Consumer adoption of pro-poor service innovations in subsistence marketplaces

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ABSTRACT

Despite some extant research on innovation adoption in subsistence marketplace contexts, little is known about subsistence consumers and how they evaluate so-called pro-poor innovations. This research identified six existing, empirically tested, and well-cited innovation adoption models and collected data on them within a subsistence context. Extending existing research, data was collected across two separate and distinct pro-poor services targeted at the subsistence segment, and structural models were compared based on mediating relationships. This research contributes to the subsistence marketplace literature by providing guidance about *how* antecedents within these models affect subsistence consumers' evaluations of pro-poor service innovations in this increasingly important context. The research provides novel practical and theoretical insights through the development of new, testable hypotheses in the area and explores the effect of service type and geographic area (urban versus rural).

1. Introduction

Subsistence marketplaces and the Bottom of the Pyramid (BOP) have attracted significant scholarly attention in the business literature (e.g., Prahalad, 2005; Prahalad & Hammond, 2002; Viswanathan & Rosa, 2007). Consumers in these markets have typically been characterized by low literacy levels, poor health, limited access to media and other infrastructure, geographic isolation, and an inability to meet basic needs (e.g., Prahalad, 2005; Sheth, 2011). Interestingly, despite such constraints, these consumers have adopted mobile and internet technologies quickly, perhaps because of their lower cost compared to fixed infrastructure alternatives and a compelling value proposition in light of their circumstances. However, other innovations, such as improved cookstoves, have met with more resistance even though they offer many objective benefits (e.g., Khandelwal et al., 2017). Systematic empirical research about innovation adoption in this context has begun to develop (e.g., Hasan, Lowe, & Petrovici, in press; Miller & Mobarak, 2014), but it typically applies existing theory about innovation adoption rather than systematically examining its validity in this context. Consequently, we have a limited understanding of how such consumers adopt what are known as pro-poor innovations, which Ramani, Sadreghazi, and Duysters (2012) define as products and services "that cater to the essential needs of the poor such as healthcare, housing, food, water, and sanitation or enhance productivity and income-

generation capacity" (p. 678).

There is a vast body of research that may shed some light on the antecedents of innovation adoption (e.g., Arts, Frambach, & Bijmolt, 2011; Rogers, 2003; Venkatesh, Thong, & Xu, 2012). Some consistent antecedents have begun to emerge in meta-analysis studies (e.g., relative advantage, product complexity), but the results remain largely context dependent, and the majority of the research and theory developed has been based on consumers in economically developed contexts (e.g., Arts et al., 2011; Plouffe, Hulland, & Vandenbosch, 2001). However, there is evidence to suggest these models can be applied in the subsistence context, and indeed, much research has been done on the adoption of development interventions. Yet, in such contexts, research on innovation adoption among subsistence consumers is more limited and fragmented with researchers typically picking a favored model to use among a number of validated alternatives. For instance, Bertrand (2004) used Diffusion of Innovation theory (Rogers, 2003) to understand the adoption of HIV/AIDS preventive innovations in a range of developing countries; however, although Bertrand acknowledged the diverse theories available to understand the observed phenomenon, the selection of Diffusion of Innovations (DOI) in the article was simply justified in terms of usefulness. Previously, Bosompra (2001) had selected the Theory of Reasoned Action (Fishbein & Ajzen, 1975) to explain condom adoption in Ghana to address the same public health phenomena. Yet, Pick, Gollakota, and Singh (2014) used Rogers'

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Diffusion of Innovations theory and the Technology Acceptance Model (Davis, 1989) to predict adoption of telecenters in India. Model selection is usually justified based on the models being well established. Yet, many other possible models exist. Notwithstanding the legitimacy of these models, several variables do not hold as significant in their studies, and alternative predictors could have arguably supplemented explanatory power.

There has been little conceptual development on innovation adoption in subsistence marketplaces until more recently. Nakata and Weidner (2012) proposed a model of innovation adoption contextualized to BOP markets. This model integrated Sen's (1999) work on poverty alleviation and Rogers' (2003) Diffusion of Innovations. Beyond the typical new product characteristics, the model's key differentiating aspects include relevant product characteristics to this segment of consumers (e.g., affordability, visual comprehensibility) and a focus on the dynamics of this segment's social context (e.g., collective needs, assimilationist culture) and the marketing environment (e.g., flexible payment forms). However, this model has not been empirically tested.

More recently, numerous studies have emerged that take a more nuanced look at innovation adoption in this context by testing the impact of key antecedents (e.g., Hasan et al., in press) or by examining the unique social context of these marketplaces (e.g., Miller & Mobarak, 2014). To add to the dialogue in this research stream, this present study seeks to provide guidance on (a) which consumer-based innovation adoption models are most useful in explaining adoption intention in the context of subsistence marketplaces; (b) how this differs based on service type and geographic area; and (c) how these antecedents affect adoption intention.

To attempt to answer these questions, the research aims to compare structural models of consumer innovation adoption across different pro-poor service innovations while considering mediating relationships. This should empirically establish the validity of key consumer-based innovation adoption models in this context and uncover *how* antecedents within these models affect innovation adoption decisions.

The study was conducted across two pro-poor service innovations, and it segments consumers as either rural or urban; this provides further insight about the nature of the relationships. This research's findings should guide managers and policy makers on the levers that can be used to enhance adoption of new products and services targeted at subsistence consumers. In addition, researchers may discover the conceptual factors needed to be incorporated into future innovation adoption studies within subsistence marketplaces.

This article begins by reviewing the literature on consumer adoption of innovations and the subsistence context. Innovation adoption models relevant to the context here and which can be operationalized are then discussed. A survey based methodology is then developed that is consistent with prior research using a model comparison approach (e.g., Venkatesh, Morris, Davis, & Davis, 2003). This consists of 509 responses from subsistence consumers in Bangladesh who provided their perceptions on two different pro-poor service technologies: a mobile banking service and a government-initiated system of internet kiosks. Models are compared using Partial Least Squares (PLS), and the paper concludes by discussing the contributions of the research and implications for theory and practice.

2. Consumer adoption of innovations in subsistence marketplaces

2.1. Consumer adoption of innovations

Consumer innovation adoption literature has grown, as indicated by meta-analysis studies in the area (Arts et al., 2011). The bulk of this literature typically has focused on technologically new and innovative products targeted at consumers from economically affluent backgrounds. However, increasingly, marketers have begun to recognize the unique needs of the poor and have targeted this segment in economically less-affluent economies. Such "innovations" include services such

as mobile medical diagnosis (e.g., doctHERS), mobile money transfer, banking services (e.g., bKash, M-Pesa), fuel-efficient stoves, internet accessibility and PC kiosks (UNICEF's Digital Drum, Union Information Service Centers), online marketplaces targeted at specific demographic segments (e.g., Sheops), zero electricity air coolers and many more such products and services. These innovations may not immediately be seen as innovations and in many cases the technology has been commercialized for some time in other markets. However, this research followed the perspective taken by Lowe and Alpert (2015, p. 12) who refer to an innovation as the "*perceived* degree of newness and improvement over existing alternatives." [Italics added] This is in line with Rogers (1983, p. 11) who defined an innovation as an "an idea, practice, or object that is perceived as new by an individual or other unit of adoption". Thus a product or service does not need to be new but must be *perceived* to be new.

Furthermore, such innovations targeted at subsistence consumers have been termed pro-poor innovations by scholars such as Ramani et al. (2012) because they go beyond purely commercial considerations and can improve the livelihoods and well-being of the poor by providing access to products and services previously unavailable due to cost constraints, infrastructure challenges, and other barriers (Prahalad, 2005; Sheth, 2011; Viswanathan & Rosa, 2007). This has led scholars studying subsistence and BOP to question the factors that influence innovation adoption. Thus, context is important, and replicating such models in new contexts will provide insight into how they work in subsistence marketplaces.

Though some contemporary and well-cited innovation adoption theories (e.g., Rogers' Diffusion of Innovations) were originally developed within less-developed countries, such as Bangladesh, these studies were often based on research conducted within farming communities and were not related to subsistence *consumers*. Recent research has also made some inroads in understanding innovation adoption in emerging economies with large segments of subsistence consumers, but this has more often focused on innovation adoption among wealthier consumer segments within those markets (e.g., Kapoor, Dwivedi, & Williams, 2015), usually using a favored existing model from the literature to test hypotheses related to innovation adoption. More recently, some scholars have sought to develop a better conceptual understanding of innovation adoption within the BOP (e.g., Nakata & Weidner, 2012). However, though insightful and the first targeted effort at understanding innovation adoption within the BOP through the development of a conceptual model, Nakata and Weidner (2012) stop short of empirically testing their conceptual model. The unique characteristics of subsistence marketplaces are now explored to develop a better understanding of the context.

2.2. Characteristics of subsistence marketplaces

The growing economic importance of emerging markets has contributed to the democratization of innovations traditionally initiated in developed nations. This has given rise to new innovation development processes, such as frugal innovation (Zeschky, Widenmayer, & Gassmann, 2011). Sheth (2011) identified five key characteristics of emerging markets that have implications for innovation adoption. These are (a) heterogeneity of markets (high income inequality and inequalities in production, exchange and consumption); (b) chronic shortage of resources (access to water, electricity etc.); (c) inadequate infrastructure (e.g., distribution infrastructure, information technology infrastructure); (d) socio-political governance (e.g., heavily influenced by local community, NGOs, religious groups etc.); and (e) unbranded competition. Taking into account, these constraints innovations in such economies need to be more affordable and accessible through design and to use suitable and robust materials and technologies (Sheth, 2011). Successful innovation may thus be achieved through a "bottom up" understanding of these marketplaces (Sridharan & Viswanathan, 2008).

