A Performance Management Framework for Social Enterprises

The case of value chains for solar lighting kits in Sub-Saharan Africa

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ABSTRACT,

Low profitability and considerable risk often leave it to social enterprises to deliver valuable goods and services to the poorest populations in the world, the so-called Bottom of the Pyramid (BOP). The unique challenges of these markets combined with the low capacity of social enterprises limit the performance of these value chains.

This thesis specifically studies social enterprises operating value chains for small solar lighting kits (Pico-PV) in Sub-Saharan Africa. Research for performance improvement of these value chains only produced loose recommendation and KPIs. However, in such a format, this information has limited value for performance management purposes.

The aim of this study is to develop a Performance Management Framework (PMF) for social Pico-PV enterprises, enabling them to manage and improve their value chain performance.

We accomplished this by adapting the classical Balanced Scorecard (BSC) by Kaplan & Norton after selecting it from a shortlist of PMFs. In the adaptation process, the scorecard was filled with generic indicators and continuously reviewed and evaluated during five expert interviews. We found that a) strategically important social and environmental stakeholder groups are spread over the value chain and (b) they may all be of equal importance, thus may take a position as an 'end in themselves', as well as (c) the presence of conventional enterprises competing for the same customers. Consequently, a 'Vision Driver' sub-category was added next to the Performance Drivers described in the classical BSC. Eventually, a version of the framework was validated using a questionnaire answered by eight industry experts along with 22 generic KPIs.

The findings support the complementary value of the developed PMF as a management tool and show a strong need for better performance management, specifically in SMEs. Finally, we suggest to empirically test more harmonized sets of KPIs to move from a management to a measurement tool.

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Keywords

Pico-PV, Balanced Scorecard, Performance Management, Social Enterprises, Africa

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1. INTRODUCTION

Consumers at the so-called Bottom of the Pyramid (BOP) -the poor population in emerging economies- are often underserved. This is due to their low income, poor access to finance, remoteness, the low density of merchants, low profit margins, inefficient distribution channels and infrastructure, low liquidity of retailers, and a slow import process and fiscal barriers (Harrison, Scott, & Hogarth, 2016; Hirmer & Cruickshank, 2014). Purely economic supply and demand mechanisms often fail to move conventional producers to supply valuable goods to these potential consumers. Here it is often left to so-called social enterprises to meet this excess demand. A social enterprise: *„delivers a service that is new to recipients without necessarily being motivated by profit; the novelty here is the fact that a community now has access to a service otherwise commonly provided to less excluded groups"* (Cunha, Benneworth, & Oliveira, 2010 p. 617). These social enterprises are formed by the idealistic and social vision of their founders. Generally, such overarching purposes and objectives are referred to as the Vision & Mission of an enterprise (Ferreira & Otley, 2009). Nevertheless, social enterprises are not charities. They realize that to reach as many customers as possible, simply handing out free products is not a sustainable solution (Zahra, Gedajlovic, Neubaum, & Shulman, 2009). At the BOP, these firms need to operate profitable, while at the same time keep their products and services affordable to those that need it the most. In our analysis, we find that for social enterprises to make a lasting impact, their operations need to be extraordinarily efficient, smart, and subject to constant innovation. Only this will enable social enterprises to live up to their own Vision & Mission in the uniquely challenging environments at the Bottom of the Pyramid.

In this thesis, we develop a Performance Management Framework (PMF) for social enterprises operating at the Bottom of the Pyramid. Specifically, we work in the context of social enterprises distributing small solar powered lighting kits (Pico-PV) in Sub-Saharan Africa.
The study is organized as follows. In section 2, we introduce the value and challenges of Pico-PV. Then, we review related work on the performance of these value chains and identify the need for a PMF in section 3, followed by the research design in section 4. After this, we begin by reviewing PMFs for value chains and subsequently choose the Balanced Scorecard (BSC) by Kaplan & Norton (1992) in section 5. In section 6, we adapt the BSC to the context of Pico-PV enterprises. Afterwards, we introduce 22 generic Key Performance Indicators (KPIs) and integrate them into a practical benchmarking tool for practitioners. In section 7, we combine our findings on the practical relevance of the developed PMF and validate it along with the generic KPIs in the light of its limitations. We conclude by rehearsing this studies contribution and recommend further research in section 8. Section 9, 10 and 11 contain acknowledgements, references and appendices, respectively.

2. A FIRST STEP IN THE ENERGY LADDER - PICO-PV IN SUB-SAHARAN AFRICA

In this section, we introduce the reader to the context of this study. In subsection 2.1, we introduce the challenge of energy poverty in Sub-Saharan Africa. Section 2.2 explains the potential value of Pico-PV products for rural populations. Finally, 2.3 lays out the role of social enterprises in Pico-PV value chains.

2.1 Energy Poverty in Africa

In Africa, nearly 70% of the population has no access to grid electricity (Sándor Szabó, Moner-Girona, Kougias, Bailis, & Bódis, 2016). In rural Sub-Saharan Africa, less than 15% are electrified which makes it the most energy-poor region in the world (Pauser, Fuente, & Djerma, 2015). From a macro perspective, these conditions have an enormous impact on the productivity of these economies. On an individual's level, a lack of electricity affects the physical, social and economic wellbeing. Cooking without electricity or gas involves charcoal and other biofuels, and lighting is usually done using kerosene lanterns or candles (Lighting Africa, 2010). This leads to respiratory diseases caused by poor air quality and a lack of modern lighting further limits productive activities to daylight hours (Esper, Heather; London, Ted; and Kanchwala, 2013). In these rural households, the costs of primitive sources of energy also make a huge part of the household budget (Barron & Torero, 2015). Finally, most biofuels for cooking as well as kerosene or dry-cell battery-powered lighting have negative effects on the environment either through the release of CO2 or by polluting the local environment (Grimm, Munyehirwe, Peters, & Sievert, 2016; van Vuuren et al., 2015).

2.2 The potential contribution of Pico-PV

The pace of electrification is extremely slow as the extension of grids to these rural areas is too expensive (S Szabó, Bódis, Huld, & Moner-Girona, 2011). However, in the last decades, decentralized energy systems were becoming more realistic and affordable (Urmee, Harries, & Holtorf, 2016). Especially with the cost of solar falling year-by-year, innovative solutions were developed to help electrify rural populations. A decade ago, Pico-Photovoltage (Pico-PV) has been proposed as a first step on the energy ladder in an effort to leapfrog rural electrification (Grimm, Munyehirwe, Peters, & Sievert, 2016). These kits are small solar-powered lighting systems, which may also be used to charge basic appliances such as mobile phones or radios (see Figure 1).

Figure 1.A sales agent (left) selling Pico-PV products in rural Tanzania (By Author)

Pico-PV products substitute kerosene lanterns and candles as well as dry cell battery powered torches. This leads to better indoor air quality and reduces respiratory diseases. Quality Pico-PV lights are many times brighter than conventional off-grid lighting and enable productive activities at night, such as studying or cooking. In addition, once the initial investment is made, the need for repeated purchase of components disappears. Hence, part of the household budget is freed for other investments.
Further, sales agents are employed to distribute the solar lights in rural areas. For many agents, this is an additional and more reliable form of employment.
Some also reference the impact on the environment through the substitution of fossil fuels and dry cell batteries.

Pauser, Fuente, & Djerma (2015) link Pico-PV explicitly with the United Nations Sustainable Development Goals 7,8,12 and 13. These goals can also be translated into the triple bottom line (TBL) of social, economic, environmental impact (see Table 1). The Triple Bottom Line is a common concept to descibe sustainability in management literature.

Social
SDG 07: Ensure access to affordable, reliable, sustainable, and modern energy for all
Economic (and Social)
SDG 08: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
Environmental
SDG 12: Ensure sustainable consumption and production patterns
SDG 13: Take urgent action to combat climate change and its impacts

Table 1. Rural Electrification, SDGs and TBL

Nevertheless, bringing these products to the rural population is difficult due to the challenges of BOP markets. This leads to a situation where, despite the huge market size of 621 million un-electrified in African alone, still so few households have access to otherwise affordable modern, clean and safe energy.

2.3 The role of social enterprises in African Pico-PV value chains

According to Feller, Shunk, & Callarman (2006) 'Value chain management' is a strategic perspective on the supply chain that revolves around competitively meeting customer demands. In the case of social Pico-PV enterprises, there are multiple customers. More specifically, there are multiple distinct stakeholders that are central to the firms Vision & Mission. We identified the un-electrified rural population in Sub-Saharan Africa as most prominent of these stakeholders. Also the local entrepreneurs that make an income by distributing solar lights are central to the firms Mission (Bensch, Jersch, Kluve, & Stöterau, 2016). In addition, the local and global environment can be identified as 'stakeholder' as CO2 reduction and responsible consumption and waste reduction is also core to the objectives of Pico-PV overall (Pauser et al., 2015).

