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SOME INDICATIONS FROM RESEARCH ON USER INVOLVEMENT IN DESIGN FOR BASE OF THE PYRAMID (DFBOP)

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ABSTRACT

According to the World Bank, there are 4 billion people living on an income less than US$3 per day and 1 billion living less than even US$1 per day. This part of the population is often called "Base-of-the-Pyramid" (BoP). BoP is a definition of user and consumer group in product design science. This paper discussed difference between BoP self design action: Grassroot Innovations Approach (GIA) and current professional Design for Base of the Pyramid (DfBoP) cases. User involvement is considered as a major way to access new innovations on design approach. The purpose of this article is to give a message to Professional Designers (PDA) who want to design for/with BoP (a) GIA is different from PDA (b) GIA is challenging, but not yet well understood and, (c) research is needed to understand GIA.

Keywords: Design for Base of the Pyramid (DfBoP), product design, Grassroot Innovations Approach, Professional Design Approach

1 INTRODUCTION OF BASE OF THE PYRAMID (BOP)

World Bank estimates that there are 4 billion people living on an income less than US$3 per day and 1 billion living less than even US$1 per day. This part of the population is often called "Base-of-the-Pyramid" (BoP). Most of BoP is living in developing countries including Africa, India, China and Brazil, and so on.

The initial reminiscence about BoP is from U.S. president Franklin D. Roosevelt in his April 7, 1932 radio address, *The Forgotten Man*, in which he said "These unhappy times call for the building of plans that rest upon the forgotten, the unorganized but the indispensable units of economic power...that build from the bottom up and not from the top down, that put their faith once more in the forgotten man at the bottom of the economic pyramid." The more current usage was first defined in 1998 by Prahalad and Hart (2002), who suggested that there is a fortune to be made for entrepreneurs in BoP initiatives, while at the same time great opportunities for the world's poor to escape from poverty. Prahalad's book 'The Fortune at the Bottom of the Pyramid' (2002) proposes a framework for the active engagement of the private sector and suggests a basis for a profitable win-win engagement. He argues that all that is stopping business from designing products and services to meet the needs of the world's poor, and then efficiently manufacturing and distributing them is human ingenuity - innovation. The topic has unleashed an extensive and generally enthusiastic response from academics, businesses, NGOs and governments.

The faculty of Industrial Design Engineering, Delft University of Technology (IDE/TU) has been carrying out design exercizes with and for BoP since several years resulting in around 50 design projects on different sectors including education, health, food & nutrition, water, energy, housing, materials, connectivity, designing & tools and entrepreneurship. These designs are termed in this paper as "Design for Base of the Pyramid (DfBoP)".

2 GRASSROOT INNOVATIONS APPROACH (GIA) FROM BOP AND PROFESSIONAL DESIGN APPROACH (PDA)

At the first sight, it seems a puppt proposition that “BoP have more innovative contributions than professional designers”. Generally speaking, the education and skill of BoP is barren and then the contributing possibility of industrial innovation of BoP should be low. However, many cases of BoP industrial innovation could be found on the website or newspaper. (Figure 1 are some industrial innovation examples by BoP from website)

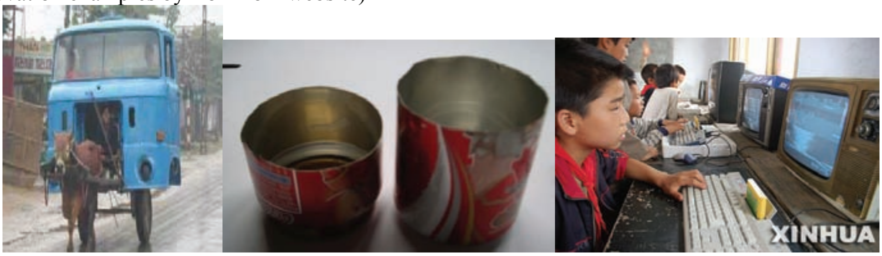

Figure 1: BoP industrial innovation examples from website (From left to right)

a. To solve traffic problem in rain, rural Chinese of Yunnan province invent new traffic tool: scalper-truck
b. Free self-making Can ashtray is very common in rural areas of China and India for family smokers
c. To help students of village school to learn computer skills in Guizhou province, China, local teachers design simplified computers with out of date black TV and second hand self-learning devices.

