

# Chapter 10

## Value Chain Thinking and Energy Projects—A Problem-Centered Value Chain Approach to Energy Based Upgrading of Rice Farmers in the Philippines

Henrik Beermann, Utz Dornberger, Ben Sebitosi, Sebastian Groh and Jonas van der Straeten

**Abstract** This paper conceptualizes the link between value chain theory and productive use (PU) focused energy projects based on microfinance mechanisms. Its main argument is that all PU of energy projects focusing on micro, small, and medium enterprises (MSME) development can be interpreted as value chain upgrading attempts. It is argued that successful upgrading greatly depends on the MSMEs embeddedness in specific market contexts. For that reason, the context must be assessed to derive energy based intervention points that cause additional income for MSMEs and consequently development. Based on this rationale, a problem-centred value chain approach is proposed. A case study of the Philippine

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H. Beermann (✉)  
International Joint Master Programme in Sustainable Development,  
Leipzig University Grimmaische, Straße 12, 04109 Leipzig, Germany  
e-mail: beermann.henrik@gmail.com

U. Dornberger  
International SEPT Programme, Leipzig University Beethovenstrasse 15,  
04107 Leipzig, Germany  
e-mail: dornberger@uni-leipzig.de

B. Sebitosi  
Centre for Renewable and Sustainable Energy Studies, University of Stellenbosch  
Matieland, Matieland 7600, South Africa  
e-mail: sebitosi@sun.ac.za

S. Groh · J. van der Straeten  
Research Group Microenergy Systems, Technische Universität Berlin,  
Secr. HBS 1, Hardenbergstr. 16–18, 10623 Berlin, Germany  
e-mail: groh@ztg.tu-berlin.de

J. van der Straeten  
e-mail: straeten@ztg.tu-berlin.de

rice market illustrates the usability of the method by outlining some risks and opportunities the rice value chain context poses to energy based upgrading attempts of rice farmers.

**Keywords** Productive use of energy · Value chain theory · Systems theory · Microfinance · Development

## Introduction

Be it ecosystem degradation, global warming, persistent inequality and poverty, or food insecurity—most of the challenges making up the poly-crisis of today’s world are in essence system failures (Swilling and Annecke 2012). Solutions to these problems must be based on holistic thinking rather than separating the problem into small, isolated pieces and solving them stepwise (Batie 2008). Fueled by advanced communication technology, trade agreements and globalized cross-border capital markets, cross-border trade and production has linked the state and future prospects of evolving countries micro, small- and medium-sized enterprises (MSMEs) to the (global) market system they participate in Kula et al. (2006). Energy related research in agricultural markets needs to “change intellectually and operationally from a narrow focus on agriculture and technological research to a better understanding of rural societies and their needs. There is a need to seek greater understanding of alternative pathways for rural economic development, placing the role of agriculture (and energy) in perspective, and redefining the role, mission, and strategy of agricultural institutions as agents as facilitators for rural economic growth” (Anandajayasekeram and Gebremedhin 2009: 8). The application of value chain theory is one result of the paradigm shift that has occurred in agricultural research during the last decades. Value chain thinking anticipates these challenges by assessing MSMEs development potential from the viewpoint of the market system they are part of. Energy projects fostering the utilization of energy services by MSMEs, but develop interventions solely at the firm’s level of energy need and use patterns, risk overlooking key external drivers’ growth and competitiveness (Wolfe and Page 2008). Therefore, the development practitioners’ perspective needs to go beyond the energy technology and farm system to ensure that the energy based intervention gains economic significance.

## Research Objectives

The power of energy technology for MSME development is based on the multifaceted opportunities energy services pose for altering the way these firms interact with market systems. Unsurprisingly, Fakira (1994) states energy is a critical