Figure 2 was adapted from the value chain model of Porter (1985). Porters' model provides a helpful framework to illustrate the value chain of social Pico-PV enterprises in Sub-Saharan Africa (Schuurman, 2014). Recalling the definition of a social enterprise, a social Pico-PV enterprise must be directly or indirectly involved in the distribution of Pico-Solar products to the Bottom of Pyramid. This may be done by directly employing sales agents or by supporting local entrepreneurs and retail partners (Bensch et al., 2016; IFC, 2012; Lighting Africa, 2010). In other words, a true social enterprise cannot - at the same time- be a pure wholesaler. We argue that a social Pico-PV enterprise must share part of the costs, efforts, and risks involved in going the last mile to the un-electrified consumer.
Pico-PV enterprises can be independent startups[1], but also emerge from existing firms[2]. These intrapreneurs are called 'brand builders' (IFC, 2012). Both exist in the form of national or international ventures. They may also take the form of hybrid NGOs[3] or for-profit social enterprises.

Most social enterprises design their own products. However, the production itself is often outsourced to an overseas manufacturer, most commonly in China or India. These products are then imported and distributed in the country of destination. As mentioned, this may be done via sales agents, but also independent entrepreneurs or partner organizations. The products are then sold to consumers through special financing schemes. Most enable customers to pay off the lamps in installments[4] or even rent products through so-called pay-as-you-go (PayG) systems[5].

3. RELATED WORK

Literature on value chains serving the so-called "Bottom of the Pyramid" produced recommendations for how they could be improved (Silvestre, 2015). Until now, few academic studies explicitly dealt with the value chains of Pico-PV products (e.g. Grimm et al., 2016; Hirmer & Cruickshank, 2014; Schuurman, 2014). Complementary to this exists a pool of literature published by industry institutions such as Lighting Africa[6],

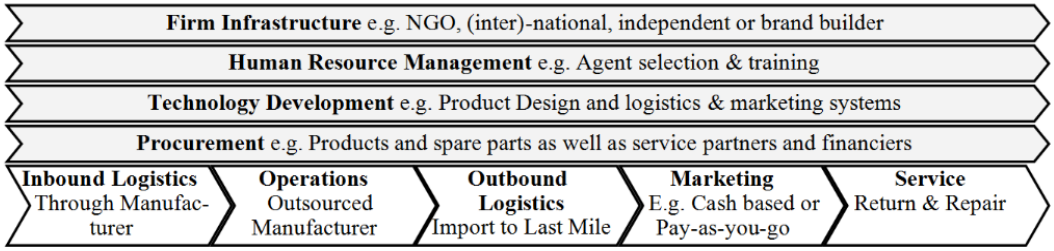

Figure 2. Typical Value Chain of a social Pico-PV enterprise in Sub Saharan Africa

1 For example, Green Light Planet

2 For example, Philips

3 An NGO or not for profit that aims to be somewhat financially sustainable

4 The first firm interviewed gives out lamps on credit so that customers can pay off the product using the money they safe on kerosene in the credit period.

5 This PrePaid system is most common for larger Solar Home Systems. However, it is also emerging in smaller Pico-PV products due to the rising competition from cheaper low-quality products. Customer pay via Mobile Payment systems such as MPesa and the product can be turn off remotely if payments are not made. They do not own the product and only pay when they use it, hence Pay-as-you-go.

6 Lighting Africa is an industry support body founded by the World Bank Group

GOGLA [7], Hystra [8], and Pico-PV organizations such as SolarAid [9]. We also find studies conducted by research institutions such as GIZ/GTZ[10] or SNV[11].

It is agreed that if implemented well, Pico-PV can make a huge contribution to the sustainable development in Africa (GTZ EnDev, 2010). However, studies also stress that, in emerging economies, poorly implemented projects and value chains can create more harm than good. If the executing organization is performing low, projects and ventures may materialize as inappropriate, ineffective or even counterproductive (Bernard, 2012; Ikejemba, Mpuan, Schuur, & Van Hillegersberg, 2017; Swidler & Watkins, 2009). Even if the diffusion or implementation itself is successful, findings suggest that there is no guarantee that effects will be sustainable (Ikejemba, Schuur, Van Hillegersberg, & Mpuan, 2017). In the context of Pico-PV, Hirmer & Guthrie (2016) found that many operations are based on insufficient market research and neglect local needs and desires. Bensch et al. (2016) found a ambiguous impact on the employment and income of solar entrepreneurs. Furukawa (2014) even found negative impacts on students' grades when compared to conventional lighting conditions. Their hypothesis is that the low quality of lights leads to flickering which caused lower test scores.

For a social Pico-PV enterprise to accomplish the goals connected to their Vision & Mission, i.e. the contribution to the SDGs associated with Pico-PV, they must sustain growth and maintain the quality of their products and services while facing the challenges of the BOP (see Figure 3). The demands proper performance management and eventually measurement.

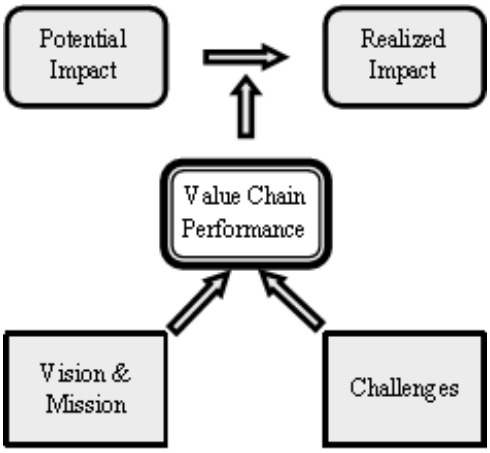

Figure 3. Contextual Framework of this Thesis

To manage and measure performance, it is important to identify the factors lead to the desired outcomes. Such factors are also known as Key Performance Indicators (KPIs). Further, these KPIs need be systematically managed. Remarkably, current research never went beyond loose recommendation and indicators which cannot be used for management purposes in this format (Figge, Hahn, Schaltegger, & Wagner, 2002).

The goal and contribution of this thesis is to create a performance management framework (PMF), which social Pico-PV enterprises may use to manage and improve their impact.

Subsequently, the main question to guide this research is: "*What is an appropriate performance management framework (PMF) for social Pico-PV enterprises operating value chains in Sub-Saharan Africa?*"

4. METHODOLOGY

In order to develop a valuable framework, we must validate the practical value and relevance of the PMF as well as of the selected KPIs. Straub (1989) suggests that validity can be assessed by using divergent sources of data and comparing the outcomes, also referred to a triangulation. Triangulation is also approved by Creswell & Miller (2000) as qualitative validation approach. We want to achieve triangulation through a combination of distinct methodologies. In subsection 4.1 and 4.2, we review relevant qualitative and quantitative validation strategies and then introduce the adapted research design in 4.3.

4.1 Qualitative Validation

Morse, Barrett, Mayan, Olson, & Spiers (2002) developed validation strategies for qualitative research. They propose five essential components of a research design. First, *methodological coherence*: *"qualitative research is iterative rather than linear, so that a good qualitative researcher moves back and forth between design and implementation to ensure congruence among question formulation, literature, recruitment, data collection strategies, and analysis* (p.17)". A second criterion mentioned by Morse et. Al (2002) is *collecting and analyzing data concurrently.* They identify the importance of "*mutual interaction between what is known and what one needs to know "as "essence of attaining reliability and validity*" (p.18). Another component highlighted is an *appropriate sample*. For the validation of a Management Information System, Straub (1989) suggests that panel discussions with experts in the field can be used to verify an instrument. Grant & Davis (1997) emphasize "*the necessity of relevant training, experience, and qualifications of content experts. A history of publications in refereed journals, national presentations, and research on the phenomenon of interest may be used as one criterion in selecting content experts*" (p. 270). The last two aspects of qualitative validation mentioned by Morse et al. (2002) are *thinking theoretically & theory building.* The former stresses the careful checking and rechecking to avoid building on ill-founded assumptions. The latter incorporates two mechanisms. The first mechanism states that the product must be an end of the research progress, and not a means to guide the analysis. The second mechanism states that the developed framework needs to be useful as a template for further development. The successful implementation of these mechanisms is further elaborated in the last section.

4.2 Quantitative Validity

In the context of framework validation, much of the literature reviewed on quantitative validation was found in the context of clinical questionnaires. Here validation of an instrument can be achieved by distributing a questionnaire to a minimum of content experts (Yaghmale, 2003). In our context, we assume that the validation of survey items is transferable to KPIs. According to Grant and Davis (1997), items in a validation instrument should test for *representativeness* and *clarity* of framework components, as well as the *comprehensiveness* of the framework as a whole.

Grant & Davis (1997) suggest that testing inter-rater agreement (IR) is important to ensure the reliability of results. IR

7 The Global Off Grid Lighting Association produces market reports for the off-grid lighting industry

8 Hystra is a consultancy group focused on marketing at the BOP

9 SolarAid is a Hybrid NGO that produces annual impact reports

10 German Development Agency

11 Dutch Development Agency

represents the number of agreements between experts, divided by the total number of ratings. IR should not be below 0.7.

