

What colour are you? Smartphone addiction traffic lights and user profiles

What
smartphone
addiction
colour are you?

Sonia San-Martín and Nadia Jiménez
Universidad de Burgos, Burgos, Spain

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Abstract

Purpose – The key concern nowadays is smartphone addiction and user profiles. Following the risk and protective factors framework, the authors aim to characterize smartphone users according to two levels: (1) individual: referred to the use (i.e. boredom proneness, compulsive app downloading smartphone addiction) and (2) microsystem: referred to family and peers (i.e. family harmony and phubbing). Besides, the authors will derive useful managerial implications and strategies.

Design/methodology/approach – First, an extensive literature revision and in-depth interviews with experts were employed to identify the addiction-related variables at the individual and microsystem level. Second, information was collected from a sample of 275 Spanish smartphone users, and a K-means clustering algorithm was employed to classify smartphone users.

Findings – The proposed traffic lights schema identifies three users' profiles (red, yellow and green) regarding their smartphone addiction and considering individual and microsystem critical variables.

Originality/value – This study proposes a practical and pioneer traffic lights schema to classify smartphone users and facilitate each cluster's strategies development.

Keywords Smartphone addiction, Compulsive app downloading, Phubbing, Family harmony, Boredom proneness, Profiles, Cluster

Paper type Research paper

1. Introduction

Currently, the smartphone is becoming an indispensable device for people's daily activities and functions. There are 3.5 billion smartphone users globally, representing 44.9% of the world population (Statista, 2020). 94% of the young (18–29-year-olds) world population own a smartphone (Turner, 2020). An average smartphone user spends 3 h per day on their smartphone and checks it 63 times a day (Milijic, 2019; Turner, 2020). During the first half of 2020, first-time app downloads grew up 28.8%, and consumers spent \$26.4 billion in the global app ecosystem (Sensortower, 2020). Besides, social media and applications are currently used as a marketing channel (Rita *et al.*, 2021), which involves a challenge to satisfactorily and ethically address users of technologies.

Smartphones are, in fact, critical devices for the world population to the point of engendering hitches. Its use is worldwide and involves calling, texting, using an application (app), reading news, checking social networking, handling e-mail, listening to music, watching TV or gaming (Busch and McCarthy, 2021). Besides, in specific moments such as in quarantines (i.e. due to COVID-19), smartphone usage has increased for shopping or attending classes (Sensortower, 2020). In this context, the COVID-19 crisis could be leading people to

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smartphone addiction since time spent connected to smartphones has increased on average one hour per day due to lockdowns (Smartme Analytics, 2020). Consequently, the COVID-19 crisis is added to the circumstances that can aggravate the smartphone addiction problem.

Smartphone addiction has attracted the interest of several researchers who have analysed it in different disciplines such as education or health (e.g. Yang *et al.*, 2019; Mahapatra, 2019). Nowadays, addiction is not just related to substance abuse, but it is also related to Internet or smartphone overuse (Kwon *et al.*, 2013), and it implies a challenge for society, education, and business managers. However, an agreed smartphone user classification according to addiction levels and risks and protective factors and corresponding practical recommendations is lacking; it is crucial to derive managerial strategies to address each cluster. One exception is Kiss *et al.* (2020), who identified four users' profiles according to their digital devices usage.

The risk and protective factors framework (Jessor, 1992) within the social-ecological approach by Bronfenbrenner (2002) applied to study behavioural disorders (such as smartphone addiction), helps to understand complex interactions between inter- and intra-individual factors (Hong and Garbarino, 2012). In this sense, this paper seeks to propose an innovative traffic lights schema to classify smartphone users according to crucial risk (boredom proneness, addiction and compulsive app downloading and phubbing) and protective factors (family harmony) at individual and microsystem levels. The final aim is to derive practical strategies and recommendations for companies involved. Two research questions are proposed:

RQ1. Are there (and how many) different clusters of smartphone users according to risk and protective factors?

RQ2. What social and managerial challenges and implications can be derived from current smartphone use and users?

These findings will enrich existing knowledge through the following contributions: offering an easily understood classification of smartphone user profiles to derive strategies and face addiction levels, using individual and microsystem behavioural variables that involve risk and protective ways facing addiction. To the best of our knowledge, this is the first academic study with a recent broad sample of Spanish smartphone users and proposing business strategies for each cluster with experts' help.

2. Smartphone addiction, user profiles, individual and microsystem level variables

2.1 Smartphone addiction and user profiles

Smartphone addiction can be regarded as "excessive use of smartphones in a way that is difficult to control and whose influence negatively extends to other life fields" (Gökçearsan *et al.*, 2018, p. 640). The World Health Organization has not still recognized smartphone addiction as such. There is some agreement regarding the fact that mobile addiction involves excessive or problematic smartphone use, and it is broadly understood as a behavioural addiction (Yen *et al.*, 2009; Billieux *et al.*, 2008; Mahapatra, 2019). Researchers have addressed the issue of smartphone addiction (Roberts *et al.*, 2015; Lian and You, 2017), and others prefer to speak about mobile phone dependence (Seo *et al.*, 2015) or problematic smartphone use (Busch and McCarthy, 2021; Elhai *et al.*, 2016). Some authors state that individuals are not really addicted to the smartphone device but functions supplied by the device and applications (apps) (Sha *et al.*, 2019). Mobile ubiquity has led to better access to information, increased connectedness and several conveniences that also increase smartphone usage (Handa and Ahuja, 2020).

As for the smartphone user profiles, there are few recent studies considering clustering for this kind of addiction. While there is more literature on Internet addiction user profiles, smartphone user profiles lack the extent of our knowledge. Moreover, some studies only

distinguish addicts vs non-addicts (e.g. [Shu and Chieh-Ju, 2007](#)). [Vaghefi and Lapointe \(2016\)](#) classified individuals into five types (i.e. addicts, fanatics, highly engaged, regular and thoughtful users), considering their dependence and self-regulation regarding smartphone use, their information technology addiction and liability to addiction. [Kayri and Günüç \(2016\)](#) also offered a typology according to Internet addiction and socioeconomic level and found three clusters (i.e. no addiction, risk of addiction and addiction).

