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A model to evaluate the success of Solar Home Systems

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ABSTRACT

Around 20% of the world's population currently do not have access to electricity while the importance of electricity services for society continues to increase. Solar Home Systems (SHS) are a competitive option for supplying basic electrification under meteorological conditions in Sunbelt countries. However, many of the SHS electrification programmes have failed in the past. Furthermore, their evaluation is often still based on one individual indicator such as the number of disseminated systems. This research explores how to measure success of SHSs in a comprehensive manner. Success can be defined as the achievement of self-set goals. From this statement a model of success was developed which incorporates all key-stakeholders and their multiple self-set goals. The model of success combines the individual level of success with the SHS implementation's overall success. A hypothetical example is used to demonstrate the application of the model. The challenges relating to the measurement of success are also illustrated. The resulting methodology combines general success factor research, diffusion of innovation research, and lessons learned from SHS projects. The drawbacks of the current approaches to SHS implementation, and their characteristic of still being an innovation, were also determined. The proposed model of success can be applied to pre-evaluate SHS programmes, to evaluate existing SHS projects, and to observe and evaluate the development of SHS implementation over time.

Contents

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1. Introduction

Electricity is a driving force in the development of societies and in the achievement of the Millennium Development Goals (MDGs) [1,2]. Currently, approximately one fifth of the world's population lack access to electricity. The electrification rates for the twenty least- developed countries range between 9% and 47.3% [3]. Interestingly, a much higher percentage of inhabitants of these countries are telephone (cell phone) subscribers. With the exception of Eritrea (4.6%) and Ethiopia (9.4%) the figures lie between 14.1% and 77.6% [3]. This shows that there is a need for meeting the very basic electricity needs for appliances such as cell phones, which can be met with a minimum basic electricity supply.

Electrification by grid extension is a very expensive option for dispersed rural households [4,5]. The ratio of the costs of grid extension to the income that would be earned from the amount of electricity consumed means that this is not an economically feasible option for utilities. Solar Home Systems have been promoted as a viable solution and, indeed, the best option for off-grid electricity supply [4,6–8]. So far, many SHS programmes have been implemented in developing countries, but only a few appear to be successful [9–13].

The reason for the lack of success is still a vital research question. Not many researchers have addressed the question, 'Why are some programmes more successful than others?' Most of the previous studies attempting to answer this question were not based on a comprehensive understanding of these programmes, for example how the programmes are planned, designed, and implemented. There was no exact definition or set of criteria for successful programmes. Some studies define the SHSs' success and related indicators based on successful and failed programmes [14]. But no model was yet proposed to define the success of SHSs incorporating all key players and their requirements. Therefore, a model to determine the success of Solar Home Systems is required which incorporates further indicators of success along with the indicators developed by Urmee and Harries [15].

This research aims to develop a model to evaluate the success of SHS implementation. The guiding questions of this research are:

i. What are the elements that need to be incorporated in measuring the success of SHSs?
ii. How are these elements linked with each other?
iii. How should these elements be assessed to determine the success of a SHS implementation?

This paper addresses the first two questions by proposing a model of success incorporating the viewpoints of all players. The concept of Freeman on stakeholders is applied for grouping the respective players in the environment of SHSs [16].

The paper defines Solar Home Systems as small systems, based on a PV generator, with a nominal power between 50 W_p and 150 W_p.

The term "successful" is used to describe a situation where all of the goals of involved stakeholders are achieved.

The considerations of success are applicable for any approach to the dissemination of SHSs, be it a donor, governmental, or any other institutional driven programme, as well as the dissemination of SHSs by the private sector. Therefore, the term "implementation of SHSs" is used in this paper. The terms "project" and "programme" are exclusively used when the implementation is conducted within a planned course of action.

2. Approaches to determining success of Solar Home Systems

The success factors of SHSs reported by many researchers are based on specific projects. Asif [13] and others report that Bangladesh's SHS regime is the most successful at present [17]. Grameen Shakti summarizes the success factors for the Bangladesh SHSs as [18]:

- no provision of direct subsidies in the programme;
- innovative financing is available for the consumers;
- a supply of locally developed and manufactured SHS components;
- a good supply chain network;
- training of local technicians and Users is built in within the implementation programme;
- highly motivated staff; and
- the coupling of income to the SHS.

According to other researchers, successful SHS projects are those which address certain factors such as the affordability, cultural views, income generation by the systems, the Users' familiarity with the technology, and which have a clear view on specific engagement of stakeholders beyond the donor/government funding [19–22].

2.1. Success factor research

Many research projects have been conducted to answer the question, 'What are the criteria for measuring the success of a business?' Early research in this field included the PIMS study (Profit Impact of Market Strategies) by General Electric which started in the 1960s. This study was further developed by the SPI (Strategic Planning Institute) [23]. A major finding of the PIMS study was the high importance of the quality of products and services. This lesson can be transferred to the SHS business.

Welge and Al-Laham point out that the Return on Investment (ROI) dealt with in the PIMS study is an insufficient indicator for success of a business when contemplated in isolation [24]. This implies that the research on the success of SHSs needs to consider benchmarks beyond the ROI and should incorporate multiple indicators to measure that success.

Bullen and Rockart propose that success is based solely on a few Critical Success Factors (CSFs) [25]. But, in referring to this source, these CSFs depend on multiple influences: industry type and position, environmental factors such as the current economic situation of the industry's sector, national policies, temporal factors (an internal or external short term impact), and, last but not the least, the contemplator's point of view. These views can be applied to SHS implementation as they also feature Critical Success Factors. But these also differ for the different stakeholders involved in the SHS environment. For example, international manufacturers of SHS components will deal with other CSFs than those of local entrepreneurs selling and installing SHSs in the implementation area. Also, the employees' views on the success of the SHSs of