This kind of industrial innovation is called Grassroot Innovations (GI), while the innovation approach of BoP is named Grassroot Innovations Approach (GIA). After a simple comparison between GI case and Professional Design (PD) cases (Experience from IDE/TUD), some features of “GIA” could be conducted roughly as:

1. The motivations of GI are not market-driven or technology-driven, but need-driven. Obvious needs such as transporting, energy or water could be found in many cases
2. The design ideas of GI are completely based on local experience. The sources of idea generation are from local context. (E,g. Cola can is easily be collected after use or from garbage)
3. The process of GIA lacks of sharp directions or systematic steps and so is difficult to be concluded. BoP users are not educated professional designers but sometimes they are capable of finding the short and quick path from requirements to solutions. However, the process of their innovation is not follow Professional Design Approach (PDA) such as Pahl and Betiz (1980) or Roozenburg and Eekels (1998), and somewhat expend current design methodologies through observation.
4. The successful solutions of GI are easy to be accepted and copied by local residents. Generalization of solutions or upscaling are not aimed at in these cases.

As a result, GI provide a challenge for scientists and for professional designers who are interested in BoP cases.

3 USER INVOLVEMENT

The initial research in IDE/TUD about user’s contribution in DfBoP is started from 2003 through design cases, which is defined as “User involvement of DfBoP cases” or “Design with BoP”. The previous view of points about user involvement of DfBoP includes “Local users provide context information, which help designers to confirm product requirements” and “Local users are evaluators of each design step”. The term “Co-design” has been used frequently as one innovation definition to achieve user involvement in DfBoP design. For example, in the cooperation DfBoP project “Safe Drinking Water for rural India” by IDE/TU and Domestic Appliances of Philips (DAP) in 2005, a group of women living in rural Bangalore were invited to attend the design process as evaluators as Figure 2.

Figure 2: Local mothers in rural Bangalore are choosing preferred concept, one of three concepts based on current products

It is without doubt that user involvement or Co-design is important in DfBoP, but it is not yet clear about "What extent does user involvement affect DfBoP?" After DfBoP practice in BoP countries, the design thinking of "Driving creative creation" start to be surface slowly.

Before exploring the role of "Creative creation" in DfBoP projects, there are two sub-questions should be answered at the first.

3.1 Function of user involvement

The first question is that "What kind of function does user play in a product design process? " Recently, it is not clarified the functions of user involvement for DfBoP in the basic design cycle such as Roozenburg model (1998) or fishtrapmodel (2006).

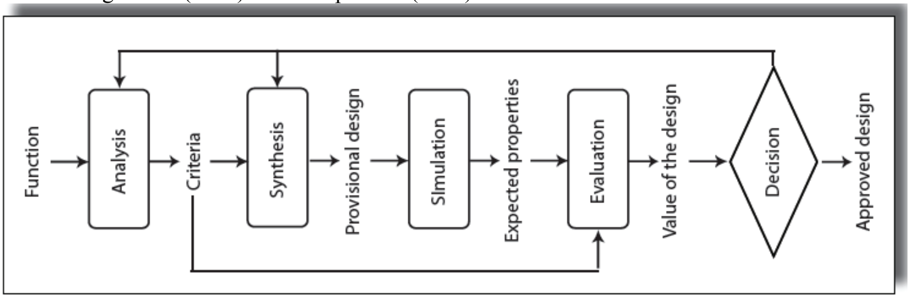

Figure 3: The basic design cycle of Roozenburg model

Figure 3 is the basic design cycle from Roozenburg model, which is used very often in DfBoP projects within IDE/TUD, and there are five stages in this model (Hoog etc, 2008):

- Analysis- The point of departure in product design is always the function of the new product: the intended behaviour in the widest sense of the word. Not only the technical function, but also the psychological, social, economic and cultural functions that a product should fulfil. In the analysis phase the designer forms an idea of the problems around such a new product idea (the problem statement) and formulates the criteria that the solution should meet (the design specification). Essential to any problem definition is a goal: in defining a problem, one will have to form an image of a future situation, which is to be prefered to the present one.
- Synthesis- The second step in the basic design cycle is the generation of a provisional design proposal. The word synthesis means the combining of separate things, ideas, etc., into a complete whole. Synthesis is the least tangible of all phases of the cycle, because

human creativity plays the most important part. But the origination of ideas cannot be localized in a particular phase of the basic design cycle: the synthesis step is only the moment of externalization and description of an idea, in whatever form (verbally, sketch, drawing, model, etc.)The result of the synthesis phase is called a provisional design; it is not yet more than a possibility, the value of which can only become apparent in the later phases of the cycle.

