

## CATALYZING NEW PRODUCT ADOPTION AT THE BASE OF THE PYRAMID

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### Abstract

One of the more perplexing of the entrepreneurial issues at the Base of the Pyramid (BoP) is how to catalyze new product adoption by BoP consumers. Because S-shaped adoption dynamics are the result of cultural transmission bias, the question can be rephrased as, how can an entrepreneur overcome conformity bias. We modified the Technology Acceptance Model (TAM) to include conformity bias. We then qualitatively applied the model to three examples from the literature, namely fuel stoves in Darfur refugee camps, M-Pesa in Kenya and Tata Nano in India. We found that selling in road shows and tent shows catalyzed technology adoption; and all other things being equal, the less radical innovation diffused more easily than the more radical innovation. Operationalization of the results is discussed.

**Keywords:** Base of the Pyramid, conformity bias, diffusion of innovations, India, irrational herding, Kenya, new product adoption, Sudan, Technology Acceptance Model

## Introduction

Entrepreneurial issues and opportunities at the Base of the Pyramid (BoP) have been discussed in broad terms, where the BoP refers to the poorest socioeconomic group. Various definitions exist, where the BoP comprises nearly four billion people who live on less than two US dollars per day or three billion people who live on less than two-and-a-half US dollars per day (Prahalad and Hart 2002, Prahalad 2005). Tracey and Phillips (2011) identified three Institutional theory strategies available to entrepreneurs at the Base of the Pyramid, namely institutional brokering, spanning institutional voids, and bridging institutional distance. Agnithotri (2013) presented micro-cases in favor of treating the bottom [sic] of the pyramid as suppliers, producers, co-owners, and/or employees, rather than only as consumers (as promoted in, e.g., (Prahalad 2005, Prasad and Ganvir 2005, Weidner et al. 2010, Payaud 2014). Others promoted the Base of the Pyramid as a source to be mined for innovation (Prahalad 2012, Khavul and Bruton 2013, Pattnaik et al. 2015).

One of the more perplexing of the entrepreneurial issues at the Base of the Pyramid is how to catalyze new product adoption by BoP consumers. By catalyze we mean both causing to begin and accelerating. No clear picture has yet emerged. Some have characterized the Base of the Pyramid as preferring to make brand-based purchases (Chikweche and Fletcher 2011, Rahman et al. 2013). Others have focused their investigations on who makes purchase decisions (Chikweche et al. 2012). Various models of product adoption have been developed and fit to data from the BoP and elsewhere, most prominently the Technology Acceptance Model (TAM) (Davis 1989, Davis et al. 1989, Venkatesh and David 2000) and Diffusion of Innovations (Rogers 2003, Nakata and Weidner 2012). These models have received ad hoc customization with new and additional variables for specific applications. Still other variables or concepts have been proposed outside of the contexts of models to explain product adoption, such as newness (Goode et al. 2013), design newness vis-à-vis technical newness (Goode et al. 2013, Talke et al. 2009, Mugge and Dald 2013), complexity (Feiereisen et al. 2008, Bohlmann et al. 2012, Zhao et al. 2012, Ziamou et al. 2010), appropriateness (Ray and Ray 2011, Sesan 2014, Jønsson et al. 2012), and cultural familiarity (Lin 2007, Moalosi et al. 2010). Cultural familiarity is accomplished by integrating culture into product design (Moalosi et al. 2010), and by extracting cultural features from cultural artefacts and embedding them in modern products (Lin 2007). The role of national culture is also a common variable in product adoption studies. These analyses are often based on Hofstede's (1997) work-related cultural dimensions, viz. individualism, power distance, uncertainty avoidance, masculinity, and long-term orientation (Singh 2006, Yalcinkaya 2008, Broekhuizen et al. 2011, Rubera et al. 2012).

The forementioned Technology Acceptance Model (TAM) and its extensions comprise an untenable aspect: they assume that the diffusion of innovation occurs only through individual cost-benefit analysis, to the exclusion of biased cultural transmission (e.g., conformity bias). Yet Henrich (2001) showed that environmental learning (i.e., acquiring payoff-relevant or cost-benefit-relevant information through action and interaction in local social, economic, and

ecological environments) alone never produces S-shaped adoption dynamics; rather, conformity bias can produce an S-curve; and a combination of environmental learning and biased cultural transmission can also generate S-dynamics, but only when conformity bias is the predominate force in the spread of new behaviors. That explains why the TAM variables (perceived usefulness, perceived ease of use) are not well correlated with actual usage (Turner et al. 2010): the TAM variables explain variations to the S-curve but not the S-curve itself. What is needed is the addition of a cultural transmission extension to the TAM (Figure 1). This extension would respond to the allegation that there was a lack of research that deepened the TAM by “adding new variables explaining how the existing variables produce the effect they do” (Bagozzi 2007: 244). Conformity bias would be the social force that overcomes non-assimilationism (Nakata and Weidner 2012) and other limits to novel behaviors (Brosnan and Hopper 2014) such as neophobia, conservatism (the disinclination to explore or adopt new possibilities or opportunities), functional fixedness (the disinclination to use familiar objects in novel ways) and the endowment effect (the bias towards preferring an existing option over a new one).

Recognizing the importance of cultural transmission in adoption dynamics begs the question: how is cultural transmission catalyzed? Once that is known, it can be operationalized for use by entrepreneurs. Questions relating to cultural transmission catalysis are often addressed under the rubric of irrational herding, which is the phenomenon in which herd members passively mimic others' choices and/or refer to others' decisions as a descriptive social norm (Zhuang and Liu 2012). The role of irrational herding behavior has been examined for example in online product choice (Huang and Fen 2006) and in stock market investors (Yang et al. 2015). What has been less studied is the question of how to break herds, which is the initiation (vis-à-vis the acceleration) of cultural transmission. Queues are said to play a catalytic role (Debo and Veeraraghavan 2009). Consumer opinions were found to play a more determinative role than expert opinions (Huang and Fen 2006). A mathematical analysis suggested encouraging early sales or selling to groups (SgROI 2004). Another approach to the problem of cultural transmission catalysis focuses on peer effects/influences, such as those catalyzed by Solar Community Organizations (Noll et al. 2014) and by mobile carriers (Krackhardt 2014). The two approaches are likely equivalent.

