Design Considerations for Base of the Pyramid (BoP) Projects.

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Abstract

The objective of this paper is to propose a framework for the development of design projects for the base of the pyramid (BoP). Throughout this research, it is intended to give answer to the following working hypothesis: from design perspective, what does it means to develop products, services and services systems (PSS) for the BoP, with superior quality with respect to sustainable development values? What kind of strategies and design methodologies should be adopted for the design and development of this kind of projects? What is their profile taking into account functional, aesthetics, economic, cultural and environmental performance premises involved? A proper answer to those questions may facilitate guidelines definition for project development. Also, it will be possible to identify a set of proper tools and methods, as well as precise assessment criteria and evaluation systems, in terms of environmental and social impact.

KEYWORDS: sustainable product design; design for the base of the pyramid; sustainable design innovation

Introduction

Many regions of the world are experiencing a period of rapid economic growth and evolving into a transitory phase between developing and developed status. Whilst the benefits of economic development in emerging economies such as Brazil, Russia, India, China, and South Africa cannot be denied, they also imply an enormous increase in environmental and social impacts, such as, a rapid depletion of natural resources in order to satisfy the fast growing market's demands (Kandachar, 2010).

As the concept of sustainability is broadening, the role of the designer is extending beyond straightforward problem solving. Instead of focusing on the design of more environmentally benign products and processes, designers are challenged towards complex design thinking. Design can be a key enabler to foster change towards sustainability. However, it is necessary to understand how to address project development in order to attend the demands of the base of the pyramid (BoP), composed by more than 4.5 billion people with limited access to

products and services to satisfy their most basic needs, such as, sufficient food, adequate shelter and access to clean water (WRI & IFC, 2007; Prahalad & Hart, 2002).

The objective of this paper is to propose a framework for the development of design approaches for the BoP taking into account guidelines and requirements for project development, as well as a definition of proper tools and methods for creating sustainable products, services and service-systems.

Innovation for sustainability for the BoP

The ever-growing "gluttony" for goods and services in emerging markets seems to consistently outpace the gains in efficiency achieved along the last decades, when more sustainable design practices began to emerge. If sustainability is to be accomplished, global solutions for sustainable consumption and production are needed. Therefore, some of the approaches to design for sustainability (DfS) are not enough to provide a high quality context of life for an expected population of 9 billion by the year 2050. As it has been widely discussed, the efficiency of products and processes would need to be improved by a factors of 10 to 20 (UNEP, 2009; Kandachar 2010). This includes developing completely new products, improving the product as well as the services connected to it, and developing entirely new functional systems of products and services.

Innovation is a fundamental element in the implementation of DfS approaches. It is a broad concept usually related to a "successful implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations" (OECD, 2005). Despite being a widely accepted, this definition of innovation focuses only on the technological perspective and it doesn't consider the implications of introducing or improving a new product or process into a specific cultural context. By not taking into consideration those aspects may lead to the rejection and failure of any proposal, no matter how advanced or how environmentally friendly it might be (Jacobs, 2007).

Since innovation for sustainability entails changes at both technological and cultural levels, we adopt a more comprehensive definition. As stated by Wijnberg, innovation is "something new, which is presented in such a way that the value will be determined by the selectors" (2004). Within this perspective, selectors can be, for example, the users of a service whose values are defined by the cultural context they belong to. This context functions in relation to a complex system of tangible and intangible norms an values that is not always easy to interpret in terms of design requirements, for example.

Approaches such as, Eco-redesign, Cradle to Cradle, Biomimicry, Life Cycle Assessment, Product-Service Systems, and Creative Communities, can be considered different forms of innovation for sustainability. According to the definition proposed above, the success of any these DfS approaches resides in the potential to promote changes not only in technological terms –technological dimension– but also the capacity to foster new behaviours and consumption patterns at the socio-cultural level –socio-cultural dimension, (Manzini & Vezzoli, 2005), resulting in a broad offering of possibilities of environmental and social benefit (Brezet,1997).

We propose the following categorisation of different DfS frameworks according to the potential to trigger incremental or radical changes in technological and socio-cultural terms (figure 1). The T axis corresponds to the technological dimension and the C axis to the

socio-cultural dimension of innovation. Each DfS framework is positioned according to the material and energy inputs it requires; for instance, if the product of technological change (T) and socio-cultural change (C) implies a reduction of 90% in the use of natural resources and energy, the framework can be considered sustainable. The resulting hyperbola SL = T x C represents the sustainability limit, and each framework is located above or below the curve according to the SL condition.

