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DO THE POOR BENEFIT FROM CORPORATE SOCIAL RESPONSIBILITY? A THEORY-BASED IMPACT EVALUATION OF SIX COMMUNITY-BASED WATER PROJECTS IN SRI LANKA

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Abstract

Corporate Social Responsibility (CSR) can work as an effective means towards minimising business risk and maintaining amicable relationships with diverse groups of stakeholders. While many studies have examined the impacts of CSR on firm value and customer perceptions, little is known about the effects of a philanthropic engagement of the private sector on external stakeholder groups, such as local communities in developing countries. This paper examines welfare effects of six community-based water supply projects that were supported by a thermal power plant in Sri Lanka as part of the company's CSR strategy. The implications of these CSR activities are analysed from the perspective of the project beneficiaries, the majority of them poor smallholder farmers. Household production and labour income functions are estimated from survey data to analyse two pathways through which the water projects affect the beneficiaries' lives. First, the households get individual access to water that allows for the irrigation of home gardens, increases land productivity and changes households' farm output and income (irrigation channel). Second, the projects have an indirect effect on households' income via a time channel, i.e. the effect that due to the individual water access the households save time as there is no need any more to fetch water from far away water bodies or wells. This allows for a reallocation of labour time for other productive income-generating activities. Despite the considerable costs that households have to bear for an individual water connection, the study finds a systematic, positive net income effect of the projects on the beneficiaries via both the irrigation and the time channel. Qualitative evidence supports these findings and also reveals additional positive, non-monetarised project impacts. As the water projects would not have been realised without the subsidiary financial support of the power plant, it is concluded that the company's CSR engagement is increasing the welfare of the beneficiary communities.

Keywords: Corporate Social Responsibility; Productivity Method; Theory-based Impact Evaluation; Club Goods; Stakeholder; Smallholder Farmers; Community-Based Water Supply; Sri Lanka; Welfare Changes.

JEL codes: D13 (Household Production), D61 (Allocative Efficiency, Cost-Benefit Analysis), H41 (Public Goods), H42 (Publicly Provided Private Goods), H43 (Project Evaluation; Social Discount Rate), M14 (Corporate Culture; Social Responsibility); Q12 (micro-analysis of farm firms, farm households, and farm input markets), Q12 (micro-analysis of farm firms, farm households, and farm input markets), Q51 (Valuation of Environmental Effects).

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ACRONYMS

CBO	Community-based Organisation
CEB	Ceylon Electricity Board
CSR	Corporate Social Responsibility
CWSSP II	Second Community Water Supply and Sanitation Project
DFI	Development Finance Institution
GRI	Global Reporting Initiative
ISO	International Organization for Standardization
NGO	Non-governmental Organisation
RCT	Randomised Control Trial
UN	United Nations
UNGC	United Nations Global Compact

Exchange rate used:

LKR (Sri Lankan Rupee) 100 = EUR (Euro) 0.68; EUR 1 = LKR 146.76
(average exchange rate: 15 November 2010—15 November 2011)

1 INTRODUCTION

To proceed towards the Millennium Development Goals (MDGs), the United Nations has called upon the public and private sector to mobilize both international and domestic resources for poverty alleviation, economic growth and development (UN 2003; UN 2014). As exemplified by initiatives such as the "UN Global Compact," more and more national and multinational businesses collaborate with public and civil society actors, pledging to actively promote sustainable development, human rights, international labour norms and environmental concerns along global value chains (UNGC 2014, p. 7, UNGC 2013, p. 3-4). By adopting Corporate Social Responsibility (CSR) policies, firms move beyond legal compliance and actively seek to become "good corporate citizens" (Carroll 1998).

Much of the growing body of academic work on corporate responsibility focuses on conceptual questions, impacts on firms' economic performance and CSR communication strategies. Missing so far are studies that analyze not just the effects of social responsibility to the firm, but also the impacts of CSR measures on stakeholders other than shareholders, customers, employees and suppliers. These include people living in local communities in developing countries, which are often the target of firms' CSR engagement but of less strategic importance as a stakeholder group. This paper contributes to closing this knowledge gap by presenting an empirical case study on the impacts of CSR activities of a private energy supplier in Sri Lanka.

As part of a larger evaluation study commissioned by a German development finance institution, a theory-based impact assessment was carried out to estimate the welfare effects of a 100-MW thermal power plant from the local population's perspective. Such effects include potential benefits from electricity provision and from the company's CSR projects and potential costs from environmental pollution and changes in land use. The empirical case study presented in this paper focuses on six community-based water projects that received complementary funding out of the power plant's CSR budget. The study aims at identifying welfare effects of the water projects on the beneficiary households, the majority of them poor smallholder farmers. We employ a set of theory-based approaches to model the changes in households' output, labour allocation and income and test them empirically using data from a random sample of the benefitting households.

Having in mind a readership interested in the diversity of social empirical research, the study's context, theoretical foundations and methodology are explained extensively. Beyond its immediate research objective, i.e. assessing the welfare impacts of the community-based water projects on beneficiary households, the study puts the focus on two overarching areas of academic interest. First, it contributes to filling the research gap with regard to assessing the impacts of CSR in developing countries. Second, the study demonstrates the analytical rigour of theory-based impact evaluation to assess the effects of development interventions.

The next chapter (Chapter 2) positions the study within the current academic debate on CSR. Chapter 3 provides details on the company, its CSR engagement and the case study context. In Chapter 4, the conceptual framework for assessing the impact of the company's CSR activities is outlined in detail, arguing for a theory-based, rigorous

assessment of the benefits and costs that are emerging from the CSR-supported community-based water projects. Chapter 5 outlines the research methodology and the analytical steps taken in assessing the welfare impacts. The empirical results of the study are presented in Chapter 6. Based on multivariate regressions, various impact channels of the CSR activities are first analysed separately. Finally, the aggregate impact of the community-based water projects is presented, along with some complementary evidence on the projects' monetary and additional non-monetarised impacts. The paper ends with a summary and some conclusions (Chapter 7).

2 THE CONCEPT OF CORPORATE SOCIAL RESPONSIBILITY

This chapter aims at defining and conceptualising "Corporate Social Responsibility" (CSR) and explores its contribution to addressing global challenges such as poverty alleviation. After a general introduction to the concept and its emergence, the chapter looks at the specific role of CSR in the context of developing countries. An overview of the state of the art is provided, highlighting a knowledge gap on the social welfare implications of CSR, particularly on external, secondary stakeholders in developing countries.

2.1 Defining Corporate Social Responsibility

While the idea of "Corporate Social Responsibility" is not new, the ubiquitous use of the term and loose synonyms such as "Corporate Citizenship," "Corporate Social Performance" and "Corporate Sustainability" is a rather recent phenomenon. CSR is commonly described as a self-regulatory framework through which corporations oblige themselves voluntarily "to further some social good, beyond the interests of the firm and what is required by law" (McWilliams & Siegel 2001, p. 117; cf. EC 2011; Kaltenborn & Norpoth 2014; Jonker et al. 2011). To implement CSR, "enterprises should have in place a process to integrate social, environmental, ethical, human rights and consumer concerns into their business operations and core strategy in close cooperation with their stakeholders" (EC 2011, p. 6). In contrast to the objective of profit-making, which primarily attends to the interests of company owners and shareholders, CSR measures are aimed at various groups of *stakeholders*. Stakeholders are constituent groups within or outside the company that can affect and/or are affected by the firm's operations. Employees, customers, suppliers and communities are usually the most important stakeholders of a firm, apart from its shareholders (Torres et al. 2012, p. 15). Other typologies additionally list investors, top-level management, the government, competitors or even "mute" or absent stakeholders such as "the natural environment" or "future generations" (Castelo Branco & Lima Rodrigues 2007, p. 7; cf. Hopkins 2003).

Not all stakeholders are equally influential or important from the perspective of the company. It has therefore become common to distinguish between primary and secondary stakeholders. Owners and shareholders, top-level management and employees are certainly among the *primary stakeholders* of a company, "without whose continuing participation the corporation cannot survive as a going concern" (Clarkson 1995, p. 106). Such stakeholders legitimize a company's existence and have substantial influence on its performance. Other primary stakeholders are customers, suppliers, and government institutions that provide markets and infrastructure and to whom legal and fiscal obligations may be due (ibid.). In contrast, *secondary stakeholders* are "those who influence or affect, or are influenced or affected by, the corporation, but they are not engaged in transactions with the corporation and are not essential for its survival. The media and non-governmental organisations (NGOs) belong to this category, due to their capacity to mobilize public opinion, either in favour of or against the company (ibid., p. 107). Communities residing in a firm's immediate environment can be primary or secondary

stakeholders, depending on the scope of the consequences that they are likely to experience due to the company's presence, and their ability to influence business success.

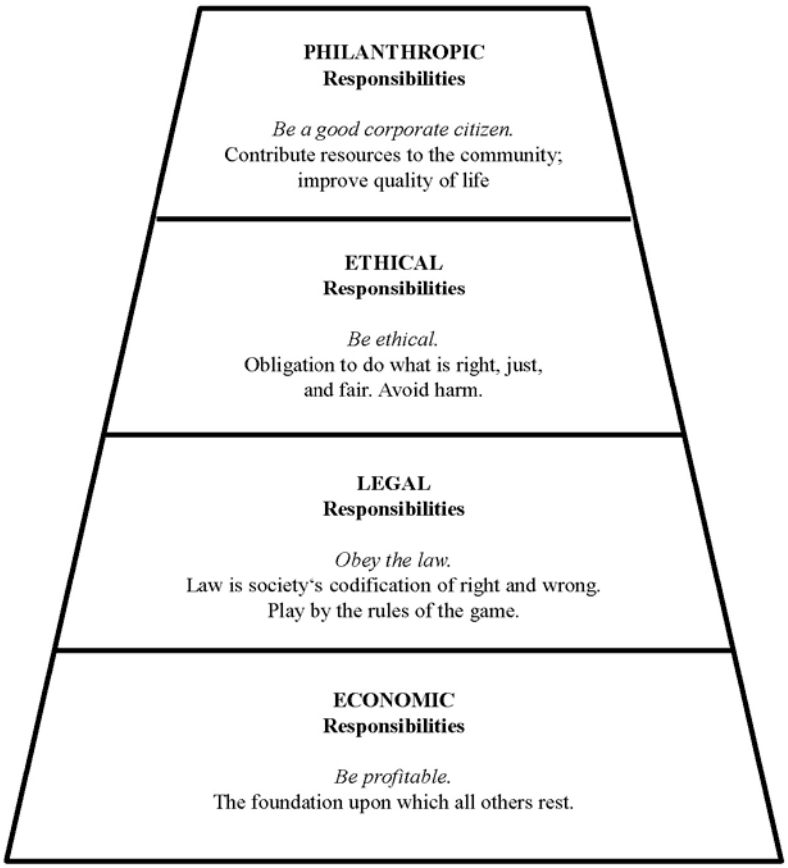

Figure 1 The pyramid of CSR (Carroll 1991, p. 42)

There are diverse ways with which companies can implement CSR in practice and attend to the demands of their stakeholders. Archie Carroll has described CSR as a "pyramid" consisting of four distinct layers or dimensions (Figure 1). The bottom layer of the pyramid refers to firms' economic responsibilities, as these are "the foundation on which all other rest" (Carroll 1991, p. 42). Apart from being profitable and obeying the law, "good corporate citizens" are also expected to demonstrate ethical behaviour and "give back" to communities and other stakeholders through philanthropic projects (Carroll 1998, pp. 1-2, 6). Whereas the *ethical dimension* of CSR refers to social norms such as self-constraint and altruism, *philanthropy* can be defined as "discretionary wealth transfer of net income to stakeholders" (Windsor 2006, p. 98). According to Carroll, a company's "total CSR" thus consists of a combination of measures that attend to all four dimensions. For example, a company's CSR strategy could comprise the following elements:

- Adopting internationally acknowledged environmental standards and a "code of ethics" against child labour (legal and ethical responsibility; as demanded not just by law and governments, but also by civil society organisations and customers);
- Promoting a family-friendly work environment (ethical responsibility; as demanded by employees and public opinion); and

- Donating a share of revenue to development projects (philanthropic responsibility; demand by customers, communities and NGOs).

Concluding so far, the term CSR will be used in the remainder of this paper to refer to *voluntary activities of companies directed at fulfilling perceived social responsibilities towards their various stakeholders.*

Whether businesses should engage in CSR, and to what extent, has been a matter of vivid academic debate since the second half of the 20th century (cf. Jonker et al. 2011, pp. 19-21 for an overview). Milton Friedman, one of the harshest critics of CSR, has claimed that "there is one and only one social responsibility of business—to use its resources and engage in activities designed to increase its profits so long as it stays within the rules of the game" (Friedman 1970). According to Friedman, social responsibility reflects the "socialist view that political mechanisms, not market mechanisms, are the appropriate way to determine the allocation of scarce resources to alternative uses." As companies' investment "under the cloak of social responsibility" could be harmful for business (and, hence, ultimately for society), he regards CSR as a "threat to an ideal free market resting on private property" (ibid.). In this view, shareholders are the only legitimate stakeholders, and profit-maximization is the only objective of a firm (cf. Jonkers et al. 2011, p. 25).

Friedman's stance has been challenged by Robert Edward Freeman, who in the 1980s introduced the *stakeholder perspective on CSR* (Freeman 1984; 2004). According to Freeman, firms have an impact on the environment and society as a whole and are, therefore, obliged to attend to the needs of all stakeholders, not just their shareholders (Jonkers et al. 2011, p. 25). This argument is closely related to the notion of *externalities*, which may "arise when firms create social costs that they do not have to bear, such as pollution" (Porter & Cramer 2011, p. 5). In this view, CSR could be conceptualized as a pragmatic way to establish relationships with various constituent groups and to internalize externalities that are caused by a firm. However, CSR is not simply a moral obligation but also mandatory from an economic point of view, as stakeholders are not just affected by, but also able to influence a firm's success (Wood & Jones 1995, p. 231; Castelo Branco & Lima Rodrigues 2007, p. 11):

- Stakeholders define the norms and expectations with regard to corporate behaviour (through lawmaking and public opinion);
- They experience the effects of corporate behaviour (through creation of welfare and externalities such as pollution);
- They evaluate the outcomes of corporate behaviour (through demand/consumption and public opinion).

Hence, there is an interdependent relationship between firms, their stakeholders and wider society (Porter & Kramer 2011, pp. 4-5). International debates on sustainability and globalisation, as well as the rapid advancement of information technologies and social media in recent years have increased public awareness and have forced companies to respond to stakeholder expectations. Today, the question is no longer *if* companies should engage in CSR but rather *how*. Around the globe, CSR has become a key strategic concern that companies cannot afford to ignore (Jonkers et al. 2011, pp. 16-17, cf. Du, Bhattacharya & Sen 2007).

2.2 CSR in Developing Countries

As indicated above, there is a growing political and scholarly interest in the contribution of corporate social investment to address societal problems. This includes the role of business in "tackling the critical issues of human development and environmental sustainability in developing countries" (Visser 2008, p. 473). This section explores the distinct characteristics of CSR in the context of developing countries[1].

To meet the developmental challenges commonly associated with low- and middle-income countries, bi- and multilateral aid agencies are increasingly seeking partnerships with the private sector to fight poverty and reach the UN Millennium Development Goals (cf. UN 2007; BMZ 2011a, 2011b; EU 2013; Gilbert & Jenkins 2014; DFID 2003). CSR has thus been regarded as "an alternative route to the public delivery of development" (Frynas 2005, p. 582, cf. Blowfield & Frynas 2005, p. 499). It has been noted, however, that frame conditions and drivers of CSR in developing countries might be distinctly different from those in developed countries, due to the specific socio-economic environment and priorities of poor countries (Visser 2008, pp. 480-488; cf. Blowfield & Frynas 2005, p. 499). Consequently, Visser proposes a modification of Carroll's CSR pyramid (cf. Figure 1) "to illustrate how CSR actually manifests in developing countries" (ibid., p. 492).

Companies' economic responsibilities remain at the base of this modified CSR pyramid (Figure 2), as "many developing countries suffer from a shortage of foreign direct investment, as well as from high unemployment and widespread poverty" (Visser 2008, p. 489). In contrast to Carroll's original CSR pyramid, philanthropic contributions are of relatively higher importance in developing countries than in the developed world, as "companies cannot succeed in societies that fail, and philanthropy is seen as the most direct way to improve the prospects of the communities in which their businesses operate" (ibid., p. 490; cf. Frynas 2005, p. 582). Supposedly linked to governance gaps such as a poorly developed legal infrastructure and weak law enforcement mechanisms in developing countries, companies' legal responsibilities rank lower in the modified CSR pyramid (ibid., p. 491). Finally, ethical responsibilities appear to have the least importance for CSR in developing countries and are often restricted to an adoption of voluntary codes of conduct (ibid., pp. 491-492). Visser (2008, pp. 492-493) thus identifies several *distinctive features of CSR in developing countries*:

- CSR in developing countries is mostly practiced by large national and multinational companies, especially those with recognized international brands;
- CSR is most commonly associated with philanthropy, through corporate social investment in sectors such as education, health, sports, environment and community services;
- Formal CSR standards and reporting systems focus on issues (e.g. fair trade, HIV/AIDS, child labour) and sectors (e.g. agriculture, mining, textiles) that are of particular relevance for developing countries;

1 In line with Visser (2008, p. 474), the term "developing countries" in this paper refers to low and middle income countries (as opposed to high income countries) as defined by the World Bank (cf. http://data.worldbank.org/about/country-and-lending-groups, accessed 01-11-2014).

- Through their corporate social investment, businesses often support the provision of social services that are traditionally regarded as a government domain in developed countries, e.g. provision of infrastructure, schools, hospitals and housing.

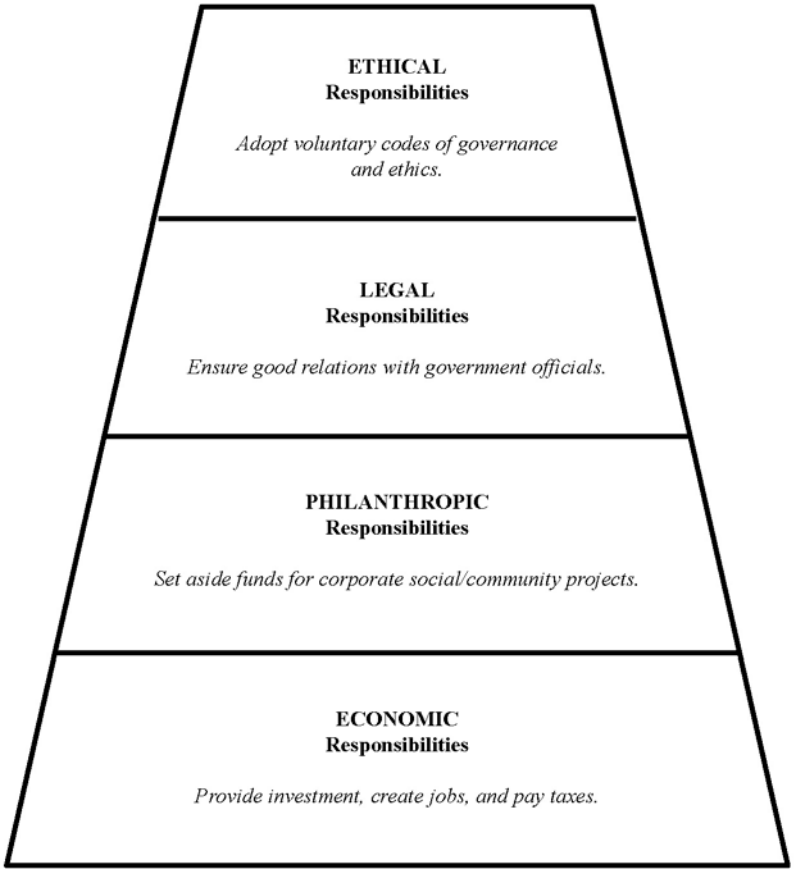

Figure 2 CSR pyramid for developing countries (adapted from Visser 2008, p. 489)

The latter point (i.e. the assumption of government functions by corporations) has raised criticism because companies are not democratically legitimized, but instead are driven by their own economic agenda rather than social goals (cf. Banerjee 2008, p. 74). As much as companies—including much-wanted international investors—could be tempted to bypass strict international social and environmental legislation by locating in areas with weaker governance, they may also choose to invest in CSR that is suited to their public relations agenda rather than to national development priorities (cf. Newell & Frynas 2007, p. 672, Blowfield & Frynas 2005, pp. 504-506). However, if CSR activities were based on local development priorities and coordinated with government and civil society efforts, they could produce important benefits in the societies in which they operate, beyond just contributing to national tax income and creating a few new jobs. If CSR is adopted as an approach to international development, we thus have to find answers to one fundamental question: Who, apart from the company, benefits from CSR in developing countries, how and why? (Newell & Frynas 2007, p. 669). We will return to that question in the next section.

2.3 Impacts of CSR

As explained in Section 2.1, firms have a strategic interest in good stakeholder relationships and expect various positive impacts from their CSR investment. At the same time, stakeholders' expectations with regard to the role of business in promoting social goals such as poverty alleviation have grown. This section scrutinizes existing evidence on the impacts of CSR, distinguishing between effects on the companies and effects on society, exemplified here by corporate social investment in developing countries.

Impacts of CSR—the Firm's Perspective

The first and most obvious expected benefit of CSR relates to companies' "core business," i.e. profit-making. Many studies have examined the link between a company's CSR investment and its *financial performance* (McWilliams & Siegel 2001, pp. 117-118; Blowfield 2007, pp. 689-690; Wood & Jones 1995, pp. 245-246). Research findings suggest that the impact of CSR on financial performance is moderated by customer satisfaction, companies' competitiveness, the type of activities supported, the stakeholders targeted and the channels through which CSR is communicated (Schmeltz 2012; Luo & Bhattacharya 2006; Wood & Jones 1995). As regards the association between CSR and *company size*, it has been observed that larger firms spend more on charity in absolute terms, but less in relative terms than smaller firms (Wood & Jones 1995, p. 244).

