transporting the chips differed from those for fresh cassava. Large Vietnamese warehouses were the primary destination for cassava chips, which would then export most of their stock to China for animal feed and biofuel production. Chip warehouses relied more heavily than starch factories on Cambodian produce, since Vietnamese farmers did not produce cassava chips. Typically, Vietnamese warehouses did not directly purchase their chips from Cambodian farmers, but instead relied on Cambodian traders to aggregate the chips and transport them over the border. Sometimes these traders would use Cambodian middle-men (fee-for-service agents) to connect them with farmers who could supply cassava chips. In some rare cases, warehouses would facilitate this process by extending credit to their trusted traders in Cambodia.

By 2015, Tay Ninh was Vietnam's most important cassava-processing province. Factories ranged in size, depending on the number of production lines they contained. As observed during field research in 2015 and 2017, the largest factories had up to four production lines, and a production capacity of up to 300 tons of dried starch per day. This level of output required about 1200 tons of fresh cassava, of which up to 60% was sourced from Cambodia (Large factory, Binh Phuoc, Interview, 13 January 2018). In 2018, however, all of these factories were producing well below their capacity, due to cassava shortages (see Section 3.3). While Cambodian farmers and traders typically characterised Vietnamese factories as powerful network actors, factory owners instead saw themselves as being at the “very end of the chain,” as one Tay Ninh factory owner described (Interview, 18 January 2016), implying a situation of relative powerlessness in relation to international buyers, who set the price.

These starch factories – or “stoves” as Vietnamese cassava traders called them – each had five to six loyal traders who they regularly dealt with. After tracking and communicating with a core group of nine traders over a period of two years, it was clear that Vietnamese traders specialised in either chips or tubers. Some tuber traders, known as “farm-to-factory” traders, used networks of Cambodian middle-men to connect them to farmers. They would then buy the farmers’ harvests with lump-sum payments that were calculated based on visual estimate of the likely yield before the crop matured. The purchase price would factor in the cost of Vietnamese labour for cassava harvesting, as well as transport costs. It was this type of trader who first introduced cassava to Phum Prambei (see above). Over time, Cambodian buyers also emerged, operating weighing and aggregation facilities. Farmers who owned or could hire a tractor would transport their cassava to these Cambodian buyers. The Cambodian traders would then sell and transport the goods directly to Vietnamese factories, or collaborate with Vietnamese traders to arrange transport to factories. Often, specialised Vietnamese agents at the border would take care of the border paperwork and informal fees.

For chips, on the other hand, the main buyers were large Vietnamese warehouses. These warehouses did not directly purchase chips from Cambodian farmers. Instead, they dealt with Cambodian traders who aggregated and bought chips from farmers, and transported them to Vietnamese warehouses that were often located near the border. In some rare cases, warehouses would also extend lines of credit to trusted traders in Cambodia. Although the Vietnamese government has attempted to develop a domestic biofuel industry, the policy has been stop–start and has not established a secure market for chips. Indeed, one large warehouse owner shared that the firmer market for chips in China would remain more lucrative than the domestic biofuel market for the foreseeable future (Warehouse owner, Tay Ninh, Interview, 7 January 2018). Visits

to two medium-sized and two large warehouses showed that most of their stock was sent to China for animal feed and bio-fuel production.

Although dried and fresh cassava circulated through different trading networks, both intersected through shared Cambodian and Vietnamese state actors at the border. Cambodian border police and Vietnamese military personnel at checkpoints routinely required informal payments for fresh and dried cassava shipments (Mahanty, 2018). For dried cassava, however, additional costs applied for Vietnamese buyers wanting to re-export their cassava chips. Trucks loaded with cassava chips had to also clear border customs and quarantine procedures when entering Vietnam from Cambodia. Without obtaining a “certificate of origin” and quarantine certificates which were issued at the border, problems and additional costs would arise when it was time to export the goods through Saigon port. Often the factories or warehouses would organise agents to manage the border-crossing process and fees. These transactions were crucial to the import, processing, and/or re-export of cassava, making the border checkpoint an important actant in dried and fresh cassava circulation.