In the present study we ask, how have entrepreneurs successfully catalyzed new product adoption by BoP consumers? We ask our question through the rubric of our modified Technology Acceptance Model, in which we add Conformity by Individuals to the two original variables Perceived Usefulness and Perceived Ease of Use. Our study is qualitative (Smith et al. 2013). We examine three examples from the literature. In each example we look for evidence that selling to groups, as in road shows and tent shows, catalyzed technology adoption.

The present work is relevant to those studying or practicing entrepreneurship at the Base of the Pyramid, as well as those studying rural entrepreneurs (McElwee 2006, Pyysiäinen et al. 2006, Vesala 2007, McElwee 2008, McElwee and Bosworth 2010, Vik and McElwee 2011), indigenous entrepreneurs (Hindle and Moroz 2010), entrepreneurs in transitional economies (Tanas and Audretsch 2011) and in extreme environments (Solymossy 2005), female entrepreneurs (McElwee and Al-Riyami 2003, Poggessi et al. 2015) and technology entrepreneurs

(Ferreira et al. 2015). It is relevant to those studying the TAM. It is also relevant to those studying herding, flocking and peer effects/influences in consumer behavior.

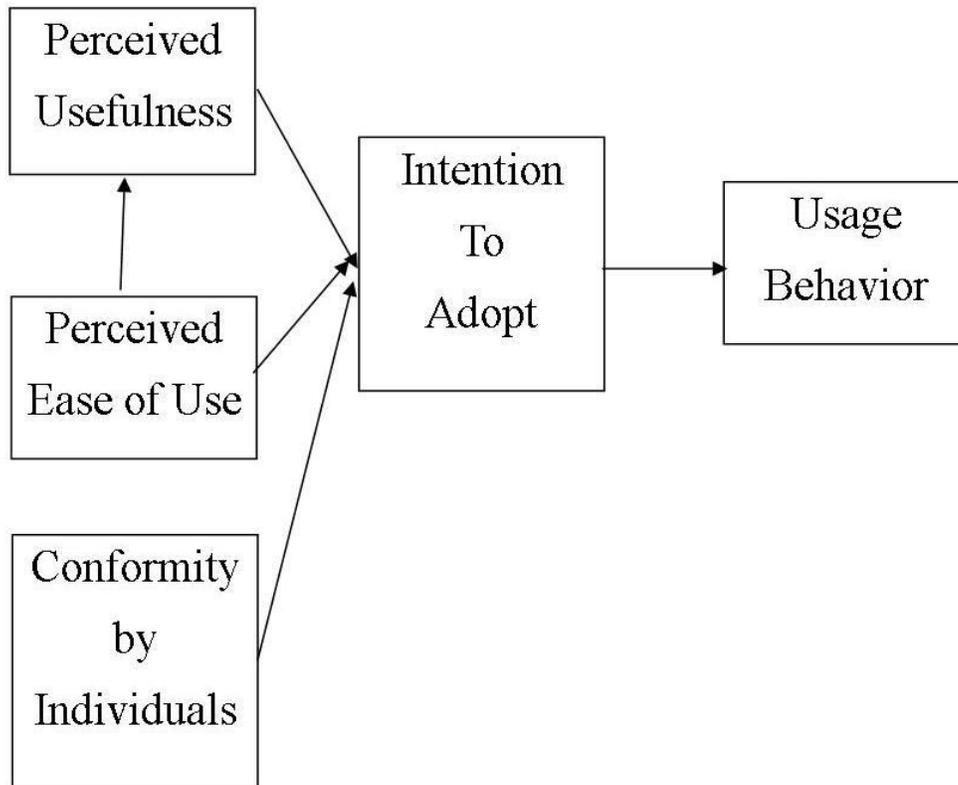


Figure 1. Cultural transmission (conformity by individuals) extension to the Technology Acceptance Model.

### Theoretical Background

#### *The Adoption of Technology at the Base of the Pyramid*

The most widely used model in the adoption of information technology appears to be the Technology Acceptance Model (TAM) (Seyal et al. 2011). The TAM was derived from the Theory of Reasoned Action (TRA) (Fishbein and Ajzen 1975). The TRA assumes that individuals are rational decision makers who constantly calculate and evaluate the relevant behavior beliefs in the process of forming their attitude toward the behavior. Hitherto, the TAM has been a member of the class of models that has explanatory power because of, rather than in spite of, its idealizations (Knuuttila 2011, Murad 2011, Portides 2011, Vorms 2011, Kennedy 2012). That is, the TAM may work, at least in some cases, because it describes an extremely simplified (and not very productive) case in which there is no cultural transmission.