Based on a supply and demand model of CSR, McWilliams & Siegel (2001, p. 125) predict a neutral relationship between CSR and financial performance in general, as a "firm that produces a CSR attribute will have higher costs but also higher revenues, whereas the firm that produces no CSR attributes will have lower costs but also lower revenues." They conclude that in order to maximize profits, firms always will invest (only) as much in CSR as their stakeholders are willing to pay for it. However, the authors do not provide empirical evidence that supports their assumptions. In contrast, a meta-analysis of 127 studies conducted between 1972 and 2002 concludes that there is a "positive association, and certainly very little evidence of a negative association, between a company's social performance and its financial performance" (Margolis & Walsh 2003, p. 277). An update of the latter meta-study, this time comparing results from 251 studies, confirms a positive, albeit small effect of CSR on companies' financial performance (Margolis et al. 2009).

Along similar lines, a more recent analysis of empirical data from 57 globally operating firms suggests that CSR, in general, has a positive impact on firms' brand equity. The study also reveals that a combination of CSR activities directed at customers (e.g. related to customer relations, product quality & safety) and local communities (i.e. philanthropy, such as donations and volunteer programmes) has a particularly large impact (Torres et al. 2012, p. 21). The authors argue that CSR directed at customers is more *visible* than initiatives aimed at other stakeholders. In contrast, CSR activities directed at local communities are perceived as particularly *credible*, as "such (secondary) stakeholders are distant from the interests of global brands' headquarters," signalling a sincere commitment to ethical behaviour and lack of self-interest. In a similar vein, Ingenbleek & Immink (2010, p. 54) suggest that CSR directed at primary stakeholders can provide "pragmatic legitimacy" to a company's corporate behaviour, whereas measures aimed at secondary stakeholders provide "moral legitimacy" in correspondence with societal values and expectations.

The importance of credibility in CSR may explain the tremendous popularity of environmental and social certification schemes such as the ISO standards and international CSR initiatives such as the UN Global Compact (UNGC) and the Global Reporting Initiative (GRI) (see Conroy 2007, EU 2013 and Kaltenborn & Norpoth 2014 for overviews). The UNGC as the largest international initiative to date has already been signed by 8,000 companies in 140 countries, deriving its credibility not just from UN reputation but more importantly from the participation of more than 4,000 civil society signatories (UN Global Compact 2013, p. 4; cf. Kaltenborn & Norpoth 2014, p. 405). Still, such initiatives have been criticised for representing mere minimal standards, misuse as advertising and costly reporting requirements.[2]

While there might not always be proof of tangible financial benefits of corporate responsible investments, it could become costly for firms to abstain from CSR and ignore stakeholder demands (Conroy 2007 provides several examples for this). Consider the realistic case of a company that is able to demonstrate compliance with international product quality and safety standards, pays taxes due to local government authorities but fails to ensure adherence to international labour norms and workplace safety at some of its offshore manufacturing plants. In countries with weak governance and/or dysfunctional law enforcement mechanisms, workers will have little bargaining power to enforce their rights or claim compensation in case of an accident. Such stakeholders with "urgent claims but low power" have been described as *discretionary stakeholders* (Ingenbleek & Immink 2010, p. 54). However, if such "weak" stakeholders are assisted by "stake watchers," such as NGOs or the (global) media, they might well become powerful, with the ability to cause serious harm to a firm's reputation by influencing the purchase behaviour even of distant consumers (Dobele et al. 2014, p. 147). This has been famously exemplified by Nike, the American multinational footwear and apparel company that faced international campaigns against exploitative labour conditions in its Asian supplier factories in the late 1990s, resulting in a plunge in revenue and share value (Conroy 2007, pp. 11-13).[3]

Often in response to public relations disasters, companies use CSR as an *insurance against reputational risk* that could manifest in boycotts of brands and loss of consumer loyalty (Jonkers et al. 2011, p. 41; Blowfield 2007, p. 690). Conroy (2007, pp. 8-9) stresses the "enormous value of brands," which can account for a large share of companies' market capitalization. Hence, reputational risk is a particular concern for companies with large brand equity, even if "little is known empirically about the mechanisms of reputation" (Windsor 2006, p. 108).

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2 The following websites exemplify this critique of the UN Global Compact and other global CSR initiatives from the perspective of civil society groups: http://globalcompactcritics.blogspot.de/ and http://www.global-ethic-now.de/gen-eng/od_weltethos-und-wirtschaft/od-03-neue-art/od-03-106-global-com-kritik.php (accessed 29-07-2014).

3 A more recent case is the 2013 collapse of the Rana Plaza building in Dhaka (Bangladesh), which left more than 1000 people dead and over 2000 injured. The building accommodated several garment factories that produce for international clothing retailers such as Benetton, Mango and Primark. While the catastrophic working conditions in the garment factories and the plight of the victims featured prominently in the international media, the full consequences of the disaster for the companies and their stakeholders are yet to be established.

Another argument for companies to invest in CSR is to *enhance innovation and firms' competitiveness* (Porter & Kramer 2011, p. 6; Jonkers et al. 2011, p. 41; Luo & Bhattacharya 2006). Porter & Kramer (2011, pp. 8-9) claim that alleged "externalities" can also cause internal costs for the firm. Quoting empirical examples, they show that CSR investments, e.g. switching to renewable energies in the production process, reducing packaging or investing in employees' health care, can save costs and increase efficiency at least in the long run, creating "shared value" for the company, its stakeholders and society as a whole. Closely linked to innovation, companies may invest in CSR for the purpose of *product and market differentiation*. By creating demand for innovative products and attending to new markets, firms could gain an edge over their competitors. Consumers' positive valuation of CSR has been exemplified by the success of "socially responsible" businesses such as "The Body Shop" or American ice cream brand "Ben & Jerry's" (McWilliams & Siegel 2001, p. 119; cf. Jonkers et al. 2011, p. 42; Blowfield 2007, p. 690). However, other authors have questioned whether such positive effects can be sustained in the long run, as competitors cannot be prevented from imitating a firm's CSR strategies (Reinhardt 1998).

In order to achieve the desired effects as spelled out above, CSR needs to be effectively communicated to various stakeholder groups. It does not surprise, therefore, that one rapidly growing branch of the literature is concerned with *CSR communication* and its effects on consumers' buying behaviour, response and attitude towards the company (Du, Bhattacharya & Sen 2010; Schmeltz 2012).

Impacts of CSR in developing countries

Several journal issues in the past decade have been devoted to the question whether companies' CSR investments contribute to societal goals such as poverty alleviation in developing countries (see the overviews of Blowfield & Frynas 2005, Newell & Frynas 2007, Blowfield 2007, Visser 2008, Dobers & Halme 2009 and Kolk & Van Tulder 2010; cf. Gilbert & Jenkins 2014 for a recent overview of CSR case studies in Africa). The growing case study evidence paints a heterogeneous picture of CSR. A wide spectrum of theoretical perspectives and methods has been employed to determine impacts of an even wider range of CSR projects, making an aggregation of research findings impossible. Some doubts have emerged from these studies whether companies' motives to invest in CSR can be reconciled with the needs of local stakeholder groups in developing countries:

> "While there are clearly zones of compatibility between business-led CSR initiatives and efforts by the development community to engage business in efforts to tackle poverty, *CSR as a business tool* is distinct from *CSR as a development tool*." (Newell & Frynas 2007, p. 670, original emphasis)

This is illustrated by a study on community development programmes sponsored by multinational oil companies in Sub-Saharan Africa. CSR has been adopted by the companies to win the support of political decision-makers, avoid or calm down community protests, manage external stakeholder perceptions and maintain the motivation of employees in a controversial industry with evident adverse impacts. As a consequence, it appears that the companies' CSR agendas have been shaped by the priorities of individual government officials, influential stakeholder groups, "media-friendliness" of projects and feelings of company employees, rather than responding to

the developmental priorities of local communities (Frynas 2005, pp. 583-587; cf. Mzembe & Meaton 2013).

Frynas (2005, p. 587) describes some technical deficiencies of CSR projects, including insufficient project duration, lack of (adequately trained) staff, lack of beneficiary participation and "non-functioning white elephants." Concern has also been raised that private sector contributions to poverty alleviation could fail to achieve the desired outcomes in contexts of weak governance and macro-economic performance (Ite 2004, p. 1). One could argue, however, that such problems are not restricted to CSR projects but apply to aid projects implemented by non-business actors and profit-driven private investments in developing countries as well. Drawing from various case studies, some "key success factors" of CSR projects have been identified (Gilbert & Jenkins 2014, pp. 8-9; cf. Frynas 2005; Kolk & Lenfant 2012):

- Partnership of companies with government and civil society actors;
- Alignment with national policies and development plans;
- In-depth analysis of relevant stakeholders and local needs;
- Local ownership and community involvement;
- Strong leadership support at the corporate and policy level.

As has been observed from case studies in Sub-Saharan Africa, companies' motives to invest in CSR (e.g. maintaining security of reliable and high-quality supply, achieving production efficiencies, hiring well-trained staff) are not necessarily opposed to developmental goals but may well overlap with national priorities, such as job creation, capacity-building, and promotion of small- and medium enterprises (cf. the case studies in Gilbert & Jenkins 2014). The judgement of well-meant CSR activities by the intended beneficiaries themselves, however, remains generally unknown, due to a lack of rigorous impact evaluation studies. It appears that we know very little indeed "about the impact of CSR initiatives in developing countries, and what we do know raises questions about both the efficiency of CSR approaches and the tangible benefits for the poor and marginalized" (Blowfield & Frynas 2005, pp. 506-507).

Due to the descriptive nature of most case studies, the lack of scientific rigour and reliable data, it is impossible to distil a comprehensive, general picture with regard to the outcomes of CSR. For the same reason, the rationale for involving the private sector as a development agent remains unclear without systematic studies on CSR impacts (cf. Blowfield 2007, p. 685; Newell & Frynas 2007, p. 671; Visser 2008, p. 493). Consequently, there is an "urgent need for further research on CSR in developing countries" (Visser 2008, p. 493).

2.4 Research Gaps and Critique

As spelled out in the previous sections, companies have pragmatic reasons to adopt CSR policies. Apart from positive effects on financial performance, CSR could promote innovation and competitiveness of a firm. CSR may also help to create and maintain amicable relationships with various stakeholders and thus reduce companies' reputational risks (e.g. by adopting certification schemes). In contrast, surprisingly little is

known about the effects of corporate responsibility on social welfare, and this particularly applies to CSR in developing countries.

Fostered by advances in communication technologies and the global exposure of "corporate misbehaviour," companies' practices have come under increased public scrutiny. Linked to that is the growing demand for CSR by governments and civil society, as the magnitude and interconnectedness of contemporary global problems calls for contributions from all available sources, including from corporations (cf. Margolis & Walsh 2003, p. 270). Consequently, society's expectations with respect to corporate behaviour and responsibility towards stakeholders have increased dramatically, and firms' awareness of this fact is growing (Conroy 2007, p. 31; Schmeltz 2012, p. 30). At the same time, it remains unclear whether companies are able to fulfil such societal expectations. CSR is a normative and vaguely defined concept, and it is inherently difficult to "disentangle science, interest and ideology" in related research (Windsor 2006, p. 112). It does not surprise, therefore, that most of the academic work analyzes CSR from the firm perspective. As highlighted above, many studies have investigated whether companies' voluntary investments are rewarded by the desired financial benefits and/or reputational gains, and how social responsibility can best be communicated to stakeholders. There appears to be considerably less "hard evidence" with regard to the impacts of CSR on society, especially on external, "discretionary" stakeholder groups such as local communities (Blowfield 2007; Visser 2008).

This has fuelled critique from civil society and academics alike (cf. Jonkers et al. 2011, pp. 23-24 for a brief overview). CSR has been accused of being a "zero sum game" that benefits corporations at the expense of their stakeholders. According to Banerjee (2008, p. 74), CSR is an ideological movement that intends to legitimize and consolidate the power of large corporations, with dubious impacts on social welfare. To him, the withdrawal of the state and the corresponding contribution of corporations to societal goals are matters of concern:

"Corporations do not have the ability to take over the role of governments in contributing to social welfare simply because their basic function [...] is inherently driven by economic needs. [...] Markets, however efficient they may be in setting prices, cannot be counted upon to ensure that corporations will always act in the interest of society. Social investment and social justice can never become a corporation's core activity."

Corporations have also been accused of "green washing," i.e. using CSR exclusively for reputational gain, or to simply take advantage of tax rebates.[4] Due to the diversity of "responsibilities" and stakeholders, CSR activities in one sector could be used to disguise corporate misconduct in another area (Jonkers et al. 2001, p. 24). Likewise, CSR might be conceived by stakeholders as an "indulgence fee," which is a particular challenge for firms operating in notoriously controversial industry sectors such as mining and other extractive industries, in which negative social and environmental impacts appear inevitable (Dobele et al. 2014; García-Rodríguez et al. 2013; Emel et al. 2012). Considering the vagaries and ambiguities of the CSR concept (Blowfield & Frynas 2005, p. 503; Newell & Frynas 2007, p. 673) among growing scepticism of consumers and the

4 For instance, US firms are enjoying a 10% rebate on corporate tax obligations for charitable contributions (Margolis & Walsh 2003, p. 269).

general public, companies are under increased pressure to demonstrate the credibility of their CSR engagement and positive impacts on society, e.g. by focusing their activities on external, "discretionary" stakeholders (cf. Jonkers et al. 2011, p. 48).

In conclusion, the rationale for and the effects of CSR investment from the firm perspective are well-documented. Considerably less is known about the social welfare implications of corporate social initiatives, and this applies specifically to the role of CSR in developing countries (Blowfield 2007, p. 683). A shift in the research agenda "away from confirming the consistency between corporate actions and economic premises about the firm" (Margolis & Walsh 2003, p. 283) towards assessing the impacts of CSR initiatives appears necessary. While there is a "vital need to understand how corporate efforts redress social misery [and] actually affect their intended beneficiaries" (ibid., p. 289), scholars interested in CSR impact studies are potentially confronted with a methodological dilemma. As researchers depend on companies' cooperation for access to information, concerns about the objectivity and scientific rigour of CSR impact studies generally appear justified. This particularly applies to academic journal articles that are authored by company staff themselves (Sparkes 2014 is an example of this). Moreover, firms' internal impact assessments and reporting systems to establish and communicate "social return on investment" (SROI) are inherently fraught with subjectivity and defy any scientific evaluation standard (cf. Jönvik & Olsson 2009, pp. 17-22 for an overview of such SROI tools).

Two large research gaps emerge from the current literature on Corporate Social Responsibility and motivate this study. First, to scrutinize the credibility of companies' CSR commitment, there is a need to assess impacts of corporate investment on local stakeholders in developing countries, including less powerful groups that are likely to be affected by firms' operations. Second, there is a need for objective empirical studies that systematically assess the benefits (and costs) of CSR measures from the perspective of the intended beneficiaries. The case study, which is introduced in the following chapter, intends to contribute to filling both research gaps.

3 THE CSR CASE STUDY AND ITS CONTEXT

This chapter provides details on the setting of the evaluation study. An overview of the company and its CSR strategy is given, followed by a comprehensive description of the six community-based water supply projects that were co-funded out of the company's CSR budget. These water projects were the object of the impact evaluation.

3.1 Introduction to the Firm and Motivation of the Study

This paper examines the CSR activities of a privately-owned and operated thermal power plant in Southern Sri Lanka. With 48.6% of Sri Lanka's total installed capacity, thermal power from coal, diesel and other fossil fuels dominates the national energy mix, along with hydropower (48.4%, CEB 2013).[5] Private electricity producers play an important role in Sri Lanka's power generation and operate a third of the country's total installed capacity. The remaining balance is provided by power plants operated by the national electricity authority, the Ceylon Electricity Board (CEB).

The 100-MW power plant is located in a rural area, about 8 kilometres outside a Southern Sri Lankan town (urban council) with almost 60,000 inhabitants. The plant generates power from burning imported heavy furnace oil, which the plant obtains from a state-owned refinery. The company is one of seven privately-owned and operated thermal power plants in Sri Lanka. In 2013, it contributed 6% of the country's total installed power-generating capacity (CEB 2013). The plant started operations in 2005 as a joint venture between the German-American manufacturer of the diesel engines and a Sri Lankan conglomerate with diversified assets in the energy, tourism, logistics and service sectors in six countries.[6] Within the conglomerate, the plant is considered as a "strategic investment," alongside other projects related to energy production and infrastructure development. Based on a 10-year power purchasing agreement, the company sells its electricity output to CEB at a guaranteed unit price. At the time of the survey, the company had around 80 employees. While the majority of highly-qualified staff (plant management, engineers, chief technicians) are from the capital and other urban areas of Sri Lanka, the company claims that about half of its employees are recruited from the surrounding communities.

Since the engine manufacturer sold its share, the plant has been owned jointly by the Sri Lankan parent company (74%) and a German development finance institution (DFI)

5 With regard to total energy generated in 2013, the national share of thermal power was 40% (hydropower: 58%, CEB 2013). Hydropower and biomass-based energy supplies, the only large-scale indigenous primary energy resources in Sri Lanka, are expected to increase only marginally in the near future, as economically viable sites for hydropower generation are already in use, and biomass-based energy production is facing increased land use competition for food production (cf. Government of Sri Lanka 2008, pp. 1A-13A). With only 3%, other renewable energy sources such as wind power have not played an important role so far (CEB 2013).

6 According to its latest annual report, the conglomerate had a market capitalisation of LKR 39.7 billion (approx. EUR 242.9 million), a total revenue of LKR 36.6 billion (EUR 223.9 million), assets worth LKR 61.1 billion (EUR 373.8 million) and a total workforce of more than 6,000. The company holds 1.6% of total market capitalization in the Colombo Stock Exchange, where it has been listed since 1983.

(26%). A public entity owned by the German government, the DFI commissioned an independent evaluation study to investigate the external effects of the power plant on the environment and on society. This paper is an extended version of the evaluation report. Drawing on the empirical data collected by the authors in Sri Lanka on behalf of the DFI, the study focuses on the social welfare implications of the company's CSR investment in six community-based water supply projects.

3.2 The Firm's CSR Strategy

The CSR activities of the power plant are informed and mandated by the parent company's commitment to sustainability and stakeholder engagement.[7] According to the conglomerate's website, this engagement is guided by the following motives:

- Return on investment, profit and growth for investors, business partners and shareholders;
- Career progression, benefits, remuneration, working facilities and personal development for employees;
- Product and service quality, cost and reliability for customers;
- Economic, social and environmental impact including local purchasing and employment for communities.

Apart from shareholders, employees, customers and communities as listed above, the conglomerate regards investors, financial institutions, industry partners and associations, suppliers and service providers, environmental interest groups and government and regulatory authorities as important stakeholder groups. Whereas investors, shareholders, employees and business partners belong to the company's "internal stakeholders," communities are counted among its "external stakeholders."

The conglomerate was one of the first companies in Sri Lanka to join the UN Global Compact in 2002 and is an active member of the national UNGC network. Since 2007, the parent company has been developing and implementing an "integrated sustainability policy." "Development of local communities" is listed as one out of eight current priorities for implementing this sustainability framework, along with compliance, environment, occupational health and safety, human rights at the workplace, internalisation of UNGC and women's empowerment principles, human resource issues and reporting on sustainability performance. As regards the latter, the conglomerate has adopted the latest GRI sustainability reporting framework (cf. www.globalreporting.org, accessed 07-11-2014). In 2012, the conglomerate was recognised as Sri Lanka's "Best Corporate Citizen" by the Ceylon Chamber of Commerce. In line with this CSR engagement, the conglomerate encourages all its subsidiaries to champion sustainability

7 For information on the CSR strategy of the conglomerate, we draw on interviews with managers in the Colombo head office, annual reports and the company webpage. For information pertaining to the CSR strategy of the power plant, we additionally use information from on-site interviews with company staff at various managerial levels and informal reports that have been availed by the company.

issues which are strategic to their business and the industry in which they operate "to create a competitive advantage" for the company.[8]

CSR activities of the power plant

The CSR activities of the power plant, which are the focus of this study, are a reflection of the parent company's comprehensive sustainability policy. In line with this policy, the power plant has so far obtained and sustained certification under three international standards:

- Since 2004: ISO 14001 (environmental management);
- Since 2007: ISO 9001 (quality management);
- Since 2008: OHSAS 18001 (occupational health & safety management).

Furthermore, the company intends to obtain social accountability certification (SA 8000) in the future. To fulfil the obligations and expectations arising from these international certifications and the conglomerate's sustainability policy, the company has devised a range of programmes and measures addressed at the above-mentioned priority list, e.g. development of local communities, human resource development, environment, and occupational and workplace safety. We restrict our analytical focus to those elements of the company's CSR strategy that are expected to have an immediate impact on local communities living in the vicinity of the power plant, i.e. the plant's "external" or secondary stakeholders (cf. the definition in Section 2.1).

External effects of the power plant

As regards the company's *environmental management*, on-site inspection of the power plant and nearby villages confirms the information provided in internal documents and on the conglomerate's website:

- Emissions of greenhouse and other toxic gases in the surroundings of the power plant are below legally stipulated levels; no visible air pollution was observed around the plant;
- The transmission line corridor from the plant to the nearest substation is less than one kilometre in length; impact on biodiversity thus appears tolerable (tree height under the transmission line corridor is restricted to 25 metres);
- Thermal discharge is dissipated through exhaust air and radiators only; no water is used for cooling;
- Waste water contaminated with oil is treated at a filtration unit which separates oil from water; the collected sludge is sold to a third party; unproblematic waste water is directed to sewage pits;
- The plant is using state-of-the-art technology and equipment to achieve maximum efficiency[9] and is, according to its 2010-2011 annual report, "constantly seeking ways to improve the efficiency of the plant's operations" such as cooler modifications to save costs and energy;

8 Deputy Chairman's message on the company website.

9 According to a certificate of the independent technical inspections organization TÜV Rheinland, the plant's energy efficiency is "in accordance with EU standard from the Best Available Techniques (BAT) Data Sheet."

- Air quality monitoring and other environmental control mechanisms are in place; no incidents of significant spills have been reported so far.

