



# LUND UNIVERSITY

## Design of Product Service Systems at the Base of The Pyramid

Jagtap, Santosh; Larsson, Andreas

*Published in:*  
[Host publication title missing]

2013

[Link to publication](#)

*Citation for published version (APA):*  
Jagtap, S., & Larsson, A. (2013). Design of Product Service Systems at the Base of The Pyramid. In A. Chakrabarti, & R. V. Prakash (Eds.), [Host publication title missing] Springer.

*Total number of authors:*  
2

### General rights

Unless other specific re-use rights are stated the following general rights apply:  
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

Read more about Creative commons licenses: <https://creativecommons.org/licenses/>

### Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

LUND UNIVERSITY

PO Box 117  
221 00 Lund  
+46 46-222 00 00

# Design of Product Service Systems at the Base of The Pyramid

Santosh Jagtap and Andreas Larsson

**Abstract** The Base of the Pyramid (BoP) consists of about two-fifths of the world population. This population can be categorized as poor with income of less than 2 dollars per day. It is important to alleviate poverty. One of the promising approaches to tackle the wicked problem of poverty is business development combined with poverty alleviation. In this approach, integrated solutions are necessary in order to address the diverse issues in the BoP. These integrated solutions are in the form of product service systems (PSS) rather than the conventional product-oriented or service-oriented solutions. In this paper, we explore different issues that need to be addressed in the PSS design at the BoP. We have also explored strategies used in this PSS design. We have used a case study to explain these issues and strategies. In addition, we have identified salient characteristics of the PSS design at the BoP.

**Keywords** Product service systems · Design at the BoP · Design for sustainability

## 1 Introduction

The base of the world income pyramid, generally called the ‘Base of the Pyramid’ (BoP), consists of poor people. About two-fifths of the world population can be categorized as poor. Their income is less than 2 dollars per day. Many researchers

---

S. Jagtap (✉) · A. Larsson  
Innovation Engineering, Department of Design Sciences, Faculty of Engineering,  
Lund University, Lund, Sweden  
e-mail: Santosh.Jagtap@design.lth.se

A. Larsson  
e-mail: Andreas.Larsson@design.lth.se

prefer the poverty line of 2 dollars per day [1]. About a fifth of the world population is classified as extremely poor with income of less than 1.25 dollars per day.

Poverty is multifaceted, and has three intertwined characteristics as follows [1]: (1) Lack of income and resources required to satisfy basic necessities such as food, shelter, clothing, and fuel; (2) Lack of access to basic services such as public health, education, safe drinking water, sanitation, infrastructure, and security; and (3) Social, cultural, and political exclusion.

### ***1.1 The Fight Against Poverty***

It is important to alleviate poverty. Poverty is a trap—children born to poor parents are likely to grow up to be poor adults. Mahatma Gandhi often said—poverty is the worst form of violence.

Karnani [1] has analysed poverty reduction approaches. Since the 1990s, three different poverty reduction approaches have received attention. The first approach, namely ‘microcredit’, envisioned by Muhammad Yunus in Bangladesh, suggests that granting small loans to the poor can help them to grow their businesses, and thereby can help them to climb out of poverty [2]. The second approach of granting formal property rights to the poor was formulated by the Peruvian economist Soto [3]. The underlying principle of this approach is that property rights will give the poor access to credit, and thereby will help in poverty reduction. The third approach, popularised by the late Prahalad [4] proposes solutions involving business development combined with poverty alleviation. These solutions, consisting of business strategy, focus on the poor people as producers and consumers of products and services. The third approach can use the elements of the first approach (i.e., microcredit), and is powerful as it efficiently uses the resources of businesses.

### ***1.2 Business Development Combined with Poverty Alleviation***

In this paper, we focus on the third approach of business development combined with poverty alleviation. According to Prahalad and Hart [5], the most visible and prolific writers in the area of the BoP, this business strategy is important in “...lifting billions of people out of poverty and desperation, averting the social decay, political chaos, terrorism, and environmental meltdown that is certain to continue if the gap between rich and poor countries continues to widen.” This suggests that such a business strategy offers a potential approach to meet the challenges of social, economic, and environmental sustainability at the BoP.