The Technology Acceptance Model (TAM) assumes that technology adoption is driven by perceived usefulness and perceived ease of use, but numerous extensions have been proposed. But in a study on the adoption by students of short message service (SMS) advertising, Muk and Chung (2015) added a third dimension which they called social influence. This additional dimension accounted for the effects of opinions of others on attitudes toward technology acceptance. They performed their study comparatively on subjects in the United States and South Korea to test whether the respective Hofstede (1997) cultural scores of the two nations would have an effect on the TAM outcomes (the United States ranks #1 in individualism whereas South Korea ranks #43). They did not observe a national effect on their results. They suggested that this lack of distinction between the United States and Korea was a symptom of modernization in Korea, such that the Korean subjects (students) relied more on personal experience rather than on cultural values. Venkatesh and David's (2000) extension, so-called TAM2, postulated that subjective norm, image, job relevance, output quality and result demonstrability were determinants of perceived usefulness. TAM2 has been used for example to model information technology adoption in Saudi Arabia (Baker et al. 2010). Venkatesh and Bala (2008) later proposed TAM3, in which computer self-efficacy, computer anxiety, and computer playfulness, perceptions of external control, perceived enjoyment and objective usability comprise determinants of perceived ease of use. Seyal et al. (2011) extended the TAM with variables taken from Roger's (2003) Innovation Diffusion Theory, namely perceived credibility, perceived image, perceived financial cost, compatibility, motives to use, influence of reference groups and attitude. Seyal et al. (2011) applied their model to the diffusion of m-banking in Brunei Darussalam, and found that perceived usefulness, compatibility and motives were determinant to technology adoption. Tobbin (2012) sought to identify the factors that led to the adoption of m-banking in rural Ghana. He used the Technology Acceptance Model (TAM), modified with the addition of a perceived economic factor (the availability of surplus money) and perceived trust. He found that all factors were significant. He also found that affordability and convenience were determinants of perceived usefulness, and mobile knowledge, age and gender affected perceived ease of use. Urmee and Gyamfi (2014) reviewed the global adoption of fuel stoves by the Base of the Pyramid (BoP). They found that diffusion depended on the compatibility of the stoves with social expectations, the conformity of the stoves with local needs and culture, the attitudes of the users and the costs of the stoves. These factors could be modeled with either Roger's (2003) model or a modified Technology Acceptance Model.

### *Conformity Bias*

Conformity is the phenomenon in which an individual displays a particular behavior because it is the most frequent the individual witnessed in others (Claidière and Whiten 2012). Conformist transmission can maintain both similarities within, and differences between, cultural groups (Boyd and Richerson 1996). Cannarella and Piccioni (2007: 182) propose what they call “territorial inertia,” or “high pervasiveness degree involving a large number of agents operating within the same area subjected to mutual influences.” Claidière and Whiten (2012: 127) propose importing the distinction between informational and normative conformity from social psychology into behavioral ecology and evolutionary biology. In information conformity, a person conforms in order to find information about reality. In normative conformity, people conform to social rules to maintain and develop group identity. Yair (2008) argued that although James S. Coleman engaged in theoretical investigations to develop models that explained rational action in social contexts, Coleman’s empirical investigations were driven by non-rational assumptions about action. Coleman assumed that actors in modern society experience insecurity and existential anxiety, and those actors then choose to conform to the values, expectations and norms of significant others in order to reduce their existential uncertainties (Yair 2008: 53-54). Thus the social pressure is a matter of maintaining the status quo. But conformity can also be the catalyst to social change, as demonstrated by the Henrich (2001).

The empirically-derived transmission model of culture suggests that humans rely on cultural transmission to acquire the majority of their behaviors (Henrich 2001). This learning occurs through transmission biases. Henrich’s (2001: 997) model dealt with direct bias, prestige bias and conformity bias. Direct biases derive from the intersection of our ideas, beliefs, practice and values, with our learning psychology. Here, people copy a behavior or an idea because there is something about it that appeals to them, given their particular cultural traits and their particular psychologies (preferences, ease of storage and recall from memory, goals). Under prestige bias, people copy the ideas or practices of prestigious or successful individuals, even if those ideas or practices have nothing to do with the prestige or success. Under conformity bias, people preferentially imitate ideas and behaviors that are expressed by a majority of a group over those expressed by a minority, even when their personal opinions or behavior will not be known by the other group members.

## **Methods**

The present study is a qualitative, literature-based investigation into strategies of action, namely technology introduction and technology acceptance. We performed a literature search on the introduction and diffusion of technology-based products at the Base of the Pyramid. We then coded the results by whether or not the introduced product would likely provoke a rejection by the target consumers based on a social pressure to conform. For those articles that likely

described an innovation that would likely provoke a rejection based on a social pressure to conform, we coded the article based on whether that innovation occurred in materials, fabrication & assembly or process, because each of those innovations occurs differently (Linton and Walsh 2003, Walsh et al. 2015): M for materials (e.g., metal stoves in Sub-Saharan Africa), F&A for fabrication and assembly (e.g., the unexpectedly low price of the Tata Nano automobile), and P for processes (e.g., the use of mobile phones to exchange money). We also coded the articles by the presence or absence of such words as values, trust, compatibility, attractiveness and accommodate. We selected one example from each M, F&A and P category, based on the depth and scope of the available literature. We subsequently analyzed the three instances under the rubric of our modified Technology Acceptance Model.

## Cases

### *The Technologies*

The Social Construction of Technology (SCOT) typically defines technology as comprising artefacts, knowledge and social relations, such that technological development is an outcome of social interactions (Olsen and Engen 2007). Technology in the SCOT framework is therefore not limited to high technology. The library (Carr 2014), the recumbent bicycle (Ahmed et al. 2015) and contraception (Watkins 2011), for example, have all been studied with the SCOT.

In this study we consider the introduction of three technology-based products to the Base of the Pyramid: fuel stoves, automobiles, and mobile banking (m-banking). Fuel stoves, which term includes three-stone fires (Bates et al. 2005), are a traditional technology. Improved fuel stoves have been introduced to the Base of the Pyramid since 1970 (Urmee and Gyamfi 2014). Though automobiles are a well-known and highly diffused technology, the Tata Nano seeks to redefine the concept of the car to make it affordable for the Base of the Pyramid. This move necessitated redesigning major features of the architecture, as well as redesigning the value chain (Ray and Ray 2011). M-banking is a relatively new field and as such has many competing definitions (reviewed in Seyal et al. 2011). We define it to encompass one of the most successful mobile phone-based person-to-person money transfer systems, M-Pesa (Eijkman et al. 2010, Mas and Ng'weno 2010). As such we adopt Pousttschi and Schurig's (2004) definition of m-banking as executing financial services in the course of which the customer uses mobile communication technology.