In the BOP and subsistence markets, the focus is on understanding critical and aspirational needs and evaluating product usage instructions that take into account the creativity, inventiveness and adaptability (Prahalad, 2005) of consumers forced to find solutions and coping mechanisms in the face of severe income constraints. Product design in BOP markets needs to cater for multiple uses and local sustainability as well as family needs and community welfare (Viswanathan, Sheth, Gau, & Chaturvedi, 2009). Low consumer literacy adds emphasis to visual comprehension due to consumers' concrete rather than abstract thinking styles (Viswanathan & Gau, 2005). This suggests the need to use pictorial images, for example, to enhance comprehension (Hasan, Lowe, & Rahman, 2017). Design should also ensure functionality compatible with cultural norms and constraints (Donaldson, 2006).

2.3. Culture and innovation adoption in subsistence marketplaces

Because of the previously mentioned need-based consumer differences, there is interest in better understanding such consumers and product development to meet local needs and wants (Ernst, Kahle, Dubiel, Prabhu, & Subramaniam, 2014). Scholars have identified a gap in understanding the value of cultural dimensions in innovation adoption models (Donthu, 2017). Several Hofstede dimensions have been linked to innovation adoption. For example, at a macro level, national culture explains a substantial component of innovation rates (Dwyer, Mesak, & Hsu, 2005), which have been associated with high scores on individualism and low scores on uncertainty avoidance and power distance (Shane, 1993).

Individualistic societies are characterized by a desire for independence from groups and for autonomy over conformity and an emphasis on personal achievement and individual autonomy and freedom (Shane, 1993). Relatedly, one definition of innovativeness is the extent to which individuals make decisions independently of the experience of others (Midgley & Dowling, 1978). Thus, as a trait, innovativeness itself may relate directly to individualism. High uncertainty avoidance is associated with formalized procedural use and more constrained innovation through adherence to rules (Hofstede, 2001). Individuals in high uncertainty avoidance cultures have a lower tolerance for risk and an anxiety towards adoption of new products (Png, Tan, & Wee, 2001). Furthermore, high levels of both uncertainty avoidance and masculinity negatively influence adoption of complex IT innovations (van Everdingen & Waarts, 2003), and high scores on individualism have been linked to higher patent cooperation treaties (Jang, Ko, & Kim, 2016). Hence, countries with high individualism and low uncertainty avoidance may be more receptive to innovations (Lynn & Gelb, 1996; Steenkamp, Hofstede, & Wedel, 1999; Yaveroglu & Donthu, 2002).

Along with the usual economic, infrastructure, and literacy constraints, the collectivist orientation of subsistence marketplaces (Burgess & Steenkamp, 2006; Nakata & Weidner, 2012) may be a contributing factor to the slower adoption rate of new products in developing countries (Talukdar, Sudhir, & Ainslie, 2002). The influence of Hofstede's individualism dimension may be more complex than initially thought. Although Shane (1992) contended that individualistic societies are more inventive than those with lower individualism, Taylor and Wilson (2012) pointed out that some forms of collectivism (i.e., patriotism) can foster national innovation, but collectivism that favors loyalties to local products can hinder innovation.

To some extent, innovation adoption models have captured cultural considerations, but at an aggregated level. For example, Nakata and Weidner's (2012) contextualized model of innovation adoption for the BOP takes into explicit account such markets' collectivist nature. This context consists of social capital, nature of culture (e.g., assimilationists), and the presence of collective needs, are expected to exert a positive effect on propensity to adopt an innovation. Economic constraints and risk of marginalization can be compensated for by resource strengths (community or social capital) that enhance consumption alternatives (Hill, 2002). In assimilationist cultures, aspirations of integration into a dominant subculture may be fulfilled by the adoption of products seen to be desirable in that dominant, economically privileged subculture. Yet, nonassimilationist cultures or groups can regard these products as alien or imposed (Üstüner & Holt, 2007). Cultures that emphasize embeddedness consider that people belonging to collective groups with a desire to extract meaning and achieve identification with group goals and a shared way of life (Burgess & Steenkamp, 2006) may increase the motivation to adopt innovations that foster this integration. Thus, the mechanisms by which cultural dimensions influence innovation adoption, in general, and BOP markets, in particular, ought to be further studied (Donthu, 2017).

Within subsistence marketplaces, some research exists, but there is little evidence of what models are appropriate and which innovation adoption antecedents have the most effect on innovation adoption. In such cases where cultural considerations are likely to be important, one research approach in the innovation adoption and behavior change literature over the last three decades is to empirically compare key models from the literature in that cultural context (e.g., Davis, Bagozzi, & Warshaw, 1989; Hasan et al., in press; Mathieson, 1991; Taylor & Todd, 1995; Venkatesh et al., 2003; Venkatesh et al., 2012). This research takes a similar approach and draws on several well-used models from the literature to ascertain which antecedents may predict innovation adoption among subsistence consumers and to evaluate how these antecedents affect innovation adoption through their structural relationships.

3. Models of innovation adoption

The literature was examined to identify consumer innovation adoption models useful in the model comparison process in the subsistence context. Relevant models were selected based on number of citations (with "first three year citation counts" also being used to take account of model recency), relevance to the consumer context, relevance to subsistence marketplaces and the BOP (with prior application in this context as a significant factor), and minimal similarity among constructs from the models compared. Based on these criteria, the Theory of Reasoned Action (Fishbein & Ajzen, 1975), the Theory of Planned Behavior (Ajzen, 1991), the Diffusion of Innovations (Rogers, 2003), the Technology Acceptance Model (Davis, 1989), the Consumer Acceptance of Technology model (Kulviwat, Bruner II, Kumar, Nasco, & Clark, 2007), and the Value-based Adoption Model (H. W. Kim, Hock, & Sumeet, 2007) were chosen. These models, their constructs, and relevant articles are briefly outlined in Appendix A.

Rogers' (2003) Diffusion of Innovations model is probably one of the most widely established works in the area of innovation adoption. It proposes five key constructs that directly affect an innovation's speed of diffusion, including a consumer's perception of its relative advantage, complexity, compatibility, trialability, and observability. These constructs are proposed to directly affect adoption (i.e., with no mediation) and to be independent and statistically discriminant. Despite widespread application, study results have been inconsistent regarding these antecedents' effects. For example, compatibility has been seen to overlap with relative advantage and has not been regarded as a discriminating construct. Likewise, some have argued a more complex product would be one that reduces that product's relative advantage. A recent meta-analysis study found relative advantage, compatibility, and observability are stronger influencers on an individual's adoption intention than complexity and trialability (e.g., see Arts et al., 2011), though the situations under which this occurs are still unclear.

Social psychology theories have been used to explain innovation adoption, although these are also applied more broadly. The Theory of Reasoned Action proposes that an individual's volitional behavior (e.g., in this case, whether or not to adopt a new product) is a function of an individual's *intention* to adopt this product (Fishbein & Ajzen, 1975).

Intention is a function of an individual's attitude towards the object (e.g., attitude towards the innovation) and their subjective (social) norms, which reflect a social influence on the decision. Such social norms ought to be an important factor in influencing adoption for subsistence consumers because of their more collectivist nature. The Theory of Planned Behavior builds on the Theory of Reasoned Action to reflect the degree to which an individual perceives they have control over performing the behavior (Ajzen, 1991, p. 188). In this sense, given the constraints subsistence consumers face, perceived behavioral control should be a significant influence. Like the Diffusion of Innovations model, empirical testing of the Theory of Reasoned Action and Theory of Planned Behavior have led to inconsistent results, and this is reflected in meta-analysis results (Armitage & Conner, 2001). For example, on the one hand, Chau and Hu (2001) and Davis et al. (1989) found only attitude and perceived behavioral control significantly influence intention, and Mun, Jackson, Park, and Probst (2006) observed only subjective norm and perceived behavioral control significantly influence intention. On the other hand, Lowe, Lynch, and Lowe (2015) noted only attitude and subjective norm significantly influence behavioral intention. Therefore, as with the Diffusion of Innovations model, there is no clear and consistent guidance about which predictors are most likely to affect adoption within the Theory of Planned Behavior framework.

Building upon the Theory of Planned Behavior, Davis (1989) developed the Technology Acceptance Model to explain an individual's adoption decisions. Although initially developed within an information systems context, that model has been widely accepted among innovation adoption scholars because of its intuitiveness and parsimony. Specifically, and analogous to elements of the Diffusion of Innovations model, the Technology Acceptance Model proposes an individual's adoption decision is a function of an individual's perceived ease of use and perceived usefulness. Perceived ease of use is similar to perceived complexity from the Diffusion of Innovations model. However, perceived usefulness, which reflects an overall evaluation of usefulness (a bit like a perceived benefit or utility), is subtly different from perceived relative advantage, which reflects an incremental benefit over existing ways in which consumers satisfy this need. In light of the Technology Acceptance Model's extensive use in the literature meta-analysis, research by King and He (2006) revealed a similar inconsistent relationship on intention and behavior among the constructs. Though the Technology Acceptance Model is parsimonious and useful, researchers have begun to extend it by integrating it with other theoretical domains.