4.3 | Demobilisation

As a “flex crop” that has diverse and multiple applications, cassava competes in global markets with other starchy crops (Borras et al., 2016). For this reason, although the global market outlook for cassava is strong, demand for the crop and its price is closely coupled to that of its key competitors, maize and sugarcane (Smith et al., 2018). Cassava networks have therefore experienced sudden shifts in demand and price in recent years – notably 2016 – due to international developments, such as changes to Chinese state subsidies for maize (Smith et al., 2018). Field observations show that the price paid to farmers by scale traders for fresh cassava in Cambodia more than halved between January 2016 and January 2017, from Riel 240/kg (or US\$ 0.06/kg) to Riel 108/kg (US\$ 0.026/kg). Another issue, specific to cassava chips, has been the volatile nature of the biofuel market in east Asia, as well as policy uncertainty regarding the introduction of 10% ethanol fuel in Vietnam (Smith et al., 2018; Vietnamese Government Official, Interview, 18 January 2018). The effects of these factors, while geographically remote from cassava producers and traders in my study area, have created significant uncertainty with consequential effects for each network.

By late 2017, there was a distinctive pattern of “demobilisation” in cassava production in border districts. In Phum Prambei, financial losses caused some farmers to lose their land through distress sales or debt default. Those with sufficient assets to buffer a poor season were starting to plant other crops such as green bean, cashew (relatively low cost), rubber (higher cost due to the longer wait for production) or even the most capital-intensive crop of pepper, taking on major loans of up to US\$20,000 for the latter. In relatively remote areas such as Phum Buon, some farmers left their crop in the ground, unable to afford the labour to harvest it, with the hope of harvesting the crop in the following season if the price improved. Overall, this created a fall in cassava production during 2017, which was acutely felt by downstream processing industries in Vietnam. In January 2018, Vietnamese factories reported that only about 50% of the expected volume of cassava was being transported over the border and that they were consequently running at a fraction of their capacity. Smaller traders in Cambodia started to buy and aggregate other types of commodities, reflecting the changes in crop cultivation. However, for Vietnamese brokers whose contacts centred on cassava, it was difficult to make such a change. One Vietnamese middle-man whose work involved connecting Vietnamese factories and Cambodian traders, observed that brokers like him would “die with their tongue out”³ (*chết lè lưỡi*) because of the fallout from market volatility (Trader, Interview, 7 January 2018).

In addition to price pressures, cassava pathogens started to take hold in Mondulkiri during 2017. The Cassava Mosaic Disease, a virus transmitted by the whitefly (*Bemisia tabaci*), entered Cambodia in 2015 (Wang et al., 2016). Mondulkiri was initially less affected than Tbong Khmum, because Tbong Khmum was the first port of call for diseased Vietnamese cassava stems coming across the border. On the Vietnamese side of the border, this disease reached crisis point during 2017, with the Tay Ninh People's Committee declaring a disease epidemic on 28 July 2017 (Hoang, personal communication, 25 January 2018). The Cambodian government similarly released a statement in mid-2018, confirming that it was considering urgent action to stem the spread of this disease, which was gripping all of Cambodia's eastern border provinces, particularly Ratankiri, Mondulkiri, Tbong Khmum, Kratie, and Kampong Thom (Chan, 2018). This provided further impetus to farmers who were considering other crops for price reasons. Although the associated fall in cassava production buoyed the price of cassava during 2018 (Sokhorng, 2018), price alone was not enough to overcome these other disruptions in the short term.

Meanwhile, the pressures on processing industries on the Vietnamese side of the border were amplified by the government's efforts to regulate environmental wastes from these industries. The waste water from cassava processing can be high in biological contaminants and cyanide. Citing these concerns, the provincial environmental agency in Tay Ninh closed eight factories for waste water violations during 2015 (Tay Ninh Department of Natural Resources and Environment, Interview, 13 April 2015). Several remaining processing plants were being monitored for environmental violations. Although

their tough standards disadvantaged smaller operators the most, officials argued that it served environmental protection interests to limit production to only those factories that had the capacity to comply with waste processing regulations. In January 2018, factory owners cited environmental compliance as a key financial stressor that amplified the constraints imposed by reduced cassava flows.

In the context of demobilisation it is noteworthy that price effects were felt within both of the cassava networks, but the overall trend towards market intensification and commodity agriculture continued. In this sense, market formation pressed on regardless of the fortunes of the cassava networks, fuelled by the commodification of land and farmer debt. The market continued to evolve in new directions as farmers took up new crops, engaged in land sales, and new migrants needed to sell labour rather than work their own land. This points to the importance of looking beyond individual commodity networks, to consider their place within broader processes of market formation.

5 | MARKET TRANSLATION AND THE CO-PRODUCTION OF SOCIO-NATURE

The paper shows that contemporary cassava markets overlay a deep history of market engagements that accelerated through colonisation. As proposed by critical scholars, global connections and shifts, such as the rise of China and the liberalisation of South-East Asian economies, have played a significant role. These developments rekindled the integration of this borderland into global markets, and provided the impetus for cassava production and processing. Land governance arrangements and the emergence of political elites in the post-conflict period further supported market development. This provided a set of conditions that converged in time and place – a frontier assemblage or conjuncture (Li, 2014) – that supported and sustained the incorporation of this frontier region into global markets (Watts, 2012). The combination of these factors propelled the overall demand for cassava, and facilitated the political and economic conditions for its production.