### ***1.3 BoP People: Producers and Consumers***

In this paper, we focus on the BoP people as producers and consumers of products and services. The businesses at the BoP design and develop products and services to serve the BoP producers, and to market these products and services to the BoP consumers. By focusing the poor as producers, their income can be raised. This can also help to generate employment opportunities for them, and can alleviate poverty. There are two ways to focus on the BoP people as consumers.

- First involves tapping BoP markets by selling products and services to the poor with the primary aim of earning profits. This approach may not be sustainable, and may not help to alleviate poverty. Karnani [6] has rigorously argued that this approach cannot alleviate poverty, and that it can exploit the poor.
- In the second way, businesses aim at the development of the poor and accordingly market appropriate products and services to them. In this approach, innovative solutions are devised to seek financial sustainability combined with the development of the poor.

In this paper, we focus on the second way when the BoP people are seen as consumers.

## **2 Research Aims and Research Methodology**

In the approach of business development combined with poverty alleviation, some interventions are designed, developed and implemented in the BoP. These interventions need to address complexly intertwined issues (i.e. constraints)—such as poor physical infrastructure, lack of knowledge and skills of the poor, etc—in the BoP. In order to address these diverse issues in the BoP through the design and development of interventions, an integrated approach using knowledge from technical, social and management sciences is necessary [7, 8]. In this integrated approach, the interventions take the form of product–service systems (PSS) rather than the conventional product-oriented or service-oriented solutions. PSS consists of a set of products and services that jointly fulfill the needs of users. PSS can reduce the use of resources and the generation of waste as fewer products are manufactured.

While some authors have highlighted the need and importance of PSS at the BoP, much less work has been carried out in this area. In this paper, the following questions are explored.

- What are the different issues that need to be addressed in the PSS design at the BoP?
- What are the strategies used in the PSS design at the BoP?
- What are the salient characteristics of the PSS design at the BoP?

We have explained these issues and strategies by using a case drawn from the study of United Nations Development Programme (UNDP) [9]. The UNDP led an initiative called ‘Growing Inclusive Markets’ (GIM). In this initiative, they analyzed several cases from different sectors (e.g., energy, healthcare, etc.) and countries. In order to explain the issues and strategies in the PSS design at the BoP, we selected one case from the UNDP study. This case is about a project where a for-profit company, Afrique Initiatives, used Information and Communication Technologies (ICTs) to monitor health conditions of children from low-income families in Mali.

Based on our literature review in the area of the BoP, we have identified some salient characteristics of the PSS design at the BoP.

### 3 PSS Design at the BoP: Issues and Strategies

In our prior research, we synthesized issues and strategies in the PSS design at the BoP [8, 10, 11]. We pulled together issues and strategies in this PSS design from the reviewed literature [5, 6, 12, 13]. We compared these issues and strategies with those identified in the UNDP study [9]. We used this UNDP study as a reference because the sample size of cases analysed in this study is large, and these cases are drawn from different sectors and countries. Our research identified that the issues and strategies of the UNDP study are comprehensive and include those identified in the reviewed literature.

#### 3.1 Issues in PSS Design at the BoP

The issues in PSS design at the BoP are as follows.

- *Market information* This issue takes into account the knowledge of businesses regarding the BoP, for example, what the poor need, what capabilities the poor can offer, etc. Businesses often lack detailed information about the BoP markets and in particular about the rural BoP. The presence of intermediaries (e.g., market research, rating services) to consolidate or distribute information on the BoP cannot be assumed.
- *Regulatory environment* The regulatory frameworks are under- or un-developed in the BoP. In addition, enforcement of the existing rules is inadequate. Complying with the bureaucracy in developing countries can be time consuming and monetarily expensive. For example, in the Latin America and the Caribbean, opening a business takes about 73 days, and in Organisation for Economic Co-operation and Development (OECD) countries, it takes on average 17 days [9].
- *Physical infrastructure* This issue considers the inadequate infrastructure (e.g., roads, electricity, water and sanitation, hospitals, etc.) in the BoP.

