

SOCIAL INFLUENCE IN TECHNOLOGY ADOPTION RESEARCH: A LITERATURE REVIEW AND RESEARCH AGENDA

Research paper

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Abstract

Social influence has been shown to profoundly affect human behavior in general and technology adoption (TA) in particular. Over time, multiple definitions and measures of social influence have been introduced to the field of TA research, contributing to an increasingly fragmented landscape of constructs that challenges the conceptual integrity of the field. In this vein, this paper sets out to review how social influence has been conceptualized with regard to TA. In so doing, this paper hopes to inform researchers' understanding of the construct, provide an overview of its myriad conceptualizations, constructively challenge extant approaches, and provide impulses for future research. A systematic review of the relevant literature uncovers that extant interpretations of social influence are 1) predominantly compliance-based and as such risk overlooking identification- and internalization-based effects, and 2) primarily targeted at the individual level, thereby neglecting the impact of socially rich environments. Building upon these insights, this paper develops an integrated perspective on social influence in TA research that encourages scholars to pursue a multi-theoretical understanding of social influence at the interface of users, social referents, and technology.

Keywords: Social influence, subjective norm, technology adoption, technology acceptance model, information systems.

1 Introduction

The impact of social influence on human behavior in general and information technology adoption (TA) in particular has been widely acknowledged (Triandis, 1980; Venkatesh et al., 2003; Asch, 1953). Social influence has originally been defined as the change in an individual's thoughts, feelings, attitudes, or behaviors that results from interaction with another individual or a group that is perceived to be similar, desirable, or expert (Kelman, 1958; French and Raven, 1959). Within information systems (IS) research, social influence has been incorporated as "the interpersonal considerations" of TA (Chan et al., 2010, p. 525) in acknowledgment that such decisions are often done "collaboratively, or with an aim of how they fit in with, or affect, other people or group requisites" (Bagozzi, 2007, p. 247; Fulk et al., 1990).

A significant body of IS research integrates the notion of social influence in its theoretical foundation and explores the relationship between social influence and TA. Social influence has been incorporated into all major theoretical models that underlie TA research, such as the Theory of Planned Behavior (Ajzen, 1991), the Technology Acceptance Model 2 (Venkatesh and Davis, 2000), and the Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003).

However, this body of research is stratified. The interdisciplinary foundations of social influence have led to a heterogeneous set of conceptualizations. These include, for example, subjective norm, group

norm, social identity, social capital, social network configuration, and critical mass (Venkatesh et al., 2003). Constructs like subjective norm view social influence as a perceived social pressure to perform or not to perform a behavior (Fishbein and Ajzen, 1975). Others, like social identity, understand social influence as a function of an individual's emotional and evaluative identification with a group (Tajfel, 1978). These starkly different interpretations of social influence pose a challenge for TA research. Moreover, while there is theoretical consensus that social influence matters for TA, inconsistent empirical results undermine the explanatory power of the construct and question the validity of its present conceptualization. Some studies have found support for social influence on IT adoption (Dickinger et al., 2008; Sykes et al., 2009; Chatterjee et al., 2015), while others have not (Pavlou and Fygenson, 2006; Chan et al., 2010; Zhang et al., 2006). Some studies found an effect for women, but not men (Venkatesh and Morris, 2000); for novice, but not experienced users (Karahanna et al., 1999); and for mandatory, but not voluntary adoption contexts (Venkatesh and Davis, 2000). A number of scholars suggested that these inconclusive findings may result from a tendency to assume a limited conceptualization of social influence in TA research (Malhotra and Galletta, 2005; Gallivan et al., 2005; Bagozzi, 2007).

As a result, IS scholars expressed the need to better understand social influence itself and the relationship between social influence and TA (Karahanna and Limayem, 2000; Mathieson, 1991; Legris et al., 2003). In response, a number of studies added to a more pluralistic understanding of social influence in TA research. For example, Dholakia, Bagozzi, and Pearo (2004) introduced group-level determinants – group norms and social identity – as antecedents to behavioral intention in their examination of virtual communities. Other researchers explored TA decisions at the group level to better account for social dynamics (Sarker and Valacich, 2010). While this increasing pluralism promises to more fully capture the range of social impulses that govern TA, it also further contributes to an increasingly fragmented landscape of constructs that threatens the conceptual integrity of the field.