- Simulation- Simulation is a deductive sub-process. Simulation is forming an image of the behaviour and properties of the designed product by reasoning and/or testing models. Here, the whole array of technological and behavioural scientific theories, formulae, tables and experimental research methods is available to the designer. Yet, in practice many simulations are based merely on generalizations from experience. Simulation leads to expectations about the actual properties of the new product, in the form of conditional predictions.
- Evaluation- Evaluation is establishing the value or quality of the provisional design. To do so, the expected properties are compared with the desired properties in the design specification. As there will always be differences between the two, it will have to be judged whether those differences are acceptable or not. Making such a value judgement is difficult, for usually many properties are involved.
- Decision- Then follows the decision: continue (elaborate the design proposal or manufacture it) or try again (generate a better design proposal). Usually the first provisional design will not be a bull's eye and the designer will have to return to the synthesis step, to do better in a second, third or tenth iteration. But one can also go back to the formulation of the problem and the design specification. Exploring solutions appears to be a forceful aid to gaining insight into the true nature of a problem: one might therefore often want to adjust, expand, or perhaps sharpen up the initial formulation of the problem. The design and the design specification are thus further developed in successive cycles and in a strong interaction, until they fit one another.

To explain the action of BoP user in Figure 3, totally 24 DfBoP cases within IDE/TUD have been chosen for case studies, and most of them are organized as master graduation projects, which are about 30 academic weeks (6 months). The students (design groups) will finish different tasks of a product development process according to different needs from industrial partners (MNCs, NGOs and local companies). (Table 1) All cases are happening in developing countries such as India, China or Africa and design fields including water, health, energy and so on.

Through observation from project reports, user involvements have been found in all cases and the actions are organized by using six methods: brainstorm, interview, context mapping, questionnaire, experiment and comparison. The statistic result of user involvements in DfBoP cases has been displayed in Figure 4.

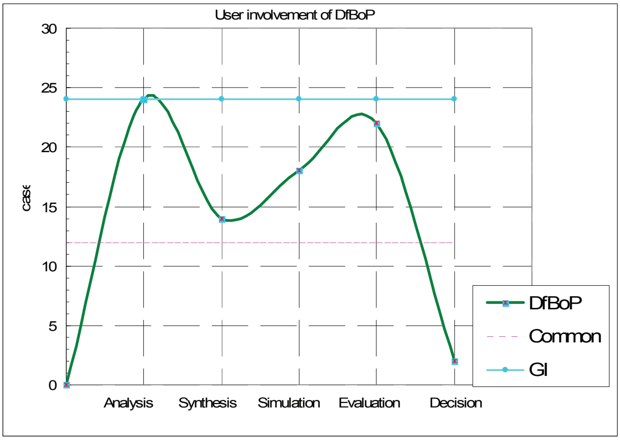

Figure 4: The result comparison among current DfBoP cases, common and GI

The Figure 14 is based on empirical research: the green line is fitted from 24 case statistic result, the blue line is the result of "GI" (or they could be called complete user involvement), and the pink line is the arithmetic mean of common design cases. The statistic result showed that in DfBoP cases, the importance of "user involvement" has been aware by designers in DfBoP. The actions of "user involvement" are concentrated on "analysis", "simulation" and "evaluation", but less in the "decision". Although the number of DfBoP cases, as well as design methodology, is limited in this paper, the indication of user involvement about process in DfBoP is achievable. In the next step, some experiments will be set up to test the relationship between the actions of user involvement and design outputs in DfBoP.