In developed countries, the logistics system that is necessary for accessing consumers, selling to them, and servicing products exists, and only minor changes may be required for specific products. In the BoP, the existence of a logistics infrastructure cannot be assumed. PSS at the BoP need to work in hostile environment (e.g., noise, dust, abuse of products).

- *Knowledge and skills* The poor, generally, are illiterate and do not possess knowledge and skills regarding the availability of products, usage of products, etc. Furthermore, this lack of knowledge and skills inhibits them from starting their own businesses. PSS design at the BoP needs to take into account the skill levels of the poor. The heterogeneity of the BoP regarding language, culture, skill level, and prior familiarity with the functions or features of the PSS can be a challenging task in the PSS design.
- *Access to financial services* The poor lack access to credits, insurance products, and banking services. This puts limits to the purchases made by them. In addition, they cannot protect their meager assets from events such as illness, drought, etc. The PSS design at the BoP must take into account the price-performance relationship.

### 3.2 Strategies in PSS Design at the BoP

The strategies in PSS design at the BoP are as follows.

- *Adapt products and processes* This strategy includes product redesign, business model innovation, and technological adaptation. PSS design at the BoP can benefit from technological ‘leapfrogging’—that is—avoiding intermediate steps to replace poor technology with the state of the art. While technology helps to deal with the daunting challenges in the BoP, it needs to go hand-in-hand with innovations in business models.
- *Invest in removing market constraints* This strategy includes investing for: educating consumers; enhancing or building capacities of the poor (e.g., supporting small producers who form a part of the supply chain); and building social marketing (e.g., health campaigns to increase demand of malaria nets).
- *Leverage the strengths of the poor* This strategy builds on the knowledge, networks, and abilities of the poor and their communities (e.g., developing cooperatives of the poor, employing the poor to fulfill some tasks of a business, leveraging the knowledge of the poor to design and develop PSS).
- *Combine resources and capabilities* Through collaborations and partnerships, this strategy combines resources and capabilities of different organizations such as businesses, NGOs, charitable sector, local governments, etc.
- *Engage in policy dialogue with governments* Businesses can overcome different issues in the BoP by engaging in dialogue with relevant governments, and this can help, for example, to formulate appropriate regulations, reduce bureaucracy, etc.
- PSS design at the BoP uses one or more of these above five strategies, which address one or more of the applicable issues.

## 4 Case Study: Pésinet's PSS in Healthcare Sector from Mali

In Mali, one child out of five dies before fifth birthday, and about 43 % of children are underweight. There is limited access to modern healthcare. The limited number of trained doctors and nurses worsen the problems. Furthermore, 40 % of the population lives more than 15 km away from a health facility.

More than 50 % of child mortality in Africa can be prevented. 55 % of children's mortality-causes can be detected easily by periodically checking basic symptoms, for example the evolution of the weight of a child, which is an accurate indicator of young child's health status. Patients in Africa usually come too late to a doctor. If diseases are detected and treated earlier on, mortality can be substantially reduced. This can also avoid risky and expensive emergency treatment, and health spending for households would be lower.

Afrique Initiatives, a for-profit company, focuses on investing in small- and medium-sized African businesses in order to promote sustainable enterprise and private sector development. Afrique Initiatives has the following main focus areas: education and training, nutrition, health, and information technologies (IT). Afrique Initiatives established an organisation called Pésinet with the aim of monitoring health conditions of children from low-income families. Pésinet implemented an intervention in Coura, a region near the capital city Bamako in Mali. The challenges faced by the people in this region are: malaria, low income, poor or no literacy, poor sanitation, and lack of adequate water supply infrastructure. Affordability is a crucial issue as the average income of the families in this region is less than 4 US dollars a day.