4.3 Adopted Research Design

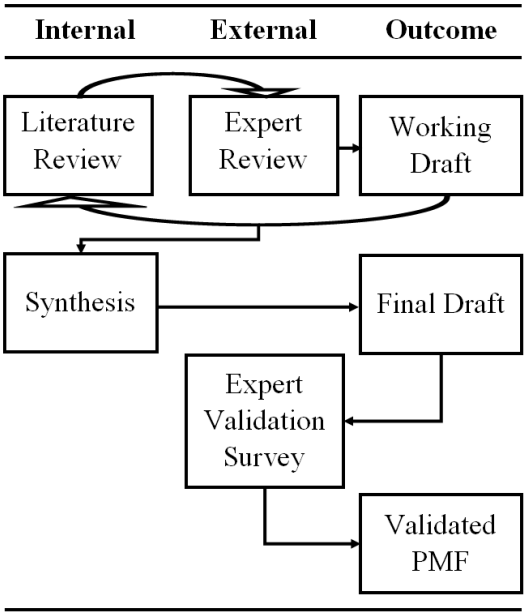

Figure 4. Research Design

In the first step to establishing the PMF for social Pico-PV enterprises, we reviewed literature on Performance Management Frameworks for value chains. A shortlist of three PMFs was compiled and compared. After identifying and adopting a suitable PMF, we developed the first set of generic KPIs using desk research. This draft was evaluated together with an industry expert. The input from the interview as well as continued desk research was used to create an improved draft, which was in turn reviewed by another expert. This process was repeated with five experts (see Table 2).

Expert/ Date	Position/ Organisation
Expert 1 (31.05.17)	Founder Small Pico-PV Startup*
Expert 2 (Skype) (05.06.17)	Subsidy Fund Manager East Africa Development Agency
Expert 3 (Skype) (07.06.17)	Senior Policy Advisor for BOP World Bank Program for Solar
Expert 4 (Skype) (08.06.17)	Business & Sales Director for Africa Medium Pico-PV Startup*
Expert 5 (Skype) (09.06.17)	Senior Data Scientist Leading Pico PV Enterprise*

*Lighting Africa Associate12

Table 2. Expert Interviews

The findings were cross-checked in literature and by experts. If facts were mentioned in one source, we consulted other sources to complement the findings or to gather more detailed data. Exploring the findings in literature together with experts granted a more relevant and realistic picture. Expert quality was granted by focusing on experts that were affiliated with social Pico-PV enterprises in Africa and who occupied a relevant and senior position. Shortly after the last interview, a version of the PMF along with the developed KPIs was sent to the interviewees as well as other experts for validation via a questionnaire. Next to items for KPI validation, the instrument also contained items about the need for performance improvement and the practical value of the developed PMF.

Using this research design, we fulfill the conditions for triangulation by combining qualitative and quantitative methodologies as well as primary and secondary data sources.

5. EXPLORING PERFORMANCE MANAGEMENT IN VALUE CHAINS

In this section, we explore literature to create a foundation for our new PMFs. In subsection 5.1, we first make a shortlist of existing PMFs followed by a justified choice for the Balanced Scorecard. In subsection 5.2 we then describe the classical BSC in greater detail and explore its adaptations in the context of social and sustainable management. We eventually conclude that for the context of social Pico-PV enterprises, the existing variations of the BSC are not sufficient.

5.1 Performance Management Frameworks for value chains

In this subsection, we explore what Performance Management Frameworks exist for value chains and identify which is most suitable for social Pico-PV enterprises.

Such a framework needs to fulfill certain criteria. At first, it should be well validated and established. To us, important indicators of such qualities are the journal in which it was published and the utilization by other scholars. Further, it must be compatible with non-economic objectives. For this we reviewed if, and how, a framework has been adopted in comparable contexts, i.e. sustainability and social enterprises. For guidance, literature surveys on Performance Management Systems (Ferreira & Otley, 2009) Supply Chain Management (Estampe, Lamouri, Paris, & Brahim-Djelloul, 2013) and Social Enterprises performance (Chmelik, Musteen, & Ahsan, 2016) were consulted. Accumulated from the above literature surveys, a total of 24 frameworks were identified. Three PMFs were shortlisted for a more thorough evaluation: The Balanced Scorecard (BSC) by Kaplan & Norton, the Supply Chain Operation Reference Model (SCOR) by the Supply Chain Council and the Excellence Model by the European Foundation for Quality Management (EFQM). Relative to the other frameworks, these seemed most established and practical.

Balanced Scorecard. The BSC was introduced by Harvard's' Kaplan & Norton in 1992 and quickly found its way into standard management textbooks. In the original framework, it compares the *financial-*, *customer-*, *internal business processes-* and *learning & growth perspectives*. It sets the *Vision & Mission* in the center of a firm's strategy. Revolving around this, the BSC maps the causal relationship among the perspectives and the firm's objectives.

SCOR. Established by the Supply Chain Council in 1996, the Supply Chain Operation Reference Model is the standard diagnostics tool for many supply chain professionals. It looks at the general supply chain components; *source, make, deliver and return*, with an overarching planning dimension. Performance is evaluated for reliability, responsiveness, flexibility, costs and asset turnover. It is a collection of best practices from various experts and frequently updated.

EFQM Excellence Model. Also developed in the early 90s, it is a benchmark used by many industry leaders in Europe and beyond. This model looks at five different enabling factors: *Leadership*, *People*, *Strategy*, *Partnerships & Resources* and

12 Lighting Africa Associate. Actors in the lighting industry can earn a certificate from the Lighting Africa Program if they comply to their standards. In June 2017, 52 organizations were listed that designed, manufactured and/or distributed Pico-PV products

Process, *Products & Services*. These are linked to performance indicator – or results – of *People*, *Customer*, *Society*, and ultimately, *Business Results*.

The main reason for choosing the BSC over SCOR and EFQM is that the latter demand a higher degree of sophistication as well as a larger number -over 50- of performance indicators. To us, creating such a high tier catalog of indicators for Pico-PV was neither realistic nor valuable. For strategic management purposes as it does not focus on KPI only. The BSC is a strategic management tool and relatively simple and intuitive. This is important as especially smaller social Pico-PV enterprises often do not have the capacity for advanced performance management (Expert 1-5). The Balanced Scorecard has also been picked up and remodeled by a range of scholars for the use in social enterprises, non-profits, public sector, and sustainability. According to Chmelik et al. (2016), the BSC "*can be easily transferred to social ventures whether purely social, socio- economic, or economic* (p. 80)". Due to the wide range of usage of the BSC, we cannot only draw from these adaptations but also from their development methodologies. Overall, we argue that the BSCs' applicability to non-conventional enterprises also stems from its focus on the firms Vision & Mission, which can always be independent of the economic bottom line.

5.2 The classical BSC and its adaptations in social and sustainable management

The Balanced Scorecard in its original form contains four perspectives which components are interlinked through causal relationships, with the firms Vision & Mission at the center (see Kaplan & Norton, 1992). The strategic importance of the perspectives is depicted in a 'Strategy Map' (Kaplan & Norton, 2000).

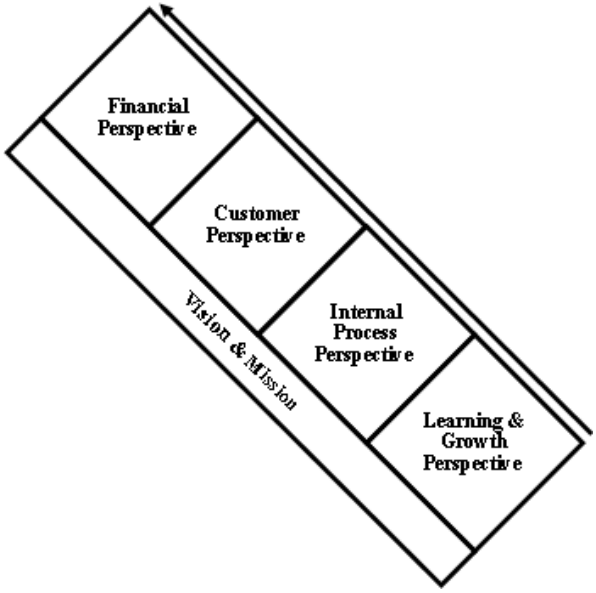

Figure 5. Classical order in a Strategy Map

In the classical model for conventional enterprises, the *Financial Perspective* takes the ultimate position (see Figure 5). Here we find traditional financial performance measures that make the economic bottom line. Nevertheless, these indicators are also important to any social enterprise that seeks to grow in a sustainable and organic manner (Zahra et al., 2009).

However, when establishing the BSC, Kaplan & Norton wanted to expand the firm's strategic scope beyond these short-term oriented metrics. As a result, they introduced three additional perspectives: The *customer perspective* contains what is important to the customer and how they see one's products, services, and business; The *Internal process perspective* concern the systems through which the customer's desires are met; and the *Learning & Growth perspective*, in which the firm reviews what it needs to survive and grow in the other three dimensions.
Connected to each perspective are three distinct categories of metrics. At first, the strategic core issues are the g*oals* and *objectives* that correspond to the firms' Vision & Mission. Secondly, the *Performance Drivers* are the most important *means* to achieve these goals; these can be described as the *KPI*. Lastly, there are *hygienic factors*; these indicators are necessary and need to be satisfied in order to be competitive. The latter are usually excluded from the BSC as they do not provide any competitive advantage (Figge et al., 2002).