An example of this extension is the Consumer Acceptance of Technology model (Kulviwat et al., 2007), which considers consumers' affective reactions by integrating constructs from the PAD (pleasure, arousal, and dominance) domain. This serves to "balance" the utilitarian nature of models such as the Diffusion of Innovations model, Theory of Reasoned Action, Theory of Planned Behavior, and Technology Acceptance Model. Nasco, Kulviwat, Kumar, and Bruner II (2008) and others have used the Consumer Acceptance of Technology model and found further empirical support for this construct.

Departing from conventional innovation adoption theories, Kim et al. (2007) conceptualized innovation adoption from a value maximization perspective and defined the key antecedents to adoption as perceived benefits (i.e., usefulness and enjoyment) and perceived sacrifices (i.e., technicality and perceived fee). These antecedents affect adoption intentions through perceived value, which becomes a central construct in the model. The definition of usefulness Kim et al. used is the same as the definition of perceived usefulness from the Technology Acceptance Model and reflects an individual's perceptions, rather than some objective criteria. Kim et al. found usefulness, enjoyment, technicality, and perceived fee have a significant impact on perceived value, and perceived value has a significant relationship with adoption behavior. Setterstrom, Pearson, and Orwig (2013) studied the adoption of mobile-enabled wireless technology using the Value-based Adoption

Model and found that usefulness, enjoyment, and perceived fee significantly influence perceived value and that perceived value significantly influences adoption behavior. However, technicality does not have a significant effect. Wang, Yeh, and Liao (2013) found similar results. Therefore, as with other innovation adoption models, it appears the effect of the antecedents have been somewhat inconsistent, although the core links in the model seem to be validated.

Most research has applied these models to economically affluent consumer segments. However, recognizing the changing nature of marketing within such markets, Nakata and Weidner (2012) integrated the Diffusion of Innovations with theories from the poverty research area (e.g., Sen, 1999) to develop what they termed the Contextualized Bottom-of-the-Pyramid model. This is the only model that has been proposed for the BOP specifically, but it does not have operational measures and has not been empirically verified. This article proceeds by explaining how the model comparison process was implemented.

4. Materials and methods

This study's procedure followed a similar process as Venkatesh et al. (2003), whose model comparison process identified relevant models to their context and then developed a survey to collect data on these models by using measures of all the relevant model constructs.

4.1. Research context

This study was conducted in Bangladesh because large segments of consumers there are BOP consumers. In fact, a third of the Bangladeshi population was below the poverty line in 2017 (World Bank, 2017). Furthermore, one of this article's authors is from Bangladesh, fluent in Bengali, and highly familiar with its culture; this facilitated the research process.

It is difficult to precisely define and measure culture within a country, and there is also likely to be significant within-country variance, but conventional cultural models seem to suggest Bangladesh shares several commonalities with other BOP countries, particularly in terms of collectivism, a common characteristic of subsistence marketplaces (Burgess & Steenkamp, 2006; Nakata & Weidner, 2012). According to the 6-D model of culture (Hofstede Insights, 2018), Bangladesh is a relatively collectivist society (Individualism = 20), and it scores high in Power Distance (Power Distance = 80), reflecting an acceptance of hierarchy. It also scores high on Masculinity (Masculinity = 55) and Uncertainty Avoidance (Uncertainty Avoidance = 60), indicating a culture that is more orthodox in its behavior. Bangladesh seems to exhibit a number of commonalities with other countries that have large segments of BOP consumers, particularly in terms of collectivism, individualism, masculinity, and uncertainty avoidance (see Table 1).

Two pro-poor service innovations were selected for this study from a larger list of possible pro-poor innovations which satisfied the criteria of Ramani et al. (2012). These service innovations were bKash mobile banking (a commercial mobile money service targeted at the poor) and

Table 1
Hofstede Insights of countries that have large segments of BOP consumers.
Source: Hofstede Insights, 2018.

	Bangladesh	India	Nigeria	Brazil	Tanzania	Ecuador
Power distance	80	77	80	69	70	78
Individualism	20	48	30	38	25	8
Masculinity	55	56	60	49	40	63
Uncertainty avoidance	60	40	55	76	50	67
Long-term orientation	47	51	13	44	34	–
Indulgence	20	26	84	59	38	–

Union Information and Service Centre (UISC, a public service designed to bring government services to the poor through information technology).

A subsidiary of BRAC Bank (one of the country's largest banks and affiliated with one of its most well-known NGOs), bKash is a pioneering mobile banking service *for the poor*, providing 24-hour banking services to poor Bangladeshi consumers through mobile phones. It provides a scalable mobile money platform to enable cheaper and more efficient money transfers (e.g., cash deposits, cash withdrawals, and payment services) and has been touted as a revolution in banking for the poor because it conveniently enables these services through mobile phones. Previously, such consumers would have had very limited access to formal banking and financial services because of barriers related to infrastructure, cost, and social exclusion. Because of the ubiquity of mobile phones, consumers can use a non-web-enabled mobile phone to send or receive money to another person. Typically, money transfers are small (i.e., < 10,000 BDT or about US$120), and users pay a relatively small fee of 5 Bangladeshi taka (equivalent to about US$0.06). bKash agents are widely available throughout urban and rural areas and, if needed, can assist consumers with transactions (e.g., depositing or withdrawing money). Though bKash has been a success in its own right, it has also been supported by well-known funders such as the Bill & Melinda Gates Foundation. As of March 2016, the number of bKash users was 21.2 million (12.5% of Bangladesh's population).

Union Information and Service Centre (UISC) centers are small kiosks that are part of a larger government-instituted digital network and are based within urban and rural areas of Bangladesh. The centers use information communication technology to facilitate the provision of mainly government but also private services. There are > 4554 UISCs located across Bangladesh (Union Digital Centre. a2i website, 2017) within each of the country's Union Parishads (the lowest tier of government). UISCs provide both free and fee-based services and are considered an important contributor to citizens' welfare. Uses vary and depend upon need (e.g., a villager can try to learn English using digital resources or a school child can access their exam results), but the services' main purpose is to make information and other resources more accessible to the poor. Other public services provided by UISCs include birth registration, electric bill payment, telemedicine, passport applications, and overseas job applications. UISC also provides other services like photocopying, assisted computer usage, and various types of computer and vocational training. Those running a UISC act as facilitators to assist with usage if required (e.g., because of literacy constraints or technological know-how). Consumers can use these services by themselves or be assisted by someone with more technical expertise.

4.2. Data collection procedures and measurement

Two questionnaires were developed for bKash and UISC. Screening questions were used to ensure only eligible respondents were included. For instance, respondents were screened based on whether they had previously heard about the service and whether they earned less than US$5 a day. Questionnaires were developed to measure the constructs of the different innovation adoption models being tested (see Appendix B for a list of measures). To develop measurement items, previous literature was first reviewed to identify suitable measures; these were subsequently adapted and used in this research. The questionnaires were then translated into Bengali to facilitate data collection in the local setting, and back-translation was carried out to ensure translation equivalence (Harkness, van de Vijver, & Mohler, 2003). Specifically, one translator (a native Bengali speaker, who had been living in the United Kingdom for seven years) translated from the source language (English) into the target language (Bengali). Later, another translator (a native Bengali speaker with a master's degree in English) translated the target language (Bengali) text back into the source language (English), and any errors were rectified.

Despite back translations, there are often challenges administering questionnaires to this target population because of their literacy constraints and unfamiliarity with responding to questionnaires (Viswanathan, Hastak, & Gau, 2009). As such, there are several considerations when administering questionnaires to such respondents, including careful administration by well-trained interviewers, the use of realistic stimuli with pictographic representation, concrete tasks, the need to interact with respondents while the survey is in progress, and buy-in from notable members of the local community.

To account for these considerations, the questionnaires were administered verbally and in person by trained interviewers. The person-to-person nature of the interviews meant if any difficulties arose, respondents could be assisted throughout the process. Interviewers were recruited and carefully selected based on prior government census-related interviewing experience. First, the questionnaire instrument was administered in a pretest by one of the researchers, who then trained and debriefed the field workers by discussing the survey's nature and likely interview length and challenges that could be encountered with administration.

The pretest served to gain relevant community stakeholders' cooperation. There were nine subsistence consumers, four local school teachers, a chairman, and a district commissioner. Thus, community stakeholders were aware of the questionnaire and its administration in the community; this facilitated its acceptance. Pre-testing was useful and pointed to some important wording changes that enhanced respondents' understanding of the questions. After significant changes were made to ensure greater understanding and interpretability, the questionnaire was tested once again on a sample of the same consumers as in the target population. Visual stimuli with pictographic symbols were also used in conjunction with the measures of this study (e.g., Martini & Page, 1996) to assist respondents in answering the questions because of their literacy constraints.

Respondents were approached in different tea stalls, marketplaces, and shops (bKash agents, UISC kiosks) in Bangladesh. They were also interviewed at different times of the day and various locations in urban and rural areas, including the Dhaka, Comilla, and Feni districts. The average interview length was about 50 min. Although very labor intensive, this was most appropriate considering the literacy constraints exhibited by many respondents.

4.3. Sampling method

The survey sample size consisted of 509 respondents, with a 92.6% response rate.[1] The sample size satisfied the recommendations of Hair, Anderson, Tatham, and Black (2010) for generating reliable estimates in structural modelling. Convenience non-probability sampling was used, which, although not an optimal sampling approach and cannot be claimed to be generalizable, was the most practical because there were no reliable sample frames for the target population. Male respondents represented 80.1% of the sample. In terms of age, 50.6% were between 18 and 30 years old, 28.8% were between 31 and 35 years old, and 20.6% were over 36 years old. The distribution by residential area was balanced (59.7% urban area).

