Networks, translocality, and the resilience of rural livelihoods in Northeast Thailand

Insights from a social network perspective

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Abbreviations

BAAC	Bank of Agriculture and Cooperatives
DOAE	Department of Agriculture and Extension
SNA	Social network analysis
SES	Social-ecological system

I. Summary

Building resilient livelihoods among smallholder farmers is key for reaching global development goals, in particular with regard to the eradication of extreme poverty and hunger. Small farms are home to large shares of populations, and are the prevailing sources of food and livelihoods in the Global South. However, in the context of global social and environmental change, rural communities are experiencing increasing threats to the social and environmental conditions on which they rely. A particularly controversial topic in the discussion of how rural communities can thrive and build resilience amidst global change is the role of migration.

Whether migration poses a threat or is conducive to how rural communities build resilience remains a disputed question. Whereas, at the end of the last century, pessimistic views on migration prevailed, portraying environmental migration as a global security issue, since the beginning of the new millennium migration has re-emerged as the "new" buzzword on the agendas of governments and international development organizations. An optimistic view of migration has been particularly fueled by the recognition that in a globalized world rural migration constitutes an important livelihood strategy, with international remittances far exceeding global development assistance. Furthermore, a positive view of migration has been propagated by the popular notion of migration as adaptation, leading to a shift in the perception of migration, from a failure to adapt to climate change to a means of building resilient livelihoods. While today it is commonly agreed upon that migration is a complex phenomenon, with climate change being one important driver out of many, the scientific debate continues to be torn between positive and pessimistic camps with diverging assumptions about migration outcomes, depending on the analytical focus and scale of investigation.

In the midst of this debate, the concept of translocality has gained momentum as an integrative perspective for overcoming the divide between positive and pessimistic camps. Conceiving of migration and mobility as the norm rather than the exception, a translocal perspective overcomes dichotomous divides between "here and there", "the rural and the urban", and "the north and the south". More particularly, a translocal perspective shifts the analytical focus from either the area of origin or the area of destination of migration to the embeddedness of mobile and immobile actors in migration-induced translocal social networks. Proponents of a translocal perceptive argue that translocal social networks, by facilitating the flow of resources, knowledge, and ideas between multiple places, strengthen the capacity to cope, to adapt, and to explore alternative livelihood pathways, and hence hold potential to promote the resilience of migrants and sending households alike. While a growing number translocality studies have yielded valuable empirical insights into the multi-local and multi-facetted nature of translocal connectedness, they have failed to provide a structural understanding of translocal social networks and their role in building resilient livelihoods. Accordingly, the question remains open as to what structural patterns and what flows channeled through translocal social networks facilitate or impede livelihood resilience.

In order to substantiate the debate on the role of migration in resilience building, this study provides empirical evidence, by taking a translocal social network perspective on the resilience of rural livelihoods in Northeast Thailand. Based on a systematic literature review of current research on social networks and the resilience of rural communities in the Global South, this study provides the conceptual and operational framework of a translocal social network perspective to the resilience of rural livelihoods, based on methods of formal social network analysis (SNA). Against the backdrop of this framework, two empirical case studies, conducted in Northeast Thailand, provide detailed insights into the socio-spatial patterns of households' network capital and a structural and spatial explicit understanding of translocal innovation transfers in small-scale farming communities.

Research findings highlight the translocal character of today's rural livelihoods in Northeast Thailand. Whilst livelihoods remain mostly locally rooted, translocal networks are of pronounced rele-

vance for sustaining rural livelihoods and drivers of agricultural innovation. At the same time, this study reveals that translocal networks are not equally available and beneficial among rural households and facilitate different types of innovation transfers with differential resilience outcomes.

In rural areas of Northeast Thailand, poor households, which are relatively deprived of translocal bridging capital, critically rely on migration-related translocal capital in terms of financial support to cope with adverse livelihood conditions. At the same time, poor households are confronted with the erosion of local bonding capital, in particular in terms of agricultural labor. Migration-related innovation transfers can induce bottom-up innovation processes providing opportunities for poor households to adapt their farming practices to labor shortage and increasing climate variability in the short term; however, they do not prevent the marginalization of small-scale rice farming in the long-run. In contrast, better-off households can benefit from their more abundant and more formalized translocal network capital, as well as from their more favorable structural position within extension-driven top-down innovation networks in order to transform their livelihoods towards large-scale cash-crop production and agriculture businesses. While large-scale cash-crop farming promotes economic growth and income, its detrimental social and environmental consequences threaten the resilience of farming systems in the long run.

Altogether, these findings suggest that rural households of different socio-economic statuses rely to different extents on migration-related translocal networks and on formal translocal networks which provide different resilience capacities and consequently result in different levels of resilience. Obviously, in the context of the transformation of rural livelihoods in Northeast Thailand, translocal social networks reinforce rather than reduce social and spatial differences.

Against the backdrop of these findings, the author argues that – regardless of whether one takes an optimistic or pessimistic stance towards migration – translocal livelihoods should be acknowledged as a matter of fact in rural societies, and should no longer be ignored – whether by scientists, practitioners, or policy makers. More research sensitive to the spatial and social patterns of rural livelihoods and a better exchange between researchers, practitioners and policy makers is needed in order to leverage the potentials of translocal social networks for building resilient rural livelihoods, while mitigating their downsides.

II. Context of this study

This study is submitted to the *Promotionsausschuss* of the *Mathematisch-Naturwissenschaftliche Fakultät* of the *Rheinische Friedrich-Wilhelms-Universität Bonn* as *Kumulative Dissertation*.

It provides a synthesis of three scientific articles that I have written and published during my time as research associate in the context of an applied research project on climate change, migration, and resilience building in Northeast Thailand ("*Building resilience through translocality. Climate change, migration and social resilience of rural communities in Thailand (TransRe)"*). Research was conducted between the years 2014 and 2018 and was funded by the German Federal Ministry of Education and Research (BMBF), grant number 01LN1309A.

All three research articles are double-blind peer-reviewed articles published in internationally listed journals, namely *Ecology and Society* (Article I), *Geoforum* (Article II), and *Agriculture and Human Values* (Article III). The articles are the outcome of an open and dynamic research process and have been subject to considerable revisions in the course of extensive reviewing processes. Whilst each article can be read as a stand-alone publication with distinct motivation, objectives, and approaches, all three articles share an engagement with the role of translocal social networks in the resilience of rural livelihoods. As Article I provides the conceptual and methodological framework for empirical research presented in Article II and Article III, all three articles are best understood as complementary contributions.

This study frames the three articles by embedding them within the broader discourse on migration, development, and environmental change and by providing theoretical and conceptual context. Key research findings are synthesized from a resilience perspective and discussed against the backdrop of literature on rural livelihoods and rural transformation in Northeast Thailand. In this way, the study contributes to and substantiates the ongoing discussion on the role of migration in building resilient rural livelihoods.

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1. Introduction

Promoting resilient livelihoods in rural communities continues to be key for reaching human development goals (FAO and IFAD 2019). The majority of the world's poor live in rural areas (Castaneda et al. 2016), mostly residing on small farms, which account for the vast majority of farms worldwide (Wiggins et al. 2010; Gatzweiler and Braun 2016). Home to large shares of rural population and prevailing source of livelihoods in the Global South (Rigg 2006), small farms are of crucial importance in terms of poverty reduction, natural resource management, and food security (Gatzweiler and Braun 2016; FAO and IFAD 2019). In the context of global social, economic, and environmental changes however, small-scale farming communities, are experiencing increasing threats to the social and environmental conditions on which they rely (FAO and IFAD 2019), as they lack adequate resources, knowledge and institutions (Milan et al. 2015) required for reducing vulnerability and building resilience (Adger 2000; Wilson 2012; Alam et al. 2018; Walsh-Dilley 2019; Dapilah et al. 2020).

Whilst the necessity of building resilience in rural communities is well acknowledged, controversies persist regarding existing opportunities and constraints. A particularly controversial topic in the discussion of how rural communities can thrive and build resilience amidst global change is the role of migration (De Haas 2012; Piguet 2013). Whether migration poses a threat to or is beneficial to how rural communities build resilience remains a controversially debated question, whereas the perception of the role of migration in rural development has been subject to major shifts in paradigms during the last decades (De Haas 2012). This includes a) a shift from conceptualizing migration as failure to conceptualizing migration as opportunity for resilience-building, and related with this b) a shift in the analytical focus from local to networked translocal livelihoods.

The following section elaborates on these major paradigm shifts and introduces the reader to translocal livelihoods in the context of agrarian change, migration, and climate change in Northeast Thailand, the region in which empirical research for this study has been conducted. Against this backdrop the section concludes by sketching out the objective of this study.

1.1 From migration as failure to migration as adaptation

Over the last decades, migration has emerged as a core issue in the debates about how to spur human development in the context of global environmental change. Ideas about the role of migration, however, are heavily disputed and have undergone considerable and abrupt changes (De Haas 2012).

While national debates, particularly in countries of the Global North, tend to frame migration as a security issue and as a development failure, the international development community has "rediscovered" the potential of migration to facilitate development and strengthen resilience, including in poor countries (De Haas 2012). As Bettini and Gioli (2016) point out, proponents of this "new enthusiasm" around migration are highlighting migrants agency and praising remittances, including flows of money, knowledge and ideas, as a source of community resilience (Faist 2008; Tacoli 2009, 2011; Deshingkar 2012; Bettini and Gioli 2016). A positive stance regarding has also found its way into the discourse about environmental change and human mobility. Rather than a failure (Faist 2008) or problem, migration is increasingly recognized as a means of adaptation (McLeman and Smit 2006; Black et al. 2011a; Warner and Afifi 2014) which, if regulated properly, can promote climate change-resilience (Ober 2014, 2019).

A positive attitude to migration in the development discourse is not new; in the discourse the pendulum shifted between optimistic and pessimistic views during the second half of the last century (De Haas 2012). In the post war era of "developmentalism" during the 1950s and 1960s, migration was seen as means of leveling discrepancies in the international labor market and as a cornerstone of development in industrialized and developing countries. This optimistic view vanished with the in-

ternational oil crisis and massive economic downturn in the mid 1970s. Informed by neo-Marxist theories, migration was interpreted as not only provoking "brain drain" but also aggravating dependencies and inequalities between the Global North and the Global South. Pessimism and near-neglect of the issue of migration persisted until the 1990s. Migration only lost its negative connotation, around the end of the last century in the context of the re-emergence of liberal development agendas. Since the new millennium, migration has gained increased popularity as the new development "mantra" among governments and international organizations (Faist 2008). One particular factor explaining the increased attention being paid to migration is the spectacular surge in global remittances (De Haas 2005), which – since the 1990s – exceeds the volume of official development assistance and, in 2017, reached a record volume three times the size of official development assistance (World Bank 2018). Remittances are argued to be the ideal bottom-up source of development finance, as they are less affected by political barriers and more effective than bureaucratic development programs, and directly support those who really need it (De Haas 2012).

In parallel and partly overlapping with the migration-development discourse the role of migration gained wider public attention in the emerging discourse about the consequences of environmental change, and in particular climate change. Starting in the 1980s and culminating in the early 2000s the debate about the link between the environment and migration was dominated by an alarmist tone, supposing that climate change would potentially cause a massive exodus from the Global South to the Global North (Bettini and Gioli 2016; Boas 2017). In this discourse, migration was portrayed as a failure to adapt to climate change and as a last resort, illustrated by powerful metaphors such as "climate refugees" or "the human wave" (Piguet 2013). These alarmist myths have been heavily criticized by migration scholars, for being overly simplistic and deterministic (Piguet 2013). Drawing on growing empirical evidence, migration scholars have emphasized that there is no unidirectional causal relation between environmental change and human mobility (McLeman and Smit 2006; Piguet 2013) and that human response to environmental change is context-specific and might vary due to existing vulnerabilities and individual capacities (Black et al. 2011b; Black et al. 2011a; Boas 2017). It has also been argued that affected populations do not necessarily cross international boundaries, but rather migrate internally and only for a limited period of time until they can return back to their homes. Attention has also been drawn to those unable or unwilling to move (Black et al. 2013).

Most prominently, the influential Foresight Report (2011) has called for a nuanced assessment of the environment-migration nexus (Piguet 2013) conceptualizing migration decisions as the consequences of the complex and multi-causal interplay of drivers, framing conditions, and individual characteristics (Black et al. 2011b; Foresight 2011). Driven by this impetus, the perception of migration has undergone change, from an indicator of limits to adaptation, to a means of adaptation to environmental change (Warner and Afifi 2014). Proponents of the migration-as-adaptation narrative conceptualize migration is a major strategy for dealing with environmental risks (McLeman and Smit 2006; Sakdapolrak et al. 2016), since financial remittances tend to act counter-cyclically and increase in times of shock or hardship (Bettini and Gioli 2016) and, in the long run, can sustain local agriculture by providing necessary means of investment (Deshingkar 2012) and can strengthen households' social resilience by building economic, human, and cultural capital (Sikder and Higgins 2017). Social remittances, such as the flow of knowledge and ideas, can promote social learning, fostering adaptive capacity (Tacoli 2009, 2011). Accordingly, proponents stress that migration is more than coping (Ober 2014) and should be seen as a means of long-term resilience building of populations both staying and going (Foresight 2011; Bettini and Gioli 2016).

However, almost one decade later, concerns regarding an overly enthusiastic view of migration remain, as the relation between migration and resilience is often assumed rather than tested empirically (Siegmann 2010). Obviously, migration, should not be overestimated as a silver bullet (De Haas 2012; Ober 2014), as outcomes of migration are highly context-specific (Borderon et al. 2019) and

empirical evidence suggests that migration can also have negative impacts on human well-being and can increase existing inequalities (Howell 2017; Mohan and Flaim 2019). Hence, in order to make migration work for adaptation, it has been pointed out, not only do adequate political and regulatory frameworks need to be in place (Ober 2014), but so do structural reforms in food, land, energy, and poverty policy (Mohan and Flaim 2019). This is particularly true because structural constraints to development, are unlikely to dissolve through individual migration (De Haas 2012; Borderon et al. 2019). Without a better understanding of the livelihoods of migrants and related households of origin, it has been argued, the current discourse around migration as adaptation runs the risk of favoring the implementation of neo-liberal agendas of shifting responsibilities from the state to the individual (Felli and Castree 2012).

1.2 From local to translocal livelihoods

The revival of an optimistic view of migration is informed by extensive empirical evidence on the role of migration and remittances in the areas of origin of migrants. Roots of this research date back to the 1980s and 1990s when the merging of two theoretical frameworks, namely the "New Economic of Labour Migration (NELM)" and the "Sustainable Livelihood Approach (SLA)" provided the theoretical base for a new generation of research allowing for a nuanced view on the role of migration for development and climate-change adaptation (Haas 2010; De Haas 2012). From this perspective, migration is considered a deliberative process in which households make migration decisions as an attempt to maximize income and minimize risks (Schöfberger 2013). Drawing on growing empirical evidence, proponents of this perspective argue that migration is a strategy of household income diversification, helping to reduce agriculture-related seasonality in household income and smoothing household consumption patterns (Ellis 2003). Hence, migration should be seen as a livelihood strategy rather than a last resort, and as an investment to improve household well-being (De Haas 2012). While proponents point to the potentially positive role of migration and remittances in setting development dynamics in motion, they also acknowledge that negative development outcomes are possible, depending on the degree to which sending regions provide attractive environments to invest and return (Taylor 1999; Taylor and Lopez-Feldman 2010; De Haas 2012).

The role of migration in rural livelihoods is also highlighted by research on rural transformation and agrarian change, making the point that rural livelihoods are increasingly diversified and multi-local (Rigg 2006; Berdegué et al. 2014; Rigg and Oven 2015). Against the backdrop of increasing mobility and social connectedness, geographical dichotomies, such as the " the global / the local", "the rural / the urban", "North / South" are blurred (Steinbrink 2009; Greiner and Sakdapolrak 2013b). As rural communities are more and more integrated into broader networks (De Haan and Zoomers 2003), the notion of rural communities as territorially bounded social systems, and therefore as the major analytical unit of conventional livelihood assessments, has become obsolete (Schnegg 2007). Hence, in order to provide meaningful information on rural livelihoods in the context of an increasingly connected world, it has been argued that research ought to study the rootedness and dispersion of rural livelihoods (De Haan and Zoomers 2003).

In order to overcome the sedentary and community-centric bias of conventional livelihood studies, a growing number of studies are adopting a translocal perspective on rural livelihoods (Greiner and Sakdapolrak 2013a, 2013b). Starting from the assumption that mobilities are an integral part of human life (Sheller and Urry 2006), the concept of translocality highlights the simultaneous situatedness of mobile and immobile actors at the origin and destination of migration (Brickell and Datta 2011; Greiner and Sakdapolrak 2013b; Boas 2017) and by doing so emphasizes the interdependencies between geographically distant but socially connected places. The concept of translocality draws on the idea that translocal social practices, simultaneously both result in and are structured by trans-

local social networks (Greiner and Sakdapolrak 2013b; Steinbrink and Niedenführ 2020). These translocal social networks facilitate material and immaterial flows, including people, resources, ideas, and knowledge, between areas of origin and destination of migration, and hence are hypothesized to bear the potential for resilience-building in rural communities of origin (Scheffran et al. 2012; Sakdapolrak et al. 2016).

Despite the attention given to social networks at the theoretical level, empirical evidence on the role of translocal social networks in building resilience in the areas of origin has remained limited. Rooted in qualitative research traditions, the majority of translocality studies refer to social networks as a metaphor for connectedness rather than to social networks as an analytical concept. Empirical studies have provided in-depth understanding of the meaning and evolution of particular translocal relations. However, a structural perspective on translocal networks, providing insights into their socio-spatial patterns and the flows channeled through them, and how they foster or impede resilience, is lacking so far.

1.3 Translocal livelihoods in Northeast Thailand

Rural communities in Northeast Thailand provide a good example for studying the role of migration in general and the role of translocal social networks in building resilience of rural livelihoods in particular.

Geographically, Northeast Thailand – or the so-called Isan – is a vast plateau area bordering Laos and Cambodia with poor environmental conditions due to marginal soils, variable rainfall, and a long dry season (Grandstaff et al. 2008; Rigg and Salamanca 2011). Lagging behind other parts of the country in terms of socio-economic development (Le Mare et al. 2015), livelihood systems in Northeast Thailand – for a long time – have been characterized by poverty and subsistence-oriented farming based on rain-fed rice cultivation on small-scale paddy fields (Rigg and Salamanca 2011; Rambo 2017).

In the last decades, however, the Isan has been losing its image as a "backward" region, thanks to rapid technological and societal transformations. Fueled by global market trends and public investments in agriculture, research, market infrastructure, and social support systems, the Isan region is experiencing the rapid transformation from subsistence to market-oriented agriculture (Grandstaff et al. 2008; Rambo 2017), hand in hand with demographic and social changes, including the commodification, formalization, and delocalization of rural livelihoods (Rigg 2006; Rigg and Salamanca 2009; Rigg and Oven 2015). Shifting "from farm to non-farm, from local to extra-local, from community to state and from social to economic" (Rigg and Salamanca 2009, p. 267), today's livelihoods in the Isan are more than ever integrated into the larger world through a multiplicity of extra-local networks (Rambo 2017).

Although the so-called "rainfed revolution" has provided new prospects for rural livelihoods in Northeast Thailand (Grandstaff et al. 2008), pockets of rural poverty continue to exist throughout the region (Promburom and Sakdapolrak 2012). A particular challenge to the future development of Isan livelihoods is climate change. Climate change is expected to affect rice farming and, in particular, prevailing rain-fed paddy rice farming in the Northeast (Marks 2011; Sakdapolrak 2014; Arunrat et al. 2018). Due to geographical position and poor environment conditions Northeast Thailand is particularly prone to drought, accounting for more than half of Thailand's highly drought-prone areas (UNDP 2010). Various climate models predict overall rising temperatures and precipitation in the region which are likely to result in increasing intensity of weather extremes such as drought and flood (Marks 2011; Promburom and Sakdapolrak 2012; USAID 2014; Naruchaikusol 2016). While the consequences of climate change and the efficiency of available adaptation measures are still being debated (Attavanich 2013; Lacombe et al. 2017; Arunrat et al. 2018; Sinnarong et al. 2019), increas-

ing variability and unpredictability in rainfall patterns in combination with more frequent temperature extremes are likely to put additional pressure on the productivity of and revenues from small farms, which are in a less preferable condition to strive in the context of climate change than large farms are (Arunrat et al. 2020).

Amid these changes, rural households and small-scale farming systems have proved remarkably resilient (Rigg and Salamanca 2011). It has been argued that a particularly important aspect of this resilience lies in the ability of rural households to increasingly tap non-farm and extra-local livelihood sources (Rigg and Salamanca 2011, 2009). Over the last decades, migration has been an important livelihood strategy of rural households throughout Thailand (Promburom and Sakdapolrak 2012) and in particular the Isan region, where the majority of households are – in one or another– involved in migration (Rigg and Salamanca 2011; Le Mare et al. 2015). Due to continuous internal international migration and mobility, communities are increasingly embedded within networked relations with other places (through either material, functional, or imagined relations) and rural households' footprints are increasingly multi-sited (Rigg and Salamanca 2009, 2011; Rigg and Oven 2015).

Migration has substantial potential for rural livelihoods in the Isan region. Financial remittances sent by migrating family and household members help to meet household expenses (such as child education, health, debts re-payment and house-renovation) and agricultural activities (in particular agricultural inputs) (TransRe 2017). Social remittances foster adaptive capacity by inducing learning processes and facilitating bottom-up innovation processes, for example the introduction of innovations and the initiation of participatory decision-making processes (Sakdapolrak et al. 2014; Peth and Sakdapolrak 2020b). Whilst the delocalization of rural livelihoods through migration can be considered as a successful adaptation strategy of Isan households to deal with agrarian and climate change, it comes at the cost of eroding rural communities (Rigg and Salamanca 2009) and that of migrants' vulnerability (Porst and Sakdapolrak 2018). Furthermore, the delocalization of rural livelihoods tends to have aggravating effects on existing socio-economic disparities, the ageing of rural societies and the lack of agricultural labor (Funahashi 1996; Rigg and Salamanca 2009).

Recent studies into the social practices of translocal livelihoods of Isan households and its migrants (Peth et al. 2018; Porst and Sakdapolrak 2018; Peth and Sakdapolrak 2020a; 2020b; Porst and Sakdapolrak 2020) draw a nuanced picture of the resilience outcomes of migration at different levels and scales. For example, it has been shown that remittances do not necessarily result in higher levels of resilience, if financial remittances are invested in consumptive use rather than in agricultural changes. Social remittances, such as knowledge and skills acquired during migration, run the risk of being lost if they are not adapted to the local context of farming and if necessary investment capital is missing (Peth and Sakdapolrak 2020a; Peth and Sakdapolrak 2020b). Also migration might advance precious livelihoods of already marginalized households, due to lower returns and high costs of migration. Moreover, migration might challenge the resilience of particular household members , for example migrants confronted with harsh social and economic conditions in destination areas, or non-migration household members suffering from addition burdens at home, in particular women (Porst and Sakdapolrak 2018; Peth and Sakdapolrak 2020b; Porst and Sakdapolrak 2020).

Whilst these studies provide valuable insight into the complex and dynamic nature of translocal livelihoods, they have been limited to the qualitative study of particular translocal relations. What is lacking so far is a structural approach that goes beyond metaphorical conceptualizations of translocal connectedness and draws s attention to the structural patterns of local and translocal networks in which migrants and rural households are embedded (Rockenbauch and Sakdapolrak 2017; Rockenbauch et al. 2019a, 2019b).

1.4 Objective and scope of this study

This study contributes conceptually, methodologically, and empirically to the controversial debate on the role of migration in resilience-building. Drawing on recent developments in migration, livelihood, and resilience research, the objective of this study is to investigate the proposition that migration-related translocal networks hold potential for resilience-building by strengthening rural households' capacity to cope and adapt to risks and to explore alternative livelihoods pathways.

The conceptual and methodological contribution of this study lies in addressing the resilience of rural households' livelihoods through the lens of a translocal network perspective, based on methods of formal social network analysis (SNA). Taking the example of Northeast Thailand, a rural region in rapid transformation characterized by high levels of migration and the shift from subsistence-based towards market-oriented agriculture, this study's objective is to provide empirical evidence of i) the structural features of translocal networks in which rural households are embedded, and ii) the flows that are channeled through translocal networks. By synthesizing empirical research findings in terms of resilience capacities and by embedding them in the context of rural transformation in Northeast Thailand, this study allows for a nuanced picture of iii) the role of translocal networks in the resilience of rural households – up to now not only an under-conceptualized but also an under-researched aspect in the study of rural livelihoods.

Research for this study was conducted in an explorative and step-wise process. Initial desk work took the form of a systematic review of current research and yielded the conceptual framework for empirical work. Empirical work, conducted in Northeast Thailand, included a comparative case study of rural households' translocal network capital and a case study of translocal agricultural innovation transfers in small-scale farming communities.

The rest of this study is structured as follows: Chapter 2 provides the theoretical background, and Chapter 3 presents the conceptual framework and operational concept. Chapter 4 provides an overview of methods applied and selected study sites. Chapter 5 presents key research findings from desk work and empirical work and Chapter 6 provides a discussion of research findings and identifies conceptual and methodological implications. Chapter 7 concludes the study and provides an outlook on challenges and promising pathways for future research. Published research articles are presented in Chapters 8-10.

2. Theoretical background

In order to investigate the role of translocal social networks in rural households' resilience in North-east Thailand, this research synthesizes three emerging research perspectives that are providing impetus to a fresh approach to the nexus between migration, development, and the environment, namely i) resilience thinking, ii) translocality , and iii) social network analysis.

2.1 Resilience thinking

Resilience thinking is pervasive. In the recent decade, resilience has become the new "sustainability", the new "buzzword" in science and policy discourses (Brown 2014; Cutter 2016; Petzold 2017). Resilience emerged as a key concept in guiding social and ecological transformations in the context of human-caused global change (Folke et al. 2016) and as strategies for building resilience are increasingly incorporated into adaptation plans, developments strategies and environmental management (Davoudi et al. 2012; Davoudi et al. 2013), there is a growing need to understand how resilience can be facilitated, supported, and sustained at the local level (Dapilah et al. 2020).

A thorough engagement with the term's meaning is of particular urgency, as resilience is far from being a well-defined concept (Downes et al. 2013), but is rather a boundary-spanning object, the malleability of which has encouraged transdisciplinary exchange at the cost of conceptual clarity and empirical applicability (Brand and Jax 2007; Brown 2014; Cutter 2016). Despite its popularity and discursive power resilience remains a loosely defined and contested concept with multiple and often diverging meanings (Brown 2014; Cote and Nightingale 2012; Brand and Jax 2007). Dispute is ongoing in particular with regard to the definition and interpretation of social resilience and its relation to other concepts, the foremost being vulnerability and adaptive capacity (Gallopín 2006; Cutter et al. 2008; Downes et al. 2013; Cutter 2016).

In order to provide context, this section addresses the concept's roots in ecology and its application in the context of research on social-ecological systems (SES) and then moves on to the concept of social resilience and the critical engagement with social resilience research.

2.1.1 From ecological to socio-ecological resilience

Over the last decades, the concept of resilience has developed from a descriptive concept emphasizing the persistence of ecological systems, through resilience as a normative concept informing the adaptive management of SES, towards an integrative way of thinking about complexity, uncertainty, and social transformation in the context of environmental change (Folke et al. 2010; Keck and Sakdapolrak 2013).

Roots of the resilience concept date back to 1960s and early 1970s, when ecologists started to investigate ecosystem behavior in the context of change and disturbance (Folke 2006). In his seminal paper, Holling (1973) scrutinized the prevailing assumption that ecosystems dynamics tend towards stable equilibrium, by introducing the descriptive concept of resilience, defined as "a measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables" (Holling 1973, p. 14) and, more particular, as " the amount of disturbance that a system can absorb without changing state" (Gunderson 2000, p. 426).

This understanding of resilience was later termed "ecological resilience", in contrast to "engineering resilience" which is understood as the time a variable needs to return to an equilibrium state after disturbance (Pimm 1994; Gunderson 2000). While engineering resilience is concerned with main-

taining efficiency of function and presumes the existence of linear systems near to a stable equilibrium state, ecological resilience emphasizes the existence of function, in dynamic multiple-equilibria systems (Gunderson 2000; Folke 2006).

Whereas the concept of resilience remained relatively unnoticed by mainstream ecologists, it sparked research in other disciplines, such as anthropology, ecological economics, management and complex systems theory. It took until the 1990s before resilience gained attention from a wider audience. In the context of emerging sustainability science, resilience developed from a descriptive into a normative concept guiding and supporting more inclusive approaches to the adaptive management of coupled SES (Folke et al. 2010).

Research on SES builds on the insights that ecosystems and social systems are inextricably linked (Gunderson and Holling 2002; Folke 2006). Drawing from complex systems theory, SES are perceived as organic and path-dependent systems with feedbacks over multiple scales that allow the system to self-organize (Folke 2006). Regime shifts in SES are not necessarily the outcome of external disturbance but also as the outcome of internal stress and the system's ability to learn and adapt. In this regard, resilience is an emergent property of SES arising from self-organization and adaptive change across spatial and temporal scales (Gunderson 2000). Accordingly, Walker et al. (2004) have defined social-ecological resilience as "the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure and feedbacks, and therefore identity, that is, the capacity to change in order to maintain the same identity" (Walker et al. 2004).

Several authors have argued that, in order to move from a metaphor to measurement, resilience definitions need to be specific about changes and systems under study (Carpenter et al. 2001; Brand and Jax 2007). Attempts at building specified resilience, however have been criticized for running the risk of focusing too narrowly on a particular threat without being able to avoid a regime shift (Folke et al. 2010). In contrast, attempts at building general resilience do not refer to either the part of the system that might cross a threshold, or the kinds of shocks the system has to endure(Folke et al. 2016). Instead of conceiving of resilience as an end, general resilience builds on the notion of resilience as process, acknowledging that crises may open up new forms of adaptability and transformational change (Folke et al. 2010). In other words, general resilience is the capability of SES to adapt and transform in response to uncertainty and unfamiliarity (Folke et al. 2016).

In this broad sense, the concept of resilience helps us to think about the interplay between structure and processes in a dynamic fashion, while embracing complexity and uncertainty (Folke 2006). Acknowledging the importance of internal change, and more specifically the unpredictability of change, resilience thinking provides a framework for the management of SES that encourages the ability of system components to change and adapt, rather than to control or avoid change (Berkes et al. 2003). Resilience thinking hence shifts the focus away from persistence and toward adaptation to and management of change and uncertainty, and at the same time acknowledges that social change is essential for SES resilience (Folke et al. 2010). In this sense, resilience thinking addresses adaptability and the more radical concept of transformability, and their interrelation across multiple scales (see *Box* 1) (Folke et al. 2010).

Box 1: Adaptability and transformability

Adaptability *is a relevant part of resilience and is defined as "the capacity of a social-ecological system to adjust its responses to changing external drivers and internal processes and thereby allow for development within the current stability domain, along the current trajectory" (Folke et al. 2010). More particularly, adaptability is "[…] the collective capacity of the human actors in the system to manage resilience" (Walker et al. 2004).*

Transformability *refers to "the capacity to create a fundamentally new system when ecological, economic, or social (including political) conditions make the existing system untenable." (Walker et al. 2004) . Transformation draws on resilience on multiple scales. Transformational change at smaller scales can enable resilience at higher scales, while the capacity to transform at smaller scales draws on the resilience of other scales. Transformation implies making use of crisis as windows of opportunity, novelty, and innovation by recombining sources of knowledge and experiences. In its radical nature, transformation can be forced or deliberate, and is intrinsically political as it involves "breaking down resilience of the old and building up resilience of the new" (Folke et al. 2010).*

2.1.2 Towards situated social resilience

More or less at the same time as its appearance in ecology, the concept of resilience also entered the social sciences in the field of child phycology. However, both concepts developed in relative isolation with little exchange between disciplines (Masten and Obradovic 2008). Today social resilience has moved into the center of attention of a wide range of research concerned with the question of how societies deal with threats and perturbation (Maurer 2016; Copeland et al. 2020), particularly research on climate-change adaptation, disaster risk reduction, and development (Bahadur et al. 2013; Skerratt 2013; Ifejika Speranza et al. 2014; Aldrich and Meyer 2015; Rigg and Oven 2015; Alam et al. 2018; Uddin et al. 2020). The concept of social resilience has also found resonance in migration research (Deshingkar 2012; Scheffran et al. 2012; Sakdapolrak et al. 2016; Sikder and Higgins 2017; Porst and Sakdapolrak 2018; Ober 2019; Peth and Sakdapolrak 2020a; 2020b; Porst and Sakdapolrak 2020) where, however, it is approached from a rather critical stance.

Similar to the concept of social-ecological resilience, social resilience developed from a concept emphasizing the capacity of responding to risks, through a concept incorporating learning and adaptation, to a concept embracing transformative aspects such as power, politics, and participation. Although still in the making and far from being settled, social resilience constitutes a promising concept in its own right providing new perspectives for understanding vulnerability in the context of environmental change (Keck and Sakdapolrak 2013). Social resilience is synthesizing resilience thinking with insights from vulnerability and livelihood research. Rather than a systems perspective social resilience adopts an actor-based approach, concerning social entities, including individuals, organizations, or communities, and their ability to deal with environmental and social threats. Threats considered in current research on social resilience include natural hazards and disasters, long-term stresses associated with unsustainable resource management and environmental variability, and issues of social change and social development (Keck and Sakdapolrak 2013).

An early attempt to make resilience fruitful in a development context is Adger's (2000) definition of social resilience as "the ability of communities to withstand external shocks to their social infrastructure" (Adger 2000, p. 361). From this point of view, resilience refers to the capacity of social entities, here rural communities, to persist and protect themselves from hazardous events. Conceptualized on the community level rather than on the individual level, social resilience sensu Agder (2000) is closely related to the available social capital and related to the resilience of ecological systems. Whereas, according to Adger (2000), social resilience is positively related with the capacity to cope with stress

and, hence, provides a loose antonym of vulnerability, a diverging conceptualization is provided by Turner et al. (2003), who define resilience as an element of vulnerability alongside exposure and the sensitivity to hazards. Until today, the relation between resilience and vulnerability remains contested. Several authors have argued that resilience is neither the flip-side of vulnerability nor a subset of vulnerability (Cutter et al. 2008; Cutter 2016) and that instead the two should be seen as closely related (Miller et al. 2010) but distinct concepts (Obrist et al. 2010).

Since these early definitions, the concept of social resilience has experienced qualitative changes. Rather than conceiving of resilience as an outcome, it is increasingly understood as a social process (Obrist et al. 2010; Porst and Sakdapolrak 2018). From an actor-oriented perspective, social resilience is seen as the ability to respond to and to recover from a threat, and as "social agency" (Bohle 2009) – the ability of proactive social actors to change and learn in response to a threat (Cutter et al. 2008; Sikder and Higgins 2017; Peth and Sakdapolrak 2020a). Accordingly, attention is shifted from the question of how to enable people to cope with change towards the question of how to create the potential to translate adversity into opportunity and to enhance the capacity of individuals, groups, and organizations to deal with threats more competently; attention has also been given to the analysis of institutions and networks that enable people to access resources and learn from experiences and develop new ways of dealing with problems (Glavovic et al. 2003; Obrist et al. 2010). Recently, there is growing interest in social networks as essential sources of communities' resilience, and in particularly in rural communities' resilience (see *Box* 2) (Wilson 2012; Berkes and Ross 2013; Skerratt 2013; Aldrich and Meyer 2015).

Box 2: Social networks and community resilience

Social networks and community resilience are related in multiple ways. Social networks provide access to resources and support for managing risk and vulnerability (Woolcock and Narayan 2000; Cassidy and Barnes 2012; Baird and Gray 2014; Islam and Walkerden 2014), facilitate social learning and innovation (Conley and Udry 2001; Bandiera and Rasul 2006; Isaac et al. 2007; Spielman et al. 2011; Isaac et al. 2014; Isaac and Matous 2017) as well as adaptive management (Olsson et al. 2004; Folke et al. 2005; Bodin and Crona 2009; Bodin and Prell 2011), and hence are highlighted as a critical source of community resilience (Wilson 2012; Berkes and Ross 2013; Skerratt 2013; Ifejika Speranza et al. 2014; Aldrich and Meyer 2015; Dapilah et al. 2020). As research is scattered across different strands, however, the link between social networks and the resilience of communities, remains under-researched, conceptually and methodologically (see Article I). This has begun to change only recently, as formal methods for measuring social network structure are increasingly applied in order to understand how resilience can be built from the bottom up (Bodin and Prell 2011; Misra et al. 2014; Halley McCann et al. 2016; Wilkin et al. 2019).

Despite its growing popularity, concerns have been raised regarding both the operationalization and conceptualization of social resilience research (Davidson 2010). In practical terms, it has been argued that – despite claims of embracing complexity, non-linearity, and uncertainty – the application of the resilience concept in social sciences contributes little to the understanding of how individual resilience relates to the resilience of larger social systems. Based on snapshot assessments, social resilience research has tended to consider very short temporal scales for accessing changes, and – due to a preoccupation with the local scale – has done little to understand cross-scale dynamics (Downes et al. 2013). Regarding the conceptualization of social resilience, proponents of a critical science perspective have raised concerns regarding the concept's origin in natural science. The direct transfer of ideas about of ecological systems to the social realm is seen as problematic (Cannon and

Müller-Mahn 2010), particularly because it assumes that ecological and social systems are essentially "similar" (Cote and Nightingale 2012). Failing to recognize resilience as socially contingent (Brown 2014), the concept of social resilience is criticized for downplaying the social constructedness of vulnerability and the role of politics and power relations (Cannon and Müller-Mahn 2010). The concept is also criticized for providing a conservative perspective on society, being focused on the functionality and persistence of systems, supporting the status quo in favor of "business as usual" instead of facilitating fundamental changes (Brown 2014). In the mainstream development community, for example, resilience is often simply equated with economic growth (Rigg and Oven 2015). Finally, social resilience research is criticized for turning a blind eye to implicit normative assumptions about desirable outcomes and processes of societal transformation (Brand and Jax 2007; Brown 2014) and its tendency to lose sight of the critical question "resilience for whom?" (Siegmann 2010; Cote and Nightingale 2012; Cretney 2014). In fact, social resilience is far from being a neutral scientific concept (Brown 2014), but is rather a power-laden framework that enables particular perspectives on change while obscuring others (Cote and Nightingale 2012).

Against this background, authors are calling for a "situated approach" to social resilience, shifting attention from actor capacities towards the consideration of structural constraints and power asymmetries in transformation processes (Cote and Nightingale 2012). It has been argued that the consideration of structural constraints is of particular importance, because the capacity of a social actor to cope with, and adapt to a threat is not only defined by persons' endowment with capitals and willingness to learn and invest, but also by societal factors determining their access to assets, their opportunities for learning, and their participation of in decision-making processes (Lorenz 2013). Accordingly, social resilience research not only ought to address the interplay between social structure and the agency of social actors, their potentialities, creativity, and capacities (Bohle 2005; Bohle et al. 2009), but also needs to overcome the managerial attitude that objective problems could be resolved in the form of technical and apolitical solutions (Keck and Sakdapolrak 2013). Instead, social resilience research ought to address the capacity to participate in governance processes and address asymmetries in power and knowledge (Keck and Sakdapolrak 2013). By moving away from the content of knowledge to its social production and by shifting attention away from abstract criteria (such as flexibility, redundancy, etc.) towards the cultural and political context of social systems, a "situated approach" to social resilience draws attention to critical questions, such as "resilience for whom and at what cost to which others?" (Cote and Nightingale 2012, p. 485).

While acknowledging the deficiencies of current approaches, Keck and Sakdapolrak (2013) consider the concept of social resilience to provide a fresh perspective on today's challenges of global change. Synthesizing existing approaches to social resilience, they suggest an agency-oriented framework of social resilience (Bohle 2009) that distinguishes three different resilience capacities (see *Box* 3).

According to Keck and Sakdapolrak (2013) the strengths of an actor-oriented social resilience approach are threefold: first, it conceives of uncertainty and change as normal. Building on the notion that the world is in permanent flux, social resilience is conceptualized as a process rather than an end. Second, by emphasizing "the embeddedness of social actors in their particular time- and place-specific ecological, social and institutional environments" (Keck and Sakdapolrak 2013, p. 14), resilience is a relational rather than an essentialist concept. Third, as it draws attention to processes of social learning, participative decision-making, and societal transformation, social resilience is also a political concept (Keck and Sakdapolrak 2013).

Box 3: Resilience capacities *(adapted from Keck and Sakdapolrak (2013))*

Coping capacities *address how social actors absorb and overcome immediate threats by means of resources that are directly available. Responses are re-active and short-term and involve little change in the status quo. The underlying rationale is the restoration of present levels of well-being.*

Adaptive capacities *refer to pro-active and preventive measures that social actors employ as a consequence of learning from past threats in order to anticipate potential future risks. Adaptation involves purposive incremental changes meant to sustain the status quo in the face of future risks. In contrast to coping, adaptation involves strategic and long-term planning and requires social learning and innovation.*

Transformative capacities *involve deliberate and radical changes in livelihoods, not only in order to secure, but also to enhance peoples' livelihoods in the context of change and uncertainty. Crucial for exploring and pursuing alternative livelihoods is the ability to access resources from the wider socio-political arena (e.g. from governments or NGOs) in order to participate in decision-making processes and in order to craft institutions that foster well-being and resilience to future risks.*

2.2 Translocality

Like resilience thinking, the emergence of the concept of translocality represents a shift in scientific and societal paradigms – here the shift away from sedentary-biased conceptualizations of development towards the reconceptualization of development within a mobile world. By integrating the notions of mobility, migration, and socio-spatial interconnectedness (Greiner and Sakdapolrak 2013b), a translocal perspective provides the opportunity of a nuanced perspective on the complex link between migration and development. Moreover, by offering the opportunity for integrating livelihood-oriented migration research with social resilience research, a translocal perspective bears the potential for a critical engagement with the nexus between migration, development, and the environment, and in particular the concept of migration as adaption (Sakdapolrak et al. 2016).

2.2.1 From sedentary bias to grounded transnationalism

Commonly, conceptualizations of migration contain a certain "sedentary bias", ultimately framing migration as a "problem" to be addressed, and as a response to crisis rather than a part of people's lives (Bakewell 2008; Castles 2009; Hummel et al. 2012). In contrast, research on mobilities conceptualizes distance and movement as "constitutive for economic, social and political relations" and acknowledges mobility as integral part of human life (Hummel et al. 2012). The notion that mobility and migration are major livelihoods strategies (Steinbrink and Niedenführ 2020) and are the norm rather than the exception in many rural communities and exist regardless of climate change is also a central starting point on which translocality research builds (Sakdapolrak et al. 2016).

Translocality is a relatively new concept in the field of migration research, emerging from a critical engagement with deterritorialized notions of transnationalism (Greiner and Sakdapolrak 2013b). Translocality takes an actor-oriented approach to migrant experiences and draws attention to multiple forms of mobility, including everyday movements (Brickell and Datta 2011). At the same time, translocality emphasizes the importance of localities in peoples' lives (Oakes and Schein 2006) and stresses the role of local-to-local connections, both real and imagined, within transnational migrant networks. As Brickell and Datta (2011) summarize, translocality can be imagined as "situatedness during mobility" (Brickell and Datta 2011).

Translocality as a research perspective addresses the simultaneous embeddedness of actors across different locales, and hence challenges dichotomous geographical conceptions such as "space and place", "the rural and the urban", and "core and periphery" (Steinbrink 2009; Greiner and Sakdapolrak 2013b) Translocality research can hence be understood as form of "grounded transnationalism" (Brickell and Datta 2011) drawing attention to the questions "who moves?" and "who does not?" (Greiner and Sakdapolrak 2013b). Adopting a Bourdieusian-informed conceptualization of social practices, translocality sheds light on how mobile and immobile actors negotiate and struggle over various capitals that are valued differently at different scales, and thereby raises questions of power and powerlessness. Finally, as the concept is concerned with peoples' daily practices in relation to locality, it draws attention to the interrelation between migration and changes in the physical and natural environment. Accordingly, translocality can provide fruitful insights into the relation between development, environmental change, and migration (Greiner and Sakdapolrak 2013b).

2.2.2 From local to translocal social networks

A central assumption underlying the translocality concept is that, despite the delocalization of livelihoods, locality still matters and migrants stay connected with their sending communities. Rather than perceiving migration as a single event in the form of a unidirectional movement, the concept of translocality highlights the importance of dynamic feedback processes between areas of destination and origin (Greiner and Sakdapolrak 2013b; Sakdapolrak et al. 2016). Through mobility and movements, the setting of social interaction – the locale – is expanded. Locales eventually become translocales, providing the context and setting of translocal social practices (Sakdapolrak et al. 2016). According to Steinbrink and Niedenführ (2020), transmigration, the physical movement of people, is the precondition for social translocalization, which is the spatial expansion of social networks spanning areas of origin and destination of migration. In turn, translocal social networks provide the context for economic translocalization, i.e. the diversification of household incomes. Once established translocal social networks further facilitate the translocalization of rural livelihoods, as they reduce the risks associated with migration (Steinbrink and Niedenführ 2020). For a simplified representation of the translocality concept see *Figure* 1.

With the idea that, in the course of migration and mobility, social relations are evolving in space and time, translocality challenges de-territorialized notions of space and the idea of frictionless networked spaces of flows and accelerating mobility (Jessop et al 2008). The concept of translocality assumes that social networks are explicitly spatial in nature and that social networks connect mobile and non-mobile actors beyond what usually is defined as place (Greiner and Sakdapolrak 2013b). These migration-induced translocal social networks facilitate not only material flows of people and resources, but also social remittances, such as immaterial flows of ideas, symbols, knowledge and practices between mobile and non-mobile actors (Levitt 1998, 2009; Levitt and Lamba-Nieves 2011).

The position of actors within translocal networks is decisive of the access to particular resources, while, at the same time, the lack of resources might result in exclusion from translocal networks. Translocal social networks have been highlighted as both the precondition for and result of translocal social practices, and as such as an intermediary between the "global and the local", between the "the micro and the macro level" (Ryan and D'Angelo 2018; Steinbrink and Niedenführ 2020), and between "agency and structure" (Bohle 2009; Greiner and Sakdapolrak 2013a, 2013b; Steinbrink and Niedenführ 2020).

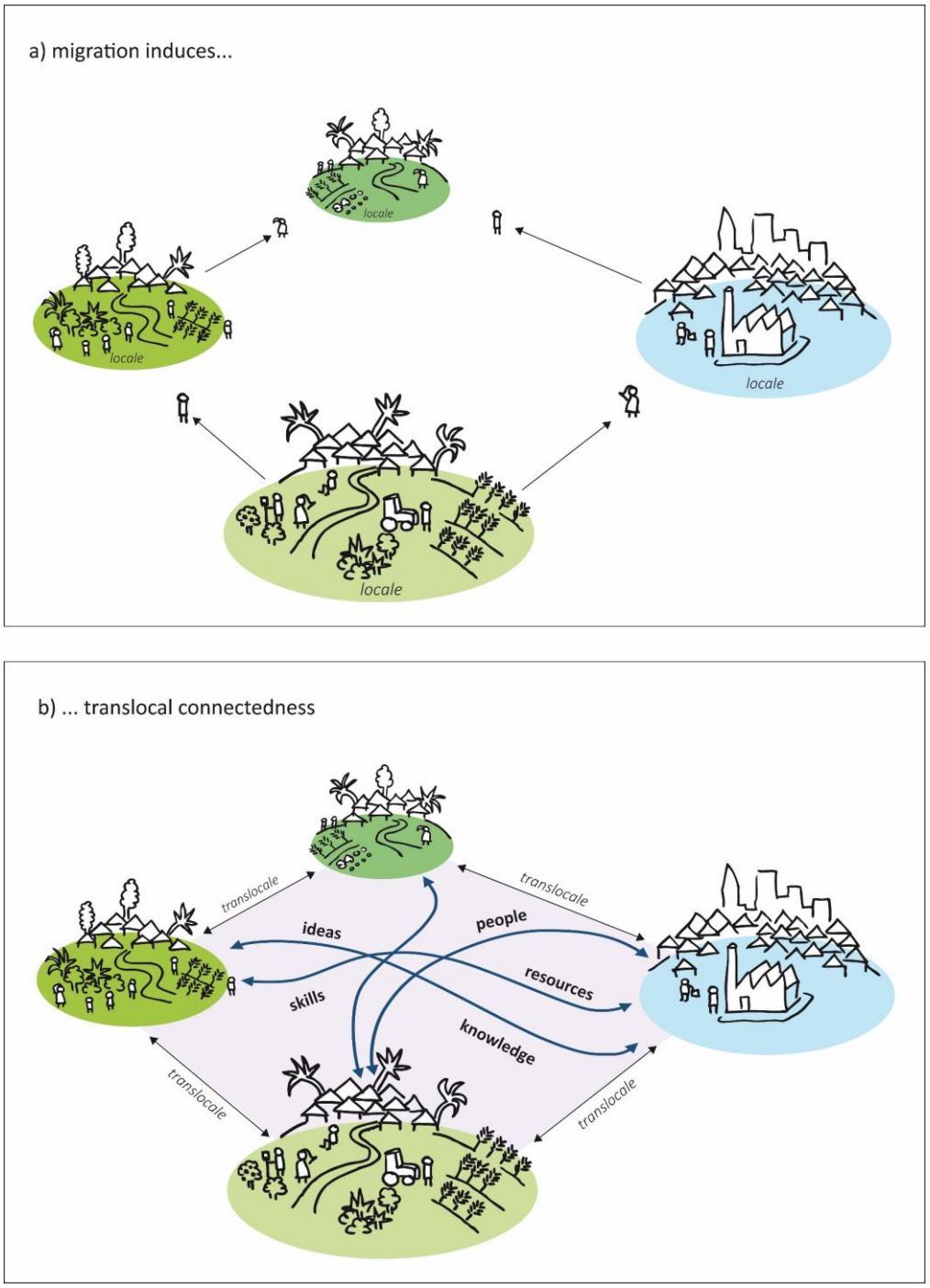


Figure 1: Simplified representation of the translocality concept
(adapted from Greiner and Sakdapolrak (2013a); TransRe (2018))

Facilitating material and immaterial flows within rural areas and between rural areas and rural areas (Greiner and Sakdapolrak, 2013a), translocal social networks provide access to resources, knowledge, and ideas required for coping with and adapting to risks, and for exploring alternative livelihoods pathways. Against this backdrop, it has been argued that migration-related translocal social networks bear the potential to promote resilience in areas of origin of migration (see *Box* 4) (Scheffran et al., 2012; Sakdapolrak et al., 2016).