Chmelik et al., (2016) reviewed performance measurement in international social enterprises and referred to a BSC adaptation by Bull (2007). To bring the BSC into the context of social enterprises, Bull drastically changed the perspectives and their fundamental principles. For example, Bull converted the financial perspective into a 'multi-bottom line' including economic, social and environmental metrics. Further, Bull changes the customers perspective into a 'stakeholder environment'.
When critically reviewing this approach, we must conclude that it is not feasible. We argue that by integrating all bottom lines in a single perspective, the possibility to map out causal relationships between them is corrupted. Especially objectives connected to consumers cannot be logically integrated with financial objectives. Further, integrating all stakeholders connected to the firms Vision & Mission into a single perspective is not feasible either. This is becasue, taking the example of Pico-PV, the demands of each must be met on various levels in the Strategy Map. For example, consumer needs are met in the Customer Perspective, while the employee satisfaction is typically part of Learning and Growth (Kaplan & Norton, 2005). Further, environmental protection may take place in the Internal Process Perspective.
We want to make clear that employees and even the environment may be strategically relevant stakeholders in conventional enterprises as well. The difference is that these stakeholder groups are equally, and sometimes even more important than shareholders in social enterprises.

Kaplan (2001) also reexamined his original framework for the use in the non-profit sector. The author argued that the four original perspectives were perfectly compatible with this context. According to the Kaplan, by changing the geography of the Strategy Map, one could move i.e. the customer perspective above the financial perspective. This would correspond to converting the financial perspective from an 'end' into a 'means' for customer satisfaction. However, the criticism here is similar. While this approach preserves the integrity of the cause-effect relationships, changing the geography of the perspectives is not sufficient if more than one Vision & Mission related stakeholder group exists in multiple perspectives.

Another well-established and well-cited[13] adaptation of the BSC in the context of conventional enterprises is the Sustainability Balanced Scorecard (SBSC) by Figge et al.

13 287 citations on Wiley InterScience and Journal H5-index of 38 (median 62) according to google scholar (June 2017)

(2002). They adapted the BSC for performance management along the triple bottom line. In line with Kaplan (2001), Figge et al. (2002) argue that, in theory, any social or environmental issues could be integrated into the classical dimensions. However, they proposed to add a non-market perspective for businesses that fulfill two conditions: *"(i) environmental and social aspects have to be strategically relevant, i.e. they are either strategic core aspects or performance drivers and (ii) it is not possible to include these aspects appropriately, i.e. according to their strategic relevance, into the four conventional perspectives of the BSC"* (Figge et al., 2002 p.276). This new perspective takes a parallel position in the strategic map and incorporates strategic non-economic objectives. They give the example of 'avoiding child labor' as non-market objective, which in their example corresponds with a 'good image', which leads to 'customer satisfaction' and ultimately an increased 'market share'. (Figge, Hahn, Schaltegger, & Wagner, 2002a p.282). This approach may be applicable to conventional enterprises. However, recalling the definition of a social enterprise, we need to reject it in our context. To extract non-economic objectives in this manner is disregarding their importance to the Vision & Mission of the social enterprises. One could argue that KPIs in the non-market perspective are comparable to hygiene factors, i.e. to achieve customer satisfaction.

Concluding, the BSC is ideal as a basis for the adaptation, particularly due to its Vision & Mission centered approach. However, the various adaptations and modulations of the BSC only partly meet the demands for application in our context. It is neither feasible to change the existing perspectives, nor to extract social and environmental objectives into an extra perspective. At least for Pico-PV, it is also not possible to simply change the geography of the perspectives either. Therefore, we use our findings and further literature to adapt the BSC to the context of social Pico-PV enterprises in the next section.

6. ESTABLISHING A PERFORMANCE MANAGEMENT FRAMEWORK FOR SOCIAL PICO-PV ENTERPRISES

This section is organized as follows. In 6.1, we adapt the BSC to the Pico-PV context by adding a 'Vision Driver'. In 6.2 we develop a set of 22 generic KPIs for the Pico-PV industry. Finally, in 6.3, we introduce a benchmarking tool integrating the 22 KPI as a practical modulation of the new BSC for social Pico-PV enterprises.

6.1 Adapting the Balanced Scorecard to the context of Social Pico-PV Enterprises

Summarizing the findings of the former sections on social Pico-PV enterprises we conclude; (a) strategically important social and environmental stakeholder groups are spread over the value chain and (b) they may all be of equal importance, thus may take a position as an 'end in themselves' in the Strategy Map. At first, this is a dilemma since only one perspective should take the position as an ultimate end in the Strategy Map.

A third characteristic we found in interviews and further literature review is, to our knowledge, particularly unique to the Pico-PV industry. Manufacturers from China have begun to enter the market with generic products that do not provide the same quality and safety. However, these products are much more affordable, giving them a huge competitive advantage due to the financial constraints of consumers at the BOP. *"You can go to really remote parts of Africa and see that the generics are already there"* (Expert 3). Thus, there exists a uniquely challenging situation in which social enterprises are in competition with conventional enterprises. In addition, these products, as they break quickly, negatively affect the trust of consumers in Pico-PV. This also thaws the diffusion and acceptance of quality Pico-PV products and challenges performance on all bottom lines, especially profit. However, a *"race to the bottom"* in price and quality, as Expert 2 reported, is not an option.

Synergizing the findings, we decided to introduce the category *Vision Drivers* as a subcategory of *Performance Drivers* (see Figure 6). KPI in this category represent the core challenges of the enterprise. Firstly, they are unique to the social enterprises

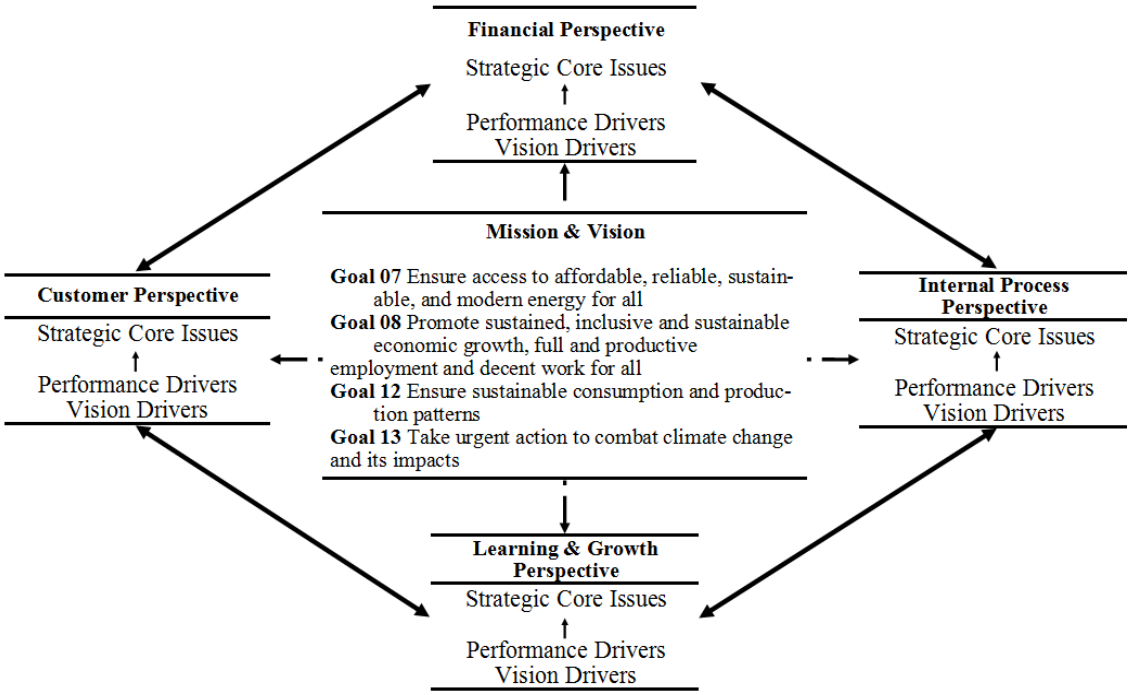

Figure 6. A Balanced Score Card for social enterprises in the African Pico-PV industry

as conventional business models do not take into account the social and environmental bottom lines. Secondly, they demand expenditures that do not occur to conventional enterprises. Vision Drivers furtehr play a double role. On the one hand they are, similar to *Performance Drivers*, indicators for *Strategic Core Issues*. On the other hand, they represent also a strategic goal, thus 'ends in themselves' as they are directly linked to one of the Mission & Vision related stakeholder groups. Hence the Vision Drivers may also be a mechanism to monitor performance for stakeholder groups other than consumers or shareholders. It funsitons as an ituitive mechanism for managers to focus on certain indicators and maybe even weigh their importqance accordingly.

Overall, the Strategy Map of the classical BSC is kept intact. As mentioned in the introduction, social enterprises define themselves as not being a charity. Their goal is to be profitable and to ultimately grow organically without the need for subsidies. Thus, we argue that the causal flow ending in the financial perspective is most feasible from a managerial point of view. This perspective was also most practical during the expert interviews. However, for e.g. Hybrid NGOs, the consumer perspective may be more logical on top. Nevertheless, while the enterprise model between them is different, the underlying Vision & Mission remains largely the same. In these case of a social Pico-PV enterprise, these may be summarized by the United Nations Sustainable Development Goals 7, 8, 12 & 13. Not all actors agreed on these SDG as being core to their Mission. Nevertheless, combining the findings from literature and the reports across experts, we conclude that these make the overall Mission & Vision of the Pico-PV industry. Thus ideally, a social enterprise should strive to account for all of these goals.