resource to liberate MSMEs from low value, low productivity and low income activities. Following Boardman and Kumani (2012: 152), “there is often a two-way relationship between the lack of access to adequate and affordable energy services and poverty. The relationship is, in many respects, a vicious cycle in which people who lack access to cleaner and affordable energy are often trapped in a re-enforcing cycle of deprivation, lower incomes and the means to improve their living conditions while at the same time using significant amounts of their very limited income on expensive and unhealthy norms of energy that provide poor and/or unsafe services”. Hence, a general consensus exists amongst development practitioners in regard to the high relative potential energy technology has for MSME development. Groh (2014) argues that based on the existence of an energy poverty penalty, it is likely that households’ and micro-businesses’ development path is inhibited or at least delayed. According to Kirubi (2006), energy is a necessity, though not a sufficient means for MSME development. This implies that, even if energy is considered as a barrier to development, removing this barrier does not necessarily cause additional income and economic growth. To cause profound changes, complementary factors, such as infrastructure, access to capital, the availability of information, skills or social services must be integrated in the design of energy based development interventions (UNDP 2011). Despite those basic insights, literature that systematically assesses the importance of context for energy based MSME development projects remains scarce. Against this backdrop, this paper aims at answering the following research question: Which role can value chain theory play to support energy projects aiming at MSME development? The question is addressed by conceptualizing PU focused energy projects as value chain upgrading attempts. On this basis, a problem-centred value chain approach is proposed. The practical relevance of the approach is elucidated by assessing some of the risks and opportunities the rice value chain in the Philippines poses to energy based upgrading of rice farmers by means of solar based drying technology.

## **The Systemic Value Chain Approach**

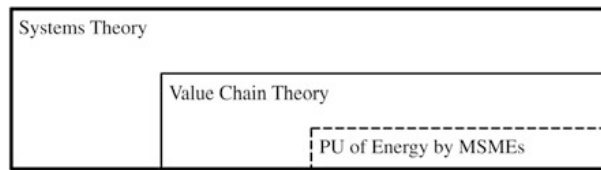
Agricultural goods usually pass through many hands as they move from farm to fork. The goods move along a value chain, defined as “the full range of activities and services required to bring a product or service from its conception to sale in its final markets” (Kula et al. 2006). The value chain approach centres on the “inter-relatedness of those actors gradually adding value to product or service as they pass it from one link of the chain to the next” (UNIDO 2011: 1). These different actors undertaking value adding activities are linked by the flow of products, finance, information and services (KIT and IIRR 2010). Value chain assessments analyse key market actors, the relationships between them, and other factors influencing the performance of an industry. The assessment is centred on the chains metabolism:

Flows of information, finance, knowledge as well as the formal and informal relationships determining these flows. Limiting factors to increased efficiency, productivity and competitiveness are identified and strategies to overcome these barriers are developed (Fries 2007; Miller and Jones 2010). These strategies are based on value chain interventions—concerned activities that facilitate a systemic change of the value chain in regard to an intended goal, such as increased competitiveness of the chain or single firms.

The advantage of such an approach for development projects is that interventions can be tailored according to the context they are embedded in. Its disadvantage, however, is that researchers are endangered by losing sight of the bigger picture because one gets easily caught in particular value chain details (UNIDO 2011). A systematic and systemic analysis of the factors affecting the performance of the firms in a value chain is needed: Systematic in a sense that the process of data gathering must be conducted according to an organized method guided by the assessments purpose, and systemic in a sense that the gathered data must be analysed from a structuralist viewpoint. As there is “no single instrument or a defined ‘recipe’ to follow” (Miller and Jones 2010), it’s up to the researcher to decide on how to do that. The approach applied herein is based on the value chain framework proposed by USAID.<sup>1</sup> It applies a “market system perspective to analyse microenterprises needs and opportunities to [...] prioritize programming options available” (Wolfe and Page 2008). According to the framework, “value chains have both structural and dynamic components. The structure of the value chain influences the dynamics of firm behaviour and these dynamics influence how well the value chain performs” (Kula et al. 2006). The systemic nature of this causal model becomes obvious when comparing Kula’s statement with Sterman’s (2000) explanation of the basic rationale of systems theory: “The behaviour of a system arises from its structure. The structure consists of feedback loops, stocks and flows, and nonlinearities created by interaction of the physical and institutional structure with the decision-making processes of the agents acting within it”. A solid understanding of the systems structural patterns is necessary to understand how they cause behavioural patterns. This, in turn, is a prerequisite to identify places to intervene in (market) systems, and to develop interventions in order to change the system’s behaviour according to a given goal (Senge 1990; Meadows 2008). As such, the value chain framework is an application of this fundamental rationale and is therefore subsumed herein under the systems theory umbrella. Following this rationale, systems theory and value chain theory form a nested hierarchy. Just like a matryoshka doll, systems theory represents the highest level of analytical abstraction and the value chain approach an application of basic insights of systems theory (see Fig. 10.1). On a further subordinated level, PU projects can be subsumed as value chain upgrading attempts, which is discussed in the following section.