To develop a set of profiles that would capture students' addiction to digital devices and their usage relative to risk, [Kiss et al. \(2020\)](#) identified four distinct user profiles through cluster analysis. The first cluster was labelled as strongly protected sensation-seekers who were more prone to problematic use with moderately high protection levels but with the highest scores on the boredom proneness and sensation-seeking scales. The second cluster consisted of more balanced and non-vulnerable users, who achieved average scores on both risk and protective factors scales. The third cluster was labelled protected, conscious users prone to problematic use with lower levels of problematic use and risk factors and higher protective factors levels. The fourth cluster was labelled as strongly problematic, unprotected users, who achieved the highest scores of problematic use, and they were the less protected and had the lowest protective factors scores.

2.2 The risk and protective factors framework and addiction-related variables at the individual and microsystem level

The risk and protective factors framework provides a theoretical background for researching problematic behaviours among youth ([Jessor, 1992](#)). This framework, employed initially on medicine and psychiatric research ([O'Connell et al., 2009](#)), applies a socio-psychological and epidemiological perspective to explain the whole complex of personal, social and other environmental factors that can explain and even prevent behavioural disorders amongst youngsters ([Jessor, 1992](#)).

A later approach to this framework (i.e. social-ecological approach) suggests that four contextual domains help determine predictors of behavioural problems and addictions ([Bronfenbrenner, 2002](#)). These four domains are recalled by [Hong and Garbarino \(2012\)](#) as personal level (individual), microsystem level (family and peers), exosystem level (community) and macrosystem level (societal). The personal level refers to individual youth characteristics (i.e. psychological characteristics). The microsystem level refers to the individual direct environment (e.g. home) and comprises interpersonal relationships. Thus, at this level, family, school and compeers are the primary microsystem elements for youth. In this work, we are going to focus on these two levels as they are where most problems regarding incorrect use of smartphones appear and then are translated to a broader social level (i.e. exosystem and macrosystem levels; not considered in this study).

There are opposing factors in each level that can lead and mitigate the development of some behavioural disorders, called risk and protective factors ([Jessor, 1992](#)). A risk (protective) factor is understood as an individual attribute or environmental context that increases (reduces) the possibility of addiction, behavioural problem or disorder ([Clayton, 1995](#)). This research focuses on risk and protective factors to classify smartphone users at the individual and microsystem levels. [Table 1](#) shows several factors at the individual level have more incidence to explain smartphone addiction, and studies about the effect of factors at the microsystem are scarce and related to the context in which the individual behaves. The methodology section explains how experts helped us select the most mentioned risk and protective factors.

Next, we are dealing with the factors considered at the individual level (compulsive app downloading and boredom proneness) and at the microsystem level (phubbing and family harmony), taking into account the literature revision and experts' opinions and considering that they can have implications for society and management.

Table 1.
Risk and protective
factors of smartphone
addiction

Level	Risk	Protective
Personal level (individual)	<ul style="list-style-type: none"> • Fear of missing out (FoMO) (Handa and Ahuja, 2020; Wolniewicz <i>et al.</i>, 2020) • Boredom proneness (Kiss <i>et al.</i> 2020; Regan, <i>et al.</i> 2020) • Body dissatisfaction (Liu <i>et al.</i>, 2020a) • Female gender (Choi <i>et al.</i>, 2015) • Alcohol use (Choi <i>et al.</i>, 2015) • Smoking (Choi <i>et al.</i>, 2015) • Anxiety (Choi <i>et al.</i>, 2015) • Depression (Choi <i>et al.</i>, 2015) • Impulsivity (Regan <i>et al.</i> 2020) • Nomophobia (Regan <i>et al.</i> 2020) 	<ul style="list-style-type: none"> • Resilience (Choi <i>et al.</i>, 2015; Kiss <i>et al.</i> 2020) • Self-control (Kim <i>et al.</i>, 2018; Ekşi <i>et al.</i>, 2020; Kiss <i>et al.</i> 2020) • Self-esteem (Kiss <i>et al.</i>, 2020) • Character strengths (Choi <i>et al.</i>, 2015) • Mindfulness (Regan, <i>et al.</i> 2020) • Conscientiousness (Lian and You, 2017) • Virtues (Lian and You, 2017)
Microsystem level (family and peers)	<ul style="list-style-type: none"> • Being phubbed (Chotpitayasunondh and Douglas, 2016; Xie <i>et al.</i>, 2019) • parental neglect (Kwak <i>et al.</i>, 2018) • Domestic violence (Jeong <i>et al.</i>, 2020) • Family dysfunction (Liu <i>et al.</i>, 2020b) 	<ul style="list-style-type: none"> • Family harmony (Kim <i>et al.</i>, 2018; Ekşi <i>et al.</i>, 2020) • Parent–child attachment (Xie <i>et al.</i>, 2019) • Teacher support (Jeong <i>et al.</i>, 2020)

2.2.1 *Individual level: compulsive downloading and boredom proneness.* 2.2.1.1 Compulsive downloading. Younger users are predisposed to compulsive phone usage. Okazaki *et al.* (2019, p. 2) highlight that compulsive technology-related uses and “compulsive buying have become an important societal issue that needs to receive more attention from social marketers and policymakers”. Notwithstanding, research suggests that smartphone addictive behaviours are closely associated with other behavioural disorders (Pourrazavi *et al.*, 2014). Parylak *et al.* (2011) propose that smartphones also incite some compulsive behaviour regarding the technology sphere. Following Hsiao (2017, p. 276), *compulsive app downloading* could be understood as “the individual’s lack of control over [downloading] mobile app and the tendency to spend too much time and effort on mobile apps”. This concept is novel, since to the best of our knowledge, compulsive buying literature has not spoken about compulsive “buying” [downloading] of apps since there is an abundance of free app version in the apps’ market (Tang *et al.*, 2019). Compulsiveness involves the consumer propensity to impetuous, non-reflexive, immediate and kinetical app download (Rook and Fisher, 1995; Altintas *et al.*, 2010). This behaviour could respond to the individuals’ inability to control a desire triggered by smartphone addiction symptoms (Altintas *et al.*, 2010). Compulsive app downloading could reflect compulsion and, a ritual answer to uncontrolled thoughts about obtaining products [apps] (Okazaki *et al.*, 2019, p. 3) that might be due to smartphone addiction and which involves a challenge for businesses that develop apps and want to be socially responsible (Mrad and Chi Cui, 2020).