Box 4: Translocal social resilience

An example of how the concept of translocal social networks can be applied for a nuanced understanding of the nexus between migration, development, and the environment is the concept of translocal social resilience, as proposed by Sakdapolrak et al. (2016). The concept of translocal social resilience integrates the concept of translocality with actor-oriented conceptualizations of social resilience, and a constructivist approach to human-environment relations. In doing so, the concept of translocal social resilience places emphasis on i) the translocal social practices of mobile and immobile social actors, who are ii) embedded in translocal social networks that facilitate the flow of resources, practices and ideas between places of origin and destination of migration, which influence iii) actors' social resilience in terms of their capacities to cope, adapt and transform, and, consequently, shape iv) the way society interacts with its environment (Sakdapolrak et al. 2016). While the concept's strength lies in providing an alternative to neoliberal interpretations of the migration-as-adaptation narrative, its empirical contribution has been limited so far, because an operable definition of translocal resilience is still lacking.

Although "networks" are omnipresent and ubiquitous in translocality research, the term's conceptualization remains vague and contested (Peth and Sakdapolrak 2020a). Several authors have expressed their dissatisfaction with prevailing network conceptualizations as they fail to grasp translocal dynamics (Greiner and Sakdapolrak 2013b; Peth and Sakdapolrak 2020a). While McFarlane (2009) proposes the alternative term "translocal assemblage", Verne (2012) suggests the term "rhizome", in order to express the complexity, dynamics and relationality of translocal connectedness (McFarlane 2009; Verne 2012).

Whether the term "networks" is referred to or not, most translocality studies share a metaphorical conceptualization of translocal connectedness. From a metaphorical stance, translocality research preferably focuses on family or kinship networks of strong and reciprocal support (e.g. Peth and Sakdapolrak 2020a) between members of a translocal households (Steinbrink and Niedenführ 2020), thereby ignoring weak ties connecting beyond the social realm of households and kinship. Furthermore, through a focus on migration-related translocal social relations, translocality studies miss the chance of contextualizing migration-related social structure with non-migration-related social structure, such as local community networks, public support, and market structures.

Rooted in qualitative research traditions, translocality studies place attention on the visualization and analysis of particular translocal connections, for example between migrants and the sending households, or within members of diaspora communities. While providing valuable insights into the complex and dynamic nature of translocal livelihoods, translocality studies have so far refrained from the application of structural network approaches. Apart from a few exceptions, structural approaches have not found entrance into migration research in general and translocality research in particular (Bilecen et al. 2018). In sum, the prevailing metaphorical reference to strong and reciprocal social networks, and the focus on particular translocal relations, stands in the way of gaining a deeper understanding of the role of social structure in translocal livelihoods.

2.3 Social network analysis

The third emerging research perspective relevant to this study is the so-called social network paradigm and the related boom in social network research.

Without a doubt, social network are "en vogue" (Steinbrink et al. 2013). In the course of economic, political and social globalization the social network concept has gained currency as a model for explaining and organizing the social (Kadushin 2012; Fuhse 2018), culminating, inter alia, in postulates about the era of the "network society" (Castells 2001). Today, most commonly, social networks are used as a metaphor for expressing complex interrelationships (Hollstein and Straus 2006). In the broadest sense, "social networks are structures of individuals or institutions, which are held together by some form of interdependency" (Baird and Gray 2014). More particularly, social networks have been conceptualized as a form of societal coordination between market and hierarchy (Powell 1990), as the mode of global production and governance systems (Glückler 2010), and as safety nets of mutual and reciprocal support (Baird and Gray 2014), as well as the source of social capital (Woolcock and Narayan 2000; Woolcock 2001) and resilience (Folke et al. 2005). While the vague contours of the social network concept and its conceptual elasticity make it an attractive vehicle for interdisciplinary exchange (Grabher 2006), this comes at the cost of its theoretical and epistemological value.

In its original meaning, the social network paradigm provides an alternative to the dichotomy between individualism and structuralism (Mayhew 1980) by operationalizing social structure in terms of social relations tying distinct social actors to one another (Leinhardt 1977). Structural approaches, focusing on the relationship between entities rather than on entities themselves, can be found in research across scientific disciplines. In social sciences, structural approaches are represented by the field of social network analysis (SNA) (Freeman 2004).

In SNA, social networks are defined "a specific set of linkages among a defined set of persons, with the additional property that the characteristics of these linkages as a whole may be used to interpret the social behavior of the persons involved" (Mitchell 1969, p. 2).Two major characteristics of SNA can be derived from this definition. First, instead of referring to social networks as a metaphor (Hollstein and Straus 2006), SNA employs formal network definitions as analytical tools for approaching societal phenomena (Mitchell 1974). Second, SNA focuses on the structures of relationship among social actors rather than on individuals themselves (Scott 2013; Bolíbar 2016). An important motivation for doing so is the so-called "anticategorial imperative" (Emirbayer and Goodwin 1994), assuming that social behavior cannot be explained as the result of individuals' common possession of attributes, norms and values, but rather as the result of their interactions that give rise to qualitatively new emergent qualities, above all social structure (Emirbayer 1997). Instead of treating arbitrary lists of social variables as causal factors, SNA hence, shifts the analysis of structural patterns of social relations right to the core of the social sciences (Grabher 2006).

Drawing on a rather loose federation of approaches (Emirbayer and Goodwin 1994), SNA has gained particular attendance in methodological terms, as a broad strategy for analyzing social structure characterized by four features: (i) a focus on ties linking social actors, (ii) the systematic analysis of (relational) empirical data, (iii) networks visualization, and (iii) the use of mathematical and / or computational models (Freeman 2004). Today, methods of SNA are applied in a wide range of scientific fields, reaching far beyond disciplinary boundaries of traditional social science (Borgatti et al. 2009; Borgatti and Halgin 2011; Molontay and Nagy 2019).

This section introduces the roots and the development of SNA and provides an overview of its theoretical foundations. It then moves on to provide an overview of conceptual and methodological decisions that need to be considered when carrying out SNA-based analyses, and concludes with some critical considerations and current trends in the field of SNA.

2.3.1 From formalistic sociology to interdisciplinary network science

The idea, that the patterning of social ties has important consequences for social actors' behavior has a long history (Freeman 2004; Holzer and Stegbauer 2019). The roots of SNA date back to Simmel' s call for a formalistic sociology, which directs attention to social structure regardless of its substantive content (Emirbayer and Goodwin 1994). Although Simmel did not refer to the term "network", his work on dyads (relations between two persons) and triads (relations between three people) as basic building blocks of social life, is commonly considered the foundation of SNA (Grabher 2006; Korom 2015). In the 1930s, scientists in diverse strands of research took up the study of social relations in order to uncover the "fabrics of social life" (Scott 2011). The foundation of modern SNA can be traced back to at least three main research strands, which developed on sometimes intersecting and sometimes diverging paths: (i) the educational and development psychologists around Jacob Moreno and Helen Jennings, who established the field of "sociometry", the formal representation of social configurations; (ii) the Harvard school of sociologists, who studied patterns of interpersonal relations and clique formation, as well as (iii) the Manchester school of anthropologists, who in the 1960s and 1970s used insights from the latter two strands in order to investigate community structures, inter alia in African tribal societies. Research, however, remained scattered across research strands, lacking a integrative paradigm. It was only in the 1970s that a group of sociologists at Harvard University, based on major mathematical innovations, established formal SNA as a technical methodology for analyzing relational social data (Freeman 2004; Scott 2011; Korom 2015). From then on SNA has gained popularity in numerous fields from social, natural, economic, and political sciences (Grabher 2006; Borgatti et al. 2009; Borgatti and Halgin 2011).

Sparked by major methodological advances in information technology and computational techniques and driven by innovative work in physics in the 1990s a new strand of network is shifting the focus towards network dynamics and the explanation of network transformations (Freeman 2004; Borgatti et al. 2009; Scott 2011). Over the last two decades, "network science" has emerged as an interdisciplinary field or research focusing on complex networks, drawing on the theories and methods of graph theory, statistical physics, computer science, statistics, and sociology (Molontay and Nagy 2019). As this broad "network science" is not necessarily concerned with social phenomena, the following subsections refer to SNA in the sense of sociological network research.

2.3.2 Theorizing social networks

Despite the popularity of social networks there is considerable confusion about network theorizing (Borgatti and Halgin 2011). Until today, there is no commonly agreed-upon theoretical ground on which network analysis could build on (Emirbayer and Goodwin 1994; Hollstein and Straus 2006; Fuhse 2015; Holzer and Stegbauer 2019).

In its broadest sense, theories about social networks can be distinguished into two distinct domains: "network theory", which refers to the consequences / outcomes of social structure (networks as independent variable), and "theory of networks", which refers to processes that determine social structure (networks as dependent variable) (Borgatti and Halgin 2011; Hennig et al. 2012). This section focuses on network theory; hence, on theories explaining network outcomes.

Network theory investigates how network structure, through particular network functions, is translated into network outcomes. In an attempt to consolidate the loose foundations of network theory, Borgatti and Halgin (2011) have proposed the systematizing of structural network research according to underlying network models and the type of network outcome in focus.

In SNA, generally, two broad perspectives can be distinguished, each of them building on different models of how social networks make a difference. The connectionist perspective portrays social net-

works as being constituted by direct exchanges between its actors. The underlying "flow model" conceives of social networks as conduits for material or immaterial flows between actors, in the form of knowledge, information, people, or resources. In contrast, the structuralist perspective portrays social networks as girders of society. The underlying "coordination model" conceives of social networks as bonds that enable or restrict social action (Borgatti and Halgin 2011).

Considering the network outcomes of interest, the field of SNA can be further systematized along two distinct research strands. Research in the social capital strand is characterized by a focus on performance (i.e. the capability of networked actors to achieve particular aims). In contrast, research in the diffusion strand explains homogeneity / heterogeneity (i.e. the degree of congruence / divergence of attitudes or behavior among networked actors) (Borgatti and Halgin 2011).

According to the particular "network model" (flow / coordination) and "network outcome" of interest (success / homogeneity), SNA can be classified into four fields, with research in each field addressing a particular network function (capitalization, coordination, contagion, and convergence) (see Figure 2). The following sub-section introduces to the network models and network functions addressed, while the subsequent sub-section provides an overview of theories in the strand of social capital and diffusion research relevant in the context of this study.

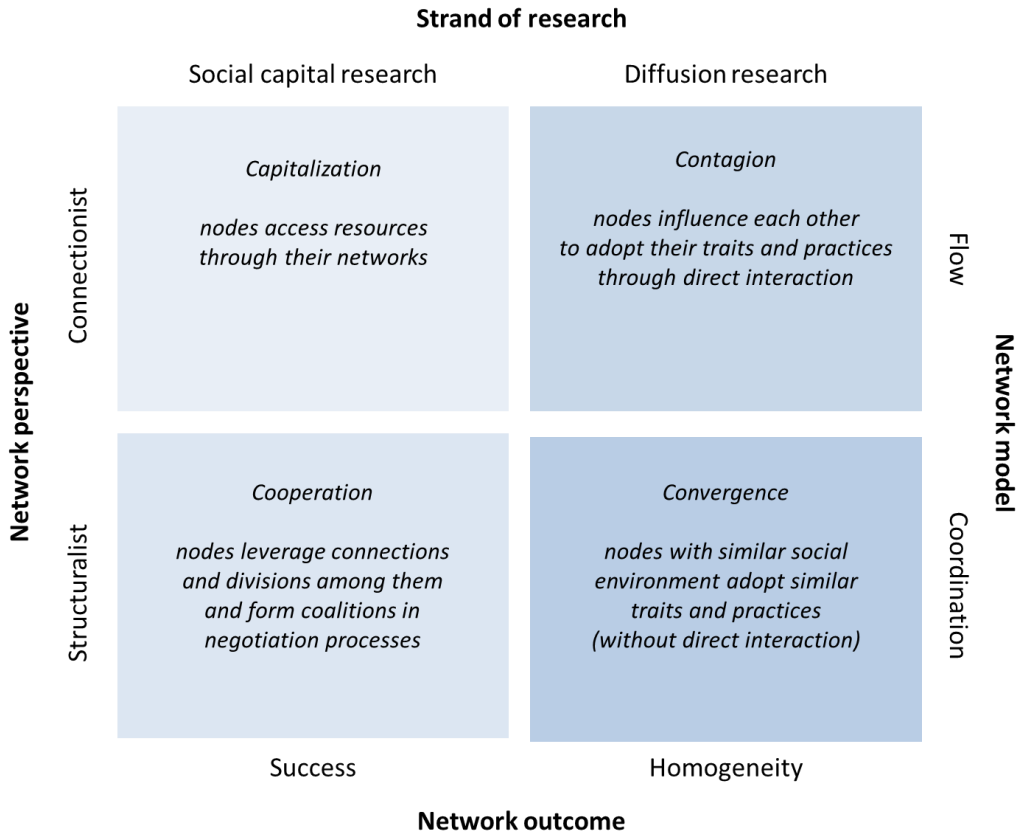


Figure 2: Network functions by network model and network outcome, network perspective and associated strands of research *(adapted from Borgatti and Foster (2003); Borgatti and Halgin (2011))*

Flow model: capitalization & contagion

An implicit notion underlying most network theories is that social networks function as "pipes" facilitating material and immaterial flows between nodes, either physically, e.g. in the form of the exchange of material resources, or mimetically, e.g. in the form of the contagion of information and ideas (Borgatti et al. 2009). This network function has been referred to as the "flow model". The flow model is the most popular way of thinking about networks, and forms the core of the connectionist stream of network research (Borgatti and Halgin 2011). Depending on the network outcome in focus, the flow model explains two different network functions:

- *Capitalization* describes differences in the success or performance of social actors according to their network position. The underlying assumption is that social networks provide access to resources and that the structural position of an actor is decisive of the amount, quality, and diversity of flows of resources (Borgatti and Halgin 2011). The capitalization function is the basis of social support literature (Walker et al. 1993), and connectionist social capital theories (Bourdieu 1983; Lin 2001).
- *Contagion* refers to the spread, and hence homogenization, of actors' traits and practices (more particularly actors' attitudes or behavior) through direct interaction / transmission of flows between actors (Borgatti and Halgin 2011). Network position, for example, is decisive of the time upon arrival and the non-redundancy of information, whereas adoption decisions of particular actors are thought to be a function of the proportion of directly related adopters. Contagion is subject to flow-based theories of diffusion (Valente and Rogers 1995; Rogers 2003).

Coordination model: cooperation & convergence

A less prominent network explanation of how networks make a difference is provided by the "coordination model". Underlying the coordination model is the notion of networks as girders or bonds that help alignment and coordination, or – in some cases – even prevent social action (Borgatti and Halgin 2011). This model is informed by a structuralist stance, focusing on the structure of relations rather than on the content of relations. Network functions related to the coordination model are:

- *Cooperation* describes the ability of actors to exploit connections and divisions among them as means of controlling resource flows and as leverage in negotiation processes. An underlying assumption is that nodes can exclude other actors through joining up with specific actors exclusively. Groups of nodes can from coalitions, thus acting as one single node, and thereby increase their capabilities in negotiation processes (Borgatti et al. 2009; Borgatti and Halgin 2011). The network function of cooperation forms the basis of structuralist social capital theories (Burt 2000), research on power in exchange networks (Bonacich 1987) and has also informed research on network coordination (Powell 1990).
- *Convergence* explains homogenization processes in the absence of direct interaction between actors. Underlying assumption is that nodes with similar social environments demonstrate similarities in traits and practices, and hence can be considered a special form of coordination through which actors align without directly cooperating (Borgatti and Halgin 2011). Convergence is subject to the theory of structural equivalence, and forms the basis of the broad stream of positional analysis in network research (Emirbayer and Goodwin 1994; Scott 2011), and therefore can be referred to as a counter-narrative to flow-based explanations of diffusion.

Social capital theories

Network research focusing on the success or performance, either at the node or network level, is known collectively as the social capital literature (Borgatti and Halgin 2011). The concept of social capital has developed symbiotically with the emergence of SNA, at the same time benefiting from and fueling research into social networks (Borgatti and Foster 2003).

Social capital, basically, is a theory of social networks (Burt 2000; MacGillivray 2018), and more particularly a theory of the benefits of social relations (Borgatti and Halgin 2011). In essence, social capital is a metaphor for advantage, stating that "people who do better are somehow better connected" (Burt 2000, p. 347). Various definitions of social capital have proposed, among the most popular definitions by Bourdieu, Coleman, and Putnam. Whilst Bourdieu (1983) has defined social capital as the sum of the actual and potential resources that result from social networks, Coleman (1988) defines social capital as a variety of different entities that inhere in social structure and facilitate coordination among actors within this structure (Portes 1998). Drawing on Coleman, Putnam (1993) more generally defines social capital as "features of the social organizations such as trust, norms, and networks that can improve the efficiency of society by facilitating coordinated actions" (Putnam et al. 1993, p. 167). Although all three definitions of social capital diverge to a considerable extent, they agree on the notion that social structure is a "[…] kind of capital that can create for certain individuals or groups a competitive advantage in pursuing their ends"(Burt 2000, p. 348).

The connectionist view of social capital focuses on the resources that flow through social ties. Social capital, from this stance, is seen as the quantity and quality of ties a particular actor ("ego") has to resource-full others ("alters") (Borgatti and Foster 2003). Connectionist conceptualizations of social capital are rooted in social support literature (Walker et al. 1993) and social resource theory (Lin 1982) and are prominently represented in social network definition by Bourdieu (Bourdieu 1983). A connectionist understanding of social capital underlies the conceptualization of social networks in vulnerability and livelihood research and is inherent in the notion of social networks as safety nets and as a source of social capital (Etzold 2017; Steinbrink and Niedenführ 2020).

The structuralist view of social capital tends to neglect the content of ties, but focuses on the structural patterns of the network a particular actor is embedded in (Borgatti and Foster 2003). For example, Coleman is takes a topological view of social capital. A central argument of Coleman is that social capital is created through network closure. Densely connected networks guarantee the observance of norms, reduce risk, and facilitate trust (Portes 1998; Burt 2000). A similar notion is also implicit in Putnam's definition, which refers to broad cross-cutting interconnections among group members that knit together a society and contribute to its ability to prosper (Borgatti and Foster 2003). In contrast, Burt (2000) describes social capital as a function of brokerage opportunities. Adopting a structuralist view of the phenomenon of the "strength of weak ties" (Granovetter 1973), the theory of structural holes (Burt 1992), explains differences in the performance of social actors due to the lack of ties among actor's alters (Borgatti and Foster 2003). Structural holes – that is, weak ties connecting between otherwise unconnected subgroups – create competitive advantages for those whose relationships span the holes. Structural holes offer the opportunity to broker information and to control interaction among people on opposite sides of the hole (Burt 2000). For an overview of varying social capital conceptions see *Figure* 3.

	Bourdieu	Coleman	Granovetter* / Burt	Putnam
What?	Resources accessible through social networks	Dense sub-groups (closure)	Weak ties* / structural holes	Horizontal ties (bonding / bridging) and vertical ties across levels (linking)
For what?	Gain in economic and cultural capital	Cooperation among social actors	Competitive advantage in markets	Democratic and economic performance
How?	Mobilization of resources	Sanctioning / trust building	Acquisition of information	Cooperation and solidarity
Network perspective	Connectionist	Structuralist	Connectionist*/ Structuralist	Structuralist
Network model	Flow	Coordination	Flow* / Coordination	Coordination (cross-level)

Figure 3: Overview of social capital conceptualizations *(adapted from Fuhse (2018))*

Probably the most popular conceptualization of social capital is that of Putnam (2000) and in particular his distinction between "inward-looking" bonding and "outward-looking" bridging social capital (Putnam 2000). Bonding capital, considered crucial for "getting by" in times of need, arises from strong-knit ties within a more or less homogeneous group of similar actors. Bridging capital, assumed to be crucial for "getting ahead", arises from rather loose-knit ties connecting actors beyond a social subgroup (Baird and Gray 2014; Woolcock 2001).The binary between bonding and bridging capital, however, has been criticized for being too simplistic (Patulny and Lind Haase Svendsen 2007), diverting attention toward differences between network actors instead of accounting for the resources these actors are able and willing to provide (Ryan et al. 2008; Ryan 2011). Accordingly, authors have highlighted the role of linking capital – vertical bridging ties to institutions at higher societal and organizational levels holding relative power and influence (Woolcock 2001).

Diffusion theory and social learning

Network research explaining which pairs of nodes makes similar choices has been referred to as homogeneity literature. Most prominently this strand of research is represented by work on the diffusion or adoption of innovations (Borgatti and Halgin 2011).

The diffusion of innovation theory (Valente and Rogers 1995; Rogers 2003) attempts to explain how ideas and practices spread within and between communities (Valente and Rogers 1995; Rogers et al. 2019). Diffusion research has its roots in a variety of disciplines, including anthropology, economics, geography, and sociology. Central premises underlying the diffusion paradigm are that social rather than economic factors influences adoption decisions (Valente 2005) and that ideas and practices spread through interpersonal contacts of communication (Valente and Rogers 1995). From a social network perspective the adoption of innovations is seen as a social process, and more particularly as a process of "social learning" (Conley and Udry 2001; Valente 2005).

Different models of diffusion exist. Models of collective experimentation conceptualize social learning as processes in which every actor of a social unit is updating his or her opinion about a technology

according to information on the outcomes of experiments from every other actor. In contrast, network models assume that information on new technologies is not freely available between actors but shared through social networks (Conley and Udry 2001). From a social network perspective, innovation adoption is explained in terms of network exposure: the proportion of a node's contacts that have already adopted the innovation, assuming that the likelihood of adoption increases with the number of adopters in a node's personal network (Valente 2005). Exposure can be operationalized either from a connectionist or a structuralist viewpoint. From a connectionist stance, network exposure relates to social influence in terms of transmission of information, persuasion, or direct pressure. From this point of view, the likelihood of adoption can be measured in terms of the number of direct ties to alters who have already adopted. From a structuralist stance, network exposure relates to social influence, social comparison or competition. From this point of view, the likelihood of adoption is measured in terms of structural equivalence (Valente 2005).

While diffusion theory focuses on how innovations spread throughout a social system (Rogers 2003), social learning theory provides deeper insights into the social process of knowledge acquisition and creation (Glückler et al. 2017). Social learning theory conceives of learning as a relational process that is embedded in the relationships and interactions between people (Elkjaer 2000; Genilo 2007). In this sense, the capacity for learning depends on the relational infrastructure as a source of knowledge and advice. Multiple network features have been found to be positively related to social learning and innovation, including tie quantity and quality (e.g. strong / weak ties), network structure (e.g. density, centralization), actor position (e.g. centrality, brokerage). For innovation to materialize, it has been argued, the right mix of structural features is needed (Newman and Dale 2005) as well as, in particular, boundary-spanning individuals connecting between core and periphery (Bodin and Crona 2009; Klerkx et al. 2010; Glückler et al. 2017). Besides structural features emphasis is placed on the social aspects of learning. Learning is considered not as merely the transmission of knowledge, but as a social relationship between the seeker of advice and the provider of advice. For example, advice-seeking behavior is determined by social status and interrelated with collaboration, or friendship (Glückler et al. 2017). Accordingly, innovation transfer through social networks, is not only a matter of efficient network structure, but also a matter of motivated and skilled actors able to span boundaries between subgroups in order to mobilize knowledge, power, and resources (Moore and Westley 2011).

2.3.3 Conducting social network analysis

SNA builds on representational formalism borrowed from graph theory (Butts 2009). Formally, a social network is defined as a finite set of actors and one of many possible sets of social relations of a specific type that link between these actors (Emirbayer and Goodwin 1994; Borgatti and Halgin 2011). Pair-wise relations between two actors or so-called "dyads" are the basic building blocks of social networks. Overlapping dyads result in a larger structure of relationships; that is, the social network (Hennig et al. 2012).

Networks can be conceptualized as graphs, sets of distinct actors ("nodes") with a set of pairwise relations ("ties"/"edges") between them, which can be represented in the form of sociograms or matrices (Butts 2009; Scott 2011). Ties are strictly dyadic consisting of either unordered pairs (directed ties) or ordered pairs (undirected ties). Ties are either dichotomous (present or absent) or valued (in order to represent their strength or frequency) (Scott 2011). This representational formalism provides opportunities and constrains at the same time. On the one hand the framework of social networks seems "[…] so restrictive as to be useless" (Butts 2009, p. 414), on the other hand its generalizability allows application to virtually any phenomenon (Butts 2009).

When conducting SNA, it should be noted, that – in general – social networks do not exist as such. The definition of a social network is a theoretical act, and hence can only provide an approximation of the more complex social system under study (Butts 2009; Hennig et al. 2012). As a theoretical construct, social networks – unlike social groups – do not have natural boundaries and do not necessarily have to be connected. Who or what is defined as nodes and what is defined as ties depends on the research question and explanatory theory (Butts 2009; Borgatti and Halgin 2011).

There is no standardized way of carrying out network analyses. According to Hennig et al. (2012), there are specific conceptual decisions that need to be addressed before empirical network research is conducted. This includes the definition of a) the dependent / independent variable, b) the level of analysis, c) the type of network, d) the relations of interest (Hennig et al. 2012).

a) *Dependent / independent variable:* in a first step, dependent and independent variables need to be specified. If the question is how network structure affects social behavior, the network is the independent /explanatory variable. If the question is how and why people are linked in a specific way, then the network is the dependent variable.

b) *Level of analysis:* furthermore, the level of aggregation needs to be decided upon. This requires the decision as to whether nodes represent individuals, or rather aggregates, such as households, social groups, or organizations.

c) *Network type:* depending on the scope of interest, two different approaches to network assessment can be applied:

   - *Socio-centric approaches* capture the internal structure of interactions between members of a unit of analysis. Such complete networks entail all direct and indirect relations between all members of a defined population. Complete networks can be differentiated into one-mode networks, and two-mode networks. One-mode networks represent specific substantive connections between a single set of actors. Two-mode networks consist of two distinct sets of actors (e.g. persons and organizations) or, more generally, two distinct sets of units (e.g. people and social events) and the relations between these two (e.g. affiliation with an organization / participation of people in social events). The assessment of complete networks requires the a-priori definition of a limited number of network members and the systematic assessment of all possible ties between them. Depending on network size, this can be a time and resource-intensive endeavor, unless secondary information about interactions is already available.

   - *Ego-centric approaches* capture the social embeddedness of particular actors. Ego networks describe the direct interactions between individuals (egos) and their social environment (alters), whereas personal networks, in addition, also account for the structure of an ego's social environment, i.e. the relations between alters. Unlike complete networks, ego networks are applicable in contexts in which alters are unknown, and hence are suitable for mass representative surveys. While most empirical work has been conducted on either complete or ego networks, in recent years, a growing number of studies are applying *hybrid approaches*, in order to add "openness" to socio-centric approaches and "structure" to ego-centric approaches.

d) *Relations of interest:* finally, the relations of interest need to be defined. Connections between actors can be distinguished by content and form. Content refers to the substantive type or relation (e.g. friendship or exchange of information), while the form refers to the properties of the connection, which exists independently from its content (e.g. its strength or frequency).

In general, there are two distinct strategies for analyzing network structure. The "relational" or "social cohesion" approach focuses on connectivity between actors, either direct or indirect (Emirbayer

and Goodwin 1994). Conceptually, relational approaches draw on the "flow model", conceiving of social networks as conduits of flows (Borgatti and Halgin 2011). Measures of interest from a relational perspective are, for example, measures of network connectivity, fragmentation, and different forms of centrality (Hanneman and Riddle).

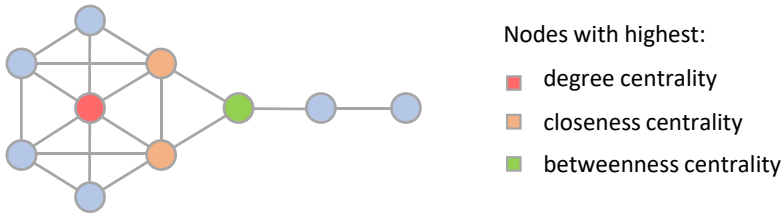
In contrast the "positional approach" focuses on the patterns of relations that define an actor's position relative to all other actors in the network – that is, the "position" or "role" that an actor / or a set of actors occupy within a social system (Emirbayer and Goodwin 1994). Positional approaches build on the bonding rather than on the distributing function of networks. Measures include "structural equivalence" or "substitutability", which are analyzed with the help of sophisticated methods of matrix clustering (block models) (Scott 2011).

Based on theorems of graph theory a broad range of mathematical procedures can be applied to analyze formal network properties (Wasserman and Faust 1994; Scott 2013). Descriptive network measures build on concepts, such as adjacency, reachability, distance, connectivity, and embeddedness. These concepts are basically defined on the dyad level, but can be aggregated on a higher level , i.e. the actor level, the sub-group level, and the network level (Hennig et al. 2012) . For an overview of selected measures relevant in the context of this study see *Box* 5.

Box 5: Selected network measures *(adapted from Hanneman and Riddle (2005))*

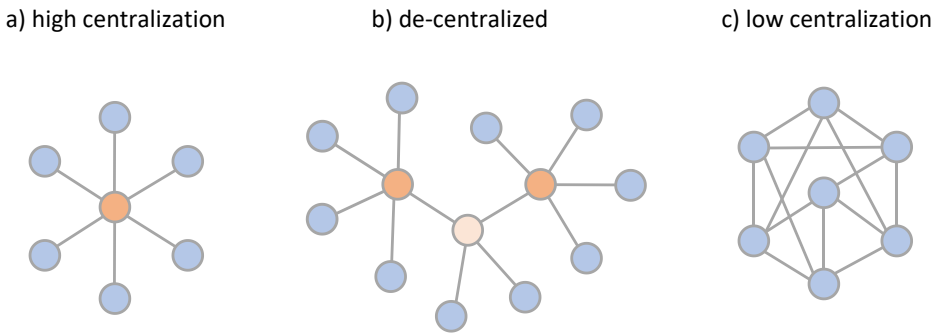
Centrality describes the location of particular actors in terms of how close they are to the center action in a network. The most popular centrality measures are:

- *Degree centrality* refers to the number of direct ties an actor possesses. In directed networks in-degree measures the number of ingoing ties, whereas out-degree measures the number of outgoing ties. The underlying assumption is that actors with many ties are in an advantaged position, because they have alternative ways of satisfying needs and are able to access more resources. High in-degree can be indicative of resource access or prestige. Actors with many outgoing ties are supposed to be influential actors.
- *Closeness centrality* emphasizes the distance between an actor and all others in the network or, in other words, how close one actor is to all the others, and hence is an indicator of the influence an actor has on other actors in the network.
- *Betweenness centrality* explores the extent to which an actor is located on the shortest possible paths (geodesics) between other actors in the network, and hence is a suitable measure of brokerage and the power to control flows between subgroups of a network.



- While centrality focuses only on direct ties an ego has to its alters and can be applied for the study of ego networks and complete networks alike (Marsden 2002), closeness and betweenness centrality require data on the structure of relations between a defined set of actors (complete networks), and therefore are not applied in the context of this study.

Degree centralization measures the variance in actors' degree in a given network expressed as a percentage of the variance in actors' degree in a perfectly centralized network of the same size (i.e. a star network). In networks of high degree centralization, degree is unequally distributed among actors, implying that positional advantages are unequally distributed. Centralization can be also calculated for other centrality measures.



Density expresses the extent of dyadic connection in a network. Density is the ration of the number of ties in a given network to the maximum possible number of ties in a network of the same size. In networks of high density information and resources are circulated more rapidly and equally, while a network of low density might be indicative of limited flow of resources and information. High density, however, might not always be advantageous, in particular in networks with closed sub-groups where access to novel information is lacking.

2.3.4 Towards a relational network perspective

Concerns regarding the theoretical foundations of SNA research have a long history (Mitchell 1974). Probably the most frequent critique is that SNA does not provide a (native) theory of its own (Borgatti and Halgin 2011), but is "merely descriptive" or "just methodology" (Borgatti et al. 2009). It has been argued that SNA is used as a tool for analyzing social structure rather than for understanding social structure (Salancik 1995) treating networks as uncontextualized analytical construct and therefore over-abstracting social relationships (Bolíbar 2016). Preoccupied with technical procedures and empirical findings, it has further been argued, SNA inadequately conceptualizes human agency and the role of culture and, therefore, fails to address how intentional, creative human action serves to constitute social networks that, in turn, constrain social actors (Emirbayer and Goodwin 1994). Undoubtedly, SNA's principle achievement lies in transforming a mere metaphorical understanding of social networks into a tool for social analysis; however, these tools "[…] by themselves fail ultimately to make sense of the mechanisms through which these relationships are reproduced or reconfigured over time" (Emirbayer and Goodwin 1994, p. 1447).

With regard to the relationships between culture, agency, and social structure Emirbayer and Goodwin (1994) have identified three approaches to SNA: a) structural determinism, in its purest form expressed by the anti-categorical imperative, neglecting the causal role of actors' beliefs, values and normative commitment altogether; b) structural instrumentalism, which acknowledges the prominent role of actors, but reduce agency narrowly to instrumental forms of utility-maximization; c) structural constructivism, which more adequately addresses human agency and the transforming impact of culture and norms, but nevertheless pays insufficient attention to the impact of cultural and political discourses on social agency. Against the backdrop of conceptual and theoretical shortcomings, criticists have called for a relational approach that takes in to consideration "[…] not only structural but also cultural and discursive factors will necessarily entail a fuller conception of social action than has been provided thus far by network analysts" (Emirbayer and Goodwin 1994, p. 1447; Emirbayer 1997).

The call for a relational network approach has sparked theoretical work laying out the foundations of relational sociology (Fuhse 2015; Fuhse 2018), which is still in the making. Attempts to add meaning to social structure are being taken up by a growing number of qualitative approaches to SNA, a qualitative and participatory social research and network visualization (Hollstein and Straus 2006; Schönhuth et al. 2013). Recently, mixed-methods approaches combining standardized network assessments with qualitative methods have emerged a fruitful way to overcome the shortcomings of overly formalistic network analysis (Bellotti 2016; Bolíbar 2016; Ryan and D'Angelo 2018).

3. Conceptual framework

This section provides the conceptual framework of this study, which brings together three peer-reviewed research articles arising from desk work and empirical work in Northeast Thailand conducted over a period over 5 years. Thereby this section serves two objectives: a) introducing to the conceptual underpinnings and scope of a translocal network perspective on rural livelihoods, and b) providing an operational concept integrating the three research articles.

3.1 A translocal network perspective on the resilience of rural livelihoods

In an attempt to scrutinize neoliberal interpretations of the migration as adaptation narrative and in order to provide a nuanced picture of the role of migration in resilience building, this study applies a structural translocal network perspective to the resilience of rural livelihoods.

Refraining from both exaggerated optimistic and overly pessimistic accounts of the nexus between migration, development, and the environment (De Haas 2012; Piguet 2013) and accounting for the diversification and delocalization of rural livelihoods in the context of rural transformation in the Global South (Rigg 2006), this study builds on the notion that migration is a major livelihood strategy and a key aspect of rural transformation around the world (Ellis 2003; Kelly 2011) that exists regardless of climate change (Sakdapolrak et al. 2016). Drawing on the concept of translocality (Brickell and Datta 2011; Greiner and Sakdapolrak 2013b), migration is considered to result in increasing translocal connectedness between places of origin and destination of migration, in the form of translocal social networks facilitating material and immaterial flows within rural areas and between rural areas and rural areas (Greiner and Sakdapolrak 2013b). Leaning on the concept of translocal social resilience (Sakdapolrak et al. 2016), these translocal social networks are hypothesized to bear the potential to foster the resilience of rural livelihoods by providing access to resources, knowledge, and ideas required for coping with and adapting to risks, and for exploring alternative livelihoods pathways (Scheffran et al. 2012; Sakdapolrak et al. 2016).

Besides acknowledging the translocalization of rural livelihoods through migration, this study also accounts for the fact that rural livelihoods are increasingly commercialized and formalized in the course of market and state interventions (Rigg 2006; Rigg and Salamanca 2009; Berdegué et al. 2014). In the course of rural transformation, locally bound and close-knit networks are expected to converge into spatially and socially diversified networks spanning multiple geographical and societal sources of livelihoods. Whilst the scope of interest of this study lies in providing an understanding of the role of migration-related translocal social networks in the resilience of rural livelihoods, it also accounts for formal networks connecting to public and private institutions, as they provide the context in which translocal livelihoods are embedded. In order to overcome the vague conceptualization of social networks in migration and translocality research and the lacking acknowledgement of social networks' spatial dimension in the study of community resilience (Rockenbauch and Sakdapolrak 2017; Wilkin et al. 2019), this study conceptualizes translocal social networks in a socially and spatially explicit manner. This means that translocal networks are considered as being characterized by the interplay between institutional and non-institutional actors located at different geographical places, connected through local and translocal ties that can be either informal or formal.

Conceptually and methodologically, the role of translocal social networks and rural households' resilience is assessed by means of a structural approach, based on theorems and methods of social network analysis (SNA) (Wasserman and Faust 1994; Hennig et al. 2012).

A structural approach (see Chapter 2.3) places the focus of interest on how social and spatial patterns of translocal social networks (*independent variable*) relate to the resilience of rural livelihoods (*dependent variable*).

Taking a structural translocal network perspective on the resilience of rural livelihoods in Northeast Thailand (see *Figure* 4), this study addresses the following overarching questions:

- What are the socio-spatial patterns of translocal social networks (in terms of social composition and geographical distribution)?
- What are flows and how are flows channeled through translocal social networks?
- How do network features (socio-spatial patterns and flows) relate to the resilience of rural livelihoods, in terms of the capacity to cope, to adapt, and to transform in the context of rural transformation?

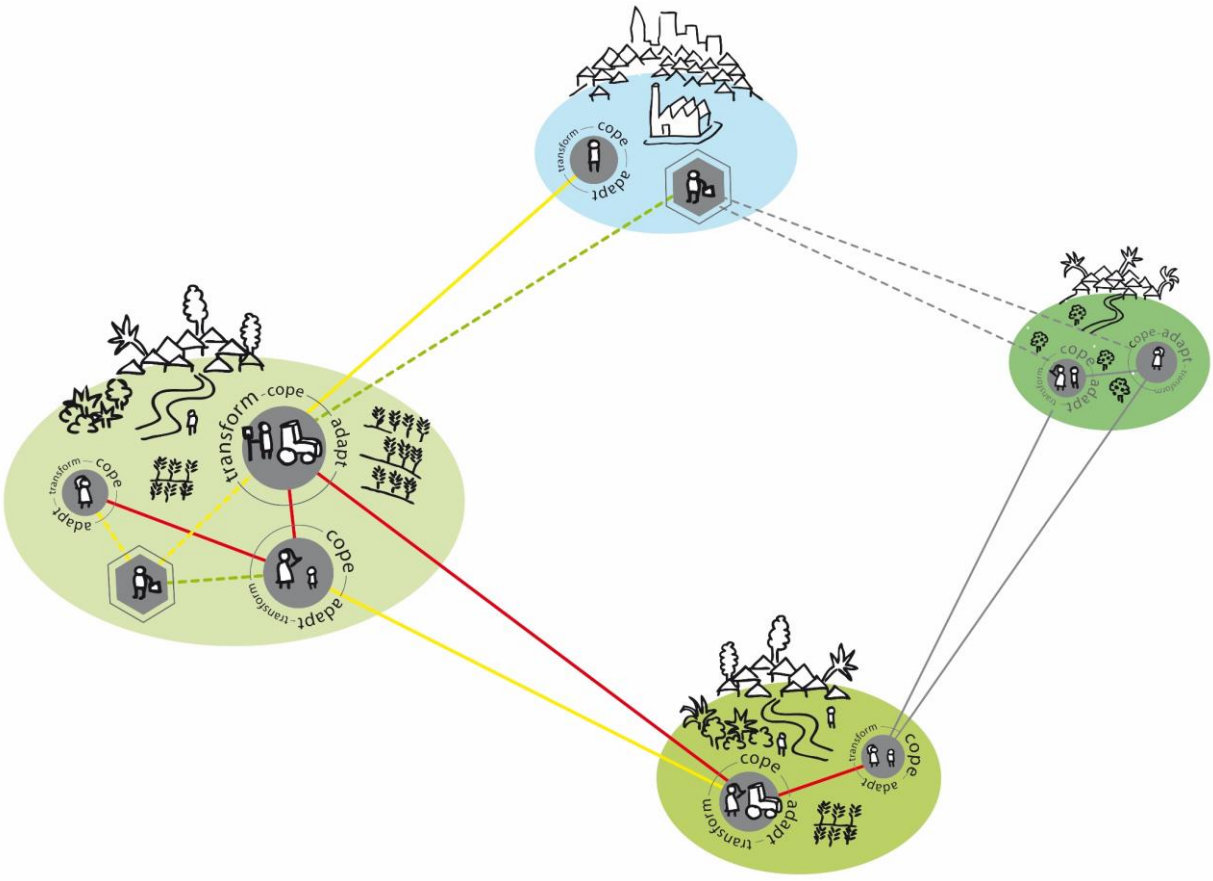


Figure 4: Translocal network perspective on the resilience of rural livelihoods *(own figure).*
In the process of the diversification and delocalization of rural livelihoods, localized and close-knit networks have converged into socially and spatially diversified translocal social networks comprised of institutional and non-institutional actors (shape of nodes), connected through local and translocal ties (lines within / between places) that can be either informal or formal (solid / dotted lines). Facilitating various flows (colored lines) between areas of origin and destination of migration translocal social networks shape actors' capacity to cope, adapt, and transform, and, consequently, also shape the resilience of rural livelihoods.

Drawing on a working definition (TransRe 2016) and leaning on Peth and Sakdapolrak (2019) translocal social resilience, in the context of this study, refers to the capability of rural households embedded in translocal networks to deal with stress and adversity, and to take opportunities arising at different localities and scales to maintain or increase their well-being. For conceptual and methodological reasons –this study is referring to translocal social resilience in terms of general resilience, which is – unlike specific resilience – less about dealing with an immediate and definable shock, but about dealing with uncertainty in all ways (Folke et al. 2010). By referring to translocal social resilience in terms of general resilience, this study accounts for the fact that rural livelihoods in Northeast Thailand are contested by a bundle of associated risks, including climate change as well as others, such as price volatility, poverty, diseases, and death (Rigg and Salamanca 2009; Rambo 2017).

With reference to Keck and Sakadapolrak (2013), translocal social resilience is addressed through the less of the capacities to cope, to adapt, and to transform. For the purpose of this study a slightly modified definition of resilience capacities[1] is applied (see *Figure* 5).

- *Capacity to cope*: in terms of buffering shocks and "getting along" / sustaining livelihoods under adverse conditions by ex-post and short-term measures (not necessarily reacting to a specific shock).
- *Capacity to adapt*: in terms of actively changing ways of doing things (here agricultural activities), as a consequence of learning from past experiences and social learning / interaction with peers.
- *Capacity to transform:* in terms of deliberate and radical changes in livelihoods, in order to not only secure, but also enhance livelihoods in the face of continuous change. Exploring alternative livelihood pathways requires not only the ability to draw on resources and social learning but also the ability and willingness to take advantage of environmental and socio-economic changes.

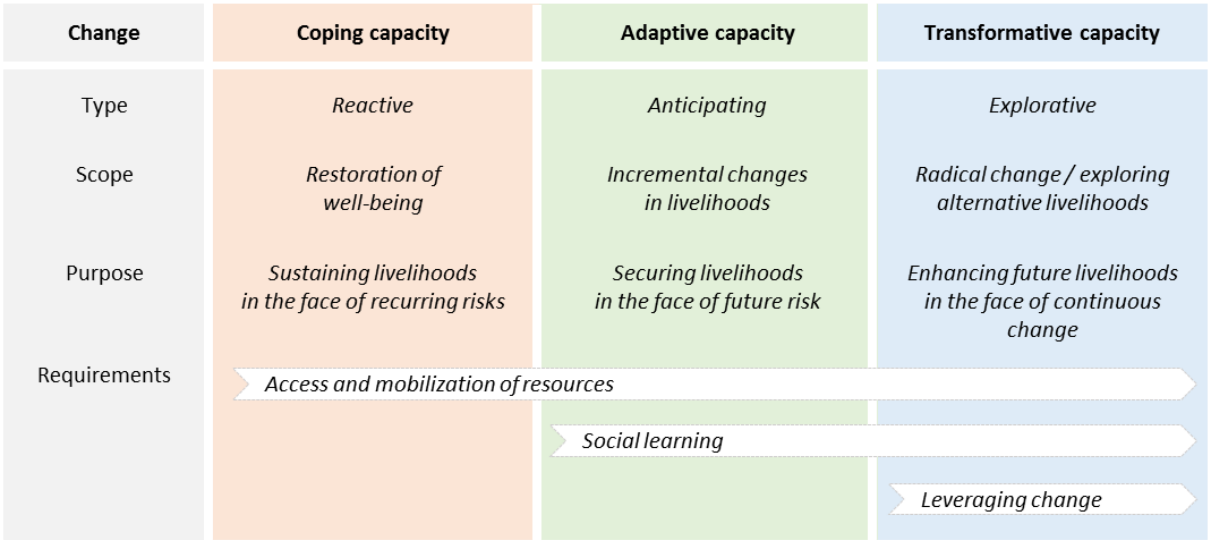


Figure 5: Selected characteristics of resilience capacities *(adapted from Keck and Sakdapolrak (2013))*

[1] *The modified definition of resilience capacities takes into account that, due to methodological constraints, empirical research presented and synthesized by this study did not explicitly address temporal dynamics in networks and resilience. Furthermore it takes into account that empirical research did not address aspects of participation in decision-making processes, which is commonly highlighted as a crucial aspect of transformative capacity (Keck and Sakdapolrak (2013)).*

In sum, the study's conceptual contribution lies in combining a structural translocal network perspective, capturing the structural features of and flows channeled through translocal social networks, with an actor-oriented conceptualization of social resilience emphasizing social actors' capacity to cope, to adapt, and to transform rural livelihoods.

3.2 Operational concept

This study brings together the results of an explorative and step-wise research process. Research activities started with extensive desk work (Article I) providing the conceptual and methodological foundations of consecutive empirical field work comprising two case studies with distinct conceptual and methodological approach (Article II / Article III). This study frames the three articles by embedding them in the broader discourse and by providing the theoretical background and conceptual framework. The synthesis discusses research findings from a resilience perspective and distills conceptual and methodological implications (see *Figure* 6).