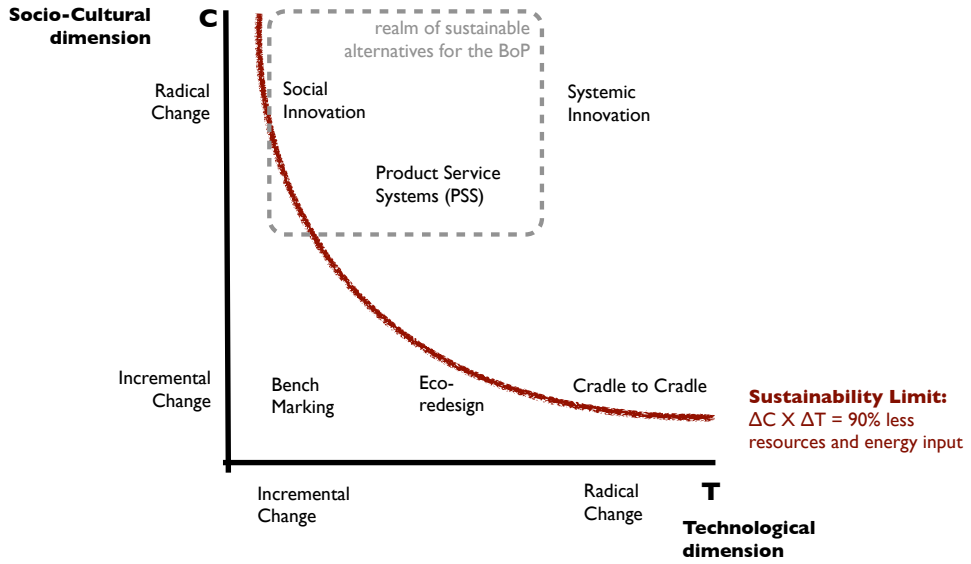

Figure 1: DfS frameworks according their level of cultural or technological change. Adapted from Manzini & Vezzoli, 2005.

Looking at the technological dimension, it can be said that Benchmarking and Eco-design approaches fall behind sustainable requirements for the BoP context, while Cradle to Cradle can be considered a sustainable option only in the long term. Benchmarking and Eco-design alternatives, despite of being positive approaches in terms of environmental and social impact, don't necessarily convey a shift on user's behaviour of consumption, and they also depend on high influxes of materials and energy along the life cycle, for example. Conversely, Cradle to Cradle (Mc Donought & Braungart, 2002) regardless of being a sustainable approach for the BoP, requires considerable research efforts and investments to develop new technologies for materials and products to circulate in closed, technical or biological loops, at the end of the life cycle, reducing drastically the impact on the ecosystems.

On the other hand, approaches on the socio-cultural side of innovation rely on new forms of social organisation capable to move outside the mainstream models of living and producing, creating sustainable ways of living without necessarily depending on technological advances (Manzini, 2007). These locally based and network-structured initiatives can have a potential for BoP projects because they enable access to products and services through new business models and interaction proposals among community members. Product Service Systems (PSS), for example, entail long-term changes in both dimensions of innovation facilitating the process of socio-economic development by leapfrogging the stage characterised by individual consumption/ownership of mass-produced goods in favour of a low resource intensive, service economy (Tukker & Tischner, 2004). Also, PSS are forms of social construction based on "attraction forces" (such as goals, expected results and problem-solving criteria), which catalyse the participation of several stakeholders in a value co-production process (Morelli, 2006).

Strategic approaches to innovation for the BoP

What does innovation mean within the context of design for the BoP? The following example may help to describe better what the concept is about: Regarding the development of lower extremity prosthetics, researchers at the Massachusetts Institute of Technology (MIT) developed the Powerfoot BIOM, an advanced model of prosthesis, equipped with small motors and electronic sensors that reproduce in a natural way the work of muscles and tendons (Stefanovic, 2009). With a cost of about US $ 25000, the Powerfoot BIOM becomes a remote possibility for 85% of the over 20 million people who suffered amputation in tragedies such as wars and diseases worldwide. Alternatively, in India a wooden prosthesis of vulcanised rubber has been developed. The Jaipur Foot allows the user to have a life without the limitations of a wheelchair or a pair of crutches, and despite not having the same modern aspect and the capabilities of the MIT equipment, it enables the user walking and running, driving, pedalling, squatting, sitting cross legged and even climbing into trees, all this at a cost of US $40 (Prahalad, 2005).

