

HOW PARTICIPATORY PRODUCT DESIGN AND MICRO-ENTREPRENEURSHIP FAVOR THE DISSEMINATION OF PHOTOVOLTAIC SYSTEMS IN CAMBODIA

Angèle Reinders¹, Henry de Gooijer², Jan Carel Diehl³

¹ University of Twente, Department of Design, Production and Management, P.O.Box 217, 7500 AE Enschede, The Netherlands, ² KamWorks, Cambodia, ³ Delft University of Technology, The Netherlands

ABSTRACT

Photovoltaic (PV) systems can provide affordable and sustainable electricity in rural areas in low-income countries, and simultaneously accelerate regions' development [1, 2]. It makes sense to implement PV power in Cambodia, since at present 2 million out of 2.1 million Cambodian households don't have access to electricity from the public grid. Typically, 55% of the households use rechargeable car batteries and 35 % use dry cells or have no access to any form of electricity at all [3]. Though solar irradiation is abundant in Cambodia (over 1900 kWh/m².year), Kamworks is only one of the few companies in Cambodia which focuses on a market for PV products. Its aim is to provide affordable and durable PV products which fulfill the functional needs of consumers and to contribute to sustainable development of Cambodia. In this scope participatory product design has been applied to design PV products which can be locally produced. Also the company is developing a distribution network for micro-entrepreneurs, who will sell PV products. In this paper the activities of Kamworks will be illustrated and discussed.

1. PARTICIPATORY PRODUCT DESIGN

1.1 Identifying product-market combinations

Kamworks (2006) is a spin-off of long-term cooperation between the Dutch charity Pico Sol and the Khmer Foundation for Justice, Peace and Development. The company focuses on a market of low-income consumers and aims to connect to indigenous culture and the socio-economic context of Cambodia. It is in this scope that participatory methods have been used to identify product-market combinations. Interviews, observations and focus group sessions were used to identify needs and wishes of the Cambodian consumer in their daily life. Also a SWOT-analysis of PV technology and the capabilities of Kamworks was applied. This resulted in the generation of many product-market combinations (PMCs) for the application of PV technology [3]. The PMCs were scored on 18 assessment factors composed from the company product credos - affordable, fulfilling a need,

locally producible, sustainable and durable - and marketing theory. In this way 6 most promising PMCs were identified: a lamp, a burglar alarm, a battery rental service, a radio, a high quality battery and a charger for small electronics.

1.2 Participatory product design

In order to design a PV powered lamp [4], its packaging [5] and a mobile kiosk for PV merchandise [6], participatory research was carried out. In the case of the lamp 15 households were approached to get insight in rural life, the needs for lighting and human interaction with current lamps such as kerosene lamps and electric lamps fed by batteries. It was concluded that a PV powered lamp should enable people to execute multiple tasks for which reason it should have different options for fixation. The lamp should be used for stationary tasks - such as cooking and eating, reading and selling goods - which requires ambient light with illumination levels above 30 lux. Also it should be used for mobile tasks - such as walking, fishing and hunting - which requires directional (spot) light above 50 lux. Moreover, fixation both on the ground and the ceiling should be possible and mobile use should be possible by carrying the lamp in just one hand.

1.3 Design of products

The outcomes of the participatory research were the main input for the 'physical' product design. As an example, Figure 1 shows Kamworks' PV powered lamp, named the Angkor Light, in hanging positions [4].

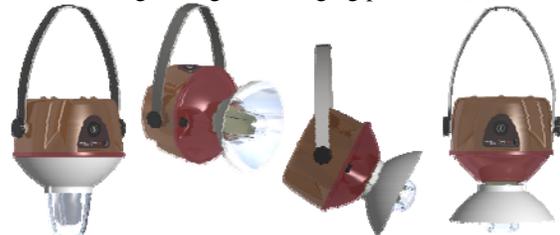


Fig. 1 The Angkor Light, a PV powered lamp.

Packaging not just protects a product; it also provides information about the use of a product. Figure 2 shows a detail of the packaging of the Angkor Light which communicates important messages ensuring safe and reliable product use to local consumers. Therefore

information is presented in both English and Khmer, and in graphic pictures [5].

In the framework of participatory product design, prototypes of the Angkor Light have been evaluated by the target group to improve the final embodiment design.