Arguably the most striking feature of the company's environmental management strategy has been the creation of a "green belt" around the power plant on 34 acres of the 44-acre property. As can be observed from time series satellite images (available on Google Earth), the plant was constructed on formerly degraded land in 2005. Reforestation started soon after the construction phase, resulting in the current dense forest cover around the plant. There is no visual impairment from the power plant, as constructions are hardly visible from outside the property due to the green belt.

Despite the use of sophisticated technology, continued efforts to minimise environmental impacts and enhance efficiency and the green belt, the plant produces CO_2 emissions amounting to 263,000 tons per annum and is, thus, not eligible to obtain carbon credits and participate in Clean Development Mechanism projects. Apart from the fact that thermal power plants inevitably emit carbon into the atmosphere, the company is effectively managing its local impacts on the environment and natural ecosystems and is operating well above legal compliance levels.

Nevertheless, we asked the surveyed households whether they experienced any environmental impact from the power plant. Noise and smell from the trucks that deliver the heavy fuel on a daily basis were reported by a few households living on the access road to the plant. Only three of the surveyed households in the village closest to the plant had initially noticed the noise of the plant's diesel engines at night, but admitted that they could not (or hardly) hear that noise anymore, as it is probably absorbed by the green belt now. In two households, interview respondents claimed that they have observed a decrease in rainfall in the past years and attributed this to the power plant. Two other households were generally worried about the environmental impacts of the plant but could not provide further explanations. In five of the six project communities, no household reported any environmental effect from the power plant. We therefore assume on fairly safe grounds that emissions and other adverse environmental effects of the power plant cannot be felt by the local population or are below tolerable levels.

From the perspective of the local population the core activity of the thermal power plant, i.e. *power generation*, does not play an important role in their daily lives. Due to the power purchasing agreement with CEB, the generated power is directly fed into the national grid. The project company is unable to sell electricity to the locals, so that households do not directly benefit in this regard. However, local communities have been affected directly and indirectly through the *development of infrastructure* by the company:

- A new main line (investment cost: LKR 7 million), which was constructed by the company in 2004 for the plant's own electricity supply, has enabled nearby households to get connected to the national grid.
- Two local roads were constructed by the company in 2004, i.e. the main access road to the plant, which is used by the fuel trucks, and a second road for regular vehicle traffic. The latter 3.1 km stretch of black-topped road (investment cost: LKR 4 million), which was non-essential for the plant's operations, was constructed by the company and thereafter handed over to the local government authority.

- The roads (and allegedly also the availability of power due to the new main line) have attracted some local industries, such as metal crushing companies and poultry farms. In 2010, the government declared the area surrounding the power plant an industrial zone.

It can be assumed that especially the company's road construction has created tangible benefits for local communities, including better accessibility, local employment and increased land prices. The latter was confirmed by informants residing near the power plant's access road. According to the local residents, the value of agricultural land in the area is normally within the range of LKR 700,000 to 2.5 million per acre (depending on quality and availability of irrigation). In contrast, an acre of land close to the black-topped road is valued at approx. LKR 10 million per acre.[10]

Development of local communities

In addition to the above-described CSR activities, the company has pledged to spend 1% of its annual expected profit (averaging around LKR 10 million per year) on *projects aimed at the development of local communities* in the vicinity of the power plant. This is illustrated by the list of projects that were funded from the company's CSR budget in the year 2009/2010, according to an internal company report:

- Construction of water tanks and other water-related infrastructure in six rural villages upon request of the local communities (total funding: LKR 6 million);
- Construction of a pilgrims' rest house (*dharmasalawa*) at one of the main Buddhist temples, upon request of the chief incumbent of the temple (total funding: LKR 200,000);
- Construction of a fence and gate for a school, which is located 600 metres from the power plant, upon request of the principal and parents of the school (total funding: LKR 499,378);
- The "model garden" that has been created in the power plant's green belt was used for various educational and training programmes for school children and youth (e.g. on bee-keeping and medicinal plants).[11]

Whereas environmental management and measures directed at employees reflect a company's legal or ethical responsibilities, community development projects such as those mentioned above fall into the category of *philanthropy* or "discretionary CSR" directed at external, secondary stakeholders (cf. Windsor 2006, p. 98; Sections 2.1 and 2.3). As mentioned before, it is this category of activities that is generally regarded as a particularly "credible" form of CSR, which promotes a company's "moral legitimacy" (Torres et al. 2012, p. 21; Ingenbleek & Immink 2010, p. 54; cf. Section 2.3). Yet, interviews with managers and local residents also suggest a pragmatic motivation behind the company's investment in local development projects, as reportedly there had been strong initial antagonism from nearby communities in the construction phase of the power plant. As villagers mentioned during the household interviews, they had been approached by environmental organizations who informed them about potential

10 Notwithstanding this, most households interviewed for this study do not yet have a legal title deed to the land that they have been using for sometimes more than 20 years, due to the specific context of land tenure in Sri Lanka.

11 No information was obtained on the cost of the green belt and the educational/training programmes.

environmental hazards of the power plant, reflecting the influence and importance of secondary stakeholders and "stake watchers" (cf. Section 2.3). This sensitisation may thus explain the concerns and "observations" of a few residents with regard to the plant's environmental impacts. Yet, as described above, the majority of interviewed households even in the village closest to the plant had not felt any impact at all. In villages farther away, some people had not even heard of the power plant at all. The majority of local residents that were consulted during the field research were aware of the power plant chiefly due to the company's CSR engagement and expressed their extreme happiness about the financial support to their water projects. Even without an assessment of the welfare effects of the water projects, it appears that the philanthropic focus of these CSR activities alone works effectively to promote the company's good reputation among nearby communities.

3.3 The Community-Based Water Projects

As explained in the previous section, the company is devoting a fixed share (1%) of its net annual profit to philanthropic spending. Between 2009 and 2011, the company has invested LKR 10 million (approx. EUR 68,000) of its CSR budget in six community-based water supply projects, which are the focus of this impact evaluation. This section describes the water projects and the company's involvement in them in more detail.

Setting of the water projects

While the power plant is located just a few kilometres away from a Sri Lankan town (urban council), its surroundings have remained distinctly rural and agricultural in character. The project area, which used to be covered with dense forest, has been developed for agricultural production since the 1960s under public resettlement schemes. To make productive use of still abundant land resources in an area with erratic rainfall, the government developed irrigation infrastructure (dams, water reservoirs, canals) for agricultural use and allocated parcels of land to smallholder farmers from the densely-populated coastal areas of Sri Lanka's South. It turned out, however, that drinking water supplies for the population were unreliable and in many cases unsafe for human consumption. The local population thus relied (and in many cases still relies) on fetching water of varying quality from a few groundwater sources (via deep wells or water pumps), or directly from dams, rivers and irrigation canals. As revealed by the survey, households used to spend one and a half hours per day on average to collect water for various purposes, thereby travelling distances between a few hundred metres and five kilometres to those water sources. In addition, many households had to buy drinking water from local water vendors during the dry season.

Due to this situation, the six villages in question were prioritized by the Sri Lankan government in the context of a national water supply scheme, the "Community Water Supply and Sanitation Project II" (CWSSP II). As a precondition for public co-funding (from the Sri Lankan government and international aid agencies), the residents formed community-based organisations (CBOs) in their villages between 2007 and 2008. They were also required to contribute a share of the installation costs themselves, through cash and labour contributions of the CBO members, i.e. the intended beneficiary households.

However, the six communities, which are located within a perimeter of two to 14 kilometres around the power plant, had been unable to raise the required cash contribution for the water projects, due to the poverty of their members. It was in this situation that community representatives from the six villages, with the support of local politicians and government officials, approached the company about a partnership, asking for financial support of their CWSSP II water projects. The administration manager of the power plant, who is also responsible for the company's CSR activities, thereafter entered into discussions with the communities to identify their precise needs. The company eventually decided to support the water projects out of its CSR budget, thus complementing government and community co-funding. The six projects could then be implemented and were launched between May 2010 and March 2011.

Characteristics of the community-based water projects

In line with the goals of CWSSP II, the aim of all projects was and still is the safe and reliable supply of piped water to individual households through water projects that are governed by a community-based organisation (CBO). All CBOs have a written constitution, an elected executive body and employ staff for the management and maintenance of the project. To attain economic viability of the projects, while at the same time meeting members' demand for water, the CBOs have developed site-specific regulations and water tariff schemes. Before getting an individual, metered water connection at their house, eligible CBO members have to make the required contribution in cash and labour. This contribution is fixed for all households within one locality but varies between villages, depending on the scope of the projects and the financial capacity of their members. In case of the six water projects in question, households paid between LKR 1,500 and LKR 7,280 in cash. In addition, the member households contributed between 13 and 21 days of labour. As could be witnessed during the field research, such labour included hard physical work such as digging ditches and burying water pipes and involved both men and women. The combined contribution of cash and labour thus ranged from LKR 9,080 to LKR 15,680 per member household across the six projects. "Late comers" (i.e. households who did not initially commit themselves to the project by becoming CBO members) are "penalized" by having to pay a considerably higher cash amount to join the project (Table 1).

Once connected, households have to pay a monthly user fee plus the consumption-dependent user charges. In three of the six villages, the monthly fee has been subdivided into a maintenance fee and a CBO membership fee. As can be seen from Table 1, all CBOs have implemented an incremental fee structure for the consumption-dependent user charges. This tariff scheme thus subsidizes smaller users and discourages excessive water use. CBOs have developed clear regulations to enforce the timely payment of water bills. Reportedly, sanctions such as penalty fees for late payment and temporary disconnection are working. Defaulting has been the exception so far, and the overwhelming majority of CBO members have been able to pay their water bills regularly. However, at the time of the field research, some of the CBOs were in the process of revising their fee structure, due to members' perception that user charges were beyond their financial capacity.

To stay economically viable, all projects must at least generate sufficient funds to cover regular maintenance costs and savings for necessary future investments. Moreover, all

CBOs have plans to invest additional profits into services for their members, such as microfinance schemes. One organisation has already started a loan scheme for the construction of toilets and showers to improve sanitation. In other villages, plans were underway to offer micro-loans for the promotion of small enterprises, once the water projects would have generated sufficient funds for such programmes.

Table 1 Water tariff schemes in the beneficiary communities (as of October 2011)

Water related expenditures	Water project/beneficiary community (CBO)					
	Village 1	Village 2	Village 3	Village 4	Village 5	Village 6
Investment for individual connection:						
for founding members:						
in cash (LKR)	3,440	4,100	1,500	2,760	3,880	7,280
in labour	15 days @ LKR 800	15 days @ LKR 700	21 days @ LKR 500	13 days @ LKR 500	13 days @ LKR 400	14 days @ LKR 600
Total (LKR):	15,440	14,600	12,000	9,260	9,080	15,680
for late comers (LKR):	19,200	15,000	30,000	30,000	25,000	23,000
Monthly fees (LKR):						
Maintenance fee	168	100	150	100	115	115
CBO membership fee	10	0	0	5	0	10
User tariffs per m³ (LKR):	1-10 m³: 15 11-15 m³: 20 16-20 m³: 25 > 20 m³: 30	1-5 m³: 10 6-10 m³: 15 11-15 m³: 20 16-20 m³: 25 > 20 m³: 40	1-5 m³: 15 6-10 m³: 20 11-15 m³: 25 16-20 m³: 35 21-25 m³: 70 26-30 m³: 100 >30 m³: 150	1-15 m³: 10 16-20 m³: 15 > 20 m³: 30	1-5 m³: 10 6-10 m³: 15 11-15 m³: 20 16-20 m³: 30 > 20 m³: 50	1-5 m³: 10 6-10 m³: 15 11-15 m³: 20 16-20 m³: 30 21-25 m³: 40 26-30 m³: 50 31-40 m³: 60 41-50 m³: 70 51-60 m³: 80 61-70 m³: 90 > 70 m³: 100

Contribution of the power plant

As mentioned earlier, the communities had been unable to raise the required cash contribution due to their members' poverty. It was, therefore, the co-funding from the power plant that eventually made the implementation of the water projects possible, as it reduced households' cash and labour contribution to an affordable level and thus enabled the CBOs to claim the public subsidy. This view was mutually shared by company staff, CBO representatives and the local households that were interviewed during the field research.

Table 2 Overview of the six water projects

Project/CBO	Description of the water projects
Village 1	• Beneficiaries: 505 households (according to CBO membership list) • Water source: well near a stream; abundant supply • Water quality: safe (full water filtering/purification system) • Water use: all purposes, no use restrictions • Company contribution: one overhead water tank (capacity: 60 m³), 14% of total cost
Village 2	• Beneficiaries: 216 households (according to CBO membership list) • Water source: well (seasonal shortages in the dry season) • Water quality: safe (according to laboratory reports; no filtering system required) • Water use: all purposes (but irrigation discouraged in dry season) • Company contribution: one pump house and transformer, 20% of total cost Remarks: Smallest of the six water projects; company funding enabled installation of electric pump (low maintenance cost)
Village 3	• Beneficiaries: 310 households (according to CBO membership list) • Water source: two groundwater wells; currently sufficient • Water quality: safe (according to laboratory reports; no filtering system required) • Water use: all purposes (but excessive use discouraged via fee structure) • Company contribution: one ground tank (capacity: 40 m³), one well, 11% of total cost Remarks: most remote village; high maintenance cost due to diesel-powered pump; households do not have access to irrigated farmland (rain fed irrigation); water is main limiting factor for agriculture
Village 4	• Beneficiaries: 403 households (according to CBO membership list) • Water source: well, river; abundant supply • Water quality: unsafe (high mineral content) • Water use: all purposes except drinking (drinking water is carried from wells considered as safe) • Company contribution: one overhead tank (capacity: 40 m³), 14% of total cost Remarks: CBO has requested the company to fund a water purification system
Village 5	• Beneficiaries: 402 households (according to CBO membership list) • Water source: ground well, deep well; abundant supply • Water quality: safe (but people report bad taste) • Water use: all purposes; no use restrictions • Company contribution: two ground tanks (capacity: 2 x 60 m³), 4% of total cost Remarks: CBO has requested the company to fund a water purification system
Village 6	• Beneficiaries: 1,148 households (according to CBO membership list) • Water source: lake (dam); abundant supply • Water quality: safe (full water filtering/purification system) • Water use: all purposes; no use restrictions • Company contribution: one overhead tank (capacity: 60 m³), 6% of total cost Remarks: largest of the six water projects; company has pledged to finance a second overhead tank

Table 2 gives a descriptive overview, whereas Annex 1 provides some key data on the six water projects and the company's CSR contribution. As can be seen from Annex 1, the total investment cost for the water projects ranged from LKR 9.7 million to LKR 39.5 million, depending on the size (beneficiary number) and technical scope of the project (with or without water purification system, with diesel or electric pump). More than half (i.e. 52-65%) of the initial investment for the six projects was provided from

public sources (funds from the Sri Lankan government and international aid agencies). The communities contributed 21-44% of total cost, the dominant portion of this in the form of labour. The company closed the remaining financing gap of between 4% and 20% of total project cost by funding specified components of the water projects, such as a water tank or a pump house and transformer. In sum, the plant-owning company invested LKR 10 million (approx. EUR 68,100) in the six water projects out of its CSR budget between 2009 and 2011.

Characteristics of the beneficiary population

The number of beneficiary households in each village ranges from 216 to 1148, according to the CBO membership lists. Altogether, 2,984 beneficiary households (approx. 12,740 individuals) voluntarily joined the six CBOs and became eligible for a water connection. Out of these, 2,490 households (83%) were already connected at the time of the survey, while most of the remaining members were still in the process of getting their water connection. Only very few CBO members mentioned that they had been unable to raise the required cash and labour contribution so far and left the CBO. As can be seen from Annex 1, the village population is in most cases considerably larger than the beneficiary population. The non-member households in the respective locations have an alternative access to water, either from a safe well or from a public water connection. The CWSSP II projects, instead, are targeting those households who are out of the reach of such alternative water sources.

Who are the people that benefit from the water projects and the company's CSR investment? According to the household survey data (cf. Sections 5.1 and 6.1) almost 90% of the beneficiary households in the six villages are involved in farming. They own small houses which are surrounded by home gardens, where a variety of crops is grown. Typical crops include bananas, coconuts, vegetables, manioc, mung beans, mangos, bethel nuts, papayas, lemons, oranges and pumpkins. Many farming households have access to another piece of irrigated farm land outside the village, where mostly paddy is cultivated. Apart from subsistence production, the majority of farm households (63%) are also selling their crops on the market. Bananas and other fruits, coconuts, bethel nuts, cashew nuts, lemongrass and pepper are typical cash crops in the project villages. Only 8% of households own livestock, with just a few families keeping livestock for commercial purposes. Apart from agriculture, many families (76%) are also involved in other productive economic activities. Household members earn an income as day labourers, are involved in agriculture-related trade, operate small businesses (e.g. shops, brick production), work in the public sector or find employment in some of the few local manufacturing industries. Transfer income, either government subsidies or remittances from family members working in the national capital or abroad, is received by 22% of households. Considering all sources of cash income, including sales of agricultural output, the annual per capita income in the region amounts to EUR 374 per annum, so that on average, people have to live off one Euro per day.

Concluding from the previous paragraphs, the six water projects differ in size and technical scope, but also have important commonalities:

- Based on a needs assessment, the villages have been prioritized for a national community water supply scheme (CWSSP II);

- Beneficiary households get an individual, metered water connection at their residential houses;
- The projects are run by community-based organisations (CBOs), whose members have to make a cash and labour contribution before getting connected;
- The projects would not have been realised without the co-funding from the company's CSR budget.

4 ASSESSING THE IMPACTS OF THE WATER PROJECTS: THEORETICAL APPROACH

Following the detailed description of the community-based water projects that were co-funded from the power plant's CSR budget, this chapter elaborates the theoretical framework for assessing the welfare effects of the six projects. After a brief introduction to the current discourse on impact evaluation of development interventions, we explain why and how we are applying the productivity method for evaluating the welfare effects of the water projects and present our empirical model.

4.1 Rationale for a Theory-Based Impact Assessment

When the power plant and the surrounding villages were visited for the first time in September 2011, discussions with local residents revealed that the water projects have brought about a number of changes in people's daily life:

- In all villages, the provision of water at their residential houses allows the beneficiary households to reallocate the time saved from transporting the water from dams, canals, rivers or wells to their homes to alternative uses, i.e. additional time for leisure, farm work, daily and salaried labour or working as traders, brick makers or shop owners. These changes were perceived as beneficial by the local population.
- In all villages people reported that due to the year-round, reliable availability of water they were now able to irrigate their home gardens, allowing for production increases and a shift towards high-value crops (e.g. vegetables) that need permanent irrigation. Again, this change was seen as positive by the locals.
- In all villages, the beneficiary households got an individual, metered water connection after an initial, upfront investment in cash and labour. In addition, they have to pay their monthly water bill, consisting of a fixed fee and consumption-dependant user charges. This brings about an increase in household expenditures, signalling costs of change.

These positive and negative changes were the focus of the empirical field study that was conducted in November 2011. The study aimed at scrutinizing whether changes in household welfare that local people attributed to the water projects were indeed systematic or random by nature, whether there were additional non-random changes that the water projects had brought about and, finally, to investigate the magnitude of the produced benefits and costs from the perspective of the affected people.

As explained in the introduction, the study intends to not just contribute to filling the research gap on impacts of CSR in developing countries but also to address the global "evaluation gap," i.e. the general lack of evidence with regard to impacts of development interventions (International Initiative for Impact Evaluation undated, p. 1; cf. White 2009, White 2014; Bravo-Ureta 2014). We propose a theory-based approach for this impact evaluation, in line with global initiatives[12] that aim at enhancing the effectiveness of

12 Such initiatives include the "Evaluation Gap Working Group," the "International Initiative for Impact Evaluation (3ie)" and the "Network of Networks Impact Evaluation Initiative" (NONIE; cf. CGD 2006, Leeuw & Vaessen 2009, White 2014).

development interventions through "rigorous" evaluation methodologies and evidence-based policy making. Before proceeding to explain our theoretical approach in more detail, some evaluation-related terms require definition.

According to the "International Initiative for Impact Evaluation" (3ie), *impact evaluation* aims at measuring the "net change in outcomes amongst a particular group, or groups, of people that can be attributed to a specific program using the best methodology available, feasible and appropriate to the evaluation question(s) being investigated and to the specific context" (3ie n.d., p. 1). As this definition suggests, impact evaluation intends to detect changes due to a project or programme, regardless of who funds it (White 2013, p. 4). This study aims at evaluating the *impacts of the community-based water projects,* which were jointly financed from public sources, the company's CSR budget and the contribution of the participating households. Evidently, changes due to the water projects cannot be accredited to the company's CSR funding alone, but were possible only through the co-funding of all parties. However, as explained in the previous chapter, the water projects would not have been realized without the company's complementary funding, as the communities had been unable to raise the required own contribution by themselves. We therefore argue that observed welfare changes that are causally linked to the community-based water projects can be regarded as consequences of the company's CSR investment.

Impact evaluation aims at establishing the difference between what happened with the project and what would have happened without it by comparing the factual with the *counterfactual* situation (CGD 2006, p. 12). In the case of an ex-post evaluation, as in this study, the counterfactual is the "situation or condition which hypothetically may prevail for individuals, organizations or groups were there no development intervention" (OECD/DAC 2002, p. 19; cf. Bravo-Ureta 2014, p. 53). The major challenge of any impact evaluation is the *causal attribution* of observed changes to the project or intervention. Attribution can be defined as the attempt to understand and quantify the extent to which a project has had an impact on those variables that were expected to change due to the project. Closely linked to attribution, *rigour* has been highlighted as another yardstick to judge the methodological quality of impact evaluations. According to Clemens & Demombynes (2011, p. 2), an impact evaluation is rigorous if it measures a policy's (or programme's) effect "with great attention to scientifically distinguishing true causal relationships from correlations that may or may not reflect causal relationships."