Both, the Powerfoot BIOM and the Jaipur Foot are examples of innovation. However, at first glance, the former seems to be a more radical innovation. It is the result of a technology-driven dynamic process that introduces radical changes decurrent of new scientific developments. While the latter appears to be just an incremental innovation that emphasises minimal changes to an existing products at a low amount of investment, and a very low (financial) risk. Nonetheless, if we consider the two dimensions of innovation previously described, it is possible to formulate a more comprehensive understanding of what innovation could be for the BoP context. For example, by mapping different DfS approaches within the domain of existing and new technologies –technological dimension, and the realm of existing and new meanings –socio-cultural dimension, it is possible to generate a matrix representing three strategic approaches to innovation (figure 2), which can guide the decision making process for BoP projects. These approaches are incremental, evolutionary, and revolutionary innovation.

Figure 2: Approaches to innovation within the socio-cultural and technological perspective. Adapted from Verganti 2009 and IDEO, 2009.

Incremental innovations – lower left quadrant of figure 2, relates to solutions built on existing technologies and familiar meanings to users. This type of approach is called market-pull, and it normally derives from studying how users deal with their daily problems and proposing a solution to it (Verganti, 2009). For instance, until recently, foot prostheses were designed to merely restore basic walking capabilities. This function was often achieved with crude, non-articulating, unstable, or manually locking joints made of heavy materials, and providing basic structural support with limited function, connecting the user's residual limb to the ground. For a long time, protheses development focused on providing basic functionality and users' concerns were hardly introduced into solutions (Norton, 2007).

Evolutionary innovations are proposals based on new technology offerings or new meanings for the user. They can be either technology-driven by transforming new scientific developments into new industrial processes and products, or design-driven conveying new meanings and uses to artefacts. For instance, over the last couple of decades design has helped to create an entirely new awareness towards prostheses with sophisticated high-tech products that facilitate both mobility and a self-determined life. Natural movements are imitated with the help of intelligent technology, as in the case of the Powerfoot BIOM, where movements can get very close to those of a human leg. Also, aspects such as, appearance, cost, ease of use and maintain, durability, and size availability have been gradually incorporated in prostheses development, yet, this kind of approach still remains unaffordable for the majority of users not only in emerging economies but also in developed markets.

Conversely, revolutionary innovations or "design epiphanies" – upper right quadrant of figure 2, deal with the comprehension of subtle and unspoken dynamics in sociocultural models that results in "proposing radically new values, meanings, and languages that often imply a deep change in sociocultural regimes" (Verganti, 2009). This approach normally takes place when technological breakthroughs merge with radical meanings, as in the case of the Jaipur foot. It introduced both, technological and socio-cultural requirements in the development of an extremely low-cost limb prosthesis. As a result, the Jaipur foot has virtually the same range of movements and the closest appearance of a normal human foot. In this case, both technical and functional requirements, and user's expectations and unspoken needs, resulted in a lightweight (total weight varies between 1,3 Kg to 2, 25 Kg), and waterproof prosthesis that can be worn with shoes or without shoes depending on the desire and the need of the patients. Also, the production process is fast and efficient, making a patient only to wait one to two days to get a new limb (BMVSS, 2007).

Taking into account the three approaches to innovation, how it is possible to translate these concepts into the BoP context? As a point of departure, solutions for the BoP need to go way beyond market-pull strategies such as, packaging redesigns, reducing the durability of products, adapting products developed for other market segments, expanding distribution networks to reach the small retail, or reassessing costs and price schemes (Hart, 2008). Instead of this, solutions for the BoP need to focus on evolutionary or revolutionary innovation strategies. This means introducing new meanings and new technologies, or both, into the market. Initially, new offerings formulated with this perspective might not be as good as those used by customers in mainstream markets. They may appear particularly unattractive, often limited in function, and extremely inexpensive, as in the Jaipur foot case, but allow that a larger population of less skilled or less wealthy people can have access to products and services to satisfy their most basic needs.

However, design for the BoP is a new field and its knowledge base needs to be expanded. Since the BoP context is rather different from the one that characterises developed

economies in the diversity of the user needs, motivations, and social dynamics, new integral design methodologies and tools, which bring together user context research, business development, sustainability, and innovation are yet to be developed (Diehl, 2009).

Guidelines for approaching the BoP

BoP solutions need to be simple, functional, and potentially open-source artefacts and systems with an inherent capacity to transform human lives by enabling users to become empowered, and self-supporting entrepreneurs (Smith, 2007). To this end, it is imperative for the design team to have an in-depth understanding of the context and needs of low-income potential users to produce meaningful and creative approaches.