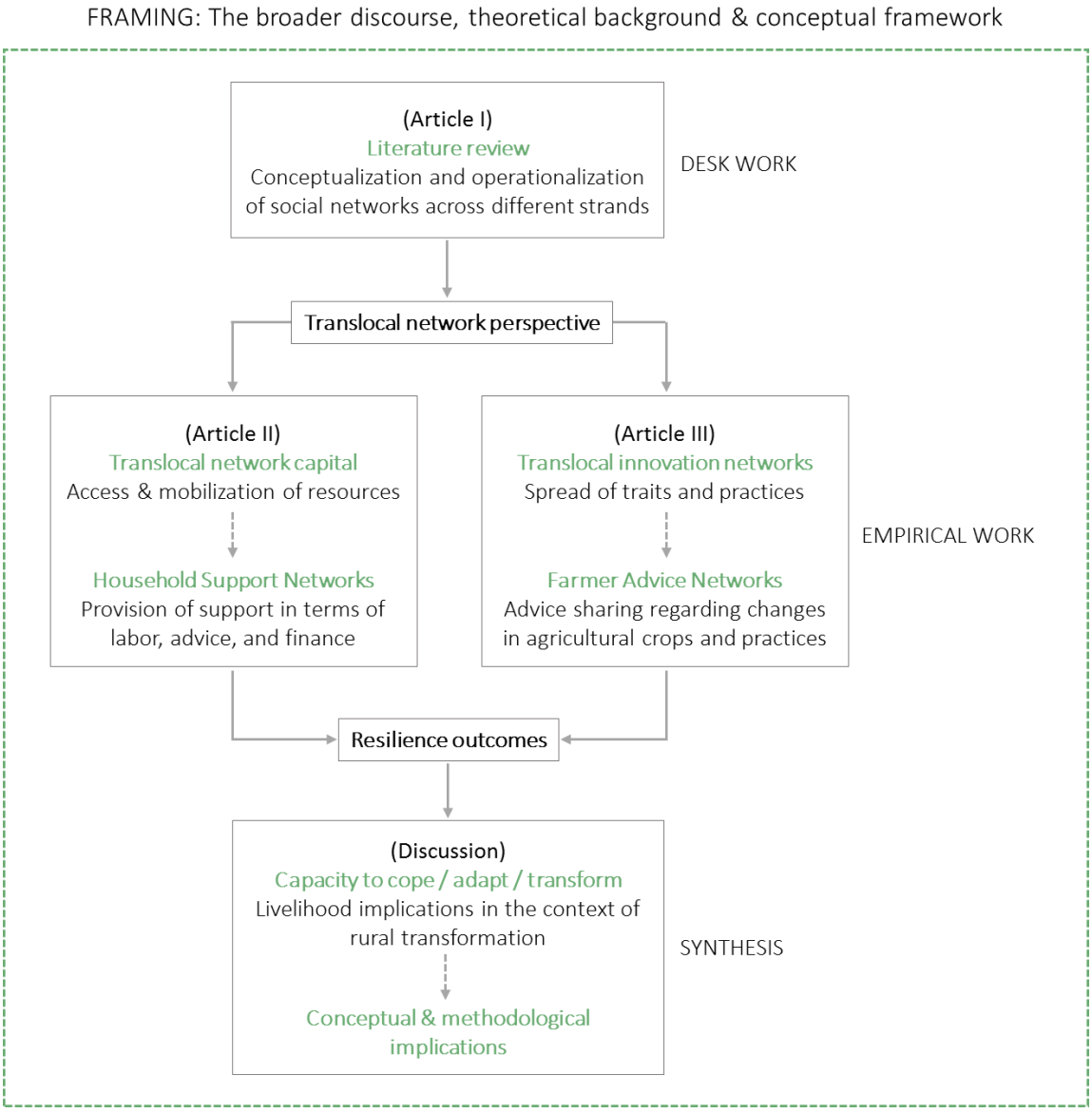


Figure 6: Stages of the research process *(own figure)*

3.2.1 Desk work

Desk work was conducted at an early stage of the research process, prior to empirical work. The purpose of desk work was to provide an overview of the status of current research on issues of social networks and resilience in the context of rural communities in the Global South. As an outcome, desk work provided the conceptual groundwork of a translocal network perspective on the resilience of rural livelihoods, as applied in this study.

Literature review (Article I):

Article I entails a systematic review of case studies on social networks and resilience, conducted in the context of rural communities of the Global South. Reviewed case studies from different strands of research are analyzed in terms of how they conceptualize and operationalize social networks. Based on a discussion of strengths and weaknesses, general challenges of social network research in the context of rural communities in the Global South are identified. Against this backdrop, a translocal network perspective, conceiving of rural communities as embedded in translocal networks facilitating the flow of resources, knowledge, and ideas between areas of origin and destination of migration, is proposed as a promising framework for understanding the resilience of rural livelihoods. In doing so the article contributes to the emerging corpus of literature on community resilience (Berkes and Ross 2013; Skerratt 2013; Aldrich and Meyer 2015; Dapilah et al. 2020). With regard to the scope and design of this study, the literature review is of central relevance, as it informed the conceptualization and operationalization of the consecutive empirical inquiry.

3.2.2 Empirical work

The empirical part of this study, demonstrates how a translocal network perspective on the resilience of rural livelihoods can be applied in practice and which empirical insights it can yield. Empirical work comprises two case studies revealing the patterns of translocal social networks and their role in rural livelihoods in Northeast Thailand.

Translocal social networks are conceptualized from a connectionist perspective, assuming that translocal networks facilitate material and immaterial flows between areas of origin and destination of migration. Flow-based explanations of network outcome are addressed from the stance of social capital research and that of diffusion research. The social capital stance is represented by a case study on translocal network capital (Article II), whereas the diffusion stance is represented by a case study on translocal innovation networks (Article III). Conceptual and methodological differences between both studies are described below; for an overview see also *Table* 1.

Translocal network capital (Article II)

Article II takes a social capital stance regarding translocal networks, and hence is concerned with flow-based explanations of performance. The network function of interest is capitalization, here the amount and quality of livelihood resources accessible through social networks. In doing so, this study stands in the tradition of research on social support networks, vulnerability and rural livelihoods (Bohle 2005), and aims to substantiate the ongoing discussion around social networks as a coping mechanism and as a source of social capital (Woolcock and Narayan 2000; Woolcock 2001; Adger 2003; Baird and Gray 2014; Steinbrink and Niedenführ 2020).

Translocal network capital is addressed by investigating the socio-spatial patterns of rural households' support networks providing access to agricultural labor, advice, and finance. Support networks are operationalized as ego networks, and are sampled by means of stratified random sampling. Actors comprise households (egos), and are differentiated by socioeconomic status (poor, middle, rich), and receive support from various actors (alters), differentiated by relational group (household members, relatives, neighbors and acquaintances, and institutions). Ties comprise different types of support (agricultural labor, advice, finance) and are differentiated by social composition (bonding / bridging) and geographical distribution (local / translocal). The scope of analysis lies on revealing the socio-spatial patterns of households' network capital and importance, by support type and socio-economic status.

Table 1: Conceptual and methodological differences between case studies

	Translocal network capital (Article II)	Translocal innovation networks (Article III)
Stance	Social capital (flow-based explanation of performance)	Diffusion (flow-based explanation of homogenization)
Network function	Capitalization	Contagion
Network of interest	Household support networks	Farmer innovation networks
Network approach	Ego networks, stratified random sampling	Partial network constructed from snowball-sampled ego networks
Actors	Households (egos) differentiated by socio-economic status (poor, middle, rich), receiving support from various actors (alters) differentiated by relational group (household members, relatives, neighbors & acquaintances, institutions)	Farmers (egos), receiving advice from various actors (alters) differentiated by occupation (farmer / institutional representative)
Ties	Support provided differentiated by type (agricultural labor, advice, and finance), social composition (bonding / bridging) and geographical distribution (local / translocal)	Advice provided differentiated by type (adoption, implementation, general), tie strength (weak / strong), formalization (informal / formal) and geographical distribution
Analytical scope	Socio-spatial patterns (social composition and geographical distribution) and importance by function and socio-economic status	Tie characteristics (geographical distribution, tie strength and formalization), network structure, and key actors

Translocal innovation networks (Article III)

Article III takes a diffusion stance regarding translocal social networks, and hence is concerned with flow-based explanations of homogenization. The network function of interest is contagion, here the spread of agricultural innovations through social interaction among farmers. Theoretically and conceptually this study is rooted in research on agricultural innovation (Conley and Udry 2001; Valente and Rogers 1995) and aims to contribute to a better understanding of processes of social learning in the context of networked innovation systems (Klerkx et al. 2010; Spielman et al. 2011; Schut et al. 2015).

Translocal innovations network are addressed in the form of farmers' advice-sharing networks providing information and knowledge regarding changes in agricultural crops and practices. Advice networks are operationalized as partial networks constructed from snowball-sampled ego networks. Actors comprise farmers (egos) who recently changed their agricultural crops and practices, and various actors (alters) providing advice regarding changes, differentiated by occupation (farmer / institutional representative). Ties comprise advice provided, differentiated according to type of advice (adoption, implementation), tie strength (weak / strong), formalization (informal / formal) and geographical distribution (local / translocal). The scope of analysis focuses on tie composition (geographical distribution, tie strength and formalization), network structure, and key actors.

3.2.3 Synthesis

The synthesis integrates empirical research findings on households' translocal network capital (Article II) and translocal innovations networks (Article III) from a resilience perspective. Therefore research findings on the patterns of translocal network capital and translocal innovation networks are synthesized in terms of coping capacity, adaptive capacity, and transformative capacity and are discussed against the background of information and literature on rural transformation, migration, and rural livelihoods in Northeast Thailand in order to address the question "resilience for whom and at whose cost?" In a last step, drawing on insights from desk work (Article I) and empirical work (Article II / Article III), the conceptual and methodological implications for future research on translocal social networks and the resilience of rural livelihoods are identified.

4. Methods

This section is providing an overview and critical assessment of the viability of methods applied in the context of desk work and empirical work. This section also includes criteria for study-site selection and a description of rural livelihoods in respective study sites.

4.1 Systematizing the academic field (Article I)

To gain an overview of how the role of social networks in the resilience of rural communities in the Global South is conceptualized and operationalized across various research strands, a systematic literature review was conducted (Petticrew and Roberts 2006).

In order to identify relevant case studies a stepwise research procedure was applied, starting with a search of ISI Web of Knowledge and Science Direct using the terms "social network", "resilience" "rural community", and key terms related to the three strands of literature (e.g. "natural resource governance", "agricultural innovation", and "social support"). To ensure comprehensibility additionally an open research was conducted, including, inter alia, case studies that were frequently cited by previously identified sample studies. The selection was restricted to peer-reviewed articles published in English between 2000 and 2015 and excluded all non-empirical articles and articles not related to the domain of rural development. Only selected case studies from the Global South, based on the categories "low-income countries" and "middle-income countries" (World Bank 2016) were nominated for review. The sample derived from this research procedure was analyzed according to how studies a) conceptualize and b) operationalize social networks. Besides this, c) key findings that related to aspects of the resilience of rural communities in the Global South were summarized for each strand.

The resulting corpus of literature comprises studies with different research traditions and theoretical assumptions. Comprised studies vary significantly in the way how they conceptualize and operationalize social networks, as well as in the degree to which they address the link between social networks and resilience. Accordingly the review process needed to be based a relatively broad set of categories, which prevented a nuanced analysis. As the literature research for this article was finalized in the year 2015 a number of more recent publications, cited in this study, could not be included.

4.2 Selecting study sites and gaining an overview of rural livelihoods

The selection of study sites was carried out in the context of the overarching research project on climate change, migration, and resilience-building in Northeast Thailand ("*Building resilience through translocality. Climate change, migration and social resilience of rural communities in Thailand (TransRe)"*). In the year 2014, an explorative field trip to more than 50 rural communities yielded the selection of four sub-districts across North and Northeast Thailand as project study sites, based on a comprehensive set of criteria including, inter alia, exposure to climate risk, migration history and prevalence, distance from provincial municipalities, environmental conditions and socioeconomic variables. During a second field visit in 2015, in all four study sites the objective, scope, and members of the project were presented at a public event organized by the sub-district administration. Consecutively, in every village of the selected study sites, focus-group interviews with village representatives (Narayanasamy 2009; Nyumba et al. 2018) were conducted in order to gain information on rural livelihoods, migration, and the impact of climate change.

Against the background of this information, for the purpose of conducting empirical studies, out of the four project sites, three study sites located in Northeast Thailand were selected: i) Kan Lueang sub-district in Burriram province, ii) Ban Chai sub-district in Udonthani province, and iii) Nam Kum

in Phitsanulok province (see *Figure* 7). While rain-fed agriculture is the characteristic livelihood activity at all sites, agricultural portfolios and practices, and socio-economic and environmental factors differ significantly.

a) Due to its geographical location, less than 300 kilometers northeast of Bangkok and the Eastern Seaboard, and thanks to good transportation infrastructure, the transformation of rural livelihoods in the sub-district of Kan Lueang, Buriram province, is more advanced than in other study sites. Since largescale farming of cash crops, such as sugarcane and cassava, has become an attractive business opportunity, previously high rates of migration are dropping. In recent years, agriculture in Kan Lueang is exposed to increasingly severe droughts and floods further accelerating the shift from rice farming towards less drought sensitive cash crops. While beneficiaries of this transformation are large-scale farmers and external investors, landless households – which are more frequent than in other study sites – have to work as wage laborers on cash-crop plantations or have to leave permanently for a life in the urban centers.

b) Rural livelihoods in Ban Chai sub-district, Udonthani province, are characterized by subsistence-oriented small-scale rice farming in combination with high levels of internal and international migration. Continued migration has provided households with additional income and has sustained small scale farming activities, but has also resulted in the erosion of community networks, the lack of agricultural labor, and the devaluation of agricultural practices. Despite atomized landholdings, in Ban Chai too, large-scale farming of cash crops, in particular sugarcane, is gaining momentum, with massive environmental and social consequences. Although future climate projections predict less pronounced productivity losses than in other regions of Thailand, variability and unpredictability of rainfall patterns in combination with a lack of agricultural labor are already challenging small-scale rice farming today.

c) Unlike the other study sites Nam Kum sub-district, Phitsanulok province, is located in a remote mountain valley at the Lao border. Livelihoods are characterized by intensive small-scale rice farming in the valley bottom in combination with maize farming on sloped land during the dry season. Since the introduction of maize as a second-season cash crop, already low levels of migration have significantly dropped. Limited availability of farming land and intensive cultivation, however, are resulting in high pressure on natural and human resources. Communal arrangements, such as labor exchange are providing an important source of support, however, increasing competiveness among farmers, the introduction of labor-saving machinery, and changes in the on and offset of the rainy seasons are also challenging rural livelihoods in Nam Kum.

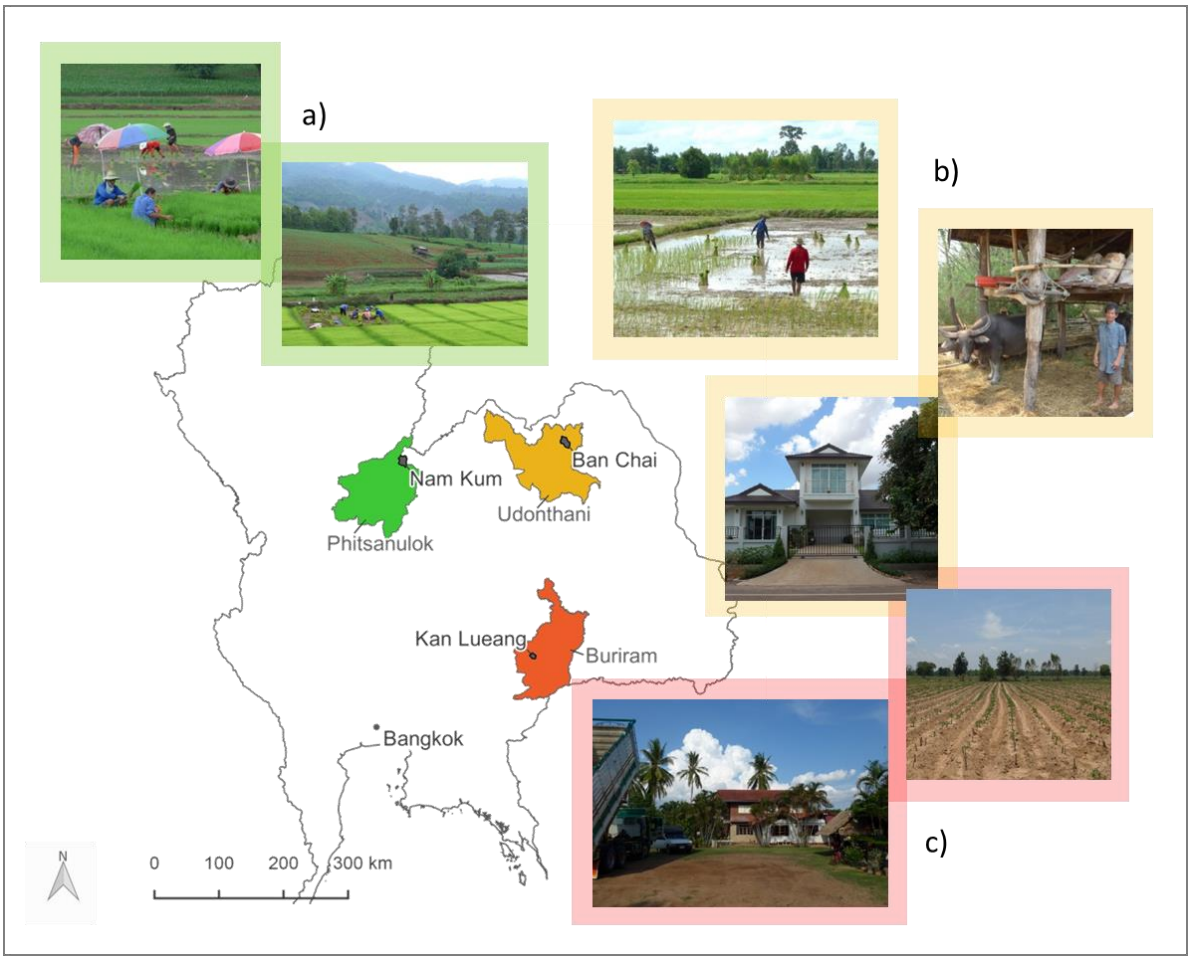


Figure 7: Selected study sites in Northeast Thailand *(own figure):*
a) Nam Kum sub-district, Phitsanulok province: intensive small-scale farming of rice and maize sustained by unpaid labor exchange; b) Ban Chai sub-district, Udonthani province: marginal small-scale farming in the context of continuous migration, lack of labor, and the shift towards cash-crop farming; c) Kan Lueang sub-district, Buriram province: extensive large-scale cash-crop farming in the context of market integration and increasing climate-related risks. Empirical work for Article II was conducted in all three study sites, whereas empirical research for Article III was conducted in Ban Chai sub-district, Udonthani province, only.

4.3 Assessing and analyzing translocal network capital (Article II)

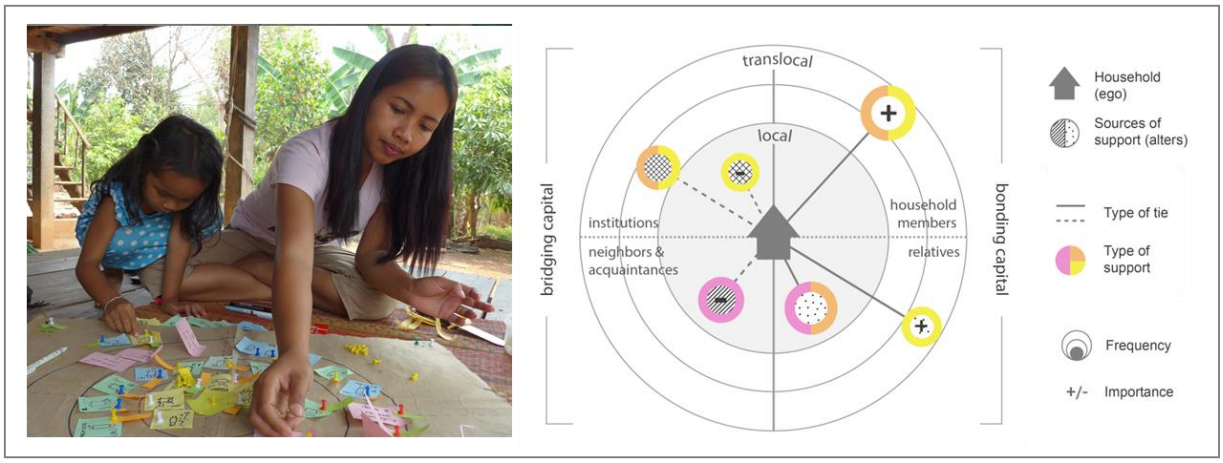
To assess households' network capital, during April and July 2015, household interviews were conducted in six rural communities across the three study sites of Kan Lueang, Buriram province, Ban Chai, Udonthani province, and Nam Kum, Phitsanulok province (see *Figure* 7). An overview of the conceptualization and operationalization of translocal network capital is provided in *Figure* 8.

The selection of rural communities was based on information regarding local livelihoods, migration history and prevalence, and environmental conditions derived from previously conducted focus-group discussions. As a guide to selecting households in each of the six villages, a participatory mapping exercise (Narayanasamy 2009) was conducted in which villagers were asked to indicate households on a map according to land size and agricultural machinery as a proxy for wealth and involvement in migration as a proxy for translocal connectedness. The resulting community maps provided the basis for household sampling.

Household interviews consisted of two thematic parts. Part A included a semi-structured interview with household representatives focusing on household livelihoods, agricultural activities, and migration history. Part B involved a participatory network mapping activity combing quantitative ego network assessment (Hennig et al. 2012; Scott 2013) with qualitative methods of network visualization and evaluation (Hollstein and Straus 2006; Schönhuth et al. 2013).

For the purpose of network mapping, a modified version of the name-generator activity (Marsden 2005) was applied. The interviewee (ego) was asked to identify network actors (alters), relevant for providing support in terms of a) labor, b) advice, and c) finance. Alters were indicated using colored cards to represent different actor groups (household member; relatives; acquaintances and friends; social institutions). Each alter was placed according to its geographical location on a pin board, consisting of concentric circles (Kahn and Antonucci 1980) representing different geographical levels (e.g. village, Thailand, abroad) with the household in the middle. Different support types were indicated by a colored point-it marker. The activity was conducted stepwise for each support type, yielding the household's labor, advice, and financial network. In order to account for relevance, for each support type assessed, interviewees were asked to indicate the importance of alters with regard to household livelihoods using colored pins (resulting in scores from 0-4). Results were recorded and captured in the form of researcher's notes and photos of the respective network maps.

70 Household interviews *(3 study sites)*



- *Stratified sampling*
- *Household interviews / participatory mapping*
- *Type of support (labor, advice, finance)*
- *Ego-network: socio-spatial patterns (bonding / bridging, local / translocal)*
- *Perceived importance (scoring)*

Figure 8: Conceptualization and operationalization of translocal network capital *(own figure)*

Based on households' livelihood data, all sampled households were classified ex-post into three wealth categories. Therefore a simple composite household wealth index was constructed based on the following indicators: land ownership as the major household asset and agricultural production factor; housing facilities as a visible indication of wealth; the availability of bigger vehicles and agricultural machinery as a means of agricultural production and transportation; and the membership with state-owned financial institutions as a means of formal credit access.

Data from interviews with 70 household representatives of different wealth categories in three study sites in Northeast Thailand involving information on a total number of 762 alters and 891 ties were

selected for analysis. Network data was transferred to Microsoft Excel Sheets and was analyzed using STATA 13 Software package. In order to analyze the socio-spatial patterns and importance of households networks, tie frequency and tie importance were calculated according to geographical level (local / translocal) and actor groups (migrating household members, relatives, neighbors, institutions) and disaggregated according to support types (labor, advice, finance) and wealth categories (poor, middle, rich), respectively. In a first step the frequency of ties and scores per household were calculated, and then in a second step the average frequency of ties and scores by support type and wealth category. In combination, averaged tie frequency and averaged score frequency indicate tie relevance. Averaged tie frequency indicates the extent to which a particular actor group at a particular geographical level provides support. An averaged score frequency that exceeds the averaged tie frequency indicates that ties are perceived as relatively more important; an averaged score frequency that is lower than the averaged tie frequency indicates that ties are perceived as relatively less important.

Although the applied method proved viable in providing fine-grained insights into the socio-spatial patterns of households' network capital, it comes with several restrictions. The participatory mapping exercise was particularly time-intensive and required a high degree of adaptation to local context. As interviewees had difficulties recalling actors according to abstract support types, questions included in the name generator needed to address the particularities of agricultural livelihoods in each study site. Although the visualization of network actors on the pin-board helped the researcher in keeping track of various alters, it was not necessarily intuitive for interviewees. The repetitive style of raising questions about different support types and supporting alters was tiring and, in particular, the ranking of alters turned out to be a challenging task. Restrictions also exist regarding the analysis of network data. As the mapping exercise only assessed first-order ego networks (that is, only relations between ego and its alters but no relations between alters), analysis remains restricted to the identification and comparison of patterns (social and spatial composition) of ego networks. Information on network structure (in the sense of the structure of relations between multiple network actors) cannot be derived from this methodology. As the overall sum of completed household interviews was rather low the researcher refrained from analytical approaches (e.g. to identify relations between network patterns and households characteristics) and focused on descriptive statistics of network patterns instead.

4.4 Assessing and analyzing translocal innovation networks (Article III)

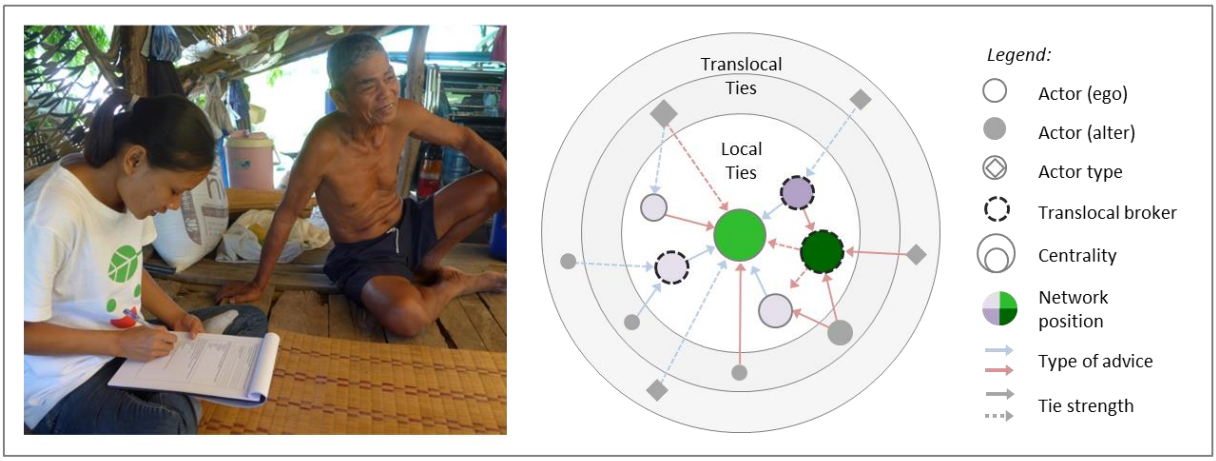
The assessment of translocal innovation networks was carried out in one of the three selected study sites between June and July 2016. The decision to select the sub-district of Ban Chai, located in Udonthani province (see *Figure* 7) was made on the basis of a high prevalence of migration, the sensitivity of small-scale rice farming to climate-change-induced volatility in rainfall patterns, and rapid changes in agricultural crops and practices in the context of market developments and agricultural policies. *Figure* 9 provides an overview of the conceptualization an operationalization of translocal innovation networks.

To assess farmers' advice-sharing networks, name and attribute generators (Marsden 2005) were implemented in form of a standardized network questionnaire in combination with a snowball sampling strategy (Isaac et al. 2014; Ricciardi 2015). Following alters of already interviewed egos, snowball sampling is a suitable strategy for exploring the embeddedness of egos, if network actors cannot be identified ex-ante. Furthermore, snowball sampling provides structural insights into the connectedness between interviewed egos. Consecutively assessed ego networks can be merged into a partial network which can be analyzed for its structural features. As networks constructed from snowball-sampled ego networks are likely to resemble the social structure between anyway closely-related

actors, rather than the structure between subgroups, the interpretation of their structural features need to be treated with care (Scott 2013; Ricciardi 2015).

Ego networks of advice were conducted with the help of a network questionnaire. This network questionnaire combined a standardized assessment of relevant changes in agricultural crops, practices, and businesses over a given period of time (five years), with a standardized name generator, identifying alters who provide advice in terms of adoption and in terms of implementation of these changes. Additionally, alters providing general advice on agricultural issues were also assessed. In a consecutive step, a standardized attribute generator in the form of questions regarding the attributes of alters, such as location, sex, age, relational category, etc., was implemented. Additionally, interviewees were also asked to provide information on their relationships with alters, including information on frequency of contact, perceived closeness, and mode of interaction.

60 Farmer interviews *(1 study site)*



- *Snowball sampling*
- *Agricultural changes in the last 5 yrs. (crop, practice, business)*
- *Type of advice (adoption, implementation, general)*
- *Ego-network: actor location, tie strength (weak / strong)*
- *Constructed network: tie composition & distribution, actor network position*

Figure 9: Conceptualization and operationalization of translocal innovation networks *(own figure)*

Snowball sampling started with two randomly selected farmers in one randomly selected village of the sub-district. Follow-up interviews were conducted with all alters located in the sub-district. In order to limit the scope of the assessment, ego networks of alters located in the sub-district but outside the starting village were assessed, but none of their alters where followed up. This procedure was continued until 20% of all households in the starting village had been interviewed. After reaching this threshold, only alters identified during preceding interviews were interviewed, without following up on any new alters. It is important to note that the decision to limited snowball sampling geographically and by means of an arbitrarily defined threshold, has implications on the overall network structure. However, as the number of network alters outside the starting village was generally low, and as the number of new alters declined significantly towards the end of the sampling process, the author considers the sampling bias to be relatively low

In addition to the network assessment, semi-structured interviews were conducted with relevant stakeholders, including farmers identified as key actors, village representatives, and representatives of district institutions (extension agencies and private companies). Information from semi-structured

interviews provided qualitative insights into agricultural innovation processes and background information on the institutional context of innovation systems.

Statistical analysis of agricultural changes, network patterns, and actor characteristics was conducted using STATA; while network visualization was performed in Gephi. For the purpose of network analysis, a partial innovation network was constructed, including all actors providing or receiving advice on agricultural changes between the year 2011 and 2016, whereby members of the same household were treated as one single actor, except for migrating household members. From this network, weighted innovation networks were derived for selected agricultural changes (e.g. changes regarding rice farming) in which tie weight indicates the number of different types of support provided (adoption, implementation, general).

For each network, tie characteristics were calculated, including the number and share of ties according to locality (local / translocal), tie strength (weak / strong) and type of advice (adoption / implementation / general). Four distinct network positions (central sender / receiver; peripheral sender / receiver) were classified according to egos' degree centrality and advice-sharing behavior. Translocal brokers were defined as egos receiving a particular type of advice on a specific change from translocal levels and providing the same type of advice on the same type of change to local actors. While the calculation of tie characteristics and network position incorporated all ties and actors, the calculation of structural features (centralization and density) was conducted for local networks of interviewed farmers (egos) only (excluding translocal actors and ties).

Whilst the assessment of innovation networks by means of a standardized questionnaire was more straight forward than the network mapping activity applied for the assessment of translocal network capital (Article II), more time and resources were required to follow up network alters. Identification of network alters and making appointments for interviews was a lengthy process. The resulting relatively small sample size (of interviewed alters) was not sufficient for analytical approaches. A further constraint on the analysis of the constructed translocal networks derived from snowball-sampled ego networks lies in the fact that translocal actors (that is, actors outside the sub-district) have could not be interviewed. Hence, the majority of structural network measures, which commonly require complete network data, could not be applied in the context of this study. In order to prevent misinterpretations, analysis of actor-level measures was restricted to degree centrality, which is essentially the same in ego networks and complete networks. Furthermore, network-level measures such as density and degree centralization were assessed only between actors at the local level.

5. Results

This section presents results of desk work and empirical work conducted in the context of this study. Below, key messages are presented for each research article. For a more detailed description of research findings and illustrative figures see the respective articles.

5.1 Strengths, weaknesses, and general challenges of current research on social networks and the resilience of rural communities (Article I)

Based on a detailed review of case studies (according to the categories presented in *Table* 2) the systematic literature review identifies the following strengths and weakness of current social network research in each of the three research strands of i) natural resource governance, ii) agricultural innovation, and iii) social support

i. Studies in the strand of natural resource governance address the capacity of social networks to navigate the transformation of social-ecological systems towards sustainable resource use and resilience. Approaching networks from a systems perspective and drawing on elaborated methods of SNA, studies on governance networks have been particularly successful in identifying structural features conducive to resilient resource management, as well as scale-mismatches and barriers to same. A particular restriction of structurally explicit approaches, however, lies in the need for clearly defined network boundaries. Defining network boundaries ex-ante poses a restriction on the study of social networks in the context of highly dynamic rural societies, as network boundaries might be dynamic and network members might be unknown. Also conceptually, studies tend to focus on the local level as the primary scale of resource governance. Of further concern is an excessively narrow focus on issues of resource management at the cost of socio-economic context and the tendency to perceive of management as a collaborative process, downplaying conflicts and the role of power asymmetries. More particular, the idea that SNA can be used as tool to improve governance runs the risk of reducing resilience-building to a mere technical challenge.

ii. The strand of agricultural innovation comprises studies concerned with the capacity of social networks to promote adaptive capacity through social learning and technology adoption in the context of agrarian change. Strengths of prevailing descriptive approaches and econometric modelling are the provision of insights into a variety of actor and tie characteristics influencing actors' adoption decision. Conceptually and methodologically, studies on are less restricted to the local level. Although spatial aspects are explicitly accounted for, the understanding of how innovation takes place across various spatial scales remains vague. A particular weakness lies in the dominance of actor-based approaches and the limited ability to address structural features of innovation networks and to link them with resilience outcomes. Furthermore the prevailing conceptualization of social networks as pipes runs the risk of oversimplifying innovation processes, which are not only driven by contagion in the form of direct interactions between actors, but also by their structural embeddedness and by social, political, and economic context.

iii. Studies in the strand of social support, conceive of social networks as crucial embodiment of social capital and as a coping strategy in times of need. Strengths are the combination of quantitative and qualitative network approaches and a community perspective sensitive to network context and the temporality of network dynamics. Particular drawbacks of studies in this strand are prevailingly vague network conceptualizations, and tautological assumptions about the positive role of social capital, rooted in strong and reciprocal ties. Of further concern is the narrow focus on community networks as the primary analytical scope of vul-

nerability and livelihood assessments. The neglect of the spatial dimension of social support networks, however, runs the risk of omitting relevant aspects of rural livelihoods, especially in the context of migration and mobility.

On a general level, the review identifies the following challenges to adequately addressing the role of social networks in the resilience of rural communities in the Global South:

- First, social network research tend to focus on network outcomes and has difficulties with assessing network dynamics.
- Second, whilst studies tend to overemphasize network structure, the role of agency in shaping and reproducing social networks remains vague.
- Third, the neglect of the spatial dimensions of social relations poses a significant shortcoming given the highly mobile character of many rural societies.

Based on this assessment, the authors of the review propose linking future research with the concept of translocality. A translocal social network perspective addresses the embeddedness in and connectedness between places shifts the focus of research from bounded entities toward the connections between places; it takes into account the dynamic interrelationship between structure and agency and provides a multidimensional conception of social relations. Hence, the authors argue, it offers a framework well suited to the complexity of rural-urban realities in the Global South.

5.2 Socio-spatial patterns of households' network capital (Article II)

Participatory network mapping provides fine-grained insights into the social composition and spatial distribution of households' network capital, aggregated by support type and socio-economic status across three study sites. Tie composition (bonding / bridging) and tie distribution (local / translocal) are presented in terms of frequency and importance for household livelihoods. This network data is enriched by quantitative data on household characteristics and qualitative information recorded during network mapping activities.

On a general level, the assessment underlines that translocal network capital is a relevant source of rural livelihoods, since a considerable extent of support available to rural households is provided through translocal ties. Of pronounced relevance to rural livelihoods are migration-related translocal ties, in particular among poor households. On a more disaggregated level the network assessment highlights that translocal network capital is functionally and socio-economically differentiated. Translocal network capital is a context-specific source of resilience which is not equally viable for different types of support and not equally accessible for all households.

Translocal support networks are functionally differentiated as they matter less in terms of labor, more in terms of advice and in particular in terms of financial support. Labor is predominantly provided through local ties, in particular through local bonding ties with relatives who make up the biggest share in labor support and are valued as a highly important source of labor. Local bridging ties with neighbors and agricultural service providers also account for a considerable share in labor support; however, they are of relatively lesser importance.

Advice is more translocal than labor, although the local level continues to be the most frequent source of advice. Local advice is of generally greater importance than translocal advice, and mostly provided through local bonding ties with local relatives. Translocal advice, instead, is predominantly provided through translocal bridging ties with district institutions, such as the district branch of the Department of Agricultural Extension (DOAE). Like local formal sources of advice, these translocal bridging ties are considered as being of low importance.

Finance is the most translocalized type of support. Translocal financial support is not only more frequent, but also considerably more important than local financial support. Translocal financial support is predominantly provided through translocal bonding ties with migrating household members and relatives at national and international levels, which are considered highly important sources of finance. Also translocal bridging ties to financial institutions, such as the Bank of Agriculture and Agricultural Cooperatives (BAAC), provide considerable financial support, but are of relatively lower importance than migration-related translocal ties. At the local level, financial support is predominantly provided through local bridging ties to neighbors and, in particular, local financial institutions, such as village funds and saving groups. However these sources of local finance are generally of low importance.

Translocal networks are socio-economically differentiated as they are unequally distributed among and of different relevance for poor and better-off households: poor households have less translocal capital at their disposal, but rely more critically on limited translocal networks than better-off households do. At the same time, frequent local capital of poor households turns out to be of lower efficiency than among better-off households. Local networks are the dominant source of support available to poor households, in particular in terms of labor. While preferably drawing on local bonding ties, poor households also draw frequently on local bridging ties with neighbors and local institutions, in particular in terms of labor and financial support. However, for poor households, local bridging ties are associated with relatively higher costs (e.g. for hiring labor) and low efficiency (e.g. in terms of credit volume). Under these circumstances, poor households critically rely on their relatively limited translocal capital. Migration-related translocal networks are of critical relevance to poor households, in particular for accessing financial support, as expressed by a high share and pronounced importance of translocal bonding ties with migrating household members and relatives. The reliance on migration-related translocal capital is particularly pronounced, as poor households are lacking access to formal translocal networks, expressed by a particularly low share of translocal bridging ties to financial institutions, such as the BAAC.

Better-off households have more translocal capital at their disposal, but at the same time rely less critically on translocal networks than poor households do. Among rich households translocal ties are of high frequency and importance, in particular in terms of translocal bridging ties to financial institutions, in particular the BAAC and other private credit providers, in order to sustain capital-intensive cash-crop farming. Also in terms of advice, formal translocal ties to institutions, such as the DOAE, are frequent sources of support. Local capital is not only less frequent among better-off households than among poor households, but also more bridging in nature. Local bridging ties are particularly frequent in terms of labor. Unlike poor households, which lack access to financial sources, better-off households can draw on hired wage laborers and paid agricultural service providers as a flexible and efficient source of labor required for planting and harvesting cash crops. In terms of advice, a relatively higher share and importance of local bridging ties underlines rich households' networking capacities with local peers (e.g. other rich farmers) and institutional representatives (e.g. village head).

Contextualizing these networks patterns with literature on rural livelihoods and rural transformation in Northeast Thailand, the authors conclude, that better-off households benefit more from their more abundant and diverse translocal network capital than poor households do. The plight of the poor, the authors argue, results not only from a limited availability of translocal bridging capital, but also from a one-sided reliance on migration-related translocal bonding ties in combination with less effective local bridging capital. Against this backdrop, the authors call for a more nuanced conceptualization of the spatially and functionally diversified nature of rural households' network capital in mobile and translocally connected societies of developing and emerging countries.

5.3 Structural features of and key actors in agricultural innovation networks (Article III)

The assessment of translocal innovation networks (Article III) yields information on agricultural changes (over a time span of 5 yeas) and related advice-sharing networks regarding sugarcane and rice farming in a selected study site in Northeast Thailand. Quantitative network data comprises information on tie distribution and composition and structural features, actor roles, and actor attributes. Quantitative data is triangulated with qualitative information from semi-structured key-informant interviews in order to gain a deeper understanding of innovation processes and related innovation systems.

In quantitative terms, tie composition and distribution suggests that the local level is the major source of agricultural advice. Local advice is shared through sparse networks of strong ties between local farming peers. Nevertheless, advice sharing is far from being self-contained, as the considerable share of translocal advice regarding particular agricultural changes suggests.

Regarding the characteristics of translocal advice, network analysis reveals that translocal advice is mostly state- and market-related, whereas migration-related translocal advice plays a minor role in quantitative terms. Formal translocal ties with institutional representatives (e.g. staff of the Department of Agricultural Extension (DOAE) or private companies) account for the majority of translocal advice and, characteristically, are mostly weak. Informal translocal ties with individual actors (e.g. migrating household members and relatives) account for a limited share of translocal advice and are equally strong and weak.

In more detail, the analysis of network features and involved key actors shows that, albeit limited in frequency, translocal ties can make difference, depending on the agricultural change and the related innovation system under study. As the spread of sugarcane farming in the study site demonstrates, in sparse but highly centralized translocal innovations networks in which translocal advice is driven by extension services and brokered by central and influential elite farmers, translocal innovation transfers can facilitate rapid agricultural change.

In less effectively structured translocal innovation networks too, such as the rice network, particular key actors can make a difference. As the shift towards rice broadcasting and cutting as well as the case of specialty rice farming demonstrate, translocal innovation transfers can materialize, if particularly boundary-spanning individuals broker advice between translocal and local levels. Even in the absence of boundary-spanning individuals, translocal innovation transfers can materialize, if return migrants pass on their embodied migration experience to local peers (either actively through advice sharing or passively through observation).

Finally, the analysis of qualitative data derived from semi-structured interviews points to the relevance of context. Sophisticated agricultural innovations, as observed in sugarcane farming, are only viable in the context of market developments and market infrastructure, regulating policies, and formalized agricultural extension support. As the analysis of innovations in rice farming suggests, migration-related innovation transfers are likely to be limited to incremental adaptive changes that are geared towards limited household resources and that are compatible with social practices of farming. This way migration-related innovation flows enable farmers that are potentially overlooked by formal extension systems to innovate. The viability of such migration-related innovation transfers, however, depends on the type of migration and the agro-ecological context of the area of destination.

In providing a detailed understanding of structural features of advice sharing, key actors involved and framing conditions of translocal innovation transfers, the findings enrich the ongoing discussion on the role of translocal networks in agricultural innovation. While underlying the relevance of translocal innovation transfers, this study also challenges overly simplistic conceptualizations of social remittances as a driver of agriculture change.

6. Discussion

This section aims to critically discuss the proposition that migration-related translocal networks bear the potential to foster the resilience of rural livelihoods (Scheffran et al. 2012; Sakdapolrak et al. 2016). Therefore this section explores the relation between empirically assessed network patterns and resilience outcomes. Following the call for a situated social resilience approach (Cote and Nightingale 2012), empirical findings are contextualized with literature and information on rural livelihoods and rural transformation in Northeast Thailand in order to address the questions: "resilience for whom, and by what means?" The section concludes by sketching out conceptual and methodological implications for future translocal network research.

6.1 Translocal resilience capacities

The objective of the following sub-section is to synthesize key research findings on the structural features of network capital (Article II) and agricultural innovation networks (Article III) from a resilience perspective, and more particularly, in terms of resilience capacities (Keck and Sakdapolrak 2013). While doing so, it should be considered that resilience outcomes are not always attributable to only one capacity, as boundaries between capacities are difficult to draw and, in reality, might overlap. This is particularly relevant because this study is assessing general resilience without reference to specific risks. Furthermore it should be noted that, due to differences in the conceptualization of social networks (Chapter 3), insights from empirical case studies do not equally contribute to all three resilience capacities. For a condensed synthesis see *Figure* 10*.*

6.1.1 Translocal networks and coping capacity

What is the role of translocal networks in providing coping capacity in terms of buffering shocks, getting along and sustaining livelihoods under adverse conditions? In answering this question this section focuses primarily on interpreting research findings regarding households' network capital (Article II).

The network capital perspective

Socio-spatial patterns of network capital (Article II) suggest that translocal networks are critical sources of coping capacity, in particular in terms of finance and labor support, and especially among poor households.

The finding that, for accessing financial support, translocal bonding ties with migrating household members and relatives are of pronounced frequency and importance is in line with studies emphasizing the role of financial remittances for sustaining rural livelihoods in Northeast Thailand (Rigg and Salamanca 2011; Rigg et al. 2012; Rindfuss et al. 2012). In the researched study sites, financial remittances are primarily used for covering short-term consumptive household expenses, for sustaining subsistence-based agricultural activities, and for the repayment of debts (TransRe 2017; Peth and Sakdapolrak 2020a; 2020b). These spending patterns underline the relevance of migration as a strategy for diversifying income sources, minimizing income risks, and smoothing household consumption (Ellis 2003; De Haas 2012; Schöfberger 2013). At the same time, spending patterns suggest that financial remittances are primarily used for the sake of coping (in terms of sustaining livelihoods) rather than for the sake of adaptation and transformation (in terms of changing and enhancing livelihoods). This coping bias contradicts findings on remittances usage in other Asian countries,

such as Bangladesh, which suggest that remittances are strengthening adaptive capacity, for example, by facilitating investments in agricultural land (Sikder and Higgins 2017).

More particularly, the finding that poor households – despite generally low levels of translocal capital – draw more frequently on and attribute relatively higher importance to translocal bonding ties with migrating household members and relatives than better-off households do supports the notion that family- and kinship-related financial remittances are particularly relevant for sustaining the livelihoods of poor households (Osaki 2003; Rindfuss et al. 2012; Sikder and Higgins 2017). Higher relevance does not imply that poor households draw on higher absolute amounts of remittances. Higher relevance of remittances among poor households might be explained by the fact that the relative share of remittance in household income is greater among poor households than among better-off households (Osaki 2003).

The viability of migration as a financial coping strategy, in particular for poor households, is questionable, in several regards. Financial remittances are not a timeless flow of money, but are temporally restricted and fluctuating, depending on contracts and social obligations between migrants and receiving households and might rise or decline over time (Rindfuss et al. 2012; Paerregaard 2015; Peth and Sakdapolrak 2020b; Porst and Sakdapolrak 2020). If remittances become essential for the maintenance of household livelihoods they can foster long-term dependency. This is particularly the case if remittances are not invested in income-generating activities (Osaki 2003). Furthermore, not all households can equally participate in migration and benefit from remittances (Groth et al. 2020). Migrants with poorer socio-economic backgrounds are likely to remit less and less frequently, because they tend to work in low-paid jobs rather than in white-collar positions (Porst and Sakdapolrak 2018). Also more income-yielding international migration is less viable for poor households, as it requires high up-front costs (Peth et al. 2018). Poor households have fewer means of buffering migration risks, such as unforeseen costs during migration, the early or abrupt end of working contracts, or even long-lasting health problems. Continued indebtedness due to failed migration is an prevalent issues among households in Northeast Thailand (Peth and Sakdapolrak 2020a). Under such circumstances, it has been argued, migration can turn into an erosive coping strategy (Warner and Afifi 2014; Etzold 2017; Porst and Sakdapolrak 2018). Moreover, the strategy of coping through migration might become obsolete in times of systemic and correlated crises, such the Asian Crisis 2009 or the current global Coronavirus pandemic –in which rural households are particularly reliant on external sources of support.

With regard to the socio-spatial pattern of network capital, the critical reliance of poor households on migration-related translocal capital becomes particularly evident, when considering the finding that poor households are highly dependent on local bridging ties to local financial institutions. Unlike financial institutions at the district or national level, local financial institutions, including public microfinance institutions, such as rotating village funds, or informal lending groups, such as saving groups, provide only limited credit volumes (Menkhoff and Rungruxsirivorn 2011). It has been shown that poor households in Northeast Thailand, due to limited or irregular income sources, tend to use credit offered by local financial institutions to cover household expenses and agricultural input supplies, rather than for long-term income-generating investments (Porst and Sakdapolrak 2018). Non-strategic spending and multiple borrowing – that is, taking loans from various sources at the same time – can lead to over-indebtedness, a widespread problem throughout Northeast Thailand (Chichaibelu and Waibel 2017). The urgency of this problem is underlined by statements of several household representatives who reported not being able to pay back even smaller amounts of credit and would prefer to continuously pay relatively high interest rates rather than repaying their debt with village institutions. In the situation of over-indebtedness, financial remittances can help with sustaining interest payment, but not necessarily help households to repay debts.

While migration-related translocal network capital provides poor households with coping capacity in financial terms, local network capital provides coping capacity in terms of labor. Labor scarcity is a general problem in Northeast Thailand resulting from demographic changes, continuously high rates of out-migration and the related decay of reciprocal labor exchange and community solidarity (Funahashi 1996; Bryant and Gray 2005; Rigg and Salamanca 2009; Rambo 2017). Whilst the prominent share and importance of local bonding ties underlines the fact that kinship relations continue to be an important source of labor in rural Thai societies (Foster 1975; Chandhamrong 1987; Entwisle et al. 2007; Verdery et al. 2012), the finding that poor households – despite little land and insufficient financial means – draw to a relatively high extent on local bridging ties with hired neighbors, point to the preceding commercialization of rural labor (Parnwell 2007).

As literature on the efficiency of small farms suggests, a particular strength of small farms lies in the utilization of family labor (Gatzweiler and Braun 2016). In contrast, dependency on non-family labor reduces the efficiency of small farms as non-family laborers needs to be paid and are less committed to quality. Indeed, in the researched study sites, a high share of local bridging ties with neighbors is related to higher labor costs and fluctuation, as non-kin laborers are usually paid minimum wage (which often his higher than wages being paid among kin, if kin are paid at all) and are hired on an occasional basis. Against this backdrop, a relatively high share of local bridging ties among poor households suggest that poor households are particularly affected by the erosion of the village moral economy (Rigg and Salamanca 2009; Rambo 2017). While poor households benefit from migration in terms of financial coping capacity, migration-related decline in labor force leads to the irony that a considerable share of remittances is compensated by rising costs for hiring non-kin laborers. While farming based on local bridging ties impinges on the competitive advantage of small farms, better-off households involved in larger-scale farming can benefit from economies of scale and can capitalize on local bridging ties as a source of relatively cheap wage labor and mechanized services for planting and harvesting cash crops.