### *Materials Innovation: Fuel Stoves*

Since 1997, development and relief agencies have been supplying fuel stoves of various types to refugee camps in Darfur, Sudan. Abdelnour and Branzei (2010) treated the Darfur refugee camps as markets, and sought to determine why some development and relief interventions successfully

enabled “subsistence marketplaces” while others delayed or distorted them. They identified three temporal stages of market development in which agencies and other actors played sometimes changing roles. In Stage 1 (1997-2002), the focus was on reducing or eliminating the health risks of wood burning stove smoke in kitchens. In Stage 2 (2002-2005), the focus was on reducing or eliminating the rape of women who left the refugee camp in search of fire wood. In Stage 3 (2005-2008), the focus was on building a local economy. Within these stages, the agency Intermediate Technology Development Group (ITDG), which later changed its name to Practical Action (PA), focused on developing individual production skills and consumer-user acumen; the agency Cooperative Housing Foundation, which later changed its name to CHF International, initially focused on developing the local economy (local fabrication and assembly, distribution by female entrepreneurs) through funding a local plant to produce metal stoves; and the Berkeley Lab focused on optimizing the technology by redesigning the metal Tara stove from India. CHF International eventually broadened its focus to encourage increased involvement by the consumer-users.

Across these three stages, a variety of stove technologies were introduced. ITDG/PA introduced mud stoves in 1997. In 2003, ITDG/PA introduced Liquid Petroleum Gas (LPG) cookers. In 2006, CHF International introduced metal stoves in cooperation with Lawrence Berkeley National Laboratory. These metal stoves possessed high combustion efficiency and good heat transfer efficiency; and they used less than half the fuel of the traditional three-stone fire and cut emissions in half, and cost \$20 to make (Kramer 2012). In mid-2006, International Lifeline Fund introduced brick stoves. The indigenous Darfur stove comprised a three-stone ring, the top of which simultaneously accommodated both a small (16–19 cm diameter) and large (23–28 cm diameter) round-bottomed pot. The introduced mud stoves also comprised natural materials, as they were constructed of brick covered with mud walls. The tops of the mud stoves also accommodated round-bottomed pots, albeit only a single pot at a time. The metal stoves could accommodate a single round-bottomed pot.

These releases of stove technologies to some extent overlapped, a situation to which some of the agencies responded by competing with each other through product subsidies and free product distributions. These market interventions likely distorted the diffusions that would have occurred based solely on product merits. For example, Christensen et al. (2015) found in rural Malawi that those who paid the deeply discounted price for a water purification product were more likely to re-obtain and use the product than those who paid a moderate price or who took it for free. Yet some observations are relevant and interesting. By Stage 3, 80% of the households had a mud stove and frequently used them. By the end of Stage 3, the demand continued for both mud stoves and brick stoves, but the supply of metal stoves exceeded the demand even at heavily subsidized prices. By 2008, more than 80% of the people surveyed who have received a fuel-efficient stove were still using it, and the majority of stoves in use in the Darfur refugee camps were mud stoves (Table 1; ProAct Network 2008). Abdelnour and Branzei (2010) similarly reported that, by 2008, 90% of the stove owners in the Darfur refugee camps used mud stoves, and that the 49% who owned both mud and metal stoves preferred the mud stoves.

State	Percent of the population using mud stoves
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North	77%
West-Geneina	88%
West-Zalingie	95%
South	74%

Table 1. From ProAct Network (2008).

Why did mud stoves diffuse more than metal stoves? According to the ProAct Network (2008: 52), “the mud stove was easily adopted because of its accessibility, affordability and ability to use even low grade fuel such as charcoal particles.” Abdelnour and Branzei (2010: 625) cited the affordability of the mud stove as a reason for its preference over metal stoves. They also reported that about 70% of the stoves were distributed for free in eight camps, but the mode of distribution was not mentioned. In terms of the Technology Acceptance Model (Table 2), the mud stoves enjoyed high Perceived Usefulness, high Perceived Ease of Use, and high Conformity by Individuals. Apparently no effort was made to integrate either mud or metal model into the culture, but the mud stoves integrated more easily perhaps because it was not as radical an innovation as the metal stoves. Urmee and Gyamfi (2014), in a review of global improved fuel stoves programs, pointed out that superior efficiency was not a sufficient condition for diffusion. Other factors for diffusion included perceived ease of use, safety, time saving and attractiveness.

Technology Acceptance Model variables	Mud Stoves	Metal Stoves
Perceived Usefulness	High	Unknown
Perceived Ease of Use	High	Unknown
Conformity by Individuals	High	Low

Table 2. Technology Acceptance Model applied to Fuel Stoves.

*Process Innovation: M-Pesa*

M-Pesa is a mobile phone-based payments system introduced to Kenya by Safaricom, the country’s leading mobile telephony operator. Rather than providing full banking functionality, M-Pesa provides users with the functions of storing and transferring relatively small amounts of money at a relatively low cost. M-Pesa was an unqualified success. It was launched in March 2007. As of June 2010, 46% of the adult population of Kenya was using M-Pesa (Mas and Ng’weno 2010). Mobile telephony did not have social pressure against it in Kenya in 2007 when M-Pesa was introduced. There was already a 34% mobile telephone penetration into the Kenyan adult population (Banka 2013). Mobile telephones are currently “ubiquitous” in rural Kenyan livestock communities (Butt 2015). However, carrying and transferring money using mobile telephones was foreign at the time. Before M-Pesa, money was transferred over distances by bus companies (Eijkman et al. 2010, Mas and Ng’weno 2010) or the post office (Mas and Ng’weno 2010).

Some researchers suggested that a key to M-Pesa’s success is its use of a large network of retail shops where consumers can make deposits and withdrawals (Eijkman et al. 2010), but a broader view suggested that M-Pesa was successful because it built awareness and trust through branding, provided a consistent user experience while building an extensive network of retailer-agents, and designed an effective consumer pricing and agent commission structure (Mas and Ng’weno 2010). In this analysis we focus on the branding aspect, which we interpret here as a successful effort to overcome the social pressure to conform by rejecting the product.