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<sup>1</sup> [www.microlinks.org/good-practice-center/value-chain-wiki](http://www.microlinks.org/good-practice-center/value-chain-wiki).



**Fig. 10.1** Nested hierarchy of systems theory, value chain theory, and PU of energy

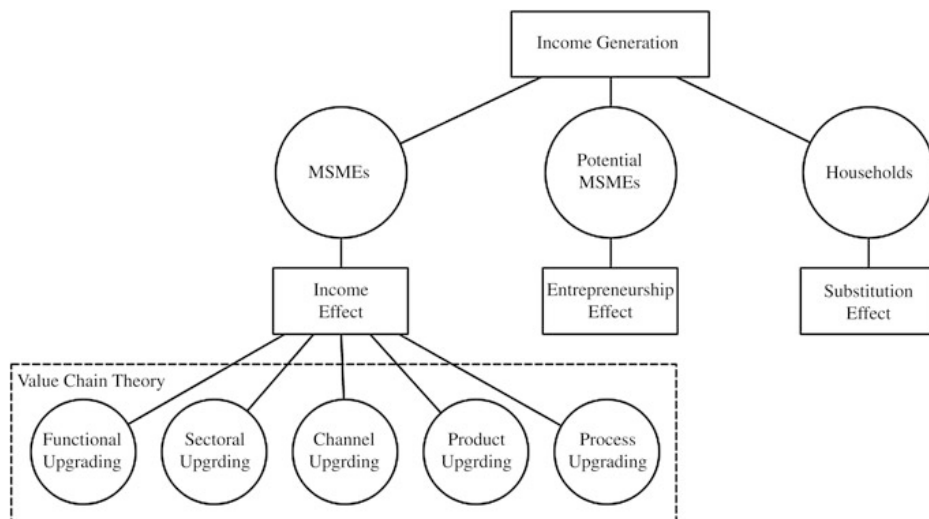
## Value Chain Theory and PU of Energy

From a value chain perspective, a firm's decision to invest and thereby facilitate an intended economic change is a dynamic response to an opportunity to do so. This opportunity is posed by the interplay of a value chain's structural and dynamic elements. In value chain theory this process is understood as upgrading, defined as the process of implementing an innovation that increases the value a firm adds to a good or service (Pietrobelli and Rabelotti 2005). Following Schumpeter (1939), an innovation is an economic decision to adopt a particular intervention in order to cause an intended economic change. Value chain literature distinguishes between five upgrading types, namely process upgrading (improving production efficiency), product upgrading (improving a products quality), functional upgrading (doing things different, performing higher level stages of the chain), channel upgrading (tackling different end markets), and sectoral upgrading (applying skills gained in one value chain to participate in another) (e.g. Humphrey and Schmitz 2002; Miller and Jones 2010). The nature of a successful innovation process, in other words the application of a single or combination of these upgrading strategies, depends on the market structure an MSME is embedded in.

Productive use (PU) of energy is defined as the utilization of energy "either directly or indirectly for the production of income or value" (White 2002). The definition is based on a contemporary understanding of the term development as goes beyond the sole increase of financial income (see Sen 1999). However, for the sake of the discussion herein, PU of energy is understood as the utilization of an energy service in a way that the financial income of an MSME is increased. The term "energy service" is used herein to apply an end-users-perspective to energy projects. Energy itself does not make a difference in poor people's lives'; it is rather the service the energy provides such as cooling, heating, or communication (Allderdice et al. 2007). The potential of energy technologies to increase the income of MSMEs provides an opportunity to finance these technologies on a loan-basis. This provides an opportunity to break the poverty cycle many MSMEs are trapped in, despite the fact that the MSME might not be creditworthy from the viewpoint of conventional banking as they lack bankable collaterals. Designing energy based loan projects in a way that the potential income effect energy technology holds is maximized is a necessity to realize the "synergy potential of financial and energy inclusion" (Groh 2013). Following this logic, microfinance institutions (MFIs) are showing an increased interest in diversifying their portfolio by including energy