4.4. Reliability and validity

Reliability and validity of the constructs were tested using PLS. Initially, convergent validity was tested by identifying whether the items loaded significantly (p < 0.01) on their respective constructs. All Composite Reliability (CR) coefficients were well above the recommended threshold of 0.70 (Appendix B). All Average Variance

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[1] The response rate is very high partly because the survey was conducted in areas where these services were available and also because respondents seemed generally interested in engaging with the interviewer because of the novelty of participating in a survey.

Explained (AVE) coefficients (except Technicality) were in excess of recommended thresholds (Fornell & Larcker, 1981), thus indicating convergent validity. Discriminant validity was tested by comparing interconstruct correlations with the AVE square roots for each construct (Lowry & Gaskin, 2014). The constructs revealed discriminant validity according to typical criteria because the square root of AVE for each construct was greater than the respective interconstruct correlations (Fornell & Larcker, 1981).

4.5. Assessment of common method Bias

The procedural controls suggested by Podsakoff, MacKenzie, Lee, and Podsakoff (2003) were used in this research to minimize Common Method Bias (CMB). The writing and formatting of two survey questionnaires were carefully considered and pretested to avoid ambiguous and unfamiliar terms in the questionnaire. For pretesting these questionnaires, a focus group of 15 BOP consumers and local government officials evaluated the survey questionnaire to identify and clarify any ambiguous or unfamiliar terms. Survey participants were informed this research was conducted for a university project, instead of commercial purposes. Respondents were also informed there were no right or wrong answers. In addition, three sets of questionnaires were used to counterbalance the order of questions and reduce bias related to priming effects and mood effects induced by item context.

5. Results

5.1. Model comparison

Structural models were compared, taking into account the mediating relationships. Comparing models using only direct effects (Hasan et al., in press; Venkatesh et al., 2003) was limited because the effect of important antecedents may have been obscured based on shared variance and lack of discrimination between constructs. An assumption that each independent construct exerts an effect on adoption of the innovation directly has been stated in some models (Compeau, Meister, & Higgins, 2007), and these studies have assumed direct effects of the antecedents based on the principles of regression analysis (Pedhazur, 1997), which typically involves linear and direct effects. However, though statistically sensible, considering only direct effects may be less theoretically desirable. Comparing models based on their structural relationships could also potentially provide a theoretically richer understanding of the antecedents to adoption, and understanding how antecedents might operate is very important. According to Compeau et al. (2007), if one's goal is to *predict* behavior, then focusing on direct effects is acceptable. However, they also suggested if one's goal is to use the finding to *influence* behavior, a richer understanding of the ways antecedents might operate is required. Analyzing the interrelationships among each model's antecedents is an approach suitable for PLS analysis and helps in understanding how the antecedents might affect the dependent variable (e.g., their mediating relationships).

In this research, the innovation adoption models were compared based on the following criteria: (a) percentage of the model's statistically significant parameters, (b) explained variance (Adjusted R^2) of the endogenous construct, and (c) theoretical interpretation of the paths. The analysis began by comparing the models based on these criteria, followed by a mediation analysis to detect mediation and a Multi Group Analysis (MGA) to examine the nature of the relationships between the two services and between urban and rural consumers.

5.2. Model comparison (indirect effects of the antecedents)

Table 1 presents the explained variance (Adjusted R^2), the beta coefficients, and the percentage of statistically significant parameters in each model, initially for both services in aggregate.

5.2.1. Explained variance (R^2) of the endogenous constructs

After considering the interrelationship among the antecedents of these key models, these models explained between 11.11% (Value-based Adoption Model) and 29.10% (Diffusion of Innovations model) of the variance in BOP consumer's intentions to use pro-poor innovations. Though R^2 is one measure that can be used to compare model fit, it should be noted that less emphasis should be placed on this as a criteria because models with indirect effects (e.g., Technology Acceptance Model, Consumer Acceptance of Technology model, and Value-based Adoption Model) will have a lower R^2 than models with direct effects. The Consumer Acceptance of Technology model (18.70%) was superior to the Value-based Adoption Model (11.11%) and comparable to the Technology Acceptance Model (18.10%) in explaining BOP consumers' intention to use pro-poor innovations. With regard to the Technology Acceptance Model, perceived usefulness and perceived ease of use explained 19.10% of the variance in BOP consumer's attitudes towards using pro-poor innovations. Perceived ease of use explained 19.60% of the variance in BOP consumers' perceived usefulness regarding pro-poor innovations. The adjusted R^2 for intention within the Value-based Adoption Model was 11.11% (Table 2), and enjoyment, technicality, and perceived fee explained 63.80% of the variance in BOP consumers' perceived value regarding pro-poor innovations. The adjusted R^2 of the Consumer Acceptance of Technology model was 18.70% for intention (Table 2) and arousal, pleasure, perceived usefulness, and perceived ease of use explained 31.20% of the variance in BOP consumers' attitude towards using pro-poor innovations. Perceived ease of use and relative advantage explained a quarter of the variance in BOP consumers' perceived usefulness.

5.2.2. Percentage of the model's statistically significant parameters

Even though the Consumer Acceptance of Technology model had one of the highest R^2 values for intention, it also had a high proportion of statistically significant path coefficients (78%). However, other models, including the Technology Acceptance Model (100%), the Theory of Reasoned Action (100%), the Theory of Planned Behavior (100%), the Diffusion of Innovations model (80%) and the Value-based Adoption Model (80%), had a higher percentage of statistically significant parameters. Simpler models may have a large proportion of constructs that are statistically significant merely because they have fewer antecedents.

5.2.3. Theoretical interpretation of the paths

The coefficient of perceived usefulness on attitude was positive and statistically significant in the Technology Acceptance Model ($\beta = 0.275$, $p < 0.05$) and the Consumer Acceptance of Technology model ($\beta = 0.181$, $p < 0.05$) after including the indirect effects of antecedents. The coefficient of perceived ease of use on attitude appeared to be always positive and statistically significant in respective models (Technology Acceptance Model $\beta = 0.243$, $p < 0.05$, and Consumer Acceptance of Technology model $\beta = 0.147$, $p < 0.05$). The coefficient of attitude on intention was positive and statistically significant in the respective models (Technology Acceptance Model $\beta = 0.427$, $p < 0.05$ and Consumer Acceptance of Technology model $\beta = 0.434$, $p < 0.05$) after considering interrelationships among these antecedents (see Table 2).

Table 2 also summarizes the effects of all the constructs examined. Across the model investigated, perceived fee ($\beta = 0.717$, $p < 0.05$) exhibited the strongest effect on perceived value. Enjoyment exhibited a stronger effect ($\beta = 0.161$, $p < 0.05$) than that of technicality ($\beta = 0.099$, $p < 0.05$), despite showing a weaker direct effect than perceived fee on perceived value across the Value-based Adoption Model. Noticeably, usefulness ($\beta = -0.004$, $p > 0.05$) was not significant to influence perceived value, as suggested in the Value-based Adoption Model. Attitude in respective models (Technology Acceptance Model $\beta = 0.427$, $p < 0.05$ and Consumer Acceptance of Technology model $\beta = 0.434$, $p < 0.05$) exhibited a stronger effect on intention

Table 2
Structural model comparison.

Models	Independent variables	Adj. R^2	Beta	% of statistically significant parameters
TRA	Attitude → Intention	$R^2_{Int} = 23.70\%$	0.319**	100%
	Subjective norm → Intention		0.251**	
TPB	Attitude → Intention	$R^2_{Int} = 27.10\%$	0.236**	100%
	Perceived behavioral control → Intention		0.204**	
	Subjective norm → Intention		0.249**	
DOI	Compatibility → Intention	$R^2_{Int} = 29.10\%$	0.406**	80%
	Complexity → Intention		−0.078**	
	Observability → Intention		0.105**	
	Relative advantage → Intention		0.024	
	Trialability → Intention		0.164**	
TAM	Ease of use → Attitudes	$R^2_{Int} = 18.10\%$	0.243**	100%
	Usefulness → Attitudes	$R^2_{Att} = 19.10\%$	0.275**	
	Attitude → Intention	$R^2_{PU} = 19.60\%$	0.427**	
	Ease of use → Usefulness		0.445**	
VAM	Enjoyment → Perceived value	$R^2_{Int} = 11.11\%$	0.161**	80%
	Perceived Fee → Perceived value	$R^2_{PerVal} = 63.80\%$	0.717**	
	Perceived Value → Intention		0.336**	
	Technicality → Perceived value		0.099**	
	Usefulness → Perceived value		−0.004	
CAT	Arousal → Attitude	$R^2_{Int} = 18.70\%$	0.143**	78%
	Attitude → Intention	$R^2_{Att} = 31.20\%$	0.434**	
	Dominance → Attitude	$R^2_{PU} = 25.40\%$	0.006	
	Ease of use → Attitude		0.147**	
	Ease of use → Usefulness		0.352**	
	Usefulness → Attitude		0.181**	
	Pleasure → Attitude		0.230**	
	Relative advantage → Attitude		0.05	
	Relative advantage → Usefulness		0.263**	

Note: 1. **p < 0.05. 2. CAT = Consumer Acceptance of Technology model; DOI = Diffusion of Innovations; TAM = Technology Acceptance Model; TPB = Theory of Planned Behavior; TRA = Theory of Reasoned Action; VAM = Value Based Adoption Model.

than that of perceived value (β = 0.336, p < 0.05). For the Consumer Acceptance of Technology model, relative advantage (β = 0.263, p < 0.05) exhibited a strong effect on perceived usefulness, yet relative advantage was not a significant influencer of attitude (β = 0.05, p > 0.05). To further understand the interrelationships between variables in the model, mediation tests were conducted following the Preacher-Hayes procedure (Preacher & Hayes, 2008). The findings of the Preacher-Hayes test are shown in Table 3 and are explained next.