In order to get a better understanding of how design requirements for the BoP should be defined and addressed, we conducted a literature review of theoretical frameworks and practice-based research projects that have been introduced to BoP contexts. First, we selected published case studies describing how BoP projects were carried out: Smith, 2007; Prahalad, 2005; Kandachar, 2008; Anderson & Markides, 2006; Kandachar, de Jonhg & Diehl, 2009; Hart, 2008; ASME, 2009; and Ideo, 2009; Larsen, & Flensborg, 2011. From this data we identify design requirements that were taken into consideration by the design team during project development. After analysing and classifying the information, four inter-related clusters emerged. In figure 3 the four clusters that define integral product development for the BoP are presented:

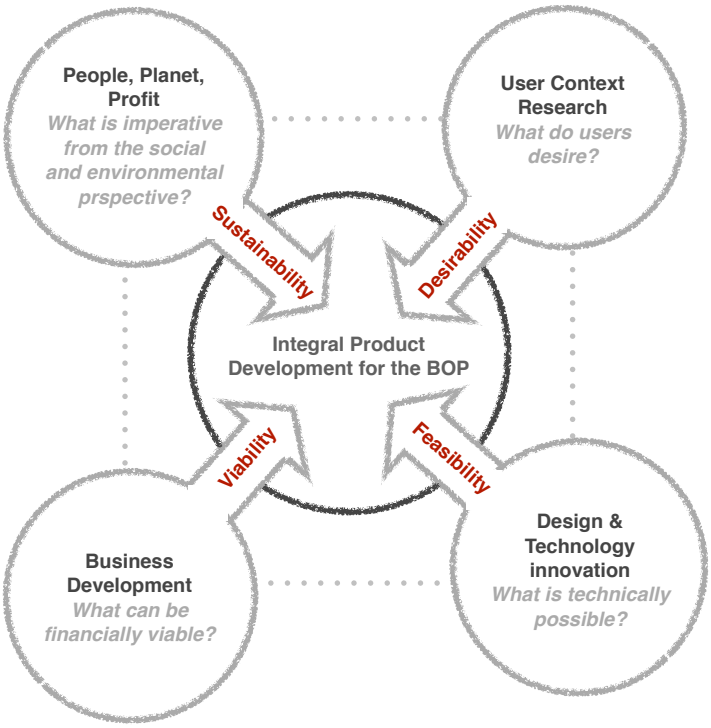

Figure 3: An integral product development approach for the BoP

Usually, BoP projects begin with a definition of requirements that determine what a user desires to satisfy its needs –desirability cluster. Following, the design team explores ways to transform promising ideas into a concrete solutions –feasibility cluster, by combining both the technological and socio-cultural dimensions of innovation previously presented. Next,

the team needs to define a reliable financial model –viability cluster– for the solution to become possible in economic terms. Finally, some of the studies call attention to the environmental and social impacts that a solution entails, and suggest sustainability cluster as an underpinning requirement for BoP projects.

In order to grasp what do people desire, it is important to get a deeper understanding of the socio-cultural context in which users are immersed. To this end, the requirements from the *desirability cluster* help to define forms of inquiring through user context research the unspoken aspects, values, and relationships that surround a specific design problem, and cannot be discovered through traditional design approaches such as, direct observation or structured interviews. Instead of this, there is consensus that BoP projects need to encourage users to participate as team members in a co-creation, user-centred approach (Smith, 2007; Kandachar, 2008; Hart, 2008; Kandachar, et all, 2009; and IDEO, 2007). Co-creation has the benefit of involving the user and producer as allies through direct engagement with professionals to create solutions that are truly responsive to their needs. This approach provides businesses opportunities to create new values among users (Kandachar, 2010). Unlike the traditional design process, where a designer comes up with a new solution to a problem after getting enough data from the user, in the BoP context, is the final user who, together with the design team helps to define the problem and proposes a possible solution to it. The designer's role is thus transformed from problem-solving into a design thinking facilitator, giving support and guiding the multi-disciplinary team through the process of finding the most suitable solution. For instance, approaches such as Participatory Rural Appraisal (Chambers, 1997), Action Learning (Revans, 1980) and Co-creation methods have proved to be very helpful during all stages of product development process (Diehl, 2009). Participatory development involves community members to identifying the challenges they face as well as the resources they have to address a challenge. In this way, developments are more responsive to the real needs of the community and better maintained once they are put into place (Smith, 2007), creating a sense of cohesion and empowerment for the community members in such a way that they get better prepared to deal with analogue future situations in a creative and autonomous way.