related products and services (Kebir and Heipertz 2010) and applying innovative finance mechanisms to finance these offers (e.g. value chain finance). PU focused interventions cause an economic change in a way that the value a MSME adds to a good or service increases. Hence, PU of energy can be interpreted as value chain upgrading based on an energy service related intervention. This implies that every energy project focusing on PU of energy by MSMEs can be interpreted as one or a combination of the 5 upgrading types process-, product-, functional-, channel- and sectoral upgrading. In theory, access to energy services can generate income in three major ways: First, a currently used energy source can be substituted by a more cost efficient alternative (substitution effect). Second, access to energy can offer new business opportunities and thereby promote the emergence of new firms (entrepreneurial affect). Third, access to energy services can offer the possibility to alter a firms production process in a way that the value added to a good or service is improved (development effect) (see Fig. 10.2).

It is this income effect that constitutes the link between energy projects and value chain theory. By means of four examples, this linkage is exemplified in Table 10.1. In case of process-, product-, functional-, and channel upgrading, the discussed logic applied. Taking the example of seafood value chains, an investment in an energy efficient refrigerator can improve the energy service cooling in a way that the relate expenses reduced. This example is a process upgrading approach, as the efficiency of the value adding activity cooling is optimized. This income effect can be a basis for a micro-loan based finance approach. The case of energy-based sectoral upgrading is different though. Following the example used in Table 10.1, a biomass gasification power plant that is embedded in an agricultural community offers new value adding activities to local farmers. If the power plant is based on energy crops, providing the opportunity to farm and sell these crops means



**Fig. 10.2** Energy-based income effects and value chain upgrading

**Table 10.1** Linking energy technology and value chain upgrading

Energy technology	Energy service	Improvement	Upgrading type
Energy efficient refrigerator	Cooling	Reduced cooling expenses by	Process upgrading
Solar tunnel dryer	Drying	Improved quality of agricultural goods	Product upgrading
Energy efficient electric vehicle	Mobility	Ability to bridge exploitive middlemen	Functional upgrading
Solar home system (SHS) to provide energy for internet access	Information	Ability to respond to changing market conditions	Channel upgrading
Biomass gasification power plant	Does not apply	Offering new value chain based on energy crop needs of biomass power plant	Sectoral upgrading

exposing these farmers to a new value chain. The major difference of this channel upgrading example to the other upgrading types is that the income effect is not based on an energy services implemented on the level of the MSME, but it is a the provision of a new value chain based on the biomass needs of the power plant. The second major difference is that the investment costs for projects' like this usually exceeds the financial capabilities of MFIs.

## Proposal of a Problem-Centred Value Chain Approach

What are the implications of the previous discussion for energy based development projects? The basic rationale of the applied value chain approach is that an investment in energy technology must be seen as a dynamic response of a market actor in terms of an opportunity the value chain context poses. The context consists of different structural elements and dynamics—with each of these either supporting an investment opportunity, posing a risk to an investment opportunity, or being neutral. It is the sum of these influences that determines whether or not an opportunity to invest exists [for a generic discussion of these causal linkages see Dunn et al. (2006)]. Value chain assessments are undertaken ex-ante to the development of a context tailored intervention. However, despite the importance of market based information for the design of energy based MSME development projects, conventional value chain theory seems to be incommensurate with the reality of energy based development work. New projects are often started with a given, idea of where and how to intervene in a firm system, as well as an assumption in regard to the financial benefits of such an intervention. Undertaking an open-ended (in terms of the intervention) value chain assessment is resource intensive and therefore out of realm of most energy projects. Hence, the question is how to bridge both approaches—how to utilize “intervention-open” value chain

thinking in order to support “intervention-closed” PU of energy project? As a first attempt to answer this question, this paper proposes to reverse the value chain rationale and undertake problem-centred value chain assessments. In this regard, problem centered means that all gathered information is related to an ex-ante defined upgrading strategy. The data collection process is limited to the influence (supportive, hindering, neutral) the value chains structural and dynamic elements have on a given energy based upgrading strategy. Thereby, market-related risks and opportunities to the given upgrading strategy are derived, which enables decision-makers to design a project in a way that the risk/benefit ratio of the project is optimized and the income generation effect maximized.

