



## Differential innovation of smartphone and application use by sociodemographics and personality



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### ABSTRACT

In the current study, we explore predictors of smartphone and smartphone application use in a large, diverse, population representative South Korean sample ( $N = 9482$ ). Sociodemographics (e.g., gender, age, education, and income) were major predictors of smartphone and smartphone application use. Generally, younger, educated, and wealthy individuals tended to use smartphones and smartphone applications to a greater extent. Females tended to use smartphones, e-commerce applications, and relational applications more compared to males. Openness, extraversion, and conscientiousness were associated with increased probability of smartphone ownership. Extraversion was associated with decreased literacy application use and increased relational application use. Conscientiousness was associated with decreased e-commerce application use. These results imply that sociodemographics and personality predict smartphone innovation.

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### 1. Introduction

In the third quarter of 2012, the worldwide smartphone owning population reached 1 billion, in 2013 the smartphone industry reached a new milestone as comprising 55% of total mobile phone purchases, and in the first quarter of 2014, the revenue of the global smartphone industry reached US\$ 74 billion (Business Wire, 2012; Gartner, 2013; Shah, 2014). Smartphone applications are also becoming a huge industry in their own right with analysts predicting global sales of smartphone applications to reach US\$ 38 billion by 2015 (Bilton, 2011; Lessin & Ante, 2013). As the market share of smartphones continues to increase, the technology is changing the way individuals interact with information daily and even hourly. Smartphones allow users to work, play, and stay informed with world events anywhere and anytime. Smartphones are becoming an increasingly integral, and habitual, part of modern life (Oulasvirta, Rattenbury, Ma, & Raita, 2012).

Despite the widespread growth in smartphone use, considerable differences have emerged between adopters and non-adopters in terms of individual demographic and psychological characteristics. Theories of innovative behavior (e.g., Coale & Watkins, 1986; Rogers, 2003) postulate that individuals differ in their willingness

to engage in novel practices. For example, much demographic research indicates that younger and well-educated individuals typically adopt innovative behavior more quickly (Cleland & Wilson, 1987; Johnson-Hanks, Bachrach, Morgan, & Kohler, 2011), and those with the greatest earnings power tend to more easily overcome barriers to innovation (Easterlin & Crimmins, 1985). In addition to these structural considerations, personality likely also influences the willingness to adopt new technology. Personality refers to individual differences in patterns of cognition, emotion, and behavior that are relatively stable across time and situation (John, Naumann, & Soto, 2008). For example, the trait openness to experience refers to an individual's willingness to engage with new ideas or practices compared to an eagerness to reject such new ideas or practices (McCrae & Costa, 1997).

Until this study, a large, diverse, population representative study of smartphone behavior, demographics, and personality has not been conducted. The current study fills this gap in the literature by testing the associations among these variables in a large, diverse, population representative South Korean sample ( $N = 9482$ ) to examine the individual characteristics of smartphone adopters.

### 2. Smartphone trends

Beyond the overall rise of smartphone adoption throughout the world, nowhere is this trend more prevalent than in South Korea.

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In 2011, South Korea ranked fourth in overall smartphone ownership rate at 38.3% of all mobile phone users and the next year became the country with the highest overall ownership rate at 67.6% of all mobile phone users (Business Korea, 2013). These numbers are especially notable when compared to the global average of just 14.8%. Recently, South Korea overtook the U.S. in revenue generated by application sales in Google's Play mobile store, a staggering figure when you consider that South Korea is a country of only 50 million people (Cheng, 2014). With rates of smartphone ownership increasing in South Korea and throughout the world, the smartphone phenomenon is clearly impacting changes in communication and information behavior trends. Smartphones are changing the daily routines of their users, with time spent on a smartphone now surpassing time spent online on a computer in the U.S., U.K., and Italy (Nielsen, 2014). In the U.S., most of that time is spent on social media (29%), gaming (18%), and entertainment (15%) applications. In comparison, users spend 9% and 3% of their time texting and making phone calls, respectively. With increases in accessibility as well as speed, wireless Internet allows users to do more with their mobile devices than ever before. Smartphones, more so than other mobile phones, also allow increased customization of the user experience making this technology ideal for exploring the impact of individual differences on use.