2.2.1.2 Boredom proneness. As Kiss *et al.* (2020) state, psychological factors, such as boredom, serve as useful tools for providing information to better understanding the role of risk factors when dealing with the youth’s problematic use of digital devices. Wolniewicz *et al.* (2020) consider boredom proneness a trait-based tendency to experience a lack of interest, indifference or apathy. Individuals who experience high levels of leisure boredom may engage in deviant activities such as substance use (Leung, 2007). Kiss *et al.* (2020) has suggested that having an abundance of time is central to boredom. Leisure boredom might be related to other forms of addiction and has been implicated in deviant activity involvement, particularly drug use and delinquency. Increasingly, the cell phone allows adolescents, while having not much to do, to be engaged in several activities, such as texting in SMS, gaming, shopping, accessing the Internet, reading online news, shooting and viewing pictures or

video, among others. Not surprisingly, literature found that the higher the level of boredom a person experiences, the higher the likelihood of being dependent on the smartphone (Leung, 2007), recycling and clothing disposal (Kwon *et al.*, 2020) and shopping impulsively (Sundstrom *et al.*, 2019; Bozaci, 2020).

2.2.2 Microsystem level: phubbing and family harmony. *2.2.2.1 Phubbing.* Phubbing is the act of ignoring someone by using the smartphone instead of interacting face-to-face with others (Chotpitayasunondh and Douglas, 2016). “The person engaging with a smartphone instead of paying attention to another person or persons during social interaction is called a phubber, while the person(s) who is/are being phubbed, that is, phone snubbed, during the social interaction is called the “phubbee(s)” (Al-Saggaf and O’Donnell, 2019, p. 132). When someone is phubbed, he/she reports less trust in the phubber, a decreased perceived quality of communication and diminished satisfaction with the relationship (Chotpitayasunondh and Douglas, 2016). Phubbing is considered an irritating and impolite act (Miller-Ott and Kelly, 2017) and, people who have been phubbed described strategies to evade face-to-face lost contact. Sometimes this action (phubbing) is used to compensate for the related needs and avoid the sense of social exclusion (David and Roberts, 2017). Xie *et al.* (2019) find that individuals’ mobile phone addiction suffers intensification after facing phubbing. Existing research on phubbing highlighted several factors that could cause one to use their smartphone while having a face-to-face conversation with others, including smartphone addiction, SMS (texting) addiction, social media addiction, Internet addiction and to some extent, game addiction (Wolniewicz *et al.*, 2020). Phubbing can also affect concentration and relations among education stakeholders when the mobile device is used for non-academic purposes (Hall-Newton *et al.*, 2019).

2.2.2.2 Family harmony. Regarding the microsystem level, the family environment is related to several behavioural problems, including problematic smartphone use (O’Connell, 2009; Altintas *et al.*, 2010; Busch and McCarthy, 2021). Family harmony plays a role against the development of psychopathology and represents a resource to face life stress (Kavikondala *et al.*, 2016). Family harmony is defined as “a value that expresses the closeness, cooperation, and relationships among family members and contributes to the individuals’ well being” (Ekşi *et al.*, 2020, p. 3).

Buctot *et al.* (2020) affirm that individuals that show smartphone addiction also show a problematic relationship with family mainly due to users’ diverted attention, and they try to hide their abusive use from family. Thus, the youth’s family background is crucial in determining youth’s behaviour regarding smartphone use (Buctot *et al.*, 2020). Family models and norms influence the development of addictions and, not receiving open and mutual communication with the family or close support negatively affect youth’s behaviour (Yen *et al.*, 2007; Kavikondala *et al.*, 2016) and exacerbate the problematic technology use (Ekşi *et al.*, 2020) and affect learning good or bad consumption habits (Scholderer and Grunert, 2001; Kleinschager and Morrison, 2014; Essiz and Mandrik, 2021). Moreover, Dinc (2015) suggests that an intimate atmosphere where youths often see their family members using smartphones contributes to smartphones’ extensive use amongst youngsters. Lee and Lee (2017) found that parental attachment is negatively associated with smartphone use addictive tendency, acting protectively.

3. Methodology

3.1 Study sample and measures

The selected sample comprised Spanish smartphone users. Although 44.9% of the world population owns a smartphone (Statista, 2020), this percentage is much higher in Spain (74.3%). Spain was the European country with the highest penetration of smartphones. Spain occupies the fifth position in 10 countries ranking with higher smartphone usage

(Turner, 2020). According to a recent report, 45.3% of young Spaniards between 18 and 24 years old declare themselves addicted to their smartphone (Rastreator, 2019). It reflects that 25.6% of the Spanish population consider mobile addicts, and 77.3% affirm they could not live without a smartphone.

Following our purpose of identifying types of smartphone users regarding their risk to become smartphone addicts, we employed a targeted non-probability sampling method with Prolific platform (i.e. 18–25-year-olds, resident in Spain and gender-balanced sample). Prolific is a crowdsourcing website (<http://www.prolific.ac>) supported by the University of Oxford that allows collecting data via online surveys. Participants were offered compensation of €2.23 for filling the survey. 275 valid questionnaires were obtained, with a response rate of 91.6%. The sample profile is slightly predominantly masculine (58.1%), between 18 and 22 years old (66.9%), studying university degrees (66.5%) and spending an average of 4.94 (SD: 3.28) hour per day using their smartphone. According to the secondary data available about the Spanish youth population smartphone use and addiction, the sample profile and the national profile are similar. 46.7% of the young Spanish males between 16 and 25 years old (41%) with middle and high education (93.9%) spent daily using their smartphone an average of 3.5 h (De-Sola *et al.*, 2019; Ditrendia, 2019).