In sum, the patterns of translocal network capital (Article II) suggest that poor households – although they have less abundant translocal capital at their disposal – critically rely on migration-related translocal ties as a source of finance for coping with adverse livelihood conditions. However, among poor households, financial remittances are likely to be less abundant, are more likely to be associated with higher risks, and are more likely to be invested less strategically than among better-off households. At the same time, the composition of local network capital suggests that poor households are more affected by the erosion of local bonding capital, and hence are to a relative high extent reliant on costly local bridging ties to cope with the lack of agricultural labor and to cover agricultural and household expenses.

The innovation network perspective

The assessment of translocal innovation networks (Article III) by definition addresses aspects of adaptive capacity rather than coping capacity. Aspects of coping capacity come into play when taking a pessimistic stance towards the diffusion of agricultural innovation, interpreting agricultural change not as the outcome of deliberative social learning (Conley and Udry 2001) but as the consequence of immediate hardship and lack of resources. Immediate hardship has been reported in few cases by particular interviewees, for example the need to compensate for financial obligations of family members or the abrupt absence of household labor due to death or arrest. In the overall sample, however, agricultural change in order to cope with hardship remains the exception. Instead, coping with the continuous lack of resources, whether in the form of labor or money, is a key motive underlying agricultural changes in Northeast Thailand. The lack of agricultural labor, for example, is a decisive factor in the de-intensification of small-scale rice farming in the form of the shift from rice transplanting to

rice broadcasting. As the technique of rice broadcasting and, related to this, the technique of rice cutting, were introduced in an experimental trial-and-error fashion, the author considers them to be an expression of adaptive rather than coping capacity.

On a more abstract level, the decisions to implement particular agricultural changes could be interpreted in terms of coping with peer pressure (Foster and Rosenzweig 1995; Monge et al. 2008). As reported by interviewees, peer pressure in the form of persuasion and social influence is relevant in the context of cash-crop farming. For the case of sugarcane farming, successful sugarcane farmers (mostly larger-scale farmers) are role models for smaller-scale farmers, who are tempted to adopt sugarcane for the sake of quick and easy cash income. As patterns of translocal innovation networks suggest, adoption decisions driven by peer pressure are more likely to be facilitated through local ties, in particular strong local ties.

6.1.2 Translocal networks and adaptive capacity

To what extend do translocal networks provide adaptive capacity, understood as the ability to anticipate and prepare for future uncertainty through social learning and purposive ex-ante changes to rural livelihoods? Insights into households' network capital (Article II) provide broad answers to this question, whereas a more nuanced understanding of the role of translocal networks in adaptive capacity is provided through the lens of translocal innovation networks (Article III).

The network capital perspective

Socio-spatial patterns of households' network capital (Pater II) suggest a mixed picture of the role of translocal networks in providing advice relevant for changes in rural livelihoods.

The finding that households, across socio-economic status, give preference to local sources of advice and in particular draw on local kinships ties as the major source of agricultural advice is in line with the assertion that farmers make decisions in consideration of their local peers (Foster and Rosenzweig 1995; Genilo 2007) and confirms the critical role of strong and bonding ties in agricultural change (van den Broeck and Dercon 2011; Tatlonghari et al. 2012; Ricciardi 2015). Outstanding is the relatively higher share and importance of local bridging ties among better-off households, in particular with other better-off households and institutional representatives at village and sub-district level. This finding suggests that better-off households have better institutional networking capacities, and can draw on more diverse sources of agricultural advice, including village representatives and local focal points of the Thai agricultural extension system.

Besides the preference for local capital, network patterns also suggest a considerable role played by translocal capital in adaptive capacity. More specifically, the finding that translocal advice is dominated by bridging ties with extension agencies, such as the district branch of the DOAE, underlines the growing importance of policies and markets for small-scale agriculture in Northeast Thailand (Grandstaff et al. 2008; Rigg and Salamanca 2009; Rambo 2017). At the same time, the low importance of translocal bridging ties calls into question the relevance of extension advice. A common concern among household representatives, for example, was that that agricultural extension services were rather generic and technical and not adapted to specific needs of local farmers[2].

[2] Notable in this context is the relatively higher importance of translocal bridging ties among poor households. One possible reason explaining this pattern is that farmers have to register with extension services in order to receive money from public compensation schemes, on which poor households critically rely on in order to cope with drought and flood related harvest losses. In this context institutional advice serves a coping motive rather than social learning and adaptive change.

This assertion corresponds with critical voices blaming public extension programs for their low efficiency and a one-sided top-down approach resulting in a lack of ownership among farmers (Bryant and Gray 2005; Fielding and Aung 2018). In contrast, the high importance of translocal bonding ties with migrating household members and relatives is in line with studies underlining the role of migration-related social remittances in adaptive capacity, for example as a source of ideas and knowledge about agricultural crops and practices. However, at the same time, their limited frequency supports the notion that migration-related social remittances, in the rural areas of Northeast Thailand, are the exception rather than the norm (Peth and Sakdapolrak 2020b).

The innovation network perspective

Looking at adaptive capacity from the perspective of translocal innovation networks (Article III) provides a more nuanced understanding of the role of translocal networks in agricultural change. While reiterating the role of local networks of knowledge creation and social learning (Genilo 2007), findings from research into innovation networks highlight the relevance of translocal innovation transfers, and provide a structural understanding of how and under what conditions translocal networks are driving agricultural innovation processes.

Translocal innovation transfers are particularly effective in the context of highly centralized networks. The assessed advice-sharing network on sugarcane represents a typical example of a centralized extension-driven innovation system, in which top-down innovation flows are mediated through mostly weak and formalized translocal ties between extension staff and elite farmers acting as translocal brokers and role models in strong local networks (Fielding and Aung 2018). Given its sparse but effective structure (Isaac 2012), the sugarcane network fosters rapid translocal innovation flows and, consequently, the rapid shift from small-scale rice farming to extensive sugarcane farming. The spread of sugarcane farming, however, cannot be simply interpreted as an expression of adaptive capacity, understood as the ability to learn and to take measures in order to mitigate future problem. Instead, it is more likely that farmers' decisions to change from rice to sugarcane farming are influenced by a combination of social learning in networks (Conley and Udry 2001), the accommodation to social pressure (Foster and Rosenzweig 1995; Monge et al. 2008), and economic and political incentives (Feder et al. 1985; Feder and Umali 1993).

The shift towards sugarcane production has to be explained against the backdrop of international market developments and national policies promoting the production of bio-energy as an attempt to reduce Thailand's dependency on rice production. This includes the introduction of market price regulations, the promotion of processing facilities, and the professionalization of agricultural extension services (Fielding and Aung 2018; Pipitpukdee et al. 2020). Sugarcane farming requires high upfront investments (for labor, inputs, and machinery), and, in order to be economically viable, requires economies of scale. This is the reason why better-off households with sufficient land and means of investment are more likely to be involved in large-scale sugarcane farming. However, as network analysis reveals, adoption rates are also high among small-scale farmers. This broad innovation spread is possible because, at the local level, centrally positioned large-scale farmers provide incentives for small-scale farmers to adopt sugarcane. Large-scale farmers not only enact peer pressure as role models, but actively outsource production to small-scale farmers in order to fulfill their own quotas with sugarcane factories. A further reason that explains the adoption rate among small-scale farmers lies in the fact that larger-scale farmers not only offer seed and inputs, but in some cases also take over the whole process of planting and harvesting, and thereby reduce costs and risks for involved smallholders.

While innovations in sugarcane farming are primarily driven by market development and policies and are facilitated through extension and local elite farmers, migration-related innovations play a

minor role. A different picture is revealed for rice farming. Migration-related translocal innovation transfers do matter in rice farming. As network analysis reveals, not only is translocal advice on changes in rice faming more frequent and provided by a more diverse set of actors at different geographical scales; translocal advice on changes in rice farming is also more equally received by local farmers of different socio-economic statuses. The observed shift from transplanting rice to broadcasting rice in combination with the application of rice-cutting techniques serves and an illustrative example of how return migrants can act as incubators of agricultural change, even in the absence of direct translocal advice sharing, through the mechanism of observation. Early adopters of broadcasting and cutting gained inspiration for changing rice-farming practices from observing farmers in other regions of Thailand during migration, but did not seek translocal adoption or implementation advice from them. As return migrants implemented the observed agricultural practice in a trial-and-error fashion, the spread of rice broadcasting and rice cutting, can hence be interpreted as an example of a bottom-up innovation that underlines the role of local farmers' creative potential in agricultural innovation (Genilo 2007).

Although broadcasting rice comes at the cost of relatively lower productivity (particularly if applied by hand) and intensified weed growth, the shift from transplanting to broadcasting rice is attractive to small-scale farmers, as it significantly reduces time and labor costs (Genilo 2007). Broadcasting can also be applied on plots that lack sufficient irrigation due to variable rainfall patterns. The technique of rice cutting helps to control weed growth and, if applied properly, improves yields while reducing the need for herbicides on broadcasted fields. In combination, broadcasting and rice cutting can be considered as an adaptive strategy, which on the one hand accommodates rice farming to an ageing farming population and the lack of agricultural labor, and on the other hand helps to adapt to variable rainfall patterns, reduces the ecological footprint of rice farming, and increases food safety.

Considering the multiplicity of barriers potentially hampering the transfer of social remittances (Peth and Sakdapolrak 2020b), how can the migration-related knowledge transfer around rice broadcasting and rice cutting be explained? For migration to induce agricultural change, it has been argued, knowledge acquired during migration needs to be applicable to the local context of smallholder farming systems (Peth and Sakdapolrak 2020b). For applicable knowledge to lead to the decision to adoption new crops or practices, farmers need to be able and willing to invest and take risks. As smallholder farmers are confronted with multiple and complex risk contexts, however, they tend to balance livelihood risks for their agricultural activities (Eitzinger et al. 2018; Binder and Schöll 2010). In particular for Northeast Thailand, it has been shown that households with less favorable socio-economic standing tend to rely on financial remittances for sustaining agricultural activities rather than taking the risk of changing agricultural activities (Porst and Sakdapolrak 2020).

An important reason why return migrants have been successfully in facilitating the adoption of broadcasting and rice cutting techniques among local farmers in the study site lies in the fact that these techniques do not require high up-front investments, are independent of extension or marketing infrastructure, can be implemented gradually alongside existing practices of rice farming, and are adaptable to locally specific agro-ecological conditions. According to these attributes, rice broadcasting and rice cutting can be defined as incremental innovations. Incremental innovations increase functional capacity through small-scale improvements and enhance competence by extending existing skills (Henderson and Clark 1990; Kaine et al. 2008). A further advantage of rice broadcasting and rice cutting is the fact that these techniques can be explored in a trial-and-error fashion and can be easily imitated by observing neighboring peers, and hence, do not necessitate active advice-seeking. This latter fact is of particular relevance, since farmers in the research study site prefer to observe their peers rather than actively seeking advice.

6.1.3 Translocal networks and transformative capacity

After discussing empirically assessed network patterns in terms of coping and adaptive capacity, the following section explores the role of translocal networks in transformative capacity. As neither of the two cases studies has focused on typically cited aspects of transformative capacity, such as participation in decision-making processes, in the following, transformative capacity will be considered broadly in terms of the ability and willingness to take advantage of environmental and socio-economic changes to enhance and explore alternative livelihood pathways.

The network capital perspective

The analysis of the socio-spatial patterns of households' network capital (Article II) provides an indication of transformative capacity in terms of advice and financial support, in particular among better-off households.

For the transformation of rice-based subsistence-oriented livelihoods towards cash-crop-based market-oriented livelihoods, access to specialized extension advice and formal credits of high volume are important assets. As the analysis of network capital suggests, better-off households in particular draw a considerable share of advice through translocal bridging ties to public extension institutions, such as the district branch of the DOAE, and private companies, such as sugarcane factories. This translocal institutional advice entails specific and technical advice required for successful cash-crop farming and marketing. Furthermore, better-off households have better access to translocal bridging ties in terms of financial support, in particular credit by public financial institutions, such as the BAAC and other private banks. Access to formal credit is a necessary precondition for large-scale cash-crop production (for renting additional land, investments in seedlings, inputs, machinery, and labor). Although credit coverage by the BAAC is high throughout rural Thailand (Chichaibelu and Waibel 2017), network patterns suggest that the poor are relatively deprived of these institutionalized financial resources. A reason for this imbalance lies in the fact that formal bank loans require collaterals in the form of land or a group of trusting farmers, which the poor are often lacking.

While these findings suggest that better-off households are in a better position to use their more abundant translocal capital for transforming agricultural livelihoods, it should be noted that for better-off households capital-intensive cash-crop farming also comes at the cost of increasing dependency on external risks. Unforeseen market price fluctuations or harvest losses might exceed the coping capacities of even better-off households, especially if households are over-indebted.

The innovation network perspective

The analysis of translocal innovation networks (Article III) adds an additional perspective to the understanding of the role of translocal networks in transformative capacity. In the context of the overall transition from subsistence-oriented rice farming to the market-oriented production of cash crops, better-off households can take advantage of their better institutional connectedness and – as the analysis of translocal innovation networks reveals – gain additional benefits from brokering advice to small-scale farmers, who are subcontracted as additional suppliers and as off-takers of seedlings and inputs. As owners of agricultural machinery and means of transport, better-off households also have better opportunities to establish themselves as middlemen for agricultural products and as service providers (e.g. for land preparation, planting, and harvesting).

With regard to climate change, the change from rice to sugarcane farming can be considered a viable adaptation strategy due to its lower requirements in terms of soil fertility and its lower susceptibility to climate-change-induced rainfall variability. While models predict a drastic decline in sugarcane

productivity for central and eastern regions of Thailand, northeastern regions are expected be less affected by climate change (Pipitpukdee et al. 2020). However, the transformative capacity of particular households does not necessarily imply higher levels of resilience. The trend towards large-scale sugarcane farming comes with social and environmental costs that run risk of threatening the resilience of farming systems in the long run.

As the analysis of translocal advice-sharing networks regarding changes in rice farming reveals, transformative change can also materialize in the absence of centralized and top-down-organized innovation systems. That fact that, under particular circumstances, migration-related translocal innovation transfers bear transformative potential is illustrated by the case of specialty rice farming for urban consumer markets. The adoption of nutritious and high-priced specialty rice in combination with more sustainable production methods can be interpreted as a contribution to smallholder resilience in terms of income diversification, nutrition, and food security, as well as in terms of ecological sustainability. Specialty rice was introduced to the study site by a young female return-migrant, who had sought inspiration for the farming of specialty rice during her prior occupation as a journalist for an agricultural magazine. Setting up a farmers' group for sustainable rice farming, she quickly established herself as a central node in the local rice network. At the same time, drawing on her translocal networks acquired during migration, she managed to become a translocal broker and middle man linking local farmers with regional and urban markets. By transforming her own livelihoods (from a journalist to a farmer and middleman), she has provided the opportunity for group members to adapt their rice-farming practices and diversify their income sources. On a conceptual level, this example illustrates that transformative capacity arising from an actor's favorable structural position (here the transformative capacity of the return migrant), provides the basis for adaptive capacity among its network alters (here the adaptive capacity of the members of the farmer group) (Kaine et al. 2008).

Unlike rice broadcasting and rice cutting, the introduction of rice varieties in combination with sustainable management practices, farmer organization, and direct marketing channels can be interpreted as a radical innovation (Henderson and Clark 1990; Kaine et al. 2008) in the sense that it overcomes established modes of production and marketing and provides incentives for the revitalization of small-scale agriculture. Indeed, over the last decades, in Thailand the market for organic and locally produced food is steadily rising, as a consequence of changing preferences among urban consumers and social movements campaigning against agro-industrial food production (Bopp 2016). As in other Asian countries, rural areas in Thailand are experiencing the return of young and highly qualified migrants, who are motivated to explore organic farming practices and new marketing channels, such as direct and online sourcing (Suh 2019). However, transformative change induced by return migrants is likely to remain the exception as their business models are usually limited to niche markets and ideas of return migrants face multiple social and cultural barriers, inter alia the reluctance of and the rejection by elderly farmers.

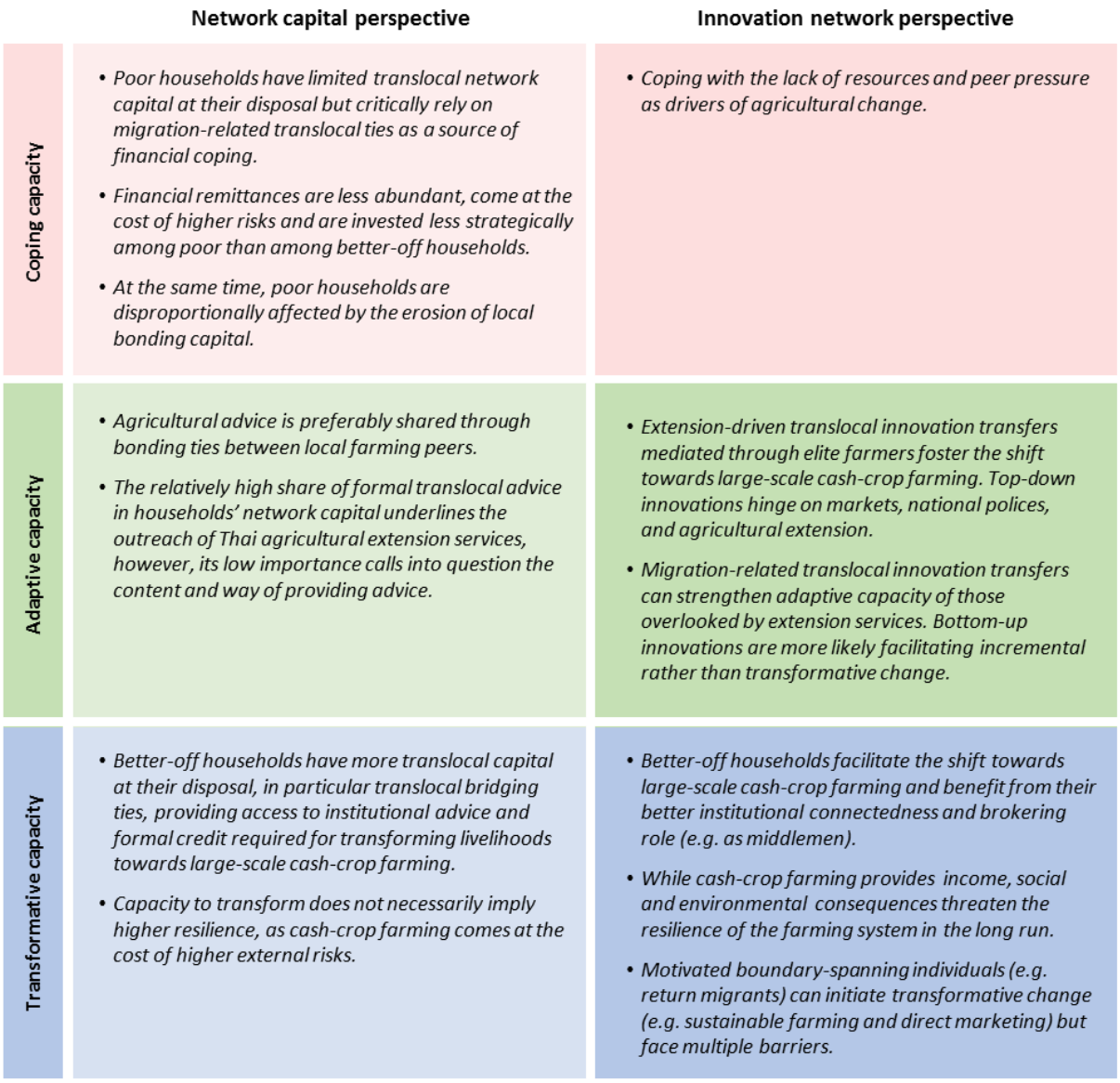


Figure 10: Synthesis of empirical research findings with regard to resilience capacities

6.2 Resilience in the context of rural transformation

As the synthesis of empirical research (see *Figure* 10) provides only relatively static snapshots of socio-spatial patterns and flows in space and time, the evaluation of the role of translocal networks in the resilience of rural livelihoods requires their contextualization in the ongoing process of rural transformation. Rural livelihoods in Thailand are in rapid transition, characterized by four major changes: the shift "[…] from farm to non-farm , the shift from local to extra-local, the shift from community to state, and the shift from social to economic" (Rigg and Salamanca 2009, pp. 258–259). In the course of rural transformation, the process of delocalization and the process of formalization of rural livelihoods are inseparably linked which each other.

The formalization and marketization of rural livelihoods in Northeast Thailand is closely related to rural development policies. The Thai state is known for having implemented a plethora of policies for promoting rural development, including investments in agricultural research and extension, rural development programs, support schemes, subsidies and price-regulation schemes (Rigg and Salamanca 2009). State and market interventions in the Isan date back to the early 1960s when the Thai

government initiated development programs in order to push back communist influence and increase national unity (Parnwell 2007), and continue until today. Without these politically motivated interventions Northeast Thailand would have not experienced the miracle of the "rain-fed revolution" (Grandstaff et al. 2008) and would not have become a focal area in Thailand's bio-economy (Fielding and Aung 2018). While promoting economic growth, the increasing influence of external actors, market, and state authorities has accelerated the erosion of traditional rural community structures, a process that can also be observed in other transforming societies in the Global South (Rigg and Oven 2015).

Traditional Isan community structures have been described as "village moral economy", characterized by high levels of social capital and self-reliance, low levels of inequality, and egalitarian structures. According to Parnwell (2007) the village moral economy used to have the function of primordial capital, "[…] a redistributive social safety net in times of economic, environmental, and social stress or shock in the absence of support mechanisms emanating from outside the community" (Parnwell 2007, p. 993). In the course of state and market interventions, however, this local capital characterized by cooperation, assistance and mutual support is increasingly replaced with extra-local bridging capital characterized by social welfare, development support, and administrative organization (Parnwell 2007; Rigg and Salamanca 2009; Rigg and Oven 2015).

Rural development programs have also fostered the delocalization of rural livelihoods. With the improvement of transportation systems the Isan has become increasingly integrated into Thailand's economy, resulting in a rapid rise in outmigration of wage laborers. Once employment and education opportunities improved, migration patterns gradually shifted from seasonal to long-term, and from internal to international migration and permanent movement away from rural communities (Parnwell 2007). While remittances promote economic well-being among rural populations, outmigration is one major reason for the decline of communal arrangements, such as labor exchange, and the commercialization of agricultural labor and the ageing of rural populations (Funahashi 1996; Parnwell 2007; Rigg and Salamanca 2009). In the context of a lack of agricultural labor, a growing share of financial remittances is directed into the maintenance of small-scale agricultural activities, which due to migration are becoming increasingly untenable.

In sum, the transformation of rural livelihoods in Northeast Thailand is resulting in the gradual replacement of traditional sources of resilience, based on local bonding ties, by a combination of spatially transplanted bonding sources and new sources of state- and market-related bridging ties. This is not a neat transition, but involves multiple, overlapping, and contingent changes resulting in temporal and spatial livelihood mosaics (Rigg and Salamanca 2009), with new opportunities and new constraints, increased resilience on the one hand and accentuated vulnerability on the other (Rigg and Oven 2015; Porst and Sakdapolrak 2018).

6.3 Resilience for whom and by what means?

Concluding the above sections, in the context of the rural transformation ongoing in Northeast Thailand, households of different socio-economic statuses draw to different degrees on both informal migration-related networks and on formal translocal networks, and the livelihood implications of doing so are unevenly distributed among households of differing socio-economic status. Poor households' networks are considerable different from those of better-off households in terms of social composition, spatial distribution, degree of formalization, and the resources they provide, and hence also in terms of resilience outcomes.

6.3.1 Poor households

Poor households critically rely on limited translocal network capital, in particular on migration-related translocal capital providing financial resources for coping with adverse livelihood conditions. While the translocal capital of poor households is predominantly bonding in nature, the opposite is the case for poor households' local capital. Local bridging ties with neighbors and local institutions, however, provide inefficient means of coping with declining kinship labor and limited access to public and private financial institutions. In this situation, translocal innovation networks can provide adaptive capacity to households suffering from a lack of labor and high labor costs. While poor households tend to be less centrally positioned in translocal advice-sharing networks concerning the production of cash crops, such as sugarcane, structural patterns of advice-sharing networks concerning traditional crops, such as rice, enable poor households to benefit from migration-related knowledge transfers. As demonstrated by the spread of rice-broadcasting and rice-cutting techniques, migration-related bottom-up innovations can benefit also less connected farmers, who would typically be overlooked by extension services; however, these migration-related knowledge transfers are more likely facilitating incremental rather than transformative changes.

6.3.2 Better-off households

In comparison, better-off households have more translocal network capital at their disposal but rely less critically on it. Translocal capital of better-off households is primarily bridging in nature, providing access to institutionalized advice and finance required to adapt and transform agricultural activities. Unlike poor households, better-off households can benefit from their abundant local bridging capital as a source of cheap and flexible labor for large-scale cash-crop production and as a means of networking with local institutions. Better-off households tend to occupy central positions within translocal advice-sharing networks around cash-crop farming and – due to their better institutional connectedness – play an important role in the facilitation of top-down innovation flows. As translocal brokers and role models, better-off households are important facilitators in and beneficiaries of the change from rice-based towards cash-crop-based agricultural livelihoods. Due to their favorable capital endowment and structural position in translocal innovation networks, better-off households can transform their own livelihoods towards large-scale cash-crop production and agricultural business models, such as agricultural service providers or middlemen.

6.3.3 Migration-related translocal networks

As outlined above, migration-related translocal networks are particularly relevant among poor households in terms of translocal boding ties, providing the capacity to cope with adverse livelihood conditions and to implement incremental changes to their agricultural activities. A closer look at the conditions under which poor households draw on migration-related translocal networks, however, reveals that relying on migration-related translocal networks is a "double-edged sword". On the one side migration-related translocal networks provide access to additional income sources of uncorrelated risk context, and hence allow for the evening out of household consumption and the maintenance of agricultural activities. Furthermore, migration-related innovation transfers provide adaptive capacity, in the form of incremental changes to social practices of rice farming, also for marginalized and less connected farmers. On the other side, migration-related translocal networks come at the cost of out-migration of labor forces and the decline of the rural moral economy (Rigg and Salamanca 2009; Rambo 2017) which impinge on the relative competiveness of small farms (Gatzweiler and Braun 2016).

Under these conditions, basically two options are possible: first, households continue their farming activities, by redirecting a growing share of remittances into agricultural inputs, agricultural labor and machinery. In this case, coping capacity gained through translocal networks is compensated for the purpose of subsidizing inefficient small-scale rice farming, which, inter alia due to migration has become increasingly untenable. Second, households make use of adaptive capacity, inter alia facilitated through translocal innovation transfers, in order to de-intensify their farming practices. The techniques of rice broadcasting and rice cutting are examples of how migration-related innovations can enable farmers to adapt to the requirements of translocal livelihoods and changing rainfall patterns. The fact that these techniques spread among farmers without extension support, and also among farmers who typically would be missed out of public programs, underlines the role of migration-related bottom-up innovations in building resilience. However, when judging the role of migration-related innovation in household resilience, it is important to note that the decision to adopt such innovations is not driven by deliberate decision-making but, in the first line, by the lack of alternatives. Due to out-migration of the younger generation, the trend from seasonal towards long-term migration, and the break-down of communal labor arrangements, ageing households have to make the choice between stopping farming completely or de-intensifying their farming activities (Funahashi 1996). To conclude, migration-related-translocal networks can help to strengthen poor households' resilience – inter alia through financial remittances and translocal innovation transfers. However, in order to draw on and maintain translocal networks, poor households rely on continued labor migration which compensates potential gains in coping and adaptive capacity.

A more optimistic picture of the role of migration-related translocal networks is revealed when looking at the case of specialty rice farming. Unlike rice broadcasting and rice cutting, specialty rice farming can be considered as counteracting the general trend toward the marginalization of rice farming, as it is not only restricted to a modification of agricultural crops, but also involves tapping new marketing channels and social innovation, such as farmer organization. Against the backdrop of growing consumer demand for healthy and locally produced food, and a thriving organic movement in Thailand (Bopp 2016), return migrants can be considered potential change agents in the revitalization of small-scale agriculture. Judging the likelihood of such a scenario is beyond the scope of this study. However, based on empirical findings it can be stated that transformative changes arising from translocal networks and translocal innovation transfers remain the exception. This assessment is in line with studies from Northeast Thailand, pointing to the multiplicity of barriers to the transfer of social remittances (Peth and Sakdapolrak 2020b).

In sum, it can be concluded that, unless gains from migration exceed the costs of migration and are invested strategically, migration-related translocal networks in the worst case cement the status quo of marginal livelihoods, and in the best case do not provide the necessary means to escape precarious livelihood conditions. This appraisal is line with other studies concluding that the poor utilize social capital to meet basic needs but rarely for advancement (Elliott et al. 2010) and underlines that geographic mobility does not monotonically relate to social mobility (Rigg 2006). Whilst suggesting potential resilience gains for particular households and under particular conditions, in general, empirical evidence synthesized by this study does not support overly optimistic accounts of migration as an avenue for escaping marginal rural livelihoods. Instead, this study is in line with critical voices, stating that translocal livelihoods are reinforcing rather than evening out social and spatial disparities (Bott et al. 2020; Steinbrink and Niedenführ 2020).

6.3.4 Formal translocal networks

The formalization of social relations, as documented by this study, is of relevance for both poor and better-off households in Northeast Thailand. For poor households formal ties mostly matter at the

local level in terms of bridging ties to village institutions providing rather limited sources for coping with shortages in labor and finance respectively. Instead, for better-off households, formal ties matter mostly at translocal levels in terms of extra-local bridging ties to extension services and banks providing advice and formal credit required to transform agricultural livelihoods towards large-scale cash-crop farming.

The finding that better-off households can capitalize on their more abundant formal translocal networks, and can gain competitive advantages from their more favorable structural position between in top-down-organized extension systems, corresponds with the assertion that in Thailand, "unbridled development tend to go to those who are already comparatively wealthy and better educated, while […] those who are already poor or marginalized […] tend to lose out" (Fielding and Aung 2018, p. 12). However, among better-off households too, the benefits derived from formal translocal networks are questionable. While formal translocal networks can provide transformative capacity in the short term, this does not necessarily result in higher levels of resilience in the long run. Large-scale cash-crop farming is highly capital-intensive and is a frequent reason for high levels of indebtedness, including among better-off households. Cash-crop farming also comes at the cost of increasing dependence on external factors such as market and policy changes, in particular in the context of national, or global crises (Liamchamroon 2020). Volatility in yields or prices, in combination with strict contract schemes, which leave little possibility for farmers to negotiate, can lead to situations in which the capacities of even large-scale farmers are exceeded, particularly if they have taken high debts or have pledged to overambitious quotas (Fielding and Aung 2018).

As discussed above, formal translocal networks are important drivers of agricultural change in rural communities in Northeast Thailand. In the context of highly centralized innovation systems, formal ties between district extension agencies and local elite farmers can facilitate rapid top-down innovation transfers. These findings underline the massive outreach of the Thai development state (Rigg and Salamanca 2009) and underline their critical role in driving the transformation of Northeast Thailand from a region previously dominated by subsistence-based small-scale paddy rice farming to market oriented large-scale cash-crop production (Grandstaff et al. 2008; Rambo 2017).

From a resilience perspective, the shift towards sugarcane farming in Northeast Thailand can be interpreted as an example of a forced transformation (Folke et al. 2010) which is driven by larger-scale processes, such as world market prices and Thailand's bio-economy strategy which aims to promote Northeast Thailand as a priority area for sugarcane production (Fielding and Aung 2018). While this transformation offers economic perspectives to previously marginalized rural areas and provides income opportunities to those households able to change and transform their agricultural livelihoods, those households lacking adequate means and networks are running the risk of losing out. In order to be economically viable, sugarcane farming requires economies of scale. Despite public price-regulation schemes and political attempts of aggregating farmers into larger groups, sugarcane farming remains less attractive to small-scale farmers. Particularly disadvantaged are farmers without adequate land titles as they are excluded from participation in government initiatives (Fielding and Aung 2018). Smallholder farmers often have no other choice than farming sugarcane as informal subcontractors or to rent out their land to larger-scale sugarcane farmers.

Sugarcane farming not only deepens social and economic differences but also threatens the ecological resilience of farming systems. The rapid expansion of cash-crop production, in Northeast Thailand, has resulted in a decline of grazing and forest land and in increased soil erosion and soil salinity (Ekasingh et al. 2008). Only recently has the burning of sugarcane fields, a common practice of facilitating the harvesting process, been banned for its negative impact on air quality in Thailand (Phumruang 2020). In order to meet quotas and quality standards, sugarcane farming requires intensive use of agro-chemicals. Increasing application rates of industrial fertilizer and, in particular, herbi-

cides have resulted in the contamination of ground water and neighboring food crops, and have been identified as a cause of severe health problems (Bopp 2016; Board 2019; Rujivanarom 2020), particularly among wage laborers who are hired for the application of agro-chemicals on large-scale plantations, lacking adequate knowledge and equipment for self-protection.

Most affected by the detrimental social and environmental consequences of sugarcane farming are poor households, which benefit least from it. Even better-off households which have the capacity to transform and profit from cash-crop production in the short term, might find themselves confronted with increasing economic and environmental adversity and declining household resilience in the long term. Accordingly, the detrimental social and environmental consequences of sugarcane farming underline that economic growth does not automatically lead to higher levels of resilience and serves as an illustrative example of how growth-oriented state interventions "[…] have done more to extract people from the countryside and from farming than they have to support rural living and farm-based livelihoods" (Rigg and Salamanca 2009, p. 261).

6.4 Conceptual implications

To study the role of translocal networks in the resilience of rural livelihoods, empirical work presented in this study has drawn on connectionist network conceptualizations and has approached translocal networks from the stance either of social capital or diffusion research. The following section elaborates on conceptual implications for research on social capital and the diffusion of agricultural innovations, as well as on implications for translocality research.

6.4.1 Social capital research

Socio-spatial patterns of households' support networks in Northeast Thailand clearly support the notion that "space matters" for social capital too (Elliott et al. 2010). By revealing the geographical distribution and social composition of households' network capital, this study has underlined the need to move beyond the prevailing notion of locally bound social capital (e.g. Putnam 2000) and towards a translocal network perspective. Empirical findings clearly scrutinize the binary between "inward-looking" bonding capital and "outward-looking" bridging capital (Patulny and Lind Haase Svendsen 2007). More particularly, findings suggests that attempts to either conflate bonding capital with intra-community ties and bridging capital with extra-community ties (e.g. Woolcock and Narayan 2000) or to reduce extra-community ties to formalized linking ties (e.g. Islam and Walkerden 2014) over-simplify the spatially and functionally diversified nature of rural households' network capital in increasingly mobile and translocally connected rural societies in emerging and developing countries.

With regard to resilience outcomes of network capital, findings from this study are in line with critique regarding tautological statements about the positive development outcome of social capital (Portes 1998). Research findings reveal that network capital is not a uniform resource which is applicable for any purpose and equally accessible among community members (Ryan et al. 2008; Elliott et al. 2010; Ryan 2011; Steinbrink and Niedenführ 2020). The finding that households of different socio-economic statuses benefit in different ways and to different extents from translocal network capital contests the idea that translocal social capital is a prime resource of the poor (Bott et al. 2020). Furthermore, the assessment that among different households network capitals of different geographical distribution and different social composition provide different capacities of resilience which are potentially in competition with each other highlights the fact that social capital is not monotonically related to resilience, and draws attention to the question of under what conditions social capital fosters and under what conditions it undermines resilience (MacGillivray 2018).

With regard to the question of what role migration-related translocal networks plays in the resilience of rural livelihoods, patterns of households' network capital point to the fact that poor households in particular critically rely on migration-related translocal bonding capital as a financial coping mechanism. However, as discussed above, among poor households remittances from migrating household members and relatives are likely to be less resourceful sources of support and are likely to be less strategically invested than among better-off households. At the same time, poor households, in the context of the delocalization of rural livelihoods, are more affected by the erosion of local bonding capital, which leads to a situation in which migration gains in terms of remittances are compensated by migration costs in terms of agricultural wage labor. Accordingly, findings suggest, the plight of the poor does lies not only in the fact that they lack extra-local and bridging capital (Woolcock and Narayan 2000), but also in a one-sided overreliance on migration-related bonding capital in combination with less effective local capital.

6.4.2 Agricultural diffusion research

Based on the assessment of the structural features and key actors in translocal advice-sharing networks, this study has underlined that while agricultural advice sharing is a prevailing local phenomenon, translocal networks matter for agricultural innovation. Research findings underline the fact that agricultural innovation networks are far from being self-contained (Matous 2015; Matous and Todo 2018) and hence confirm the call to more seriously address the spatiality of innovation processes (Binz et al. 2014; Glückler et al. 2017). At the same time the findings challenge the popular conceptualization of networks as conduits for the contagion of novel information and knowledge that underlies agricultural innovation research (Valente and Rogers 1995; Conley and Udry 2001) and also informs translocality research (Greiner and Sakdapolrak 2013a, 2013b).

Besides reiterating that adoption of agricultural innovation faces multiple social, economic, and cultural barriers, and depends on a wide array of factors, with several of them being distinctive features of smallholder farming (Feder et al. 1985; Feder and Umali 1993; Llewellyn and Brown 2020) the assessment of translocal innovation networks points to the fact that innovation transfers are more complex than the simplistic notion of contagion through advice sharing suggests. In particular in rural communities with poorly developed advice-seeking cultures, observation of peers is of critical relevance for the local spread of innovations, as it is related to physical proximity and the visibility of agricultural plots. As this study reveals, however, observation is not restricted to the local level but also matters during migration. Network assessment building solely on the assessment of communication networks regarding agricultural issues (e.g. Isaac 2012; Isaac et al. 2014) therefore risk missing out these more subtle mechanism of contagion.

Besides the lack of consideration of barriers and farming conditions and an overly simplistic conceptualization of the nature of innovation transfers, a further misconception lies in the assumption that migration and translocal networks facilitate the transmission of "new" information and knowledge (Scheffran et al. 2012; Sakdapolrak et al. 2016; Peth and Sakdapolrak 2020b). While studies on isolated agricultural communities suggest that long-distance ties are of particular importance to agricultural innovation, because they connect across different agro-ecological conditions (Wossen et al. 2013; Matous and Todo 2018), this study underlines that, in highly connected and integrated rural communities, the likelihood of learning something factually new about agriculture through migration-related translocal networks is relatively limited. In the context of high outreach of agricultural extension services and media coverage, as is the case in Northeast Thailand, it is less the novelty than the relative advantage of an agricultural innovation that is decisive for smallholders' adoption decisions (Llewellyn and Brown 2020).

Finally, the idea of "knowledge gain" as the decisive driver of agricultural change also ought to be questioned. As the analysis of particular key actors in translocal innovation networks suggests, the impact of migration on agricultural innovation lies not so much in the acquisition of knowledge about an improved crop or practice as is the exposure to unfamiliarity and previously unknown environments. This assessment corresponds with increasing empirical evidence that migration not only results in incorporated social remittances (e.g. knowledge, skills) but also in intangible social remittances (e.g. views, values, motivation) (Peth and Sakdapolrak 2020a). As discussed above, in the observed study site, the confidence and motivation of particular return migrants to make a change to their agricultural livelihoods is a decisive factor for agricultural change.

6.4.3 Translocality research

According to the above outlined consideration regarding the conceptualization of social capital and the diffusion of agricultural innovations, for translocality research the following conceptual implications can be drawn:

In order to contextualize the role of translocal social networks, translocality studies ought to shift their focus on translocal relations towards the interaction between local and translocal networks. As outlined above, understanding the full impact of translocal networks on livelihood resilience requires the consideration of translocal as well as local networks. In the same vein, translocality studies ought to move from a preoccupation with migration-related networks comprised of strong and reciprocal household or family ties, towards accounting for formal translocal networks as well. In the context of rural transformation, the formalization of social relations is gaining importance and hence should be considered regarding its impact on translocal livelihoods.

Furthermore, this study has made the point that, in order to better understand mechanisms of agricultural innovation, translocality research ought to refrain from overly simplistic assumptions about the diffusion of innovations, which are implicit in the connectionist conceptualization of translocal social networks. A narrow focus on the flow of knowledge and ideas via networks of direct social interaction might miss other important pathways of innovation. Additionally, the assumption of "novel knowledge" and "knowledge gain" as deciding factors in adoption decision runs the risk to downplay social, economic, and cultural reasons for adoption. Against this backdrop, translocality research ought to account for the interplay of financial and social remittances, in particular intangible social remittances, such as skills, belief and motivations, and the constraining or incentivizing effects of the socio-economic and cultural environment. Peth and Sakdapolrak (2019) provide a conceptual model of the transfer of social capital, which could provide a qualitative framing for further structural assessments of translocal innovation networks.

In order to better employ the potential of the translocality concept for understanding the interrelation between migration and changes in the physical and natural environment (Greiner and Sakdapolrak 2013b), a further issue that ought to be embraced by translocality research is the role of social networks in natural resource management (Bodin and Prell 2011). The application of SNA in the strand of natural resource governance has yielded plentiful and detailed insights into the question of what structural features foster the transformation towards resilience in SES. These insights however have remained unnoticed by migration and translocality research. Although the issue of natural resource governance has not been in the focus of empirical studies presented by this study, strengths and weaknesses were systematically analyzed in the form of the preceding literature review (Article I). Against this backdrop, the author confidently argues that exchange beyond disciplinary boundaries would offer the opportunity to overcome limitations and blind spots on both sides; whether the metaphorical and connectionist conceptualization of social networks and the focus on strong and bonding ties in translocality research, or the preoccupation with the local level as the

primary scale of resource use and the tendency to downplay conflicts and the role of power asymmetries in governance networks. The integration of a connectionist perspective on flows of remittances between migrants and receiving households with a structuralist perspective on coordination processes between stakeholders involved in natural resource management provides a promising pathway for understanding resilience not only at the actor and household level, but also at the level of the related SES in areas of origin and destination.

6.5 Methodological considerations

To explore the relation between translocality, networks, and the resilience of rural livelihoods in Northeast Thailand, this study has operationalized a translocal social network perspective, based on theorems and methods of formal SNA. As the empirical application in the various study sites in Northeast Thailand demonstrate, SNA is a powerful tool for assessing and analyzing the structure of translocal networks, and hence is a promising avenue towards sharpening and revitalizing the concept of social networks for translocality research. However, at the same time, SNA constitutes a highly restrictive conceptual and methodological framework (Butts 2009), which needs to be adapted to the realities of translocal livelihoods. Against this backdrop, future research applying SNA for the study of translocal networks ought to address the following aspects.

6.5.1 Defining appropriate network boundaries

SNA is most powerful when applied for the study of complete networks with clearly defined network boundaries. However, boundaries of farmers' networks are difficult to define (Bourne et al. 2017), in particular in a translocal context. Broader definitions of the unit of analysis (e.g. migration system) would render assessing all actors and ties impossible, whereas narrower ones (e.g. village) would omit ties spanning different places.

This study has demonstrated that the assessment and evaluation of ego networks by means of participatory network mapping is a suitable way to gain insights into the socio-spatial patterns of rural households' network capital. Whilst ego-network assessments provide information on the translocal embeddedness of particular households they fail to provide a structural understanding of translocal networks. Snowball sampling of ego networks has proved to be a fruitful way of assessing information on translocal embeddedness and the structure of translocal networks. The structural features of networks constructed from snowball-sampled ego networks, however, need to be interpreted with care as they tend to focus on subgroups of densely connected actors rather than revealing structural holes between subgroups (Scott 2013; Ricciardi 2015). An alternative approach would be the assessment of complete networks between a clearly defined group of actors (e.g. all households of a rural community) in a first step. In a second step, network data could be completed with data on translocal ego networks (e.g. actors at district, national, and international levels). A common drawback of all these approaches is that they privilege the local level (as the level at which networks are assessed) and fail to reveal the structural patterns of translocal networks between actors at different geographical levels. But: a truly translocal network assessment would require following the trajectories of migrating network members, and hence is hardly applicable, especially if international migration is considered. Obviously, there is no single ideal all-purpose sampling strategy. In any case, the definition of clear sampling criteria is paramount as they influence network size, and hence the feasibility of any translocal network assessment.

6.5.2 Accounting for temporal and spatial dynamics

A major weakness of the applied approach is that network assessments provide only snapshots of social structure for a given point in time. Synchronic network assessments, however, do not account for temporal and spatial dynamics of social networks (Violon et al. 2016; Ryan and D'Angelo 2018). More particular, static network assessments, by definition, contradict the dynamic conceptualization of translocality (Greiner and Sakdapolrak 2013b) and the idea of social resilience as a process (Keck and Sakdapolrak 2013). To unravel the processual character of social resilience, future research on translocal networks ought to focus on longitudinal network assessments, which could not be implemented in the context of this study, due to time and resource constraints.

A makeshift applied in the context of this study was the reference to cumulative past and current household practices for the assessment of network capital, and the reference to a clearly defined time period and materialized changes for the assessment of innovation networks. However, this cumulative approach makes it difficult to distinguish between sporadic and long-lasting relations (Violon et al. 2016). In order to gain an understanding of network dynamics, the empirical study of household network capital also included the assessment of past networks at a time of experienced drought and flood as well as future networks under the scenario of increasing climatic risks. However, this approach proved not to be viable due to methodological difficulties and inconsistent results, and hence the respective data was not considered for analysis.

In light of this experience it can be concluded that, in order to gain a sound understanding of network dynamics and causality, longitudinal network assessments (Ryan and D'Angelo 2018) are a prerequisite. Ideally longitudinal network assessments are combined with baseline (household) surveys and qualitative methods and network visualizations, in order to control for changes in household parameters and the individual characteristics of their members. Also, for future translocal network research, it is strongly recommended to more actively engage with current developments in network science. Dynamic network analysis (DNA) is a promising and growing discipline in network science, providing assessment and analysis tools for analyzing spatial and temporal dynamics in multi-mode, multi-link networks (Breiger et al. 2003; Carley et al. 2007).

6.5.3 Accounting for social context

Despite standardized procedures, network assessments build on the subjective imagination and perception of social actors' networks, which are likely to be influenced by subjective meaning and motivation, cultural norms, and social practices (Emirbayer and Goodwin 1994). For example, a general reluctance of interviewees to recall network alters was a common issue during the assessment of household network capital. Reasons for this reluctance might lie the abstract nature of scientific inquiry (although it was adapted to local livelihoods and visualized by means of network mapping), but also might be related to the inconvenience of admitting one's own dependence. Furthermore, the assessment of translocal innovation networks was complicated by the fact that farmers prefer to observe peers rather than actively seeking advice. As discussed above, the lack of an advice-seeking culture among farmers in the study site is an explanatory factor regarding the sparse nature of translocal innovation networks.

This study shows that, to add meaning to social structure, a combination of quantitative and qualitative network approaches is promising. Approaches applied in the context of this study, such as the visual mapping and scoring of network alters, is an example of how qualitative and quantitative approaches can be fruitfully combined; however, semi-qualitative approaches require time and are difficult to implement at a large scale. Mixed-methods approaches, combining quantitative network questionnaires with semi-structured interviews with selected key actors, are an option for achieving

both aims, quantitative networks data and qualitative insights (Bellotti 2016; Ryan and D'Angelo 2018). More thought and resources are required in order to fully exploit these integrative approaches.

6.5.4 Paying attention to power and gender inequalities

For the assessment of translocal network capital, this study has focused on the local household as a uniform analytical unit and relied upon network information provided by respective household representatives. For the assessment of translocal innovation networks too, household membership has been used as a criterion for actor aggregation. Actor aggregation by household level, however, is an abstraction that runs the risk of omitting information on power and gender inequalities. In reality, rural households are social groups constituted by diverse actors and are characterized by gendered power relations (Peth and Sakdapolrak 2020a; Porst and Sakdapolrak 2020). In particular with regard to the study of translocal contexts, the viability of the households concept as an analytical unit is debatable, as it has a local connotation and presumes joint decision-making (Greiner 2012; Peth and Sakdapolrak 2020a). Translocal networks as assessed by a single household representative are hence likely to provide a skewed picture of the household's actual network. In order to understand the differential migration outcomes for members of the same households, it has been argued that resilience research needs to disaggregate households according to their respective members and their differential embeddedness at different geographical places (Porst and Sakdapolrak 2018). This is particularly relevant, as aspects of gender alongside generational and cultural norms are decisive regarding remittances sending and usage (Porst and Sakdapolrak 2020) and contribute to differential migration outcomes among men and women (Le Mare et al. 2015).

7. Conclusions

This study contributes to the controversial debate on the role of migration in resilience-building by shedding light on the role of translocal social networks in the resilience of rural livelihoods. Adopting a translocal social network perspective, based on methods of SNA, this study provides a conceptual and operational framework for systematically assessing and analyzing the socio-spatial patterns of and flows channeled through translocal social networks spanning beyond rural communities and between areas of origin and destination of migration.

As a means to this end, this study integrates a systematic literature review and two empirical studies conducted in selected study sites in Northeast Thailand, a region in rapid transition from small-scale rain-fed rice farming to larger-scale cash-crop production characterized by high levels of mobility and migration resulting in increasingly diversified and delocalized household livelihoods.