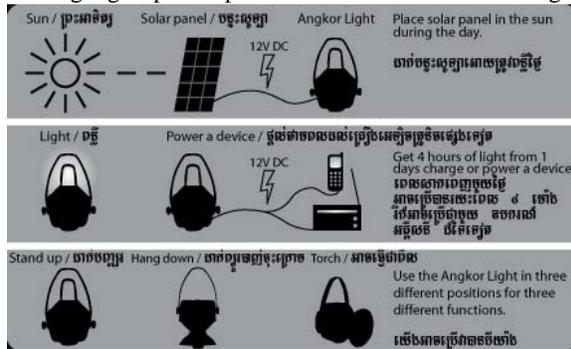


Fig. 2 The packaging informs about appropriate product use.

1.4 Local manufacturing

In order to create employment for young Cambodians, Kamworks' products have been designed for local production. For example, in the case of the lamp, vacuum forming instead of injection moulding was selected to be the production process for plastic parts [7]. The process involves a vacuum which is applied to suck a preheated plastic sheet over a mould. Vacuum forming requires low capital investments for the equipment, the moulds and the plastics used. Medium size runs of small parts therefore become economical. Detachable moulds are required for vacuum forming, see Figure 3.

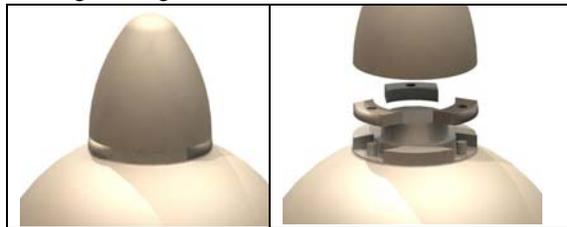


Fig. 3 Detachable inserts create rips in the upper plastic casing of the Angkor Light.

2. MICRO-ENTREPRENEURSHIP

2.1 Why micro-entrepreneurship fits Cambodia

Micro-entrepreneurship is the base of the traditional Cambodian way of life. Most people earn money in small family firms that are based on agriculture (85%), trade and skills. Only a few percent of the Cambodians earn income from large-scale industry. Kamworks' development strategy is to connect to this situation by supporting small-scale business of micro-entrepreneurs.

2.2 Dissemination of PV products

For the dissemination of PV products, a network of vendors - micro-entrepreneurs – is being established by

Kamworks. The vendors are trained and equipped by the company. For this purpose a training centre, called the Solar Campus, has been founded. It provides micro-entrepreneurs with a commercial training to improve their business skills and with a technical training to enhance their knowledge about PV technology [8]. On a monthly basis, vendors will have joint meetings at Kamworks' Solar Campus to discuss their business status and to build up a joint identity. Identity is important, both for "Kamworks-awareness" of the vendors as for the recognition of PV products from Kamworks by the customer. Therefore, a shared vision of the micro-entrepreneurs is considered as a prerequisite for the success of dissemination of PV products through networks of micro-entrepreneurs.

To set up a customer group, a vendor needs to have an outlet in the villages in his area of operation. For this purpose a mobile kiosk has been developed which enables micro-entrepreneurs to make a daily move around the villages [6]. The mobile kiosk has been designed as a carrier bicycle with a softly shaped polyester box. Because of promotional objectives the mobile kiosk is equipped with lighting and sound equipment powered by a small solar panel.

3. CONCLUSIONS

Dissemination of PV products in Cambodia is favoured by the operational strategy of Kamworks which connects to small-scale business of local micro-entrepreneurs. Participatory product design leads to PV products which fit to the needs and wishes of local customers and which can be locally produced.

REFERENCES

- [1] Ramani, K.V. and Heijndermans, E., "Energy, Poverty and Gender, a synthesis", The World Bank, Washington D.C. (2003).
- [2] Reinders, A.H.M.E. et al., "Sukatani revisited: on the performance of nine year old solar home systems and street lighting systems in Indonesia", *Renewable & Sustainable Energy Reviews* 3, 1 (1999).
- [3] Rotman, M., "Exploratory research for appropriate Product Market Combinations in Cambodian rural areas", (University of Twente, Enschede, 2006).
- [4] Boom, S., "Design of a solar lantern for the Cambodian Market", (Delft University of Technology, Delft, 2005).
- [5] Ruiter, S. "Design of the packaging and an introduction game of the KamWorks' solar lantern", (University of Twente, Enschede, 2007).
- [6] Reitenbach, M., "Design of a mobile solar kiosk for Cambodian micro-entrepreneurs", (Delft University of Technology, Delft, 2007).
- [7] Kranen, M., "Prototyping and manufacturing of the KamWorks' solar lantern", (University of Twente, Enschede, 2007).
- [8] Heerink, J., "Development of educational kit for micro-entrepreneurs of PV products in Cambodia", (University of Twente, Enschede, 2007).