6.2 Towards a Performance Benchmark for social Pico-PV enterprises

In this section we introduce a potential performance measurement tool for social Pico-PV enterprises based on the PMF established in the former section. At first, we explain the KPI selection process in 6.1. In 6.2 we introduce the components of the four perspectives including the KPI, including a total of 22 KPIs. In 6.3, a practical modulation for performance benchmarking is explained A detailed overview of the individual Strategic Core Issues, Performance Drivers and Vision Drivers can be found in the Appendix as well as an illustration of the potential PMF modulation.

6.2.1 KPI selection process

In the next subsection, we develop the set of KPI for each of the four perspectives. This section we describe the selection process for these KPI.

A first step to developing KPIs is to decide what needs to be measured. This corresponds with the *strategic core issue* in the BSC. In the context of cause and effect relationships, strategic core issues may be compared to latent variables. This means that we cannot directly observe the state of these variable and have to measure them through indicator variables (Veaux et al., 2012). These Key Performance Indicators are contained in the *Performance Drivers* category. To make them reliably measurable, these indicators should be as objective as possible and ideally quantitative (PWC, 2007). Especially for social enterprises, we include *Vision Drivers* as a subcategory of Performance Drivers. KPIs in this category (a) are directly linked one of the stakeholder groups other than consumers or shareholders or (b) are especially challenging to achieve as they represent costs which conventional competition does not occur. These KPIs represent the core challenges of social enterprises in the African Pico-PV industry. In the philosophy of the BSC, this selection of KPI should follow the Pareto principle (Hubbard, 2009 p.186). Translating the law of Pareto to the context of BSC, it states that by selecting 20% of most relevant indicators from a larger pool of relevant indicators, the set of KPIs will explain 80% of performance. For the BSC, a range of 17 to 25 KPI is recommended (Kaplan & Norton, 1996).

All Strategic Core issues and KPIs in this study were selected based on (a) being explicitly mentioned by experts or Pico-PV related literature, or (b) being a standard KPI measures of the given strategic core issue. An example would be Return on Assets (ROA), which is not explicitly mentioned by the experts but which is a basic measure of efficiency. Efficiency in turn was a strategic core issue to experts and in literature.

6.2.2 Financial Perspective

Strategic Core issues. The fist strategic core issue (SCI) is *Sustainable Organic Growth*. When the industry emerged over a decade ago, angel investors and philanthropists supported the first entrepreneurs. Especially in the early stages, external capital was needed to push products down the supply chains. With marketing strategies being largely experimental, "*companies have a high cash burn and little to no revenues"* (Bardouille, 2012 p.70). With growing proof-of-concept and the establishment of support organization such as Lighting Global, the industry became more professional. In one of the largest independent distributors 'd.light', the founders were moved aside from the executive tasks and replaced by management professionals: *"It has changed a lot in these 10 years. Anybody who wants to survive in this business needs to start doing these things"* (Expert 4).
The second SCI is *Finance Worthiness.* Subsidies are still needed in many markets to reach out to the most rural populations and compete with cheap knockoffs. This is possible because cash-poor rural merchants and shopkeepers will always purchase the cheapest product when they look for supplies at the ports and wholesalers. However, the program manager of a large development agency managing subsidies in east Africa explained that they are only providing performance based financing.

Performance Drivers. Four KPIs were chosen for this perspective. The *EBITDA Margin* as a metric for basic profitability and the ability to generate cash from operation (Ross, Westerfield, & Jaffe, 2013 p.51), also recommended by GOGLA and Expert 3. The second metric is a very common metric for efficiency; *Return on Assets* (ROA). It basically tells us how much money we generate out of our assets. Again, here we suggest EBITDA as a reference point.
A further important KPI for enterprises in Africa is curency Risk, with the most common measure being the *FX Exposure* (GOGLA, 2017). The representative of the medium enterprise reported*: "We did a lot for a long time and then the country lost all its capital. There was no currency in the country"* (Expert 4).

Vision Drivers. As Vision Driver, we identified the balance in which subsidies and Profit are, hence *subsidies to operating expenses.* One experts' former employer -an NGO- ended up being unsuccessful as they were not professional enough. *"No amount of aid can solve this problem*" (Expert 4). Subsidies are (a) unique to these enterprises and (b) hard to overcome in the face of generics squeezing profit margins. Being able to sustain operations once subsidies dry up is important for all stakeholders, not only stakeholders and investors. At first, there is a responsibility towards the firm's employees. Secondly, the warranty and reverse logistics are important to reduce financial risk for consumers.

6.2.3 Customer Perspective

Strategic Core Issues. The core issues found in this study could be well represented by an BOP analogy to the 4Ps' of marketing , the 4As' (Shah & Desai, 2013). *Availability;* The Product needs to be available where it is really needed and where it can create the most value. A*ffordability*; those in need should be able to finance the product. A further factor that seemingly often neglected is the *Acceptability*; Sometimes consumers at the BOP have specific needs & wants (Hirmer & Guthrie, 2016). Finally, *awareness;* customers also need to be aware of and understand your value proposition.

Performance Drivers. Hard to quantify, but essential, is the *design and functionality* of a product. For example, in some regions certain colors or shapes might be inappropriate (GTZ EnDev, 2010). Also features such as USB charging or a Radio feature might be perceived with variable value across regions (ibid). Most importantly, the brightness of the product is important for consumer satisfaction (Expert 1). Research shows that brightness correlates with attention span as well as productivity (Cajochen, Zeitzer, Czeisler, & Dijk, 2000; Campbell & Dawson, 1990).
Another KPI is *Price divided by Average Product lifetime*. *"If the device breaks down before it breaks even, the customer will be financially worse off, deterring future customers and leading to market spoilage"* (Bardouille, 2012 p.67). Consumers cannot afford any such miss-investments, so the pricing and financing scheme needs to absorb as much risk as possible.
Very important is also the *training of the last mile sales agent*. To communicate our value proposition in rural markets, firms cannot utilize on mass media or other digital promotion. Sales agents need to convey your value proposition and explain how to operate your product safely. "Sometimes they don't even know that they have to hold the panel face-up into the sun" (Expert 1). Agents also need to regain the trust of customers if they had an unpleasant experience with a generic product in the past. Hence, there is a strong need for proper training of agents.

Vision Drivers. The Vision Driver in this category is the t*otal of customers previously un-electrified*. Goal of the Pico-PV industry supported by the Lighting Africa initiative is to provide 250 million people with modern, affordable and healthy lighting (Lighting Africa, 2010) by 2030. It might be a powerful strategy for a business to drive sales by marketing products in on-grid markets, may it be in African or in industrialized nations. This strategy might also be used to cross-subsidize costs in rural BOP markets. Nevertheless, it should not draw attention away from the main target group.

6.2.4 Internal Process Perspective

Strategic core issues. The bulk of the costs in the Pico-PV value chain from the perspective of most social enterprises are upstream in the supply chain (IFC, 2012). Thus, *cost efficiency* here can have a large impact. Looking downstream, *liquidity* is very hard to achieve, but also very important to bring products into the market and to absorb risks (Expert 1-3). Thirdly, reverse logistics and *after sales services* are an additional cost factor but can also have an impact on competitive advantage if it is embedded in a competitive strategy (Janse, Schuur, & De Brito, 2010).

Performance Drivers. There is ambiguity around how to quantify product quality as one product may be more or less valuable to different customers (Expert 3). However, we argue that to a vast extent quality may be explained by how much light can be emitted per use, thus *lumen hour per average duty cycle*[14]. This is can be justified by that greater marginal technological performance improvements are associated with LEDs and batteries compared to other components (Lighting Africa, 2010).
Further, the import process occurs high fixed costs (Expert 1, Expert 2). Next to the costs of materials, landed costs make over half of the cost structure (HYSTRA, 2017). Thus, the *Import Lot size* needs to be optimized.
Ideally these overheads need to be covered by gross profit margins. However, most rely on subsidies to cover operational expenses (Expert 2). One effective way to increase gross margins is to increase the *sales per agent per month* (Expert 1, Expert 2, Expert 5).
Regarding the liquidity, short-term financial health is most commonly monitored by looking at the *Working Capital Ratio* (Ross et al., 2013). However, given the use of subsidies to cover operating expenses make it difficult to interpret this ratio in the traditional sense.

Vision Drivers. To achieve the vision of waste reduction and responsible consumption, a *Return & Repair service* should be offered (Hirmer & Cruickshank, 2014). By far not all social enterprises provide this service effectively, as it is an additional cost factor (Expert 3). However, offering consumers a warranty can significantly take away financial risk and grant a unique advantage relative to generics (Expert 1).
Challenges by generics and with the support of subsidies, distributors may be tempted to sell their products below the *wholesale price*. However, a subsidy manager in east Africa reported: "*For us the biggest concern is that products are not sold below their wholesale cost*" as they do not want to encourage losses (Expert 2). These challenges need to be overcome through innovation and efficiency both increase operational efficiency and make products worth the premium.
Lastly, the quality standards for social Pico-PV enterprises are given by *Lighting Global*[15]. These dictate -next to warranty-lumen maintenance, truth in advertising, durability and system quality and should be maintained as rigorously as possible.