Table 3 points out a complementary mediation (β = 0.167, p < 0.05) between perceived ease of use, perceived usefulness, attitude, and intention. The mediation was statistically significant for both the Technology Acceptance Model and the Consumer Acceptance of Technology model. Perceived ease of use can directly influence the intention and/or can indirectly influence intention through perceived usefulness and attitude. For the Value-based Adoption Model, the effect of perceived usefulness (β = 0.039, p < 0.05), enjoyment (β = 0.041, p < 0.05), and technicality (β = 0.065, p < 0.05) on intention was mediated by perceived value (complementary mediation). Thus, perceived usefulness, enjoyment, and technicality can directly influence intention and/or can indirectly influence intention through perceived

value. In addition, the effect of perceived fee (β = 0.104, p < 0.05) on intention was mediated (indirect mediation) by perceived value. Hence perceived fee does not directly influence intention. Perceived fee indirectly influences intention through perceived value. In the Consumer Acceptance of Technology model, the effect of relative advantage (β = 0.173, p < 0.05) on intention was mediated (only indirect mediation) by perceived usefulness and attitude. Relative advantage did not directly influence intention. This perceived advantage seemed to *indirectly* influence intention through perceived usefulness and attitude.

5.3. Multi Group Analysis (MGA)

MGA was conducted to account for the influence of service type (bKash and UISC) and geographical area (urban and rural) on the path coefficients. Initially, MGA divided the total sample into two subsamples (i.e., bKash and UISC). Then, MGA estimated the path model for each subsample. This research followed the Henseler (2007) procedure, which employs the bootstrap outcome of each subsample to assess significant differences in the subsamples.

Table 4 shows no significant difference among the path

Table 3
Preacher-Hayes test of mediating effects.

Models	Independent variables	Beta	Mediation type
TAM	Ease of use > Usefulness > Attitude > Intention	0.167**	Complementary mediation
VAM	Usefulness > Perceived value > Intention	0.039**	Complementary mediation
	Enjoyment > Perceived value > Intention	0.041**	Complementary mediation
	Technicality > Perceived value > Intention	0.065**	Complementary mediation
	Perceived fee > Perceived value > Intention	0.104**	Indirect only mediation
CAT	Relative advantage > Usefulness > Attitude > Intention	0.173**	Indirect only mediation
	Ease of use > Usefulness > Attitude > Intention	0.167**	Complementary mediation

Note: 1. **p < 0.05. 2. CAT = Consumer Acceptance of Technology model; TAM = Technology Acceptance Model; VAM = Value Based Adoption Model.

Table 4
Multi Group Analysis results.

Models	Paths	β	β$_{bKash}$	B$_{UISC}$	MGA (β$_{bKash}$ - B$_{UISC}$)	β$_{Rural}$	B$_{Urban}$	MGA (B$_{Rural}$ − B$_{Urban}$)
TRA	Attitude → Intention	0.319**	0.374**	0.310**	0.064	0.278**	0.288	0.01
	Subjective norm → Intention	0.251**	0.208**	0.105	0.103	0.240**	0.22	0.02
TPB	Attitude → Intention	0.236**	0.252**	0.249**	0.003	0.248**	0.220**	0.028
	Perceived behavioral control → Intention	0.204**	0.270**	0.165**	0.105	0.136	0.205**	0.069
	Subjective norm → Intention	0.249**	0.211**	0.093	0.118	0.183**	0.247**	0.064
DOI	Compatibility → Intention	0.406**	0.400**	0.206**	0.194	0.12	0.421**	0.3
	Complexity → Intention	−0.078**	−0.044	−0.17	0.126	−0.103	−0.056	0.047
	Observability → Intention	0.105**	0.168**	0.225**	0.056	0.334**	0.053	0.281**
	Relative advantage → Intention	0.024	0.022	−0.105	0.127	0.109	−0.032	0.141
	Trialability → Intention	0.164**	0.115**	0.041	0.074	0.139	0.191**	0.052
TAM	Ease of use → Attitudes	0.243**	0.250**	0.252**	0.002	0.179**	0.123	0.056
	Usefulness → Attitudes	0.275**	0.312**	0.206**	0.106	0.354**	0.293**	0.061
	Attitude → Intention	0.427**	0.473**	0.315**	0.158**	0.372**	0.364**	0.008
	Ease of use → Usefulness	0.445**	0.462**	0.573**	0.110**	0.599**	0.395**	0.205**
VAM	Enjoyment → Perceived value	0.161**	0.371**	0.026	0.344**	0.210**	0.119**	0.091
	Perceived fee → Perceived value	0.717**	0.193**	0.861**	0.668	0.693	0.659**	0.034
	Perceived value → Intention	0.336**	0.440**	−0.343**	0.783**	−0.349	0.390**	0.739
	Technicality → Perceived value	0.099**	0.282**	−0.055	0.337**	−0.094	0.032	0.126
	Usefulness → Perceived value	−0.004	0.062	−0.012	0.074	−0.025	0.039	0.065
CAT	Arousal → Attitude	0.143**	0.164	0.131	0.033	0.119	0.055	0.064
	Attitude → Intention	0.434**	0.481**	0.324**	0.157**	0.372**	0.369**	0.003
	Dominance → Attitude	0.006	−0.005	0.049	0.054	−0.107	0.021	0.128
	Ease of use → Attitude	0.147**	0.163**	0.017	0.146	0.055	0.116	0.061
	Ease of use → Usefulness	0.352**	0.361**	0.470**	0.110	0.565**	0.318**	0.247**
	Usefulness → Attitude	0.181**	0.192**	0.179**	0.013	0.278**	0.197**	0.081
	Pleasure → Attitude	0.230**	0.163	0.391**	0.228**	0.28**	0.214**	0.067
	Relative advantage → Attitude	0.005	0.097	−0.047	0.144	0.152	0.057	0.095
	Relative advantage → Usefulness	0.263**	0.308**	0.162	0.146	0.124**	0.329**	0.205

Note: CAT = Consumer Acceptance of Technology model; DOI = Diffusion of Innovations; TAM = Technology Acceptance Model; TPB = Theory of Planned Behavior; TRA = Theory of Reasoned Action; VAM = Value Based Adoption Model.
Note: 1. **p $<$ 0.05 2. *p $<$ 0.1.

relationships of the bKash subsample and the UISC subsample for the Theory of Reasoned Action, the Theory of Planned Behavior, and the Diffusion of Innovations model. For the Technology Acceptance Model, there was a significant difference such that the attitude → intention path coefficient was higher for the bKash subsample (β = 0.473, p $<$ 0.05) than for the UISC subsample (β = 0.315, p $<$ 0.05). The influence of perceived ease of use on perceived usefulness was higher in the UISC subsample (β = 0.573, p $<$ 0.05) than the bKash subsample (β = 0.462, p $<$ 0.05). For the Value-based Adoption Model, the influence of enjoyment → perceived value coefficient was only significant in the bKash subsample (β = 0.371, p $<$ 0.05). On the other hand, the enjoyment → perceived value coefficient was not significant in the UISC subsample (β = 0.026, p $>$ 0.05). Also, perceived value had a positive influence on intention in the bKash subsample (β = 0.440, p $<$ 0.05). However, perceived value had a negative influence on intention in the UISC subsample (β = −0.343, p $<$ 0.05). Perceived value represents the consumer's perception of a technology based on the benefits and sacrifices required to use the technology. The influence of technicality on perceived value was only significant in the bKash subsample (β = 0.282, p $<$ 0.05). This may be attributed to the technical nature associated with a mobile banking service. In the case of the Consumer Acceptance of Technology model, the influence of attitude on intention was higher in the bKash subsample (β = 0.481, p $<$ 0.05) than the UISC subsample (β = 0.324, p $<$ 0.05). Interestingly, the influence of pleasure on attitude was significant in the UISC subsample (β = 0.391, p $<$ 0.05), but not for the bKash sample (β = 0.163, p $>$ 0.05).

With respect to geographical area (urban or rural), few significant differences emerged, as shown in Table 4. For the Diffusion of Innovations model, there was a significant difference in the observability → intention coefficient such that the path coefficient was only significant for the rural subsample (β = 0.334, p $<$ 0.05). For the Technology Acceptance Model, there was a significant difference in the ease of use → usefulness coefficient such that the path coefficient was

higher for the rural subsample (β = 0.599, p $<$ 0.05) than the path coefficient of the urban subsample (β = 0.395, p $<$ 0.05). As might be expected, for the Consumer Acceptance of Technology Model, there was also a significant difference in the ease of use → usefulness coefficient such that the path coefficient was higher for the rural subsample (β = 0.565, p $<$ 0.05) than the path coefficient of the urban subsample (β = 0.318, p $<$ 0.05).