The interpretation of research findings from a resilience perspective (Keck and Sakdapolrak 2013) and their contextualization in the context of the overall process of rural transformation taking place in Northeast Thailand (Rigg 2006; Rigg and Salamanca 2009; Rambo 2017) shows that already privileged households are in a better position to benefit from market opportunities and institutionalized support schemes, whereas poor households are comparatively more affected by the dissolving of the rural moral economy. Better-off households can take advantage of their more abundant formal translocal networks in order to transform their agricultural livelihoods. In contrast, poor households, whose overall network capital is less translocal and more bonding in nature, critically rely on migration-related translocal networks in terms of remittances, in order to cope with adverse livelihood conditions.

Under certain circumstances, poor households can benefit from migration-related innovation transfers. Labor-saving and sustainable farming practices, the diversification of agricultural crops, and new marketing channels introduced by dedicated and motivated return migrants can be considered bottom-up innovations that provide resilience in the context of rapidly changing farming systems. However, migration-related innovation transfers remain limited to incremental rather than transformative changes and depend on the type of migration, the dedication and motivation of farmers, and the social and economic context. Whether migration-related translocal networks tend to stabilize the status quo of marginal livelihoods or can provide means of revitalizing small-scale agriculture therefore remains a question of perspective and context.

In the context of national policies and international market trends, extension-driven "top-down" innovation transfers are driving rapid agricultural changes at the local level. The resulting transition towards cash-crop farming provides the opportunity for better-off farmers, who can capitalize on their favorable position in translocal innovation networks in order to transform their agricultural livelihoods towards large-scale cash-crop production and agricultural businesses. Large-scale cash-crop farming, however, comes at the cost of increasing dependency of rural livelihoods on external variables, such as market and policy change, as well as environmental degradation, and hence challenges the resilience of the overall farming system.

Against the backdrop of these findings, what conclusions can be drawn with regard to the role of translocal social networks in the resilience of rural livelihoods? First, whilst the local level remains the major level of social interaction and the major source of livelihoods and innovation, in Northeast Thailand, translocal networks are a crucial aspect of rural livelihoods, which would be omitted by either community-centric or space-blind approaches. Understanding the resilience of rural livelihoods in Northeast Thailand thus requires a translocal perspective, which takes into account the structure of social relation at both the local and translocal levels.

Second, translocal networks that rural households maintain and in which they are embedded are not only migration-related. As this study has revealed, migration-related translocal networks are more relevant among poor households than among better-off households and are restricted to particular agricultural innovations. Migration-related translocal networks nourish coping and to a certain extent adaptive capacity, but rarely provide transformative capacity for escaping the status quo of marginalized small-scale farming. In contrast, formal translocal networks are particularly relevant among better-off households providing advice and finance required for the transformation towards large-scale cash-crop farming. In the form of top-down-organized extension systems around cash-crop farming, formal translocal networks facilitate rapid agricultural changes. While the market- and policy-driven transition towards cash-crop farming promotes economic growth and income, it comes at the cost of social and environmental consequences that threaten the resilience of the farming system in the long run.

Third, in order to evaluate the role of migration-related translocal networks in the resilience of rural livelihoods, they need to be seen in the context of ongoing rural transformation in Northeast Thailand, as well as in many rural areas of the Global South (Rigg 2006: Rigg and Salamanca 2011; Rigg et al 2012), in which delocalization through migration is only one aspect among others. As outlined in this study, In Northeast Thailand, market and state-driven interventions have resulted in the formalization of social networks, with massive consequences for rural societies and their natural environment. Accordingly, focusing too narrowly on migration-related translocal networks, while losing sight of formal translocal networks, would lead to a skewed assessment of the potential of migration in resilience-building.

In sum, these conclusions call into question an overly positive view of migration and translocal connectedness as a means of resilience-building, which prevails in current scientific and political debates. As outlined above, the delocalization of rural livelihoods through migration is only one aspect of rural transformation and does not necessarily provide an avenue for escaping rural poverty. Obviously, in the researched study sites, geographical mobility has resulted in the diversification of rural livelihood resources and in the expansion of social networks far beyond community boundaries. However, geographical mobility does not monotonically relate with social mobility (Rigg 2006), nor does resilience necessarily lead to increased well-being (Tebboth et al. 2019). Instead, this study suggests that, in the context of the delocalization of rural livelihoods, the status of poor households is shifting from “old” poverty characterized by immobility and resource limitations to “new” poverty characterized by mobility under precarious conditions (Rigg 2006; Rigg and Oven 2015; Porst and Sakdapolrak 2018). This assessment is in line with other critical voices, emphasizing that translocal livelihoods and related translocal networks are a product of structural and spatial inequality and tend to reinforce rather than even out social inequality and spatial disparity (Bott et al. 2020; Steinbrink and Niedenführ 2020).

Translocal social networks are not only sources of resilience that are unequally viable and unequally beneficial among households, they have consequences for humans the environment in the long run. In Northeast Thailand, the delocalization of rural livelihoods through migration and translocal networks fosters social resilience at the household level. At the same time, it accentuates the marginalization of small-scale farmers and fosters the transition towards market-oriented crop production which, in turn, challenges the resilience of the overall farming system. This highlights that in SES, social resilience is inseparably linked with ecological resilience (Folke et al. 2010), an aspect which migration and translocality studies all too often fail to address.

As a matter of fact in many rural societies around the globe, networked translocal livelihoods should no longer be ignored by community-centric research or by space-blind development policies. Although translocal networks should not be overestimated as a panacea for rural development, a

structural understanding of the translocal embeddedness and connectedness of rural households is a prerequisite for building resilient rural livelihoods. A structural translocal social network perspective as applied in the context of this study has proven a fruitful means to this end.

A structural translocal social network perspective also offers itself as a corrective to migration and translocality studies which, despite conceptual claims, rarely refer to social networks as an analytical concept. On the basis of two empirical studies in Northeast Thailand, this study has shed light on some conceptual fallacies underlying social capital and diffusion research, and has revealed blind spots in translocality research, including a preoccupation with networks of strong and bonding ties, a focus on migration-related translocal networks, and a connectionist bias regarding the diffusion of innovations. However, adapting the overly rigid framework of SNA to the multifaceted and complex realities of translocal rural livelihoods is a non-trivial endeavor. Key challenges include, inter alia, the definition of adequate network boundaries, the addressing of spatial and temporal dynamics, network context, and gendered power imbalances. First step towards overcoming these challenges have been provided by this study.

In order to better leverage the potential of translocal social networks for building resilient livelihoods in an increasingly connected world, more research is needed on how to strengthen the positive aspects while mitigating negative consequences of migration and translocal livelihoods. Inspiring examples of how the potential of migration and translocal networks can be leveraged for inclusive community-based adaptation are provided by the recently published practitioner's guide "Migration as Adaptation" (TransRe 2018).

8. Literature review (Article I):"Social networks and the resilience of rural communities in the Global South: a critical review and conceptual reflections"

Preface

This literature review provides a systematic overview of empirical work addressing the issues of social networks and resilience in rural communities in the Global South. Case studies from three strands of research, including i) natural resource management, ii) agricultural innovation, and iii) social support are analyzed according to how they conceptualize and operationalize social networks. Based on this assessment, the authors discuss strengths, weaknesses, and general challenges of current network research and call for a translocal social network perspective in the study of resilience in rural communities.

The motivation for this review stems from the authors' assessment that that the role of social networks in the resilience of rural communities remains an under-conceptualized and under-researched issue, as research remains scattered across different strands and has rarely been integrated from a resilience perspective. This review therefore aims to delineate common ground for interdisciplinary exchange and identifies steps towards a more comprehensive social network perspective on the resilience of rural communities in the Global South. In doing so, the article also contributes to the emerging literature on community resilience.

Studies in the strand of natural resource governance address the capacity of social networks to navigate the transformation of SES towards sustainable resource use and resilience. Strengths lie in structurally explicit approaches based on methods of formal SNA for identifying structures conducive to resilient resource management as well as scale-mismatches and barriers to same. Restricted by methodology, research has tended to focus on static and clearly identifiable management systems. Further weaknesses are the tendency to conceive of management as a collaborative process, downplaying conflicts and the role of power asymmetries.

The strand of agricultural innovation comprises studies concerned with the capacity of social networks to promote adaptive capacity through social learning and technology adoption in the context of agrarian change. Prevailing descriptive approaches and econometric modeling are providing insights into a wide variety of actor and tie characteristics influencing adoption decisions. Weaknesses lie in the dominance of actor-based approaches and the limited ability to address structural features and their link with resilience outcomes. Furthermore, the prevailing conceptualization of social networks as pipes risks oversimplifying innovation processes.

Studies from the strand of social support, conceive of social networks as a crucial embodiment of social capital and as a coping strategy in times of need. Strengths are the combination of quantitative and qualitative approaches and a community perspective sensitive to network context and temporal network dynamics. A challenge arises from vague conceptualizations resulting in tautological assumptions about the positive role of social capital, rooted in strong and reciprocal ties. Of further concern is the narrow focus on community networks and the neglect of the spatial dimension of social networks.

On a general level, authors identify the following tendencies, which they consider challenges to adequately addressing the role of social networks in the resilience of rural communities in the Global South: first, social network research tend to focus on network outcomes and has difficulties with assessing network dynamics. Second, while studies tend to overemphasize network structure, the role of agency in shaping and reproducing social networks remains unaddressed. Third, the neglect

of the spatial dimensions of social relations poses a significant shortcoming given the highly mobile character of many rural societies.

As way to overcome these challenges, the authors propose linking future research with the concept of translocality. A translocal social network perspective addresses the embeddedness in and connectedness between places, and shifts the focus of research from bounded entities toward the connections between places; it takes into account the dynamic interrelationship between structure and agency and provides a multidimensional conception of social relations. Hence, the authors argue, it offers a framework well suited to the complexity of rural-urban realities in the Global South.

Abstract

In the last decades, a growing scholarship has outlined the crucial role of social networks as a source of resilience. However, with regard to the Global South, the role of social networks for the resilience of rural communities remains an under-researched and under-conceptualized issue, because research remains scattered between different strands and has rarely been integrated from a resilience perspective. To provide common ground for the exchange between disciplines and to identify steps towards a more comprehensive social network perspective on the resilience of rural communities in the Global South, we present a systematic review of contemporary case studies from three strands of research: (i) natural resource management, (ii) agricultural innovation, and (iii) social support. Although studies in each strand have their own particular strengths and weaknesses in addressing aspects of the resilience of rural communities in the Global South, they all share a static view of the outcomes of social networks, tend to emphasize structure over agency, and neglect spatial dimensions of social relations. To address these challenges, we propose a translocal social network perspective on resilience that views rural communities as being embedded in social networks that connect people and facilitate the flow of resources, information, and knowledge between places.

8.1 Introduction

Rural communities can be understood as vulnerable social-ecological systems (SES) that need to build resilience to withstand internal and external stresses from social, economic, and political changes (Adger 2000; Wilson 2012). It has been argued that many aspects of adaptive capacity reside in social networks (Adger 2003) and that these are a crucial source of resilience (Folke et al. 2005; Folke 2006; Berkes and Ross 2013). This applies in particular to rural communities in the Global South, where often a lack of access to resources, knowledge, and functioning institutions is a major obstacle to sustainable development (Etzold et al. 2012). However, although investigations into the role of social networks is growing at a fast pace, it remains scattered across different strands of research, with related but separate research agendas (Videras 2013). With this paper, we provide a systematic review of current case studies from three of these strands, addressing different aspects relevant to the resilience of rural communities. By analyzing how case studies conducted between 2000 and 2015 conceptualize and operationalize social networks, we level the ground for the exchange between disciplines. Concluding we identify prospects for more fruitfully employing a social network perspective in investigating the resilience of rural communities in the Global South.

During the last decades, resilience has emerged as a key concept across disciplines for investigating responses to changes in human and ecological systems (Folke et al. 2010), resulting in a variety of ways in which resilience is understood, investigated, and applied (Downes et al. 2013). From a concept originally concerned with the persistence of ecological systems in the context of external disturbances (Holling 1973), resilience has developed through a concept underlining the role of adaptive capacity for navigating coupled SES (Gunderson and Holling 2002; Berkes et al. 2003) to one

emphasizing the transformation of SES in the face of global change (Walker et al. 2004; Folke 2006; Folke et al. 2010). Attention has thus widened from the ecological to include also the social dimensions of resilience (Adger 2000; Cote and Nightingale 2012). This comprises, for example, human agency, social learning, and the skills and capacities of social actors to cope with, adapt to change, and facilitate transformation (Folke et al. 2010; Moore and Westley 2011; Berkes and Ross 2013; Keck and Sakdapolrak 2013; Skerratt 2013; Cretney 2014; Ifejika Speranza et al. 2014).

Similar to resilience, the concept of social networks has been applied in a wide range of sciences from the social to the physical (Borgatti et al. 2009; Scott 2011). Intermediating between micro and macro levels, the investigation of social networks is expected to provide answers to central challenges pertinent in sustainability science, such as promoting social learning, linking knowledge with action, and enhancing collective action (Henry and Vollan 2014). Social networks have been shown to foster the capacity to buffer, adapt to, and shape change (Moore and Westley 2011) by providing resources needed to cope with external stresses and disturbances (Adger 2003), and fostering humans' ability to initiate social innovations and act collectively (Folke et al. 2005; Newman and Dale 2005; Moore and Westley 2011). Against this background, resilience scholars are increasingly embracing the study of social networks as a promising way to operationalize social-ecological systems research (Janssen et al. 2006; Bodin et al. 2011; Bodin and Tengö 2012; Bodin et al. 2014).

In general, a social network perspective refuses individualistic explanation of human behavior and places emphasis on the study of the relations between individuals and the structure of these relationships (Emirbayer and Goodwin 1994; Wasserman and Faust 1994; Fuhse and Mützel 2010). However, there is no uniform theoretical explanation as to why and how the structure of social relations matters (Borgatti et al. 2009; Fuhse and Mützel 2010), which has resulted in various conceptualizations and operational approaches toward social network research.

Probably the most common and intuitive conception of social networks is as "pipes" (Podolny 2001), connecting various actors through flows of resources, information, or knowledge (Borgatti et al. 2009). Another popular conception is that of networks as "social capital" (Putnam 2000). In essence, the concept of social capital addresses the value of social connectedness (Borgatti and Foster 2003) in terms of competitive advantages (Burt 2000) derived from resources embedded in social structure (Lin 1999). Finally, the conception of networks as a "form of coordination," as opposed to other principles of coordination such as market or hierarchy (Powell 1990) ,emphasizes the deliberative character of social networks and their potential to facilitate collective action, self-organization, and cross-scale coordination (Schneider et al. 2003; Olsson et al. 2004; Folke et al. 2005; Carlsson and Sandström 2008; Newig et al. 2010).

With regard to the operationalization, three approaches to social networks can be distinguished: metaphorical, descriptive, and structurally explicit (Bodin and Prell 2011). In general, studies following metaphorical approaches treat networks as binary variables, which either do or do not exist, whereas studies following descriptive approaches distinguish key properties of networks, such as size, density, or strength of ties. In contrast, studies following structurally explicit approaches draw on formally defined methods of social network analysis (SNA) to analyze structural patterns of social relations derived from relational data.

Although recent years have witnessed major advances in employing a social network perspective in research on SES in general (Bodin and Prell 2011), the role of social networks for the resilience of rural communities is still under-researched and under-conceptualized. An increasing number of studies are applying a social network perspective in order to address diverse issues such as, for example, the diffusion of sustainable agricultural practices (Conley and Udry 2001; Bandiera and Rasul 2006; Isaac 2012), the exchange of financial and material support in times of need (Cassidy and Barnes 2012; Scheffran et al. 2012; Islam and Walkerden 2014), and collective action regarding the

sustainable management of natural resources (Tompkins et al. 2002; Crona and Bodin 2006; Ramirez-Sanchez and Pinkerton 2009). However, findings from these studies have rarely been integrated from a resilience perspective because contrasting conceptualizations and operationalization of social networks are hindering the exchange between disciplines. Moreover, a systematic synthesis of current research on social networks in rural communities in the Global South is lacking, as are conceptual reflections about implications for future research on the resilience of rural communities.

To close this gap, we present a systematic review of case studies from three different strands of research: (i) natural resource governance, (ii) agricultural innovation, and (iii) social support. Although studies in these strands do not necessarily refer to the concept of resilience in explicit and theoretically founded ways, we opt for a review of studies from these strands because they provide examples of how a social network perspective can be applied in addressing different aspects relevant to the resilience of rural communities in the Global South. For example, research on governance networks provides insights into how social networks facilitate collective action of stakeholders and the navigation and transformation of management systems; research on agricultural innovation networks reveals how social networks facilitate learning between farmers about improved agricultural crops and practices and therefore foster purposeful adaptation to changing conditions; and research on social support networks addresses the role of social networks as a means for households and communities to cope with changes by providing access to resources in times of need.

Although investigating related things, research in each strand is rooted in a different disciplinary background and hence tends to look at social networks from a different perspective. For example, research in the strand of natural resource governance is influenced by environmental management and SES research and hence focuses on social networks as a means of improving collaboration between stakeholders; research in agricultural innovation is informed by agricultural and development economics and hence perceives networks as a means of improving knowledge diffusion and social learning between farmers; and research on social support networks is shaped by vulnerability and disaster risk research and hence is primarily concerned with networks as a livelihood strategy of households and communities. Accordingly, studies from each strand tend to conceptualize and operationalize social networks differently.

By systematically analyzing how studies across these three strands conceptualize and operationalize social networks, this review aims at critically discussing the viability of current social network research and intends to reflect conceptual implications for future research. In the following sections, we outline the analytical framework and present the findings of our review. Based on this, we discuss strengths and weaknesses of each strand in addressing different aspects of resilience. Finally, we conclude by proposing a translocal social network perspective as a conceptual framework for future research on social networks and the resilience of rural communities in the Global South.

8.2 Methods

To allow scientific studies with different research designs to be compared, we performed a systematic literature review (Petticrew and Roberts 2006). We applied a stepwise research procedure, starting with a search of ISI Web of Knowledge and Science Direct using the terms “social network,” “resilience,” and “rural community.” Based on this preliminary sample, we included key terms related to the three strands of literature we aimed to address, such as “natural resource governance,” “agricultural innovation,” and “social support.” To ensure comprehensibility, we decided on an additional open research approach including, inter alia, case studies that were frequently cited by previously identified sample studies. We restricted the research to peer-reviewed articles published in English between 2000 and 2015 and excluded all non-empirical articles and articles not related to the domain of rural development and only selected case studies from the Global South, based on the catego-

ries “low-income countries” and “middle-income countries” (World Bank 2016). We analyzed the final sample derived from this research procedure according to how studies (a) conceptualize and (b) operationalize social networks. Besides this, we (c) summarized for each strand key findings that related to aspects of the resilience of rural communities in the Global South.

To analyze how social network research is conceptualized (a), we applied the following categories (see *Table* 2):

a.(1) Conceptual framing: With this category, we indicate whether studies address resilience implicitly or explicitly, and how they frame social networks and resilience.

a.(2) Network variable: This category indicates whether studies treat social networks as an independent or dependent variable. Studies treating networks as an independent variable focus on how the structure of social relations impacts social behavior. If the focus is on why people are linked in a particular way, networks are treated as a dependent variable (Bodin and Crona 2009; Hennig et al. 2012).

a.(3) Network narrative: We choose this category to address underlying theoretical assumptions about how networks make a difference. This includes the conception of social networks as “pipes” (Podolny 2001), as “social capital” (Bourdieu 1986; Coleman 1988; Putnam 2000) and as a “form of coordination” (Powell 1990).

To analyze how social network research is operationalized (b), we applied the following categories:

b.(1) Network approach: In line with Bodin et al., we distinguished between metaphorical approaches, descriptive approaches, and structurally explicit approaches (Bodin et al. 2011).

b.(2) Network definition: This category refers to the definition of actors and the social relations of interest between them (Wasserman and Faust 1994), e.g., farmers, households, or institutions and the exchange of material support, information, or knowledge; as well as to the definition of the scale of interaction (Bodin and Prell 2011), e.g., cooperation between different levels at different administrative or geographical scales.

b.(3) Network analysis: With this category, we indicate on which network level the analysis focuses, e.g., the individual actor, the subgroup, or the network level (Bodin and Crona 2009; Bodin and Prell 2011), and which specific characteristics are highlighted, e.g., actor, tie, or structural characteristics or network context (Entwisle et al. 2007; Doreian and Conti 2012).

General categories were used to be able to account for a broad spectrum of case studies. In reality, categorization is not a clear-cut process, and studies could be attributed to more than one category. Hence, except for the network approach, we allowed multiple nominations, for example, a combination of network narratives. At the same time, we took into account that categories might not be applicable in all cases. For example, a study following a metaphorical approach might not be explicit about the network level or characteristics addressed.

Table 2: Categories applied for the literature review

	Category applied	Questions addressed
a) Conceptualization	a.1) Conceptual framing	Is resilience addressed explicitly or implicitly?
		How are social networks and resilience framed?
	a.2) Network variable	Are social networks treated as dependent or independent variables?
	a.3) Network narrative	What is the underlying conception of social networks?
b) Operationalization	b.1) Network approach	What methodological approach does the study follow?
	b.2) Network definition	What are the social relations of interest?
		Who are the actors and what are the relevant scales of interaction?
	b.3) Network analysis	On what network level does the analysis focus?
		What network characteristics are addressed?
c) Key findings		What key findings can be summarized regarding the question of how social networks relate to aspects relevant to the resilience of rural communities?

8.3 Results

Sixty case studies were selected for in-depth analysis: 22 studies from strand (i) natural resource governance, 17 studies from strand (ii) agricultural innovation, and 21 studies from strand (iii) social support. In the following, we present an overview of how these studies conceptualize and operationalize social networks and summarize key findings for each strand. We refer to general characteristics of each strand and highlight particular case studies only where they are needed to illustrate differences in the conceptualization and operationalization of social networks.

8.3.1 Strand (i): Natural resource governance

Research in this strand is concerned with the question of how social networks affect the ability to adaptively manage natural resources. The case studies deal with issues, ranging from climate policy (Moeliono et al. 2014) to water and dryland management (Stein et al. 2011; Sundstrom et al. 2012; Carien de Villiers et al. 2014; Nuno et al. 2014; Mannetti et al. 2015) and coastal area management (Tompkins et al. 2002; Crona and Bodin 2006; Bodin and Crona 2008; Ramirez-Sanchez and Pinkerton 2009; Crona and Bodin 2010; Gelcich et al. 2010; Marín and Berkes 2010; Cohen et al. 2012; Marín et al. 2012; Cárcamo et al. 2014; Marín et al. 2015; Pietri et al. 2015).

Network conceptualization

Conceptual framing: Social networks are conceptualized as key factors for understanding collective action and learning in SES. Even if studies do not explicitly refer to resilience, they conceptualize social networks as central to the management of natural resources. Particular studies draw on concepts such as adaptive co-management and hence implicitly refer to the resilience of SES (Marín and Berkes 2010; Stein et al. 2011; Moeliono et al. 2014; Apgar et al. 2015; Mannetti et al. 2015)

Network variable: Studies predominantly focus on the structure of social relations and their impact on management outcomes, treating social networks as an independent variable, though there are exceptions that take into account factors impacting social networks, such as ecological (Ramirez-Sanchez and Pinkerton 2009), economic (Rico García-Amado et al. 2012), and political changes (Ireland and Thomalla 2011; Sundstrom et al. 2012).

Network narrative: Underlying most studies is the conception of networks as a "form of coordination," either focusing particularly on the communication and knowledge flows between resource users at the community level (Crona and Bodin 2006, 2010), or with an emphasis on formal organizational networks (Gelcich et al. 2010; Stein et al. 2011; Cohen et al. 2012; Cárcamo et al. 2014; Moeliono et al. 2014; Nuno et al. 2014; Pietri et al. 2015). Furthermore, several studies refer to social networks as a structural feature of "social capital." In this way, they either explain the performance of particular organizations (Marín and Berkes 2010; Marín et al. 2012) and individual actors (Ramirez-Sanchez and Pinkerton 2009; Rico García-Amado et al. 2012) or investigate the potential of collective action for conflict resolution (Sanginga et al. 2007) and disaster risk recovery (Ireland and Thomalla 2011; Marín et al. 2015).

Network operationalization

Network approach: Structurally explicit approaches, and in particular the application of SNA techniques, are characteristic of most studies in this strand, however, there are also studies that refer to social networks in metaphorical terms, treating networks as an binary variable (Tompkins et al. 2002; Sanginga et al. 2007; Gelcich et al. 2010; Sundstrom et al. 2012)

Network definition: The social relations emphasized involve information, knowledge exchange, and collaboration between resource users and stakeholders. Network boundaries are defined with reference to management systems with a limited set of stakeholders and with clear ecological, geographical, or administrative boundaries. Whereas social ties in most cases are perceived as facilitating exchange and mutual understanding, few studies point to the restrictive potential of social ties (Marín and Berkes 2010; Marín et al. 2012). Several studies explicitly address cross-scale interactions between various political and administrative stakeholders (Tompkins et al. 2002; Gelcich et al. 2010; Stein et al. 2011; Cohen et al. 2012; Cárcamo et al. 2014; Marín et al. 2015) .

Network analysis: The focus of research comprises the network, the subgroup, and the individual level, whereby the focus of analysis is on structural network characteristics such as density, centrality, or fragmentation. Common tie characteristics are those of importance, frequency, or intensity. Several studies distinguish between bonding, bridging, and linking ties (Sanginga et al. 2007; Bodin and Crona 2008; Ramirez-Sanchez and Pinkerton 2009; Stein et al. 2011; Cohen et al. 2012; Marín et al. 2012; Marín et al. 2015; Sundstrom et al. 2012; Cárcamo et al. 2014; Apgar et al. 2015). Few studies highlight the influence of network context (Tompkins et al. 2002; Rico García-Amado et al. 2012; Sundstrom et al. 2012) or actor characteristics, such as leadership or socioeconomic power (Bodin and Crona 2008; Crona and Bodin 2010) to explain agency or lack thereof.

Key findings

Studies identify heterogeneity, cross-scale interaction, network density, and actor centrality as key factors influencing the resilience of governance networks. For the latter two factors, dense and centralized networks with strong bonding ties are shown to be effective in managing simple tasks (Rico García-Amado et al. 2012), while fragmented networks are shown to limit communication and hence adaptive capacity (Cárcamo et al. 2014; Mannetti et al. 2015). Furthermore, for successful transformation toward sustainable governance, studies indicate the need for decentralized and heterogene-

ous networks that entail bridging ties between administrative and institutional scales of management (Gelcich et al. 2010; Cohen et al. 2012; Marín et al. 2012; Marín et al. 2015) and, in particular, the need for brokers who facilitate collaboration between these scales (Stein et al. 2011; Cárcamo et al. 2014; Moeliono et al. 2014; Nuno et al. 2014; Pietri et al. 2015). Studies elaborating on possible reasons for inertia in governance processes reveal homogeneity among centrally positioned opinion-leaders as a potential barrier to collective action (Crona and Bodin 2006; Bodin and Crona 2008; Ramirez-Sanchez and Pinkerton 2009; Crona and Bodin 2010; Moeliono et al. 2014; Mannetti et al. 2015). Social capital based on linking ties (Marín et al. 2015) and flexible arrangements with changing roles and responsibilities are suggested as better suited to meeting the challenges of adaptive management (Apgar et al. 2015). Particular findings show that, successful governance networks can enhance resilience to natural disasters (Marín et al. 2015), but favorable structures alone might not be sufficient to promote proactive resilience building if resource users are excluded from formal institution building (Ramirez-Sanchez and Pinkerton 2009).

8.3.2 Strand (ii): Agricultural innovation

Research in this strand is concerned with processes of social learning in the context of rural transformation. The case studies reviewed, for example, range from acceptance of improved crop varieties (Bandiera and Rasul 2006; van den Broeck and Dercon 2011; Tatlonghari et al. 2012; Thuo et al. 2014) through the implementation of sustainable and risk-mitigating agricultural practices (Mazzucato and Niemeijer 2000; Conley and Udry 2001; Isaac et al. 2007; Matuschke and Qaim 2009; Arora 2012; van Rijn et al. 2012; Matouš et al. 2013; Wossen et al. 2013; Isaac et al. 2014) to the use of modern information and communication technologies (Butt 2015).

Network conceptualization

Conceptual framing: In contrast to studies in the other two research strands, the majority of literature in this strand does not address resilience explicitly. However, from a development economics' perspective, studies perceive of social networks as factors shaping social learning and adaptive changes in the context of agrarian change, and hence implicitly address aspects relevant to resilience. A system's perspective is rare, although there are attempts to embed it in the context of innovation systems (Spielman et al. 2011; Arora 2012; Isaac 2012). A few studies link agricultural innovation with adaptive management (Isaac et al. 2007) or conceptualize social networks as a form of social memory contributing to resilience (Isaac et al. 2014).

Network variable: The majority of studies focus on the outcomes of networks—here the adoption of agricultural practices or technologies—treating social networks as an independent variable. Studies that address the impact of external changes on social network structure are the exception (Mazzucato and Niemeijer 2000; Arora 2012; Isaac et al. 2014; Butt 2015).

Network narrative: Underlying most studies is the conception of networks as pipes through which "flows" of information, knowledge, and advice are transferred and circulated between actors. Less frequently, social networks are conceptualized as social capital, explaining differences in adaptation processes between different groups of farmers (Hoang et al. 2006; Tatlonghari et al. 2012; van Rijn et al. 2012).

Network operationalization

Network approach: In this strand, descriptive approaches predominate, characterized by an emphasis on econometric methods. A smaller number adopt structurally explicit approaches using methods

of SNA (Isaac et al. 2007; Spielman et al. 2011; Arora 2012; Isaac 2012; Isaac et al. 2014). Few studies adopt metaphorical approaches (Mazzucato and Niemeijer 2000; Butt 2015).

Network definition: The most frequently investigated social relation is information and advice sharing between farmers and external actors such as extension staff and NGOs (Arora 2012; Matouš et al. 2013; Wossen et al. 2013). Challenging the assumption that the village level is suitable for defining the reference group for social learning, specific studies compare innovation networks between different study sites, and highlight the role of information exchanges between villages (Mazzucato and Niemeijer 2000; Conley and Udry 2001; Matuschke and Qaim 2009; Isaac et al. 2014) and rural and urban areas (Isaac 2012; Wossen et al. 2013).

Network analysis: In contrast to studies in the governance strand, the dominant level of observation is not that of the network or subgroup but that of the individual farmer. For analysis, descriptive studies predominantly focus on actor and tie characteristics. Actor characteristics addressed include, for example, farm size, wealth, experience, gender, ethnicity, and geographic location, whereas tie characteristics addressed include kinship and friendship relations. The latter are referred to as strong or bonding ties (van den Broeck and Dercon 2011; Tatlonghari et al. 2012), while relations to external actors and institutions are referred to as weak or bridging ties (Wossen et al. 2013; Thuo et al. 2014). Structurally explicit studies focus on structural measures for explaining information diffusion, such as network density and fragmentation, as well as on actor centrality for identifying brokers of agro-ecological knowledge (Isaac et al. 2007; Isaac 2012; Isaac et al. 2014). Network context is addressed by a few studies highlighting the roles played by institutions (Hoang et al. 2006; Spielman et al. 2011; Arora 2012), information technologies (Butt 2015), or migration (Isaac et al. 2014).

Key findings

Studies do not explicitly elaborate on the link between network features and resilience. However, they identify key factors influencing social learning and decision-making processes and hence provide insights into adaptive processes crucial for the resilience of SES. In this regard, studies highlight actor and tie characteristics rather than network structure. Challenging the simple assumption that having more actors in a network increases the likelihood of adopting new technologies, studies reveal that decisions are based on imperfect knowledge and are oriented toward the experience and adoption behavior of network members (Conley and Udry 2001; Matuschke and Qaim 2009; Wossen et al. 2013), and are often subject to strategic considerations (Bandiera and Rasul 2006). Regarding tie characteristics, two groups of studies can be distinguished. The first group identifies social and geographical proximity as conducive to information diffusion: Strong and homophilous ties, for example kinship ties, are shown to facilitate information diffusion (Bandiera and Rasul 2006; Hoang et al. 2006; Matuschke and Qaim 2009; van den Broeck and Dercon 2011; Tatlonghari et al. 2012). In contrast, the second group of studies emphasizes the role of bridging and linking ties between diverse actors from civil society, public extensions, and the private sector, which provide farmers with access to external sources of information and experiences (Arora 2012; van Rijn et al. 2012; Matouš et al. 2013; Wossen et al. 2013; Isaac et al. 2014; Thuo et al. 2014). Within this group, particular studies highlight geographical factors. First, ties to geographically distant actors increase the likelihood that farmers will gain access to new information (Wossen et al. 2013), and second, experiences gained from farming in different agro-ecological settings can help to build social memory (Isaac et al. 2014). With regard to network structure, those studies applying structurally explicit approaches argue that, unlike governance, innovation requires sparse but efficient networks with a few central actors acting as brokers between formal and informal networks (Isaac et al. 2007; Isaac 2012; Isaac et al. 2014). Particular studies point to the critical roles played by elite actors linking external actors

and the community, and the danger of reproducing power imbalances through external interventions (Hoang et al. 2006; Spielman et al. 2011; Arora 2012).

8.3.3 Strand (iii): Social support

Research in this strand focuses on reciprocity between rural households as a way of pooling scarce resources and as a means of household risk management. Case studies reviewed include, for example, work on social networks as part of rural livelihood strategies (Kadigi et al. 2007; Torkelsson 2007; Nygren and Myatt-Hirvonen 2009; Ekblom 2012; Rindfuss et al. 2012; Goulden et al. 2013; Baird and Gray 2014), recovery from climate risks (Bosher et al. 2007; Rotberg 2010; Islam and Walkerden 2014, 2015), climate-change adaptation (Scheffran et al. 2012), and sustainable resource management (Downey 2010; Zimmerer 2014; Abizaid et al. 2015; Katikiro et al. 2015; Orchard et al. 2015).

Network conceptualization

Conceptual framing: The majority of studies in this strand conceptualize social networks as a source of resources supportive to the resilience of rural households and communities. Even studies not explicitly addressing resilience share the conceptualization of networks as coping strategy in times of need (Kadigi et al. 2007; Torkelsson 2007; Nygren and Myatt-Hirvonen 2009; Rindfuss et al. 2012; Gallego and Mendola 2013; Lyle and Smith 2014; Abizaid et al. 2015; Katikiro et al. 2015) and hence refer to particular aspects of resilience. Unlike studies focusing on governance and innovation, studies on social support more frequently take a community perspective conceiving of social networks as a means for communities to deal with external shocks and risks (Cassidy and Barnes 2012; Ekblom 2012; Baird and Gray 2014; Islam and Walkerden 2014; 2015).

Network variable: Studies tend to focus on the outcomes of social networks and therefore treat social networks as an independent variable. However, there are also studies treating social networks as a dependent variable, emphasizing how social support networks are influenced by the impact of socio-economic factors, such as livelihood diversification (Baird and Gray 2014; Orchard et al. 2015), gender (Torkelsson 2007), caste influence (Bosher et al. 2007), and migration (Scheffran et al. 2012; Gallego and Mendola 2013; Zimmerer 2014).

Network narrative: Most studies in this strand refer to the notion of networks as social capital explaining differences in the vulnerability of households due to their different embeddedness. Unlike literature on agricultural innovations and governance, few studies in this strand build on the notion of networks functioning as pipes for the exchange of different types of support (Rindfuss et al. 2012; da Costa et al. 2013; Zimmerer 2014; Abizaid et al. 2015; Katikiro et al. 2015) or as a form of coordination (Downey 2010).

Network operationalization

Network approach: In comparison to the other two strands, this strand is characterized by a more equal presence of all three operational approaches. Descriptive approaches, characterizing social networks according to the nature of the ties involved, account for the majority. Metaphorical approaches that refer to either the existence or the decline of social networks as an explanatory variable of resilience are more frequent than in other strands (Kadigi et al. 2007; Ekblom 2012; Scheffran et al. 2012; da Costa et al. 2013; Zimmerer 2014; Katikiro et al. 2015). Structurally explicit approaches, drawing on methods of SNA (Downey 2010; Cassidy and Barnes 2012; Lyle and Smith 2014; Abi-

zaid et al. 2015; Orchard et al. 2015) are more frequent than in the strand of agricultural innovation but less frequent than in the governance strand.

Network definition: The dominant social relation of interest is the exchange of material, financial, and emotional support between rural households at the village level. Studies tend to concentrate on the village level (Cassidy and Barnes 2012; Islam and Walkerden 2014; Lyle and Smith 2014; Abizaid et al. 2015), though there are also studies emphasizing the role of social ties that extend beyond the community (Ekblom 2012; Rindfuss et al. 2012; Scheffran et al. 2012; Gallego and Mendola 2013; Islam and Walkerden 2015; Orchard et al. 2015).

Network analysis: The main level of analysis is that of the individual, in this case, households, whereas structurally explicit studies also give attention to the network level (Cassidy and Barnes 2012; Lyle and Smith 2014). Frequently addressed characteristics include tie reciprocity and tie strength, the latter being operationalized either as bonding ties of kinship and bridging ties of neighborhood and friendship (Islam and Walkerden 2014, 2015), or as bonding ties within the community and bridging ties to actors outside the community (Rotberg 2010; Baird and Gray 2014; Islam and Walkerden 2014, 2015; Orchard et al. 2015). Compared to other strands, there is a stronger focus on network context, including social institutions and socioeconomic changes (Torkelsson 2007; Nygren and Myatt-Hirvonen 2009; Baird and Gray 2014; Katikiro et al. 2015; Orchard et al. 2015). Structurally explicit studies focus on structural characteristics such as density, hierarchy, and the centrality of particular households (Downey 2010; Cassidy and Barnes 2012; Lyle and Smith 2014; Orchard et al. 2015).

Key findings

Regarding the coping aspect of social networks, several studies emphasize the importance of strong ties of reciprocity and trust at the community level (Kadigi et al. 2007; da Costa et al. 2013; Goulden et al. 2013; Katikiro et al. 2015) or, more specifically, to the combination of strong and weak ties (Rotberg 2010; Islam and Walkerden 2014, 2015). Particular studies point to the importance of temporal dynamics by revealing that the composition and viability of bridging and bonding ties is not fixed but changes over time (Baird and Gray 2014; Islam and Walkerden 2014). Network transitions from traditional support systems to diversified market-oriented networks are shown to have ambiguous implications for community resilience. For example, transitions might foster the capacity to cope with high-incidence/low-severity impacts, while at the same time reduce the ability to manage low-incidence/high-severity shocks (Baird and Gray 2014; Orchard et al. 2015). With regard to actor characteristics, studies show that gender and socioeconomic status determine access to and ability to utilize social networks (Bosher et al. 2007; Torkelsson 2007; Cassidy and Barnes 2012; Rindfuss et al. 2012; Abizaid et al. 2015). Taking into account network structure, some studies conclude that more central households are more resilient because they can access more resources (Cassidy and Barnes 2012; Lyle and Smith 2014). Dense networks are shown to have higher redundancy and hence better opportunities to mobilize resources and act collectively, while larger and less redundant networks might yield greater returns (Orchard et al. 2015). Taking into account the effect of external factors on support networks, a small group of studies indicates the effects of migration either on participation in community networks (Gallego and Mendola 2013), or on livelihoods and resilience in the places of origin (Ekblom 2012; Rindfuss et al. 2012; Scheffran et al. 2012).

8.4 Discussion

This review of case studies on the role of social networks in the Global South extends beyond disciplinary boundaries. Its categorization system permits the different strands to be compared and thus allows similarities, differences, and blind spots to be revealed. This opens up the opportunity to critically assess the viability of a social network perspective for addressing the resilience of rural communities in the Global South as well as to discuss implications for future research.

8.4.1 Strengths, weaknesses, and challenges of current social network research in the Global South

Strand (i): Natural resource governance

Approaching social networks from a systems perspective, this strand addresses the capacity of social networks to navigate the transformation of SES toward sustainable resource use and resilience. A particular strength of this approach lies in linking social network patterns with particular resilience features (Newman and Dale 2005; Janssen et al. 2006). Against this background, studies provide instructions for strengthening the resilience of governance systems; they offer opportunities to identify cross-scale mismatches and barriers in governance processes (e.g. Crona and Bodin 2006; Stein et al. 2011; Moeliono et al. 2014; Nuno et al. 2014), to recognize potential change agents (e.g. Crona and Bodin 2010; Cárcamo et al. 2014; Moeliono et al. 2014), to design more sustainable governance regimes (e.g. Gelcich et al. 2010; Cohen et al. 2012; Hennig et al. 2012; Marín et al. 2012; Pietri et al. 2015; Marín et al. 2015). In doing so, they can draw on the elaborated toolkit of SNA, which is increasingly applied not only in the context of resource governance in the Global South but around the globe (Bodin and Prell 2011). Particularly promising in this regard is the application of SNA for disentangling coupled SES and for investigating the alignment of social and ecological structures and processes (Bodin and Tengö 2012; Bodin et al. 2014; Alonso Roldán et al. 2015).

Structurally explicit approaches, as applied in most studies, have their drawbacks, however. Formal assessment of network structure requires clearly defined network boundaries (Scott 2013), a methodological restriction in the context of dynamic rural societies. As well, the focus on definable management systems tends to ignore particularities of resource governance in the Global South, such as social, economic, and political conditions impacting the livelihoods, needs, and rationalities of stakeholders. Another drawback stems from the underlying assumption that exchange and communication between various actors inevitably increases understanding and the willingness to act collectively (Schneider et al. 2003; Carlsson and Sandström 2008; Newig et al. 2010). This collaborative bias tends to downplay conflicts underlying many current resource management issues in the Global South (McNeish 2010), in particular the role of power asymmetries (Crona and Bodin 2010). A technical and apolitical understanding of governance is problematic because it portrays resource conflicts as a manageable task involving the modification of network patterns (Zimmer and Sakdapolrak 2012; Scott 2015). In the same way, any argument that SNA can be used as a tool to improve governance processes and hence contribute to resilience runs the risk of reducing resilience building to a mere technical challenge (Scott 2015).

Instead of assuming that favorable network patterns will "lubricate the machinery of natural resource governance" (Crona and Hubacek 2010), more attention should be paid to the skills, means, and motivation of centrally positioned actors to promote new ideas and prompt collective action (Crona and Bodin 2010; Moore and Westley 2011). A critical approach to governance ought to address the question of what mode of social-ecological interactions promotes specific governance sys-

tems and whose resilience this might foster or impede (Cretney 2014). This would also entail a stronger emphasis on the social and historical context of resource governance in the Global South.

Strand (ii): Agricultural innovation

In contrast to the system perspective of the governance strand, this strand adopts an actor-based perspective on the capacity of social networks to promote adaptive capacity through social learning and the adoption of technology in the context of agrarian change. Its strength lies in accounting for a variety of actor and tie characteristics (e.g. Conley and Udry 2001; Bandiera and Rasul 2006; Tatlonghari et al. 2012; Thuo et al. 2014) as well as social, political, and religious factors (e.g. Mazzucato and Niemeijer 2000; Matouš et al. 2013). Building on descriptive approaches utilizing sophisticated econometric methods, studies in this strand are less restricted by defining boundaries and are more conscious of the relevance of relations that cross geographic scales (e.g. Matuschke and Qaim 2009; Isaac 2012; van Rijn et al. 2012; Wossen et al. 2013; Isaac et al. 2014). Although studies do not explicitly address the links between social networks and resilience, they provide valuable information about how sustainable innovations, and hence adaptive capacity, can be promoted by research, development, and policy (e.g. Hoang et al. 2006; Spielman et al. 2011; van den Broeck and Dercon 2011).

Although the descriptive approaches offer greater flexibility in the network definition than structurally explicit approaches, they are limited in their ability to assess network structure. Furthermore, using network proxies such as group membership involves methodological problems. First, farmers might adopt or choose group membership because of unobserved individual characteristics or hidden variables. Second, the behavior of the group might influence the individual, who in turn might influence the group (Manski 1993). Ways of circumventing these problems have been suggested (Bandiera and Rasul 2006; Matuschke and Qaim 2009). However, these adjustments do not account for the simplistic conceptualization of networks as pipes, which tends to oversimplify decision-making processes in rural contexts. This omission is of particular relevance because work on social contagion (Burt 1987) suggests that social actors align their behavior with reference not only according to directly available information but also according to perceived norms and roles regarding their positions within a given network structure (Burt 1987; Grabher 2006). Of further concern is the strand's bias toward economic explanations of decision making, which downplay the roles of social, political, and environmental aspects in mediating the social and economic values of innovations.

Seen from a systemic perspective, a major factor that stands in the way of understanding resilience is the strand's focus on decisions at the individual level. Understanding how social networks facilitate or impede the adoption of more sustainable agricultural practices is a major, but not a sufficient, basis upon which to make claims about the resilience of SES (Carpenter et al. 2001). As a way forward, studies that approach innovation networks from a systems' perspective (Spielman et al. 2011; Isaac 2012) and link them to concepts such as adaptive management and social memory (Isaac et al. 2014) might be instructive in addressing multiscale interactions and positioning them in social, political, and cultural contexts (Atwell et al. 2009).

Strand (iii): Social support

This strand provides insights into the ways in which households employ their social networks as a strategy to cope with and recover from risks. Its strengths lie in providing a community perspective on household coping strategies and in employing a multimethod mix comprising quantitative and qualitative aspects of social networks. This combination offers the flexibility to take into account actor, tie, and network characteristics, as well as the impact of network context such as social institu-

tions (e.g. Bosher et al. 2007; Torkelsson 2007; Nygren and Myatt-Hirvonen 2009) and socioeconomic changes (e.g. Baird and Gray 2014; Zimmerer 2014; Katikiro et al. 2015; Orchard et al. 2015). Furthermore, in contrast to the strands of governance and innovation research, studies in this strand more explicitly account for the temporal dynamics of social networks (e.g. Rindfuss et al. 2012; Goulden et al. 2013; Islam and Walkerden 2014), and hence provide a more nuanced understanding of how the resilience of rural households evolves in the context of rural transformation (Rigg 2006).

One particular issue of concern, however, stems from reducing social networks to "assets" that households have at their disposal. A tendency to reiterate tautological assumptions about the positive role of social capital (Nygren and Myatt-Hirvonen 2009) is particularly prevalent in metaphorical approaches that consider the mere existence of networks. This is a one-sided perspective, because networks are not necessarily solely beneficial but may also exclude actors from community resources and reinforce dependencies and differences between the actors (Bohle 2005; Torkelsson 2007; Steinbrink 2009). Furthermore, networks are not always readily available but involve time and resources to maintain (Nygren and Myatt-Hirvonen 2009; Lyle and Smith 2014), and their effectiveness might be limited by risks faced by its members (Gallego and Mendola 2013). Accordingly, participation in community networks is an ambiguous proxy for resilience, not least because it excludes those who cannot afford to be part of the network (Torkelsson 2007; Cassidy and Barnes 2012). Another drawback of studies in this strand is their tendency to conceive of social networks as consisting of strong bonding ties as relations of reciprocity and trust. Indeed, a bias toward reciprocal ties neglects the fact that norms of reciprocity, in particular between close family and kin, can exert high social pressure, and hence weak ties might be prioritized when seeking support (Nygren and Myatt-Hirvonen 2009).

In terms of the resilience of rural communities, it is not only problematic to confuse social proximity with the degree of support but also problematic to narrowly focus on the community level as the primary level of social interaction. Studies taking into account the impact of external actors on the resilience of rural households (e.g. Islam and Walkerden 2014, 2015) are providing important insights on the impact of external factors but might not be sufficient to address the mobility of rural livelihoods in the Global South (Ellis 2003; Rigg 2006). Rather studies should shift attention toward social ties spanning different locations to address coping capacity in an increasingly connected world (Scheffran et al. 2012).

8.4.2 General challenges

Besides the strengths and weaknesses of each research strand, our review also identifies general challenges: current case studies on the role of social networks tend to provide a static view of network outcomes, emphasize structure over agency, and neglect the spatial dimensions of social relations. A general challenge that has to be met by future social network research in the Global South is the tendency to abstract social structure from network context (Entwisle et al. 2007). Indeed, the majority of studies focus on the outcomes of networks rather than on the question of how social networks evolve in the context of change (Baird and Gray 2014). In most cases, studies addressing the impact of external drivers such as socioeconomic and political factors are following metaphorical or descriptive approaches and thus tend to remain silent about impacts in terms of network structure. Structurally explicit approaches that could provide these insights often fail to make sense of network context. Building on heuristic assumptions about how structural patterns are related to resilience features (Bodin et al. 2006; Janssen et al. 2006), studies following an analytical explicit approach tend to make general judgments about "trade-offs" between structural features and the "right mix" of ties instead of addressing the quality of ties for particular purposes (Videras 2013) and identifying contextual aspects of social interaction (De Nooy 2013). Moreover, studies tend to focus on the assess-

ment of networks at a given point in time. In dynamic contexts, such as that of rural transformation, however, assessing "network snapshots" (Ernstson et al. 2008) is not sufficient to make causal claims about resilience in the long term (Bodin and Prell 2011). This applies in particular when taking into account that SES evolve through adaptive cycles (Gunderson and Holling 2002) and that changing systems configurations might require different social networks (Downey 2010; Goulden et al. 2013). Studies using long-term panel surveys might overcome this challenge but are time and resource consuming (Rindfuss et al. 2012).