In its first year of introducing M-Pesa, Safaricom supplemented its use of traditional mass media advertising with road shows explaining the product and demonstrating how to use it, which was a method to which the low end of the market was accustomed (Mas and Ng’weno 2010). This marketing approach sought to overcome the social pressure to conform, because it did not assume Kenyans would immediately adopt the technology-based product simply because it offered a superior solution to one of their problems. Rather, Safaricom apparently believed that the technology would have to be introduced to Kenyans on their own terms, with care taken to show how the values embodying in the product design conformed to the values of the Kenyans themselves. Namely, Safaricom utilized the marketing slogan “Send money home.” Initially the firm positioned the M-Pesa consumer value proposition as a new way to make payments on microloans, but after test marketing the product they repositioned M-Pesa as a means for urban workers to make remittance payments to relatives and friends who lived in rural locations. This slogan simultaneously acknowledged the issues facing split urban-rural families in Kenya, while positioning M-Pesa as an aspirational product rather than a poor man’s substitute for a bank. Through the road shows, and a policy of having knowledgeable clerks available at retail stores ready to explain how to use the product, the low end of the market quickly adopted the product (Mas and Ng’weno 2010).

In terms of the Technology Acceptance Model (Table 3), Safaricom managed the Perceived Usefulness and Perceived Ease of Use for M-Pesa by designing a product that did not provide too much. Rather than providing full banking services, M-Pesa merely enabled one to “send money home.” Safaricom provided opportunities for Conformity by Individuals through tent shows and by training clerks in local stores.

Technology Acceptance Model variables	M-Pesa
Perceived Usefulness	High
Perceived Ease of Use	High
Conformity by Individuals	High

Table 3. Technology Acceptance Model applied to M-Pesa.

#### *Fabrication & Assembly Innovation: Tata Nano*

The Tata Nano, a small automobile that was the brainchild of Indian businessman Ratan Tata, was intended to serve as a safer substitute for two-wheeled family vehicles such as motorcycles

scooters (Ray and Ray 2011). To serve as a substitute, the Tata Nano needed to have a price that was roughly the same as that of motorcycles and scooters. Thus Ratan Tata stipulated that the price would need to be one lakh (100,000 rupees or approximately 2,000 USD). Achieving such a price required completely redesigning not only the car but also the processes of designing and manufacturing a car. For example, Tata Motors outsourced to Indian firms approximately 80% of the component design and manufacturers, and used cheap local labor instead of expensive robots to assemble the automobiles (Ray and Ray 2011).

Initially, Tata Motors did not seek to introduce the Tata Nano to the Indians on their own terms. Tata Motors incorrectly assumed that the low end of the market would feel not be intimidated by large showrooms or a pay first-drive later booking model (Singh and Srivastava 2012). They did not make easy financing available. They chose to cut costs by not advertising through the most popular mass media channel of television. They also failed to position the Tata Nano as an aspirational product, though many of the customers turned out to be wealthy and were buying the car to show their national pride (Singh and Srivastava 2012).

Once the initial launch showed poor results, Tata Motors relaunched with low key showrooms in both urban and rural locations. They made 0% financing available. They launched a road show across 104 towns in 5 states. They also sought, through advertisements, to reposition the vehicle as a family car (Singh and Srivastava 2012). The result was a double-digit percentage jump in sales.

In terms of the Technology Acceptance Model (Table 4), at launch the Nano had high ratings for Perceived Usefulness and Perceived Ease of Use. The launch achieved low Conformity by Individuals because Tata Motors did not provide culturally accessible showrooms or to financing. The switch to road shows, coordinated with advertisements to reposition the vehicle, produced better results for the firm.

Technology Acceptance Model variables	Tata Nano – initial launch	Tata Nano – relaunch
Perceived Usefulness	High	High
Perceived Ease of Use	High	High
Conformity by Individuals	Low	Mid

Table 4. Technology Acceptance Model applied to Tata Nano.

## Discussion

The research questions addressed by this study were how to catalyze new product adoption by BoP consumers, and how to overcome conformity bias. Technology acceptance is essentially a sociological phenomenon comprising conformity bias by non-rational actors, and this was demonstrated by the examples. The diffusions of the more radically innovative products, M-Pesa and Tata Nano, were performed by providing members of a community with opportunities to accept the product together, en masse as a group. The tent shows (M-Pesa) and road shows (Tata Nano) enabled consumers to see one another buying the product. The mud stove apparently diffused more readily than the metal stove because it was less radically innovative, and apparently neither product was accompanied by an effort to integrate it into the culture.

To operationalize these results, we provide the following guidelines for entrepreneurs:

- 1) Meet the consumers where they prefer to be met. Make the meeting place (showroom) comfortable for them.
- 2) When possible, sell to groups, such as in tent shows, road shows and showrooms, so that consumers can see each other adopting the product.

A contemporary, high-tech example of this practice can be found in the marketing by Xiaomi, the Chinese mobile phone manufacturer. In China, Xiaomi sold most of its phones online; but when it moved into India, it adopted to local preferences by selling in brick and mortar stores (Dou 2015). In addition, Xiaomi set up brick and mortar showrooms in China where consumers could try out products before they bought them online; the showrooms were also meant to be a place for Xiaomi fans “to meet each other and hang out” (Osawa 2015: no page numbers).

## **Conclusion**

In the present study, we asked how to catalyze new product adoption by BoP consumers, and more specifically how to catalyze cultural transmission. We found that cultural transmission was catalyzed by selling to groups, apparently because that allowed people to see each other adopting the product. In the absence of such opportunities to see each other adopting the product, the less radically innovative option was selectively adopted over the more radically innovative option.

The main limitation of this research is that it was only qualitative. Future research can remedy this by quantitatively testing the addition of biased cultural transmission, through the variable Conformity of Individuals, to the Technology Acceptance Model. Further research can also be directed towards distinguishing between catalyzing initiation and catalyzing acceleration of technology adoption.

## Literature Cited

Abdelnour, S. and Branzei, O., (2010), "Fuel-efficient stoves for Darfur: The social construction of subsistence marketplaces in post-conflict settings," *Journal of Business Research*, 63, 617–629.