Once the requirements from user context are defined, it is necessary to specify the technical and organisational possibilities of the project. Feasibility relates to the principles of how to address technological requirements through design in order to formulate adequate solutions. Since technology plays a prominent role within the BoP context, technologies developed for rich markets cannot be automatically assumed to be suitable for the poor (Kandachar, 2008). To meet the needs of a BoP project, technology requirements need to be undertaken as a contextual process, the relevance of which should be assessed depending on the socioeconomic condition in which the solution is embedded (Srinivasa & Sutz 2008). Proposals need to take into consideration, for example, how to address alternatives for a hostile infrastructure, with limited manufacturing capacity and locally available resources, ease of installation and use, portability, and in many cases, human powered solutions (Prahalad, 2005, Fisher, 2007). It is also important to define requirements for this cluster according to the innovation approach (incremental, evolutionary or revolutionary) previously discussed, defining what the introduction of a new technology means for its prospective users.

Viability considers the potential of a project from a financial perspective. Requirements from this cluster need to be clearly defined in order to address the project's business model considering, for example, affordability, income generation capacity, and distribution systems of any given solution (Larsen, & Flensborg, 2011). Affordability is perhaps one of the most important requirement of any BoP project. It relates to the degree to which products or

services are reasonably priced to consumers, and it needs to be explored and defined in collaboration with the final users in order to determine what they are able and willing to pay (Smith, 2007). The affordability of a product can be explored applying specific research tools such as, price mapping, rapid market assessment, and resource flow (Anderson & Markides, 2006, Prahalad, 2006, Kandachar 2010, Larsen, & Flensborg, 2011). On the other hand, when solutions for the BoP are projected as platforms for income generation, they put users in an entrepreneurial perspective. It is a way to create empowerment rather than dependency, with solutions that can be used directly by the user not only to satisfy their own needs but also to generate new income (Fisher 2007). Distribution channels refers to the way a product or service will be delivered to enable access from the most isolated BOP communities where the solution takes place (Prahalad, 2006; Anderson & Markides 2006).

Finally, designing for the BoP means to deliver solutions to millions of users, and every product, whether or not it is designed with sustainability in mind, is going to be produced and used in an interconnected world. Since we are talking about solutions for more than 4.5 billion people, the environmental and social impacts involved along its life cycle need to be carefully addressed during project development. Sustainability criteria requires to permeate the decision making of a BoP project, and it needs to be incorporated from the very beginning of the development process, making use of the extensive DfS methods and tools already available in the literature (UNEP, 2009; Manzini, 2005; Brezet, 1997). Designers have a fundamental role in the definition of sustainability requirements, because any decision is interlinked with the requirements from other clusters, therefore, sustainability becomes the bridge between what is desirable, feasible, and viable from the environmental and social perspective as well. Since the BoP approach is a recent one and the majority of the debate has focused on the economic implications, it is important to highlight that in the projects and methodologies observed in this study, sustainability is not considered a priority for project development. A probable reason for this is that the BoP approach emerged recently, aiming at poverty alleviation and development, and it is view as an alternative to envision new ways toward identifying business opportunities, considering business models, developing products, and expanding investment (Hammond, 2007) instead of exploring sustainable ways of living. In table 1, the list of project requirements is summarised according to the four clusters described above.

Whereas the development of robust design methods for the BoP is still at a formative stage, the abundance of practice-based research cases can serve as a point of departure to define guidelines and methodological considerations. They will be explored in the next section.

clusters proponents	Desirability	Feasibility	Viability	Sustainability
Prahalad (2006)	▸ challenging conventional wisdom ▸ education of customers ▸ interfaces ▸ deskilling of work	▸ process innovation ▸ design for hostile infrastructure ▸ deep understanding of functionality	▸ price performance ▸ hybrids ▸ scalable and transportable ▸ distribution: accessing the customer	▸ conserving resources ▸ eliminate, reduce and recycle
Anderson & Markides (2006)	▸ acceptability		▸ affordability ▸ availability ▸ awareness	
Smith & Polak (2007)	▸ co-creation	▸ infinite expand ▸ miniaturization ▸ appropriate technology	▸ affordability	▸ participatory development

clusters / proponents	Desirability	Feasibility	Viability	Sustainability
Fisher (2007)	▸ ergonomics and safety ▸ cultural acceptability	▸ design for available manufacturing capacity ▸ strength and durability ▸ ease of installation and use ▸ portability ▸ energy efficient (human powered)	▸ income generating ▸ return on investment ▸ affordability	▸ environmental sustainability
Asme (2009)	▸ consider the context ▸ design for DIY (do-it-yourself)	▸ transparent technology ▸ appropriate solutions not appropriate technology	▸ embrace the market	
Kandachar (2010)	▸ user-centered ▸ co-creative ▸ multiple stakeholders	▸ adaptability ▸ reliability ▸ systemic thinking	▸ Affordability ▸ availability ▸ accessibility ▸ BoP as producers	▸ sustainable development ▸ corporate social responsibility