A range of methodologies have been proposed to construct a credible counterfactual and, from that, accredit observed changes to a particular intervention. This is typically done by comparing a "treatment group" that benefits from the intervention with an adequate "control" or "comparison group" that has not been exposed to the intervention. In a *randomised experiment*, a sample out of the population is randomly selected ex ante, i.e. before the intervention. Thereafter, the project is "applied" to the treatment group, which is again randomly selected out of the population sample. Typically, surveys are conducted both before and after a project. Observed mean differences in interesting variables between the two groups are then attributed to the project, as it is argued that members of both groups have been randomly selected and shall thus not differ systematically ex-ante except for the treatment. This approach, also called a "randomised control trial" (RCT), is

currently regarded as the "gold standard" in impact evaluation (Deaton 2010, p. 438; Banerjee 2007, pp. 115-116; cf. White 2013; Banerjee & Duflo 2012).

As regards the attribution problem, RCTs have some advantages over other impact evaluation approaches, such as quasi-experiments, judgemental matching, before-after or double-difference comparisons (cf. Leeuw & Vaessen, pp. 21-34 and Khandker, Koolwal & Samad for methodological overviews; cf. CGD 2006, pp. 78-80 and White 2013 on the advantages and limitations of randomised evaluation studies). Quite obviously, however, RCTs are only possible under particular circumstances, i.e. when they are factored into the project design *before* implementation, ideally with the involvement of the evaluation team, and when it is possible to identify an adequate control group.

For evident reasons, a RCT was not possible for the case study at hand. The communities in which the water projects were implemented had been prioritized under a national water supply and sanitation programme according to their need. It was not left at the discretion of the government or some other organisation to determine who in the communities should be in a treatment or a control group. Principally, all eligible beneficiary households could join the water projects, if they were willing and able to become a CBO member and make the required cash and labour contribution. Nonetheless, a small "comparison group" naturally emerged in this study, as not all sampled households had already gotten their water connection at the time of the survey (cf. Chapter 5). This group, however, was too small for conducting a statistically meaningful treatment—control group comparison with 22 households only.

The context of this impact evaluation illustrates some general problems of RCTs. First, households could not be excluded from the treatment. Second, systematic differences between the project beneficiaries and other households could be expected ex ante, as villages elsewhere did not face the same water supply problems than the communities targeted for the projects under CWSSP II. This bias results from the needs-based prioritisation of project communities and self-selection of the participating CBO member households. Consequently, it would have been problematic to randomly select treatment and control group members from among all communities in the programme area and to arrive at a sufficiently large sub-sample of beneficiary households. RCTs and related evaluation approaches not only come with some practical and ethical challenges, but also face a major theoretical disadvantage. While they are, at least to some extent, able to show *whether* a development intervention works or not, they are unable to argue on safe theoretical grounds *why* this would be the case.

Theory-based evaluation approaches have been advocated to address this "black box" problem of experimental studies (Reade 2008, p. 8). According to White (2009, p. 3), theory-based impact evaluation aims at understanding why a project or intervention has (or has not) had an impact. Theory-based evaluations thus examine "the assumptions underlying the causal chain from inputs to outcomes and impact" (ibid.). The author proposes six *key principles* of theory-based impact evaluation (White 2009, p. 7):

1. Map out the causal chain (programme theory);
2. Understand context;
3. Anticipate heterogeneity;
4. Rigorous evaluation of impacts using a credible counterfactual;
5. Rigorous factual analysis;
6. Use of mixed methods.

These principles are reflected in our approach to evaluating the impacts of the six community-based water projects that were co-funded by the power plant. As further explained below, the theoretical base of the impact evaluation is a household production and a labour income function of the project beneficiaries. Our initial assumptions on how the water projects affect individual welfare (positively or negatively) will be specified for both and tested through econometric analysis using sample households' data. As suggested by White, we will "allow the data to lead the theory" and identify in a first analytical step all those variables that significantly influence households' welfare (ibid., pp. 8-9). With such an approach, we are able to account for contextual variables, heterogeneity of the sample population and unexpected effects. From the analysis of the factual situation (i.e. people's life with the water projects) the counterfactual (i.e. people's situation if there were no water projects) can be simulated. We are, therefore, not just able to tell why and through which mechanisms the water projects affect the beneficiaries' welfare; we can also quantify the project-related impacts in monetary terms.

4.2 The Productivity Method

To assess the welfare changes induced by the community-based water projects empirically, a household production function will be estimated for the beneficiary households (cf. Section 4.3). Taking the functional relationship between input factors and a predetermined output indicator (e.g. agricultural production, income or consumption) as the theoretical model for assessing welfare impacts of development interventions has its roots in microeconomic theory, as exemplified by the theory of the farm household (Barnum & Squire 1979). More recently, production functions have been conceptualized as "production frontiers" to measure technical efficiency, i.e. the gap between actual output and the maximum output that could be produced at a given level of technology from a specified set of inputs (Battese 1992, p. 185, Bravo-Ureta & Pinheiro 1993, Kudaligama & Yanagida 2000, Bravo-Ureta 2014, p. 52). The productivity (or income) method has also been proposed as a technique to valuate environmental goods and services through "revealed" preferences for private goods that are either complementary to or substitutes for public environmental goods (Bergen et al. 2013, Bockstael & MacConnell 2007, Olschewski et al. 2006, Carson & Bergstrom 2003, Hufschmidt et al. 1983, King & Mazzotta 2000). Apart from microeconomic applications to analyze farm households' productivity and technical efficiency (Herdt & Mandac 1981, Ahmed & Sampath 1992, Battese & Coelli 1992, Bravo-Ureta & Pinheiro 1993, Hossain et al. 2006, Rahman et al. 2012, Weinhold et al. 2013), agricultural production functions have also been used to examine the relationship between factor inputs and output at the macro-level for national and cross-country comparisons (Cornia 1985, Zuberi 1989, Kudaligama & Yanagida 2000).

Production functions and the underlying welfare concepts thus appear universally applicable as theoretical models to guide empirical analyses in a wide range of settings, including impact assessments of agricultural development projects (Bravo-Ureta 2014, p. 52). As argued above and further explained below, it is assumed that the provision with an individual, metered water connection and the resulting availability of year-round irrigation affects various determinants of the beneficiary households' welfare outcomes, including income. The empirical literature provides strong evidence for a poverty-reducing impact of irrigation projects in developing countries, mainly via agricultural productivity increases of rural farming (Ahmed & Sampath 1992, Hussain & Hanjra 2004, Hussain 2007, Hussain et al. 2007, Jin et al. 2012). Apart from this productivity effect, irrigation may also have indirect and distributive effects on income and food consumption through declining output prices, thus potentially benefiting landless labourers and net food consumers (Dillon 2011, Hussain & Hanjra 2004, Lipton et al. 2003). However, the literature also highlights an unequal distribution of benefits among social groups as well as potential negative effects, related to the displacement of households for large-scale irrigation projects, environmentally unsustainable extraction of groundwater sources and insufficient or even negative health effects due to the contamination of drinking water sources (Hussain et al. 2007, Lipton 2007). As regards the latter, Lipton (2007, p. 136) remarks that "irrigation may improve drinking water quality, but need not." He therefore suggests to link rural irrigation with water and sanitation projects:

> "The yield, employment, food-price, and hence consumption and nutrition effects of fertilisers and improved seeds—which do far better with irrigation—usually make its net health impact on the poor positive; but it could be better. Effects on drinking-water contamination and disease vectors require more emphasis on choice of techniques, development of new techniques (e.g. of arsenic filtration), and collaboration between water, agriculture and health authorities" (Lipton 2007, p. 137).

Lipton's remark applies well to the context of the study area in Southern Sri Lanka, where the government had developed irrigation infrastructure to increase agricultural productivity since the 1960s but failed to supply safe and reliable drinking water to large parts of the rural population (cf. Section 3.3). While many beneficiary households in the study area were using plots of irrigated farm land even before the launch of the community-based water projects, most of them lacked access to safe drinking water supplies and relied on rain-fed irrigation for cultivating the dry land plot near their homes. It is therefore hypothesized that the water projects that were co-funded by the power plant change the productivity of the beneficiary households, mostly poor smallholder farmers, by supplying a club good (water) at a fee (including upfront investment and user charges), resulting in corresponding welfare changes. As explained above and further detailed in the following section, the productivity method offers a suitable theoretical framework to show not just *whether* the water projects have a welfare effect on the beneficiary households. It also allows an estimation of the *scope* of this effect and to detect the underlying causal mechanisms.

4.3 The Theoretical Model

In order to assess the welfare effects of the company's CSR engagement, the present study examines the economic costs and benefits of the community-based water projects to the local population. It is assumed that the water projects have an impact on agricultural production, reallocation of labour time and household expenditures. These changes have different implications for people's welfare as they are touching upon households' consumption and productive activities:

- The permanent availability of water at their residential houses allows the households to extend their personal water use (consumption) and/or to use parts of the water for irrigating their home gardens, leading to increased yields or diversification of produced crops that may be used for own subsistence and/or for being sold at the local markets (productive use).
- The reallocation of labour time, which without the project would have been used for collecting water, allows the households to either extend reproductive or leisure activities (consumptive use) or, alternatively, to use this saved time for productive farm and non-farm economic activities.[13]
- Furthermore, the water projects reduce expenditures for a group of households that formerly relied on seasonal purchases of water to fill their individually-owned water tanks.[14]

On the other hand, the beneficiaries have to pay for their individual use of water in accordance to the water tariff scheme of their communities (cf. Table 1). These payments have a dual character. On the one hand, they reflect the households' willingness to pay for the consumptive benefits of the project (more leisure, more water for personal use, more food). On the other hand, they represent household expenditures for getting additional inputs (from saved labour) or for improving the productivity of the production factor land (from irrigation of home gardens). In the frame of this study we concentrate on discovering the changes that the water projects bring about for the production activities of the affected households and translate these changes into monetary terms, i.e. into economic benefits and costs. As argued earlier and demonstrated by our empirical model below, the productivity method is an appropriate approach to do so. The changes affecting consumption and reproduction were not neglected altogether but will be described in qualitative terms in the results chapter (cf. Section 6.6).

We take an income function of the beneficiary households as the empirical model of our assessment. The households in the study area draw cash income (Y) from a variety of sources, including farming (index *fa*), other productive activities that involve labour time such as day labour, contract labour and entrepreneurial activities (index *op*) and transfer income (remittances and governmental subsidies, index *tr*). A household's total income (index *ttl*) can therefore be expressed as shown by equation (1):

13 Cf. Gross et al. 2013, p. 28 for a review of empirical literature on time savings linked to water supply projects in various developing countries. This review does not, however, list any evidence from Sri Lanka.

14 This group consists of 60 households, i.e. 28% of the survey sample (cf. Section 6.3.3 for further details).

(1) $Y_i^{ttl} = Y_i^{fa} + Y_i^{op} + Y_i^{tr}$ with i = 1, ..., n farming households

Transfer income is not altered by the water projects, so there is no need for further analytical treatment of this income category. It nevertheless may have an effect on the household's time allocation between income generating activities and leisure and therefore may indirectly affect the water project's impacts. In contrast, farm income and other productive income, are expected to be directly affected by the above described changes in the availability of production factors (labour) and through increasing the productivity of the home gardens. The latter represents a quality enhancement of the production factor land.

In general, farm output (X^{fa}) will be produced combining labour (L) and skills (h), physical capital (K) and land ($Land$) on the basis of a given technology (A). In the six project villages farming follows traditional patterns, so that the level of farming technology (A) is assumed to be equal for all households. Farming in the region is small-scale, "low-tech," labour-intensive and uses land of different quality (irrigated land, $Land^{wet}$, and dry land, $Land^{dry}$) for the generation of agricultural output.

The human capital stock h per worker in farm household i is not included in the production function, as no large variation is expected among the households in the region for this variable. Due to Sri Lanka's public education policy, a national literacy rate of 98% and a fairly even distribution of schools across the country, we assume relative homogeneity of beneficiary households' formal educational level and farm-related knowledge.

Farming largely relies on manual labour (L). The use of labour for farming activities depends on the household's utility-maximizing allocation of time between three mutually exclusive activities: the time used for farming or for other productive activities, both income generating and utility increasing, and the equally utility-increasing use of time for leisure. This utility maximization problem is solved by each household under a number of constraints, including the household's demographics, the availability of land and capital goods and the amount of transfer income the household receives.

For the capital stock of the smallholder farms–i.e. basic agricultural auxiliaries like hoes, shovels, cleavers and axes–we assume that it is more or less equal for all households. Animal husbandry does not play an important role in the local farm economy, and oxen are not used for ploughing. An important element of the capital stock is the availability of an individual access to water, allowing households to irrigate their home gardens around the year. This element does vary between households that are connected to the community-based water projects and unconnected households. The latter continue to rely on fetching or buying water, making it unlikely that they use the scarce available water for irrigation due to the required labour and/or expenditures. In addition, quantities consumed vary among the connected households, corresponding to different water use intensities.

It goes without saying that land is a very important production factor. Two different land qualities are used for agricultural production in the region. The first category of land is small, rain-fed plots of land, on which the residential houses are located. Farmers typically grow a variety of fruits, vegetables and spices in home gardens surrounding their

houses. The second category of land consists of larger, often very productive plots of irrigated land outside the village, where farmers typically grow paddy, bananas and other cash crops. The effects of capital and of both types of land are expected to be positive.

Due to the small plot size of land of both categories, it cannot be ruled out that agriculture in the region is characterized by labour surplus. In other words, the families' agricultural land may not be sufficiently large to absorb all available family labour, a phenomenon observed across the globe in areas dominated by smallholder farming and large household sizes. In the case of labour surplus, the marginal productivity of agricultural labour equals zero. Hence, the general impact of the project on labour (*L)* is unclear. More available labour may increase households' agricultural production, but could also be neutral with regard to agrarian output, depending on whether the hypothesis of labour surplus in agriculture holds true. As a final variable, "other productive income" enters the agricultural production function with a negative sign. Its inclusion guarantees that the above described optimisation between different time uses is appropriately reflected in our model. It is expected that a larger income from other productive activities will motivate households to reduce agricultural activities and to partly substitute cash income from sales of agricultural output with the higher income from other productive income sources. Hence, the farming households' production function contains the following explanatory variables (expected impact on agricultural output indicated by the signs above the variables):

$$(2) \qquad X_i^{fa} = f[A,\ \overset{+}{K}_i\ ,\overset{+,0}{L_i}\ ,\overset{+}{Land}_i^{dry}\ ,\overset{+}{Land}_i^{wet}\ ,\ \overset{-}{Y}_i^{op}\ ]$$

Selling this output at the constant market price p[15] generates the farming household's turnover. Subtracting the individual household's fixed (C_i^f) and variable costs of farming (C_i^v) yields the households' profits from farming activities, i.e. farm income (equation *3*):

$$(3) \qquad Y_i^{fa} = [f(A,\ \overset{+}{K}_i\ ,\overset{+,0}{L_i}\ ,\overset{+}{Land}_i^{dry}\ ,\overset{+}{Land}_i^{wet}\ ,\ \overset{-}{Y}_i^{op}\ )p - C_i^{fa},\ with\ \ C_i^{fa} = C_i^f\ + C_i^v(X_i)$$

Equations (2) and (3) suggest that the community-based water projects affect households' farm income three channels. The first channel is an increase of agricultural output due to the enhanced capital stock—i.e. individual access to water–and the associated potential of using services generated from this capital stock increase, i.e. enjoying the reliable provision of irrigation water on dry land plots. The second channel is the potential reallocation of labour time saved from fetching water to farming activities which would result in higher farm output and income. The third channel is the expenditure channel. Agricultural income declines when the costs of farming increase, as households using irrigation water from the community-based projects have to pay for the consumed quantities.

15 The constancy of the output price for agricultural products results from the assumption that the demand for these products in the region is fully price elastic, i.e. quantity changes from changing agrarian practice in the six beneficiary villages are assumed to be too small in relation to the total quantities that are exchanged on the regional markets in Southern Sri Lanka to have an effect on agricultural output prices.

Other productive income may also be affected by the project via the time channel. A household can allocate the labour time saved from water collection for salaried work, daily labour or entrepreneurial activities. The latter's use of labour for generating other productive income is described by equation (4):

$$(4) \qquad L_i^{op} = g[\overset{+}{w}^{op}, \overset{-}{Y}_i^{fa}, \overset{+}{L}_i]$$

The labour that a household allocates to other productive income-generating activities positively depends on the overall number of labourers in the household (L) and on the wage rate (w) that can be realized from such activities. It is compared to the farm income so that, *ceteris paribus*, the labour allocated to other productive activities rises with the wage rate from such activities, and falls if farm income is larger. Considering "farm income" as a variable in (4) mirrors the inclusion of the income from other productive activities in equation (3). Its inclusion reflects the potential interdependence of the two income sources as moderated through the household's time-allocation decision. Hence, income from other labour-related productive activities is represented in equation (5) by multiplying the labour allocated to other productive activities with the constant wage rate:[16]

$$(5) \qquad Y_i^{op} = g[\overset{+}{w}^{op}, \overset{-}{Y}_i^{fa}, \overset{+}{L}_i] w^{op}$$

In contrast to farm income from equation (3) the realisation of other productive income does not require the allocation of additional inputs apart from own labour. Therefore, other productive income is net income from which no expenditures are to be deducted.

Equations (2) and (4) allow us to empirically estimate all quantitative impacts that are resulting from changes in agricultural practice, factor endowments and product and factor prices on households' total outputs based on production functions or labour income functions. Considering equations (1), (3) and (5), this allows us to calculate the consequences of these quantitative project impacts on farm households' total income.

Inserting equations (3) and (5) into equation (1) and considering the assumptions highlighted above as regards the demand for agricultural products and labour, the total differential of the modified equation (1) illustrates the empirical strategy pursued in this study:

16 Again, a fully elastic demand, in this case for labour, is assumed. This is compatible with the small total share of labour supply in the six project villages vis-à-vis the total size of the regional labour markets.

$$
\begin{aligned}
dY_i^{ttl} &= dY_i^{fa} + dY_i^{op} + dY_i^{tr} = [dX_i^{fa}] \cdot p - dC_i^{fa} + [L_i^{op}] \cdot w^{op} + dY_i^{tr} \\
&= \left[\begin{array}{l} \dfrac{\partial X_i^{fa}}{\partial A} dA + \dfrac{\partial X_i^{fa}}{\partial K_i} dK_i + \dfrac{\partial X_i^{fa}}{\partial L_i} dL_i + \dfrac{\partial X_i^{fa}}{\partial Land_i^{dry}} dLand_i^{dry} \\ \quad + \dfrac{\partial X_i^{fa}}{\partial Land_i^{wet}} dLand_i^{wet} - \dfrac{\partial X_i^{fa}}{\partial Y_i^{op}} dY_i^{op} \end{array} \right] \cdot p - dC_i^{fa} \\
&+ \left[\frac{\partial Y_i^{op}}{\partial w^{op}} dw^{op} - \frac{\partial Y_i^{op}}{\partial Y_i^{fa}} dY_i^{fa} + \frac{\partial Y_i^{op}}{\partial L_i} dL_i \right] \cdot w^{op} \\
&+ dY_i^{tr}
\end{aligned}
\qquad (6)
$$

The total differential (equation 6) shows the impact of variable changes on farm income (second line) and from other productive activities (third line) plus the impact of changes in transfer income (fourth line). Equation (6) can either be estimated in total or alternatively in parts, by aggregating the parts into total changes in an additional step.

Depending on the functional form of the agricultural production function (second line) and of the labour income function (third line), the partial derivatives in (6) will either be estimated as slopes of the regression lines or in the form of elasticities. The regressions will thus reveal the quantitative extent to which changes in agricultural technology, in the production factor capital (*K*), in the allocation of labour (*L*), in the qualities of land (wet land and dry land) and in the interaction with other income sources are systematically affecting the households' total income. The data entering the regressions are real-world data, i.e. data in a world with the community-based water projects. They will show how the surveyed households' present incomes vary with present factor endowments, how they are influenced by income from alternative sources and how expenditure for metered water affects these incomes.

The counterfactual is a world without the water projects, i.e. a world in which the beneficiary households waste labour time on fetching water from rivers, wells and dams, and where they are unable to irrigate their home gardens due to a lack of water and where the bit of water they get from those sources is for free (except in those cases where households seasonally rely on buying water from water vendors).

The differences between the real-world situation, i.e. the world with the water projects, and the counterfactual, i.e. the world without the projects, are quantified throughout the research and fed into equation (6) to calculate the overall welfare effect of the water projects on the population in the six communities. By doing so it has to be remembered that the water projects were launched less than a year before the empirical data collection. The study, therefore, covers the households' net benefits from the project in a phase where a full exploitation of the project benefits could not yet be expected. As confirmed during the field research, the households were still in an "adaptation phase" at the time of data collection. They only started to realize how they could use the additionally available water to increase agricultural production, how to reallocate the saved labour time and how the monthly water bills affect their expenditures. It is expected, hence, that the empirical results will present a rather conservative estimate and that the beneficial effects of the water projects will only materialize fully after some years.

For now, this study has to rely on the available data from the adaptation phase. It can be assumed safely that dA, $dLand^{dry}$ and $dLand^{wet}$ are equal to zero as the water projects neither affect the level of agricultural technology nor the plot sizes that the households dispose of. In contrast, the projects are changing the individual households' access to capital goods services, i.e. the availability of water for irrigation and the labour that can be additionally allocated to agriculture or possibly to other productive income-generating activities through time savings from not having to fetch water anymore. Therefore, K, L and Y^{op} are assumed to be larger with the water projects as compared to the counterfactual, i.e. a world without the projects. As a result, we expect dK, dL and dY^{op} to be larger than zero already in the adaptation phase, by comparing the scenarios with and without the projects. The estimated coefficients for the partial derivatives in equation (6) will reveal whether and to what extent changes in these variables lead to systematic output reactions. As the scope of such variable changes will be known from the empirical data, the regressions based on equation (6) will reveal the impact of the community-based water projects on the total income of the beneficiary households in the six project villages.