6. Discussion

This study addresses calls in the literature to develop a better understanding of pro-poor innovation adoption among the BOP and subsistence marketplaces (e.g., Nakata & Weidner, 2012). Arts et al. (2011) reviewed 77 studies on innovation adoption, mostly carried out in developed countries. In doing so, their results point to the important element of context in understanding consumer innovation. Given the unique context of subsistence marketplaces, expanding our understanding of innovation adoption in this research area is important.

This research contributes to the literature at the intersection between innovation adoption and subsistence marketplaces by comparing existing innovation adoption models in this new context across two different services with distinct characteristics. Specifically, the study contributes by (a) providing guidance about which models work best in this context and showing that some kind of hybrid model is needed to best explain adoption intentions; (b) developing propositions about key constructs used by subsistence consumers in the innovation evaluation process (see Section 6.2); (c) empirically assessing relevant mediating relationships; and (d) empirically evaluating the nature of these relationships across two distinct pro-poor service innovations and within urban and rural areas. Such information is useful for managers and policy makers to understand the needed levers to enhance adoption and for researchers to understand how best to conceptualize related research questions. A summary of the key findings from the analysis is

Table 5
Summary of key findings.

No single model is distinctly superior in explaining subsistence consumers' intentions to adopt pro-poor innovations.
⇒ The Diffusion of Innovations model explains the highest variance (29.10%) in intention to adopt followed by the Theory of Planned Behavior (27.10%), the Theory of Reasoned Action (23.70%), the Consumer Acceptance of Technology Model (18.70%), the Technology Acceptance Model (18.10%), and the Value Based Adoption Model (11.11%).
⇒ The Technology Acceptance Model (100%), Theory of Reasoned Action (100%), and Theory of Planned Behavior (100%) have the highest proportion of statistically significant paths, but they also explain a lower amount of the variance in intention.
A hybrid model would seem to be appropriate in explaining pro-poor innovation adoption intention. The following factors should be considered based upon the statistically significant paths across the different models.
⇒ Service benefits (e.g., relative advantage and compatibility)
⇒ Control factors (e.g., perceived behavioral control, ease of use, trialability, technicality, and complexity)
⇒ Social factors (e.g., observability and social norms)
⇒ Economic factors (e.g., perceived fee and perceived value)
⇒ Hedonic factors (e.g., enjoyment, pleasure, arousal)
⇒ Attitudes towards the innovation
Any newly developed hybrid model should take account of mediating relationships because insignificant direct effects may well obscure significant and mediating relationships that have causal effects. For example:
⇒ Perceived fee indirectly influences intention to adopt innovation through perceived value.
⇒ Perceived relative advantage influences intention only indirectly through perceived usefulness and attitude.
The nature of the findings is relatively consistent across the two different services (bKash and UISC). However, Multi Group Analysis reveals some differences.
⇒ The influence of enjoyment on intention is only significant for bKash, and the influence of technicality on perceived value is only significant for bKash.
⇒ Perceived value has a positive influence on intention for bKash, whereas perceived value has a negative influence on intention for UISC.
⇒ The influence of pleasure on attitude is only significant for UISC, and the influence of attitude on intention is higher for bKash than for UISC.

presented in Table 5, and these contributions are highlighted and expanded on in Section 6.1.

6.1. Models of pro-poor service innovation adoption in subsistence marketplaces

By comparing key innovation adoption models and their structural relationships in this context across two commonly used pro-poor service innovations, this research shows which models statistically perform best. The Theory of Planned Behavior seemed to perform reasonably well, and all three predictors had a positive effect on intention to adopt new technologies, as expected. This is similar to other studies on adoption of new banking technologies (i.e., Lee, 2009) in other market contexts. The Technology Acceptance Model also had reasonable predictive validity, although this was smaller than in other studies that included BOP markets (e.g., Ashraf, Thongpapani, & Auh, 2014). With respect to the Diffusion of Innovations model, although it explained a high proportion of variance in intention, only three antecedents (compatibility, complexity and observability) were statistically significant, which differs somewhat from the meta-analysis results from Arts et al. (2011) in more economically developed countries, where observability is nonsignificant and relative advantage is significant. Other models with less overlapping constructs also indicated some promise in this context (e.g., the Value Based Adoption Model [VAM] and the Consumer Acceptance of Technology [CAT]), although seemed to explain less of the variance in adoption intention. Overall, even though Rogers' Diffusion of Innovations model seemed to statistically perform best, along with the Theory of Reasoned Action and the Theory of Planned Behavior, no single model seemed to be markedly superior. This, in itself, is an interesting finding because it seems to suggest that existing and well-established models are not sufficient by themselves to understand the innovation adoption decision in this increasingly important context.

6.2. Antecedents of pro-poor service innovation adoption in subsistence marketplaces

The model comparison process results also contribute by highlighting which independent variables are significant predictors of innovation adoption in this context. Because there is no clear "winner" among the models, this helps us to draw some inferences about the nature of the factors that affect innovation adoption in this context. Specifically, although much past research among marketing and development scholars has tended to pick a favored model and simply apply it in this new context, the present findings help us to understand which variables are most appropriate and how such models should be reconceptualized and augmented. In this regard, there are some findings from this research that provide further evidence about what is relatively well-known (e.g., social factors such as subjective norms are important influencers on the adoption decision), but other findings seem to be rather surprising. For example, one unexpected finding from this research was that hedonic factors (e.g., enjoyment, pleasure, arousal) seem to be significant influencers of the adoption decision. Most models employed in this context tend to ignore such variables; therefore, the findings here point to the need to further reconceptualize theory in this area. To try and make sense of the many variables in the various models, these factors are grouped and discussed based on their variables' conceptual and empirical similarities.[2] This exercise has enabled the development of the following broad propositions about pro-poor service innovation adoption in subsistence marketplaces:

Proposition 1. For subsistence consumers, service benefits, including (a) relative advantage, (b) usefulness, and (c) compatibility, share a positive association with intention to adopt a pro-poor service innovation.

Proposition 2i. For subsistence consumers, control factors, including (a) perceived behavioral control, (b) ease of use, and (c) trialability, share a positive association with intention to adopt a pro-poor service innovation.

Proposition 2ii. For subsistence consumers, control factors, including (a) technicality and (b) complexity, share a negative association with intention to adopt a pro-poor service innovation.

Proposition 3. For subsistence consumers, social factors, including (a) social norms and (b) observability, share a positive association with intention to adopt a pro-poor service innovation.

Proposition 4i. For subsistence consumers, economic factors, including perceived value, share a positive association with intention to adopt a pro-poor service innovation.

Proposition 4ii. For subsistence consumers, economic factors, including perceived fee, share a positive association with intention to adopt a pro-poor service innovation.

Proposition 5. For subsistence consumers, hedonic factors, including (a) enjoyment, (b) pleasure, and (c) arousal, share a positive association with intention to adopt a pro-poor service innovation.

6.2.1. Service benefits

Service benefit characteristics, such as perceived usefulness and compatibility, shared a positive association with intention to adopt. As might be expected, perceived usefulness was found to be a significant predictor of new technology adoption. Compatibility is also important, and though empirically similar to perceived usefulness, the two constructs are conceptually distinct. Thus, in light of significant infrastructural constraints, products must be compatible with existing

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[2] Empirical similarity was based on an Exploratory Factor Analysis. Further details available on request.

lifestyles and behaviors. This may include not only compatibility with existing infrastructure (e.g., the materials to repair something must be readily available) but also a significant cultural element through compatibility with existing lifestyles. For example, improved cookstoves (also known as *chulhas* in India) have been widely researched among development scholars as a solution to environmental and health concerns in subsistence marketplaces. Though often touted as technologically superior to a more traditional *chulha*, adoption of these improved devices seems to have been slow because of the behavioral change required to use them and their incompatibility with existing lifestyles. For example, Khandelwal et al. (2017) pointed out the need for the stove to be easily repaired with materials readily available and for users of improved cookstoves to learn new cooking techniques and ways to fuel the fire. Thus, it seems to be the case that improved cookstoves are not highly compatible with existing lifestyles, and on this basis, they may be perceived as less useful.

Of interest, and contrary to expectations, the relationship between relative advantage and adoption intention was not significant for either bKash or UISC. This was most puzzling because relative advantage has been a consistent predictor of adoption intention in meta-analysis studies (e.g., Arts et al., 2011). However, although there was no direct effect, relative advantage was found to influence adoption intention through the mediating role of perceived usefulness. This points to another contribution of the methodological approach here. The model comparison process was done based on comparing structural models and their mediating relationships, rather than their direct relationships with no mediation. Comparing models based on their direct relationships seems to be more common in the literature (e.g., Hasan et al., in press; Venkatesh et al., 2003) because focusing on direct effects is preferable when one's goal is to predict behavior. However, this may obscure important and theoretically meaningful relationships. The less-competitive nature of developing countries, in which slower adoption rates of innovations are more typical (Talukdar et al., 2002), may explain why consumers are less sensitive to relative advantage in this context. It could also be that because economic factors (e.g., perceived fee, perceived value) are important to this segment, it is not enough that some new product or service has a relative advantage over what currently exists. Perhaps, that relative advantage may only become important if it provides a great-enough benefit relative to the increased cost of acquisition. Interestingly, to try to resolve some of the complexity in innovation adoption research, scholars such as Arts et al. (2011) have used these terms (relative advantage and perceived usefulness) synonymously. Consistent with Kulviwat et al. (2007), the findings here provide further evidence that they are conceptually distinct, although related. Thus, future model comparison research should compare models while considering their mediating relationships, and the role of constructs such as relative advantage and perceived usefulness should be carefully conceptualized.