This intervention, implemented by Pésinet in the region Coura, monitored health conditions of children in that region, and helped to reduce child mortality rate. This intervention addressed the complexly intertwined issues in the region. The success of this intervention can be attributed to the fact that it was in the form of a PSS rather than the conventional product-oriented or service-oriented solutions. Cocreation played an important role in the design and development of this PSS. Pésinet cocreated the PSS with the following partners.

- A drug distributor, Medex from Mali
- The people from the region Coura
- An NGO, Kafo Yeredeme Ton from Mali
- Two French universities, ESSEC Business School and Ecole Centrale Paris
- Two major French telecommunications companies, Alcatel-Lucent and Orange

### 4.1 *The Broader PSS Concept*

In order to monitor health conditions of children in Coura, Pésinet used Information and Communication Technologies (ICTs). The weight of a child is

used as an indicator of its health. The pattern in the weight-change is analysed by a doctor to identify anomalies, if any, in the child's health. The child's mother subscribes to Pésinet's services by paying nominal fees. A representative from the Pésinet weighs her child(ren) twice a week. The information on this weight is transmitted to a local doctor using SMS service of mobile phones. After reviewing the weight chart, the doctor requests the visit of the mother and child if any anomalies are identified. Pésinet implemented the project in 2007. This project benefited hundreds of children.

## ***4.2 Elements of the PSS***

The elements of the PSS, aimed at monitoring the health conditions of children from Coura, are as follows.

### **4.2.1 Products**

In Mali, there are more mobiles phones than land lines, and this helps to contact remote areas. This fact was used by Pésinet in the PSS design. The products involved the use of ICTs. Required technical systems, consisting of the use of mobile phones and specific applications for data transmission, were designed by Alcatel-Lucent and Orange. The weight reading of a child is sent to a centralized database using these applications. A computer application that can be used by doctors processes this data on weight readings, and presents the evolution of the child's weight in a visual format. The doctor sends an SMS to the Pésinet representative when he/she identifies an anomaly in the evolution of the child's weight. The Pésinet representative then provides the mother with a consultation voucher.

Mali was selected because Alcatel-Lucent and Orange were already settled in the country. Alcatel-Lucent and Orange offered their support to Pésinet on their own, motivated by the 'digital divide' issue. While their involvement was as a part of their Corporate Social Responsibility, Orange gets some profits, as it charges for the SMS sent by the doctors.

### **4.2.2 Business Model**

A team of students from the ESSEC Business School and the Ecole Centrale designed the business plan (e.g., subscription fee-structure to cover the operating costs and child sponsoring for low-income families). In Mali, the subscription fees are 500 Communaute Financiere Africaine (CFA) per month (about US\$1.05) and include access to medicines. These fees entirely cover the operation costs, consisting of the Pésinet representatives' and doctor's wages, the scales renewal, the



internet connection, medicines, and the salary of one manager. The doctors are employed by public hospitals, and are either directly compensated by Pésinet or indirectly through a financial contribution made to the hospitals.

### **4.2.3 Marketing and Awareness Program**

Pésinet's staff organised small parties to inform the community in Coura regarding issues such as diarrhoea, cholera, etc. In the initial phase of the awareness raising program, the doctors went to the elementary schools and held their consultations with mothers and their children. Pésinet then kept promoting its services through word of mouth and District Associations.

The NGO, Kafo Yeredeme Ton from Mali, raised awareness by carrying out the marketing campaign together with Pésinet, by going door-to-door for a couple of months. The involvement of women community leaders in the programme helped to raise the awareness.