3.2 Context of user involvement

The second question is that "What kind of design context does user provide in DfBoP? " Local context, as the fundamental of DfBoP, has been mentioned in DfBoP research papers such as Stuart (2002) and Kandachar (2006). And Kandachar proposed that DfBoP may start from user context. It is understandable that "You are the person who knows yourself best". But it is trouble to induct factors from context because most of them are dependent variables and immeasurable (This problem is also met in common product development). Kandachar(2007) concluded that DfBoP contexts are including four aspects of science: society, technology, market and management, while these contexts are sourced from user data.

To get the deeper understanding of user involvement in DfBoP, some important DfBoP design related factors have been assumed (Jiang, 2009) through 24 case studies. The frequency of user involvement has been shown in table 2. Key words index has been used as the statistic method.

As an initial result, it indicates the possibility of more user involvement actions in these design factors.

4 DISCUSSION

4.1 The role of GIA

Compared with standard western design approaches, GIA of BoP seems specific, simple, sufficient and even sustainable. As a complete user involvement design action (without professional designers), GIA indicates another design approach: is it possible to drive GI, add technology and market factors and result in new innovations? There are indications that this is possible. For example, the idea of Can ashtray had been from Chinese local designers, and they re-design the technical parameters and sell it in local market even foreign markets. (Figure 5)

Figure 5: The example of re-design of Can ashtray

Although the GI is not the main stream of product design, the design thinking about "the role of GI" had been started, which is initially from DfBoP.(Jiang and Kandachar, 2009) Figure 6 showed design map based on the level of user involvement.

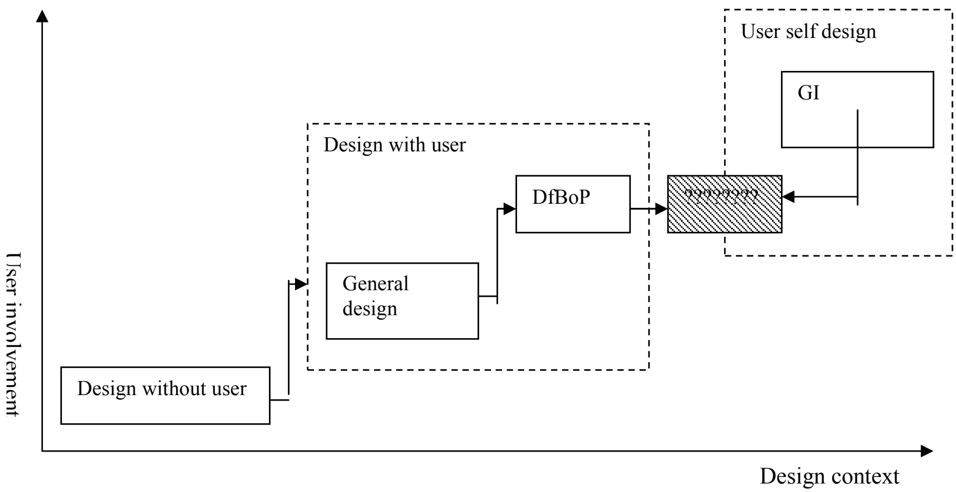

Figure 6: A possible design map with user involvement

Through the result of section 2, DfBoP belongs to "design with user" but in the middle of general design and GI. Because of the existing of GI, it seems possible to explore new design type (and definition), which interacts between "Design with user" and "User self design". (The shadow of Figure 6)

4.2 Debate: open innovation and driving GI

It is still under debate about the contribution of BoP GI for product design science, which is defined as "open innovation with BoP" (Belz, 2008). Also the assumption of driving GI is in hypothesis stage. The assumptions about driving GI (or open innovation) include two parts:

1. Predigest design process and involve users into synthesis and decision
2. Get experience from BoP directly about important design related factors

As a result, the progress of “drive” is the progress of “learn” as well. Actually, more case studies and more new design research topics are needed in this issue, before get better ideas to light minds. For instance (a) does new technology of Participatory Sensing help in understanding users at BoP? or (b) Which characteristics enable users to contribute to the innovation process? (Lettle and Herstatt, 2004)5 Case of four domain model: “Adoptable woodstove in rural India”

5 CONCLUSION

The four domain model proposed seem to work sufficiently in DfBoP projects carried out at IDE/TUD. But knowledge gaps identified in problem statement cannot be addressed completely yet. The major reason is that current framework is general and concrete protocols and algorithms are needed in practical cases. Even though some efforts have been done by researchers in IDE/TUD, it is still a long distance to understand all rules of DfBoP.