As previously said and apart from literature revision, in-depth interviews lasting an average of one hour following a semi-structured questionnaire were maintained with six experts on addiction and smartphone use. Experts from different disciplines (management, marketing, psychology, sociology and education) help us to confirm the main risk and protective behavioural factors causing addiction and included in individual and microsystem levels. The interview was divided into three key open questions with the purpose to (1) list the risk and protective behavioural factors related to smartphone addiction; (2) classify factors on individual and microsystem level; and (3) suggest some smartphone addiction profiles. After obtaining the interviews information, a hybrid thematic analysis was followed for coding (Fereday and Muir-Cochrane, 2006). This approach integrates data-driven inductive coding with theory-based deductive coding. We employ the Atlas.TI qualitative software and two researchers analysed the transcripts independently and subsequently compared their findings. Areas of disagreement were resolved by discussion. The open question related to the most critical variables that can enhance smartphone addiction shows that boredom, phubbing and compulsive behaviour were the most mentioned variables. The critical factor preventing addiction was a unanimous answer related to family (i.e. communication among family, family norms or family environment), considered in the validated family harmony concept.

Later on, prior literature was employed to develop the survey instrument. Smartphone addiction was measured using the SAS short-scale validated by López-Fernández (2017), boredom proneness was measured with the scale employed by Al-Saggaf *et al.* (2019), family harmony with the scale of Kavikondala *et al.* (2016), phubbing using the scale from Franchina *et al.* (2018) and compulsive downloading adapting the scale used by Okazaki *et al.* (2019). We use five-point Likert scales from strongly disagree (1) to agree strongly (5).

3.2 Data analyses

Data analyses were conducted using IBM SPSS statistics 26 and LISREL 8.7. First, the exploratory factor analysis (EFA) was run to test constructs unidimensionality. The varimax rotation revealed that the five studied constructs have eigenvalues higher than 1 and a total explained variance of 55.14%. At this stage, Harman's single-factor test was employed to address CMB's issue (Malhotra *et al.*, 2006). Attending Fuller *et al.* (2016), Harman's test suggests a problem with CMB if the first factor accumulates more than 50% of the variance. The exploratory factor analysis loaded with all of the items onto one factor shows that a unique unrotated factor explained 20.2% of the data variance. Thus, we discard CMB problems.

Second, a confirmatory factor analysis (CFA) revealed the measurement model convergent and discriminant validity. The results of the adjusted and re-specified model are shown in Tables 2 and 3. Three items were suppressed since they did not show the required standards to be considered reliable and valid following Bagozzi and Yi (2012). The reliability of the final scales was corroborated with the values of the alpha Cronbach's coefficient (>0.7), the coefficient of composite reliability (>0.6) and average variance extracted (>0.5) (Bagozzi and Yi, 2012) (see Table 2). Regarding the discriminant validity of the constructs, the results show that the root of the variance extracted in all cases is larger than the correlations between constructs (Farrell, 2010) (see Table 3). The measurement model shows an acceptable fit: a χ^2 (df: 372) of 703.8 ($p = 0.00$), a comparative fit index (CFI) of 0.93 and a root mean square error of approximation (RMSEA) of 0.05.

In the following section 4, results are explained.

4. Results

4.1 Cluster analysis

As previous authors have recently performed (Kiss *et al.*, 2020) in smartphone addicts, we run a K-means clustering algorithm to classify smartphone users into different groups depending on their smartphone addiction and individual and microsystem levels related factors. We used the five-factor punctuations (F1: Smartphone addiction; F2: Boredom proneness; F3: Family harmony; F4: Phubbing; F5: Compulsive app downloading) formerly validated as input variables. The K-means clustering algorithm requires, as an input, the number of output clusters to produce. To reduce the possible optimal number of clusters, we run the analysis based on our understanding of how smartphone addicts have been classified in the past ($N = 2$ to $N = 5$) (Shu and Chieh-Ju, 2007; Vaghefi and Lapointe, 2016; Kayri and Günüç, 2016; Kiss *et al.*, 2020). The number of clusters that offers better results was $K = 3$, attending the group size, the degree of significance of each factor, and the final centre values (FCV).

Furthermore, attending Punj and Stewart (1983), Kodinariya and Makwana (2013) and Krzanowski and Lai (1988) recommendations, the model selection of the optimal number of clusters was implemented in two phases. We followed the standard practice of generating all possible classifications in the first phase, ranging from $K=N$ to $K = 1$. Then, we compare the set of candidate models quality criterion by two-steps cluster analysis employing SPSS. In the second phase, we select the most appropriate model based on Akaike's Information Criterion (AIC). Figure 1 displays a graph showing how the curve has an elbow that nearly flattens after k equals three, thus corroborating $K = 3$ as the optimal number of clusters.

The analysis of variance (ANOVA) corroborates that the five factors (F1 to F5) are significant at a level of 95% to characterize the groups. The F -statistic values indicate that family harmony and phubbing behaviour produce the most extensive and smallest variations between groups. Table 4 shows the ANOVA analysis results and three conglomerates information.

The depth interviews with experts disclose that they consider helpful the employment of the traffic lights schema proposed by us as researchers. They consider colours (red, yellow and green) useful to classify smartphone users by their risk to develop smartphone addiction for two reasons: (1) it is a universal language of signals across different countries and (2) it is an easy way for the user to identify the risk to become smartphone addict regardless any personal characteristic. Also, the traffic light schema of three colours (green, yellow and red) perfectly matches the number of groups found by this research (3). Thus, each colour will be described attending their punctuation of the risk and protective factors going from green (low risk of smartphone addiction), to yellow (middle risk of smartphone addiction) to red (high risk of smartphone addiction). The following description attends to the information displayed in Table 4.