5 RESEARCH METHODOLOGY

5.1 Sampling Procedure and Survey Design

To assess the welfare effects of the community-based water projects empirically, household-level survey data are required. A stratified random sample of 200 households from the population of eligible beneficiary households, i.e. from the 2,984 households that were registered in the six CBOs, was targeted for the survey. Of these households, 2,490 (83%) were already connected to the project at the time of data collection. Most of the remaining households were still waiting to get their connection, while a few others had not yet been able to make the required upfront payment and/or labour contribution.

To account for the variation in beneficiary numbers and achieve a proportionate representation of the six villages in the sample, a 7% share of eligible households was targeted at each location. Households were randomly selected from members' lists (including connected as well as to-be-connected households) that had been availed by the CBOs. All registered households were first numbered in ascending order. Thereafter, 8% of households were selected from the numbered entries using random numbers. The larger sample was drawn to cater for interview refusals, absent households or other contingencies. As no refusals were encountered and pre-test data could be used, the procedure resulted in a final sample of 214 households, i.e. 7.2% of eligible beneficiary households. The sample composition is presented in Table 3.

Table 3 Sample Composition

	Water project/beneficiary community (CBO)						
	Village 1	Village 2	Village 3	Village 4	Village 5	Village 6	Total:
No. of registered beneficiary households	505	216	310	403	402	1,148	2,984
thereof: connected at time of survey	400	215	222	320	493	840	2,490
No. of interviewed households (stratified random sample)	40	15	22	28	28	81	214
% of registered households	7.9	6.9	7.1	6.9	7.0	7.0	7.2

The table indicates a small bias in favour of beneficiaries from Village 1. With 7.9%, their selection probability was slightly larger than in the other villages, resulting in a modest but acceptable overrepresentation. This deviation is a consequence of the pre-test that was conducted in that village. Since the questionnaire did not require many modifications, it was ultimately decided to retain the pre-test data in the sample. The table also shows that 493 instead of the initially registered 402 households in Village 5 were connected at the time of the survey. This is due to an expansion of the project after the initial registration

of members, in response to requests from additional households to get connected, and in light of the sufficient capacity of the water source to cater to the needs of those extra members. Furthermore, not all registered households were connected to the project yet at the time of the survey. The shares of connected households from the list of registered members ranged from 72% (village 3) to almost 100% (village 2). The sample composition is thus unbalanced with regard to this group. Notwithstanding such discrepancies, it was decided to sample households from among the registered beneficiaries, as the existing lists allowed the creation of a probability-based stratified random sample.

The standardised questionnaire for the household survey was developed after a pre-study visit from which first hypotheses on the expected impacts of the CSR-funded water projects relating to the irrigation channel, the time channel and the expenditure channel had been derived (cf. Section 4.3). The questionnaire accounts for the changes with regard to these channels through questions about factors of production, agricultural output and nonfarm income of the beneficiary households, in line with the data requirements of the empirical methods employed. The questionnaire was translated from English into Sinhala, the main language spoken in the study area, and pre-tested with 10 households. Minor modifications of the questionnaire were made after the pre-test, following suggestions of interpreters and survey respondents.

The household questionnaire is provided in Annex 2. It consists of six sections:

- The *introductory section* captures general information on the interview and its context, such as interview number, date and place of the interview, name of interviewer and translator.
- *Section A* accounts for household composition and characteristics (number, age and sex of household members).
- *Section B* asks for particulars of the households' location and records data on the use of water sources for different purposes and related allocations of cash and time, comparing the situation with and without the project.[17]
- *Section C* investigates household's amenities and capital endowments.
- *Section D* contains questions related to the agricultural use of production factors (types and quantities of cultivated crops, sales per type of crop).
- *Section E* finally accounts for household's total income and income composition from various sources and economic activities.

The data were collected by two enumeration teams, each consisting of a foreign researcher and a Sri Lankan interpreter, within a period of two weeks in November, 2011. At each location, a focus group discussion was first held with community members and representatives of the CBO's Executive Committee to explain the purpose of the research, to liaise with the beneficiary households and to learn more about the history and specific context of each water project. CBO representatives and community members also helped to locate the randomly sampled member households. Additional semi-structured interviews were conducted with executives of the parent company in Colombo and the

[17] Evidently, this was applicable to the 191 sample households that already had a water connection from the project at the time of the survey. For the 22 households that were not yet connected, no comparison was possible and only the data without the project could be recorded.

management of the power plant. Qualitative insights from these interviews complement the mainly quantitative evidence from the standardized household survey.

We primarily targeted the household heads as interview partners. If those were unavailable, the interview was conducted with another adult household member, e.g. the wife of the household head or an adult son. In some cases, households were visited several times until an eligible family member could be found. Throughout the interview, the researchers encouraged the interviewees to provide any additional information that they found worth mentioning in connection with the water projects. In addition, the questionnaire ended with two open questions, one of which asked about observed environmental changes due to the power plant (cf. Section 3.2).

The information thus collected produced nominally, ordinally and cardinally scaled data that were subjected to the econometric analysis (cf. the next section). Due to the expected heterogeneity in the sample, we consider p=0.10 as an appropriate significance level for the quantitative analyses. Data were retained from 213 of the 214 questionnaires. The excluded household was the only large chicken farm in the sample. It represents an individual success story with regard to welfare enhanced by the water projects. Nonetheless, this household had to be removed from the database, as it would have produced influential outliers with respect to any data related to income, factor endowments and water use. More details on this interesting case will be provided in Section 6.6. Due to a lack of income data for a few other households, the sample size had to be reduced to 208 for estimating the income functions. The data used in the regressions (cf. Chapter 6) are provided in Annex 3.

5.2 Econometric Approach

The principal purpose of this section is to present the reader with a more extensive rendition, basically a stepwise explanation, of the manner in which the quantitative results presented in Chapter 6 were obtained. This does not include the more basic methodological tools, such as testing for heterogeneity or identifying and dealing with outliers or missing values, but focuses on two more central issues to this investigation. The first methodological issue is that of correctly identifying the functional form of the various equations to be estimated. The second methodological discussion outlines the steps taken after obtaining robust and convincing regression estimates in order to assess the overall impact of the water projects on the beneficiary population.

5.2.1 Identifying the Functional Form

Selecting the correct form for the multivariate regression model in question can be tricky, specifically because the true functional form of the relationship between the theory given variables is impossible to know (Griffin et al. 1987, p. 116); additionally the case rarely arises where one functional form is the only one that yields convincing empirical results. Griffin et al. (1987, pp. 220-221) present an extensive overview of the preeminent traditional and popular functional forms including their intrinsic properties as well as a general selection guideline, including four groups of selection criteria. It is helpful here to

summarise the categories of functional form selection criteria set by Griffin et al. (1987) as either pertaining to:

1. maintenance of a priori assumptions (theoretical considerations)
2. estimation procedures
3. data structure and concerns
4. application requirements of the model

Griffin et al. (1987) additionally propose the use of power transformations, such as the popular Box-Cox transformation for the identification and comparison of alternative functional forms. Box & Cox (1964) argued that the assumptions required for the use of multiple linear regression analysis, in short that the observations are independently and identically distributed (i.i.d.) with a constant variance and with expected values captured by the estimated model parameters (Box & Cox 1964, p. 211), do not ubiquitously hold. It is argued by the authors that nonlinear transformations of the observations may both facilitate and simplify the implementation of multiple regression analysis by making them more compliant with the above mentioned assumptions. The proposed transformation is defined as:

$$(7) \qquad z^{(\lambda)} = \begin{cases} \frac{z^{\lambda}-1}{\lambda}; & (\lambda \neq 0) \\ logz; & (\lambda = 0) \end{cases}$$

The output, λ, of the Box-Cox transformation is the value for the power transformation of observation set z that would allow said observations to most closely adhere to the above mentioned assumptions of multiple regression analysis. Noteworthy here is that this suggested power transformation is calculated based only on statistical requirements whilst economic requirements remain outside its scope of operation. Thus whilst points (2) and (3) of the criteria for functional form selection outlined above can be tackled with Box-Cox transformations, it remains up to the judgment of the researcher where the priorities lay with respect to these and points (1) and (4).

Table 4 Tukey's Ladder of Transformations

λ	-2	-1	-1/2	0	1/2	1	2
y	$\frac{1}{x^2}$	$\frac{1}{x}$	$\frac{1}{\sqrt{x}}$	$logx$	$\sqrt{x}$	x	x^2
Suggested functional form[18]	Inverse quadratic	Inverse	Inverse Square Root	Cobb-Douglas/ Logarithmic	Square Root	linear	quadratic

Source: Tukey 1977, pp. 171-197.

Due to the difficulty of implementing the Box-Cox transformation result λ, whilst simultaneously ensuring adherence of the empirical functional form to economic theory, the guidelines set by Tukey (1977) were used. Tukey observes that transformations of

[18] See Griffin et al. 1998, p. 218.

variables can significantly increase the information obtained by their analysis, specifically by changing their expression in order to straighten out the data (Tukey 1977, p. 171). This proposition is often referred to as Tukey's Bulging Rule due to the attempt at reducing the bulge, convexity or concavity, of the relationship between two variables. The extension of this proposition is to allow the data to provide information on the optimal functional form which can be summarised by table 4 below which is often referred to as Tukey's Ladder of Transformations:

What the table above contains is possible values for the Box-Cox output λ and the subsequent transformation of the observations which are suggested by this precise value of λ. For example, if λ=0 then taking logarithms of the variables will result in a relationship between the observations that is as linear as possible (Tukey 1977, p. 171) and adheres to the assumptions of such regression analysis as described above. Noteworthy for our analysis is that λ=1 implies that the observations are already in the form where the resulting regression would most closely resemble a linear regression, and no transformation is required. The values for λ, i.e. the suggested power transformation, can then be used to suggest the optimal functional form to be used in the regression analysis as illustrated by the table above. However, the Box-Cox transformation may result in a λ between the attractive results stated in the table. In this case, it falls to the researcher to identify, based on the above mentioned selection criteria, whether the observations are to be transformed according to the λ result or one of the more theoretically sound transformations presented in the table. The regression results presented in Chapter 6 provide an empirical example of the implementation of the Box-Cox transformation.

Now that the first methodological concern has been illustrated and discussed it is time to tackle the second: the steps taken in order to estimate the net impact of the CSR project based on the empirical estimates that result from successfully selecting a functional form as described here.

5.2.2 Estimating the Impact of the Water Projects

The estimation of the impact of the CSR activities, i.e. the community-based water supply projects that were financially supported by the power plant, by means of a counterfactual follows seven distinct steps. Some of these steps can be combined, such as (2)/(3) and (5)/(6), as they are logical extensions of the foregoing step; however for the sake of clarity and comprehensiveness they are mentioned separately:

1. Run the factual regression
2. Estimate factual sample incomes
3. Estimate factual population income
4. Identify and alter the variables impacted by the project
5. Estimate counterfactual sample incomes
6. Estimate counterfactual population income
7. Estimate the impact

The first step uses the exercise described in section 5.2.1 to estimate both a full factual regression as well as a parsimonious one. The necessity of the full regression is twofold.

Firstly it is required in order to reach the parsimonious regression[19]. Secondly it, together with the parsimonious regression, will set the upper and lower boundaries of impact for the two models that are central to the analysis of the impact of the CSR project at hand, i.e. the farm income (Y^{fa}) and other productive income (Y^{op}) models. These four regressions describe the factual scenario, the scenario with the CSR project. For the sake of this narrative take, as an example, the estimated regression for farm income which has been simplified[20] as follows:

$$(8) \qquad Y_i^{faF} = \hat{\beta}_0 + \hat{\beta}_1 water_i + \hat{\boldsymbol{\beta}}_{\boldsymbol{x}} \mathbf{x_i} + \varepsilon_i$$

Where Y_i^{faF} is the factual farm income of household (i); $\mathbf{x_i}$ is a vector of those explanatory variables, and their estimated coefficients $\hat{\boldsymbol{\beta}}_{\boldsymbol{x}}$ that remain unchanged between the factual and counterfactual scenarios; $water_i$ is the water consumption of household (i) with the estimated impact of one unit of water on farm income being $\hat{\beta}_1$;[21] ε_i is the error term.

For this step let us continue with the example of the regression of farm income. For the latter, step one yielded the estimated coefficients, which allow us to use the regression above to predict the farm income of household (i) as explained by the model in the factual ($\hat{Y}_i^{faF}$):

$$(9) \qquad \hat{Y}_i^{faF} = \hat{\beta}_0 + \hat{\beta}_1 water_i + \hat{\boldsymbol{\beta}}_{\boldsymbol{x}} \mathbf{x_i}$$

Notice the absence of an error term (ε_i) which is dropped since we are dealing with predicted farm income and not observed farm income when calculating the impact of the CSR project. Step two also requires the estimation of $\hat{Y}_i^{op}$, i.e. the household's other productive income predicted by the model in the factual scenario.

Step three then takes the estimated aggregate farm ($\sum_{i=1}^{n} Y_i^{faF}$) and other productive ($\sum_{i=1}^{n} Y_i^{opF}$) incomes for the sample (n) and calculates the estimated aggregate farm and other productive incomes of the population in the factual situation, i.e. the world with the water project. Note that the sample is some fraction of the population as follows:

$$(10) \qquad n = \mu N;\ 0 < \mu \leq 1$$

So that from the sample aggregate factual farm income we can easily obtain the population aggregate farm income by multiplying the former by $\frac{1}{\mu}$. Naturally, this only works if one has information concerning the total population size and if the sample households were selected randomly from said population so that it can be assumed that the sample accurately represents the population distribution.

The fourth step requires the identification of the variable which needs to be altered in order to estimate the counterfactual scenario (cf. Box 1). Remaining with the familiar farm income equation this is the water usage variable in the equation above. Without the

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19 The full regression includes all variables which theoretically impact the dependant variable whereas the parsimonious model only includes those that are found statistically significant.

20 All variables that remain unaffected by the project, i.e. identical in the factual and counterfactual scenarios, are encompassed by the vector x to serve the narrative.

21 This is naturally only the case in level-level regressions, but for the sake of simplicity, and due to the results of our empirical analysis, we will continue assuming a level-level regression.

project there would be no piped water available and as such the counterfactual scenario can be explained by the following since we set $water_i=0$ due to the hypothesised absence of the project:

(11) $$\hat{Y}_i^{faC}=\hat{\beta}_0+\hat{\boldsymbol{\beta}}_{\boldsymbol{x}}\boldsymbol{x_i}$$

Step five then runs the above regression to obtain $\hat{Y}_i^{faC}$ for all households in the sample using the previously estimated coefficients identical to the factual scenario, the same variable list, except for $water_i$, which results in a counterfactual estimate of household farm income which is less than in the factual if the sign of $\hat{\beta}_1$ is positive.

Step six is identical to step three but then for the counterfactual aggregate income estimates of the population.

Box 1 Calculating the counterfactual—an example

A simple case for (4) and (5) would be a sample (n) of 100 households, a known population (N) of 1,000 households and only two variables which explain farm income, piped water and farmland. In the counterfactual scenario farmers have no access to piped water but we can safely assume that their landholding remains the same. Thus we can use the coefficient estimates $\hat{\beta}_o$ and $\hat{\beta}_{land}$ and by plugging in landholding size for each household, multiplied by $\hat{\beta}_{land}$, we can first obtain the $\hat{Y}_i^{faC}$ for each household, then by adding these we obtain the sample aggregate counterfactual farm income. Since our sample is 10% of our population, we finally multiply the sample aggregate counterfactual farm income by ten to obtain the population aggregate counterfactual farm income.

Step seven then measures the impact of the CSR project on the population by subtracting the counterfactual aggregate income estimates from the factual income estimates and adding the results for both farm and other productive incomes to obtain gross benefits:

(12) $$Gross\ Impact=\left(\frac{1}{\mu}\sum_{i=1}^{n}Y_i^{faF}-\frac{1}{\mu}\sum_{i=1}^{n}\hat{Y}_i^{faC}\right)+\left(\frac{1}{\mu}\sum_{i=1}^{n}Y_i^{opF}-\frac{1}{\mu}\sum_{i=1}^{n}\hat{Y}_i^{opC}\right)$$

If the variables identified as project related variables, for example $water_i$, positively and statistically significantly influence farm income, and the same for the time variable in the other productive income regression, then the gross impact should be positive.

Naturally it is also important to consider the costs that may be incurred by the households, in the calculation of the aggregate net impact of the project. In the present case these are the regular expenditures for using the individual, metered water connection and the upfront cash and labour contributed by the households. Data were collected on both the initial investment and water usage fees. It is, therefore, simple to calculate the costs for the sample and thus estimate the same for the population so that:

(13) $$Net\ Impact=\left(\frac{1}{\mu}\sum_{i=1}^{n}Y_i^{faF}-\frac{1}{\mu}\sum_{i=1}^{n}\hat{Y}_i^{faC}\right)+\left(\frac{1}{\mu}\sum_{i=1}^{n}Y_i^{opF}-\frac{1}{\mu}\sum_{i=1}^{n}\hat{Y}_i^{opC}\right)-\left(\frac{1}{\mu}\sum_{i=1}^{n}C_i^{water}\right)$$

Following this uncharacteristically exhaustive discussion of methodology attention can now be turned to the presentation and discussion of the results.

6 WELFARE EFFECTS OF CORPORATE SOCIAL RESPONSIBILITY: EMPIRICAL RESULTS

Having explained in detail the concept of Corporate Social Responsibility (CSR), the setting of the CSR case study in Sri Lanka, the theoretical framework and the research methodology, this chapter finally presents the empirical results of the study. Sections 6.1—6.5 report on the quantitative research findings, starting with some descriptive statistics and then analysing and aggregating the welfare effects of the CSR-funded water projects via the irrigation, time and expenditure channels and related income effects. Finally, Sections 6.6—6.7 present case study evidence from selected groups of households and look at further, non-monetarised effects of the community-based water projects that were not covered by the quantitative analyses.

6.1 Demographics, Income Composition and Factor Endowment of the Sample Households

On average, the 213 households in the survey sample have 4.27 members. From these, 3.04 are in an economically active age between 16 and 65 years. The remaining 1.23 are either younger than 16 or older than 65 years, and it is assumed that they are not involved in economic activities. This corresponds to an average 27% share of dependent household members. There are 53% female and 47% male persons in the sample. Most households (85%) are headed by a male member.

The sample households realize an average monthly cash income of LKR 19,533 from a variety of sources and economic activities. This amount is equivalent to a per-capita income of US$ 1.36 (or EUR 1.04) per day. Table 5 gives an overview of households' income portfolios and describes the various sub-samples for which income data were available.

The overwhelming majority (88%) of the 213 sample households are involved in farming, but only 56% earn *cash income from selling their agricultural output*, which on average contributes LKR 5,160 of families' cash earnings per month. About a third (32%) of the sample households produces crops for subsistence purposes only and relies on additional income sources for cash. Due to the availability of water from the CSR-funded projects, some of the farming households had just started recently with the commercial production of crops but not yet earned any cash income from this activity.

Three quarters (76%) of the sample households earn *income from other productive activities* (wage or salaried labour, trade, small business or public-sector employment). With an average LKR 11,825 per month, the income from such activities is considerably more important than farm income. Finally, 22% of households receive *transfer incomes* (LKR 2,635 per month on average). The scope of monthly transfer income varies widely, ranging from modest government subsidies of just a few hundred rupees and overseas remittances up to LKR 100,000. Of the total sample, 13% exclusively rely on farming, and 37% only on other productive activities for the generation of cash income.

Households have access to 1.8 acres (0.7 hectares) of farm land on average. In many cases, landholdings consist of a small home garden (dry land, average size: 1.1 acres/0.45

hectares) around the house and an even smaller plot of irrigated farm land outside the village settlement (average: 0.6 acres/0.24 hectares). The sample households that are connected to a community-based water project are consuming 12.21 m^3 water per month on average. The piped water is allocated to various purposes, including irrigation of home gardens, personal and household use.

Table 5 Sub-Sample Composition and Average Household Income

Income portfolio:	Obser-vations	Share of total sample (n=213)	Average total household income (LKR)	Standard deviation
All households (any combination of income sources)	208*	98%*	19,533	14,726
Households with farm income (Y^{fa}): Thereof:	101	47%	20,203	14,243
Y^{fa} only	27	13%	16,767	10,259
Y^{fa} + Y^{op} only	53	25%	20,369	14,637
Y^{fa} + Y^{tr} only	9	4%	20,056	11,157
Y^{fa} + Y^{op} + Y^{tr}	12	6%	27,308	20,200
Households with income from other productive activities (Y^{op}): Thereof:	161	76%	19,637	14,504
Y^{op} only	79	37%	18,369	13,536
Y^{op} + Y^{tr} only	17	8%	17,836	13,286
Households with transfer income (Y^{tr}): Thereof:	47	22%	22,519	18,501
Y^{tr} only	9	4%	27,444	28,540

* Although the sample comprised 213 households, income data are only available for 208 households (cf. Annex 3).

6.2 Estimating Total Household Income

To estimate the income effects of the water projects on the beneficiary households, various regression analyses, which are directly derived from equation (6), are conducted (cf. Section 4.3). In a first explorative approach, the influence of the independent variables from equation (6) is used to estimate households' total income (Y^{ttl}) from the survey data. Village dummies are added to the theory-based research variables in the regression to control for location-specific differences such as settlement size, electrification rate, proximity to the nearest tarred road, market place and town. For the specification of the village dummies, village 6 serves as a benchmark so that the regression includes k-1 village dummies with k=6. Village 6 is the largest and the only fully electrified village, and its households have the highest average monthly income among the six sub-samples.

To reflect the distance of each individual household's location to the next alternative source of water (river, well) a further, cardinally coded variable (time saved from fetching water per day; variable Time_savings_minutes) enters the regression. Following the procedure described in Section 5.2.2, we start our exploratory regression with the full set of independent variables (Model 1), then stepwise excluding the variables with the largest standard errors. This procedure results in a regression (Model 2) with five statistically significant independent variables (Table 6).