Table 1: Project requirements for BoP projects according to 4 design clusters

Towards a methodology framework

The number of factors influencing a BoP project can be very large. Yet designers need to take them all into consideration while searching for appropriate solutions, as they are interdependent (Kandachar, 2008). Traditional problem-solving methods, such as the ones used in industrial design and engineering design, might prove to be limited for approaching the BoP context, since they are conceived for a completely different –industrialised, technology-centred, consumer-driven – context. This might mislead the design team in proposing adequate solutions for the BoP.

From the practice-based cases considered in this study, we selected and analysed four approaches, which have been applied in the development of a wide range of BoP projects: Design for Sustainability (D4S), Human Centred Design toolkit (HCD), BoP protocol, and Market Creation Toolbox. These methods have different but complimentary approaches and they can provide a base for a comprehensive methodology framework that allows the design team to identify in a BoP project what do users desire, what is technically possible, what is financially viable and what is imperative from the social and environmental point of view.

The D4S approach is a collection of tools aimed at product redesign, new product development, and PSS creation with focus on sustainability assessment and business generation for emerging markets (UNEP, 2009). It presents unique and specific tools for addressing sustainability requirements along the process using, for instance, life cycle design, environmental impact assessment, and sustainability guidelines. It also presents specific tools related to policy formulation and business creation. However, it neither specify how to gather information from BoP users and their context, nor how to address co-creation tasks at different steps during the design process, demanding from the design team to search for additional tools and methods for user context research.

The HCD toolkit is a step-by-step guide for approaching BoP communities to create and deliver meaningful insights and ideas (Ideo, 2009). It is a human-centred design approach that guides the design team in all the phases of the process from collecting information, creating and prototyping ideas and finally delivering concrete solutions to the market. Yet,

the HCD toolkit doesn't consider sustainability issues into the process and therefore, it doesn't provide any sustainability tool or method.

The BoP protocol is an enterprise-based linear approach with focus on business co-creation. It aims at bringing corporations into close, personal business partnership with BoP communities trough mutual value creation (Hart, 2008). From the design perspective, the protocol serves more as a guideline than a methodology. Therefore it is difficult to put it into practice, since it doesn't present concrete tools to conduct the process. For instance, The protocol suggests workshops and action learning but it doesn't describe how or when it is appropriate to apply those activities in order to gather information from users or to guide the co-creation process to formulate design alternatives. Designers using the BoP protocol need to be aware that they need to incorporate their own tools to obtain concrete results.

The Market Creation Toolbox offers robust tools for understanding of end-users as well as business model dimensions of developing markets (Larsen, & Flensborg, 2011), but it doesn't suggests how to transform those ideas into concrete products or services. The method is supposed to be used from the moment the design team has already an idea or product as a reference point. As such, it is a useful approach to be used in the more advanced phases of the design process, specially to evaluate design concepts at the prototyping, testing and implementing stages. In table 2 the four approaches for BoP are compared in terms of objective, main steps, and main tools used in the process.

Method	D4S (UNEP, 2009)	HCD toolkit (Ideo, 2009)	BoP Protocol (Hart, 2008)	Market Creation toolbox (BIDD, 2011)
Objective	Product and PSS creation for emerging markets	Creating solutions for the BoP	Co-invention and business co-creation in partnership with BoP communities	Business model development for emerging markets
Focus	Sustainability and business creation	Human centered design	Co-creation and mutual -value building	Participatory market research
Main Steps	1. Policy formulation 2. Idea Finding 3. Strict Development 4. Realization and follow-up	1. Preparation 2. Hear 3. Create 4. Deliver	1. Pre-field process 2. Opening up 3. Building the ecosystem 4. Enterprise Creation	1. Rapid market assessment 2. Understanding end-users 3. Determining the distribution system 4. Pricing and financing 5. Marketing and communication 6. Service and maintenance
User context research tools		▸ Individual interview ▸ Group interview ▸ In context immersion ▸ Self-documentation ▸ Community-driven discovery ▸ Expert interviews ▸ Participatory co-design ▸ Emphatic design	▸ Participatory workshops ▸ Role playing ▸ Group field visits ▸ Action learning ▸ Social and institutional mapping ▸ Participatory photography	▸ Deep dialogue ▸ Self documentation ▸ Activity map ▸ Social map ▸ Ranking values