Table 2.
Descriptive statistics,
EFA and CFA results

Factor	Cod	Items	Media	SD	Weight	λ	t	R^2
F1: Smartphone addiction (7.7% of variance; α : 0.741; CR: 0.885; AVE: 0.500)	SAS1	I miss planned work due to smartphone use	2.28	1.16	0.400	0.740	10.02	0.548
	SAS2	I have a hard time concentrating in class while doing assignments or working due to smartphone use	3.73	1.15	0.545	0.521	11.15	0.272
	SAS3	I have felt pain in the wrists or at the back of the neck while using a smartphone	2.65	1.38	0.436	0.490	11.23	0.240
	SAS4	I am not able to stand not having a smartphone	2.99	1.18	0.400	0.652	10.60	0.425
	SAS5	I am feeling impatient and fretful when I am not holding	2.72	1.17	0.701	Deleted		
	SAS6	I am having my smartphone in my mind even when I am not using it	2.03	1.07	0.632	0.727	10.02	0.528
	SAS7	I will never give up using my smartphone even when my daily life is already greatly affected	2.67	1.22	0.414	0.639	10.67	0.409
SAS8	I am continually checking my smartphone so as not to miss conversations between other people on social networks	2.58	1.19	0.588	0.738	9.90	0.545	
SAS9	I use my smartphone longer than I had intended	3.3	1.22	0.622	Deleted			
SAS10	The people around me tell me that I use my smartphone too much	1.90	1.07	0.413	0.668	10.49	0.447	
F2: Boredom proneness (13.6% of variance; α : 0.853; CR: 0.935; AVE: 0.670)	BP1	I often find myself at "loose ends", not knowing what to do	3.38	1.24	0.566	0.772	10.47	0.596
	BP2	I find it hard to entertain myself	2.49	1.19	0.785	0.837	9.63	0.701
	BP3	Many things I have to do are repetitive and monotonous	3.16	1.12	0.538	0.659	11.04	0.434
	BP4	It takes more stimulation to get me going than most people	2.72	1.31	0.583	0.712	10.81	0.507
	BP5	I do not feel motivated by most things that I do	2.72	1.19	0.753	Deleted		
	BP6	It is hard for me to find something to do or see to keep me interested in most situations	2.57	1.25	0.812	0.893	8.24	0.797
	BP7	Much of the time, I just sit around doing nothing	2.45	1.34	0.717	0.823	9.85	0.678
BP8	Unless I am doing something exciting, even dangerous, I feel half-dead and dull	1.92	1.11	0.574	0.724	10.75	0.507	
F3: Family harmony (20.3% of variance; α : 0.926; CR: 0.973; AVE: 0.720)	FH1	My family functions well for all members	3.66	1.20	0.784	0.851	10.32	0.725
	FH2	My family's day-to-day interactions are peaceful	3.69	1.14	0.808	0.843	10.39	0.711
	FH3	Family members accommodate each other	3.42	1.23	0.860	0.890	9.61	0.791
	FH4	I am proud of my family	3.90	1.14	0.813	0.856	10.23	0.733
	FH5	My family is harmonious	3.49	1.23	0.944	0.959	5.69	0.920
	PO1	I use my smartphone during a conversation in a bar or restaurant	2.69	1.01	0.733	0.857	7.27	0.734
	PO2	I engage with my smartphone during a conversation	2.09	1.01	0.642	0.793	8.79	0.628
PO3	I check social media on my smartphone during a personal conversation	2.26	1.14	0.681	0.788	8.88	0.621	
F4: Phubbing (5.5% of variance; α : 0.790; CR: 0.983; AVE: 0.740)	CD1	My smartphone has unopened/unused apps in it	3.25	1.48	0.374	0.722	10.33	0.521
	CD2	Others might consider me a "downloading app-aholic".	1.41	0.771	0.531	0.699	10.41	0.489
	CD3	Much of my life centres on downloading apps	1.23	0.624	0.543	0.700	10.40	0.490
	CD4	I download apps in my smartphone that I do not need	1.98	1.20	0.706	0.774	9.66	0.600
	CD5	I download apps in my smartphone that I did not plan to download	2.25	1.28	0.602	0.746	10.00	0.556
	CD6	I consider myself an impulse downloader of apps	1.66	1.07	0.669	0.805	9.19	0.648

Cluster 1: green smartphone users. Smartphone users included in this first cluster show higher positive scores in family harmony (FCV = 0.59237) and the higher negative punctuation in smartphone addiction (FCV = -0.38367) and also in other factors [boredom proneness (FCV = -0.58406), phubbing behaviour (FCV = -0.35244) and compulsive downloading (FCV = -0.42467)] than other groups. This description could fit with smartphone user that are not at risk of developing smartphone addiction. These punctuations

	F1	F2	F3	F4	F5
F1	<i>0.707</i>				
F2	0.597	<i>0.821</i>			
F3	-0.171	-0.313	<i>0.848</i>		
F4	0.701	0.515	-0.127	<i>0.858</i>	
F5	0.679	0.611	-0.177	0.646	<i>0.799</i>

Note(s): Values below the diagonal show correlations between constructs, values on the diagonal (in italic) show the square root of AVE. F1: Smartphone addiction; F2: Boredom Proneness; F3: Family harmony; F4: Phubbing; F5: Compulsive app downloading