6.2.2. Control factors

The significance of the effect of perceived ease of use on intention was relatively consistent across service types. Perceived ease of use was also found to be a significant predictor of adoption of new technologies in another BOP context (Hossain & Jamil, 2015). The effect of perceived ease of use on intention is mediated by attitudes and seems to be marginally greater for UISC than for bKash. This may be because bKash is a simpler service to use; thus, ease of use is not seen as an issue. However, UISC may be seen as more complex by users because of the different services involved. Likewise, the influence of technicality on perceived value was only significant for bKash. Again, bKash is relatively simple to use and is a service one is likely to use away from a bKash office and without assistance, but UISC services can only be accessed at a UISC kiosk, which is staffed by someone who can assist with usage enquiries. It also seemed to be stronger for rural consumers than for urban consumers (both still significant groups). Thus, perceived ease of use is important for both rural and urban consumers, but it might be

more important for rural consumers because infrastructure and serviceability is a bigger constraint.

As might be expected, complexity was a significant predictor, and this seems to contrast with the status quo in developed economies (e.g., Arts et al., 2011). Namely, within intensely competitive developed economies characterized by dynamic technological innovation and frequent consumer exposure to technological appeals, complexity may be a lower concern or barrier. In contrast, among subsistence consumers, who are less familiar with technology, complexity may generate significant behavioral barriers towards adoption. Perhaps, consumers in developing economies are less exposed to technologically complex products and are less able to access product or service technical support due to less developed retail and customer support systems. With markets more stratified and a smaller segment of consumers able to afford high-priced and complex products, purchases may be driven more by status (i.e., reinforcement of hierarchy) and social needs. Low scores on uncertainty avoidance and power distance and high scores on individualism have been shown to be associated with higher innovation rates (Shane, 1993). Donthu (2017) pointed out that collectivism and uncertainty avoidance moderate the relationship between Technology Acceptance Model variables (i.e., perceived usefulness → intention) and directly affect perceived usefulness and ease of use.

Trialability is also a significant predictor, but only for bKash. Trialability may be a factor that can help overcome issues associated with complexity and ease of use, and it might be stronger for bKash because its services are often used away from technical assistance; at UISC service centers, users can revert to one of the center entrepreneurs for assistance.

6.2.3. Social factors

Similar to prior research (Miller & Mobarak, 2014), subjective norms were a consistent predictor of adoption intention. Though subsistence consumers have been characterized by their rich social relationships in much other research (Murendo, Wollni, De Brauw, & Mugabi, 2017), this finding serves as a useful corroboration for the validity of the findings here and suggests such social factors perform a strong and important role in this context.

As highlighted by the results of the Diffusion of Innovations model, observability of the benefits of new product features seems to be important in the subsistence context; thus, enhancing observability may augment the offer's visual comprehensibility (Hammond & Prahalad, 2004; Hasan et al., 2017). However, this effect was seen to be more significant for rural consumers, rather than urban consumers. This might suggest that in rural communities, observability has an effect because of the tighter knit and more collectivist nature of these communities. In such cases, when the benefits of an innovation are more readily observable, this is likely to have a positive effect on intention due to the social proximity of individuals and their tighter networks (i.e., stronger networks and greater peer-group influence). However, the nonsignificant effect for urban consumers may be explained by the looser communities that exist and the weaker-established networks. This is an interesting finding in light of Arts et al.'s (2011) results that showed observability is not a consistent predictor of adoption intention. For rural consumers, this would imply that not only can adoption be enhanced through public product and service demonstrations within the network but also these may not be so effective within urban areas.

6.2.4. Economic factors

Perceived value was also a significant predictor overall, as might be expected. However, interestingly, perceived value had a negative association with intention for UISC, which was contrary to initial expectations. UISC offers a compelling value proposition because most services are free, but this value proposition may become murkier because of the interaction with somewhat bureaucratic and less-understandable government systems. Thus, no matter how simple the

technology is made for consumers to use, if the services accessed are bureaucratic, then this may negatively influence perceived value of using the service. Thus, technology is not a panacea for service providers and is simply a medium through which some other service can be accessed. However, the perceived benefits for bKash are simpler and clearer, particularly compared to prior methods of money transfer.

6.2.5. Hedonic factors

In this study, emotions such as enjoyment, pleasure, and arousal were found to be significant predictors of attitude. Thus, adoption in these contexts was not entirely driven by rational or utilitarian motivations. Concepts such as value and price are at the forefront of subsistence consumers' minds (a similar observation within contexts such as Brazil has been made [Ferreira, da Rocha, & da Silva, 2014]), and existing models of innovation adoption could be adapted to reflect this. Communicating personal enjoyment of a new technology may therefore be an important communication strategy, particularly when pleasure is combined with functionality and aligned with existing lifestyles, local needs, and constraints. The notion of being able to interact with such technologies may be exciting and empowering in itself. When we consider service type, the influence of enjoyment on intention was only significant for bKash. This seems to suggest that for commercial and profit-motivated services, such as bKash, enhancing the hedonistic component may be important in influencing adoption. However, for government services, like UISC, users recognize the technology is a medium through which to access a more mundane and perhaps bureaucratic service, and as such, the role of enjoyment is more limited.

6.3. Research implications

This research has several important implications for the literature on innovation adoption and subsistence marketplaces. First, based on the model comparison process across the two pro-poor service innovations, the nature of the factors likely to affect innovation adoption seem to be clear. Rather than pick a favored model and, thus, risk model misspecification issues, researchers should be sure to measure the full range of factors, including service benefits, control factors, social factors, economic factors, and hedonic factors. Other research has begun to conceptualize this domain, but it has yet to be empirically tested.

Second, by comparing models using causal paths, rather than direct effects, this research also shows how independent variables explain intention to adopt pro-poor service innovations. This is important because a focus on the direct effects could obscure important influencing variables, as was found to be the case in this research. Thus, more generally, researchers who use a model comparison approach ought to also consider the mediating relationships to ensure the effects of some variables are not overlooked.

Finally, this research has implications for special issue calls for papers on culture because certain culture-related variables (e.g., collectivism) have close links with innovation adoption. Thus, innovation adoption across cultural models should include culture as a moderating variable.

6.4. Managerial implications

In relation to the presented findings, there are clear managerial implications. Enhancing perceived usefulness and enjoyment of new products may be effective strategies to promote new technology adoption in the subsistence context, and enjoyment may be attained through social connections. Communication campaigns may, therefore, focus on perceived enjoyment of new products (hedonic appeals), rather than purely utilitarian motives, particularly for services with similar characteristics to bKash, which may include the enjoyment obtained from social interactions (e.g., campaigns that focus on enjoyment attained through reinforced social connections and bonding when transferring money).

Subjective norms have a positive effect on attitude towards adoption of new technologies. Therefore, using affiliated consumer endorsers or other positive endorsements from associated reference groups may stimulate the adoption of new technologies. Such endorsers should be closely matched to the target group and might be socially quite proximal, as has been found in past research (e.g., Miller & Mobarak, 2014). Likewise, promotion by word-of-mouth and opinion leaders, who play an influencing role, may be an important way to stimulate adoption. For example, within the purchasing decision, a child may be an important user who may help grandparents who may be less literate (Hasan et al., 2017).

Control factors seem to also be important influencers on adoption. Therefore, messages highlighting ease of response, connectivity, and reliability of new technologies are likely to be effective, particularly among low-literacy consumers. These messages can improve both directly and indirectly purchase intentions through perceived value. The results are in line with Berger and Nakata's (2013) finding that innovations are more effectively implemented in BOP markets if they are congruent with social and market conditions. Demonstrating how the product fits existing lifestyles and generating opportunities to test new products (e.g., promotions, free trials, product testing) may be effective strategies in innovation adoption in both developed and BOP markets because they serve to reduce adoption barriers. Yet, in developing markets, unlike many developed markets, new product features should be promoted based on making the benefits more observable. Encouraging consumers to feel in control of managing new products and integrating them into their lifestyle to increase compatibility and align with their constraints are important features in the BOP context. This feeling of being in control through a belief the new product or service is easy to use and less technically complex appears to be facilitated through the positive effect of perceived behavioral control, ease of use, and the negative effect of complexity.

6.5. Limitations and further research

This study is ultimately exploratory in nature because of the non-probability sample used and the lack of research in this area, and caution should be exercised when evaluating the results. First, the study is limited to a focus on one country (Bangladesh) and consumer evaluations of two products (mobile banking and internet kiosks). One reason for this more limited form of data collection was the time it took to conduct the surveys (in many cases, around 1 h per interview). Collecting primary survey data in this environment was difficult because consumers were not easily contacted through more technologically sophisticated techniques (e.g., online surveys), and they are not always accustomed to completing surveys. Second, due to the respondents' characteristics (e.g., a low level of literacy), the surveys took more time to complete. Further research should be conducted in other regions where the BOP exists (e.g., Africa, South America, etc.) and on a greater number of product categories to enhance generalizability of the results. Finally, the context is highly collectivist and based on a predominantly Muslim culture. High levels of religiosity have been associated with more negative attitudes towards innovation (Benabou, Ticchi, & Vindigni, 2015), and religious and spiritual goals have also been seen to constrain consumers from acquiring specific possessions (Lastovicka, Bettencourt, Hughner, & Kuntze, 1999). Cultural values in Muslim countries have been found to inhibit innovation adoption (Riffai, Grant, & Edgar, 2012); however, it should be noted that Bangladesh is a secular democracy.