### **Case Study: Energy Based Upgrading of Rice Farmers in the Philippines**

The problem-centred value chain approach is applied herein to the case of energy based upgrading of rice farmers in the Philippines. Ex-ante to the assessment, a financially promising intervention has been proposed, which is the alteration of the drying process of rice farmers by means of solar based drying technology. Hence, the energy service this upgrading strategy is based on is “drying” of rice. The focus on this intervention is justified on the basis of the projects baseline-scenario, which is the current palay-drying practice of agricultural smallholders: Farmers usually dry their palay on public roads, a practice with the consequence that parts of it is consumed by free-range livestock, grains are contaminated by livestock and cracked by vehicles, the drying process depends on climatic conditions, etc. The total assumed income generation effect of the intervention must be seen in relation to business-as-usual case. The assumed financial benefits of improving the farmers drying process are: (1) Increased market value of a higher quality produce, (2) prolonged quality preservation of dried product due to lesser contamination, and (3) more efficient drying in a high humidity environment. It is assumed that all of these alterations are increasing the farm-gate price of palay. The problem-centred value chain approach contextualizes these assumptions by relating them to the local rice market. It discards, enhances, or adjusts the assumed benefits and serves as a basis for a realistic calculation of the financial viability of investing in the upgrading strategy. The gathered information serves as a basis for deriving the project’s feasible design space—potential project settings that are in line with the projects goals function while taking into consideration the projects constraints and local market conditions. On this basis, the project can be designed in a way that the income generation effect for palay farmers is maximized, which, in turn, minimizes the lending risks MFIs.



## Method

The data collection process was explorative and mainly based on qualitative interviews with value chain internal market actors and value chain external experts. The major problem of attempts to analyze the rice market in the Philippines is the unwillingness of certain market actors to talk with strangers about their business practices, a condition that defies an approach based on a large sample survey over a wide area with standardized questionnaires (Hayami et al. 1999). As discussed in the previous section, the data gathering process has been guided by challenge of designing a project in a way that the financial benefits of the drying based intervention are maximized. Structural and dynamic parameters potentially impacting on this goal have been detected during the research process—which is only possible in an explorative manner. Based on this rationale, 48 open-ended explorative interviews with key value chain actors and local rice market experts have been undertaken between August 13th and October 10th 2013 on the Philippines main island Luzon.

## Analysis

Following the rationale of the problem-centred value chain approach, and given the limitations of this paper, most conventional features of value chain assessments (e.g. a map of the market, discussion of value chain actors) are excluded from this case study. Instead, a few selected aspects of importance are explained and their relation to the projects goal function discussed.

*End market conditions:* The value chain approach is driven by the principle of demand-driven supply. End-markets play a central role in the value chain study, as they determine demand characteristics terms of quality, quantity, timing, and pricing (see Kula et al. 2006). The rice value chain must be subdivided into the palay chain (un-milled rice), and the rice chain. Both are connected by the miller. The end-market of interest for farmers is defined by the palay chain, with its different market segments defined by the specific needs of palay buyers. According to the assumptions, quality increase caused by upgrading the drying process leads to income increase on the level of farmers. However, quality is a multidimensional concept, with its subjective assessment being related to a specific end and the resources to achieving it (Allaire 2012). Whether, and to which extent an income generation effect is caused depends on the end-markets notion of quality, which determines their willingness to pay for quality alterations. Three end-markets segments have been identified: (1) The governmental National Food Authority (NFA) applies a very differentiated price mechanism based on a matrix incorporating several quality related attributes, (2) Local buyers who apply a straight payment scheme mainly based on the type of rice and the moisture content (often reduced to “wet” and “dry”, as well as the type of palay), and (3) buyers connected

to institutional markets, who are in the need to supply large quantities of high quality rice. The crux of benefit maximization is to link farmers to those of these end-market segments that (financially) acknowledge the quality alteration, which is in this case segment 1 or 3. However, quality is not the only determinant of the rice price. Figure 10.3 illustrates the dynamics governing the price setting process, which is interpreted herein as a dynamic process based on the interplay of a set of cultural, technical, market-based and political variables (Fig. 10.4).