Table 3. Discriminant validity matrix

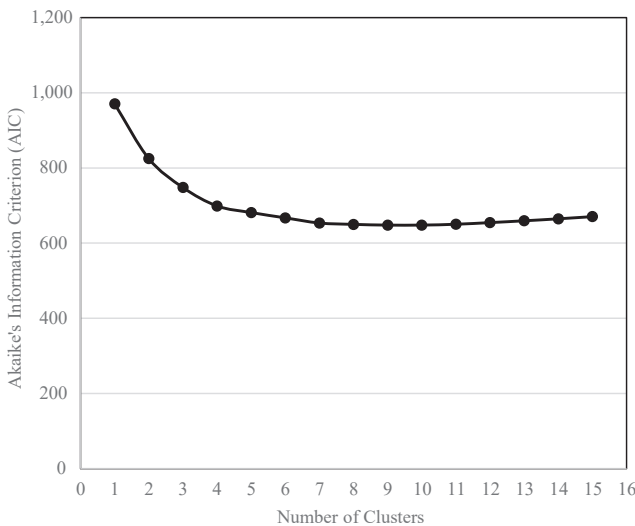


Figure 1. Number of clusters vs. AIC criterion

Factor	F	Sig. (95%)	Final centre value (FCV)			Distance from conglomerate centres			
			Green	Red	Yellow	Green (n = 125)	Red (n = 81)	Yellow (n = 69)	
F1	58.03	0.000	-0.3837	0.8430	-0.2946	Green		2.62	1.97
F2	66.39	0.000	-0.5841	0.7446	0.1840				
F3	156.45	0.000	0.5924	0.1193	-1.213	Red	2.62		2.57
F4	56.77	0.000	-0.3524	0.8383	-0.3456				
F5	88.87	0.000	-0.4247	0.9705	-0.3700	Yellow	1.97	2.57	

Note(s): F1: Smartphone addiction; F2: Boredom Proneness; F3: Family harmony; F4: Phubbing; F5: Compulsive app downloading

Table 4. ANOVA results and conglomerates information

reveal that smartphone users in this first cluster tend to be embedded in a family framework where harmony stands out. This family characteristic may prevent these users from developing smartphone addiction, boredom, phubbing others and compulsive downloading. This group represents 45.5% of the total sample.

Cluster 2: red smartphone users. The second cluster includes people who show higher positive punctuations in smartphone addiction (FCV = 0.84299), boredom proneness (FCV = 0.74456), phubbing behaviour (FCV = 0.83829) and compulsive downloading (FCV = 0.97052). This description corresponds to a smartphone user type that in fact, are addicted. Red smartphone users tend to quickly get bored, phub others by using their smartphone, download apps compulsively, and be considered addicts to smartphone use. This group represents 29.5% of the total sample.

Cluster 3: yellow smartphone users. The smartphone users included in this third cluster show higher negative punctuations in family harmony (FCV = -1.21324). This punctuation could place the users in this cluster at a medium risk of developing smartphone addiction since their family framework might not protect them from this behavioural disorder. These users' punctuations also disclose that yellow smartphone users are prone to be bored (FCV = 0.18403), and it seems that this could be the open door to engage with the smartphone. This group represents the smallest group and represents 25% of the total sample. Although they are not addicted at this moment (FCV = -0.29455), and they do not show dangerous behaviours such as compulsive app downloading, we consider they are at risk of addiction.

4.2 Clusters' demographic and smartphone use characterization

The information of the final centre values for each of the three clusters concerning the five factors (Table 4) facilitates describing differences between clusters and characterizing them considering different smartphone users' individualities (Table 5). Table 5 displays data that reveal the frequency of each group studied features and statistical post-hoc tests (Chi-square and ANOVA test) to discard or appreciate differences among groups regarding sample characteristics and smartphone usage (Pallant, 2001).

Specifically, it offers information about their demographic and socioeconomic characteristics of gender, education, average school performance and the age when receiving the first smartphone. Attending prior literature, different profiles of smartphone use could be identified in the function of the employed characteristics (i.e. gender, education, academic performance and age) (Busch and McCarthy, 2021). In addition, the daily media usage time via mobile and the number of downloaded apps are two objective variables related to smartphone addiction that are also mentioned as relevant to characterize smartphone addicts in previous studies (Noe *et al.*, 2019). Also, it is hard to ignore the situation of the pandemic that we live in nowadays, which may raise smartphone use (Smartme Analytics, 2020). Thus, we decide to include this variable too.

Thus, Table 5 displays in the first three rows the proportion of three sample characteristics (i.e. gender, education and rise in smartphone use during COVID-19 crisis) in the function of the cluster of membership. The education and the rise in smartphone use during COVID-19 crisis are the two characteristics that show significant differences between smartphone users profiles proportions attending the Chi-square test (Pallant, 2001). The third, fourth, fifth and sixth rows show four objective sample characteristics (i.e. age, daily media usage time via mobile, number of downloaded apps and average school performance) regarding the proportion of each cluster. The age, daily media usage time via mobile and the number of downloaded apps are the three objective characteristics that show significant differences between smartphone users attending the ANOVA test developed (Pallant, 2001). The difference between smartphone users' profiles attending their demographic and smartphone use characteristics is detailed in the following epigraph.

Table 5.
Descriptive
information about
clusters

Sample characteristics		Percentage per cluster			χ^2 Pearson (sig.)
		Green smartphone users	Red smartphone users	Yellow smartphone users	
Gender	Male	59.2	60.5	54.4	3.7 (0.460)
	Female	40.8	39.5	45.6	
Education	Secondary school	0.8	3.7	0.0	26.0** (0.004)
	High school	5.7	13.6	2.9	
	Vocational school	4.1	17.3	16.2	
	University degree	74.0	56.8	64.7	
	Postgraduate/PhD	2.4	0.0	1.5	
Rise in smartphone use during Covid-19 crisis	Not studying	13.0	8.6	14.7	22.3** (0.001)
	No increase	31.2	16.0	23.2	
	Less than 1 h	16.8	9.9	29.0	
	Between 1 and 2 h	30.4	35.8	33.3	
	More than 2 h	21.6	38.3	14.5	

	\bar{m} (SD)			F (sig.)
	Green smartphone users	Red smartphone users	Yellow smartphone users	
Age	21.5 (2.12)	20.8 (2.26)	21.8 (1.99)	4.5** (0.012)
Daily media usage time via mobile	4.4 (3.14)	5.9 (3.45)	4.8 (3.09)	5.9** (0.001)
Number of downloaded apps	24.5 (25.02)	31.8 (36.7)	19.3 (15.1)	4.0** (0.019)
Average school performance	9.1 (11.1)	9.9 (13.4)	7.8 (1.13)	0.821 (0.441)

Note(s): \bar{m} : mean; SD: Standard deviation. ** 95% level of confidence

4.3 Cluster descriptions and differences

This epigraph presents a description of each cluster according to the characteristics that show significant differences between groups (Table 5). Each cluster previously associated with colour regarding their smartphone addiction and considering individual and microsystem critical variables will be characterized by the main features of each profile. This practice of cluster characterization relative to certain sociodemographic and smartphone use variables is well accepted and employed in previous literature (Kiss *et al.*, 2020).