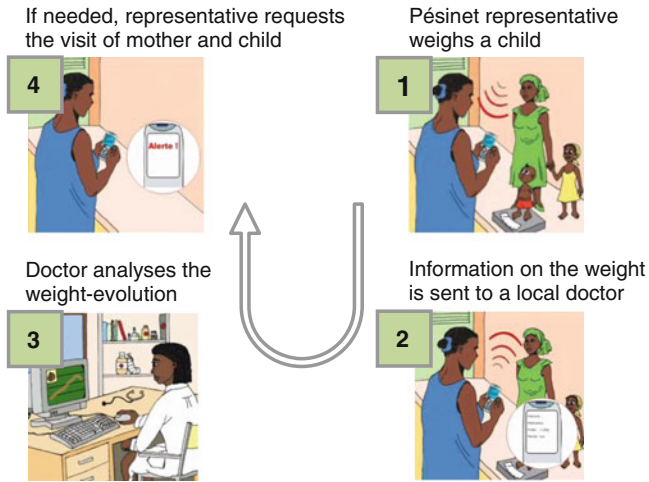
The government and local authorities were informed but not directly involved. The trust of local hospitals in Mali was achieved by informing them that the Pésinet's service would be a complementary service aimed at achieving early monitoring of children, and that the children with health issues would seek help from the regular healthcare system.

### **4.2.4 Services**

Mothers subscribe to Pésinet's service by paying a nominal fee. This service consists of weighing her children once a week at her home (twice a week for children under one) plus advice and treatment (if required) by a doctor. Children are weighed by local women called Pésinet representatives (see Fig. 1). These representatives also register symptoms such as fever, diarrhoea, vomiting, and transmit the data to the doctors using SMS service of mobile phones. The doctor makes a decision regarding the visit of the mother and child based on the pattern in the change of the child's weight. One doctor can cover about 2000 children. When the doctor identifies an anomaly in the child's health, he/she sends an SMS to the Pésinet representative, who requests the mother and child to visit the doctor.

## ***4.3 Transformation***

The Pésinet's PSS helped to achieve the following changes of state. The Pésinet's service resulted in approximately 20 consultations per week for 400 children. This service helped mothers to get necessary advice and treatment for their children in a short time-scale.



**Fig. 1** Service delivery in the case of Pésinet’s PSS—adopted from: [9], [14]

In September 2000, world leaders adopted the United Nations Millennium Declaration. This declaration is about committing to a new global partnership to alleviate extreme poverty and fulfilling time-bound targets with a deadline of 2015. These targets are known as the Millennium Development Goals (MDGs). One of the MDGs is to reduce child mortality. The changes of state, attributed to the Pésinet’s PSS in Mali, can be interpreted as a step towards achieving the MDG of reducing child mortality.

In the case of the Pésinet’s PSS in Mali, the UNDP study identified that the PSS addressed the following main issues—‘physical infrastructure’ (e.g., limited access to healthcare facilities) and ‘knowledge and skills’ (e.g., poor or no literacy). The study identified that the strategies used in the PSS design were: ‘adapt products and processes’ (e.g., use of mobile phones to transmit weight reading of a child), ‘leverage the strengths of the poor’ (e.g., involvement of local women as Pésinet representatives), and ‘combine resources and capabilities’ (e.g., partnership with Alcatel-Lucent and Orange, two French schools, a drug distributor and a local NGO).

## 5 Salient Characteristics of PSS Design at the BoP

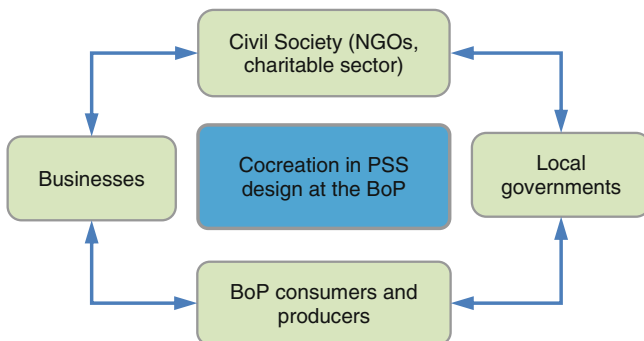
Vasantha et al. [15] review of PSS design methodologies shows that the PSS design is still in initial stages of development, and that the PSS research is not mature. While most of the studies in the PSS are focused on developed countries, much less work has been carried out in the PSS at the BoP. Based on our literature review in the area of the BoP, we can note some salient characteristics of the PSS design at the BoP.