Agnihotri, A., (2013), "Doing good and doing business at the bottom of the pyramid," *Business Horizons*, Vol. 56(5), 591-599.

Ahmed, H., Qureshi, Q.M. and Khan, A.A., (2015), "Reviving a ghost in the history of technology: the social construction of the recumbent bicycle," *Social studies of science*, 45(1), pp. 130-6.

Bagozzi, R.P., (2007), "The Legacy of the Technology Acceptance Model and a Proposal for a Paradigm Shift," *Journal of the Association for Information Systems*, 8(4), pp. 244-254.

Baker, E., Al-Gahtani, S., and Hubona, G., (2010), "Cultural impacts of acceptance and adoption of information technology in a developing country," *Journal of Global Information Management*, 18(3), 35-58.

Banka, H., (2013), "M-PESA at the Point of Sale: Expanding Financial Inclusion & Reducing Demand for Physical Cash," *Journal of Payments Strategy and Systems*, 7(4), pp. 359-369.

Bates, L., Bruce, N., Theuric, D., Owallad, H., Amatya, P., Mallae, M.B., and Hood, A., (2005), "What should we be doing about kitchen smoke?," *Energy for Sustainable Development*, 9(1), pp. 7-15.

Bohlmann, J.D., Spanjol, J., Qualls, W.J. and Rosa, J.A., (2012), "The Interplay of Customer and Product Innovation Dynamics: An Exploratory Study," *Journal of Product Innovation Management*, 30(2), pp. 228-244.

Boyd, R. and Richerson, P. J., (1996), "Why culture is common, but cultural evolution is rare. Proceedings of the British Academy," 88, pp. 77-93.

Broekhuizen, T.L.J., Delre, S.A. and Torres, A., (2011), "Simulating the Cinema Market: How Cross-Cultural Differences in Social Influence Explain Box Office Distributions," *Journal of Product Innovation Management*, 28, pp. 204–217.

Brosnan, S.F. and Hopper, L.M., (2014), "Psychological limits on animal innovation," *Animal Behaviour*, 92, pp. 325-332.

Butt, B., (2015), "Herding by Mobile Phone: Technology, Social Networks and the "Transformation" of Pastoral Herding in East Africa," *Human Ecology*, v43 n1, pp. 1-14.

Cannarella, C. and Piccioni, V., (2007), "Innovation Diffusion and Territorial Inertia," *International Journal of Rural Management*, 3(2), pp. 181–211.

Carr, P.L., (2014), "Reimagining the library as a technology: An analysis of Ranganathan's five laws of library science within the social construction of technology framework," *Library Quarterly*, v84 n2, pp. 152-164.

Chikweche, T. and Fletcher, R., (2011), "Branding at the base of pyramid: a Zimbabwean perspective," *Marketing Intelligence & Planning*, Vol. 29 Iss 3 pp. 247 – 263.

Chikweche, T., Stanton, J. and Fletcher, R., (2012), "Family purchase decision making at the bottom of the pyramid", *Journal of Consumer Marketing*, Vol. 29 Iss 3 pp. 202 – 213.

Christensen, L.J., Enno Siemsen, E. and Sridhar Balasubramanian, S., (2015), "Consumer behavior change at the base of the pyramid: Bridging the gap between for-profit and social responsibility strategies," *Strategic Management Journal*, 36: 307-317.

Claidière, N. and Whiten, A., (2012), "Integrating the Study of Conformity and Culture in Humans and Nonhuman Animals," *Psychological Bulletin*, 138(1), pp. 126–145.

Davis, F. D., (1989), "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly*, 13(3), pp. 319-339.

Davis, F.D, Bagozzi, P.R. and Warshaw, P., (1989), "User acceptance of computer technology: A comparison of two theoretical models," *Management Science*, 35, pp. 982-1003.

Debo, L.G. and Veeraraghavan, S., (2009), "Models of herding behavior in operations management" in *Consumer-Driven Demand and Operations Management Models, A Systematic Study of Information-Technology-Enabled Sales Mechanisms* edited by Serguei Netessine and Christopher Tang in the International Series in Operations Research & Management Science , Vol. 131.

Dou, E., (2015), "Xiaomi, China's New Phone Giant, Takes Aim at World," *Wall Street Journal*, June 7.

Eijkman, F., Kendall, J. and Mas, I. (2010), "Bridges to Cash: The Retail End of M-PESA," *Savings & Development*, 34(2), 219-252.

Ferreira, J.J., Marques, C.S., and Fernandes, C., (2015), "What do we [not] know about technology entrepreneurship research?," *Int Entrep Manag J*, (2015-04-29), pp. 1-28.

- Feiereisen, S., Wong, V. and Broderick, A.J., (2008), "Analogies and Mental Simulations in Learning for Really New Products: The Role of Visual Attention," *Journal of Product Innovation Management*, 25, pp. 593–607.
- Fishbein, M., and Ajzen, I., (1975), *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*, Addison-Wesley, Reading, MA.
- Goode, M., Dahl, D.W. and Moreau, C.P., (2013), "Innovation Aesthetics: The Relationship between Category Cues, Categorization Certainty and Newness Perceptions," *Journal of Product Innovation Management*, 30 (2), pp. 192–208.
- Henrich, J., (2001), "Cultural transmission and the diffusion of innovations: Adoption dynamics indicate that biased cultural transmission is the predominate force in behavioral change and much of sociocultural evolution," *American Anthropologist*, 103(4), pp. 992-1013.
- Hindle, K. and Moroz, P., (2010), "Indigenous entrepreneurship as a research field: developing a definitional framework from the emerging canon," *Int Entrep Manag J*, 6, pp. 357–385.
- Hofstede, G., (1997), *Cultures and organizations: Software of the mind*. London, McGrawHill.
- Huang, J.H. and Fen, C.Y., (2006), "Herding in online product choice," *Psychology & Marketing*, Vol. 23, pp. 413-428.
- Jønsson, J. B., Charles, E., and Kalvig, P., (2012), "Toxic mercury versus appropriate technology: Artisanal gold miners' retort aversion," *Resources Policy*, pp. 60-67.
- Khavul, S. and Bruton, G., (2013), "Harnessing innovation for change: Sustainability and poverty in developing countries," *Journal of Management Studies*, 50(2), pp. 285-306.
- Knuuttila, T., (2011), "Modeling and Representing: An Artefactual Approach", *Studies in History and Philosophy of Science*, 42, pp. 262-271.
- Krackhardt, D., (2014), "Peer Influence in the Diffusion of iPhone 3G over a Large Social Network," *MIS Quarterly*, 38(4), pp.1103-1133.
- Kramer, D., (2012), "Stove designed by US national lab improves lives in Darfur," *Physics Today*, Vol. 65, Issue 6, pp. 26-27.
- Kennedy, A.G., (2012), "A non representationalist view of model formation," *Studies in History and Philosophy of Science*, 43, pp. 326-332.
- Lin, R. T., (2007), "Transforming Taiwan aboriginal cultural features into modern product design: A case study of a cross-cultural product design model," *International Journal of Design*, 1(2), pp. 45-53.