6.2.5 Learning & Growth Perspective

Strategic Core issues. Most important for growth and innovation is *excellent management* and improving operations, products and services. Firms need to attract and retain talent, not with high compensation, but by offering them a challenge in a competitive enterprise that is having a profound impact on the BOP. This is also reflected by the high employee turnover within the industry (Expert 3).
Excellent management is also related to *innovation*. In a rapidly moving industry, it can be costly to lose competitiveness in only a single component across our value chain: Product, Logistics, Services, and Marketing Systems.
Further, *agent satisfaction* is connected to the goal of creating decent employment; on the other hand, it influences the sales rate per agent, the quality of their sales efforts, and subsequently gross margins.

Performance Drivers. One factor that has been stressed by many experts is the limited *administrative capacity* that constraints the ability to manage operations more efficiently. An ambitious team is also one of the main indicators for investors to back an enterprise (Expert 2).
The *frequency of field research* is also often constrained. Still, this is important not only to offer an acceptable product but also test different business models. For example, Expert 5 described

14 Lumen is a measure for light output. Thus, lumen hour is the amount of light that may be emitted with during the average usage period per day, or duty cycle.

15 https://www.lightingglobal.org/quality-assurance-program/our-standards/

how his firm conducts AB test with different credit periods to compare effects on sales and cash flows (Expert 5). It can also be relevant to account for region specific natural phenomena such as droughts that might affect the number of sales (Expert 2).

Further, it is necessary to constantly innovate to keep the *product 'state of the art'*. Solar is becoming more and more cost effective and so is batteries. Expert 4 reported that their business was effected changing over to lithium batteries too late,

Sales agent retention also has been reported several times as a key indicator (Expert 5). It is a good indicator of agent satisfaction, influences operational efficiency and how well money is spent on training.

Vision Drivers. An *increase in the agent income is* one of the main social bottom lines connected to the contribution to better employment. This is hard to achieve if margins are squeezed by cheap generics. However, the causal relationships can show how an increase in agent income can lead to a competitive advantage (see Appendix Figure 1).

6.3 A Social Pico-PV Enterprise Benchmarking Tool

In the current form, the framework is useful to observe the causal relationships in the organizations' strategic objectives. This can be helpful to systematically backtrack outcomes of different strategies and tactics (Kaplan & Norton, 2005 p.58). However, in a different configuration, it can also be used as a measurement tool to benchmark performance (Kaplan & Norton, 1993). Hubbard (2009) developed an Organizational Sustainability Performance Index (OSPI) based on the BSC. We modulated the BSC and introduced a simple scoring system. For this purpose, Hubbard suggest a rank KPI performance on a scale of 1 to 5, i.e. '1' being 'bad', '3' being 'average' and '5' being 'good' (Hubbard, 2009 p.188). However, this system may also be changed to i.e. absolute data.

Attached in the Appendix, Figure 1 shows the generic KPIs integrated into the proposed benchmarking tool. Appendix Figure 2 shows a hypothetical causal map based on the generic KPI. These were evaluated in the expert survey.

7. FINDINGS ON PRACTICAL RELEVANCE & VALIDITY

In Table 3, the results of the survey are shown. Three things become apparent when looking at the raw results. First, experts that entered the industry later seem to perceive contribution to the SDGs as less important than those that have been in the industry for longer. This implies that industry actors from the industries' beginnings are more idealistic. As these actors are likely to be in more senior positions, they should react to the limited idealistic drive of new employees through persistent leadership. Secondly, the experts agree that better performance is needed. They also attribute value to the developed PMF in the form of a benchmarking tool. While rater 8 ranks its value as very low, Rater 1 described it as '*excellent evaluation tool"* in the 'further comments' section. Thirdly, overall validity adjusted for experience of the selected KPIs is relatively weak. Overall, inter-rater agreement (IR) is not significant and especially low on KPI relevance. This implies that there are differences in how experts valued individual KPIs. We assume that this low agreement can be traced back to the differences in business models that make the creation of a harmonized set of KPIs across the industry difficult. Thus, we must conclude that the developed generic KPIs have little validity as a cross-industry benchmark.

Item	Rater #i	#1	#2	#3*	#4	#5	#6	#7	#8	Adjusted Average	**IR**
1. Expert Registration (1 strongly disagree, 5 Strongly agree)											
2. Interview participation Y/N		Y	Y	Y	N	N	N	N	Y		
3. Experience in years (*Y*)		**10**	**9**	**7**	**5**	**4**	**3**	**1**	**1**		
4. Self-reported qualification Judge Practical Value (*SRQ P*)		4	4	4	5	4	5	3	2		
5. Self-reported qualification – Judge KPI Validity (*SRQ V*)		4	4	4	5	3	4	4	1		
6. Importance of contribution to SDGs 8,10,12 & 13		4	5	4	4	4	3	3	3	4.10**	0,32
Practical Relevance *(1 strongly disagree, 5 Strongly agree)*											
7. Agreement with need for performance improvement		5	5	4	4	5	3	5	3	4.50**	0,29
8. Practical Scorecard value (KPI independent)		4	4	3	3	3	3	4	1	3.45***	0,32
KPI of Financial Perspective (*1 strongly disagree, 5 Strongly agree)*											
9. KPI relevance		3	3	-	2	5	4	4	1	3,10****	0,10
10. KPI clarity		3	4	-	4	4	4	3	2	3,65****	0,33
11. KPI set comprehensiveness		4	2	-	2	4	3	3	3	2,93****	0,24
KPI of Customer Perspective *(1 strongly disagree, 5 Strongly agree)*											
12. KPI relevance		3	3	-	2	4	2	4	3	2,84****	0,24
13. KPI clarity		4	4	-	3	4	2	3	3	3,58****	0,29
14. KPI set comprehensiveness		4	3	-	2	4	2	3	3	3,12****	0,24
KPI of Internal Process Perspective *(1 strongly disagree, 5 Strongly agree)*											
15. KPI relevance		3	3	-	2	4	2	4	3	2,84****	0,24
16. KPI clarity		4	4	-	3	4	2	3	3	3,58****	0,29
17. KPI set comprehensiveness		4	3	-	2	4	2	3	3	3,12****	0,24
KPI of Learning & Growth Perspective *(1 strongly disagree, 5 Strongly agree)*											
18. KPI relevance		4	4	-	4	4	2	4	3	3,81****	0,48
19. KPI clarity		4	4	-	4	4	2	3	3	3,78****	0,33
20. KPI set comprehensiveness		5	4	-	4	4	3	3	3	4,18****	0,29
* Rater did not complete the KPI section **$\sum$ (Rating**i** x *Yi* / $\sum$ *Yi*) ***$\sum$ (Rating**i** x *Yi* x *SRQ Pi* / $\sum$ (*Yi* x *SRQ Pi*)) ****$\sum$ (Rating**i** x *Yi* x *SRQ Vi* / $\sum$ (*Yi* x *SRQ Vi*))											**0.28**

Table 3. Survey results

Looking at the data from interviews, we get a more coherent picture. In all interviews, the experts reported a lack of professionalism in many social Pico-PV enterprises. All agreed that performance needs improvement, however most argued that there was no time for performance management (Expert 1,2,4,5). In an example, Expert 5 reported that his supervisor once described the interaction with an external consulting service as 'dismal'. This was due to the extreme time effort that

was spent on developing metrics and targets. In the eyes of his manager, the project was not leading to results and subsequently abandoned. Such reports are, in the understanding of the author, paradox, Professional management should -by definition- enable a firm to achieve more with the time available. We conclude that there seems to be a lack of commitment for more performance management, especially in smaller enterprises. In this context, financial institutions should have a key role in providing incentives for performance improvement. Surprisingly, the subsidy manager reported when describing his portfolio: "*some perform strongly, some not, to us they are all fine.*" [...]" *Eventually, everybody just gets their proposal approved*" (Expert 2). To us, this perspective was rather unexpected. It leads us to the assumption that this combination of easy access to subsidies and low administrative capacities is drawing the focus away from improvement and enables a 'business as usual' mentality. In this light, Expert 2 acknowledged that more coherent monitoring of performance was needed. An additional conclusion that we drew is that within higher performing firms, the Vision and Mission might be threatened. In the example of d-light, in which their success led to the replacement of the founding team as it attracted conventional investors, we see a potential hazard. We find it ambiguous what may happen if the founder's Vision & Mission is gone and profit becomes the ultimate bottom line.

Combining the results of the interviews and survey, we see a strong relevance for better performance management in smaller ventures. But also in more mature firms, as founders are replaced and newly employed staff is less connected to the initial social and environmental objectives, the original Vision & Mission needs to be embedded in everyday culture and management. The BSC and our adaptation, with its Vision & Mission centric design, is an ideal PMF to achieve this. During interviews, experts expressed interest in being informed about further developments around the PMF. Expert 4 and Expert 5 further considered presenting it to their management team. In addition, experts made suggestions on how to improve the framework, most commonly to establish different sets of KPIs, harmonized for specific regions or business models, similar to the PayG KPIs developed by GOGLA (2017).