*Enabling Environment:* Policies, institutions, climatic conditions, and other attributes collectively creating the external business setting in which value adding activities take place are subsumed under the term enabling environment (Christy et al. 2009). Various variables of this structural element are of importance. One brief example is representing all not mentioned findings: During the last decades, the developmental policy of the Philippines has been characterized by free “dole-outs” of financial and technical means, a practice that caused several unintended consequences: (1) A “dole-out mentality” has been caused that makes farmers wait for governmental interventions rather than proactively causing change. (2) Governmental presence in development projects undermines the peoples willingness to

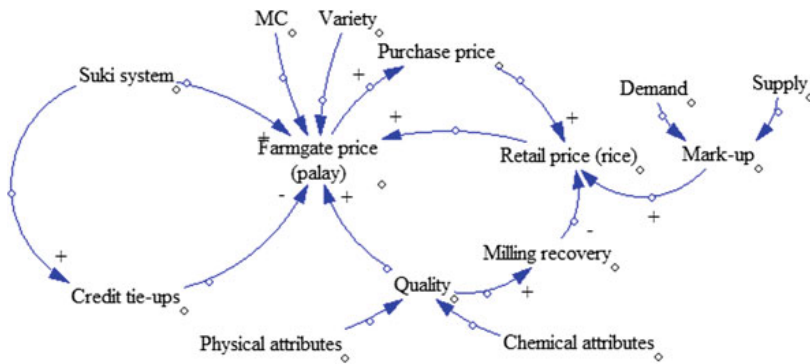


Fig. 10.3 Causal-loop diagram of the price setting mechanisms in the Philippine rice value chain

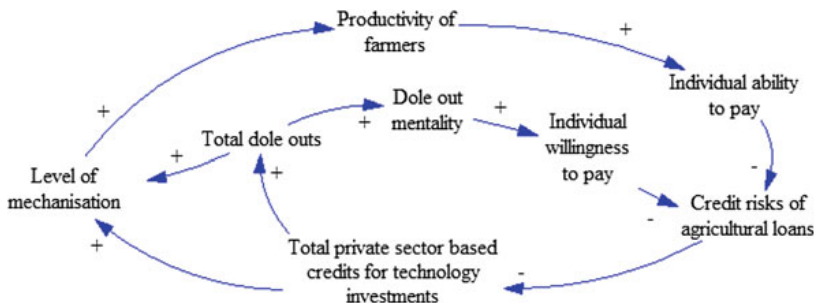


Fig. 10.4 Causal loop diagram illustrating the dynamics caused by governmental dole-out programs

pay (WTP) for micro-loans. (3) Governmental dole outs of technologies are wrecking market-based efforts to provide these technologies. The dynamic interplay of these aspects is depicted in Fig. 10.2. Governmental institutions are providing a whole range of supporting services for development projects like this. However, it must be assumed that cooperation could negatively impact on the WTP of farmers for loans. This could negatively impact on the repayment rates. For that reason, a potential cooperation with governmental institutions must be seen as very critical.

*Vertical and horizontal linkages:* According to the United Nations Industrial Development Organization (UNIDO 2011: 8), “networks and linkages are the building blocks of collective efficiency”. Vertical linkages are the relationships between market actors at different value chain nodes. Horizontal linkages refer to the relationship between market actors undertaking the same activity in a value chain. Of critical importance herein are the linkages between palay farmers and segments of potential buyers. As mentioned earlier, the NFA is applying a price setting mechanism based on several quality determinants. By upgrading the drying process of palay farmers in the intended way, the farmer’s ability to meet these determinants is improved. For this reason, farmers could theoretically realize higher palay prices by selling to the NFA. However, some aspects are questioning this approach: (1) The NFA is a governmental entity. For that reason, cooperation could cause a dole out mentality amongst farmers. (2) The complicated bureaucratic application process constitutes transaction costs. These must be seen in relation to the paid premium. (3) Research indicates that the NFA does not necessarily pay farmers immediately. More than the fact that farmers need cash immediately after harvest, the uncertainty whether or not the NFA is capable to pay entails high planning risks for the project. In sum: Although the NFA appears to be a market segment worth tackling, the assessment of the farmer-NFA linkage revealed some of the obstacles such an attempt is prone to.