Linton, J., and Walsh, S., (2003), "From Bench to Business," *Nature of Materials*, Vol 2 May 2003, pp. 287-289.

Mas, I. and Ng'weno, A., (2010), "Three keys to M-PESA's success: Branding, channel management and pricing," *Journal of Payments Strategy & Systems*, 4(4), 352–370.

McElwee, G., (2006), "Farmers as entrepreneurs: Developing competitive skills," *Journal of Developmental Entrepreneurship*, 11 (3). pp. 187-206.

McElwee, G. (2008), "A taxonomy of entrepreneurial farmers," *International Journal of Entrepreneurship and Small Business*, 6(3), pp. 465-478.

McElwee, G. and Al-Riyami, R., (2003) "Women entrepreneurs in Oman: some barriers to success," *Career Development International*, Vol. 8 Iss 7, pp.339 – 346.

McElwee, G. and Bosworth, G., (2010), "Exploring the strategic skills of farmers across a typology of farm diversification approaches," *Journal of Farm Management*, 13 (12), pp. 819-838.

Moalosi, R., Popovic, V., Hickling-Hudson, A., (2010), "Culture-orientated product design," *International Journal of Technology and Design Education*, 20, pp. 175-190.

Mugge, R. and Dahl, D.W., (2013), "Seeking the Ideal Level of Design Newness: Consumer Response to Radical and Incremental Product Design," *Journal of Product Innovation Management*, 30(Supplement 1), pp. 34-47.

Muk, A. and Chung, C., (2015), "Applying the technology acceptance model in a two-country study of SMS advertising," *Journal of Business Research*, 68, pp. 1–6.

Murad, M.H.S.A., (2011), "Models, scientific realism, the intelligibility of nature, and their cultural significance," *Studies in History and Philosophy of Science Part A*, 42 (2), pp. 253-261.

Portides, D.P., (2011), "Seeking representations of phenomena: Phenomenological models," *Studies in History and Philosophy of Science*, 42, pp. 334-341.

Nakata, C. and Weidner, K., (2012), "Enhancing New Product Adoption at the Base of the Pyramid: A Contextualized Model," *Journal of Product Innovation Management*, 29(1), pp. 21–32.

Noll, D., Dawes, C. and Rai, V., (2014), "Solar Community Organizations and Active Peer Effects in the Adoption of Residential Solar PV," *Energy Policy*, 67, pp. 330-343.

Olsen, O.E. and Engen, O.A., (2007), "Technological change as a trade-off between social construction and technological paradigms," *Technology in Society*, pp. 456-468.

- Osawa, J., (2015), "Mi Home: Where Xiaomi Fans Hang Out," *Wall Street Journal*, May 5.
- Pattnaik, B.K. and Dhal, D., (2015), "Mobilizing from appropriate technologies to sustainable technologies based on grassroots innovations," *Technology in Society* 40, pp. 93-110.
- Payaud, M. A. (2014), "Marketing Strategies at the Bottom of the Pyramid: Examples From Nestle, Danone and Procter & Gamble," *Global Business and Organizational Excellence*, 33(2), pp. 51-63.
- Poggesi, S., Mari, M. and Luisa De Vita, L., (2015), "What's new in female entrepreneurship research? Answers from the literature," *Int Entrep Manag J*, (2015-05-13), pp. 1-30.
- Pousttchi, K. and Schurig, M. (2004). *Assessments of Today's Mobile Banking Applications From the View of Customer Requirements*. Proceedings of the Hawai'i International Conference on System Sciences, January 5-8.
- Prahalad, C. K., (2005), *The Fortune at the Bottom of the Pyramid: Eradicating Poverty Through Profits*. Pearson Education, Inc. publishing as Wharton School Publishing, University of Pennsylvania.
- Prahalad, C.K., (2012), "Bottom of the Pyramid as a Source of Breakthrough Innovations," *Journal of Production and Innovation Management*, 29(1), 6-12.
- Prahalad, C. K. and Hart, S.L., (2002), "The fortune at the bottom of the pyramid," *Strategy+Business*, 26, 54-67.
- Prasad, V.C.S. and Ganvir, V., (2005), "Study Of The Principles Of Innovation For The Bop Consumer — The Case Of A Rural Water Filter," *Int. J. Innovation Technol. Management*, 2, 349-366.
- ProAct Network, (2008), *Assessing the Effectiveness of Fuel-efficient Stove Programming: A Darfur-Wide Review*, CHF International.
- Pyysiäinen, J., Anderson, A., McElwee, G. and Kari Vesala, K., (2006), "Developing the entrepreneurial skills of farmers: some myths explored", *International Journal of Entrepreneurial Behavior & Research*, Vol. 12 Iss: 1, pp.21 - 39
- Rahman, M., Hasan, M. R. and Floyd, D., (2013), "Brand Orientation as a Strategy That Influences the Adoption of Innovation in the Bottom of the Pyramid Market," *Strat. Change*, 22, pp. 225–239.
- Ray, S. and Ray, P.K., (2011), "Product innovation for the people's car in an emerging economy," *Technovation*, 31(5-6), 216-227.