Table 6 Exploratory estimation of the sample households' total income (Y^{ttl})

VARIABLES	Y^{ttl} (Model 1) (all households) Total_income	Y^{ttl} (Model 2) (all households) Total_income
HHMembers_working_age	**2,501.876**	**2,937.196**
	(0.039)	(0.007)
DepRatio	59.595	**75.769**
	(0.223)	(0.098)
Piped_Watercum	**627.462**	**443.749**
	(0.010)	(0.019)
Time_savings_minutes	-10.200	
	(0.310)	
Land_total	820.193	
	(0.156)	
Income_transfer_LKR	**0.745**	**0.742**
	(0.000)	(0.000)
village1	-2,997.398	
	(0.244)	
village2	**-5,298.648**	
	(0.081)	
village3	**-7,360.887**	**-5,273.091**
	(0.005)	(0.014)
village4	-4,667.832	
	(0.129)	
village5	-1,660.246	
	(0.627)	
Constant	3,169.312	2,446.960
	(0.384)	(0.456)
Observations	195	206
Adjusted R-squared	0.362	0.335
Prob>F	0.000	0.000

Robust p-values in parentheses; significant coefficients in bold. Only 195 and 206 households of the 208 households, for which income data were available, were included in the regressions due to missing values.

All significant variables in Table 6 display the expected signs, and both models are significantly different from zero under the F-test. In Model 1, the variables describing a household's labour force (HHMembers_WorkingAge), its use of piped water (Piped_Watercum) and the transfer income it receives (Income_transfer_LKR) plus the control variables for two of the villages are significantly different from zero. This result is reproduced in Model 2, where the number of independent variables is reduced to five, which significantly and systematically contribute to explaining households' total income. Quite interestingly, land is insignificant as a production factor in explaining total household income. Equally interesting is the size of the coefficient of the income from remittances and transfers as it deviates from unity. An additional LKR 100 received as support from family members living outside the household or from public grants increases total income by only around LKR 74. This finding confirms that the households are substituting income for leisure as hypothesized in section 4.3.

6.3 Estimating the Benefits of the Water Projects

6.3.1 The Irrigation Channel—More Income due to Increased Agricultural Production

Encouraged by the results of the first exploratory analyses with respect to the signs of the coefficients, the potential transmission channels between the CSR-supported water projects and households' welfare are now analyzed in a more systematic manner. We start by explaining households' farm income (Y^{fa}) based on equations (3) and (6). The regressions follow the procedure described above, starting with a model containing the full set of independent variables (Model 1), which is then reduced to a parsimonious model with the best-fitting statistical parameters (Model 2; Table 7).

Most village dummies plus households' productive labour (HHMembers_WorkingAge) as well as transfer income fail under the t-test to systematically explain households' farm income. The first of these findings is in line with the initially considered and now confirmed proposition that the traditional agriculture practised in the beneficiary villages might be characterized by labour surplus (cf. section 4.3). This implies that the water projects do not affect the beneficiaries' farm income via the time channel. The second of these findings – insignificance of the transfer-income coefficient from zero – in contrast results from a too small representation of transfer-income-receiving household in the subsample of farming households.

The parsimonious model (Model 2) is based on the remaining empirically valid and theory-based independent variables. These include income from other productive activities which, as expected, affects farming income negatively,[22] consumption of piped

[22] It is interesting to see that the size of the *other-productive-income* coefficient (around -0.2) from the *farm income estimates* matches the empirical findings from our first explorative regression analyses of the *households' total income* quite well (cf. Table 6). There, we found that an increase of *transfer income* motivates the beneficiaries to change the allocation of time towards activities that are not income generating. As a result, the overall effect of an inflow of additional transfer income of LKR 100 on a household's total income is only equivalent to around LKR 74 which implies a reduction by around a quarter (-0.25) due to the changed time allocation which is well in line with the effect of other productive income on farm income as presented in Table 7.

water from the projects – validating the irrigation channel – and land. In addition, the significant coefficient for Village 3 was retained in Model 2. A focus group discussion revealed that this village has a distinctly different agro-social history and agro-ecological setting than the other villages. While the latter have benefited from public irrigation schemes and in many cases have access to irrigated paddy fields, the farmers in village 3 exclusively rely on rain-fed agriculture and have no permanent source of irrigation (cf. Table 2). This explains why the farm income of households in this village is significantly smaller than in the other villages.

Table 7 Estimation of the sample households' farm income (Y^{fa})

	Y^{fa} (Model 1) (households with farm income)	Y^{fa} (Model 2) (households with farm income)
VARIABLES	Income_farm_LKR	Income_farm_LKR
HHMembers_working_age	704.013	
	(0.310)	
DepRatio	**74.280**	
	(0.069)	
Income_opincome_LKR	**-0.211**	**-0.199**
	(0.065)	(0.068)
Income_transfer_LKR	-0.014	
	(0.922)	
Piped_Watercum	**378.761**	**404.606**
	(0.028)	(0.006)
Land_total	**1,400.168**	**1,181.308**
	(0.002)	(0.001)
village1	-2,926.770	
	(0.346)	
village2	-5,158.972	
	(0.213)	
village3	**-8,550.199**	**-5,093.866**
	(0.001)	(0.001)
village4	-2,636.663	
	(0.418)	
village5	**-5,892.298**	
	(0.016)	
Constant	4,091.089	**5,246.011**
	(0.168)	(0.011)
Observations	100	100
Adjusted R-squared	0.174	0.158
Prob>F	0.00246	4.23e-05

Robust p-values in parentheses; significant coefficients in bold. Only 100 of the 101 households with farm income were included in the regressions due to missing values.

Estimating the counterfactual from the irrigation channel

To quantify the total welfare effect of the six CSR-supported water projects via the irrigation channel, we still have to simulate the counterfactual, i.e. the world without the water projects, for the sub-sample of households with cash income from farming. For this purpose, we follow the procedure described in Section 5.2.2. In a first step, we predict the individual farm income for the farming households in the sample, based on their real-world data (including actual water consumed by each individual household) and using the coefficients from the regression models in Table 7. The thus predicted counterfactual farm income for these 100 households is shown in Figure 3 and contrasted with the real-world (observed) farm income values from the sample. Figure 3 illustrates graphically the explanatory power of the model in predicting the farm income of each individual household.

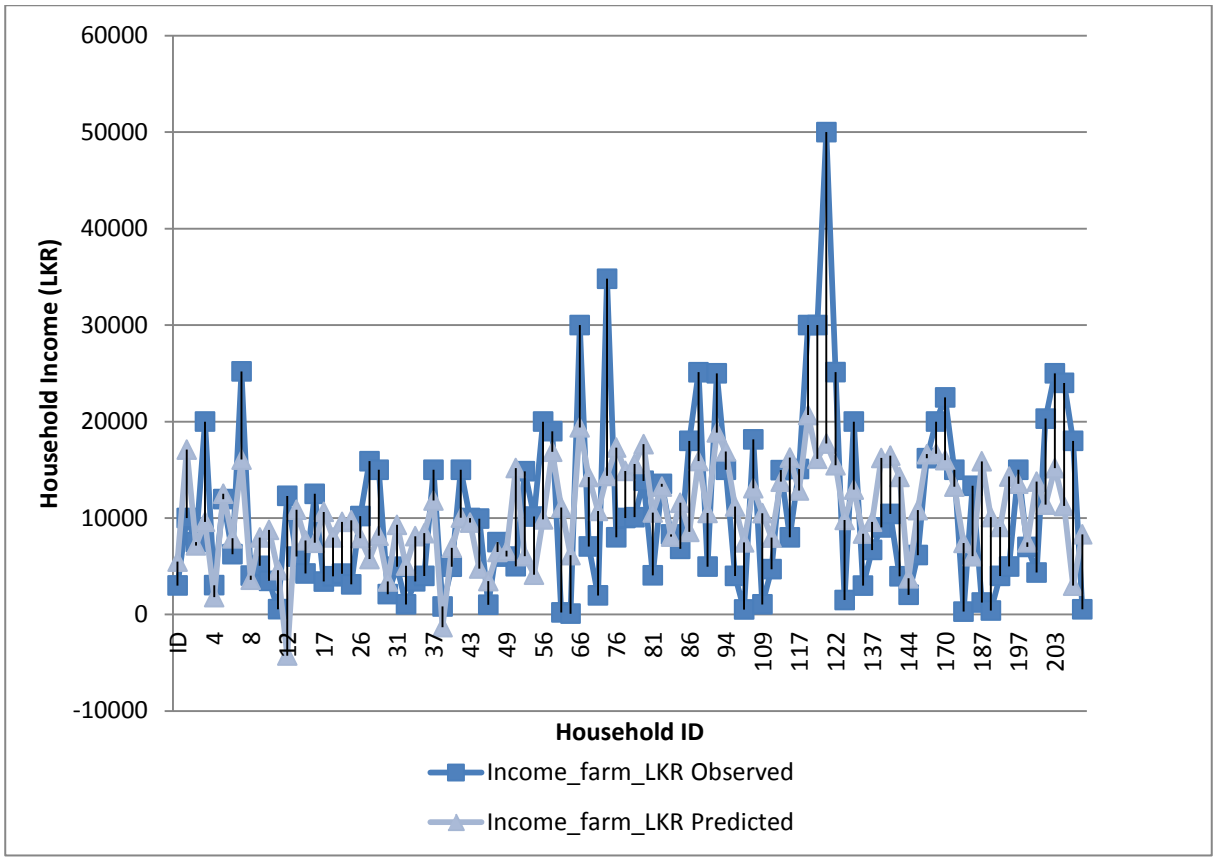

Figure 3 Real-world setting: Predicted and observed farm income

According to the regression results presented in Table 7, each cubic meter of water provided by the CSR-supported projects contributes between LKR 379 (Model 1) and LKR 405 (Model 2) to households' average monthly farm income. In the counterfactual world, i.e. a world without the project, members of farming households would be worse off, as they would not be able to irrigate their home gardens. Consequently, the households would produce less agricultural output than in the factual situation with the project, as confirmed by the regressions. For instance, a household earning the average

monthly farm income of LKR 10,525 and using the average 12.21 m^3 of piped water per month[23] in the factual situation would earn between LKR 4,625 (model 1) and LKR 4,940 (model 2) less in the counterfactual situation, i.e. in a setting without the water projects and without home garden irrigation. The community-based water projects have thus contributed considerably to improving the income of the beneficiaries via the irrigation channel.

More than half (56%) of the households in our sample received income from farming. Due to missing data, 47% (= 100 households) were included in the above presented regression analysis. As the empirical data have been obtained from a random sample, it is quite safe to assume that the same percentage of the total number of households living in the six water-project-benefitting villages, i.e. 56% out of the total of 2,984 households (cf. Table 3), i.e. 1,671 households, are also earning cash income from farming. Extrapolating the empirical results from the sample to those 1,671 households among the beneficiary population that earn cash income from farming, the total income effect of the water projects via the irrigation channel is estimated to be between EUR 582,163 and EUR 621,887.

The results presented above are based on a linear specification of the underlying household production function (cf. Section 5.2.1). Alternative approaches were also tested, including a linear per-labourer version of the production function as well as a log-linear specification of the household production function. Whereas the linear per-labourer production function exactly reproduces the results as reported above, the log-linear versions failed completely in explaining farm income. Despite the fact that the signs of the coefficients were not affected by the choice of the functional form all coefficients failed in the t-test and the determination coefficient, too, was insignificant from zero. The estimation results of these alternative approaches are therefore not reported (cf. Section 5.2.1).

6.3.2 The Time Channel—More Income due to Increased Availability of Labour

Apart from changing farm income, it has been hypothesized in Section 4.3 that the community-based water projects also affect households' income from other productive activities. In the sample, 161 of the 213 interviewed households (=76%) are drawing income from such activities. In the real-world situation, i.e. in a world with individual access to water, average monthly income from other productive activities amounts to LKR 15,130. This income is again explained by multiple linear regression models as reported in Table 8. Model 1 includes not only labour (household members in working age) in line with equation (5) to validate the time channel, but also the number of dependant household members (i.e. those that are assumed to be either too young or too old to actively contribute to income generation). The latter group is integrated into the regression model to control for potential child labour. To allow for interdependencies between different uses of time, as moderated through labour time allocation, farm income enters the regression as well. Again, we add a number of control variables that were already introduced in the previous sections.

[23] This is the average consumption of piped water among the connected sample households.

Table 8 Estimation of the sample households' other productive income (Y^{op})

VARIABLES	Y^{op} (Model 1) (households with other productive income) Income_opincome_LKR	Y^{op} (Model 2) (households with other productive income) Income_opincome_LKR
HHMembers_working_age	**3,170.552**	**2,811.130**
	(0.007)	(0.009)
DepRatio	66.731	
	(0.199)	
Income_farm_LKR	**-0.262**	**-0.357**
	(0.065)	(0.008)
Time_savings_minutes	-8.027	
	(0.421)	
village1	172.186	
	(0.940)	
village2	**-5,791.901**	**-6,399.932**
	(0.038)	(0.007)
village3	-5,513.564	**-5,635.116**
	(0.113)	(0.085)
village4	-1,021.749	
	(0.762)	
village5	-2,630.142	
	(0.402)	
Income_transfer_LKR	-0.074	
	(0.682)	
Constant	6,090.833	**8,461.309**
	(0.218)	(0.006)
Observations	153	161
Adjusted R-squared	0.081	0.104
Prob>F	0.001	0.000

Robust p-values in parentheses; significant coefficients in bold. Only 153 of the 161 households with income from other productive activities were included in model 1 due to missing values.

After a stepwise exclusion of explanatory variables with large error probabilities analogous to the regressions in Table 6 and 7, we arrive at Model 2, which provides the best statistical explanation of the sample households' income from non-farm productive activities. As in the case of farm income, both the full and the parsimonious regression models are statistically significant, all variables show the signs as hypothesized from our modelling exercise elaborated in Section 4.3, where we expected that the size of a household's labour force may positively, farming income in contrast may negatively

impact on income from other productive activities.[24] Hence, the results of both models are again used for the impact assessment.

The large, negative coefficients for village 2 and village 3 in both models point at context-related differences between the case study villages. As mentioned in the previous section, village 3 differs from the other five project villages in that farming exclusively relies on rainfall. Moreover, this village is the most remote and least accessible among the six communities. As revealed during a focus group discussion, no other productive income-generating activities apart from farming are available in village 3, explaining why residents draw considerably less non-farm income. The same applies to village 2, the smallest of the six communities. Although this village is located on the main highway and thus well-connected to the nearby town, residents mentioned that most households relied exclusively on farming or remittances for generating cash income.

Estimating the counterfactual from the time channel

Following the procedure described in the previous section, we predict other (i.e. non-farm) productive income for the 161 households based on the real-world data, i.e. data from a world with the project, which are fed into the two regression models presented in Table 8. With the project, the households on average dispose of 3.1 full-time labour equivalents in an economically productive age (15-65 years). According to the regression results (cf. Table 8), each of these members in working age contributes between LKR 2,811 (model 2) and LKR 3,171 (model 1) on average to households' monthly income from other productive sources. In the counterfactual world, i.e. a world without the project, the households would be worse of as they would be forced to allocate part of the available labour time, i.e. 96 minutes on average per day, for fetching water from the river, from a well or from other sources.[25] For each of the surveyed households this waste of labour time can be expressed in full-time labourer equivalents, based on the actual time saved by each sampled household.[26] As a result, the households would lose labour time in the absence of the water supply projects and therefore experience an average monthly reduction in income from other productive activities of between LKR 703 (under model 2) and LKR 793 (under model 1). As these estimates and calculations show, the irrigation effect of the water projects[27] is absolutely more important than the labour channel.

For extrapolation purposes we make use of the characteristics of our sample once again. As the sample is randomly selected it should be expected that the percentage of households earning other productive income (76%) is identical between the sample and the total beneficiary population. This implies that from the 2,984 beneficiary households,

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24 Again, the results of our estimates of other productive income confirm our hypothesis on changes of time allocation induced by additional income as presented in footnote 22. Here, the coefficient of farm income is between -0.26 and -0.36, cf. Table 8.

25 This is the average time saving of the connected households in the sample. As revealed during the field research, fetching water is primarily a task for working-age men in the study area.

26 Assuming that a household member needs to fetch water for 25 days in a month, monthly labour time is reduced by 40 hours due to the 96 minutes that are wasted per day for collecting water. At a full-time work load of 160 hours per month (25 days times 6.4 working hours per day) the 96 minutes spent per day to fetch water imply a loss of a quarter of the labour time of household member who works full-time.

27 See section 6.3.1.

2,268 would be generating income from other productive activities. In the counterfactual situation, these 2,268 households dispose of a quarter of a full-time labourer less, reducing their income within the margins reported above. As a result, the CSR-supported water projects have increased the annual income of the 2,268 households with other productive income by between EUR 135,406 (model 2) and EUR 152,719 (from model 1) in total, as they are not forced anymore to waste time for fetching water from far away sources but instead are provided with individual water access at their homes.

6.3.3 Savings due to Reduced Water Expenditures

More than a quarter (28%) of households in the survey sample have realised a net saving on water expenditures since joining the community-based water supply projects—despite having to pay a monthly water bill now, which includes maintenance fees and user charges. Typically, these households did not have access to any freely available water source before the launch of the community-based water projects, or require particularly large quantities of water for their livelihood strategies (e.g. brick makers). Therefore, they used to rely on buying water from private water suppliers. Such water vendors, typically locals owning a tractor with a water tank on an attached trailer, regularly supplied water at the cost of LKR 500 per cubic metre to those households, filling up their individually-owned water tanks (capacity: 1 or 2 m^3). The survey also included a few former water vendors, who had sold their tractor and reported an income loss but were still satisfied with the water project, as life had gotten much easier for their own families as well. Those 60 households formerly relying on water vendors are now saving up to LKR 2,000 per month on water-related expenditures. Extrapolating the average annual saving of these 60 sampled households (LKR 677) to the equivalent share (28%) of the project population, the total amount saved is EUR 23,259 per year.[28]

6.4 Estimating the Costs of the Water Projects—the Expenditure Channel

Up to now, the reported income effects represent the households' benefits from the CSR projects. This effect is a gross benefit, as the households are required to accept additional expenditures, i.e. input costs, if they are willing to realise these gross benefits. As information is available on each household's individual upfront investment, water use and water bill, we are able to calculate the additional economic cost that each individual household has to bear if it is connected to the water project based on the fee structures of the CBOs the sample households are living in (cf. Section 3.3, Table 1). On average, the sample households pay LKR 370 (ranging from LKR 80 to LKR 1,300) per month for the metered water consumed, for the membership, and for maintenance (LKR 4,419 per year). In addition, people had to make the upfront investment for their water connection (cf. Section 3.3, Table 1). This investment was translated into annual expenditures using the perpetuity formula at an interest rate of 5%[29] so that the average annual expenditures

[28] As some households used to buy water during the dry season only, while others relied on water vendors throughout the year, we calculate this figure for an average six month period per year.

[29] The choice of this rather low interest rate produces comparatively large annual expenditures and therefore represents a conservative estimate.

for a household of getting individual access to the water grid and of using metered water increase to a total of LKR 5,343. Based on individual data the households in the sample spent LKR 1,036,616.

Projected on the 2,490 (83%) already connected households out of the total 2,984 beneficiaries, the annual water expenditures of this group amount to EUR 81,400, which is the real world opportunity costs of the beneficiaries of having individual access to water. Under the counterfactual, i.e. in a world without the water projects, these expenditures would have been saved.

6.5 Net Aggregate Welfare Effect of the Water Projects

The last step of the analysis simply consists of an aggregation of the gross benefits and costs from the community-based water projects via the three described channels, i.e. the irrigation channel, the time channel and the cost-saving channel. This aggregation is based on the regression models and calculations explained in Sections 6.2-6.4.

Drawing the balance of the income changes that the community-based water projects have brought about for the 2,984 households in the six beneficiary villages, we arrive at the overall result of the analysis. As shown in Table 9, the dominant share of project benefits is brought about via the irrigation channel. With almost all households involved in farming and more than half (56%) involved in market-oriented cultivation, this large, systematic impact is not surprising. The indirect effect on the beneficiary households' welfare via the time channel is considerably smaller but still important, as 76% of households in the sample draw income from non-farm productive activities. Overall, the community-based water projects produce an annual net welfare increase between EUR 659,428 and EUR 716,465 for the 2,984 beneficiary households. This corresponds to an average per-capita income increase between EUR 51 and EUR 56 per annum, or 14-15% growth over households' counterfactual income (i.e. in a world without the water projects). This positive net welfare effect demonstrates that households' upfront cash and labour contributions and the monthly payment of water bills are profitable investments from the beneficiaries' perspective.

Many households mentioned during the interviews that they had just started the cultivation of vegetables and fruits for the market, but had not yet harvested and earned an income from these crops.[30] Even more households mentioned that they were planning to start vegetable cultivation in the near future. It is, therefore, safely assumed that the reported net benefit of the water projects is a conservative, lower-bound estimate of the projects' annual welfare effect only. Quite likely, a follow-up study today would reveal even larger benefits.

[30] This also explains the discrepancy between the number of farm households for which income data on crop production were available and included in the regression (101 households, cf. Table 6) and the number of farm households that reported that they were producing crops for the market (119 households).

Table 9 Estimation of total aggregate impact of the CSR-supported water projects

Gross annual benefit	
From rising farming income	EUR 582,163 to EUR 621,887
From rising other productive income	EUR 135,406 to EUR 152,719
From water bill savings	EUR 23,259
Total:	**EUR 740,828 to EUR 797,865**
Annual costs	
From increased expenditures for using individual water access	**EUR 81,400**
Net annual benefit (Gross annual benefit minus annual costs)	**EUR 659,428 to EUR 716,465**

Based on the described application of the productivity method and the theory-derived regression models, the calculated net benefit to the rural households can be causally attributed to the six community-based water projects that were co-funded by the plant owning company (cf. Section 4.2). To re-assess the claim made in Section 4.1 that the water projects would not have been realised without the co-funding from the company's CSR budget, it is interesting to compare the results of this impact assessment with secondary data from other community-based water supply projects that did not receive private-sector support. A World Bank evaluation report of CWSSP II projects[31] in other parts of Sri Lanka finds that only 53% of targeted households got connected. As the main reason for the slow and insufficient implementation of the water projects, the report mentions households' inability to afford the connection-related costs, as programme implementation (2003-2010) coincided with times of drastic inflation in the post-tsunami period in Sri Lanka (World Bank 2011, p. 6).[32] This supports and plausibly explains the claims made by informants and interview partners in the study area that the required own contribution of the intended beneficiaries was unaffordable for most households and that the six water projects would not have been realised without the supplementary funding from the power plant, which significantly lowered the individual connection costs. The high connection rate (83%) among the targeted beneficiaries of the six studied projects with on-going extension to more households at the time of the survey is another sound argument in this regard and an indicator of the projects' overall success.