The PSS design in mature and developed country markets is driven by factors such as: customers want availability or capability rather than the purchasing of physical artefacts [16]; companies can establish long-term relationship with customers [17]; companies can obtain improved knowledge regarding the product use [18]; and growing concerns for the environment. Furthermore, a key criterion for evaluating the PSS in these markets is user experience. In contrary, at the BoP, addressing the complexly intertwined issues requires integrated solutions in the form of the PSS. One of the key aims of the PSS design at the BoP is to alleviate poverty through economic, environmental, and social development. The PSS at the BoP needs to be evaluated using criteria such as: satisfaction of un-met or under-served needs of the poor, increase in their income, a step towards the achievement of one or more of the MDGs, etc.

Cocreation and combining resources and capabilities of different partners including the poor people and non-traditional partners such as NGOs and charitable sector play a crucial role in the PSS design at the BoP (see Fig. 2). This cocreation helps in different stages of the PSS design and development such as: gaining information on BoP markets, sales, distribution, logistics, etc.

In tackling the challenges of poverty, the actors—businesses, governments, and civil society—have tended to view each other through the lens of negative stereotypes: businesses are exploitative, governments are corrupt and inefficient, and civil society is naive and ineffective [1]. The cocreation in PSS design at the BoP is in contrast to this negative stereotype. In this cocreation, the actors take a positive view as follows: businesses have resources and are efficient; governments have the power; and civil society has passion and energy.

Jagtap et al. [11] analysed the data available in the UNDP study to gain quantitative findings on the issues and strategies in PSS design at the BoP. They analysed the data on 48 cases from the UNDP study. One of the key findings of their analysis is that—in the PSS design, the strategy ‘combine resources and capabilities’ is predominantly used. 65 % of the 48 cases have used this strategy in PSS design.



**Fig. 2** Cocreation in PSS design at the BoP

Jagtap et al. [11] analysis of the data available in the UNDP study shows that the issue ‘knowledge and skills’ has frequently been addressed in the PSS design at the BoP (79 % of 48 cases). This suggests that this issue is ubiquitous in the BoP. This can be attributed to the prevalent lack of education in the BoP. Although, the field of education appears to be the responsibility of governments, the businesses have generally not used policy dialogue with the governments to address the issue ‘knowledge and skills’. Instead, they have prominently used the strategies ‘invest in removing market constraints’ and ‘combine resources and capabilities’ to address this issue.

## 6 Summary and Conclusions

One of the promising approaches to tackle the wicked problem of poverty is business development combined with poverty alleviation. In this approach, integrated solutions are necessary in order to address diverse issues in the BoP. These integrated solutions are in the form of PSS rather than the conventional product-oriented or service-oriented solutions.

In this paper, we explored different issues that need to be addressed in the PSS design at the BoP. These issues are: ‘market information’, ‘regulatory environment’, ‘physical infrastructure’, ‘knowledge and skills’, and ‘access to financial services’. We have also explored strategies used in this PSS design. These strategies are: ‘adapt products and processes’, ‘invest in removing market constraints’, ‘leverage the strengths of the poor’, ‘combine resources and capabilities’, and ‘engage in policy dialogue with governments’.

We have explained these issues and strategies by using a case drawn from the UNDP study. This case is about a project where a for-profit company, Afrique Initiatives, used ICTs to monitor health conditions of children from low-income families in Mali.