The study was also limited by the assumption that such marketplaces are a largely homogeneous segment. Certain characteristics of the sample were recorded (e.g., rural or urban, gender, etc.), but the study would have benefited from comprehensively recording other consumer characteristics. Given the length of the survey based around the model comparison method employed, further questioning would have been a detriment to the study results due to increasing respondent

fatigue that would have reduced the response rate and data reliability. Clearly, however, such characteristics should add to our ability to understand this market and its different segments. Further research can address this by examining the influencing factor of consumer characteristics on a reduced set of models/constructs, such as the moderating role of cultural dimensions (Lee, Trimi, & Kim, 2013).

Appendix A. Consumer innovation adoption models

Model: brief description	Key constructs of the model	Representative literature
DOI: suggests that relative advantage, complexity, compatibility, trialability and observability are key characteristics of innovations, which affect innovation adoption decisions of consumers.	Relative advantage: the degree to which potential adopters perceive the innovation as being better than existing substitutes Compatibility: the degree to which potential adopters perceive the innovation as being consistent with their socio-cultural customs or consistent with existing values, needs, and experiences Complexity: the degree to which the new innovation is perceived as difficult to understand or use Trialability: the degree to which an innovation is able to be tested on a limited basis Observability: the degree to which an innovation's advantages or features are being witnessed, imagined or explained to others	Rogers (2003)
TRA: suggests that consumers' behaviors are determined by their intentions, which are in turn determined by their attitudes towards the action and subjective norm.	Attitudes towards behavior: "an individual's positive or negative feelings (evaluative affect) about performing the target behavior" (p. 216) Subjective norm: "the person's perception that most people who are important to him think he should or should not perform the behavior in question" (p. 312)	Fishbein and Ajzen (1975)
TPB: was developed from TRA by adding perceived behavioral control to study situations, where a consumer lacks the essential resources to perform the goal behavior.	Attitudes towards behavior: see TRA above. Subjective norm: see TRA above. Perceived behavioral control: "the perceived ease or difficulty of performing the behavior" (p. 188).	Ajzen (1991)
TAM: suggests that the perceived ease of use and the perceived usefulness are two key antecedents, which affect innovation adoption decisions of consumers.	Perceived usefulness: "the degree to which person believes that a particular technology will benefit the person to perform some tasks" (p. 320) Perceived ease of use: "the degree to which a person believes that using a particular system would be free of effort" (p. 320) Attitudes towards behavior: see TRA above.	Davis (1989)
CAT: was developed by combining the TAM model and the PAD paradigm (pleasure, arousal and dominance) of affect suggested by Mehrabian and Russell (1974).	Relative advantage: see DOI above. Perceived usefulness: see TAM above. Perceived ease of use: see TAM above. Pleasure: "the degree to which a person experiences an enjoyable reaction to some stimulus" (p. 1062) Arousal: "a combination of mental alertness and physical activity which a person feels in response to some stimulus" (p. 1062) Dominance: "the extent to which the individual feels in control of, or controlled by, a stimulus" (p. 1062)	Kulviwat et al. (2007)
VAM: was developed by the literature in the areas of technology adoption and perceived value.	Usefulness: see TAM above. Enjoyment: the extent to which using a technology seems to be pleasant in its own right, except for any performance consequences that may be predicted Technicality: the degree to which a technology is perceived as being technically excellent in the process of providing services Perceived fee: the internalization of the objective selling price of a product/service Perceived value: a consumer's overall perception of a technology based on the benefits and sacrifices required to adopt and/or use it	Kim et al. (2007)

CAT = Consumer Acceptance of Technology model; DOI = Diffusion of Innovations; TAM = Technology Acceptance Model; TPB = Theory of Planned Behavior; TRA = Theory of Reasoned Action; VAM = Value Based Adoption Model.

Appendix B. Construct measurement and validity

Construct	Items	Source	CR	AVE
Adoption intention	1) Given the opportunity, I will use bKash mobile banking services/UISC. 2) I am likely to use bKash mobile banking services/UISC in the near future. 3) I am willing to use bKash mobile banking services/UISC in the near future. 4) I intend to use bKash mobile banking services/UISC when the opportunity arises.	Schierz, Schilke, and Wirtz (2010)	0.87	0.62
Perceived usefulness	1) bKash/UISC is a useful mode of payment. 2) Using bKash/UISC makes the handling of payments easier. 3) bKash/UISC allow for a faster usage of mobile applications (e.g., money transfer, cash in, cash out). 4) By using bKash/UISC, my choices as a consumer are improved (e.g., flexibility, speed).	Schierz et al. (2010)	0.83	0.55
Ease of use	1) It is easy to become skillful at using bKash/UISC. 2) The interaction with bKash/UISC is clear and understandable. 3) It is easy to perform the steps required to use bKash/UISC. 4) It is easy to interact with bKash/UISC.	Schierz et al. (2010)	0.81	0.52
Subjective norm	1) People who are important to me would recommend using bKash/UISC. 2) People who are important to me would find using bKash/UISC beneficial 3) People who are important to me would find using bKash/UISC a good idea 1) I would be able to use bKash/UISC.	Schierz et al. (2010) Taylor and Todd (1995)	0.90	0.75

Construct	Items	Source		
Perceived behavioral control	2) Using bKash/UISC is entirely within my control. 3) I have the resources and the knowledge and the ability to make use of bKash/UISC.		0.85	0.67
Relative advantage	1) bKash/UISC offers advantages that are not offered by competing products. 2) bKash/UISC is, in my eyes, superior to competing products. 3) bKash/UISC solves a problem that I cannot solve with competing products.	Cooper and Kleinschmidt (1987)	0.94	0.85
Complexity	1) Working with bKash/UISC is complicated, it is difficult to understand what is going on. 2) Using bKash/UISC involves too much time doing mechanical operations. i.e., data input, understanding the menu 3) It takes too long to learn how to use bKash/UISC to make it worth the effort. 4) In general, bKash/UISC is very complex to use.	Cheung, Chang, and Lai (2000)	0.90	0.70
Compatibility	1) Using bKash/UISC fits well with my lifestyle 2) Using bKash/UISC fits well with the way I like to purchase products and services 3) I would appreciate using bKash/UISC instead of alternative modes of payment (e.g., credit card, cash)	Schierz et al. (2010)	0.89	0.72
Trialability	1) Before deciding on whether or not to use bKash/UISC, I want to be able to use it on a trial basis. 2) Before deciding on whether or not to use bKash/UISC, I want to be able to properly try it out. 3) I want to be permitted to use bKash/UISC, on a trial basis for some time long enough to see what it can do.	Zolait (2009)	0.84	0.73
Observability	1) I would have no difficulty telling others about the results of using bKash/UISC. 2) I believe I could communicate to others the outcomes of using bKash/UISC. 3) The results of using bKash/UISC are apparent to me.	Meuter, Bitner, Ostrom, and Brown (2005)	0.81	0.59
Pleasure	1) Happy/unhappy 2) Pleased/annoyed 3) Satisfied/unsatisfied 4) Contented/melancholic 5) Hopeful/despairing 6) Relaxed/bored	Kulviwat et al. (2007)	0.94	0.71
Arousal	1) Stimulated/relaxed 2) Excited/calm 3) Frenzied/sluggish 4) Jittery/dull 5) Wide-awake/sleepy 6) Aroused/unaroused	Kulviwat et al. (2007)	0.92	0.66
Dominance	1) In Control/cared for 2) Controlling/controlled 3) Dominant/submissive 4) Influential/influenced 5) Autonomous/guided 6) Important/awed	Kulviwat et al. (2007)	0.70	0.62
Enjoyment	1) I have fun interacting with bKash/UISC. 2) Using bKash/UISC provides me with a lot of enjoyment. 3) I enjoy using bKash/UISC. 4) Using bKash/UISC bores me (reversed).	Agarwal and Karahanna (2000)	0.78	0.72
Technicality	1) It is easy to use bKash/UISC. 2) bKash/UISC can be connected instantly. 3) bKash takes a short time to respond. 4) It is easy to get bKash/UISC to do what I want it to do. 5) The system of bKash/UISC is reliable.	DeLone and McLean (1992); Davis (1989)	0.87	0.41
Perceived fee	1) The fee that I have to pay for the use of bKash/UISC is too high. 2) The fee that I have to pay for the use of bKash/UISC is reasonable. 3) I am pleased with the fee that I have to pay for the use of bKash/UISC.	Voss, Parasuraman, and Grewal (1998)	0.78	0.91
Attitudes towards using b-Kash	Overall, please describe how you feel about bKash/UISC. For me, using bK'ash/UISC is: 1) Bad-good 2) Negative-positive 3) Unfavorable-favorable 4) Unpleasant-pleasant	Kulviwat et al. (2007)	0.82	0.54
Perceived value	1) Compared to the fee I need to pay, the use of bKash/UISC offers value for money. 2) Compared to the effort I need to put in, the use of bKash/UISC is beneficial to me. 3) Compared to the time I need to spend, the use of bKash/UISC is worthwhile to me. 4) Overall, the use of bKash/UISC delivers me good value.	Sirdeshmukh, Singh, and Sabol (2002)	0.80	0.50

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