Finally, it needs to be stressed that our analysis aimed at estimating the total net welfare effects of the CSR-supported water projects *on the immediate beneficiaries*, i.e. the 2,984 CBO member households (12,741 individuals). An estimation of the projects' implications on *wider society*, i.e. a full social cost-benefit analysis, was beyond the scope of this study. Such a complete economic analysis would have to include, among others, the company's

[31] The community-based water projects evaluated for this study were implemented in the context of the same programme (cf. Section 3.3).

[32] Consumer price data for Sri Lanka confirm this. For instance, the consumer price index steadily increased since 2004 up to a peak growth of 29% in 2008 over the previous year, and the food price index grew by a stunning 44% in the same one-year period (ADB 2014, pp. 197-198).

CSR investment into the projects (LKR 10 million) as well as the invested public funds on the cost side, and potentially increased tax income, reduction in health expenses and potential economic spill over effects within and beyond the affected communities on the benefit side. Hence, the analytical focus here has been restricted to the welfare effects for the projects' direct beneficiaries. With the expected increment of project benefits due to households' on-going efforts to expand cultivation and other economic activities, however, spill over effects become more likely and could be an interesting area for further research.

6.6 Impacts of the Water Projects on Farming and Non-Farm Activities—Some Narrative Evidence

Having estimated the aggregate monetary impact on the beneficiary population, this section provides complementary evidence how the community-based water projects have changed the life and livelihoods of individual beneficiary households. The results draw on survey data, informal interviews with concerned household members and researchers' observations, presenting exemplary insights into the ways through which beneficiaries were making use of their household water connection at the time of the field research, i.e. less than a year after the project start.

Impacts on farm households

Of the 191 sample households that already got their water connection at the time of the survey, 33% reported to have allocated more labour time to the cultivation of their farm land. Some had not been farming before and had only recently started to grow crops to save on food expenditures. Several farmers extended their cultivated area and were now using their landholding more productively, while others mentioned that they had switched to growing different crops or started to plant fruit trees due to the reliable access to irrigation that they are now enjoying. In addition, farmers mentioned that they were now cultivating throughout the year and devoting more labour to appropriately managing their farm land (both wet and dry land plots), e.g. spending more time on weeding.

Vegetable producers are among the households that particularly benefit from an individual water connection via the irrigation channel (cf. Section 6.3). Eggplants, tomatoes, chilli peppers, cabbages and green leafy vegetables are typically produced in the project area for local markets and also to the nearby urban market. As farmers stated, production of such vegetables is labour-intensive and viable only with permanent irrigation. One extremely poor five-person household (two adults, three young children) from village 5 relies on a combination of farming, wage labour and government subsidies (total per capita income: EUR 0.47 per day). The couple had started vegetable cultivation on its two-acre dry land plot after getting their water connection. They spend 2% of their monthly cash income on water from the project, which is used for all purposes, including irrigation of vegetables. With the water project, the family is saving three hours of labour time per day. This time is now used for more cultivation, and the household expects further income increases from vegetable production in the future.

Another interesting example is a "model farmer" from village 1. On a tiny plot of dry land around his residential house, the farmer has created a vegetable plant nursery, where he is propagating vegetable seedlings. He mainly supplies the seedlings to the government's

provincial agriculture department, which distributes the seedlings to local farmers. The farmer, who also has other income sources including overseas remittances, generates about LKR 19,600 per month from this farm-related business alone. This activity was possible due to the water connection and 150 minutes of saved labour time that is now allocated to the plant nursery.

Impacts on households with non-farm economic activities

More than a third (38%) of beneficiary households in the sample stated that they were using the time saved from daily water collection for income-generating activities. This supports the findings from the regressions on project-related impacts via the time channel (cf. Section 6.4). Apart from allocating more time to farming, as described above, the time-savings also have a positive impact on non-farm activities such as casual labour, trading, crafting and small businesses. With the water projects, household members are devoting more time to these activities, which are important sources of cash income in the study area. Carpenters, tailors, shop owners and wage labourers were among those households in the sample that reported to have expanded their non-farm economic activities due to the additionally available labour time.

Brick making is another important non-farm income-generating opportunity in the study area, as the nearby town provides a reliable market for construction materials. As traditional brick making relies on simple production technology and inputs, the entry barrier into this business is low even for very poor households. Albeit profitable, brick making involves hard physical labour and requires a large amount of water. Due to the individual access to metered water supply, many households in the project area were able to increase their income from brick making or were considering brick production in the future. One female-headed household (per-capita income: EUR 2.2 per day) from village 1 is saving both time and money due to the project. The widowed household head that looks after two teenage children is saving two hours of labour time per day and up to LKR 1600 per month that she formerly used to spend on water from commercial water vendors. She uses the additional labour time for producing more bricks. Due to her money savings, the woman now hires a labourer occasionally to help her with the work.

The scope of production and income increases due to the availability of the water connection was impressively confirmed by another brick making household from village 3, the poorest and most remote project village. The five-person household (two adults, three children) is earning EUR 1.80 per person and day. The household head works as a driver. His wife contributes 40% of household income from brick making. She reported that she was now able to save two hours of time per day and that her income from brick making has more than doubled since the household got the water connection.

Impacts on local industries

There are a few larger enterprises in the project area, including metal-crushing companies and poultry farms. Such enterprises are principally not eligible to join a community-based water project, and a direct welfare effect of the CSR-funded projects on them was not expected. However, one commercial chicken farm was randomly selected for the survey. The owner lives with his family in village 6 and was thus eligible to become a member of the local CBO. He is using water from the project both for the private use of his household and for his farm. As this household produced extreme outliers with regard to the research variables, it was excluded from the sample for the quantitative analyses. However, this household exemplifies how an individual water connection can create substantial opportunities even beyond traditional small-scale activities.

The chicken farmer started operations in early 2011 but was unable to expand his business during the first months due to unreliable water supply from a well. He stressed that a chicken farm not just requires a sufficient quantity, but also good-quality water to make sure that the animals stay healthy. Since August 2011, he has been connected to the water project of village 6, which provides fully purified water (cf. Table 2). With a daily consumption of 3.5 m^3 of water, the farmer is by far the largest single user of this project. About 5,000 chicken are raised on the farm, generating an average monthly turnover of LKR 960,000. The farmer is operating two shops in the nearby town, where the poultry meat is sold. More recently, the farmer had started to diversify his business and was irrigating one acre of dry land to cultivate vegetables at the time of the survey. With his business activities, the entrepreneur has created 16 new jobs in the project area, 13 on the chicken farm and three more for the commercial cultivation of vegetables.

As revealed by the quantitative analyses (Section 6.2-6.5) and further illustrated by the narrative evidence in this section, access to an individual, reliable water supply increases income, reduces expenditures and may even result in a sustainable change of livelihood strategies from traditional, small-scale activities towards more profitable economic opportunities. It needs to be stressed once again that not all households had started to take advantage of such opportunities at the time of the survey, and that the reported benefits are probably underestimating the full, longer-term impact of the water projects.

6.7 Non-monetarised Impacts of the Water Projects

Apart from the above reported monetarised benefits, the survey respondents mentioned some further positive effects of their individual water connections that were beyond the scope of this study but could provide interesting avenues for further research. These effects are linked to health, sanitation, family life and education or, more generally speaking, to people's quality of life. Qualitative evidence on such effects is drawn from survey responses and informal interviews with project beneficiaries.

Impacts on health and sanitation

Improved water quality was mentioned by many interview partners as a major non-monetary benefit of the projects in all villages except villages 4 and 5.[33] People reported that typical water-borne diseases had become less frequent in their community since the launch of the water supply scheme. Unlike the water from the projects, which is regularly checked, wells and other water sources that people used to rely on are not controlled and potentially polluted, or contain high loads of minerals such as fluoride, posing a risk of health-related problems in the perception of local informants. Several cases of kidney and bladder problems (kidney and bladder stones, kidney failure) were reported by respondent households in the sample. These health problems could be possibly linked to high mineral content of uncontrolled water sources, or simply be a consequence of insufficient drinking in the hot climate. As the study of Gross et al. (2013, pp. 22-23) suggests, time savings due to improved access to water tend to increase water consumption per person, with a potential positive impact on people's health. However, whether people's individual water consumption for drinking and cooking has increased due to the water projects is a matter of speculation. Analysing the causalities between water consumption (quality, quantity) and health was beyond the focus of this study but could be a relevant topic for further research.

As regards hygiene and sanitation in the project area, many interviewed households reported that they had built new toilets and showers after getting connected to the water project. Not surprisingly, therefore, residents shared the view that the hygienic situation had notably improved in their village since the launch of the water project. Many households also stressed the practical advantages of an individual water connection for personal hygiene. Women regarded it as much safer to care for small children, elderly or disabled family members at their home rather than having to take them to a river or irrigation canal for bathing. Again, further research would be necessary to analyse the long-term health benefits and welfare effects of improved hygiene and sanitation in the project area.

Impacts on family and community life

Almost all survey respondents repeatedly mentioned that their lives had gotten easier and more comfortable due to the water projects. Of the 191 already connected households in the sample, 83% reported that they were saving time due to the project. As described in the previous section, many respondents were already making productive use of the water connection and related time savings at the time of the survey, i.e. less than one year after the launch of the project in most cases. Only 16% of time-saving households explicitly stated that they were enjoying more leisure time due to the piped water connection. Most survey respondents rather pragmatically described the non-monetary benefits of the water projects and how they were making use of the saved time. Many women reported that

[33] Village 4 does not have a water filtering/purification system. So even if households are now enjoying the comfort and possibilities of an individual water connection at their homes for personal use and irrigation, the water from the project is regarded as unsafe for drinking, and people continue to fetch drinking water from wells. In village 5, water is safe according to laboratory tests but households reported a bad taste and, hence, continue to prefer well water for drinking. In the remaining projects, either the natural water source is confirmed to be safe, or the projects have a full filtering/water purification system.

they spend the saved time on household chores, such as cooking and cleaning. Others stressed that they were now devoting more time and attention to their children. Finally, several households mentioned that they used the time for furthering their own education or doing social work for the community.

7 SUMMARY AND CONCLUSIONS

The private sector is increasingly seen as an agent in the fight against global poverty not just via its "core business"—providing jobs, tax income and shareholder value—but also via companies' "corporate social responsibility" (CSR). While there is widespread concern about negative social and environmental externalities created by corporations, very little is actually known about the local impacts of CSR measures in developing countries. This paper contributes to filling this knowledge gap by analysing the welfare effects of six community-based water supply schemes in Sri Lanka that were co-funded by a thermal power plant as part of the company's CSR strategy. As the water projects were proposed and prioritised by the concerned communities and would not have been realised without the complementary private-sector funding, the company's support is an example of discretionary, "philanthropic" CSR directed at external, secondary stakeholders. This type of investment is regarded as a particularly credible form of CSR, as it does not create any direct benefit for the company. Nonetheless, the company also has a strategic interest to maintain amicable relationships with communities in its operating environment by supporting local development projects, thereby minimizing the risk of conflict and civil society pressure.

A theory-based impact evaluation was conducted to analyse the welfare effects of the community-based water projects. Based on a household production function, it was hypothesised that the water projects have an impact on farm income, non-farm income and expenditures of the project beneficiaries via an expected increase in agricultural production, time savings and changed water-related costs. Almost 3,000 households (approx. 13,000 individuals) in six villages in the company's surroundings are members of community-based organisations that operate the water projects, and thus eligible to get an individual household connection. About 83% of these eligible beneficiary households were already connected to a water project at the time of data collection.

We took a stratified random sample of 213 households (7% of the total beneficiary population) from the six villages and interviewed those households, using a standardised questionnaire that explored family composition, water consumption, water-related expenditures, time savings due to the project, income, farming and non-farm economic activities, and household amenities and assets. Based on the empirical data thus collected, we estimated various regression models to examine the impact of the theory-derived research variables on households' total income, farm income, and non-farm income.

The study finds a substantial, positive impact of the water projects on farm income of the beneficiary households via an "irrigation channel," i.e. production increases due to the permanent availability of irrigation. The regressions also reveal a systematic, indirect impact of the water projects on households' non-farm income, as the time saved from collecting water is now allocated to productive economic activities. Finally, a smaller share of beneficiary households is enjoying net cost savings, as they do not depend on commercial water vendors anymore. Deduced from these benefits are the project-related costs that have to be borne by the households, i.e. the upfront investment and the variable expenditures for monthly fees and consumption-dependant user charges. Extrapolating the survey results to the beneficiary population, the study reveals a total annual net benefit in the range of EUR 659,428 to EUR 716,465, which is equivalent to an average

14-15% increase over per-capita counterfactual income. This net benefit is substantial in the eyes of the beneficiary households, as confirmed by complementary qualitative research findings. As most of the water projects had been launched less than a year before the data collection, it is assumed that the revealed benefit constitutes a rather conservative, lower-bound estimate of project impacts. Apart from increasing income, the water projects have also created some non-monetary benefits, which are highly appreciated by the households in the six communities. As the water projects would not have been realised without the complementary funding from the company, we can conclude from the research results that the power plant's CSR investment significantly contributes to increasing the welfare of the beneficiaries.

The study conveys two main messages related to its theoretical approach, methodological contribution and empirical findings. *First, it illustrates the rigour and practical advantages of theory-based impact evaluation*, exemplified here by an empirical application of the productivity method. Theory allows the analyst to detect potential channels through which a given intervention (e.g. a development project or a company's CSR investment) systematically affects the welfare of the affected population. And it gives sound indications on the methods that are appropriate to empirically examine the theoretical propositions and to construct a meaningful counterfactual against which the project impacts can be measured.

The productivity method, along with other approaches derived from microeconomic welfare theory, is appropriate in a wide range of evaluation contexts. This particularly applies when welfare effects due to changes in the provision of a public or quasi-public good are to be quantified and valued from the perspective of project beneficiaries, along with spill over effects and externalities. The productivity method is suitable for ex-post evaluations—as in the given case—as well as for ex-ante simulations of expected project effects. Unlike randomised control studies and related quasi-experimental evaluation approaches (difference-in-difference approach, before-after comparisons), it does not require the collection of vast amounts of data before, during and after a project. The collection of a sufficiently large randomised and thus representative sample of good-quality household data from the beneficiary population at one point in time was the only requirement for the research objective at hand, thus constituting a rather economical approach to impact evaluation.

As this study demonstrates, a theory-based impact evaluation that is based on well-known and well-proven concepts of welfare economics, such as household production functions, is able to rigorously assess the scope of project effects in monetary terms by creating a credible counterfactual. It is also able to reveal and plausibly explain the underlying mechanisms that have caused such effects, thus unpacking the "black box problem" linked to other currently popular evaluation approaches. Theory-based evaluation studies therefore allow project stakeholders and policy-makers to learn valuable lessons and arrive at meaningful conclusions. It is hoped that better evaluations will ultimately lead to better development interventions and a more sustainable development process in low-income countries.

Second, the study contributes to filling the research gap on social welfare effects of CSR in developing societies. As demonstrated by this case study of CSR activities of a thermal power plant in Sri Lanka, it is worthwhile to look beyond just the obvious (e.g.

environmental) externalities created by private companies and also explore the welfare effects of CSR investments on external, secondary stakeholders. The presented case study demonstrates the significant annual net benefit from the water projects, which is several times higher than the economic costs of an individual household connection from the perspective of the poor beneficiary population. As illustrated by this study, the complementary funding of local development projects by the private sector via companies' CSR investment may potentially have a strong 'leverage effect' and effectively support the development process.

As a final caveat, it needs to be stressed that this study exemplifies a somewhat "ideal" case of companies' CSR engagement in developing countries. With its decision to support the six water supply projects—thus complementing public funds and filling the financial gap that the beneficiaries alone were unable to afford—the plant-operating company responded to the request and developmental priorities of the concerned communities. The increasing body of literature suggests, however, that such an "ideal case" is rather exceptional. Perhaps not surprisingly, the private sector's CSR investment in developing countries more often appears to be motivated by companies' strategic interests than by local development priorities. More rigorous impact studies are required to analyze welfare effects of CSR in developing countries. The publication of such studies shall encourage companies to try even harder to become "good corporate citizens" and play their role in the global fight against poverty.

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ANNEX 1 KEY DATA OF THE SIX COMMUNITY-BASED WATER PROJECTS

	Water Project/Community (CBO)					
	Village 1	**Village 2**	**Village 3**	**Village 4**	**Village 5**	**Village 6**
Date of project commencement	07 November 2010	14 March 2011	10 May 2010	10 October 2010	26 November 2010	27 December 2010
Project duration at time of survey	12 months	8 months	18 months	13 months	12 months	11 months
Distance from power plant	14 km	3.5 km	5 km	7 km	7 km	2 km
Distance from nearest town (urban council)	6 km	8 km	5 km	12 km	10 km	7 km
Total no. of households	1,305	300	420	1,500	662	1,500
No. of targeted beneficiary households (=registered CBO members), thereof:	505	216	310	403	402	1,148
Connected at time of survey	400 (79%)	215 (100%)	222 (72%)	320 (79%)	493 (123%)	840 (73%)
Total project cost (LKR), thereof:	14,781,361	9,769,728	9,933,197	11,866,977	21,534,603	39,503,848
Public funds (government + donors)	8,796,480 (59%)	5,388,320 (55%)	5,950,480 (59%)	7,730,240 (65%)	11,157,440 (52%)	23,400,160 (59%)
Community contribution	3,974,146 (27%)	2,419,704 (25%)	2,930,578 (30%)	2,457,387 (21%)	9,463,806 (44%)	13,718,888 (35%)
Company (CSR) contribution	**2,010,725 (14%)**	**1,961,704 (20%)**	**1,062,139 (11%)**	**1,679,350 (14%)**	**913,357 (4%)**	**2,384,800 (6%)**

ANNEX 2 HOUSEHOLD QUESTIONNAIRE

RUHR UNIVERSITÄT BOCHUM RUB Ruhr University Bochum, Germany, November 2011 IEE Institut für Entwicklungsforschung und Entwicklungspolitik / Institute of Development Research and Development Policy

Enumerator's name: _____ Interpretor's name: _____

Village: _____ Interview No. (Household ID): _____

Date: _____

Name of Household Head: _____ Sex: ☐ male ☐ female

Person interviewed (if other than household head): _____

Household benefits from company's CSR activities as follows:

☐ Water supply: overhead/ground tank (untreated water)

☐ Water supply: overhead/ground tank (with water purification/safe water)

☐ Electricity connection due to water project

Brief description of household location / remarks:

_____

Thank you very much for availing approx. 30 minutes of your valuable time for this household survey, which is conducted for academic purposes only. Confidentiality of your personal data is assured!

A) Household Composition *(resident household members only!)*

ID	Name	Sex: male=m; female=f	Age (years)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

B) Location and Household Utilities

1. Distance of house from nearest main road (black-topped):

Approx. _____ km _____ minutes walking time

2. Main roofing material of house:

☐ Straw/leaves ☐ Corrugated iron ☐ Asbestos sheets

☐ Tiles ☐ Other: _____

3. Please indicate the source(s) of water for the following purposes:

Purpose:	**NOW**, i.e. after the start of the water project: Source: 1 = piped water (purified) 2 = piped water (unpurified) 3 = water vendor 4 = well 5 = stream/river 6 = irrigation canal 7 = rainwater		**BEFORE** , i.e. without the water project: Source: 1 = piped water (purified) 2 = piped water (unpurified) 3 = water vendor 4 = well 5 = stream/river 6 = irrigation canal 7 = rainwater	
	Source	% of total consumption	Source	% of total consumption
Drinking water				
Personal hygiene (bathing)				
Washing clothes				
Irrigating crops / farmland				
Other:				

4. Do you consider the quality of your <u>drinking water</u> source as safe for human consumption?

☐ Yes ☐ No => *Give reason why:* _____

☐ Household is boiling drinking water

5. Please estimate your total monthly expenses and the time required for fetching water:

	Now (with the project)	**Before** (without the project)
Monthly expenses for water	LKR	LKR
Time required for fetching water	Hours per day:	Hours per day:

6. If your household had to fetch water before, you are now saving some time. How is your household utilizing this time?

☐ Enjoying more leisure time ☐ Using the time for other purposes: _____

If time is used for income-related purposes, please mark the following:

☐ Area under agricultural cultivation has been extended by _____ ___ (unit)

☐ Now growing different crops: _____

☐ Have now time for other productive purposes: _____

☐ Income has increased by LKR _____ per month/year (specify)

7.4 In case you are also saving money for buying water now, can you tell us how your household is utilizing the money that you save?