Cluster 1: green smartphone users. This group has a majority of males (59.2%) with an average age of 21 and a half. This group has the highest percentage of people studying university degrees (74%) in comparison with other groups (χ^2 : 26; $p < 0.000$). Regarding their smartphone usage, green smartphone users spend significantly less time using their smartphone in comparison with red users (\bar{m} : 1.5; $p < 0.000$) and yellow users (\bar{m} : 0.4; $p < 0.000$), and this group also has the highest percentage of people (31.2%) that do not notice any increase in their smartphone use time during COVID-19 crisis in comparison with other groups (χ^2 : 22.3; $p < 0.000$).

Cluster 2: red smartphone users. This cluster includes a large majority of males (60.5%). They are on average younger than 21 years old, and also, they are significantly younger than green users (\bar{m} : 0.7; $p < 0.000$) and than yellow users (\bar{m} : 1; $p < 0.000$). This cluster includes a high percentage of individuals studying high or vocational school (30.9%) in comparison with other groups (χ^2 : 26; $p < 0.000$). Regarding red users' smartphone usage, this group spends significantly more time using their smartphone in comparison with green users (\bar{m} : 1.5; $p < 0.000$) and yellow users (\bar{m} : 1.1; $p < 0.000$). This group reveals to download significantly more apps than green users (\bar{m} : 7.3; $p < 0.000$) and than yellow users (\bar{m} : 12.5; $p < 0.000$). Moreover, a higher percentage (74.1%) of individuals in this group affirms that their use of

smartphone has increased more than 1 h per day during the COVID-19 crisis in comparison with other groups (χ^2 : 26; $p < 0.000$).

Cluster 3: yellow smartphone users. This group includes similar percentages of both genders (54.4% is male, and 45.6% is female). This third group has a higher percentage of people that affirm not being studying (14.7%) in comparison with other groups (χ^2 : 26; $p < 0.000$). Yellow smartphone users are the group that download significantly fewer apps in comparison to green users (6: 5.2; $p < 0.000$) and red users (6: 12.5; $p < 0.000$). Moreover, this group also has the highest percentage of people (29%) that affirm to have boosted their smartphone usage time during the COVID-19 crisis less than 1 h, in comparison with other groups (χ^2 : 22.3; $p < 0.000$).

5. Discussion

Smartphone addiction constitutes a social and managerial challenge (Mrad and Chi Cui, 2020) and can also be a dangerous issue due to overuse, abuse or addiction and doing business. The smartphone has become one of society's most widespread and influential technological innovations (Busch and McCarthy, 2021). This study proposes an easy, innovative schema of smartphone users according to their level of addiction and related variables. Therefore, this paper's main contributions are four: (1) Drawing on multidisciplinary literature and applying a framework from epidemiology to analyse an important social issue with rich managerial practical implications. (2) The proposed traffic lights model use the risk and protective factors framework by considering critical variables at the individual (boredom proneness, compulsive app downloading) and microsystem level (phubbing and family harmony). To the extent of our knowledge, this is one of the first studies that offer a typology of Spanish smartphone users considering risk and protective variables from different disciplines to the extent of our knowledge. (3) The study answers the gap of needed studies with primary smartphone users' information since most existing studies are quickly getting obsolete and are based on Internet addiction and technology uses. In fact, smartphone addiction is changing exponentially every year. For example, the study by Kayri and Günüç (2016) offered a typology according to the level of Internet addiction and found 9% addicts, while our study shows almost 30% of addict smartphone users). Finally, (4) it helps policymakers and managers design strategies to address each of the three clusters to overcome smartphone addiction's potential adverse effects and derive recommendations for managers. We have revised the literature and have obtained the help of experts in smartphone use and overuse to offer an easily applicable typology of users (i.e. green, yellow and red smartphone users).

As mobile technology continues growing its popularity, marketing academics and managers, policymakers and society must comprehend the effect that technologies exert on individual behaviours. First, the literature is unclear whether certain constructs can be related and explain smartphone addiction (Busch and McCarthy, 2021). In this sense, the interviews with experts give us clues that disclosed boredom, phubbing, compulsive behaviour and family bond as the most critical variables related to smartphone addiction that could help classify smartphone users. To the extent of our knowledge, only the study by Kiss *et al.* (2020) classifies smartphone users according to their addiction and other variables, and ours is the first contemplating three groups, which help not only to distinguish addicts (red users) vs non-addicts (green users) but also individuals at risk of addiction (yellow users). Answering RQ1, our study offers a broad classification of smartphone users considering risk and protective factors involved at individual and microsystem levels, and each cluster corresponds to one colour of a called traffic-lights schema (i.e. green, red and yellow). In this sense, green users fit with smartphone users that are not at risk of developing smartphone addiction (this first cluster mainly shows higher positive scores in family harmony and higher negative punctuation in smartphone addiction than other groups). Red users comprise

individuals who tend to get bored quickly, phub others by using their smartphone, download apps compulsively and be considered addicts to smartphone use (this second cluster includes people who show higher positive punctuations in smartphone addiction, boredom proneness, phubbing behaviour and compulsive downloading). Finally, yellow users are the ones who are not addicted at this moment, but they are at risk of addiction (this third cluster shows higher negative punctuations in family harmony, although they are not addicted at this moment, they are prone to get bored, and it seems that this could be the open-door to engage with the smartphone addiction). Precisely, our results show that the construct of family harmony is the most relevant – one of the factors we have studied here – when addressing addiction and explaining different smartphone user behaviours, as [Buctot et al. \(2020\)](#) suggest. Boredom proneness and compulsive app downloading also help classify individuals into a group of less or more risk of addiction, as they have been identified as essential variables when dealing with smartphone overuse and dependence ([Leung, 2007](#); [Parylak et al., 2011](#)).