*Supporting Services:* Supporting services can be subdivided into either formal or informal (1) financial services (e.g. lending), cross cutting services (e.g. legal advice), and (3) sector-specific services (e.g. the availability of a certain technology) (Campbell 2008). Agricultural smallholders are usually excluded from the formal financial system. However, agriculture is an investment-intensive activity, with returns only realized at the end of the cropping season (MCPI 2010). Palay buyers are usually stepping into fill this finance gap. By providing farmers with the financial means or inputs necessary to initiate the next harvest, trader-credits are crucial for the functioning of the rice market and for ensuring food supply. However, the public perception of these credit tie-ups is rather negative; as they are often characterized by excessive interest rates (e.g. one interviewed trader charged 28 % interest per month). Farmers usually pay back in kind after harvest by accepting prices dictated by the traders. For that reason, many farmers are depended on new loans and trapped in a state of constant indebtedness. This aspect must be from the viewpoint of *utang na loob*, which is the Philippine concept of moral indebtedness. Once indebted, farmers are obliged to show gratitude even when the the financial debt is settled. From the viewpoint of designing a project that upgrades the drying process, the discussed issues have two major implications: (1) Local traders usually apply a

straight buying scheme that reduces the quality determinants to class A (bad quality), class b (average quality), class C (good quality), as well as the moisture content (either “wet” or “dry”). Upgrading the drying has a positive impact on various other quality determinants (e.g. whiteness, aroma, foreign matter, milling recovery, etc.). For maximizing the financial benefit of the upgrading attempt, farmers have to be linked to an end-market that is willing to financially acknowledge these alterations, which most probably isn’t the local trader. However, *utang na loob* might force farmers to stick to their traders, even though their financial debts are settled and another market segment offers higher prices. (2) The risk management rationale of the project is based on the income generation effect of improving the energy service “drying”—Maximizing the income generation effect means minimizing loan failures. But what if farmers are indebted by traders or even by some other suspicious external parties like 5, 6 Bombay lenders<sup>2</sup>? It can be assumed that the party applying highest social or even physical pressure is paid first—which won’t be the MFI providing energy loans.

## Discussion and Concluding Remarks

The conceptualization of PU of energy projects with the aim of MSME promotion as upgrading attempts provides a new viewpoint on PU projects. By connecting these previously unconnected dots, a new, intrinsically trans-disciplinary discursive way to think about energy projects is offered. From the viewpoint of the systemic value chain approach, it is the value chain system that poses an opportunity to invest in energy technology. Energy projects neglecting the importance of the market context will a priori limit their space of interventions to those located within the borders of the individual firm. Such a self-imposed restriction does not meet the opportunities offered by the multifaceted applicability of energy services, as the state and future development paths of MSMEs is often determined by forces located outside the firms’ borders, and access to energy services offer the opportunity to tackled intervention points beyond fuel substitution on a firm level. Furthermore, especially if an intervention is developed without proper knowledge of the local market conditions, the external market context poses risks to a given upgrading strategy that can’t be overseen and managed in advance. It might seem to be worthwhile to increase the productivity of an agricultural smallholder, but how does that make sense if the end-market is already saturated? How does it make sense to improve the productivity of Philippine banana farmers producing for the European market, if the European standard for bananas will be changed soon, challenging the farmer to alter the quality of their produce, not the quantity? Whereas traditional micro-lending neglected questions like this, there is a growing recognition amongst MFIs that a broader,

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<sup>2</sup> Their name is a play on their lending scheme and origin: For every 5 pesos, 6 have to be paid back after one month.

market-based approach to the design and utilization of their services is needed. One of the leading Philippine MFIs in this regard is the CARD Bank. Based on their past experiences in MSME lending, the institution came to the conclusion that “most of its clients, after attaining commercial-level status through its financial services, are now in need of essential non-financial services to fully develop their businesses. This range of non-financial services, known as business development services (BDS), represent the entire spectrum of services a business requires to attain sustainability when analyzed within the context of value-chain analysis. Within this context, assessing what specific types of BDS enterprises require is the first vital step in addressing the goal of helping enterprises fully realize their business potentials” (Alip et al. 2009). Energy services offer a huge development potential, but only if their implementation and application is contextualized. The problem-centred value chain approach is a first attempt to utilize the power of value chain thinking for overseeing and managing the risks and opportunities a particular context poses to a pre-defined energy based intervention. By means of a case study on upgrading of Philippine rice farmers, the approach has been tested. The discussed aspects are only a fraction of the insights gathered during the research process. However, they are sufficient to illustrate how external, value chain related factors are limiting the feasible design space of energy projects. Neglecting the local market context, and assuming an energy project can be designed in a way that the risk/benefit ratio is optimized, leaves interventions with the risk of causing adverse effects which can otherwise not only be mitigated but development effects be strengthened.

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