A much-discussed issue in network research is its inability to address the dialectical relationship between social structure and agency (Crona et al. 2011). This problem arises in the majority of our sample studies, which implicitly or explicitly build on the assumption that the presence of favorable networks is sufficient to ensure agency, here the ability to identify and enact solutions to sustainable development challenges (Newman and Dale 2007). However, addressing only one part of the iterative cycle between social processes and social structure (Bodin and Prell 2011) fails to make sense of the mechanisms through which social relations are reproduced and configured over time (Emirbayer and Goodwin 1994). Treating social structure "as is" (Bodin and Prell 2011, p. 365) does not reflect how that structure evolves through communicative processes (Fuhse and Mützel 2010; Ingram et al. 2014) and neglects the critical role played by the means, skills, and motivation of particular social actors who "make things happen" (Crona et al. 2011, p. 53) and, in particular, how they create social networks conducive to resilience (Moore and Westley 2011).

Finally, a further bias of current network research is its tendency not to take the spatial dimensions of social networks seriously. Indeed, most studies reviewed adopt a network-centric perspective, with a one-sided conception of horizontal and frictionless social "spaces of flows" (Jessop et al. 2008, p. 391). In general, spatial assumptions underpinning social inquiries should be treated with caution (Jessop et al. 2008) to avoid falling into the trap of determinism. In the context of the Global South, where mobility and multiple connections between rural and urban areas are the norm rather than the exception (Ellis 2003; Steinbrink 2009), a spatially blind form of social network research, however, risks losing sight of significant determinants of rural livelihoods. Migration is a major strategy for livelihood diversification (Rigg 2006; World Bank 2011) and climate change adaptation (Black et al. 2011b) and hence should be accounted for in studies addressing the role of social networks for the resilience of rural communities (Rindfuss et al. 2012; Scheffran et al. 2012; Gallego and Mendola 2013; Isaac et al. 2014).

Although all three challenges could apply to networks research in general, we argue that they are of particular concern for understanding the role of social networks for the resilience of rural communities in the Global South. Current social network research, with its static focus on network outcomes and its inability to take social agency sufficiently into account, is ill suited to addressing temporal and spatial dynamics in factually highly mobile societies (Ellis 2003; Rigg 2006). Furthermore, it provides an ahistorical perspective on social networks that tends to mask the political nature and colonial history of resource conflicts (McNeish 2010).

8.4.3 Toward a translocal social network perspective

Against the backdrop of these challenges, we envisage a social network perspective on resilience that takes into account the complexity and dynamics of rural livelihoods in an increasingly connected world. As a means to this end, we propose integrating research on social networks and resilience with the concept of translocality (Greiner and Sakdapolrak 2013b).

The concept of translocality addresses the increasing connectedness of daily life, which is inter alia facilitated by multiple forms of mobility, including everyday movements, and seasonal and long-term

migration (Brickell and Datta 2011). By emphasizing the simultaneous embeddedness of social actors in translocal networks spanning different locales, translocality combines the socio-spatial dimensions of both place and social networks (Jessop et al. 2008). It thereby challenges dichotomous geographical conceptions such as space/place, rural/urban, and core/periphery (Steinbrink 2009; Greiner and Sakdapolrak 2013a). Instead of conceiving of migration as a singular and unidirectional movement of people, translocality highlights the importance of migration-induced feedback processes between areas of origin and destination. This includes the circulation and flows of ideas, symbols, knowledge, and practices between mobile and non-mobile actors through translocal social networks (Greiner and Sakdapolrak 2013b). Hence, embeddedness in these translocal networks determines the availability of and access to resources and therefore has the potential to strengthen the resilience of its actors (Scheffran et al. 2012; Sakdapolrak 2014)

Accordingly, the notion of translocal resilience points to the role of translocal networks in conditioning the capacity of particular actors, households, and communities to cope with and adapt to changes, transform livelihoods, and explore alternative modes of social-ecological interaction (Sakdapolrak 2014; Sakdapolrak et al. 2016). These capacities in turn impact the means and opportunities to shape and utilize translocal networks. In other words, translocal networks are both preconditions and outcomes of the resilience of rural communities. By acknowledging that different capacities at individual, household, and community level are not necessarily complementary but might compete with each other, the notion of translocal resilience places particular emphasis on the role of social norms and power asymmetries in negotiating and defining desirable resilience outcomes. In other words, it provides a "situated" approach to resilience that broadens the scope of research toward including the processes and social relations that support resilience (Cote and Nightingale 2012).

A translocal network perspective, we claim, holds promise for addressing the challenges faced by current research on social networks and resilience in the Global South. First, by integrating the socio-spatial dimensions of networks and place, a translocal network perspective shifts the research focus from locally bound entities, such as the village, a region, or a management area, to the connectedness between actors at different places, while, at the same time, emphasizing the role of spatiality in social networks. Second, by taking into account mutual feedback processes between areas of origin and destination, it facilitates a dynamic understanding of complex rural transformations that cannot be understood by focusing on locally bound networks only. Third, it draws attention to the dialectic relationship between social structure and agency by revealing how capacities of resilience are related to daily practices of mobile and non-mobile actors in utilizing and shaping their networks. In doing so, it has the potential to contribute to a resilience research "of fine nuances," in the sense of Bourdieu, which takes into account economic and social power relations from the local to the global level (Deffner et al. 2014). Finally, a translocal network perspective would be suited to overcoming the apolitical tendencies of both resilience and network theory through reassessing resilience and social networks from a critical sciences perspective (Scott 2015).

8.5 Conclusion

This review provides a systematic overview on the conceptualization and operationalization of social networks across three strands of research and a discussion of their strengths and weaknesses in addressing aspects of the resilience of rural communities in the Global South. Research on governance networks, rooted in SES research, predominantly conceptualizes social networks as a form of coordination in the context of management system transformation. With its bias toward methods of formal network analysis, studies are powerful in providing insights into how networks can facilitate cross-scale adaptive management and how structural patterns relate to key system features relevant for the resilience of SES. However, because of methodological constraints, studies are limited to

clearly identifiable management systems and tend to underestimate the role of human agency and power asymmetries. Contrastingly, research on innovation networks, informed by development economics, centers around the conception of social networks as pipes of information exchange required for the adaptation to changing conditions. Econometric methods provide opportunities for assessing a wide range of factors relevant, for example, to the purposeful changes of crops and practices; however, they remain descriptive in nature and vague with regard to the impact of these changes on resilience on higher levels. Studies on social support, rooted in vulnerability and disaster research, address the role of social networks as a means of coping with shock. By conceptualizing social networks as social capital, studies in this strand help to broaden the scope of vulnerability and livelihoods research. However, they tend to focus on social networks as assets at the community level thereby omitting the role of migration-induced feedback processes between areas of origin and destination.

Opportunities for sharpening and developing future research agendas include inter alia a critical approach to governance networks that reconsiders the role of actors' differential agency and power asymmetries; an integration of actor- and systems-based approaches to agricultural innovation networks; and finally a shift away from stressing reciprocal and trusting relations at the community level toward addressing support networks spanning multiple locales in the context of mobility and social, economic, and political changes. More specifically, the review points to central challenges to be met in future research on social networks and resilience in the Global South. These particularly include the tendency of current network research to focus on network outcomes and the difficulties involved in assessing network dynamics, an overemphasis of network structure while undertheorizing the role of agency in shaping and reproducing social networks, and the tendency to neglect spatial dimensions of social relations despite the highly mobile character of many rural societies.

To address these challenges, we propose linking future research with the concept of translocality. A translocal social network perspective on the resilience of rural communities addressing embeddedness in and connectedness between places shifts the focus of research from bounded entities toward the connections between places; it takes into account the dynamic interrelationship between structure and agency and provides a multidimensional conception of social relations. Hence, it offers a framework well suited to the complexity of rural-urban realities in the Global South.

9. Case study (Article II): "Beyond the local – Exploring the socio-spatial patterns of translocal network capital and its role in household resilience in Northeast Thailand"

Preface

In this comparative case study conducted in three study sites in Northeast Thailand, the authors explore the socio-spatial patterns of translocal network capital and its role in rural households' resilience.

The study starts from the observation that livelihood research – whilst highlighting the importance of social support networks as a source of social capital and a critical feature of households' resilience– has contributed little to understanding the socio-spatial patterns of rural households' network social capital. Due to conceptual and methodological indifferences, the authors argue, livelihoods studies are run risk of omitting translocal networks spanning beyond community boundaries, and therefore relevant aspect of rural livelihoods. In order to close this gap, the authors apply a translocal network approach to the study of rural households' capital in three study sites in Northeast Thailand, combining methods of quantitative and qualitative social network analysis (SNA). In doing so, the authors address the questions a) for what purpose, and b) to whom does translocal network capital matter, and discuss c) the role of translocal network capital in rural households' resilience.

This study stands in the tradition of vulnerability and livelihood research conceptualizing rural households' support networks as a source of social capital. At the same time, its shares conceptual ground with resilience research, highlighting social networks as a crucial source of social resilience and a contribution to households' capacity to cope, adapt and transform rural livelihoods. Taking into account the observation that, in Thailand and other emerging and developing economies, rural livelihoods are increasingly diversified and delocalized, the central assumption of this study is that rural households are also increasingly drawing on translocal support networks, involving informal and formal sources of support at various geographical levels. Based on participatory network mapping activity in combination with semi-structured household interviews this study provides detailed insights into the composition and distribution of households' social support networks by type of support and socio-economic status. The findings reveal that that translocal network capital is less relevant in terms of labor than in terms of advice, and particularly relevant in terms of finance. Poor households have less translocal network capital at their disposal but rely more critically on migration-related translocal bonding capital, in particular on financial remittances, to cope with adverse livelihood conditions. In contrast, better-off households have more translocal network capital at their disposal, in particular bridging ties to institutions, providing advice and finance for the transformation towards market-oriented agriculture.

The authors conclude from these findings that network capital is not a uniform resource, and should not be taken for granted. Rather than being readily available, network capital relies on task specific social networks which are not equally accessible and viable among households. Furthermore, the authors argue that the plight of the poor does not solely lies in the lack of bridging capital, but in the critical reliance on migration-related translocal bonding capital in combination with a lack of effective local capital. Better-off households are instead are not only more successfully weaving translocal networks but also employ them more effectively in transforming towards market-oriented agricultural livelihoods. Obviously, in Northeast Thailand, network capital appears to make a smaller contribution to the resilience of poor households than to the resilience of wealthier households. These findings are in line with doubts regarding simplistic claims that social capital is monotonically relat-

ed with resilience and direct attention to the question of under what conditions social capital fosters resilience, and under what conditions it undermines it.

With this analysis, the authors not only add to the understanding of the role of translocal network capital in household resilience in Northeast Thailand but also underline the urgent need to scrutinize the viability of existing conceptualizations of social capital and, in particular, highlight the need for overcoming dominant notions of locally rooted social capital. The applied translocal network perspective, the authors conclude, has proven fruitful for revealing the complex socio-spatial patterns of households' network capital, and for enhancing the understanding of its role in rural households' resilience in the context of migration and rural transformation.

Abstract

Livelihood studies have highlighted social support networks as critical sources of social capital and as an important feature of rural households' resilience, however so far, have contributed little the understanding of network capital's socio-spatial patterns. Accordingly, livelihood studies have tended to omit relevant determinants of rural households' resilience, especially in emerging and developing countries, such as Thailand, where rapid agrarian change and migration have resulted in increasing translocal connectedness between rural and urban areas and unevenly distributed livelihood outcomes. This paper aims at closing this gap, by systematically assessing the socio-spatial patterns of rural households' translocal networks in Northeast Thailand. Applying a translocal network approach combining methods of formal social network analysis (SNA) and qualitative network research, we find that translocal network capital matters more for accessing advice than for labor, but particularly for accessing financial support. Although poor households have less translocal network capital at their disposal, they depend more critically on translocal networks than rich households. While poor households rely particularly on migration-related bonding ties to provide financial means for coping with precarious livelihood conditions, rich households can leverage institutional translocal bridging ties to access advice and finance for the transformation towards market-oriented agriculture. These findings suggest that, in Northeast Thailand, translocal network capital contributes less to the poors' than to the richs' resilience. We conclude by calling for a more nuanced consideration of the socio-spatial patterns of network capital and propose applying a translocal network perspective as a fruitful means to this end.

9.1 Introduction

In recent decades, social networks have gained increasing attention in the study of rural livelihoods (Scoones 2009; Steinbrink and Niedenführ 2017). Providing access to various resources in times of need, support networks have been highlighted as critical sources of social capital (Woolcock and Narayan 2000; Allison and Ellis 2001; Adger 2003; Ryan et al. 2008) and as an important feature of rural households' resilience (Cassidy and Barnes 2012; Aldrich and Meyer 2015; Rockenbauch and Sakdapolrak 2017). This includes, inter alia, the access to agricultural labor (Downey 2010; Abizaid et al. 2015), agricultural knowledge (Isaac et al. 2014; Rockenbauch et al. 2019b) , credit (Fafchamps and Lund 2003; Dufhues et al. 2012) and financial remittances (Sakdapolrak 2008; Rindfuss et al. 2012). Consequently, social support networks are increasingly recognized as important means of income diversification (Baird and Gray 2014; Johny et al. 2017), disaster recovery (Hawkins and Maurer 2010; Islam and Walkerden 2014) and climate change adaptation (Cassidy and Barnes 2012; Dapilah et al. 2020).

Whilst studies on social support networks have shed light on the importance of network capital for household resilience, they have contributed little to the understanding of its socio-spatial patterns

(Elliott et al. 2010; MacGillivray 2018). The understanding of the structural features of rural households' network capital has remained vague and most studies have tended to use social networks as a metaphor for connectedness rather than as an analytical concept. Only recently, studies are applying methods of formal social network analysis (SNA) in order to systematically assess the structural properties of households' support networks (Misra et al. 2014; Rockenbauch and Sakdapolrak 2017). The understanding of the spatial dimension of households' network capital has remained vague (Elliott et al. 2010), because studies have tended to either focus on networks between households at community level or on particular migration-related ties, rarely addressing translocal household support networks comprising local to international sources of support (De Haan and Zoomers 2003; Rockenbauch and Sakdapolrak 2017; Steinbrink 2017). Finally, the question which households are actually benefiting and which households are deprived of network capital remains open to discussion, as studies have tended to take networks for granted (Steinbrink 2017) and paid little attention to socioeconomic differences in network access and utilization (Elliott et al. 2010).

Due to these social and spatial indifferences, we argue, previous studies of social support networks have tended to omit relevant determinants of rural households' resilience. The main objective of this paper is to close this gap by systematically assessing the socio-spatial patterns and importance of translocal network capital, mapping local as well as translocal sources of support available to rural households of different socio-economic status. Therefore we apply a translocal network approach, combining methods of formal social network analysis (SNA) (Wasserman and Faust 1994) and qualitative network research (Hollstein and Straus 2006). In doing so, this paper addresses the questions, (a) for what purpose and, (b) to whom does translocal network capital matter, and discusses (c) the role of translocal network capital in rural households' resilience.

Our study is based on field work conducted in rural areas of Northeast Thailand, where rapid agrarian change (Rigg 2006; Rambo 2017) and migration (Sakdapolrak 2008; Le Mare et al. 2015) have resulted in increasing connectedness between rural communities and urban areas and in unevenly distributed livelihood outcomes (Rigg and Salamanca 2011; Rigg and Oven 2015). For sustaining livelihoods, rural households in Northeast Thailand are increasingly drawing on translocal networks stretching far beyond community boundaries.

These translocal networks, inter alia, provide agricultural labor and machinery (Funahashi 1996; Faust et al. 2000), agricultural extension and migration-related knowledge (Rockenbauch et al. 2019b), formal credit (Dufhues et al. 2012), and financial remittances (Rindfuss et al. 2012; Peth et al. 2018; Porst and Sakdapolrak 2018). The increasing integration of rural households in translocal networks (Rambo 2017), however, comes at the cost of eroding rural communities and the decline of communal arrangements, such as labor exchange networks (Funahashi 1996) and community safety nets (Rigg and Salamanca 2009). These contrary developments have evoked the question, who is profiting from the delocalization of rural livelihoods and who is not (Rigg and Oven 2015).

Analyzing fine-grained data on the geographical distribution and social composition of households' support networks in Northeast Thailand, we find that translocal network capital is less relevant in terms of labor than in terms of advice, and particularly relevant in terms of finance. Poor households have less translocal network capital at their disposal but rely more critically on migration-related translocal bonding capital, in particular on financial remittances, to cope with adverse livelihood conditions. In contrast, rich households have more translocal network capital at their disposal, in particular bridging ties to institutions, providing advice and finance for the transformation towards market-oriented agriculture. Accordingly, we argue, in Northeast Thailand, rich households are benefiting more from translocal network capital than poor households. For understanding households' resilience in mobile and translocal rural societies, we conclude, a translocal network perspective is

instructive and helps avoiding the ambiguity of often too-simplistically drawn social capital conceptualizations.

9.2 Theoretical background

This study draws on the notion of network capital and builds on a critical assessment of studies on social support networks in the fields of rural livelihood studies and translocality.

9.2.1 Social networks and network capital

Social capital scholars have highlighted social networks' role as an important source of social capital (Burt 2000; Ryan et al. 2008). Seen from a social network perspective, social capital inheres in social relations rather than in the individuals that form these relations (Elliott et al. 2010). Network capital has been defined as a specific form of social capital that makes resources available through social networks and fosters the ability to deal with daily life, seize opportunities, and reduce uncertainties (Wellmann and Frank 2001; van der Gaag and Snijders 2005; Prell 2006).

A common conceptualization of social capital distinguishes between "inward looking" bonding and "outward looking" bridging social capital (Putnam 2000). Bonding capital, considered crucial for "getting by" in times of need, arises from strong-knit ties within a more or less homogenous group of similar actors. Bridging capital, assumed crucial for "getting ahead", arises from rather weak-knit ties connecting actors beyond a social subgroup (Woolcock 2001; Baird and Gray 2014). The binary between bonding and bridging capital has been criticized for being too simplistic (Patulny and Lind Haase Svendsen 2007), diverting attention to differences between network actors instead of accounting for the resources these actors are able and willing to provide (Ryan et al. 2008; Ryan 2011). Accordingly, authors have highlighted the role of linking capital, vertical bridging ties to institutions at higher societal and organizational levels holding relative power and influence (Woolcock 2001; Hawkins and Maurer 2010).

9.2.2 Social support networks and rural livelihoods

The idea of social networks as a source of support in times of need is well established in development research (Bohle 2005; Baird and Gray 2014). Whilst vulnerability studies have conceptualized social support networks as informal coping strategy (Steinbrink and Niedenführ 2017), livelihood studies have conceptualized social support networks as a crucial source of households' social capital (Woolcock and Narayan 2000; Allison and Ellis 2001) and thereby have drawn attention to the adaptive and transforming capacities of social networks (Adger 2003; Keck and Sakdapolrak 2013; Dapilah et al. 2020). Livelihood studies, however, have been criticized for taking social networks for granted (Steinbrink and Niedenführ 2017), and for paying little attention to their social and spatial structure (Elliott et al. 2010; Rockenbauch and Sakdapolrak 2017; MacGillivray 2018).

A prominent point of critique addresses the implicit assumption of many livelihood studies that social capital can compensate for a lack of other capitals. However, instead of being readily available assets, social networks must be established and maintained. Networking is time and cost intensive (Steinbrink and Niedenführ 2017) and depends on endowment with other types of capital (Garip 2008). Households of different socioeconomic status might experience not only different necessities but also different opportunities in establishing and drawing on social networks (Ryan et al. 2008). Woolcock (2001) has described the plight of the poor as being reliant on close-knit bonding capital for "getting by" but lacking bridging and, in particular, linking capital for "getting ahead". However,

direct comparisons of network utilization among unequal social groups have remained the exception (Elliott et al. 2010).

Less prominently criticized is the fact that livelihood studies, so far, have provided only a vague understanding of the structural patterns underlying social capital. Although social capital is fundamentally a theory of social networks (MacGillivray 2018), it is only recently, that studies – inspired by developments in sociology (Borgatti et al. 2009) – are applying methods of formal social network analysis (SNA) for accessing and analyzing the structural features of household support networks (Misra et al. 2014). This includes, for example, the assessment of networks for the exchange of labor, information, and money (e.g. Cassidy and Barnes 2012; Lyle and Smith 2014; Abizaid et al. 2015).

Vague, as well, remains the understanding of social capital's spatial dimension (Elliot et al., 2010). If not abstracting from space at all (Faust et al. 2000), livelihood studies have tended to focus on community networks (Rockenbauch and Sakdapolrak 2017). This local bias can be explained with the prevailing notion of locally rooted social capital (Putnam 2000), which has led to the assumption that social capital primarily resides in dense and localized networks (Ryan et al. 2008). Also the preoccupation with households and communities as the major object of research and level of analysis has favored the study of local networks (Steinbrink and Niedenführ 2017). Besides conceptual reasons also methodological reasons exist. As the analysis of network structure is most powerful within defined network boundaries (Hennig et al. 2012), studies applying methods of SNA have tended to focus on village networks, thereby neglecting networks' dynamics in space and time (Violon et al. 2016).

Those scholars accounting for the spatiality of social networks have proposed different perspectives to social capital (*Figure* 11). For example, Woolcock and Narayan (2000) have defined bonding ties as intra-community ties and bridging ties as ties connecting beyond the community context. Islam and Walkerden (2014/15) have defined bonding ties as ties between family members and close relatives, bridging ties as ties to far relatives and friends, and linking ties as ties connecting to formal institutions external to the community. Both definitions have in common that they conflate the form of social capital with its geographical distribution. In contrast, a translocal perspective to social capital, as proposed by Elliot et al. (2010), is extending the distinction between bonding and bridging social capital to include a spatial dimension.

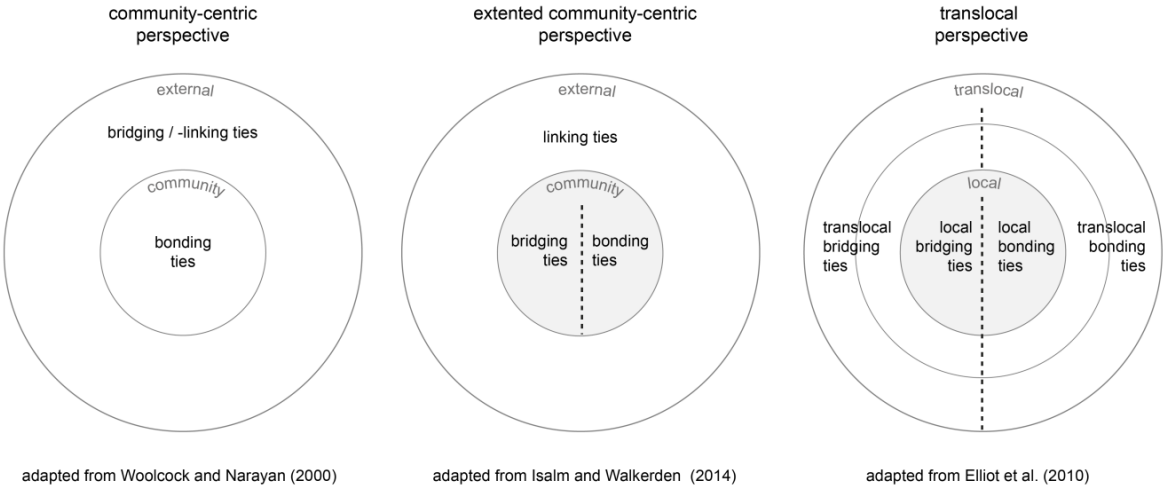


Figure 11: Conceptualizations of social capital's spatial dimension *(adapted from Woolcock and Narayan (2000), Islam and Walkerden (2014), Elliot et al. (2010))*

9.2.3 Translocal networks and household resilience

A more thorough consideration of social capital's spatial dimension (Elliott et al. 2010) is gaining particular relevance in light of the advancing diversification, marketization, and delocalization of rural livelihoods in many developing and emerging economies (Rigg 2006). Increasing frequency and diversity of interactions across geographical scales are blurring economic, social, and cultural differences between "the rural" and "the urban" (Berdegué et al. 2014). Rural households are no longer rooted in one place but function in larger networks (De Haan and Zoomers 2003), spanning places of origin and destination of migration (Steinbrink 2009; Naumann and Greiner 2017).

Against this background, a growing number of studies are applying a translocality perspective (Brickell and Datta 2011). Translocality studies focus on the embeddedness of mobile and immobile actors in translocal networks spanning places of origin and destination of migration (Greiner and Sakdapolrak 2013b; Porst and Sakdapolrak 2017). Drawing attention to the flow of people, financial remittances, knowledge, skills, and practices between places, translocality studies are providing increasing evidence that translocal networks are potential sources of household resilience and climate change adaptation (Scheffran et al. 2012; Sakdapolrak et al. 2016; Peth et al. 2018; Porst and Sakdapolrak 2018).

Albeit making the point for a shift away from the assessment of either community or migration-related networks towards the consideration of translocal networks, also translocality studies, so far, have contributed little to the understanding of the socio-spatial patterns of network capital. Most studies draw on loose conceptualizations of social networks, paying little attention to their structural features (Ryan et al., 2008) and, instead, have tended to focus on particular ties between migrants and their sending household. Accordingly, the application of SNA as a means of systematically assessing migration-related translocal networks (Bilecen et al. 2018) in particular and the assessment of translocal network capital in general has been limited.

9.3 Conceptual framework

To explore the socio-spatial patterns of translocal network capital and its role in household resilience, this paper applies a translocal network perspective to rural households' support networks in Northeast Thailand.

Based on the theoretical considerations outlined above, we conceptualize network capital as a particular type of social capital conferred through rural households' support networks. Households' support networks provide access to resources, such as labor, advice, and finance, required for coping in times of need and, potentially, for adapting and transforming household livelihoods (Sakdapolrak et al. 2016). Taking into account the observation that, in Thailand and other emerging and developing economies, rural livelihoods are increasingly diversified and de-localized (Rigg 2006; Rigg and Oven 2015), we assume that rural households are also increasingly drawing on translocal support networks, involving informal and formal actors at various geographical levels. This translocal network capital, we hypothesize, is not equally viable for different support types and is not equally available among households of different socio-economic status.

To reveal the geographical distribution and social composition of support networks we opt for an ego-centric network approach (Hennig et al. 2012; Scott 2013), focusing on the embeddedness of an individual (ego) in its social environment (alters) (Borgatti et al. 2009). Unlike socio-centric network assessments, ego-centric assessments provide limited structural information, but do not require a-priori definitions of network boundaries and therefore are applicable in a translocal context (Rockenbauch et al. 2019b).

Figure 12 represents our research framework. We define the network of receiving various types of support (ties) from various actors outside the household (alters) (van der Gaag and Snijders 2005). With regard to the type of support, we restrict our scope to social support relevant to rural livelihoods in Northeast Thailand: the provision of agricultural labor, the provision of advice regarding agricultural practices and policies, and the remitting or lending of money for household consumption and agricultural investments (Faust et al. 2000; Rindfuss et al. 2012; Chichaibelu and Waibel 2017; Rockenbauch et al. 2019b).

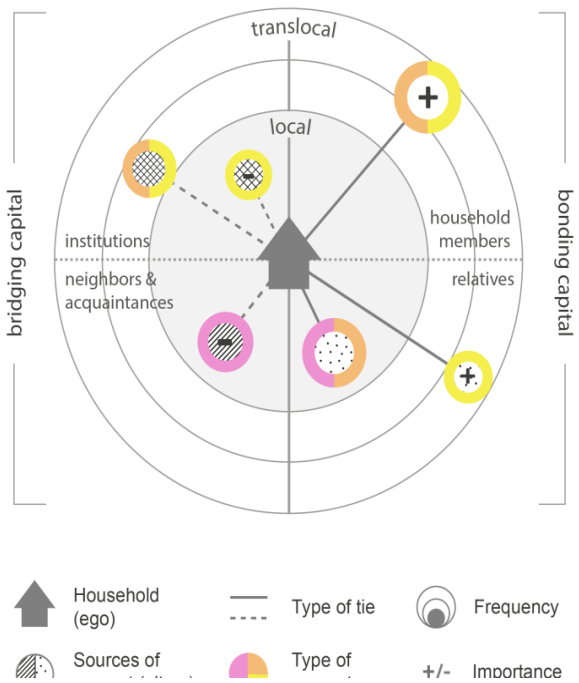


Figure 12: Conceptual framework *(own figure). Ego-centric translocal household support network consisting of the receiving household (ego) and sources of support (alters) at different geographical levels (circles). Node shading indicates actor groups (e.g. household members, relatives), and tie style indicates the according type of tie (bonding/bridging). Node color indicates the provision of different types of support (labor, advice, finance). Node size indicates the share of ties in overall support, and symbols (±) indicate the perceived importance of particular ties for household livelihoods.*

Regarding the geographical distribution of support networks, we distinguish local from translocal ties: local ties include all support originating within the village and sub-district in which households are physically rooted and most of the daily social practices materialize (Verdery et al. 2012); Translocal ties we define as ties originating from: the district level, the main administrative and political sub-center in rural areas in Northeast Thailand; the national level, in many cases Bangkok (Porst and Sakdapolrak 2018); and the international level, including countries such as Singapore, Korea, or Taiwan (Peth et al. 2018).

To characterize the social composition of support networks, we consider the social relation between the source of support (alters) and the receiving household (ego) (Hollstein and Straus 2006). Bonding and bridging ties are defined along four actor groups (household members, relatives, neighbors and acquaintances, institutions). Bonding ties are defined as all ties with household members and kin. Household ties comprise support provided by external household members temporarily or continuously staying outside the household but still perceived as a part of the household. Kinship ties comprise support provided by relatives who are not a household member (i.e. siblings who have established their own household already). Bridging ties are defined as both informal support by non-kinship neighbors and acquaintances and formalized support by institutions at various levels. In Thailand, relevant institutions include community organizations, such as saving and lending groups, or public organizations, such as agricultural cooperatives and agricultural extension agencies, and private actors, such as traders and agricultural shops (Suebvises 2018). Besides assessing the distri-

bution and composition of ties, we also account for the perceived importance of support provided. In combination, tie frequency and importance indicate the relevance of network capital for household livelihoods.

9.4 Methods

Research was conducted between March and July 2015 in Northeast Thailand under the umbrella of a research project on translocal resilience, climate change, and migration in Thailand.

9.4.1 Selection of study sites

Northeast Thailand (Isan) is one of the country's poorest regions (Le Mare et al., 2015). Although recent years have witnessed increases in crop productivity (Grandstaff et al. 2008) and the transformation towards large-scale cash-crop production (Podhisita 2017; Choenkwan and Fisher 2018), small-scale subsistence-based farming prevails. The livelihoods of Isan households are showing a remarkable resilience (Rigg and Salamanca 2011), despite economic stressors such as price volatility (Rambo 2017), labor shortage (Funahashi 1996), demographic changes, particularly population ageing (Podhisita 2017; Yuko and Rambo 2017), and climate-related risks, such as droughts and floods and increasing variability in rainfall patterns (Naruchaikusol 2016). An important aspect of this resilience is the diversification and the delocalization of household livelihoods (Rigg 2006; Rigg and Salamanca 2011). With its high rate of internal and international migration and the resulting translocal connectedness, Northeast Thailand provides a good example for studying the socio-spatial patterns of translocal network capital and its role in household resilience.

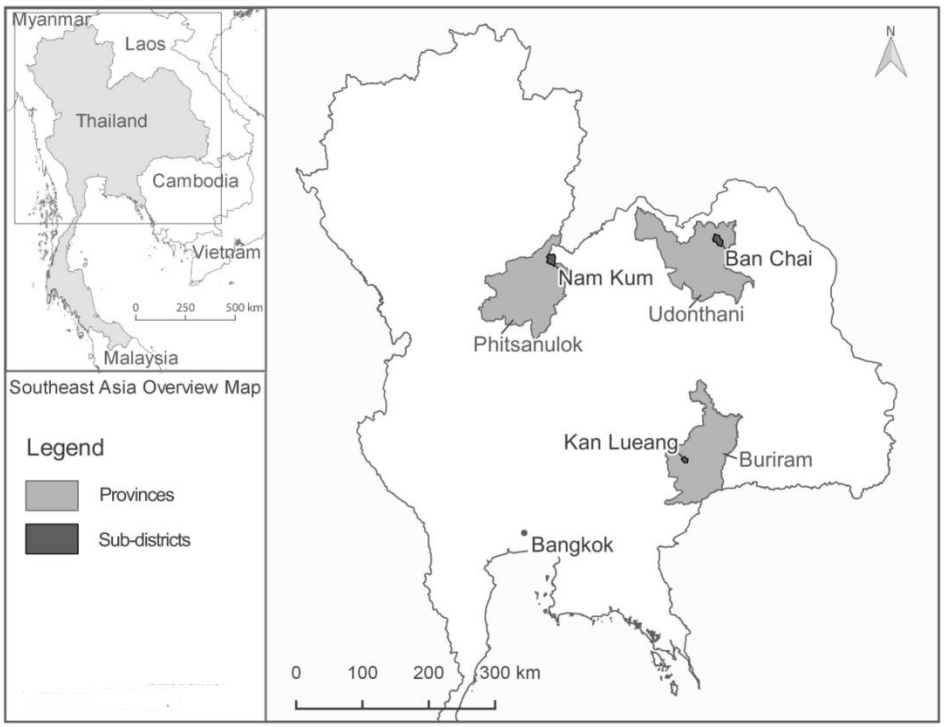


Figure 13: Location of study sites
(layout by the authors, data source: Global Administrative Areas, www.gadm.org)

Based on a set of criteria, including agro-ecological conditions, climate change impact, and prevalence of migration, we chose three sub-districts in three different provinces (*Figure* 13). In each sub-district, we conducted focus group discussions with village representatives to gain insights into household livelihoods and migration patterns. Based on this information we chose two villages in each sub-district.

9.4.2 Household interviews

As a guide to selecting households in each village, we conducted a participatory mapping exercise (Narayanasamy 2009) in which villagers were asked to indicate households on a map according to land size and involvement in migration. The resulting community maps provided the basis for household sampling.

Interviews were conducted with household representatives and consisted of two thematic parts. Part A included a semi-structured interview on household livelihoods, agricultural activities, and migration. Part B involved a participatory network mapping activity combing quantitative ego-network assessment (Hennig et al. 2012; Scott 2013) with qualitative methods of network visualization and evaluation (Hollstein and Straus 2006; Schönhuth et al. 2013). We applied a modified version of the name-generator technique (Marsden 2005). The interviewee (ego) was asked to identify network actors (alters) relevant for providing support in terms of (a) agricultural and household labor, (b) advice regarding agricultural issues, and (c) finance for household and agricultural investments. Alters were indicated using colored cards to represent different actor groups (household members, relatives, neighbors and acquaintances, institutions). Each alter was placed according to its geographical location on a pin board containing concentric circles (Kahn and Antonucci 1980) representing different geographical levels (village, district, national, abroad) with the household in the middle. Different support types (labor, advice, finance) were indicated by colored point-it markers. For each support type, interviewees were asked to score the importance of alters for the household livelihood (from 0 to 4) using colored pins (*Figure 14*).

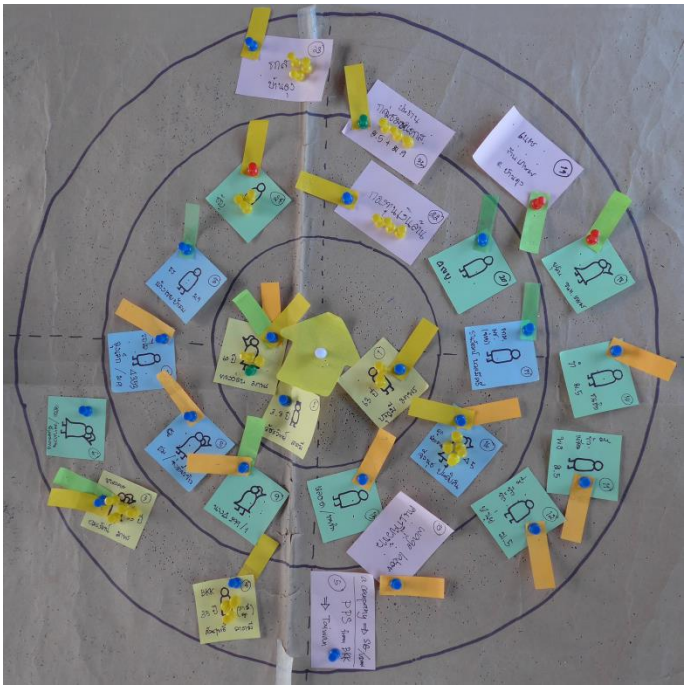


Figure 14: Results from participatory network mapping *(photo by the author). Circles indicate geographical locations, colored cards indicate actor groups, colored point-it markers indicate support types, and number of pins indicate importance.*

9.4.3 Data processing and analysis

Based on households' livelihood data, we classified all sampled households ex-post into three wealth categories. We constructed a simple composite household wealth-index based on the following indicators: land ownership as the major household asset and agricultural production factor; housing facilities as a visible indication of wealth; the availability of bigger vehicles and agricultural machinery as a means of agricultural production and transportation; and the membership with state-owned financial institutions as a means of formal credit access. To account for regional differences, we scored indicators separately for each study site. From these scores, we derived standardizes indices (0–1), which then were calculated into an overall household wealth index (Gautnam and Anderson, 2016).

This paper builds on data from interviews with 70 household representatives of different wealth categories in three study sites in Northeast Thailand and involves information on a total number of 762 alters and 891 ties. To analyze network patterns and importance, we calculated tie frequency and tie importance by geographical level and actor group, disaggregated by support types and wealth categories, respectively. We calculated first the frequency of ties and scores per household and then the average frequency of ties and scores by support type and wealth category. In combination, averaged tie frequency and averaged score frequency indicate tie relevance. Averaged tie frequency indicates the extent to which a particular actor group at a particular geographical level provides support. An averaged score frequency that exceeds the averaged tie frequency indicates that ties are perceived as relatively more important; an averaged score frequency that is lower than the averaged tie frequency indicates that ties are perceived as relatively less important.

9.5 Results

In the following, we present data on selected household characteristics (Section 9.5.1) and on the socio-spatial patterns and the importance of translocal household networks (Section 9.5.2).

9.5.1 Household characteristics

Table 3 provides an overview of selected household characteristics by wealth categories (poor, middle, rich). Involvement in migration is relatively high across all wealth categories. Current and past involvement in migration is pronounced most among middle households and least among rich households. Middle households are not only more involved in migration but also more frequently receive remittances and more frequently indicate remittances from migrants as the main household income source. In contrast, rich households rely more frequently on agriculture as the main income source, whereas the share of households indicating local wage labor as the main income source is highest among poor households. The average number of income sources is highest among rich households and lowest among poor households.

Average land size is very unevenly distributed; as particular rich households own large plots of land and particular poor farmers owning no land at all. Poor households have the least diversified agricultural portfolio and are least involved in cash-crop production. All households farm rice for self-consumption, except for some poor households lacking suitable land. Rich households grow, on average, more crop types than poor and medium households, in particular sugarcane and cassava. Participation in reciprocal labor exchange is almost non-existent among poor and rich households and rare among middle households. A relatively high share of rich households hires wage laborers through commercial middlemen. Penetration of institutional advice is relatively high across all households, but highest among rich and lowest among poor households. In particular, the share of households

receiving advice from village representatives is considerably higher among rich than among poor households. Access to loans is high across all wealth categories; however, the share of households receiving formal bank loans is considerably higher for rich households. Instead, informal loans are particularly frequent among poor and middle households.

Table 3: Selected household characteristics, by wealth category

Households (HHs)	Poor	Middle	Rich
Number of HHs	25	25	20
Migration			
HHs with at least 1 active migrant (%)	60%	76%	40%
HHs with at least 1 migrant in the last 5 yrs. (%)	80%	92%	80%
Income sources			
HHs with main income from agriculture (%)	28%	24%	70%
HHs with main income from remittances (%)	32%	48%	10%
HHs with main income from wage labor (%)	24%	12%	5%
HHs with main income from other sources (%)	16%	16%	15%
Average number of income sources	3.6	4.0	4.3
Agricultural activities			
Average land size cultivated	7	19	74
Average number of crops	1.7	2.2	2.5
HHs farming sugarcane (%)	8%	16%	50%
HHs farming cassava (%)	20%	12%	40%
HHs farming maize (%)	16%	32%	20%
HHs farming rice (%)	88%	100%	100%
HHs farming cash crops (sugarcane, maize, cassava) (%)	40%	52%	75%
Labor			
HHs involved in labor exchange (%)	20%	44%	20%
HHs hiring additional wage labor (%)	20%	24%	60%
Advice			
HHs in receiving advice from translocal institutions (%)	52%	72%	85%
HHs receiving advice from village representatives (%)	56%	76%	80%
Finance			
HHs receiving formal loan (bank) (%)	32%	60%	85%
HHs receiving informal loan (%)	20%	28%	0%
HHs receiving remittances (%)	76%	84%	60%

9.5.2 Network patterns and importance

The following sub-sections characterize networks patterns and importance by looking at tie distribution (local/translocal) and tie composition (bonding/bridging ties, actor groups), for different support types (labor, advice, finance) and wealth categories (poor, middle, rich).

9.5.2.1 Support types

Network patterns and importance differ considerably depending on the type of support provided. The most pronounced differences in terms of geographical distribution and social composition can be observed between labor networks and financial networks (*Figure* 15).

Labor is the most localized type of support and biased towards bonding ties. Although of limited frequency, translocal ties are of higher importance than local ties. Bonding ties provide the majority of labor and are considered as more important than bridging ties. In particular, labor is dominantly provided through important local bonding ties to relatives. Also, local bridging ties to neighbors are relatively frequent but of considerably low importance. The relatively higher importance of translocal labor is particularly due to a low share of highly important translocal bonding ties to seasonally migrating household members and relatives.

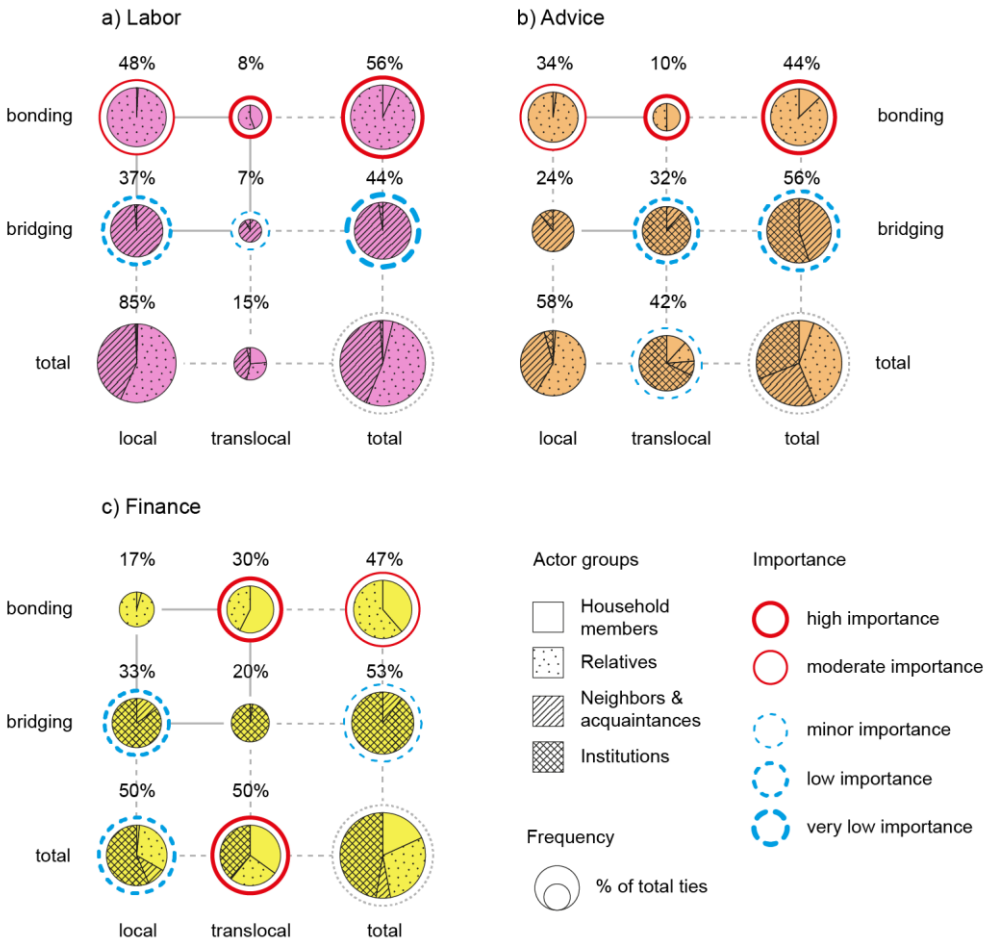


Figure 15(a–c): Tie distribution and composition in terms of frequency and importance, by support types

Advice is more translocal than labor but less than finance. Although translocal ties account for a considerable share in advice, they are considered less important than local ties. In comparison to labor and finance, advice is to a higher extent provided through bridging ties, which are, however, of low importance. The biggest share of advice is provided through local bonding ties to relatives and translocal bridging ties to agricultural extension agencies, such as the district branch of the Department of Agricultural Extension (DOAE), and private agricultural input suppliers. Translocal bridging ties are of considerably low importance. Instead, local bridging ties to neighbors – although of relatively lower frequency – are of comparatively higher importance than for labor and finance. Like for labor, the most important but least frequent source of advice are translocal bonding ties to migrating household members and relatives.

Finance is the most translocal type of support. While finance is to equal shares provided through local and translocal ties, translocal ties are considered considerably more important than local ties. Bridging ties are slightly more frequent sources of finance than bonding ties, whereby differences in the importance of bonding and bridging ties are less pronounced than for labor and advice. Finance is mostly provided by local bridging ties, in particular community institutions, including saving groups or village funds, which are, however, of low importance. Also frequent but highly important are translocal bonding ties to migrating household members and relatives working in Bangkok or other industrial centers of Thailand, such as Ayutthaya or Chonburi, and migrating household members working in foreign countries, such as Korea, Taiwan, and Israel. As well, translocal bridging ties, in particular to financial institutions, such as the Bank of Agriculture and Agricultural Cooperatives (BAAC), account for a considerable share in finance and are of comparatively higher importance than for labor and advice.

9.5.2.2 Wealth categories

Networks of poor and middle households are relatively similar in terms of tie composition but differ in terms of tie distribution. Networks of the poor and the rich differ in terms of both tie distribution and tie composition (*Figure* 16).

Poor households have the most localized networks, but perceive of translocal ties as considerably more important than local ties. Bonding and bridging ties are of equal frequency, although the former are of considerable more importance than the latter. Networks of poor households are characterized by frequent local bridging ties to neighbors and community institutions, which are, however, of low importance. Slightly less frequent local bonding ties to relatives are comparatively more important. The limited share of translocal ties in networks of poor households is dominated by translocal bonding ties to migrating household members and relatives, which are considered the most important source of support. In contrast, translocal bridging ties – mostly to translocal institutions – are of relatively lower frequency than among other households.

Middle households have better access to translocal ties, but unlike poor do not attribute particular importance to translocal ties. More than networks of others, networks of middle households are biased towards frequent and important bonding ties. Networks of middle households are characterized by a pronounced dominance of local bonding ties to relatives, which are more frequent than among other households. At the same time, middle households draw less than other households on local bridging ties to neighbors and community institutions. In comparison with networks of poor households, the relatively higher share of translocal ties is due to a higher share of translocal bridging ties, mostly to institutions. These translocal bridging ties are of comparatively lower importance than among poor and rich households, however. At the same time, translocal bonding ties to migrating household members and relatives are of equal frequency and importance as among poor households.

Rich households draw more frequently than other households on translocal support, however, like middle households do not attribute particular importance to translocal ties. Different than other networks, networks of rich households are biased towards bridging ties and differences in the importance of bonding and bridging ties are less pronounced. Like networks of poor households, networks of rich households are dominated by frequent but less important local bridging ties to neighbors and community institutions. Local bonding ties to relatives, instead, are of lower frequency than among other households. With regard to more frequent translocal ties, rich households draw more frequently on translocal bridging ties to institutions than do other households. At the same time, translocal bonding ties to migrating household members and relatives are not only less frequent but also of comparatively lower importance than among poor and middle households.