Nuanced social and material conditions then mobilised dried and fresh cassava market networks in Mondulkiri. Crucial here was the variegated character of this frontier landscape. In the 1990s and 2000s, the cessation of conflict and road network improvements promoted migration first to the lowlands, and then to progressively more remote areas with less road infrastructure. The latter localities were only suited to the production of dried cassava due to the time taken to move cassava crops to prospective buyers. Here, key material actants such as roads and forests were influential in framing market opportunities and formations. In this way, Mondulkiri's differentiated social and biophysical environment co-produced two distinct commodity networks.

Furthermore, the comparison of cassava chips and tubers has brought out the dynamism of commodity networks, which can fall outside the purview of “frontier market incorporation” perspectives. Specifically, the case shows that the mobilisation of markets can tip towards demobilisation when markets and production networks for specific commodities are subjected to stresses, such as price fluctuation, loss of soil fertility, and farmer debt. Specific actors could leave the network – in this case through land loss and migration – or take up new commodity crops such as rubber, cashew, or pepper. Here, the findings resonate with the work of Bair and her colleagues who foregrounded processes of dispossession or “disarticulation” in commodity networks (Bair, 2009; Bair et al., 2013). The Mondulkiri analysis adds that frictions within networks may play a productive role (Tsing, 2005), whether in fracturing networks or producing novel patterns of cultivation and labour.

On the subject of frontier markets more broadly, these observations about the mobilisation and demobilisation of markets suggest that market formation in frontiers is an ongoing process. It may be that this enrolment–demobilisation dynamic is an important mechanism for “frontier reinvention” of the kind flagged by Rasmussen and Lund (2018). Anna Tsing also reminds us that people can find niches and make a life, albeit precariously, on the “edges” of capitalism (2015). The cassava case similarly walks a fine line between reinvention through the uptake of new crops and opportunities, and the social and environmental risks that emerge from forest loss, price fluctuation, and disease. Time will tell whether these effects ultimately signal limits to frontier reinvention, as harbingers of Marx's “metabolic rift” (1867, 1990).

The case advances our conceptualisation of frontiers in two distinct ways. First, it affirms the relational character of frontiers (Barney, 2009). Vietnamese factory owners, seen by Cambodian farmers as central actors who set cassava demand and price, were at the same time peripheral actors in a global market framed by Chinese buyers and others. Similarly, in French Indochina, Vietnam was at the margins of the French empire, while serving as a conduit for resources from even more peripheral Indochinese territories such as Laos and Cambodia. These examples highlight that frontiers are heterogeneous and relational spaces, with implications for how markets evolve vis-à-vis global commodity circuits. Such relationality may be overlooked in analytics that focus only on incorporation into global capital (e.g., Rasmussen & Lund, 2018; Watts, 2012). Second, the case draws attention to the interplay of borders and frontiers, a relationship that scholars are still trying to grasp (Eilenberg, 2014).

In Mondulkiri, this relationship made the frontier more than a site of “loose governance” with plentiful resources (Hall, 2011). It introduced “multiple systems of rule,” spanning the regulatory apparatus of two nation states as well as various operational and local norms (Sassen, 2017). This suggests that frontier discourses are often applied to very diverse settings that warrant interrogation to gain a more comprehensive understanding of their heterogeneity and dynamism.

Finally, by combining systemic and relational perspectives in the study of frontier markets, we have gained a fuller understanding not only of the political and economic drivers of frontier markets, but the networks through which markets are mobilised. As Castree (2002) highlighted, pitting these structural and relational perspectives against each other means lost analytical opportunities. This paper therefore progresses experiments with hybridity, and illustrates how such approaches can contribute complementary and nuanced insights on how frontier markets develop within diverse socio-natures.

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ENDNOTES

- ¹ Following Latour, an actant refers to “something that acts or to which activity is granted by others. It implies no special motivation of human individual actors, nor of humans in general” (1996, p. 7).
- ² These two Mon-Khmer ethnic minorities reside throughout the Cambodia–Vietnam border region, with linguistic evidence of their presence in the area for as much as 2000 years, and archeological evidence that extends several thousand years (Keating, 2016; White, 2009).
- ³ The trader meant to imply a painful figurative death, comparable to strangulation.

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