Method	D4S (UNEP, 2009)	HCD toolkit (Ideo, 2009)	BoP Protocol (Hart, 2008)	Market Creation toolbox (BIDD, 2011)
Sustainability Tools	▸ Benchmark ▸ D4S Impact matrix ▸ D4S strategy wheel ▸ Life cycle assessment ▸ Sustainability SWOT ▸ Sustainability guidelines ▸ Sustainability radar			
Design tools	▸ Morphological box ▸ Brainstorming ▸ System maps ▸ Blueprints	▸ Personas ▸ Brainstorming ▸ Prototyping ▸ Innovation pipeline	▸ Prototyping ▸ Brainstorming	▸ Follow and observe ▸ Learning by doing ▸ Scenarios ▸ Prototyping ▸ Concept assessment
Market assessment tools	▸ SWOT analysis ▸ Innovation funnel ▸ Bricolage ▸ Business plan ▸ List of specifications	▸ Viability assessment ▸ Implementation plan ▸ Learning plan	▸ Community contests	▸ Resource flow ▸ Costumer Segmentation ▸ Price mapping ▸ Product in market

Table 2: Synthesis of four different methodological approaches for the BoP

The four analysed proposals are based on traditional problem-solving, prescriptive models. They encourage designers to follow systemic procedures where the design problem is supposed to be fully understood through intensive analytical work preceding the generation of solution concepts. (Cross, 2000). As a result, the models tended to suggest a basic structure of three main steps to the design process – analysis, synthesis, and evaluation, where specifications logically derive from problem definition, generating several design concepts by prototyping and testing diverse solutions and making a rational choice of the best alternative.

What differs from traditional design methods, however, is the extensive use of qualitative user context research tools for gathering and analysing information. Qualitative methods such as ethnography, participatory rural appraisal, social mapping, and grounded theory, can help unveil people's social, political, economic, and cultural opportunities and barriers in their own words. (IDEO, 2008). In most cases, qualitative research has been adopted from social sciences and social applied sciences, and despite some criticism (Morse, 1994), the tools have proved to be powerful for analysing and mapping the relational dynamics between people, places, objects, and institutions.

Another characteristic of the BoP approach is the engagement of users along the design process. Co-creation is a way of involving users and the design team to mutually create value. In this approach, the designer's role changes from problem-solving to design thinking, guiding a multi-disciplinary team in the decision-making process. The involvement of the user implies the building of trust and partnership among team members, a not so easy task due to the socio-cultural differences and constrains of BoP projects. Therefore, to facilitate the decision-making, the design process needs to be flexible, allowing the team to closely examine options in every step. This suggests the need of iterative phases, where it is possible for the team to rapidly review and evaluate every decision taken along the process to adjust the design objectives whenever necessary.

Taking into consideration the four clusters for integral product development for the BoP, we formulated a design methodology framework, which can be used for the creation and implementation of products and services in the context of emerging economies. Figure 4

presents a proposed methodological framework and a compilation of tools that have been extensively used along the design process of products and services for the BoP:

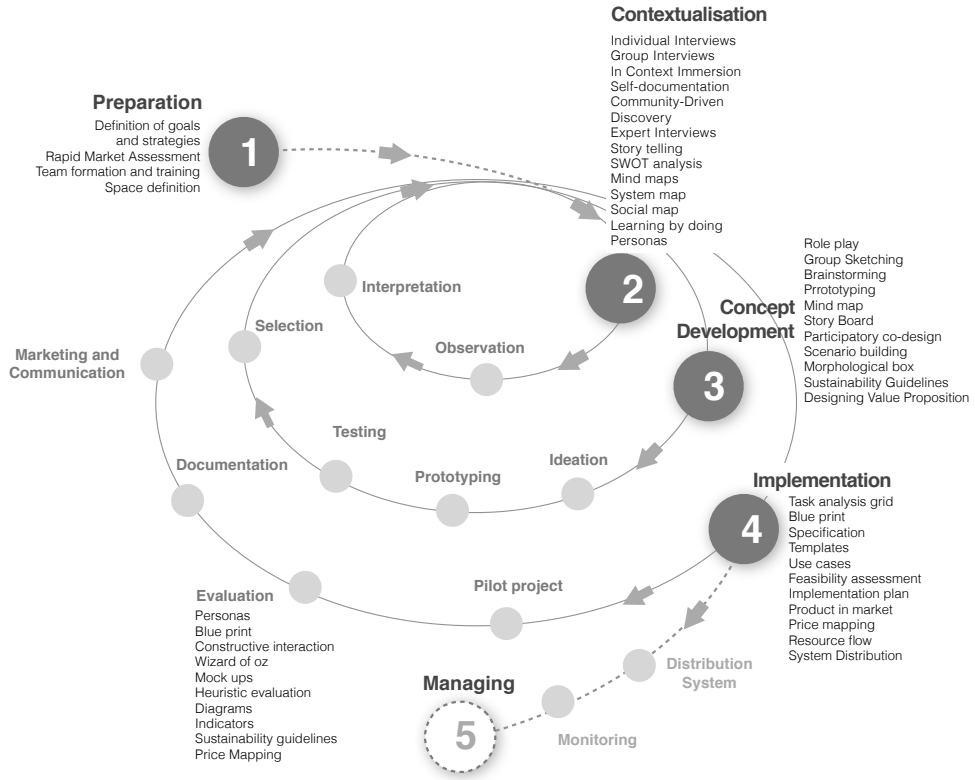

Figure 4: Proposed methodological framework and tools for the BoP.

The process encompasses five iterative steps as well as a list of tools necessary to guide the design team from finding and defining a problem until the delivery of a robust and tested solution. The five steps are:

1. **Preparation:** Before starting any design project it is necessary to define the team members, the design objectives and strategies, the community partners, and the time schedule and space required to develop and deliver a solution.
2. **Contextualisation**: Through the use of extensive qualitative research methods, the design team develops deep empathy for people they are designing for in order to inspire new solutions. At the early stage of the process, research is generative, used to inspire imagination and inform intuition about new opportunities and ideas. In later phases, these methods can be evaluative—used to learn quickly about people's response to ideas and proposed solutions.
3. **Concept development:** As a result of a co-creation process, the team will be able to find ideas, select the most promising ones, and detail design concepts. In this stage, the collected data starts to make sense for defining possible products and services opportunities as well as prototyping, testing and evaluating initial solutions.
4. **Implementation:** Once the design team has created many desirable alternatives it is necessary to move towards the implementation of the most feasible and viable solution. One of the objectives is to create a full business model using small-scale tests and continued action learning.

5. **Managing:** Before a solution is delivered to the market, it is important to foresee its post-consumption aspects, not only from the business perspective but also from the sustainability point of view. For instance, in the case of service-oriented solutions it is necessary to define the distribution system and monitoring of the service in the long term. In the case of product-oriented solutions, on the other hand, it is necessary to define the maintenance of the product as well as its (re) integration into technical or biological loops at the end of the life cycle (Mc Donought & Braungart, 2002).

Conclusion

Traditionally, when a company decides to develop a product or service for a new market, the process usually begins with the identification and analysis of the existing reference system through market assessment or feasibility studies, for example. Applying such tactics have prove to produce efficient results in matured markets, but in the BOP context, gathering information can be a very complicated task. Indeed, it is through user context research that the process of analysing and mapping the complex dynamics between people, artefacts and context becomes understandable. Yet, conducting such a process and arriving to deeper, more nuanced understanding of a complex problem might consume time and money, resources that in most cases can be scarce. Such constrains forces the design team to adapt and use qualitative methods in a "quick and dirty" way to gather and analysing data in order to transform it into comprehensive solutions.

Creating meaningful solutions for the BoP requires a systemic approach based on evolutionary or revolutionary innovation strategies that introduce not only new technologies but also new meanings to end-users. Such innovations might trigger more sustainable consumption behaviours and practices. Therefore, given the particular characteristics of the BoP context, instead of focusing on products, designers need to envision new ways to satisfy user's needs through product-service systems. PSS encourage long-term socio-cultural changes facilitating the process of socio-economic development by leapfrogging the stage of individual consumption/ownership of goods in favour of a low-tech, low resource intensive service economy.

Co-creation is underpinning requirement for a comprehensive design process. It creates a deep sense of community bonding and cohesion that helps to envision solutions that are truly responsive to the community needs. Co-creation has the potential to transform human lives, catalysing the participation of stakeholders in a value co-production process that empowers users to define what they want to satisfy their needs; to transform promising insights into a concrete, meaningful design solutions; to understand what is financially viable; and to learn why sustainability is important for a BoP project, in the long term.

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