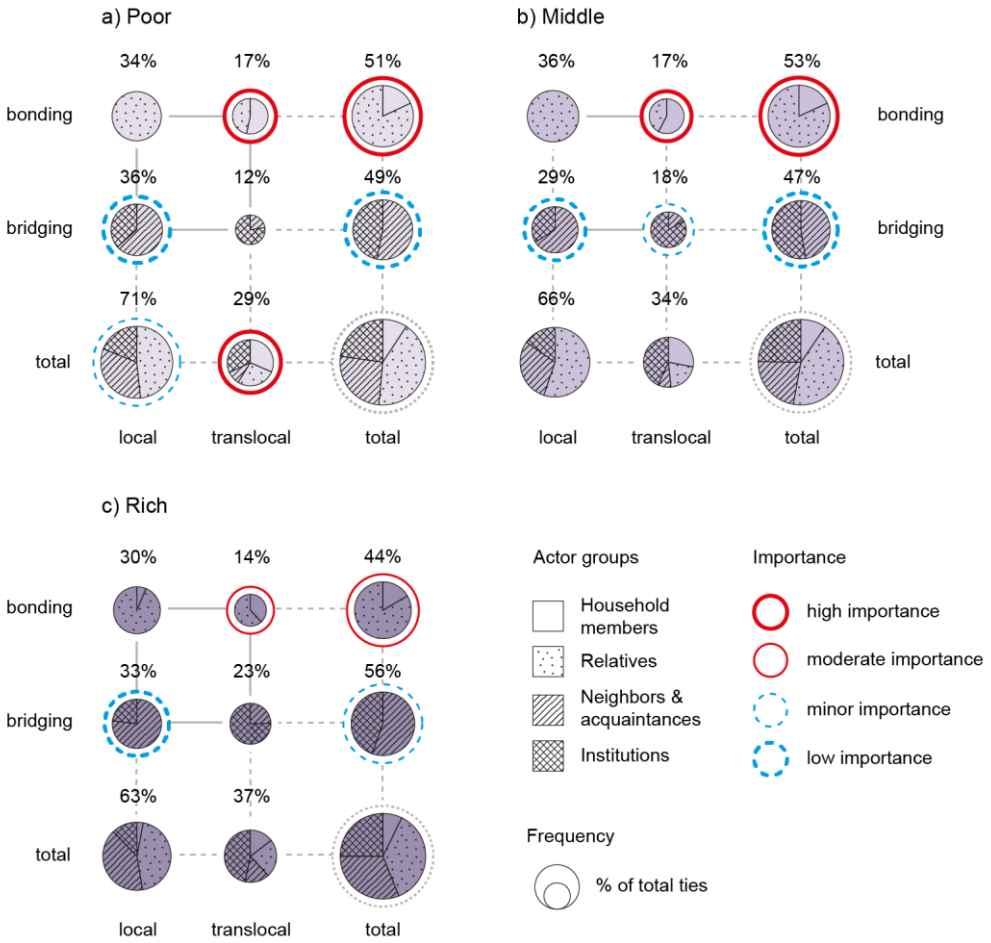


Figure 16(a–c): Tie distribution and composition in terms of frequency and importance, by wealth category

9.5.3 Support types by wealth categories

Differences in geographical distribution are most pronounced between the financial networks of rich households and those of poor households while differences in social composition are most pronounced between the advice networks of rich households and those of poor and middle households (*Figure* 17*a–c).*

Labor

Figure 17*a* shows that poor households draw least on translocal labor but attribute relatively greater importance to translocal labor than other households. The majority of labor available to poor households is provided through local bonding ties to relatives and local bridging ties to neighbors, whereas the former are of considerably higher importance than the latter. In comparison to middle and rich households, the poor have less translocal bonding ties to seasonally migrating household members, but nevertheless attribute high importance to them.

Labor networks of middle household differ from labor networks of other households in terms of a more pronounced dominance of bonding ties. In particular, local bonding ties to relatives are more frequent, while local bridging ties to neighbors are less frequent than among other households. With regard to limited translocal ties, middle households attribute comparatively lower importance to translocal bonding ties to seasonally migrating household members and relatives than do other households.

Rich households draw more than other households on translocal labor and, to an equal extent, draw on bonding and bridging ties. Characteristically, rich households draw the biggest share of labor through local bridging ties to neighbors. Local bonding ties to relatives are not only less frequent, but also of relatively lower importance than among other households. Rich households also draw more than other households on translocal bonding ties, mostly provided by relatives at district level, and perceive of them as highly important source of labor.

Advice

As *Figure* 17*b* shows, poor households draw more on and attribute greater importance to translocal advice than middle and rich households. Poor households draw the majority of advice through local bonding ties to relatives but consider them as relatively less important. Local bridging ties to neighbors are less frequent and of lower importance than among other households. The relatively higher share of translocal advice among poor households is due to a higher share of translocal bridging ties to agricultural extension agencies, such as the district branch of the DOAE. These translocal bridging ties are not only more frequent but also relatively more important than among other households. Simultaneously, poor households draw a relatively higher share of advice through translocal bonding ties to migrating household members and relatives, which are considered the most important source of advice.

Middle households draw less than other households on translocal advice. Dominant local advice is, like among rich households, of considerably higher importance than translocal advice. The high frequency and importance of local advice is particularly due to frequent and important local bonding ties to relatives, while the low frequency and importance of translocal advice is due to a particularly low share of less important translocal bridging ties to extension agencies.

Advice networks of rich households are characterized by a dominance of bridging ties. In particular, rich households draw more on translocal bridging ties to agricultural extension agencies and acquaintances than do other households. At the same time rich households draw less on translocal bonding ties to migrating household members and relatives and attribute lower importance to them. With regard to local advice, rich households draw more on local bridging ties to neighbors and attribute greater importance to them than do other households. Local bonding ties to relatives are less frequent than among other households but of high importance.

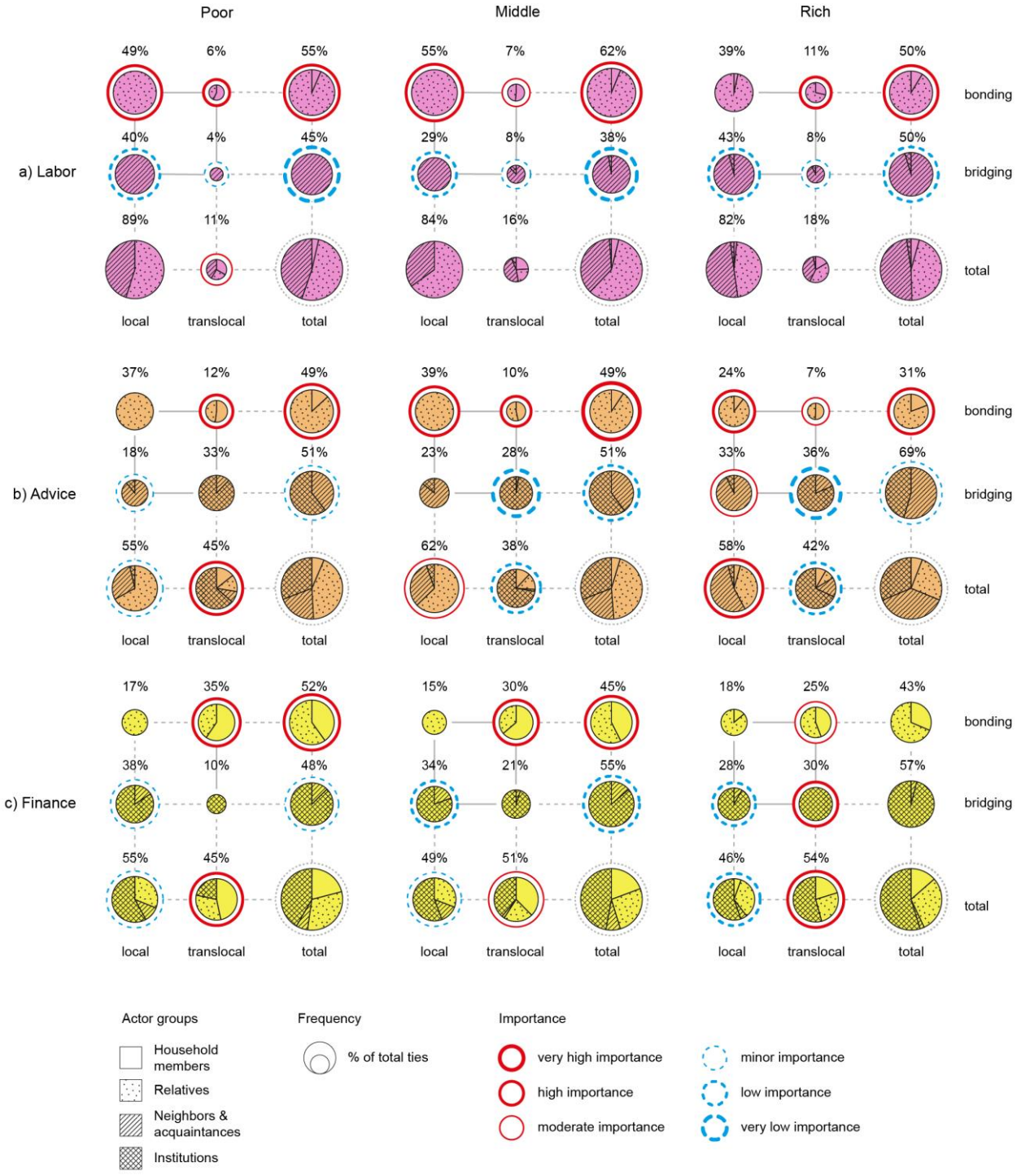


Figure 17(a–c): Tie distribution and composition in terms of frequency and importance, by support types and wealth category

Finance

Figure 17*c* shows that poor households, for accessing financial support, draw less on translocal ties but more on bonding ties than other households. Although less translocal than networks of middle and rich households, financial networks of poor households are characterized by a higher share of translocal bonding ties, in particular with migrating household members, which are considered the most important source of finance. At the same time, poor households draw more than other house-

holds on local bridging ties to community institutions, such as village funds or saving groups, and considerably less on translocal bridging ties to financial institutions, such as the BAAC.

Financial networks of middle households show similarities with those of poor households and those of rich households. Like poor households, middle households draw the majority of finance through local bridging ties to community institutions and translocal bonding ties to migrating household members and relatives. At the same time middle households draw a considerable share of finance through translocal bridging ties to financial institutions, explaining the relatively higher overall share of translocal ties and bridging ties among middle households.

Rich households draw more on translocal financial ties and attribute comparatively higher importance to translocal financial ties than other households. Unlike among poor and middle households, bridging ties account for the majority of financial support and are of comparatively higher importance. Networks of rich households are characterized by a relatively higher share and importance of translocal ties due to a higher share of translocal bridging ties to financial institutions, such as the BAAC. Local bonding ties to migrating household members and relatives, instead, are of lower frequency and importance than among other households. At the same time, rich households draw less frequently on local bridging ties to community institutions and also consider them as less important than do other households.

9.6 Discussion

In this section, we discuss for what purpose and for whom translocal networks matter. We do this by contextualizing network patterns with qualitative information from household interviews and literature on rural livelihoods, migration, and agrarian change in Northeast Thailand. Against this background, we consider the role of translocal network capital in household resilience.

9.6.1 For what purpose does translocal network capital matter?

For this study, we have posited that, in the context of agrarian change and migration in Northeast Thailand, household livelihoods are increasingly diversified and multi-sited. As the socio-spatial patterns and importance of households' support networks reveal, local networks, and in particular local bonding networks, remain the prevailing source of support. However, there are substantial differences in the geographical distribution and social composition of households' networks for different support types, challenging simplistic conceptualizations of network capital as a uniform resource and underlining the need for a more thorough consideration of the particular resources that social networks are able to provide (Ryan et al. 2008; Ryan 2011).

Translocal networks are of minor importance for the provision of agricultural labor. The dominance of labor provided through local bonding ties is in line with other authors highlighting the role of agriculture-related social relations for structuring rural Thai society (Verdery et al. 2012), and in particular the role of local kinship relations in sustaining small-scale farming (Foster 1975; Chandhamrong 1987). According to interviewees, kin are considered a more reliable and more regular source of labor than non-kin neighbors, who provide labor occasionally and only if family labor is insufficient. While the need to financially compensate neighbors might explain their relatively lower perceived importance, the finding that neighbors are, nevertheless, providing a considerable share of labor points to a general scarcity in agricultural labor (Rambo 2017). As reasons for this scarcity, authors have identified demographic changes, continuously high rates of out-migration and the breakdown of reciprocal labor exchange and community solidarity (Funahashi 1996; Rigg and Salamanca 2009; Yuko and Rambo 2017). This fits our finding that less than one third of all interviewed households

indicated actively participating in labor exchange, while another third indicated hiring groups of wage laborers through commercial middlemen.

In comparison to labor, translocal networks play a more pronounced role for agricultural advice. As our analysis shows, the provision of advice is significantly more translocal than is that of labor, but still a dominantly local phenomenon. This finding is in line with other studies suggesting that, in rural communities in Northeast Thailand – although a considerable share of agricultural advice is provided through translocal ties – the majority of advice is shared through local ties (Rockenbauch et al. 2019b). At the same time, the finding that advice is provided to a considerable share through bridging ties, in particular through translocal bridging ties connecting to institutions such as the district branch of the DOAE or private input suppliers, underlines the growing importance of policies and markets and for small-scale agriculture in Northeast Thailand (Grandstaff et al. 2008; Rigg and Salamanca 2009; Rambo 2017). That translocal bridging ties are, nevertheless, perceived to be of low importance might be explained by a general dissatisfaction with institutional performance. Interviewees, for example, stated that trainings offered by the DOAE were too generic and technical. In contrast, the importance of migration-related translocal bonding ties suggest their relevance for tapping new sources of advice and information (Scheffran et al. 2012; Sakdapolrak et al. 2016), but – as their low share in comparison to other sources of advice suggests – they are the exception rather than the norm.

While translocal networks are of low relevance for labor and of moderate relevance for advice, our finding that half of all financial support originates from outside the village and sub-district level suggests that translocal networks clearly matter for financial support. This finding is in line with studies highlighting the increasing dominance of non-local, non-farm income sources in Northeast Thailand (Rigg and Salamanca 2009; Rigg et al. 2012), whereas the particularly high formalization of financial support underlines the impact and outreach of state-driven microfinancing initiatives, such as the village fund program, and state-owned financial institutions, such as the BAAC (Rigg and Salamanca 2009; Menkhoff and Rungruxsirivorn 2011). Whilst the high credit-outreach among Thai farmers (Dufhues et al. 2012; Yuko and Rambo 2017) provides access to larger amounts of money required for investments in housing and agriculture, it comes at the risk of over-indebtedness, a persistent problem throughout Northeast Thailand (Chichaibelu and Waibel 2017). At the same time, our finding that translocal financial support is dominantly provided through bonding ties, which are considered the most important source of finance, underlines the crucial role of remittances for sustaining rural livelihoods (Rigg et al. 2012; Rindfuss et al. 2012; Peth et al. 2018; Porst and Sakdapolrak 2018). The considerably greater importance of translocal bonding ties, in comparison to local and translocal bridging ties, suggests a certain preference for migration-related over institutional sources of finance. Reasons for this preference might lie less in the remittance amount, which – depending on the occupation and destination of migrants – can vary considerably (Porst and Sakdapolrak, 2018), and more in remittances providing a more or less regular additional income source.

9.6.2 To whom does translocal network capital matter?

Disaggregating network patterns and importance by wealth categories and support types, we have shown that households of different socio-economic status have different network capital at their disposal (Woolcock 2001) and rely to different extents and for different reasons on translocal support networks.

For accessing labor support, poor households draw least on translocal ties; however, unlike suggested by Woolcock (2001), they draw more on bridging ties, in particular on hired neighbors, than do middle households. The pronounced role of local bonding ties among middle households can be explained by the kin of middle households potentially being in a better position to support each other

than are the kin of poor households. In contrast, the dominant share of local bridging ties among rich households results from their dependence on additional labor for larger-scale cash-crop production. For the same reason, rich households also more frequently hire groups of wage laborers.

Better-off households also have better access to translocal labor. The relatively larger role of translocal bonding ties suggests that rich households are more successful in leveraging translocal kinship networks as source of labor. In overall terms, however, rich households rely less critically on translocal labor than do poor households, who receive translocal labor mostly from seasonally migrating household members. This limited but highly important source of labor for poor households is likely to further decline in the future, considering the trend towards long-term migration (Rambo 2017).

A special feature of advice networks is that translocal advice is not only of greater importance but also of higher frequency for poor households than for middle and rich households. This finding contradicts the suggestion by Woolcock (2001) that the poor are mostly drawing on community-based capital. The reason for the relatively greater share and importance of local advice among middle and rich households might be because farming is more important for these households, and they thus tend to be more actively exchanging with local peers about agricultural crops and practices. Like for labor, particularly middle households can rely on more abundant kinship networks, whereas rich households draw to a considerably greater extent on bridging networks.

Furthermore, our finding that advice from agricultural extension agencies, such as the DOAE, is of similar frequency across wealth categories contradicts the assumption that the poor are necessarily deprived of linking capital (Woolcock 2001). While this indicates a high penetration of institutional advice in Northeast Thailand, the relatively lower share of poor households receiving advice from translocal institutions indicates that access to institutions remains unequally distributed. According to interviewees, poor households tend to meet agricultural extension staff during field visits or trainings while rich households are more actively seeking advice from extension staff at district offices. This finding is in line with other studies highlighting that larger-scale farmers are more likely to be well-connected to representatives of various agricultural extension agencies (Rockenbauch et al. 2019b). As the pronounced share and importance of local bridging ties among rich households suggests, the rich simultaneously tend to be better connected with local representatives, such as the village head or the village deputy, than are poor and middle households.

Our finding that poor households rely on translocal bonding sources of advice more than do rich households is in line with the assertion by Rockenbauch et al. (2019), who have found that migration-related knowledge transfers might be more viable in the context of small-scale rice farming than in the context of larger-scale cash-crop production. These findings suggest that, for advice, translocal network capital is particularly relevant for poor households, whereby the overall efficacy of poor households' translocal network capital needs to be questioned.

The notion that poor households are lacking access to extra-community resources and are deprived of bridging capital, in particular linking capital (Woolcock 2001), applies best to financial support networks. Poor households draw less on translocal financial institutions, such as the BAAC, and more than other households on community institutions, such as the village fund, because those institutions do not require collaterals and do not enforce strict repayments. However, the amount of credit available through such community institutions is relatively limited (Menkhoff and Rungruxsirivorn 2011) and hence offers less means for strategic investments.

Under those circumstances, poor households more critically rely on their limited translocal network capital and, in particular, on migration-related bonding capital in the form of financial support from migrating household members and relatives (Rindfuss et al. 2012; Peth et al. 2018; Porst and Sakdapolrak 2020). However, the question remains to whether poor households are able to benefit

from their more abundant translocal bonding capital. As we have shown, on average, poor households draw more frequently on migration-related financial support, whereas the share of households receiving remittances is higher among middle households. This discrepancy is due to relatively high within-group differences, with some of the poor households receiving a relatively high share of finance in form of remittances and approximately one third of poor households not receiving remittances at all.

Rich households, instead, rely less on migration-related resources, as suggested by the less pronounced share and importance of translocal bonding ties and the lower share of households receiving remittances. For rich households, translocal network capital is more relevant for accessing formal financial support. Translocal financial institutions, such as the BAAC, are the most important source of finance for rich households because their larger-scale farming activities and, in particular, the farming of cash crops require high financial investments in machinery, inputs, and labor (Podhisita 2017).

9.6.3 To what extent does translocal network capital matter for household resilience?

Following the previous section on revealing and interpreting differences in the socio-spatial patterns of network capital, this section discusses the extent to which translocal network capital matters for household resilience.

As we have shown, poor households have the least diversified support networks, biased towards local and informal ties, in combination with a high reliance on migration-related bonding ties. In terms of resilience, limited translocal capital implies that the poor have worse means for accessing external resources, which are particularly important for coping with covariate shocks that equally affect households in a geographical area (Trærup 2012; MacGillivray 2018). A lack of translocal support is of particular concern with regard to increasing climate risks, including droughts and floods, as well as increasingly volatile rainfall patterns, which are expected to put additional stress on agricultural livelihoods in Northeast Thailand (Naruchaikusol 2016).

At the same time, the pronounced relevance of migration-related, translocal bonding ties for financial support, suggests that the poor do have means of bolstering their resilience through migration (Scheffran et al. 2012; Sakdapolrak et al. 2016). In particular, migration-related translocal ties have been shown to be of particular importance for long-term resilience, as local ties are easily stretched to capacity (Cope et al. 2018; MacGillivray 2018). However, maintaining translocal ties is cost intensive (Elliott et al. 2010), and the resources that the poor can gain through migration-related ties might be limited, as poor households are not necessarily those who benefit most from migration (Porst and Sakdapolrak 2018). Also, remittances do not necessarily provide a stable income as they often depend on limited working contracts, changing policies and regulations, and also on the economic situation in the area of destination (Promburom and Sakdapolrak 2012; Peth et al. 2018). In the context of precarious livelihoods, limited or erratic remittances are rarely invested strategically, being used more generally to cover daily household expenses, to repay debts, and to sustain small-scale farming activities (Porst and Sakdapolrak, 2018). These issues suggest that the relatively lower resilience of poor households, arising from a lack of physical and financial capital, is further impeded by a lack of effective social capital (Cassidy and Barnes 2012).

The poor not only tend to draw on local networks, but – with their relatively high share of local bridging ties – tend to draw on less effective networks. In times of need, bridging ties with neighbors tend to provide short-term support only, as they involve high maintenance costs, while bonding ties with close relatives are more likely to provide continuous support (Islam and Walkerden 2014). In the context of small-scale farming in Northeast Thailand, local bridging ties involve higher costs than

do local bonding ties in terms of agricultural labor, and they provide relatively limited financial means. Against this background, we argue that the poor are also more affected by the dissolving of the village moral economy, entailing the decline of reciprocal arrangements and traditional safety nets (Rigg and Salamanca 2009; Rambo 2017).

In contrast, middle households seem to be in a more comfortable situation as they can benefit from abundant local and translocal bonding capital at the same time. Additionally, translocal sources of middle household are more diversified than those of poor households. Besides drawing on remittances, middle households have also better access to translocal institutions. Access to formal translocal sources of advice and finance is an important factor in successfully adapting agricultural crops and practices, which usually requires specific knowledge and larger financial investments. And, as middle household can draw on effective local bonding networks for advice and labor, we argue that adaptive changes of middle households are also more likely to be successful.

While poor and middle households can use their network capital to varying degrees to "get by", rich households are in a better position to "get ahead". The network capital of rich households not only resides to a greater extent in translocal and bridging ties but is also more diversified. Unlike the poor, the rich are less affected by the loosening of local networks. The rich not only have better financial means to cover the higher costs of maintaining bridging ties but can profit from local bridging ties in terms of good connections with village authorities. Furthermore, the higher share of translocal bridging ties is a clear asset. The rich tend to be better connected to agricultural extension agencies that provide advice relevant to cash-crop production and marketing and – through links with district financial institutions – have better means to invest in adapting and transforming their agricultural activities. At the same time, with rising amounts of formal credit invested in the production of cash crops, rich households are also increasingly exposed to the risks of crop failure and market price volatility.

In line with MacGillivray (2018), we conclude that, also in rural communities in Northeast Thailand, social capital appears to contribute less to the resilience of poor households than it does to the resilience of wealthier households. However, in the context of the delocalization of rural livelihoods, the lower efficacy of the poors' network capital seems to lie not primarily in an overdependence on local bonding ties (Woolcock 2001) but in the combined effect of loosening local networks and a critical reliance on migration-related translocal bonding ties. The translocalization of rural livelihoods – and thereby the shifting of bonding networks' capital from local to translocal levels through migration – can provide a strategy for bolstering the resilience of the poor in the context of agrarian change (Rigg and Salamanca 2011; Promburom and Sakdapolrak 2012). However, we have shown that the network capital of poor households is of particular fragility, providing just enough means for sustaining the status quo of the poors' precarious livelihoods (Porst and Sakdapolrak 2018).

Whether the rural policies and institutions implemented by the Thai government have contributed to extracting people from farming (Rigg and Salamanca 2009) or have provided the ground for a "rainfed" agrarian transformation in Northeast Thailand (Grandstaff et al. 2008) remains an open question. However, as this paper shows, in Northeast Thailand, rich households are in a better position to benefit from their translocal networks, and in particular from their linking ties with translocal institutions. Contrastingly, the livelihoods of poor households are likely to remain precarious, despite, and in some cases even because of, their overreliance on migration-related translocal bonding capital.

9.7 Conclusions

For this paper, we have applied a translocal network perspective and evaluated the role of network capital in the resilience of rural households in three sites in Northeast Thailand. Using participatory network mapping, we have gained detailed insights into the distribution, composition, and importance of translocal household support networks.

Revealing the multi-faceted socio-spatial patterns of household support networks, this study is in line with calls for overcoming the conception of spatially bounded, self-reliant, and inward-looking rural communities (Rigg and Salamanca 2009). By deciphering the "multiplexity of extra-local networks that tie Isan villagers […] into the larger world" (Rambo 2017), we are also highlighting the need for moving beyond the notion of locally rooted social network capital (Putnam 2000) and towards a translocal network perspective (Rockenbauch and Sakdapolrak 2017). Further, our study scrutinizes the viability of ambiguous conceptualizations of social capital, in particular the binary between "inward looking" bonding capital and "outward looking" bridging capital (Patulny and Lind Haase Svendsen 2007). Attempts at either conflating bonding capital with intra-community ties and bridging capital with extra-community ties (Woolcock and Narayan 2000) or at reducing extra-community ties to formalized linking ties (Islam and Walkerden 2015) over-simplify the spatially and functionally diversified nature of rural households' network capital of rural households in mobile and translocally connected societies of developing and emerging countries.

By drawing attention to particular resources channeled through translocal networks of households of different wealth categories, we have further highlighted the need to account for the functional and socio-economic differences in network capital (Elliott et al. 2010). As network patterns suggest, network capital is not a uniform resource to be taken for granted; it depends on task specific social networks (MacGillivray 2018), which are not equally accessible and viable among households (Ryan 2011; Steinbrink 2017).

Socio-economic differences in the composition and distribution of translocal networks, we argue, have implications when judging the role of social capital in rural households' resilience in Northeast Thailand. As we have shown, the plight of the poor lies not simply in an overdependence on local bonding capital (Woolcock 2001) but in a critical reliance on migration-related translocal bonding capital in combination with a lack of effective local capital. Obviously, in Northeast Thailand, network capital appears to make a smaller contribution to the resilience of poor households than to the resilience of wealthier households (MacGillivray 2018) , which are not only more successfully weaving translocal networks but also employ them more effectively in transforming towards market-oriented agricultural livelihoods (Podhisita 2017).

A more inclusive rural development requires measures geared towards harnessing the potential of migration and translocal networks and, at the same time, buffering the negative effects of dissolving village moral economies. Suitable measures can include preparation and mentoring programs for households and migrants, strengthening households' financial literacy, promoting remittances-based financing schemes, and the promotion of translocal knowledge transfers in order to make the most out of migration and mitigate negative consequences of translocal livelihoods (TransRe 2018).

We conclude that a translocal network perspective, as implemented by this study, is instructive in revealing the complex socio-spatial patterns of households' network capital and can enhance the understanding of its role in rural households' resilience in the context of migration and agrarian change.

10. Case study (Article III): "Do translocal networks matter for agricultural innovation? A case study on advice sharing in small-scale farming communities in Northeast Thailand"

Preface

In this case study from Udon Thani, Northeast Thailand, the authors are assess the role of translocal advice-sharing networks in agricultural innovation in a small-scale farming community in Northeast Thailand.

The point of departure of this case study is the authors' assertion that researches on agricultural innovation has highlighted the role of social networks in diffusing agricultural knowledge, but has broadly neglected the spatial dimension of innovation processes. This omission, the authors argue, risks oversimplifying agricultural innovation. As research on migration and rural livelihoods has pointed out, in the context of migration and mobility, translocal networks are increasingly facilitating the flow of information, ideas and knowledge between different rural areas and between rural and urban areas, and hence hold the potential to strengthen adaptive capacity in rural communities. However, the question remains as to what extent and under what conditions these translocal networks facilitate adaptive agricultural changes.

In order to close this gap, authors apply a spatially explicit translocal network perspective to investigate the role of migration-related translocal networks for adaptive change in a small-scale farming community in Northeast Thailand. Drawing on a combination of formal social network analysis (SNA), a questionnaire survey, and semi-structured interviews, this study addresses the following questions: a) to what extent are translocal networks relevant for facilitating agricultural change?, b) how is knowledge relevant for agricultural changes transferred through translocal networks?, and c) what are conditions of, and who are key actors in translocal knowledge transfers?

This study draws on research on agricultural innovation and, more particularly, research on the diffusion of agricultural innovation, conceiving of agricultural innovation as a process of exchanging knowledge through networks of communication and observation within agricultural innovation systems. Accounting for the delocalization of rural livelihoods and drawing on developments in migration research, authors conceive of agricultural innovation networks as socio-spatial in nature and hence conceptualize them in a spatially explicit manner.

Based on a snowball-sampling strategy involving standardized network questionnaires and in combination with key expert interviews this study provides a nuanced understanding of the structural features of and key actors in agricultural advice-sharing networks. The findings reveal that, in the context of the delocalization of rural livelihoods and agrarian change, translocal networks are relevant sources of agricultural innovation. Although the local level remains the major level of social interaction regarding agricultural changes, few translocal ties can be of high relevance for agricultural innovation processes. As the case study exemplifies, translocal innovation transfers are of particular relevance in sparse but highly centralized networks, e.g. around the farming of industrial cash crops, such as sugarcane. In these top-down-organized networks, formal translocal ties between external extension agents and centrally positioned local elite farmers can facilitate rapid top-down innovation transfers. Migration-related innovation transfers, instead, are found to be more likely in the context of less centralized advice-sharing networks, for example around rice farming. As the analysis of structural actor roles suggest, particular boundary-spanning individuals can act as translocal brokers and foster translocal innovation. Bottom-up innovation processes can also be facilitated by return migrants applying techniques observed elsewhere, even in the absence of direct advice-seeking.

These migration-related innovations are more likely if they involve incremental changes adapted to local practices of farming.

Based on these findings the authors call for a more thorough consideration of spatiality in the study of agricultural innovation networks. At the same time, this study has made clear the critical role of context. Understanding how structural features of innovation systems relate to innovation outcomes necessitates, inter alia, the consideration of extension systems, policies, and agro-ecological conditions. It is in this very context that formal institution-driven knowledge transfers and migration-related knowledge transfers act as complementary sources of agricultural innovation. Providing these conclusions at hand, this study highlights the relevance of translocal networks for agricultural innovation, but at the same time questions the enthusiasm regarding the potential of migration and social remittances for agricultural innovation in the areas of origin. The authors conclude that a translocal network approach, as applied in this study, is a fruitful means to disentangle the socio-spatial patterns underlying agricultural innovation, in particular if combining quantitative and qualitative approaches.

Abstract

Recent research on agricultural innovation has outlined social networks' role in diffusing agricultural knowledge; however, so far, it has broadly neglected the socio-spatial dimensions of innovation processes. Against this backdrop, we apply a spatially explicit translocal network perspective in order to investigate the role of migration-related translocal networks for adaptive change in a small-scale farming community in Northeast Thailand. By means of formal social network analysis we map the socio-spatial patterns of advice sharing regarding changes in sugarcane and rice farming over a period of five years. We find that, in translocally connected and mobile rural communities, a substantial share of advice originates from translocal levels. Translocal advice is dominantly provided through weak and formal ties with extension agencies and shared by few highly central larger-scale farmers within sparse local networks. This draws the picture of top-down translocal innovation flows driven by extension agencies and brokered through elite farmers. A closer look on institutional context and key actors of particular changes, however, suggests the potential of migration-related translocal networks and migration experience in fostering bottom-up innovations. Migration-related innovations transfers can promote adaptive capacity also among less favorably connected actors, especially if changes are geared towards limited household resources and are compatible with social practices of small-scale farming. We conclude that a translocal network perspective is instructive for research and extension interested in leveraging more inclusive agricultural innovation.

10.1 Introduction

Agricultural innovation is essential for maintaining productive agricultural systems (Wossen et al. 2013; Mekonnen et al. 2018) and a major contribution to rural development (Conley and Udry 2001; Bandiera and Rasul 2006). In light of increasing climate-related risks, agricultural innovation is also gaining attention as an important contribution to climate change adaptation and food security (Mikhail et al. 2010; Rodima-Taylor et al. 2012). But as innovation processes are often poorly understood (Bandiera and Rasul 2006), facilitating adaptive change remains a key challenge.

In recent years, research has taken major steps towards understanding agricultural innovation processes, highlighting the role of social networks in the diffusion of knowledge for adoption and implementation of improved agricultural crops and practices (Conley and Udry 2001; Bandiera and Rasul 2006; Spielman et al. 2011; Isaac 2012; Wossen et al. 2013; Thuo et al. 2014; Salpeteur et al. 2017). However, in doing so, most studies have conceptualized social relations as being self-

contained (Matous 2015) and have largely neglected the spatiality of social networks (Rockenbauch and Sakdapolrak 2017).

Omitting the spatial character of social networks (Das 2001; Jessop et al. 2008) risks oversimplifying agricultural innovation, especially when studying agricultural transformations in the Global South. In countries such as Thailand, where migration is a major strategy for sustaining rural livelihoods (Rigg et al. 2012; Promburom and Sakdapolrak 2012), translocal networks are increasingly facilitating the flow of information, ideas and knowledge between different rural areas and between rural and urban areas. These translocal networks, it has been argued, hold the potential to strengthen adaptive capacity in rural communities (Scheffran et al. 2012; Sakdapolrak et al. 2016). However, the question remains to what extent and under which conditions translocal networks facilitate adaptive agricultural changes.

Our study aims at closing this gap by applying a translocal network perspective to agricultural innovations in a small-scale farming community in Northeast Thailand. Drawing on a combination of formal social network analysis (SNA), a questionnaire survey, and semi-structured interviews, we are addressing the following questions:

1. To what extent are translocal networks relevant for facilitating agricultural change?
2. How is knowledge relevant for agricultural changes transferred through translocal networks?
3. What are conditions of, and who are key actors in translocal knowledge transfers?

By answering these questions we provide detailed insights into the socio-spatial structure underlying agricultural changes in Northeast Thailand. This way, our paper overcomes the local bias of previous network assessments and contributes to the discussion on the role of translocal networks in agricultural innovation.

10.2 Theoretical background and conceptual framework

Agricultural innovation comprises both technological and non-technological changes in the agricultural sector (Schut et al. 2015), which result from interactive learning between heterogeneous sets of actors (Klerkx et al. 2010). The knowledge required for introducing and maintaining these changes can be acquired through "learning by doing" (a function of one's own innovative capacities) or through learning "from others" (a function of one's social network) (Spielman et al. 2011). Although the understanding of social networks' role in agricultural innovation has steadily advanced, it still lacks the consideration of agricultural innovation's spatial dimension, and in particular of mobility and migration (Rockenbauch and Sakdapolrak 2017).

10.2.1 Agricultural innovation from a social network perspective

A network perspective overcomes linear models of innovation diffusion and conceives of agricultural innovation as a process of exchanging knowledge through networks of communication and observation within agricultural innovation systems (Conley and Udry 2001; Klerkx et al. 2010; Spielman et al. 2011; Isaac 2012). These innovation networks are comprised of dyadic interactions between users and producers of knowledge and involve knowledge flows between heterogeneous actors involved in innovation systems (Arora 2012)(Arora 2012), such as representatives of public institutions, NGOs and the private sector (Klerkx et al. 2010; Spielman et al. 2011). To explain knowledge diffusion within innovation networks, social network scholars have focused on different network features: (i) tie characteristics, (ii) actor network position, (iii) network structure, or a combination of these network features.

For tie characteristics, it has been argued that non-redundant weak ties bridge actors of distant subgroups and are important for acquiring new knowledge (Granovetter 1973). Contrastingly, strong ties that bond closely related actors of the same subgroup involve high levels of trust and reciprocity and hence are expected to have positive effects on the diffusion of existing knowledge. A lack of either strong bonding or weak bridging ties, accordingly, might hamper innovation (Newman and Dale 2005; Bodin and Crona 2009). More specifically, authors have highlighted the role of linking ties between local actors and institutional representatives, such as extension staff or researchers, as a means of closing the gap between informal farmer networks and formal knowledge systems (Isaac 2012; Matouš et al. 2013).

For actor network position, researchers have argued that actors centrally placed in knowledge-exchange networks tend to be more knowledgeable (Calvet-Mir et al. 2012) and more influential (Bodin and Crona 2009). Such actors are thus more likely to be agents of change (Isaac et al. 2014), acting either as facilitators or as bottlenecks of innovation flows (Bourne et al. 2017). Particular importance has been attributed to information brokers, strategically positioned actors transferring information between actors of different subgroups, for example between extension staff and local farmers (Janssen et al. 2006; Isaac 2012). By connecting and mediating between otherwise unconnected networks, these "boundary spanning" individuals can tap diverse sources and types of knowledge and hence facilitate agricultural innovation (Klerkx et al. 2010).

For network structure, it has been argued that agricultural innovation requires the right mix of different structural network properties (Newman and Dale 2005). For example, centralized networks – networks with only a few highly connected actors – have been shown to foster innovation diffusion, as information can effectively be distributed among network members (Bodin and Crona 2009). At the same time, high centralization might result in reduced access to diverse information sources, and thus prevent social learning (Janssen et al. 2006). Similarly, dense and redundant networks might foster the spread of information through increased accessibility to information but at the same time can lead to a homogenization of knowledge within closed subgroups (Janssen et al. 2006). In contrast, networks of low density might invite new knowledge, whereas the exchange of existing knowledge might be impeded (Isaac 2012). Against this background, it has been argued that agricultural innovation necessitates sparse but efficient networks (Isaac 2012) of low redundancy, high actor diversity (Isaac and Matous 2017), and few strategic bridging actors that are able to tap into diverse sources of knowledge (Isaac et al. 2014).

10.2.2 Incorporating geographical space and mobility: towards a translocal network perspective

While a social network perspective draws attention to the social fabric underlying innovation processes, relatively little is known about how innovation processes work at and between spatial scales (Binz et al. 2014). Only a few studies have addressed the role of spatiality in agricultural innovation networks: whilst, in general, geographical distance presents an obstacle to social learning and behavioral diffusion (Matouš et al. 2013), Wossen et al. (2013) find that spatial distance between network actors is positively related to the adoption of sustainable land use practices, as farmers are more likely to learn something "new" from distant peers; and Matous and Todo (2018) reveal that farmers with geographically long ties are more likely to adapt to environmental change. One central assumption underlying this argument is that spatial extensive networks connect farmers with diverse environmental experiences and environmental memory (Isaac et al. 2014; Matous and Todo 2018). In this case, long-distance ties can significantly reduce topological distance in a social network and facilitate rapid knowledge diffusion, especially if combined with strong local networks (Isaac and Matous 2017).

Obviously, long-distance ties matter more in remote rural communities constrained by information and resource scarcity than in areas with abundant communication and transport (Matous and Todo 2018). Given advancing mobility (Ellis 2003) and progressing agrarian transformation (Rigg 2006) in many countries of the Global South, however, remote communities are the exception rather than the norm. Marketization and delocalization of rural livelihoods foster the decline of customary informal networks and increase the dependency on external and formalized relations (Berdegué et al. 2014; Rigg and Oven 2015). At the same time, rural livelihoods are becoming more diverse and multi-sited (Rigg and Oven 2015). The increasing frequency and diversity of interactions blur sharp economic, social, and cultural differences between "the rural" and "the urban", blending into a continuous gradient of networked translocal spaces (Steinbrink 2009; Berdegué et al. 2014).

One important aspect of the delocalization of rural livelihoods is migration—a major livelihood strategy in many rural areas (Ellis 2003; Rigg 2006). As social ties between migrants and the sending households are usually not cut but stretched between places, migration fosters the emergence of translocal networks between areas of origin and destination (Brickell and Datta 2011; Greiner and Sakdapolrak 2013b). As these translocal networks facilitate the exchange of ideas, knowledge, and resources between the origin and destination of migrants they may strengthen adaptive capacity in rural communities (Scheffran et al. 2012; Sakdapolrak et al. 2016).

So far, few studies have investigated the effect of migration and translocal networks on agricultural innovation. For example, Scheffran et al. (2012) conclude from three case studies in Western Africa that translocal migrant networks channel information about new crops and improved practices and should thus be recognized as a means of climate change adaptation. In a study on agricultural communication networks between migrant and non-migrant farmers in Northern Ghana, Isaac et al. (2014) show that migrant farmers are positioned more centrally in agricultural communication networks, tend to more successfully apply sustainable management practices and are brokers between otherwise unconnected, socially and geographically distant subgroups. Another study on knowledge sharing between semi-nomadic pastoralists in India concludes that farmers' agricultural knowledge status is more associated with membership in migration networks than with membership in acquaintance networks (Salpeteur et al. 2016). Whilst these studies make the point for considering translocal networks and migration, they lack a spatially explicit approach that accounts for the social and spatial structure of agricultural innovation networks (Rockenbauch and Sakdapolrak 2017).

10.3 Research framework

This study, thus, adopts a translocal network perspective on agricultural innovation in a small-scale farming community in Northeast Thailand.

We conceptualize local farmers' capacity to innovate, and thereby adapt their agricultural livelihoods, as critically depending on networks of communication between various actors. Accounting for the delocalization of rural livelihoods (Rigg 2006) and drawing on developments in migration research (Brickell and Datta 2011; Greiner and Sakdapolrak 2013b), we conceive of agricultural innovation networks as socio-spatial in nature (Das 2001; Jessop et al. 2008) and hence conceptualize them in a spatially explicit manner.

Translocal innovation networks are composed of local and translocal actors and, respectively, local and translocal ties. Translocal ties entail either formal ties to institutional representatives or informal ties to individual actors. Formal ties tend to be translocal due to often centralized institutional landscapes (e.g. extension offices at district level). Instead, informal translocal ties are often related to migration of family or household members. These migration-related translocal ties connect distant but closely related actors that are embedded in different socio-economic and agro-ecological con-

texts and therefore can provide access to new knowledge and facilitate agricultural innovation (Scheffran et al. 2012; Wossen et al. 2013; Sakdapolrak et al. 2016; Matous and Todo 2018). Besides direct knowledge exchanges, agricultural innovation might also be facilitated by indirect translocal knowledge exchanges, such as through experience returning migrants bring back to places of origin (Isaac et al. 2014; Salpeteur et al. 2016).

Figure 18 presents our conceptual framework. We conceptualized translocal agricultural innovation networks as advice-sharing networks between actors involved in the agricultural sector, including farmers and non-farmers, public institutions, and private sector representatives at various spatial levels. In these networks, ingoing ties indicate advice seeking and outgoing ties indicate provision of advice. Translocal knowledge transfer through these networks can be assessed by looking at tie characteristics, actor network position, and overall network structure.

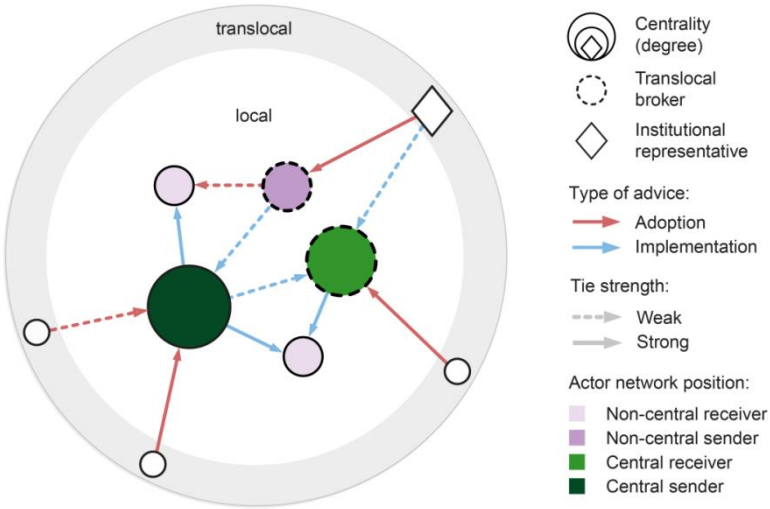


Figure 18: Conceptual translocal advice-sharing network *(own figure)*

Tie characteristics we define by the type of advice exchanged: a) the exchange of ideas and recommendations (adoption advice), and b) the exchange of instrumental advice and problem solving (implementation advice). Further we consider: tie locality (local ties originating from the same village or sub-district level/translocal ties originating from district to international levels); tie strength (strong ties/weak ties, according to closeness and frequency of contact); and tie formalization (informal ties connecting to migrating household members, relatives, neighbors or friends/formal ties connecting to institutional representatives, such as extension staff or service providers).

Actor network position we distinguish by two network features: actors' degree centrality (the number of ties an actor possesses), and their role in sharing advice (providing or receiving advice). Accordingly, actors can be classified as central sender (well-connected, mostly providing advice), central receiver (well-connected, mostly receiving advice), non-central sender (less-connected, mostly providing advice) and non-central receiver (less-connected, mostly receiving advice). According to involvement in translocal advice sharing, we further define translocal brokers as actors transmitting a particular type of advice between translocal and local actors.

Network structure we assess by two measures: network centralization—the degree to which centralities differ between network actors, and network density—the number of existing ties divided by the number of possible ties between actors (Bodin and Crona 2009).

10.4 Methods and procedures

10.4.1 Site description

This study was conducted within a research project focusing on climate change and migration in Thailand. Data collection took place from June to August 2016 in Ban Chai sub-district, Udon Thani province (*Figure* 19).

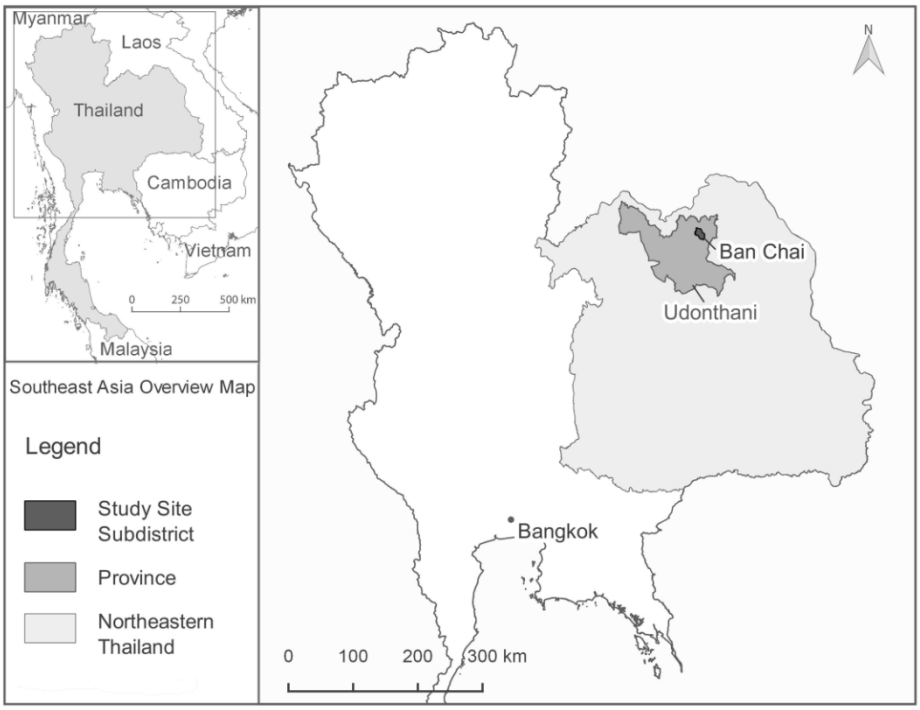


Figure 19: Location of the study site
(layout by the authors, data source: Global Administrative Areas, www.gadm.org)

As in other areas of Northeast Thailand, rural livelihoods in Ban Chai are in transition from small-scale rice farming to the more diversified, market-oriented production of cash crops (Rambo 2017; Choenkwan and Fisher 2018). Driven by market developments and policies, the sub-district of Ban Chai has experienced a sharp increase in sugarcane plantations at the expense of rice farming, grazing and forest land. At the same time, increasing variability in rainfall patterns in Northeast Thailand is placing stress on agricultural productivity, thereby increasing the need to adapt and explore alternative agricultural crops and practices (Mikhail et al. 2010; Naruchaikusol 2016; Choenkwan and Fisher 2018). Typical of Northeast Thailand, internal and international labor migration is a major livelihood strategy in Ban Chai, resulting in increasing translocal connectedness and multi-sited household footprints (Rigg and Salamanca 2011; Peth et al. 2018; Porst and Sakdapolrak 2018). With its exposure to climate change, its high rate of migration and the rapid change of its agricultural systems, the sub-district of Ban Chai provides a good example for studying the role of translocal networks in agricultural innovation.

10.4.2 Data sampling and processing

For assessing translocal advice-sharing networks, we applied methods of formal SNA (Wasserman and Faust 1994). SNA is most powerful for assessing and analyzing socio-centric networks defined as a finite set of actors and the social relations between them (Hennig et al. 2012). However, boundaries of farmer networks are difficult to define (Bourne et al. 2017), in particular in a translocal context. Broader definitions of the unit of analysis (e.g. migration system) would render assessing all actors and ties impossible, whereas narrower ones (e.g. village) would omit ties spanning different places. Alternatively, assessing ego networks provides insights into the social embeddedness of a particular actor (ego) without limiting the number and geographical location of network actors (alters) beforehand. However, ego networks provide limited information on network structure (Hennig et al. 2012).

Against this background, our research design combines ego-centric and socio-centric approaches. To assess ego networks, we applied the name generator technique (Marsden 2005). This technique allows network alters and their attributes to be identified based on a set of predefined questions. For sampling egos, we applied a snowball technique, systematically following alters of already interviewed egos. Merging all sampled ego networks, we constructed a partial socio-centric network that can be analyzed for tie characteristics and network structure, provided care is taken regarding the interpretation of results (Scott 2013; Ricciardi 2015).