8. CONCLUSION

First, we want to reexamine the two mechanisms of qualitative theory building that were mentioned in the methodology section. The first being that the product was an end of the research progress, and not a means to guide the analysis. Morse et al., (2002) associate this with the researcher's responsiveness to findings during the research process. This study critically reviewed the PMF after each expert session. Changes were made to improve draft quality and subsequently the quality of the data gathered in the next round. Hence, this condition is met. The second mechanism states that the developed framework needs to be useful as a template for further development. To achieve this, components and development process are made as clear and transparent as possible. This way the framework encourages analysis and is open to improvements. Further, the classical BSC was left mostly untouched and thus grants its integrity along with other established properties.

The theoretical contribution of this study can be seen in two findings. It reviewed three adaptations of the BSC in the contexts of social enterprise, non-profit and sustainability management. We confirmed that the original version of the BSC does not require fundamental modification to be applicable to non-conventional contexts. On the contrary, we agree with Kaplan (2001) and critically oppose proposals such as the one made by Bull (2007). In defense of the introduction of the 'Vision Driver' sub category, a strong line of reasoning was formed: (a) Strategically important social and environmental stakeholder groups are spread over the value chain and (b) they may all be of equal importance, thus may take a position as an 'end in themselves' in the Strategy Map, as well as (c) the presence of conventional enterprises competing for the same customers. These may be used as hypothesis when testing the applicability in other related industries.

For the Pico-PV industry, this study finds a need for better strategic management and professionalism. The reports of experts indicated low commitment to performance management in small and medium organizations. A need for performance improvement was also shown in the survey results. Our main assumption is that the low barrier to financial aid could release pressure for performance and innovation. This however demands further investigation. In the context of more mature and better performing organization, we argue that the developed PMF could be an anchor for the founders Vision & Mission in the firm's strategy. This is important as conventional investors and new, less idealistic staff, might dilute the importance of social and environmental objectives.

Results on the validity of the developed set of generic KPIs are mixed. Most experts report that they would have to adapt the set of indicators presented. Overall, this study may be a proof-of-concept for the use of the BSC in performance measurement at the BOP. To be used for performance measurement, more harmonized sets of KPIs and most importantly, empirically tested causal relationships between KPIs are needed. This can only be done using real firm performance data which is difficult and time consuming to obtain. However, we found that such harmonized and tested KPIs could be very valuable to fund managers and impact investors, which want to better estimate their return on investment, may it be economic, social, or environmental.

Coming to the main question of this thesis: "*What is an appropriate performance management framework (PMF) for social Pico-PV enterprises operating value chains in Sub-Saharan Africa?***"**

This study succeeded in finding a compatible performance management framework that is based on a very well established and widely used management tool, the BSC. It also succeeded in proving that the developed PMF could be applied as measurement tool by developing a generic measurement tool that was reviewed by experts. However, we must acknowledge that this thesis was subject to a limited research period of only ten weeks. For this reason, we could not move from the exploratory stage into the empirical stage as a logical next step. Nevertheless, our results, including the developed PMF, provide are a very good foundation for further research, ideally moving from a management to a measurement framework.

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11. APPENDIX

Financial Perspective	What financial metrics are most important for us?
Strategic Core Issues	*The Strategic core issues that spring from our Vision & Mission*
Organic growth	Especially for for-profit social enterprise, **Financial independence** is at the core of the **Vision & Mission**.
Finance worthiness	However, in order **get to scale**, the firm needs to attract external capital in various forms, part of which are subsidies or impact investors. Otherwise the firm will not be able to serve its main purpose, which is to provide quality services to **as many customers at the BOP as possible**.
Performance Drivers	*These KPI explain 80% of our performance*
1. EBITDA Margin	= EBITDA / Sales Earnings before Interest, Tax, Depreciation & Amortization – EBITDA - is a basic measure of the firm's **ability to generate cash from operations**. GOGLA recommends a breakeven on this level to cover for remain able to service equipment and collect payments.
2. ROA **(using EBITDA)**	= EBITDA / Total Assets Monitoring this metric is important as we want to improve **how much value we generate out of our assets**. Efficiency is becoming more and more important to **attract finance**, especially with rising maturity of industry and business.
3. FX Exposure	= (Assets - (Liabilities + Equity))/(Equity in Local Currency) This metric is recommended by GOGLA. It is the most widely used metric for **currency risk** exposure in microfinance. FX is one of the greatest contingencies and it is essential to be prepared.
Vision Drivers	*These KPI are the most important challenges for reaching our vision as social enterprise*
4. Subsidies to Operating expenses	= Subsidies / operating expenses To what extent do we **sustain our operation** without external financial support? This metric is important to monitor in order to move towards **financial independence**. As the industry is becoming more and more mature, **subsidies might dry up** and we will lose the ability to serve our core stakeholders.

Appendix Table 1. Financial Perspective

Customer Perspective	What do we need to provide to our customers and how? How do we make an impact?
Strategic Core Issues	*The Strategic core issues that spring from our Vision & Mission*
Awareness	Awareness is probably the most important **sign of technology diffusion** and a **driver of sales**.
Acceptability	Does the product offer what the customer really **needs** and look like something they **want, too**?
Affordability	Another important complement to availability. Can **everybody** buy the product if they want to?
Availability	The **main social bottom line** and foundation for success. Can we deliver our product where it is **most needed**?
Performance Drivers	*These KPI explain 80% of our performance*
5. Last Mile Agent Quality	How effective are our Sales Agents at 'selling' our **value proposition**? How well do they **promote/explain/service** our product? Do they get the **training** they need? (*Agents can be on payroll, franchisees or independents. May not apply if you work with distribution partners*)
6. Retention Rate	Or the **Churn Rate**. Do our customers **come back** to us (Cash)/ **stay** with us (PayG)?
7. Design & Versatility	Do we offer the desired **features and aesthetics** appropriate for the target region?
8. Price / Avg. Product Lifetime	In the face of generics, it is important that our products represent a **better long-term investment** for consumers.
Vision Drivers	*These KPI are the most important challenges for reaching our vision as social enterprise*
9. Total consumers previously un-electrified	The **social bottom-line**. It can be very powerful to cross-subsidize with sales on electrified markets. But it is important to **not let the means become an end**.

Appendix Table 2. Customer Perspective

Internal Process Perspective	How do we deliver our impact in the smartest, most cost-effective way?
Strategic Core Issues	*The Strategic core issues that spring from our Vision & Mission*
Cost efficiency	**Product Costs and Importing** makes the lump of total costs. And there is also room for cost reduction through innovation and smart logistics.
Liquidity	Also known as short-term **financial health**. This is important to absorb risk and to bring products to the market.

Internal Process Perspective	How do we deliver our impact in the smartest, most cost-effective way?
After Sales Impact	After Sales can have an impact on all three bottom lines through **waste reduction**, **competitive advantage** and **risk reduction for end consumers**. Nevertheless, it increases operational complexity and must be managed well.
Performance Drivers	*These KPI explain 80% of our performance*
10. Purchasing price/(lumen hour per Avg. duty cycle)	This metric is the most basic indicator of '**Cost of Quality**' for Pico-PV products. Given a product category with the same features (USB, Radio etc.), this metric assumes that the greatest marginal 'cost of quality' reduction can be achieved through improvements in LED and Battery efficiency. Cost for quality is essential for product competitiveness.
11. Lot Size per Import	Indicates how well fix costs associated with the shipping and import process are spread (also known as **landed costs**) (e.g. Shipment cost, Declaration fee, document fee, inspection fee, tax, storage, etc.), across units.
12. Sales per Agent per Month	Sales agents represent a substantial proportion in the **Gross Profit Margin** and are thus a good indicator for performance**. (***Sometimes sales are also handles through contractors or partner institutions; here the KPI needs to be adapted*). Gross Profit indicates how much money is left to **pay for operating expenses** such as shipping, promotion, administration, and overheads. This metric is important to achieve a basic cash flow that can be converted into **Working Capital**, next to subsidies.
13. Standard Deviation of the Unit Proportional Age (UPA)	UPA is the expected or ideal payback-off period of a product. The better a manager can can **forcast cashflows**, the more efficiently she can plan operations. This metrics is easiest to observe if sales data is somehow automatically or semi-automatically stored. This does not apply to all firm, howerver it can also be estimated through cash flows. Overall, being able to monitor and analyse sales data is a performance indicator in itself that is becoming increasingly important.
14. Working Capital Ratio	=Current Assets/Current Liabilities. An essential metric for liquidity & **financial health**. Generally recommended being between 1.2 and 2 (may not apply to BOP industries).
Vision Drivers	*These KPI are the most important challenges for reaching our vision as social enterprise*
15. Return & Repair service awareness	**Reverse Logistics** are an additional cost factor. However, they are also essential as the option to get broken products fixed or replaced takes away financial risk from the consumer. This could contribute to a positive **word-of-mouth effect**.
16. Consumer price above wholesale price	Given subsidies and initial Investments, an attempt to push brand awareness might be dumping products on the market (and also to compete with generics), but this is not sustainable and certainly **does not attract investors**. This challenge can be overcome by making your operations more efficient and your products worth a premium.
17. Lighting Global Standards	To what extend to you comply to the official standards? Earning the certificate might open doors to i**nvestments** and enhances **consumer trust**.