_____

8. What is the main source of energy that your household is using for *cooking* (incl. boiling of water)?

☐ Electricity ☐ Firewood ☐ Gas ☐ Other: _____

9. What is the main source of energy that your household is using for *lighting*?

☐ Electricity ☐ Kerosene ☐ Other: _____

10. Please estimate your household's total monthly expenses for energy (cooking & lighting):

10.1	Electricity for household consumption:	LKR _____
10.2	Electricity for industry/business consumption:	LKR _____
10.3	Gas, oil, kerosene:	LKR _____
	=> *Total monthly energy costs* (10.1+10.2+10.3):	LKR _____

11. Which of the following items/amenities does your household possess?

☐ TV ☐ Mobile ☐ Bicycle ☐ Motorbike ☐ Three-Wheeler ☐ Car ☐ Tractor

C) Farmland, Agricultural Production and Livestock

1. Total size of landholding: _____ acres, thereof:

dry land: _____ acres irrigated land: _____ acres

2. Would you be able to sell your land, i.e. do you have a land title? ☐ Yes ☐ No

3. Do you cultivate any of your land? ☐ Yes ☐ No

4. Is your household able to sell any crops on the market?

☐ No, exclusively producing for subsistence purposes => *continue with 6.*

☐ Yes

5. Please estimate the total amount of crops that your household has sold in the past 12 months!

	Crop	Unit	No. of units sold	Ø sales price per unit (LKR)	Total sales (LKR)
Fruits:	Bananas				
	Lime				
	Oranges				
	Coconuts				
Grains:	Paddy				
Vegetables:					
Other:	Maniok (Yam)				

6. If you are irrigating some of your farm land from the piped water supply:

Has your production changed due to the availability of piped water? ☐ No ☐ Yes:

☐ Total output has increased – growing more of same crops than before=> *Explain:*

_____

☐ Production has changed - growing new crops => *Explain:*

_____

7. Please list the number of livestock owned by your household:

☐ Do not own any livestock

_____ Buffaloes _____ Cattle _____ Chicken Other: _____

D) Household Income

1. Has your household had any <u>cash income</u> in the past 12 months?

☐ No

☐ Yes: Total cash income (gross) in the past 12 months: approx. LKR _____

Alternatively: average monthly household income: approx. LKR _____

2. Please estimate the *shares* of the different income sources that have contributed to your household's cash income in the past 12 months:

Income from own farm (sales of crops, livestock): _____ %

Income from wage labour (specify: _____): _____ %

Income from salaried employment (specify: _____): _____ %

Transfer income (specify: _____): _____ %

Other income sources (specify: _____): _____ %

3. Are any members of your household (family) currently living outside the village and financially supporting your household (i.e. providing remittance income)?

☐ No ☐ Yes: => *Add income under "transfer income" above!*

4. Have you noticed any environmental changes due to the power plant? Please describe!

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5. Finally, is there anything else you would like to share with us about how the availability of piped water supply has changed the life of your household and the community?

ANNEX 3 HOUSEHOLD DATA USED IN THE REGRESSIONS

ID	Total income (LKR)	Income farm (LKR)	Income other productive activites (LKR)	Transfer income (LKR)	Time savings (minutes)	Dep. Ratio (%)	HH Members working age	Piped Water (m^3)	Land total (acres)	village1	village2	village3	village4	village5
1	5900	3009	2891	0	150	0	4	6.00	2.00	0	0	0	0	1
2	25000	10000	15000	0	120	40	3	6.00	10.50	0	0	0	0	1
3	15000	7500	7500	0	0	33	4	0.00	3.75	0	0	0	0	1
4	20000	20000	0	0	60	33	2	6.00	3.75	0	0	0	0	1
5	8000	3040	4960	0	120	0	2	3.00	1.50	0	0	0	0	1
6	26000	11960	14040	0	120	0	6	15.99	5.00	0	0	0	0	1
7	12500	6250	6250	0	180	0	4	14.25	2.00	0	0	0	0	1
8	45000	25200	0	19800	0	0	5	9.00	8.00	0	0	0	0	1
9	16800	4032	12768	0	30	25	3	3.50	2.00	0	0	0	0	1
10	10500	5040	5460	0	180	60	2	6.00	2.00	0	0	0	0	1
11	5900	3481	2419	0	150	75	1	9.00	1.00	0	0	0	0	1
12	27500	550	9900	17050	150	50	1	7.67	1.00	0	0	0	0	1
13	82000	12300	69700	0	120	0	9	11.00	1.25	0	0	0	0	1
14	6000	6000	0	0	180	60	2	14.25	1.00	0	0	0	0	1
15	40000	0	40000	0	120	60	2	11.00	0.25	0	0	0	0	1
16	14160	4248	9912	0	120	25	3	9.00	3.00	0	0	0	0	1
17	28417	12503	15914	0	30	0	6	11.00	3.00	0	0	0	0	1
18	19000	0	0	19000	60	75	1	2.50	1.00	0	0	0	0	1
19	11000	0	11000	0	180	25	3	15.99	2.00	0	0	0	0	1
20					-35	33	4	0.00	2.00	0	0	0	0	1
21	6000				30	0	4	9.00	7.00	0	0	0	0	1
22	2000	0	0	2000	170	0	3	16.20	1.00	0	0	0	0	1
23	8320	3411	915	3994	120	40	3	9.00	3.00	0	0	0	0	1
24	9000	3960	5040	0	180	33	2	11.00	2.00	0	0	0	0	1
25	7300	4234	3066	0	120	40	3	11.00	2.00	0	0	0	0	1
26	4000	3120	880	0	240	33	2	6.00	4.00	0	0	0	0	1

ID	Total income (LKR)	Income farm (LKR)	Income other productive activites (LKR)	Transfer income (LKR)	Time savings (minutes)	Dep. Ratio (%)	HH Members working age	Piped Water (m^3)	Land total (acres)	village1	village2	village3	village4	village5
27	30000	10200	19800	0	100	20	4	14.25	3.00	0	0	0	0	1
28	33800	15886	17914	0	150	33	2	12.25	2.00	0	0	0	0	1
29	15000	15000	0	0	90	67	1	11.00	2.00	0	0	1	0	0
30	20000	0	20000	0	90	33	2	7.50	1.09	0	0	1	0	0
31	10550	2110	8440	0	50	0	2	7.00	4.00	0	0	1	0	0
32	15000	4950	0	10050	100	0	7	3.33	5.50	0	0	1	0	0
33	21000	1050	19950	0	120	25	3	11.00	4.00	0	0	1	0	0
34	6000	0	6000	0	90	33	4	14.00	2.00	0	0	1	0	0
35	3860	3435	425	0	180	20	4	11.00	3.00	0	0	1	0	0
36	32000	0	0	32000	0	0	2	16.00	3.00	0	0	1	0	0
37	8000	4000	4000	0	120	13	7	6.00	4.00	0	0	1	0	0
38	15000	15000	0	0	120	50	3	7.25	5.50	0	0	1	0	0
39					60	25	3	11.00	2.00	0	0	1	0	0
40	40000	0	40000	0	120	60	2	14.00	2.00	0	0	1	0	0
41	4865	827	4038	0	15	0	1	5.00	1.00	0	0	1	0	0
42	11000	4950	6050	0	120	25	3	10.00	3.50	0	0	1	0	0
43	15000	15000	0	0	45	60	2	15.40	2.00	0	0	1	0	0
44	10000	10000	0	0	15	0	4	11.00	5.00	0	0	1	0	0
45	14000	9940	4060	0	225	0	3	6.25	4.00	0	0	1	0	0
46	10500	0	10500	0	60	33	2	0.00	3.00	0	0	1	0	0
47	5615	1011	4604	0	110	50	2	6.25	1.00	0	0	1	0	0
48	9000	0	9000	0	270	60	2	15.99	2.00	0	0	1	0	0
49	10000	7500	2500	0	60	50	3	7.50	2.00	0	0	1	0	0
50	6000	6000	0	0	150	33	2	6.00	3.50	0	0	1	0	0
51	7000	0	3010	3990	90	0	5	11.00	4.00	0	1	0	0	0
52					0	0	3	0.00	2.50	0	1	0	0	0
53	6900	0	6003	897	110	60	2	10.70	0.50	0	1	0	0	0

ID	Total income (LKR)	Income farm (LKR)	Income other productive activites (LKR)	Transfer income (LKR)	Time savings (minutes)	Dep. Ratio (%)	HH Members working age	Piped Water (m^3)	Land total (acres)	village1	village2	village3	village4	village5
54	5000	5000	0	0	60	40	3	11.00	5.00	0	1	0	0	0
55	45000	14850	5400	24750	150	0	4	12.50	0.75	0	1	0	0	0
56	35000	10150	4900	19950	20	33	2	5.99	0.25	0	1	0	0	0
57	20000	0	0	20000	0	60	2	6.00	0.25	0	1	0	0	0
58	20000	20000	0	0	60	50	2	11.00	1.17	0	1	0	0	0
59	25000	19000	6000	0	150	0	3	10.00	9.50	0	1	0	0	0
60	14350	0	14350	0	180	25	3	6.70	0.50	0	1	0	0	0
61	8415	0	8415	0	30	0	3	10.00	0.75	0	1	0	0	0
62	25000	0	25000	0	20	25	3	5.00	1.00	0	1	0	0	0
63	10728	215	9977	536	120	40	3	15.00	2.50	0	1	0	0	0
64					120	33	2	4.00	0.50	0	1	0	0	0
65					180	50	2	13.60	0.80	0	1	0	0	0
66	8960	90	8870	0	120	25	3	12.60	0.25	0	1	0	0	0
67	30000	30000	0	0	60	17	5	16.33	5.00	0	0	0	1	0
68	9500	0	9500	0	170	60	2	33.10	0.75	0	0	0	1	0
69	25000	0	25000	0	90	25	3	21.00	1.00	0	0	0	1	0
70	15000	7050	7950	0	90	50	2	21.00	1.00	0	0	0	1	0
71	15000	0	15000	0	15	50	2	16.00	0.30	0	0	0	1	0
72	45000	0	45000	0	90	33	2	21.00	0.50	0	0	0	1	0
73	25000	0	25000	0	50	0	2	21.00	0.25	0	0	0	1	0
74	9000	1980	7020	0	5	50	2	7.50	2.00	0	0	0	1	0
75	25000	0	0	25000	50	17	5	21.00	1.25	0	0	0	1	0
76	40000	34800	5200	0	120	20	4	21.00	1.25	0	0	0	1	0
77	8000	8000	0	0	120	0	4	19.63	4.00	0	0	0	1	0
78	11700	0	9945	1755	90	20	4	16.00	2.50	0	0	0	1	0
79	10000	10000	0	0	85	60	2	13.50	1.75	0	0	0	1	0
80	48000	10080	14880	23040	90	17	5	21.00	3.50	0	0	0	1	0

ID	Total income (LKR)	Income farm (LKR)	Income other productive activites (LKR)	Transfer income (LKR)	Time savings (minutes)	Dep. Ratio (%)	HH Members working age	Piped Water (m^3)	Land total (acres)	village1	village2	village3	village4	village5
81	33000	13860	19140	0	0	14	6	21.00	5.00	0	0	0	1	0
82	15000				15	17	5	21.00	2.50	0	0	0	1	0
83	14500	4060	10440	0	90	0	6	9.50	2.50	0	0	0	1	0
84	14400	13536	0	864	90	0	5	14.50	2.00	0	0	0	1	0
85	8300	8300	0	0	60	0	2	4.50	2.50	0	0	0	1	0
86	17000	6800	0	10200	90	0	2	16.00	2.00	0	0	0	1	0
87	10000	0	10000	0	90	33	2	14.50	0.25	0	0	0	1	0
88	18000	18000	0	0	75	0	2	9.50	1.50	0	0	0	1	0
89	39000	0	39000	0	120	33	6	0.00	3.50	0	0	0	1	0
90	5500	0	495	5005	30	0	2	0.00	0.75	0	0	0	1	0
91	27000	25110	1890	0	330	33	4	16.00	2.50	0	0	0	1	0
92	14600	4964	9636	0	450	0	4	16.33	1.50	0	0	0	1	0
93	20000	0	0	20000	330	0	3	14.50	0.25	0	0	0	1	0
94	25000	25000	0	0	330	0	3	21.00	5.25	0	0	0	1	0
95	18000	0	3060	14940	0	0	4	14.25	1.13	0	0	0	0	0
96	15000	0	15000	0	30	0	5	11.00	0.69	0	0	0	0	0
97	15000	0	15000	0	60	0	4	2.50	0.50	0	0	0	0	0
98	8000	0	8000	0	0	50	3	16.00	0.75	0	0	0	0	0
99	10900	0	10028	872	0	0	4	15.25	0.50	0	0	0	0	0
100	15000	15000	0	0	0	50	1	0.00	6.00	0	0	0	0	0
101	4000	4000	0	0		20	4	0.00	2.00	0	0	0	0	0
102	8000	0	8000	0	5	0	4	0.00	0.17	0	0	0	0	0
103	13700	0	13495	206	10	0	3	2.00	0.25	0	0	0	0	0
104	29600	0	29600	0		50	2	0.00	2.00	0	0	0	0	0
105	10400	520	8944	936	60	33	2	0.00	1.00	0	0	0	0	0
106	20000	0	20000	0	0	0	5	2.50	1.50	0	0	0	0	0
107	19000	0	19000	0	30	0	3	16.00	3.00	0	0	0	0	0

ID	Total income (LKR)	Income farm (LKR)	Income other productive activites (LKR)	Transfer income (LKR)	Time savings (minutes)	Dep. Ratio (%)	HH Members working age	Piped Water (m^3)	Land total (acres)	village1	village2	village3	village4	village5
108	50000	0	50000	0	60	36	7	24.00	3.00	0	0	0	0	0
109	33000	18150	14850	0	120	60	2	11.00	1.50	0	0	0	0	0
110	15000	1050	13950	0	120	50	2	9.33	0.50	0	0	0	0	0
111	10000	0	10000	0	0	25	3	11.25	0.25	0	0	0	0	0
112	47000	4700	42300	0		50	3	7.33	3.00	0	0	0	0	0
113	9000	0	9000	0	0	40	3	6.00	0.50	0	0	0	0	0
114	26000	0	26000	0	120	25	3	11.00	0.50	0	0	0	0	0
115	4000	0	4000	0	120	50	2	7.33	0.50	0	0	0	0	0
116	34000	14960	19040	0	240	60	2	11.00	2.6125	0	0	0	0	0
117	39000	7995	9945	21060	0	33	4	6.00	5.00	0	0	0	0	0
118	29000	15080	13920	0	60	40	3	11.00	1.75	0	0	0	0	0
119	30000	30000	0	0	10	50	2	19.17	3.00	0	0	0	0	0
120	30000	30000	0	0	0	33	2	16.00	1.50	0	0	0	0	0
121	15500	0	15500	0	60	14	6	11.25	1.00	0	0	0	0	0
122	50000	50000	0	0	90	60	2	11.25	2.50	0	0	0	0	0
123	25000	0	25000	0	120	33	2	13.75	3.00	0	0	0	0	0
124	20000	0	0	20000	120	0	1	5.00	2.50	0	0	0	0	0
125	14000	0	14000	0	60	25	3	11.25	2.00	0	0	0	0	0
126	12450	0	11952	498	150	20	4	16.00	1.50	0	0	0	0	0
127	25900	25123	0	777	180	50	2	11.00	1.50	0	0	0	0	0
128	7500	0	7500	0	120	25	3	6.00	0.50	0	0	0	0	0
129	7000	0	7000	0	0	50	2	8.33	0.25	0	0	0	0	0
130	25000	0	25000	0	90	33	2	8.33	0.19	0	0	0	0	0
131	8800	1496	7040	264	30	0	3	9.73	1.00	0	0	0	0	0
132	7000	0	7000	0	0	0	2	1.00	0.25	0	0	0	0	0
133	20000	20000	0	0		60	2	0.50	2.00	0	0	0	0	0
134	30000	0	30000	0		67	2	15.75	0.13	0	0	0	0	0

ID	Total income (LKR)	Income farm (LKR)	Income other productive activites (LKR)	Transfer income (LKR)	Time savings (minutes)	Dep. Ratio (%)	HH Members working age	Piped Water (m^3)	Land total (acres)	village1	village2	village3	village4	village5
135	44500	0	44055	445		0	5	0.00	0.50	0	0	0	0	0
136	56000	0	35840	20160	120	20	4	11.00	0.50	0	0	0	0	0
137	3400	2992	408	0	120	0	2	6.00	0.50	0	0	0	0	0
138	7120	6693	427	0	0	0	2	0.00	3.00	0	0	0	0	0
139	9700	9021	679	0	150	60	2	16.00	0.25	0	0	0	0	0
140	22000	0	22000	0	60	33	2	8.33	0.50	0	0	0	0	0
141	10500	0	10500	0	360	0	2	8.33	0.13	0	0	0	0	0
142	20000	0	20000	0	60	40	3	16.00	1.75	0	0	0	0	0
143	10420	10420	0	0	180	0	4	16.00	2.50	0	0	0	0	0
144	11000	3960	0	7040	15	0	2	16.00	2.00	0	0	0	0	0
145	11250	0	11250	0	150	50	3	11.25	0.25	0	0	0	0	0
146	7500	0	7500	0	10	0	3	0.00	0.75	0	0	0	0	0
147	100000	0	0	100000	0	50	2	16.00	0.25	0	0	0	0	0
148	100000	0	100000	0	0	0	4	25.99	0.25	0	0	0	0	0
149	9500	0	9500	0	150	33	2	11.25	1.00	0	0	0	0	0
150	9600	0	9600	0	0	0	2	12.50	1.00	0	0	0	0	0
151	20000	0	20000	0	0	50	2	0.00	0.10	0	0	0	0	0
152	25350	0	15464	9887	0	0	4	0.00	0.50	0	0	0	0	0
153	30000	0	30000	0	0	0	5	16.00	0.50	0	0	0	0	0
154	13915	0	13915	0		0	2	0.00	0.19	0	0	0	0	0
155	20000	0	20000	0	0	50	2	6.00	0.12	0	0	0	0	0
156	10500	0	10500	0		50	2	0.00	0.25	0	0	0	0	0
157	15360	0	15053	307		33	2	0.00	0.25	0	0	0	0	0
159	7000	0	7000	0	120	50	3	16.00	0.50	0	0	0	0	0
160	12000	2040	9960	0	150	0	2	0.00	0.25	0	0	0	0	0
161	36250	6163	30088	0	0	0	3	16.00	3.50	0	0	0	0	0
162	20500	0	20500	0	120	67	3	16.00	0.50	0	0	0	0	0

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163	30000	0	30000	0	150	0	5	11.25	1.00	0	0	0	0	0
164	36000	16200	19800	0	240	17	5	26.00	1.50	0	0	0	0	0
165	17450	0	14484	2967	120	0	4	11.25	1.00	0	0	0	0	0
166	15000	0	15000	0	60	33	4	13.75	0.50	0	0	0	0	0
167	8400	0	8400	0	240	33	2	8.33	0.50	0	0	0	0	0
168	18500	0	18500	0	120	0	2	11.25	0.16	0	0	0	0	0
169	25000	0	25000	0	60	50	2	16.00	2.00	0	0	0	0	0
170	20000	20000	0	0	15	50	3	16.00	0.50	0	0	0	0	0
171	15000	0	15000	0	120	14	6	11.25	0.07	0	0	0	0	0
172	15400	0	14938	462	90	33	2	16.00	0.25	0	0	0	0	0
173	18360	0	18360	0	60	14	6	0.00	1.00	0	0	0	0	0
174	18725	0	18725	0	240	50	2	11.25	4.00	0	0	0	0	0
175	15000	0	15000	0	240	50	2	8.33	0.18	0	0	0	0	0
176	25000	22500	2500	0	0	17	5	16.90	3.00	1	0	0	0	0
177	18000	0	18000	0	150	40	3	20.90	3.00	1	0	0	0	0
178	5000	0	5000	0	0	33	2	10.67	3.00	1	0	0	0	0
179	15900	0	15900	0	180	29	5	16.00	0.50	1	0	0	0	0
180	15500	0	15035	465	150	50	2	11.00	1.00	1	0	0	0	0
181	15000	15000	0	0	150	50	2	11.00	2.00	1	0	0	0	0
182	5350	0	5350	0	150	25	3	12.10	1.50	1	0	0	0	0
183	18000	0	18000	0	150	25	3	11.00	3.00	1	0	0	0	0
184	29400	294	29106	0	120	67	1	14.10	1.00	1	0	0	0	0
185	20000	0	20000	0	120	40	3	13.60	1.00	1	0	0	0	0
186	20000	0	20000	0	120	33	4	11.10	1.00	1	0	0	0	0
187	46000	13340	32660	0	150	20	4	16.00	1.00	1	0	0	0	0
188	10000	0	10000	0	240	25	3	13.60	1.00	1	0	0	0	0
189	25000	0	25000	0	150	60	2	11.10	2.00	1	0	0	0	0

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190	15000	0	15000	0	120	25	3	11.00	0.50	1	0	0	0	0
191	31000	1240	29760	0	0	17	5	37.33	1.50	1	0	0	0	0
192	20450	409	20041	0	60	25	6	15.00	1.00	1	0	0	0	0
193	5000	0	5000	0	60	50	2	9.73	0.25	1	0	0	0	0
194	10000	0	4000	6000	120	33	2	8.00	0.50	1	0	0	0	0
196	16000	4000	4000	8000	60	0	2	16.00	1.00	1	0	0	0	0
197	7000	4970	0	2030	60	20	4	16.00	2.00	1	0	0	0	0
198	15000	15000	0	0	60	50	2	8.10	3.00	1	0	0	0	0
199	15000	0	15000	0		40	3	0.00	0.50	1	0	0	0	0
200	7000	7000	0	0	0	0	3	0.00	3.00	1	0	0	0	0
201	20700	4347	0	16353	120	0	5	20.90	1.00	1	0	0	0	0
202	9000	0	0	9000	180	25	3	8.10	0.25	1	0	0	0	0
203	70000	20300	20300	29400	150	0	3	27.33	1.75	1	0	0	0	0
204	4000	0	4000	0	0	71	2	16.00	0.50	1	0	0	0	0
205	25000	25000	0	0	30	0	3	24.00	2.00	1	0	0	0	0
206	17500	0	7525	9975	120	0	2	11.10	0.16	1	0	0	0	0
207	24500	24010	0	490	120	0	4	8.10	3.00	1	0	0	0	0
208	30800	0	30800	0	120	0	2	4.80	2.75	1	0	0	0	0
209	35000	18000	17000	0	60	0	3	5.00	1.00	1	0	0	0	0
210	7500	0	7500	0	60	33	2	0.00	0.20	1	0	0	0	0
211	8950	537	7966	448	120	25	3	11.00	0.50	1	0	0	0	0
212	30000	0	30000	0	0	50	2	14.10	0.50	1	0	0	0	0
213	15000	0	15000	0	0	33	2	13.60	0.50	1	0	0	0	0
214	20000	4000	16000	0	180	50	2	13.60		1	0	0	0	0
215	18000	0	18000	0	240	60	2	11.00	0.25	1	0	0	0	0