Interviews were based on a standardized questionnaire consisting of two parts. Part A focused on agricultural livelihoods and migration, comprising inter alia agricultural changes, households' migration involvement and attitude towards migration, land use and ownership, and sources of income and information. Part B focused on advice-sharing networks. To prevent the problem of fixed choices (Kossinets 2006), we limited network assessment to specific agricultural changes, instead of limiting the number of possible respondents. Therefore, farmers were asked to identify the most relevant changes in crops, practices and businesses over the last five years (2011–2016) and to name alters who provided advice in terms of ideas and recommendations and advice in terms of implementation and continuation of changes. Additionally, we asked for alters with whom farmers exchanged general agricultural information. For each of these alters, we asked the interviewee to identify the frequency of contact, perceived closeness and current location.

We started snowball sampling with two randomly selected farmers in a randomly selected village within the sub-district. Follow-up interviews were conducted with all alters located in the starting village, and with those alters within the sub-district that were identified by interviewees located in the starting village. This procedure was continued until 20% of all households in the starting village had been interviewed. After reaching this threshold, only alters identified during preceding interviews were interviewed, without following-up on any new alters.

A total of 61 farmer interviews were conducted, of which 60 were selected for network analysis. Additionally, we conducted semi-structured interviews with key actors (either in terms of local or translocal connectedness) to gain a deeper understanding of their role in the innovation network. To understand the institutional context of agricultural changes, we also conducted semi-structured interviews with institutional representatives such as the village deputy chief or with district extension staff.

Statistical analysis of agricultural changes, network patterns and actor characteristics was conducted using STATA; while network visualization was performed in Gephi. For the purpose of network analysis, we constructed a partial innovation network, including all actors providing or receiving advice on agricultural changes between the year 2011 and 2016, whereby members of the same household were treated as one single actor, except for migrating household members. From this network we derived weighted innovation networks for selected agricultural changes (e.g. changes regarding rice

farming) in which tie weight indicates the number of different types of support provided (adoption, implementation, general).

For each network, we calculated tie characteristics including the number and share of ties according to locality (local / translocal), tie strength (weak / strong) and type of advice (adoption / implementation / general). To indicate tie strength, we referred to the median of the product of closeness and the frequency of contact (expressed by interviewees on a four-level Likert item). Local ties we defined as ties connecting actors at the village and sub-district level and translocal ties as ties spanning beyond.

For classifying actor network positions, we referred to degree centrality and advice-sharing behavior of interviewed farmers (egos). Central actors we defined as actors with a higher degree centrality than the average degree centrality in the respective network. Senders of advice we defined as actors with a ratio of out- and in-degree equal to or higher than one, and receivers as actors with a ratio of out- and in-degree lower than one. Additionally, we defined translocal brokers as actors receiving a particular type of advice on a specific change (e.g. adoption advice on rice) from translocal actors and providing the same type of advice on the same change to local actors.

While the calculation of tie characteristics and network position incorporated all ties and actors, the calculation of structural features was conducted for local networks of interviewed farmers (egos) only (excluding translocal actors and ties). For calculating centralization, we subtracted the centrality score of each network actor from the maximum centrality score in the network and summed up differences. This sum was then divided by the maximum possible sum of differences. For calculating network density we divided the observed number of ties by the maximum possible number of ties (Wasserman and Faust 1994). Both network centralization and density were calculated for directed and dichotomized networks.

10.4.3 Methodological considerations

Whilst the applied research design has proven successful in revealing the socio-spatial patterns of agricultural advice sharing that would have been omitted by community-centric approaches, it comes with some methodological limitations.

First, this study defines network ties not as general exchange and communication about agricultural issues (e.g. Isaac et al. 2014) but as advice sharing regarding already materialized agricultural changes. Our study implies that networks do not reflect the general social structure through which innovations are potentially diffused, but the cumulative structure of past diffusions' pathways. On the one hand, this network definition restricts the scope for analytical approaches, but on the other hand, a change-based network definition provides room for descriptive interpretation, as each tie can be related to particular changes.

The second limitation lies in the applied sampling design. In general, snowball sampling tends to focus on closely related subgroups and hence tends to omit structural holes between weakly connected network members (Scott 2013). Moreover, the snowball-sampled networks are incomplete, as we followed-up only local alters and did not follow-up alters of interviewees located outside the starting village. We have accounted for this bias by building our analysis on node-specific network measures of interviewed farmers (e.g. degree centrality and ratio of in- and out-degree), and by calculating structural network measures only for local networks of interviewed farmers (egos).

Third, the applied approach omits temporal dynamics (Violon et al. 2016) and indirect forms of knowledge transfers (e.g. observation, embodied experiences), which may occur between gaining new knowledge and applying this knowledge (Bandiera and Rasul 2006). In order to contextualize

network structure, and, more specifically, to disentangle direct and indirect knowledge transfers, we applied a mix of quantitative and qualitative network approaches (Hollstein and Straus 2006; Bolíbar 2016). This entails the combination of network data with data on institutional context and key actors derived from questionnaire survey and semi-structured interviews.

10.5 Results

10.5.1 Current agricultural changes in the study site

Data from farmer questionnaires indicate rapid changes in farming systems in the study site, from mainly subsistence-based rice farming to commercial cash-crop production. *Figure* 20 shows that, between the years 2011 and 2016, sugarcane has rapidly gained popularity in terms of the number of applied changes. In 2016, almost 80% of all interviewed farmers grew sugarcane, with almost 60% having started sugarcane farming since 2011. Sugarcane cultivation is unevenly distributed among farmers. Less than 20% of all interviewed farmers cultivated more than 50 rai (8 hectares) of sugarcane – the minimum land size required for paying-off the credit for a big tractor – while land cultivated by larger-scale farmers accounted for 70% of all reported sugarcane land.

At the same time, *Figure* 20 suggests profound changes in rice farming. As a means of saving labor and investment costs, more than 85% of all interviewed farmers have, between the years 2011 and 2016, introduced rice broadcasting – either by hand or machine – as an alternative to transplanting. To reduce weeds, broadcasting is often combined with rice cutting, a technique originally developed in central Thailand and introduced to the study site only recently. Another recent change in rice farming is the diversification towards high price specialty varieties for urban markets.

Furthermore, interviews indicate changes such as the application of organic fertilizer or the cultivation of cassava, palm, rubber, fruits, vegetables, and flowers. The spread of these changes, however, has remained limited due to high investment costs, lack of labor, or volatile market prices. Hence, in the following, we focus only on advice sharing regarding sugarcane and rice farming, which are also the most important crops in terms of household income and food security.

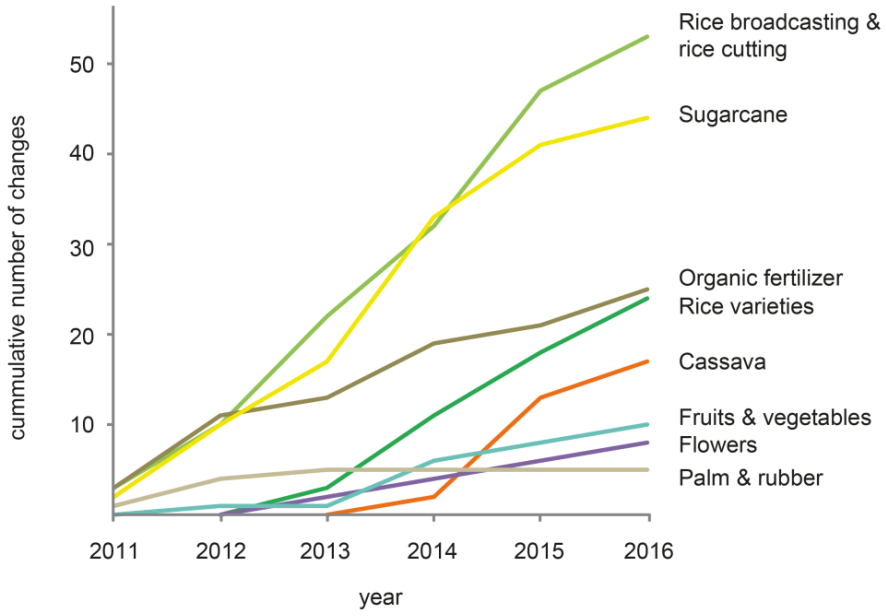


Figure 20: Cumulative number of agricultural changes between 2011 and 2016, as reported by interviewed farmers (n = 60)

10.5.2 Distribution and composition of advice

This section provides an overview of the distribution and composition of advice regarding changes in sugarcane and rice farming between the years 2011 and 2016. This way we provide an indication of the extent to which agricultural changes are facilitated by translocal advice.

According to *Figure* 21, advice on changes in sugarcane and rice farming was dominantly exchanged between closely and frequently related actors at the local level. Advice regarding changes in rice farming was mostly provided through strong ties (60%), while advice regarding changes in sugarcane farming was almost equally provided through strong (51%) and weak ties (49%). Ties between local actors provided the majority of advice regarding changes in rice (72%) and sugarcane farming (76%), whereas the dominance of strong local ties was more pronounced with regard to rice farming (53%) than with regard to sugarcane farming (42%). Advice by translocal actors located outside the sub-district was more frequent for changes in rice farming (28%) than for changes in sugarcane farming (24%). Translocal ties were mostly weak and were more frequently providing rice-related advice (21%) than sugarcane-related advice (14%). Translocal advice by closely related translocal actors was slightly more frequent for changes in sugarcane farming (10%) than for changes in rice farming (7%).

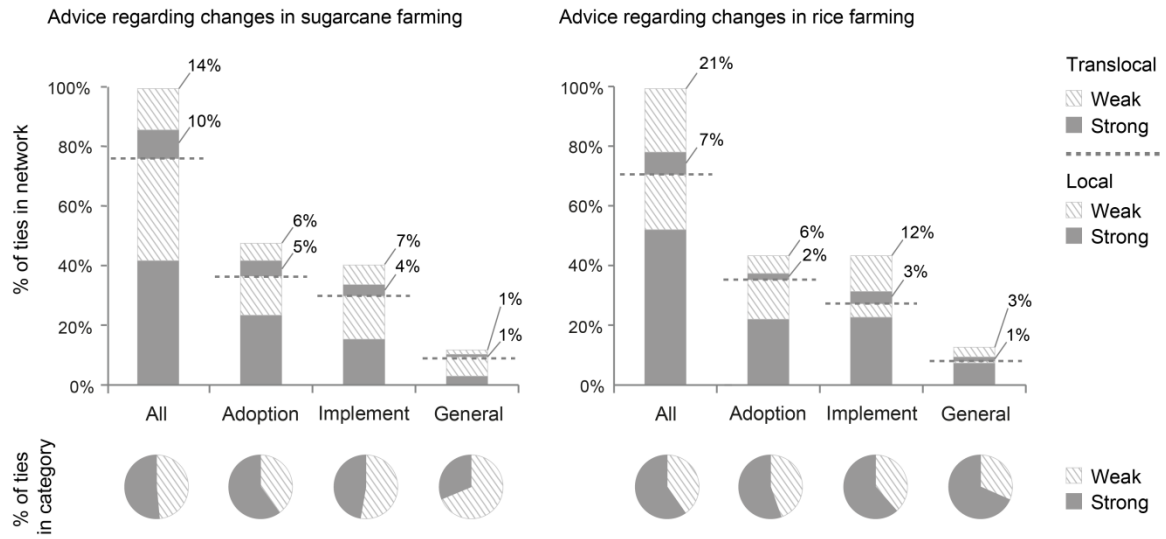


Figure 21: Distribution and composition of advice regarding changes in sugarcane and rice farming, in percentage of ties by type of advice, tie locality, and tie strength

Figure 21 further reveals that advice regarding changes in sugarcane farming was mostly providing incentives for adoption, whereas advice regarding changes in rice farming was equally concerned with adoption and implementation. Adoption advice regarding changes in sugarcane and rice farming was mostly provided through strong or local ties, in particular through strong local ties. Differences exist with regard to implementation advice, however. While implementation advice regarding changes in sugarcane farming was equally provided through strong and weak ties, implementation advice regarding rice farming was mostly provided through strong ties. At the same time, implementation advice regarding changes in rice farming was to a relatively higher extent provided through translocal ties, and in particular through weak translocal ties.

Figure 22 provides deeper insights into the composition of translocal advice. For changes in both sugarcane farming and rice farming, translocal advice was mostly provided through formal ties. While formal extension-related advice was mostly provided through weak translocal ties, informal migration-related advice was to an equal extent provided through weak and strong translocal ties. With regard to the type of advice, translocal advice regarding changes in sugarcane farming facilitated adoption and implementation to an equal extent; while translocal advice regarding changes in rice farming was mostly concerned with implementation. For both changes in sugarcane farming and changes in rice farming, translocal adoption advice was to an equal extent provided through formal extension-related advice and informal migration-related ties, whereas translocal implementation advice was mostly provided through formal extension-related ties.

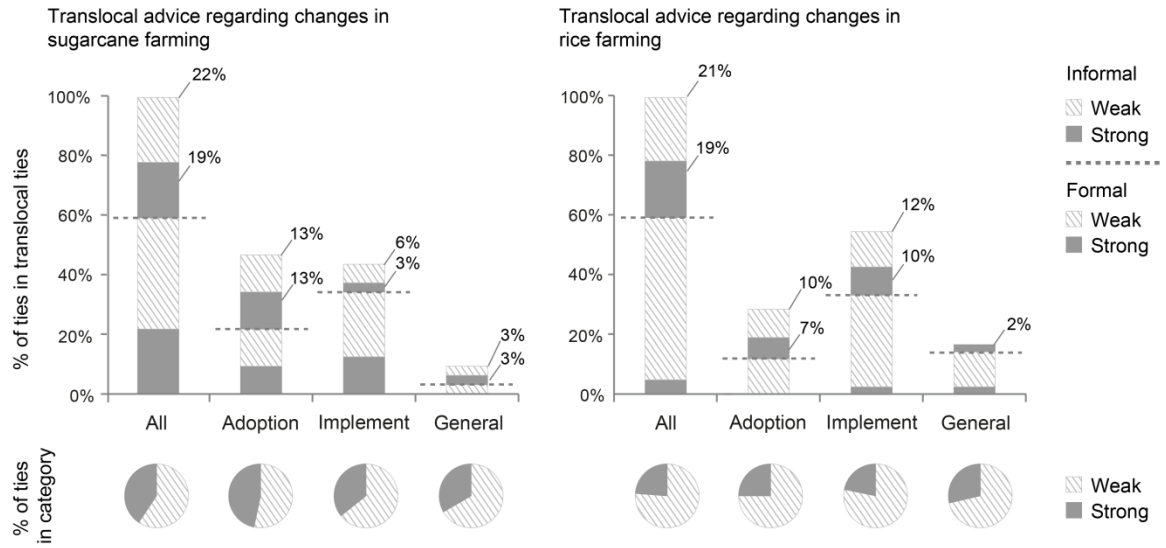
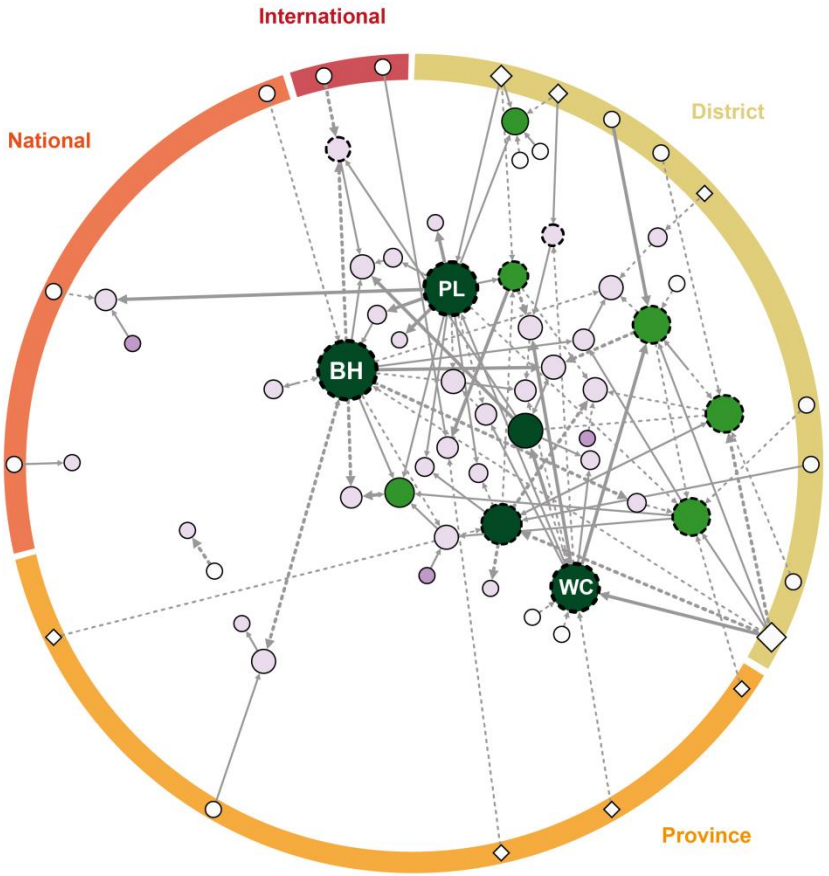


Figure 22: Distribution and composition of translocal advice regarding changes in sugarcane and rice farming, in percentage of translocal ties by type of advice, tie formalization, and tie strength

Figure 23: Sociograms of the sugarcane network and the rice network *(next page).*
Actors inside the circles represent local farmers (village and sub-district); actors on the outer circles represent translocal actors (district—international); diamonds indicate institutional actors; tie style indicates weak ties (dotted) and strong ties (continuous); tie width represents the number of different types of advice provided (adoption, implementation, general); node size represents weighted ego-network size, and node color indicates actor network position (non-central receiver/sender, central receiver/sender); dotted nodes indicate translocal brokers; acronyms identify key actors; white nodes indicate actors, who declined interviews or were not captured by the sampling design. Networks are subsets of the overall partial network. This explains why local networks include subgroups and isolates, despite the fact that we used a snowball-sampling strategy.

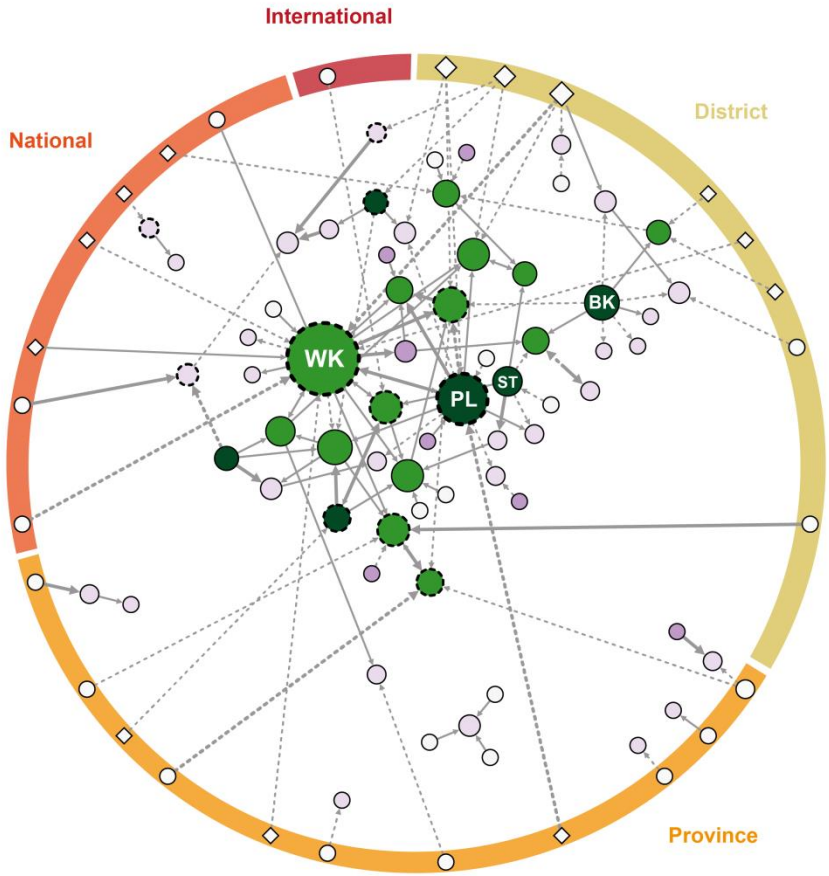
Sugarcane network:

Ties: nT = 136 (incl. 32 transl. ties)
Actors: nA = 69 (incl. 44 egos & 19 transl. actors)



Rice network:

Ties: nT = 149 (incl. transl. ties 42)
Actors: nA = 93 (incl. 56 egos & 27 transl. actors)



Tie weight:

number of different types of advice provided (adoption, implementation, general)

Tie strength:

Weak
Strong

Node size:

Centrality (degree)

Actor attributes:

Translocal broker
Institutional representative

Actor network position:

Non-central receiver
Non-central sender
Central receiver
Central sender

10.5.3 Advice-sharing networks

In this section we characterize the social and spatial patterns of advice-sharing networks regarding changes in sugarcane and rice farming derived from a total of 60 farmer ego networks. In doing so, we provide more detailed insights in how advice on agricultural changes is transferred between local and translocal actors.

Figure 23 presents the sociograms of the sugarcane network and the rice network, while Table 4 and *Table* 5 provide an overview of selected network characteristics. The sugarcane network (69 actors, 136 ties) is smaller than the rice network (93 actors, 149 ties). Both networks show similar shares of translocal actors (actors at the outer circle), with institutional representatives (diamond-shaped nodes) being more frequent and more equally spread across geographical levels in the rice network than in the sugarcane network. In the sugarcane network, institutional representatives, in particular at district level, provide the majority of translocal advice, which is received by few highly central local actors. In contrast, in the rice network, translocal advice originates more equally from translocal actors at different geographical levels and is more equally received by local actors of different centrality.

Table 4: Selected characteristics of the sugarcane network and the rice network

Network characteristics	Sugarcane network[a]	Rice network[a]
Actors (abs.)	69	93
Ties (abs.) [b]	136	149
Translocal actors (abs. / *%*)	19 / *28%*	27 / *29%*
Institutional representatives (abs. / *% of transl. actors*)	9 / *47%*	15 / *56%*
Translocal ties (abs. / *%*)	32 / *24%*	42 / *28%*
Formal translocal ties (abs. / *% of transl. ties*)	19 / *59%*	25 / *60%*

[a] *Networks are weighted, with tie strength indicating the number of different types of support provided (adoption, implementation, general)*

[a] E*ach tie is indicating the provision of one type of support (either adoption, implementation, or general)*

Table 5: Selected characteristics of the local sugarcane network and the local rice network

Network characteristics	Local sugarcane network[a]	Local rice network[a]
Egos (abs.)	44	56
Local ties between egos (abs.)	78	80
Translocal connected egos (abs. / *%*)	16 / *36%*	24 / *43%*
Translocal brokers (abs. / *%*)	10 / *23%*	11 / *20%*
Density (*directed*)[b]	0.041	0.026
InCentralization[b]	0.079	0.067
OutCentralization[b]	0.274	0.180

[a] Local networks are comprised of interviewed farmers (egos) and local ties between them

[b] Density and centralization are calculated for dichotomized local networks

Table 5 provides an overview of selected characteristics of local advice-sharing networks between interviewed farmers (egos). Low levels of density indicate that communication between local farmers operate through sparse, non-redundant networks. Of particular low density is the local rice network, which is characterized by a higher share of unconnected subgroups. Both networks are characterized by low indegree-centralization, implying that local farmers equally receive advice from each other. With regard to the provision of advice, however, relatively higher outdegree-centralization suggests that few local actors are particularly active in providing advice to other local farmers, in particular in the sugarcane network. The share of translocal connected egos and the share of egos acting as translocal brokers indicate that translocal advice is more equally accessible in the rice network than in the sugarcane network, but less effectively brokered among local actors.

10.5.4 Actor network position and actor attributes

This section classifies interviewed farmers according to their structural network position and presents the distribution of selected actor attributes. It thus reveals how and between whom advice is shared in translocal networks.

According to *Figure* 24, the sugarcane network is characterized by a clear divide between less connected actors (75%) and highly connected actors (25%). The majority of actors play a rather passive role in advice sharing and receive more advice than they provide (82%). While receivers of advice are mostly non-central actors (68%), senders of advice are mostly central actors (11%). These patterns suggest that advice sharing on sugarcane is unequally distributed and mostly driven by central actors. For the rice network, the difference between non-central actors (64%) and central actors (36%) is less pronounced. In comparison with the sugarcane network, receivers of advice are less frequent among non-central actors (52%) but more frequent among central actors (25%). At the same time, actors playing an active role in advice sharing are slightly more frequent among non-central actors (13%) than among central actors (11%). Altogether this suggests that advice in the rice network is more equally distributed and is less driven by central actors than in the sugarcane network.

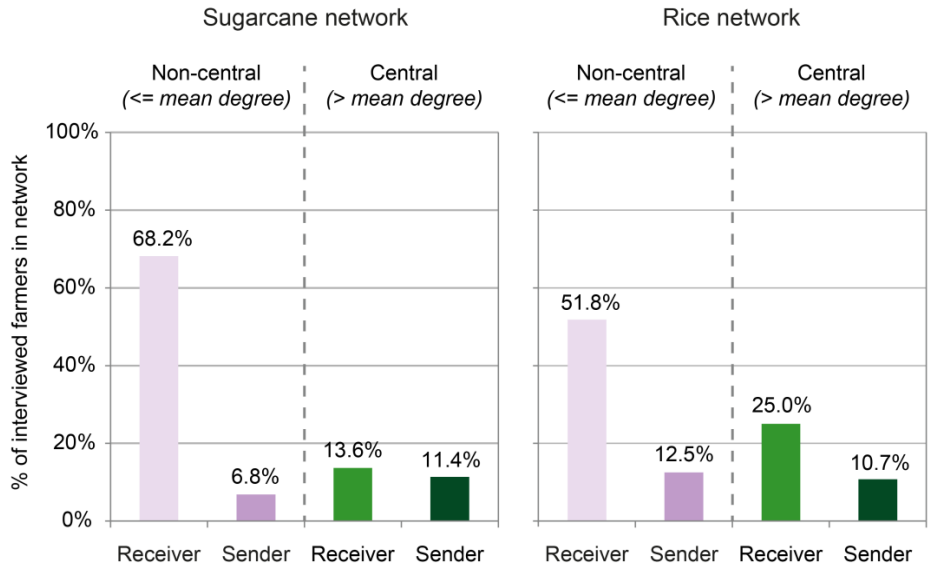


Figure 24: Share of actors by actor network position in the sugarcane network and in the rice network

As shown *Figure* 25*a*, in the sugarcane network, the share of translocal connected actors is significantly higher among central actors than among non-central actors, and so is the share of translocal brokers, receiving advice from translocal actors and providing the same kind of advice to local actors. This pattern suggests that well-connected actors are actively facilitating information flows between translocal and local actors. In comparison, in the rice network, the share of translocal connected actors and the share of translocal brokers is relatively lower among central actors. At the same time, the share of translocal connected actors among non-central actors is higher than in the sugarcane network. This pattern suggests that translocal advice regarding rice is more accessible among actors but less effectively brokered between translocal and local actors than advice regarding sugarcane.

Figure 25*b* shows that, in the sugarcane network, involvement in migration is high across network positions but lowest among central senders. Although least involved in migration, the share of actors with positive attitude towards migration suggests that central senders are most satisfied with migration outcomes. Both central senders and central receivers tend to live off agriculture, while non-central actors depend to a greater extent on remittances as their first source of income (*Figure* 25*c*). Also, central actors tend to farm larger amounts of land, while non-central actors tend to more frequently farm small and medium-sized plots (*Figure* 25*d*). Central farmers, as well, tend to rely more on formal information provided by the agricultural extension and the media, while the share of farmers relying on informal sources of information such as kin and acquaintances is higher among non-central actors (*Figure* 25*e*).

Unlike in the sugarcane network, involvement in migration is highest among central senders in the rice network. However, the share of actors with positive attitude towards migration suggests that non-central receivers are more satisfied with migration outcomes (*Figure* 25*b*). Like in the sugarcane network, non-central receivers in the rice network depend most on remittances and other income sources, while central senders rely most on agriculture as main income source. However, unlike in the sugarcane network, also non-central senders and central receivers show a high reliance on agricultural income (*Figure* 25*c*). Also land size seems to be less related with centrality than in the sugarcane network. While the share of actors cultivating large amounts of land is highest among central senders, the share of actors cultivating small and medium-sized land is highest among central receivers and non-central receivers (*Figure* 25*d*). The rice network is also more diverse in terms of information sources. Unlike in the sugarcane network, the share of actors relying on extension as the main source of information is lowest among central senders and highest among non-central senders, whereby the opposite is the case for the share of actors relying on kin and acquaintances (*Figure* 25*e*). Altogether, these patterns suggest that actor' structural position in the rice network is less clearly related with actor characteristics than in the sugarcane network.

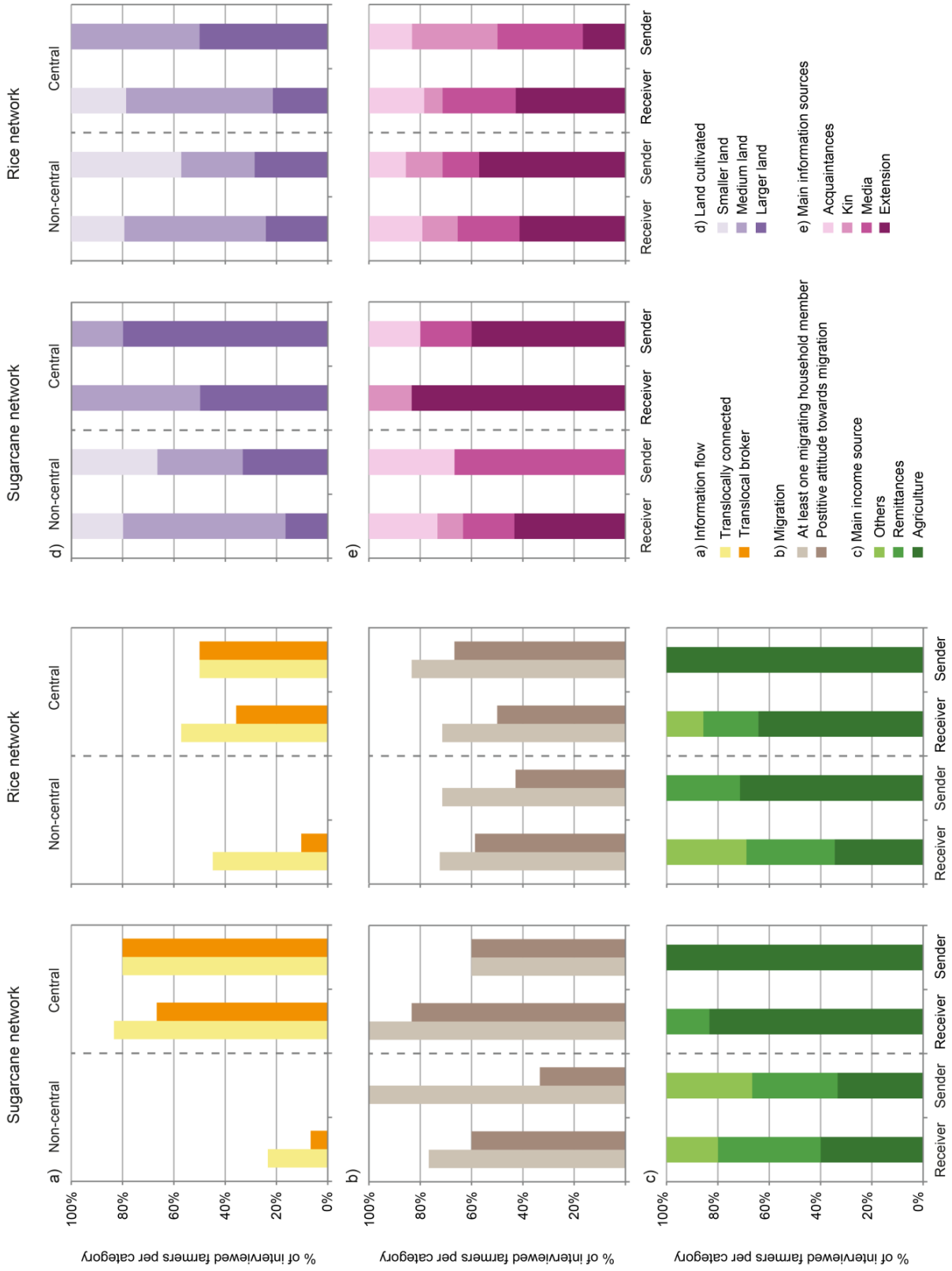


Figure 25(a–e): Actor attributes by actor network position in the sugarcane network and in the rice network

10.5.5 Institutional context and key actors of agricultural change

Making sense of the observed network patterns requires a broader understanding of the context in which agricultural change is materializing. This section summarizes qualitative data on institutional context and presents background information on selected key actors of recent changes in sugarcane and rice farming in the study site, derived from semi-structured interviews.

Changes in sugarcane farming have to be seen in the context of international market developments and national policies. In line with national development plans, processing facilities for sugarcane have recently been set up in the region. While public extension agencies such as the Bank of Agriculture and Agricultural Cooperatives (BAAC) and the district branch of the Department of Agricultural Extension (DOAE) focus on strengthening the production and marketing capacities of small-scale farmers, sugarcane factories provide trainings to contracted larger-scale farmers. Factory staff actively visits these farmers' plots to provide tailored knowledge, inputs and credit.

As the analysis of network positions and actor attributes reveals, local advice sharing on sugarcane is driven by a small group of experienced, larger-scale farmers, who are key actors for several reasons: first, as they successfully farm big sugarcane plantations, they are perceived as attractive sources of information. Second, as sugarcane farming requires high investments in land, seedlings and machines as well as detailed technical knowledge, they tend to have close ties to private and public extension agencies. Third, to fulfill their factory quotas, several large-scale farmers outsource production to small-scale farmers. In combination, these factors make larger-scale sugarcane farmers gatekeepers between informal local networks and formal extension. Indeed, the most influential farmer in the rice networks is not only larger-scale sugarcane farmer but also the local representative of the BAAC.

Also rice farming is driven by markets and policies, although to a lower extent than sugarcane farming. Extension-driven support includes advice on the certification and implementation of standards in rice farming by the BAAC or the promotion of sustainable farming practices through trainings offered by the district branch of the DOAE. However, the major change in rice farming—the shift from transplanting to rice broadcasting and cutting—has taken place without extension support.

The analysis of network positions and actor attributes in the rice network suggests that being a key-actor in the rice network is less clearly related with the size of land under cultivation and extension support but more with informal sources of information and migration. Indeed, a particularly influential actor is a small-scale farmer who gained inspiration for growing rice varieties during migration. As the initiator of a farmer group on sustainable rice production, she is well connected with extension agencies and an influential source of advice among local actors. Other key actors are early adopters of rice broadcasting and cutting who have gained inspiration during work or travel. As these key farmers did not receive any extension support in implementing broadcasting and cutting techniques, they are not necessarily among the most central and translocally connected actors in the rice network.

Selected key actors in the sugarcane network

PL is the official agricultural focal point in the village appointed by the BAAC. She has strong translocal ties to public extension agencies and coordinates villagers' participation in trainings and benefits from training herself. PL is a big sugarcane farmer and actively promotes the setting-up of a community collection point for small-scale sugarcane farmers. PL is also in charge of a project on "Good Agricultural Practices" and functions as a distributor of quality rice seeds. Accordingly, PL is among the most central and active translocal brokers in both the sugarcane and the rice network.

BH is a larger-scale sugarcane farmer from the neighboring province of Loei. As he sells seedlings to local farmers, he is frequently sought for advice on sugarcane. For his own farming activities BH derives inspiration from his family in Loei, making him a translocal broker and central sender in the sugarcane network. Although BH was among the first to cut rice, he plays a minor role in the rice network as he focuses on sugarcane farming and his rice plots are located in a less accessible area.

WC is the largest sugarcane farmer in the sub-district. She has close links with the sugarcane company and is actively contracting smaller-scale farmer in order to full-fill her quota. This makes WC the third most central actor in the sugarcane networks, in particular with regard to adoption advice.

Selected key actors in the rice network

WK is a return migrant who gained the inspiration to grow rice varieties during her work as a journalist in Bangkok. Today WK successfully heads a group of farmers growing rice varieties for specialty markets and actively advises group members on sustainable farming practices. In turn, she receives advice through the social network she established during her time in Bangkok. She is well connected to research centers, NGOs and public extension but also has strong ties to other central farmers, such as PL. Her networking skills make her the most central actor in the rice network and an agent of agricultural change.

BK is an old-aged small-scale farmer, who decided to adopt the rice broadcasting and cutting technique after observing farmers in central Thailand. Although he hardly exchanges advice with anyone else in the village, he is frequently referred to as a "good example," as his plot is directly located at the road to the market and villagers can easily observe the success of his practices. This makes him a central sender in the rice network, ranking sixth in terms of centrality but first in terms of the ratio between in- and out-degree.

ST is a seasonal migrant worker and small-scale rice farmer, driving sugarcane trucks in the dry season. During a trip to another province he observed the practice of rice broadcasting. With money from migration he bought a machine seeder and successfully started a small business, offering broadcasting services to other villagers. This makes him a central and active actor in the rice network, mostly regarding implementation advice.

10.6 Discussion

In order to judge the relevance of translocal networks for agricultural innovation in the study site, we interpret the distribution and composition of advice and characterize the different innovation systems, in which advice sharing on sugarcane and rice farming operates. Finally, we zoom in on the role of migration-related knowledge transfers for particular changes in rice farming, and shed attention to the importance of migration-related knowledge.

10.6.1 Local versus translocal: distribution and composition of advice

By analyzing the distribution and composition of advice regarding changes in sugarcane and rice farming over a period of five years, we can show that in mobile and highly connected rural areas, such as the study site of Ban Chai, agriculture-related social interactions are far from self-contained (Matous 2015). Depending on the crop under study, a quarter to a third of all advice that has facilitated changes was provided through translocal ties, influencing one-third to two-fifth of all interviewed farmers. This relatively high level of translocal connectedness in agricultural advice sharing

indicates that the "delocalization of rural livelihoods" (Rigg 2006; Rigg et al. 2012) also matters for agricultural innovation.

When looking at the composition of translocal advice in more detail, results reveal that extension-related translocal advice dominated over informal migration-related translocal advice in both the sugarcane and rice network. Thus, even in a context in which most of the households are involved in migration, migration does not necessarily result in migration-related translocal advice. At the same time, formal translocal ties were mostly weak, while informal translocal ties were to an equal share composed of strong and weak ties, suggesting qualitative differences between migration-related advice and extension-related advice.

Besides a relatively high level of translocal connectedness, results underline the prevailing local character of agricultural advice sharing in Northeast Thailand. In the study site of Ban Chai, over the last five years, the majority of advice regarding changes in sugarcane and rice farming was provided through local ties and, in particular, through strong local ties. This finding is in line with other studies on agricultural innovation in small-scale farming which point to the critical role of close-knit networks in facilitating knowledge exchange on seeds, crops and practices (van den Broeck and Dercon 2011; Tatlonghari et al. 2012; Ricciardi 2015; Mekonnen et al. 2018).

Further, results indicate spatial differences in the provision of adoption and implementation advice. While decisions to adopt a new crop or practice were to a high extent facilitated by strong local ties, implementation advice was facilitated by a relatively higher share of translocal ties, and in particular, weak translocal ties. The local bias in adoption advice we interpret as an indication that incentives to adopt a new crop or practice—in particular in the beginning of the diffusion process—are more compelling, if already implemented by a local and trusted peer (Conley and Udry 2001; Bandiera and Rasul 2006).

The relatively higher share of translocal ties in implementation advice—in particular with regard to rice farming—suggests that problem-oriented advice is not necessarily more compelling if provided by socially and geographically close actors. Whilst, in general, strong ties are particularly effective in translating knowledge into practice (Darr and Pretzsch 2008), seeking solutions from distant sources might be considered particularly relevant in a region like Northeast Thailand, with its rapidly transforming agricultural systems and high exposure to correlated risks, such as droughts and drought-related diseases (Naruchaikusol 2016; Rambo 2017).

More particularly, the finding that translocal implementation advice is predominantly sought through weak formal ties points to role of agricultural extension services in providing technical, problem-oriented assistance. In contrast, the relatively higher share of informal ties in translocal adoption advice suggests a certain role of migration-related translocal ties in facilitating adoption decisions.

10.6.2 Top-down versus bottom-up: innovation systems

Although instructive in characterizing the socio-spatial patterns of translocal advice sharing, the sole consideration of quantitative tie distribution is not sufficient for judging the relevance of translocal networks. Contextualizing quantitative network patterns with qualitative information on institutional context and key actors, we have revealed that advice sharing on sugarcane and rice operates through different agricultural innovation systems.

The sugarcane network, we interpret as the structural manifestation of a sparse but highly effective top-down-oriented extension system (Isaac 2012; Bourne et al. 2017) operating in the context of national policies and market dynamics. In this system, translocal advice is mostly provided by a few

private and public extension agencies at the district level, while recipients of translocal advice are mostly centrally positioned actors. Central actors tend to be larger-scale farmers, which are less involved in migration and depend less on remittances but do rely on agricultural activities as their main source of income, unlike non-central actors. These "elite farmers" actively broker advice between translocal and local actors, hence linking between formal and informal knowledge systems (Isaac 2012). Larger-scale farmers, such as BH or WK, act as role models in sparse and non-redundant local networks, as observable indicators of economic success, such as plot size and machinery, make them attractive sources of advice for small-scale farmers. Moreover, larger-scale farmers—which are under contract with sugarcane companies—actively source-out production to small-scale farmers, not only providing advice but also inputs and services. Given this effective arrangement, top-down translocal innovation flows, driven by extension and brokered by elite farmers, profoundly impact local sugarcane farming.

In contrast, changes in rice farming are less dominated by extension and elite farmers but to a higher extent by migration-related knowledge transfers. In the rice network, translocal ties are more frequent and also more equally distributed among farmers than in the sugarcane network. Also actor centrality is less clearly related to land cultivation but more with involvement in migration. These findings indicate that advice seeking through translocal networks is a viable adaptation strategy (Scheffran et al. 2012), especially for the less connected and economically less successful farmers (Hoang et al. 2006). Migration-related translocal innovation flows are particularly evident for the shift from transplanting to rice broadcasting and cutting, which was first implemented by a small number of return migrants. As these changes materialized without extension support, they can be interpreted as successful bottom-up innovations. However, at the same time, the lower share of translocal brokers among central actors and the lower density of the rice network suggest that translocal advice is less effectively shared between translocal and local actors than in the sugarcane network. Hence, a closer look at particular changes in rice farming is needed in order to judge the relevance of translocal networks for agricultural innovation.

10.6.3 Translocal networks versus embodied experience: migration-related translocal knowledge transfers

In the following, we place attention on two different forms of migration-related knowledge transfers: direct transfers through translocal networks and indirect transfers through embodied migration experience.

The example of sustainable rice diversification illustrates how agricultural innovations can spread successfully, if translocal and local networks are combined. The rice business of WK, a young return migrant, is thriving, because she can draw on her migration-related translocal network for accessing technical and financial advice, inspiration and new ideas that would be not available locally. At the same time, she can rely on her local network for disseminating external knowledge and for coordinating the production process. In particular, her kinship ties, as the daughter of an influential family, and her friendship with PL, helped her to gain acceptance from local farmers and to build up a sufficiently big group of producers. Hence, the example of WK demonstrates the critical role of motivated and dedicated "boundary spanning individuals" (Klerkx et al. 2010) and shows that the right mix of strong and weak ties (Newman and Dale 2005; Bodin et al. 2006) and—more specifically—a combination of long distance ties with dense local networks, can be highly effective in fostering agricultural innovations (Isaac and Matous 2017; Matous and Todo 2018).

In contrast, the example of broadcasting and cutting illustrates that translocal knowledge transfers do not necessarily require boundary spanning individuals. Translocal knowledge transfers also can be initiated by return migrants applying agricultural experiences and knowledge gained in other

places (Isaac et al. 2014; Salpeteur et al. 2016). Early adopters of broadcasting and cutting, such as BK or ST, gained inspiration for changing rice farming practices from observing farmers in other regions of Thailand during migration but did not seek translocal adoption or implementation advice from them. Instead, after return, they implemented the observed agricultural practice in a trial-and-error fashion. At the local level, these early adopters are of relevance not due to their role as translocal brokers but due to their role as "good examples". As the technology of broadcasting and cutting is easily observable and replicable, it spreads easily among local farmers, even in the absence of direct advice seeking. A further driver of fast diffusion is the provision of commercial broadcasting and cutting services by particular early adopters.

10.6.4 Intensification versus extensification: viability of migration-related knowledge

Understanding why particular changes are more likely to be facilitated through migration-related knowledge transfers also requires considering the kind of knowledge migrants acquire during migration and its applicability to rural livelihoods. As the majority of migrants from Northeast Thailand work in in the construction sector or in factories in the metropolitan areas of Thailand or abroad (Peth et al. 2018; Porst and Sakdapolrak 2018), they are unlikely to gain knowledge about different agro-ecological environments during migration (Isaac et al. 2014; Matous and Todo 2018). Even in the case of migrants working in modern agriculture, e.g. in Southern Thailand or abroad, experiences rarely result in agricultural changes after return because migrants gain only fragmented knowledge and because migration usually does not yield sufficient investment capital. In particular, sugarcane farming is highly capital and resource intensive (e.g. land, labor, inputs) and requires economies of scale. Hence, it is more attractive to larger-scale farmers focusing on intensive agriculture as main income source. Instead, the observed changes in rice farming, such as rice broadcasting and cutting, do not require specific technical knowledge, expensive machinery or specific market channels. Moreover, broadcasting and cutting can be gradually implemented alongside traditional practices of transplanting and hence offers opportunities for extensification in accordance to declining labor resources of multi-sited households and in accordance to increasingly volatile rainfall patterns. The spread of this agricultural innovation, we thus interpret as an example of how translocal knowledge transfers can foster adaptive capacity in the context of migration and climate change (Scheffran et al. 2012; Sakdapolrak et al. 2016).

10.7 Conclusions

By means of formal SNA, a questionnaire survey, and semi-structured interviews, this case study provides nuanced insights into the role of translocal and translocal knowledge transfers for adaptive changes in small-scale farming advice-sharing networks communities in Northeast Thailand. We have mapped the distribution and composition of advice regarding changes in sugarcane and rice farming over a period of five years, investigated structural patterns of advice-sharing networks, and identified the institutional context and key actors of agricultural change. With this, we are able to answer our research questions and to substantiate the discussion on the role of translocal networks in agricultural innovation (Scheffran et al. 2012; Sakdapolrak et al. 2016; Matous and Todo 2018).

First, in the context of migration and delocalization of rural livelihoods (Rigg 2006; Rigg et al. 2012), advice relevant for agricultural changes originates to an increasing extent from translocal sources. In overall quantitative terms, agricultural advice sharing remains a local phenomenon, facilitated dominantly by sparse but close-knit networks between local farmers. Local advice sharing is particularly relevant in the case of adoption decisions, as incentives to adapt a new crop or practice are

more compelling, if provided by successful local peers (Conley and Udry 2001; Bandiera and Rasul 2006).

Second, even in predominantly local advice-sharing networks, a few translocal ties can facilitate translocal innovation transfers (Matous and Todo 2018). The relevance of translocal ties, however, depends on the agricultural change under study and the structural features of the related innovation systems. In an efficiently structured network, with few translocal ties but centralized brokerage between formal extension and non-redundant informal farmer networks, such as the sugarcane network, top-down innovation flows driven by market developments and polices are likely to have a bigger impact than in a more translocal-oriented but less efficiently structured network, such as the rice network.

Third, particular-key actors can make difference. As the example of sustainable rice diversification demonstrates, single boundary spanning individuals (Klerkx et al. 2010) motivated to make a change to their agricultural livelihoods can facilitate bottom-up innovations by linking translocal and local formal and informal networks. As the example of rice broadcasting and cutting demonstrates, bottom-up innovation can materialize, even in the absence of extension support or boundary spanning individuals, if return migrants pass on their embodied migration experience onto local peers, either actively through advice sharing or passively through observation.

Fourth, context matters. Particular changes, such as the spread of sugarcane farming, are only viable in the context of adequate market infrastructure, policies, and extension systems. The potential of migration-related translocal knowledge transfers is particularly evident with regard to adaptive changes that are geared towards limited household resources and that are compatible with social practices of farming. However, the viability of migration-related knowledge transfers depends on the type and destination of migration and is higher if migrants are exposed to different agro-ecological contexts (Matous and Todo 2018). Under these conditions, migration-related knowledge transfers can potentially enable farmers to innovate, who may typically be overlooked by formal extension systems due to their lack of resources and institutional ties (Hoang et al. 2006).

We conclude that research and extension services interested in leveraging agricultural innovations for adaptive change in a more inclusive way should consider institutionalized knowledge and migration-related knowledge transfers as complementary sources of agricultural innovation. In order to disentangle the socio-spatial patterns underlying agricultural innovation, we argue that a translocal network perspective is instructive, if combining quantitative and qualitative approaches.

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