With these results in mind and together with experts' in-depth insights and with the aim of addressing [RQ2](#), some proposed strategies for each group can be the following. In the case of *green smartphone users*, the primary strategy should be to reinforce family bonds since it acts as an essential protective factor to prevent young people from developing an addiction, so they keep free of smartphone addiction. It is better than users are selective when buying apps that are useful for them instead of compulsively downloading many apps that take up space on their smartphone and are not used after installation. Managers can address families as influencers to promote good use and shopping habits with the smartphone using communication campaigns. Green users do not use the smartphone so much. Thus, they are fewer potential smartphone shoppers. Following [Mrad and Chi Cui \(2020\)](#), the prevailing negative connotation of addictive consumption poses a constant challenge to firms' efforts to promote products without risking marketing ethics problems that undermine consumers' quality of life.

On the opposite side, the *red users* should be provided with or should look for leisure activities (i.e. sports, walks, reading books, face-to-face talks) to address boredom proneness and avoid compulsive apps' downloading with their smartphones. Managers could promote that these users buy these products offline. Moreover, phubbing should be socially condemned as the social group can play an essential role in individual behaviour. With this problematic group, the family should establish communication norms, and the smartphone must not be involved to construe a good and healthy family harmony and maybe practice parental mediation. They are a big group of young people with bad smartphone use habits that should be tackled urgently to avoid growing up with those habits that worsened during the COVID-19 crisis. Although they buy a lot, they buy compulsively, and this is bad in the long run as it can derive in dissatisfaction and not making practical use of their smartphone. As [Sundstrom et al. \(2019\)](#) affirm, retailers should choose a strategy based on customer value and satisfaction, as boredom can derive in price competition and instead satisfy customers by providing an opportunity to become less bored. In this line of thought, and as [Bozaci \(2020\)](#) states, there is a need to manage boredom, which is one of the most important problems facing people today, as it is one of the triggering variables for smartphone addiction and impulse buying. As he suggests, people should be educated in areas appropriate to their abilities and interests so that they can comprehend the meaning of their behaviours or tasks and focus more on their activities to reduce their problematic use of smartphones and increase their ability to make more conscious fulfilling purchases. Parents and educational institutions, managers and employees can take precautions in reducing boredom. Policymakers should promote healthy smartphone use using campaigns as long as they download apps; this can be the means to address them, for example, developing educational apps that show how to use the smartphone properly.

Lastly, at risk of addiction, *yellow users* can also benefit from leisure alternative activities, reinforcing family bonds and avoid being addict users in the future. Therefore, they should avoid boredom as it leads to addiction and search for other activities such as sports or cultural activities. Moreover, as [Kleinschafer and Morrison \(2014\)](#) propose, household members should establish norms to socialize among them to the intergenerational transmission of desirable behaviours.

Anyway, several of the described strategies can be used differently to help the three groups face a real/potential smartphone addiction, i.e. schools can promote talks with experts, teachers, parents and youngsters to speak about smartphone risks and healthy uses. Institutions can offer training courses regarding correct smartphone use for users of different ages, education level and home situations. Apart from the family and school, smartphone content and app developers should reflect on the need to offer not only entertaining contents but also useful tools to avoid useless downloads. In addition, they could design apps that help to foment a correct use of smartphones and provide practical cues to self-regulate smartphone use time and applications (i.e. to address youth addiction to smartphones, a game app could be developed where the avatar gets tired after a certain time playing is better than forbidding the smartphone as a punishment). As other authors have suggested ([Camoiras-Rodriguez and Varela, 2020](#)), mobile retailers need to conduct market segmentation when trying to increase their customer base and choose their potential customers according to their personalities, but also to their device use and profile.

Table 6 reflects a sum up of the main social and managerial challenges deriving from the variables used in this study to characterize clusters.

Nevertheless, further research is needed since certain *limitations* of this study must be recognized. The present study considers a specific demographic group (i.e. young people), it would be interesting to replicate the study with a larger sample, with adolescents, older adults or parents. In addition, the platform (prolific) employed may be conditioning the sample since people enrolled in this kind of webs might have a specific profile that may not represent the whole population. Thus, future studies should consider new demographic profiles, but other

Risk or protective factor	Main social challenge	Main managerial challenge
Compulsive downloading	To design entertaining apps that are socially responsible and do not contribute to spending much daily time in youth's life	The roles of marketers nowadays should focus not only on making profits over the short-term but also on offering healthy, responsible, and ethical products and services (i.e. apps, contents) for individuals, improving their quality of life and benefiting society
Boredom	To manage boredom proneness as it leads to addiction. Promote healthy leisure activities (e.g. sports, cultural activities)	The managers need to be capable of detecting points to manage boredom proneness as it leads to impulse buying and not satisfactory shopping
Phubbing	To promote face-to-face communication and active listening to lead to healthy and close friendly relationships To help to avoid social exclusion	Marketers should be aware of new social dynamics that affect how individuals interact with others and may affect their relationships with others (including brands, salesman and business)
Family harmony	To promote adequate family communication, socialization and norms as they affect attitudes and behaviours	Influencers and family networks could be employed to counsel that people learn good/practical smartphone use habits (including shopping, recommending, etc.)

Table 6.
Social and managerial challenges deriving from risk and protective factors

ways to collect the information would be recommended (i.e. face-to-face). This study follows a cross-sectional design and the exclusive consideration of a single country (Spain); those are methodological shortcomings that restrict the generalization of the results. Future studies could study cross-national samples or collect longitudinal data. This study has focused on the individual and microsystem levels, but in the future other variables referring to the exosystem and macrosystem levels should be included in the smartphone user characterization, additional risk and protective factors, for example, perceived social support and social capital. Finally, future studies could develop a causal model to know how these risk and protective factors and addiction can precisely affect shopping.

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Corresponding author

Sonia San-Martin can be contacted at: sanmargu@ubu.es

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