Appendix Table 3. Internal Process Perspective

Learning & Growth Perspective	How do keep improving our product and operations, sustain growth keep maintain a healthy foundation for success?
Strategic Core Issues	*The Strategic core issues that spring from our Vision & Mission*
Excellent Management	The most important driver of success in any organization. Also, especially for smaller businesses, a dedicated team increases the chance to **attract investors**.
Innovation	In a rapidly moving industry, is can be **costly to lose competitiveness** in only a single component across our value chain: Product, Logistics, Services, Marketing Systems
Agent Satisfaction	Both important for productive operations, **effective marketing** and our **social bottom-line**
Performance Drivers	*These KPI explain 80% of our performance*
18. Administrative Capacity	Do we have **enough staff** to manage our operation? Or better, do we have enough **talent** to improve our operations? Further, **new management tools and technologies** can help to increase our efficiency (e.g. Angaza)
19. Frequency of field research	Was the target region sufficiently surveyed and do we know **what customer really need and want**? An effective approach could be i.e. **AB test** financing schemes for their effects on customer satisfaction and cash flows.
20. Product 'state-of-the-art`	Is our product using the best and/or most **cost-efficient components**?
21. Sales Agent Retention	One of the most cited indicators for employee satisfaction.
Vision Drivers	*These KPI are the most important challenges for reaching our vision as social enterprise*
22. Increase in Agent Income	Do we create **better quality employment** and increase the financial situation of our direct and indirect agents at the BOP?

Appendix Table 4. Learning & Growth Perspective

Vision & Mission	*As a social enterprise, this is the very purpose of our existence and our Vision & Mission. If we excel on all strategic core issues discussed, we will contribute to the SDGs.*
United Nations' Sustainable Development Goals	
Goal 07	**Ensure access to affordable, reliable, sustainable, and modern energy for all**
Goal 08	**Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all**
Goal 12	**Ensure sustainable consumption and production patterns**
Goal 13	**Take urgent action to combat climate change and its impacts**

Appendix Table 5. Vision & Mission

Please determine the scores corresponding to e.g. 1 (bad/worse performance) 3 (average/equal performance) and 5 (good/better performance)							
Financial Perspective						**Customer Perspective**	
Strategic Core Issues (Goals)						*Strategic Core Issues (Goals)*	
Sustainable organic growth						**Awareness**	
Finance worthiness						**Acceptability**	
						Affordability	
						Availability	
Performance Drivers (KPI)	**1-5**					*Performance Drivers (KPI)*	**1-5**
1. EBITDA Margin	3					5. Last Mile Agent Training	2
2. Return on Assets	3					6. Retention Rate	2
3. FX Exposure	2					7. Design & Functionality	3
						8. Price / Avg. Product Lifetime	4
Vision Drivers (Vision driving KPI)						*Vision Drivers (Vision driving KPI)*	
4. Financial Aid to Operating Expenses	3					9. Total Customers previously unelectrified	3
Average Sub Score	2,75					*Average Sub Score*	2,8
The financial perspective How do we reach financial independence and bring our operation to scale?		**Social Pico-PV Enterprise Performance Index**				**The customer perspective** What do we need to provide to our customers and how?	
		(e.g.) Period	Now	Past			
		Financial	2,75	2,5			
		Customer	2,8	2,5			
The internal process perspective How do we deliver our product in the smartest, most cost-effective way? How do we make an impact?		Internal	3,38	3		**The learning and growth perspective** How do we keep improving our product and operations, sustain growth and maintain a healthy foundation for success?	
		L&G	3,5	3			
		Overall Score	3,11	2,75			
Internal Process Perspective						**Learning & Growth Perspective**	
Strategic Core Issues (Goals)						*Strategic Core Issues (Goals)*	
Cost efficiency						**Excellent Management**	
Liquidity						**Innovation**	
After Sales Impact						**Agent Satisfaction**	
Performance Drivers (KPI)	**1-5**					*Performance Drivers (KPI)*	**1-5**
10. Purchasing price/(lumen hour per Avg. duty cycle)	5					18. Administrative Capacity	3
11. Lot Size per Import	4					19. Frequency of field research	5
12. Sales per Agent per Month	2					20. Product 'state-of-the-art`	4
13. Standard Deviation of the Unit Proportional Age	2					21. Sales Agent retention	3
14. Working Capital Ratio	3						
Vision Drivers (Vision driving KPI)						*Vision Drivers (Vision driving KPI)*	
15. Return & Repair service awareness	2					22. Increase in Agent income	2
16. Avg. Consumer price above wholesale price	4						
17. Lighting Global Standards	5						
Average Sub Score	3,375					Average Sub Score	3,5
Vision & Mission							
I.e.Contribution to United Nations' Sustainable Development Goals							
Goal 07 Ensure access to affordable, reliable, sustainable, and modern energy for all							
Goal 08 Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all							
Goal 12 Ensure sustainable consumption and production patterns							
Goal 13 Take urgent action to combat climate change and its impacts							

Appendix Figure 1. A generic benchmarking tool for social Pico PV enterprises operating in Sub Saharan Africa

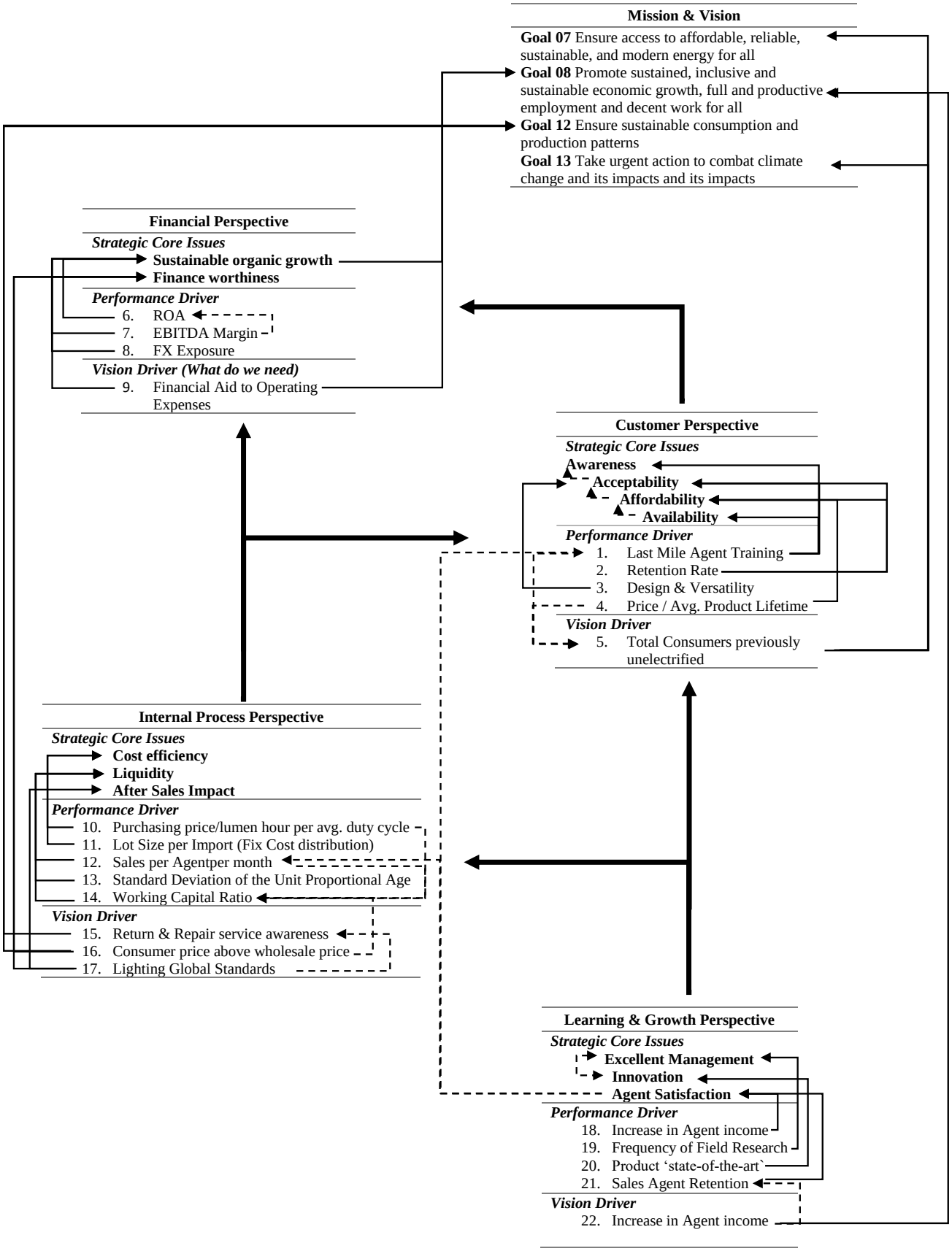

Figure 7. Hypothetical causal relationships within the generic benchmarking tool