On the other hand, it is still under debate that do we need to develop new theories and methodologies for BoP specifically? Perhaps the 4 billion potential users have their own solutions; the research on DfBoP is not only about “Design for sustainability” but also about “Design for future generations”.

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Company	Title	Date	Education	Health	Food/nutrition	Water	Energy	Housing	Material	Connectivity	Design/tools	Entrepreneur	Product Designer	Country
Helps International	Improving the climate of cooking area	2006/06		+	+		+	+					Marike Bijtelaar	Guatemala
NPSP Composieten	Natural Fibers in doors and windows	2005/10						+	+				Joan Boekhoven	India
Ecofys/Kamworks	Solar lighting	2005/10					+						Stephen Boom	Cambodia
Vestegaard Fransen	Personal water purifier	2006/04	+	+		+							Roelie Bottema	Ghana
Bosch/Siemens	Product service system for plant oil stove	2006/07		+	+		+						Elselien Epema	Philippine s
INBAR	Human powered splitting tool	2006/06					+		+			+	Willem Glasbergen	India
Impact	Support tool for village doctors	2006/09	+	+						+			Marion de Groot	China
Philips healthcare	Screening device for oral cancer	2005/11		+									Suzanne Hendrikse	India
Philips Research	Design of a malaria diagnosis	2006/08		+									Cathelijne Huis	India
Philips Apptech	Adoptable woodstove	2006/04		+	+		+					+	Leonie Ideler	India
Movendi/ MAK-D	Tricycle for disabled entrepreneurs	2006/07		+								+	Integral Design Project	Ghana
EYE, Padan	Reeling machine for silk farmer	2006/11							+			+	Annemarie Mink	India
Philips Apptech	Safe drinking water	2006/4		+		+							Maria Nguyen	India
Philips Design	Contextualizing products	2006/2		+							+		Jon Rodriguez	India
Philips healthcare	Creating market insight	2005/12		+						+	+		Jonathan Stranders	India
Micorsoft	Online Microfinance	2006/02								+	+	+	Cale Thompson	Africa
Philips Appetch	Adoptability of the U-Specs	2005/10	+	+							+		Roseliek van der	India
TU	Water supply in slums	2006/04		+		+		+				+	Fernando Del Caro	Brazil
ECOFYS	Rural Energy system	2008/04	+				+	+				+	Caluwe de	Africa
Phillips Apptech	Cooking in rural China	2007/06		+			+				+		Chang	China
Phillips Apptech	Safe drinking water for China	2007/06		+		+			+				Hoi-kee	China
Intel healthcare	Mother health	2008/06	+	+						+		+	Broeders	India
Intel healthcare	Child health	2008/06		+						+		+	Eelke	India
Intel healthcare	Interface for diabetes monitor	2008/06	+	+						+		+	Dorine	India

Table 1: 24 design cases from IDE/TU for quantitative case study

High Frequency | Middle Frequency | Low Frequency | Rare

Title	Social factors				Market factors				Technical factors			Management factors		
	Culture	Awareness	Life style	User habit	Capital Expenditure	Incomes	Business model	Service	New Technology	cost	Material	Product policy	Market rule	Partner
Improving the climate of cooking area														
Natural Fibers in doors and windows														
Solar lighting														
Personal water purifier														
Product service system for plant oil stove														
Human powered splitting tool														
Support tool for village doctors														
Screening device for oral cancer														
Design of a malaria diagnosis														
Adoptable woodstove														
Tricycle for disabled entrepreneurs														
Reeling machine for silk farmer														
Safe drinking water														
Contextualizing products														
Creating market insight														
Online Microfinance														
Adoptability of the U-Specs														
Water supply in slums														
Rural Energy system														
Cooking in rural China														
Safe drinking water for China														
Mother health														
Child health														
Interface for diabetes monitor														

Table 2: DfBoP design related factors statistic of 24 cases