Rogers, E., (2003), *Diffusion of Innovations, 5th Edition*. Simon and Schuster.

Rubera, G., Griffith, D.A. and Yalcinkaya, G., (2012), "Technological and design innovation effects in regional new product rollouts: A European Illustration," *Journal of Product Innovation Management*, 29(6), pp. 1047–1060.

Sesan, T., (2014), "What's cooking? Evaluating context-responsive approaches to stove technology development in Nigeria and Kenya," *Technology in Society*, 39, pp. 142-150.

Seyal, A.H., Rahim, M.M., Turner, R., (2011), "Understanding the Behavioral Determinants of M-Banking Adoption: Bruneian Perspectives," *Journal of Electronic Commerce in Organizations*, 9(4), 22-47.

Sgroi, D., (2004), "Controlling the Herd: Applications of Herding Theory," Cambridge Working Papers in Economics, No. 0106. Last accessed June 15, 2015.

Singh, S., (2006), "Cultural differences in, and influences on, consumers' propensity to adopt innovations," *International Marketing Review*, 23(2), pp. 173 – 191.

Singh, S. and Srivastava, P, (2012), "The Turnaround of Tata Nano: Reinventing the Wheel," *The Journal of Business Perspective*, 16(1), 145-152.

Smith, R., McElwee, G., McDonald, S. and Dodd, S.D., (2013), "Qualitative entrepreneurship authorship: antecedents, processes and consequences," *International Journal of Entrepreneurial Behavior & Research*, Vol. 19 Iss 4 pp. 364 – 386.

Sollymossy, E., (2005), "Entrepreneurship in Extreme Environments: Building an Expanded Model," *Int Entrep Manag J*, 1, pp. 501-518.

Subrahmanyam, S. and Gomez-Arias, J.T., (2008), "Integrated approach to understanding consumer behavior at bottom of pyramid," *Journal of Consumer Marketing*, Vol. 25 Iss 7, pp. 402- 412.

Talke, K., Salomo, S., Wieringa, J. and Lutz, A., (2009), "What about Design Newness? Investigating the Relevance of a Neglected Dimension of Product Innovativeness," *Journal of Product Innovation Management*, 26(6), pp. 601-615.

Tanas, J.K and Audretsch, D.B., (2011), "Entrepreneurship in transitional economy," *Int Entrep Manag J*, 7, pp. 431–442.

Tobbin, P., (2012), "Towards a model of adoption in mobile banking by the unbanked: a qualitative study", *info*, 14(5), pp. 74 – 88.

Tracey, P. and Phillips, N., (2011), "Entrepreneurship in Emerging Markets: Strategies for New Venture Creation in Uncertain Institutional Contexts," *Manag Int Rev* 51, 23–39.

Turner, M., Kitchenham, B., Brereton, P., Charters, S., and Budgen, D., (2010), "Does the technology acceptance model predict actual use? A systematic literature review," *Information and Software Technology*, 52(5), pp. 463–479.

Urmee, T. and Gyamfi, S., (2014), "A review of improved Cookstove technologies and programs." *Renewable and Sustainable Energy Reviews*, 33, pp. 625-635.

Venkatesh, V. and Bala, H., (2008), "Technology Acceptance Model 3 and a Research Agenda on Interventions," *Decision Science*, 39 (2), pp. 273-312.

Venkatesh, V. and David, F.D., (2000), "A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies," *Management Science*, 46, pp. 186-204.

Vesala, K.M., Peura, J. and McElwee, G., (2007), "The split entrepreneurial identity of the farmer," *Journal of Small Business and Enterprise Development*, Vol. 14 Iss: 1, pp. 48 – 63.

Vik, J. and McElwee, G. (2011), "Diversification and the Entrepreneurial Motivations of Farmers in Norway," *Journal of Small Business Management*, 49, pp. 390–410.

Vorms, M., (2011), "Representing with Imaginary Models: Formats Matter," *Studies in History and Philosophy of Science*, 42(2), pp. 287-295.

Walsh, S.T., Marinakis, Y.D. and Boyland, R., (2015), "Ferrofluidic: a case study," *Technological Forecasting and Social Change*, In press.

Watkins, E.S., (2011), "The Social Construction of a Contraceptive Technology: An Investigation of the Meanings of Norplant," *Science, Technology, & Human Values*, 36, no. 1, pp. 33-54.

Weidner, K. Rosa, J. and Viswanathan, M., (2010), "Marketing to Subsistence Consumers: Lessons From Practice," *Journal of Business Research*, (63)6, 559-569.

Yair, G., (2008), "Insecurity, Conformity and Community: James Coleman's Latent Theoretical Model of Action," *European Journal of Social Theory*, Volume 11, Issue 1, pp. 51–70.

Yalcinkaya, G., (2008), "A culture-based approach to understanding the adoption and diffusion of new products across countries," *International Marketing Review*, 25(2), pp. 202 -214.

Yang, Shih-Jui, Hsu, Ai-Chi, Lai, Show-Yen, and Lee, Chien-Chiang, (2015), "Empirical Investigation of Herding Behavior in East Asian Stock Markets toward the U.S. Market," *International Journal of Business and Finance Research*, 2015, v. 9, iss. 1, pp. 19-32.

Zhang, J. and Liu, P., (2006), "Rational Herding in Microloan Markets," *Management Science* 58(5), pp. 892-912.

Zhao, M., Hoeffler, S. and Dahl, D., (2012). "Imagination Difficulty and New Product Evaluation," *Journal of Product Innovation Management*, 29, pp. 76–90.

Ziamou, P., Gould, S. and Venkatesh, A., (2010), "'Am I Getting It or Not?,' The Practices Involved in 'Trying to Consume' a New Technology," *Journal of Product Innovation Management*, 29(2), pp. 216-228.