In some aspects, the PSS design at the BoP appears to be different from that in the mature and developed country markets. The PSS design at the BoP is driven by the need to address complexly intertwined issues in the BoP markets. A key criterion for evaluating the PSS in mature and developed country markets is user experience. In contrary, the PSS at the BoP needs to be evaluated using criteria such as: satisfaction of un-met or under-served needs of the poor, increase in their income, a step towards the achievement of one or more of the MDGs, etc.

Cocreation and combining resources and capabilities of different partners including the poor people and non-traditional partners such as NGOs and charitable sector play a crucial role in the PSS design at the BoP. It is important to understand the process of PSS design at the BoP, and this can be an area of future research. The issue ‘knowledge and skills’ is prevalent in the BoP. This issue needs to be addressed in the PSS design, and can pose challenges is cocreation of PSS with the BoP people. There is a need of simple and easy to use methods and tools that can help in the cocreation of PSS with the semiliterate or illiterate BoP people.

**Acknowledgments** This work was partly financed by VINNOVA within the Product Innovation Engineering program (PIEp).

## References

1. Karnani A (2011) *Fighting poverty together: rethinking strategies for business, governments, and civil society to reduce poverty*. Palgrave Macmillan, New York
2. Yunus M, Weber K (2007) *Creating a world without poverty: social business and the future of capitalism*. Public Affairs, USA
3. de Soto H (2010) *The mystery of capital: why capitalism triumphs in the west and fails elsewhere*, New York: Basic Books
4. Prahalad CK (2004) *The fortune at the bottom of the pyramid: eradicating poverty through profits*. Wharton School Publishing, NJ
5. Prahalad CK, Hart SL (2002) The fortune at the bottom of the pyramid. *Strategy and Business* 54–54.
6. Karnani A (2007) Misfortune at the bottom of the pyramid. *Greener Manage Int* 51:99–110
7. Kandachar P, Halme M (2008) Farewell to pyramids: how can business and technology help to eradicate poverty? In: Kandachar P, Halme M (eds) *Sustainability challenges and solutions at the base of the pyramid*. Greenleaf Publishing Limited, Sheffield
8. Jagtap S, Kandachar P (2010) Representing Interventions from the base of the pyramid. *J Sustain Develop* 3(4):58–73
9. UNDP (2008) Creating value for all: strategies for doing business with the poor. Available from: <http://www.growinginclusivemarkets.org/reports>
10. Jagtap S, Kandachar P (2011) Design for the base of the pyramid: issues and solutions. In: *International conference on research into design (ICoRD '11)*, Bangalore, India
11. Jagtap S, Larsson A, Kandachar P (2012) Design and development of products and services at the base of the pyramid: a review of issues and solutions. *Int J Sustain Soc (IJSSoc)* 5(3)
12. Anderson J, Markides C (2006) Strategic innovation at the base of the economic pyramid [cited 2008 21 November]; Available from: [http://www.jamieandersononline.com/uploads/ANDERSON\\_MARKIDES\\_SI\\_at\\_Base\\_of\\_Economic\\_Pyramid\\_FINAL.pdf](http://www.jamieandersononline.com/uploads/ANDERSON_MARKIDES_SI_at_Base_of_Economic_Pyramid_FINAL.pdf)
13. Keating C, Schmidt T (2008) Opportunities and challenges for multinational corporations at the base of the pyramid. In: Kandachar P, Halme M (eds) *Sustainability challenges and solutions at the base of the pyramid*. Greenleaf Publishing Limited, Sheffield
14. Pésinet [cited 2012 16 March]; Available from: <http://www.pesinet.org/wp/>
15. Vasantha GVA et al (2011) A review of product–service systems design methodologies. *J Eng Desi* 23:1–25
16. Military of Defence (2005) *Defence industrial strategy*. London: Her Majesty's Stationery Office
17. Vandermerwe S (2000) How increasing value to customer improves business results. *MIT Sloan Manage Rev* 42(1):27–37
18. Alonso-Rasgado T, Thompson G, Elfström B (2004) The Design of functional (total care) products. *J Eng Des* 15(4):515–540