### 3. Structural considerations

Obviously there are a number of important demographic or socioeconomic factors that likely influence smartphone adoption, a high cost device typically with recurring fees. In a large-scale United States sample ( $N = 2252$ ), Smith (2013) found that men were slightly more likely to own a smartphone than women (59% vs. 53%, respectively) and that aged 25–34 individuals were much more likely to have a smartphone than aged 55–64 individuals (81% vs. 39%, respectively). Further, individuals with a college degree were substantially more likely to have a smartphone than a high school graduate (70% vs. 46%, respectively), and individuals that make over \$75,000 a year were nearly twice as likely to have a smartphone as individuals that make less than \$30,000 (78% vs. 43%, respectively). Together, these statistics indicate structural obstacles to smartphone usage (e.g., comparatively higher costs and fees of smartphone usage), cohort effects (e.g., higher rates of adoption among the younger population), and the influence of lifestyle factors (e.g., use by highly educated individuals).

### 4. Personality theory and technological innovation

Beyond major structural barriers, individual differences in general patterns of behavior may predict smartphone use. The Big Five dimensional traits of extraversion, agreeableness, conscientiousness, emotional stability, and openness to experience provide a fairly broad and comprehensive description of major individual differences in personality (Digman, 1990). Individuals that are extraverted tend to act in a more outgoing and social manner compared to individuals that are less active or socially energetic. The trait of agreeableness refers to patterns of behavior marked with general concern for others and compliance with requests. Conscientiousness refers to the tendency to be organized, disciplined, and generally reliable. Emotional stability refers to having consistent (and lower) levels of anxiety, hostility, or depression compared to emotional fluctuation. Finally, openness to experience refers to the tendency to be creative, artistic, or intellectual compared to having narrow or routine interests.

People are thought to differ along these continuous dimensions due to the interaction between biological predispositions and

social learning of skills, habits, and preferences (McCrae & Costa, 2008; Roberts, Wood, & Caspi, 2008). Personality is observable early in development (Caspi et al., 2003; Measelle, John, Ablow, Cowan, & Cowan, 2005) and is highly stable across most of the lifespan (Briley & Tucker-Drob, 2014; Conley, 1984; Roberts & DelVecchio, 2000). Personality is also predictive of a number of important life outcomes, such as longevity, mental health, academic achievement, occupational achievement, and relationship outcomes (Caspi et al., 2014; Cuijpers et al., 2010; Moffitt et al., 2011; Poropat, 2009; Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007). One likely explanation for this wide ranging influence is that individuals structure their habits, lifestyle, and general interactions with the environment partially on the basis of personality (Deary, Weiss, & Batty, 2010; Shanahan, Hill, Roberts, Eccles, & Friedman, 2014).

As discussed above, the introduction of smartphones has altered the way that individuals connect with others, information, and general environmental resources. Yet, users may engage (or forgo) this new technology for many reasons. These divergent patterns of behavior are associated with psychological characteristics. Personality predicts individual differences in technology use (Devaraj, Easley, & Crant, 2008; Witt, Massman, & Jackson, 2011), online social networking applications (Back et al., 2010; Ross et al., 2009), and specifically smartphone use (Chittaranjan, Blom, & Gatica-Perez, 2013; Ehrenberg, Juckes, White, & Walsh, 2008).

Smartphone usage has been most commonly linked to extraversion and openness. Extraverts tend to use smartphones as a source of stimulation (Butt & Phillips, 2008), place importance on communication features (Lane & Manner, 2011), and express motivation for social inclusion (Park, Kim, Shon, & Shim, 2013). Similarly, the constructs of leadership and opinion leadership have consistently been linked with extraversion (Bono & Judge, 2004; Gnambs & Batinic, 2012; Judge, Bono, Ilies, & Gerhardt, 2002). Individuals that act as opinion leaders may adopt novel technologies more quickly than others and influence others by generating and spreading positive attitudes concerning the new technology (Gnambs & Batinic, 2013). Openness and associated traits predict greater adoption of smartphone use and moderate the influence of other commonly studied factors of technology adoption, such as perceived usefulness and perceived ease of use (Cho & Park, 2014). For highly open individuals, perceived usefulness is a major factor determining adoption, but ease of use is less important, indicating that the curiosity of highly open individuals may stimulate them to overcome informational barriers to use. Further, individual differences in "innovativeness," a construct very similar to openness (e.g., indicated by the item "I am interested in new ideas or information") are associated with smartphone use and intention (Kim, Seoh, Lee, & Lee, 2010; Park et al., 2013). However, most of this previous research has been based on small convenience or college student samples.

### 5. Goals of the present study

In the current study, we evaluate the predictive utility of personality and sociodemographics for smartphone adoption and smartphone application use (e.g., e-commerce, entertainment, information, literacy, and relational applications). We use a very large, demographically diverse sample compared to previous studies. This allows for highly precise effect size estimates for personality and sociodemographics at the population-level. The sample comes from South Korea, a region with high rates of smartphone usage and a potential leader of global trends. This setting provides a unique examination of the types of applications and services that are especially used in such a context, particularly because we are able to describe individual psychological and sociodemographic

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