We set out to conduct a systematic review of social influence in TA research with the aim of integrating the field's theoretical understanding of the concept and developing an agenda for future research. We seek to provide an overview of the myriad conceptualizations of the construct, both established and emerging, and we aim to uncover theoretical intersections and illuminate key differences between the concepts. In addition, this review also seeks to synthesize and expose the contextual and methodological implications of extant social influence research on TA. Finally, the review aspires to develop an integrated framework of social influence to serve as a guideline for future research. The specific research questions which guide our review of the literature are the following:

- Which conceptualizations of social influence exist and what are the processes that link different forms of social influence and technology adoption?
- Which levels of analysis have been studied in social influence research?
- Which recommendations for future research emerge when one takes an integrated perspective on social influence in technology adoption research?

Based on an in-depth review of 113 papers, a number of important findings and implications emerge. First, despite the increasing pluralism in social influence conceptualizations, extant interpretations in TA research remain heavily skewed towards compliance-based mechanisms. Second, a structural analysis reveals that social influence is overwhelmingly examined at the individual level of analysis. Building on these observations, we develop a tripartite view of social influence centered on the interactions between users, social referents, and technology, which aims to serve as guiding framework for further research.

This paper provides several critical contributions to the literature. First, it makes an important conceptual contribution by classifying and comparing extant social influence conceptualizations in the TA domain according to their compliance, internalization, and identification effects, thereby providing unique insights into the distinct underlying cognitive processes the conceptualizations draw on and the implications thereof. In so doing, this review adds to previous meta-studies which focused on selected conceptualizations of social influence, such as subjective norm (Schepers and Wetzels, 2007), the underlying theoretical models of which social influence is a component, such as the Technology Acceptance Model (King and He, 2006; Oliveira and Martins, 2011; Turner et al., 2010; Venkatesh et al., 2003), or adjacent

literature domains, such as organizational and psychology research (Borgatti and Foster, 2003; Cialdini and Goldstein, 2004; Adler and Kwon, 2002). Second, the paper contributes by not only classifying and comparing constructs, but by offering an integrated perspective on social influence in technology adoption research. This perspective highlights the multidimensional and multilevel nature of social influence and provides an integrated framework in which researchers can locate extant research and which can function as a frame of reference for future research. Third, and partially building on the integrated perspective, the paper develops clear recommendations and a research agenda for future researchers in the field of social influence in technology adoption.

2 Theoretical background: Social influence

A first challenge in exploring the notion of social influence is establishing an understanding of what social influence is, given the myriad ways in which the concept has been studied, both as a cognitive process and a structural manifestation (Agarwal et al., 2009; Friedkin and Johnsen, 1999).

Researchers who view social influence as a cognitive process distinguish between the three conceptually distinct processes of compliance, identification, and internalization (Kelman, 1958). *Compliance* is said to take place when an individual accepts influence because it hopes to achieve a favorable reaction from another person or group (Kelman, 1958). Compliance implies a change in behavior in response to social pressure without corresponding changes in beliefs or attitudes (Gallivan et al., 2005). *Identification* is said to occur when an individual adopts a behavior or opinion derived from another “because he wants to establish or maintain a satisfying self-defining relationship to another person or a group” (Kelman, 1958, p. 53). *Internalization* takes place when an individual integrates a referent’s belief into its own cognitive belief structure based on congruence in values.

These processes can be attributed to two distinct types of social influence: normative and informational. *Normative influence* is said to occur when individuals conform to the expectations of others, while *informational influence* is said to occur when individuals accept information as evidence of reality (Deutsch and Gerard, 1955; Karahanna et al., 1999; Burnkrant and Cousineau, 1975). Within information systems research, these social influence types and processes provide the principal theoretical foundation for how social influence has been studied in technology acceptance models such as TPB/DTPB, TAM2, IDT, MPCU, and UTAUT (Venkatesh et al., 2003).

Researchers assuming a structural perspective studied social influence primarily through the lens of network externalities (Katz and Shapiro, 1985) and network theory (Borgatti and Foster, 2003). These theories infer social influence from the actual prevalence of a certain behavior in an individual’s network and take into account the characteristics of that network. Network externalities, for instance, arise when an individual’s utility of using a technology increases with prevalence of use within some reference group (Agarwal et al., 2009; Katz and Shapiro, 1985). For example, the more people use a social network such as Facebook, the greater the value to the participating individuals and the higher the cost of using an alternate social network. Network theory delves one level deeper and explores how the structure of an individual’s network – defined by the “pattern and strengths of the interpersonal influences among the members of a group” (Friedkin and Johnsen, 1999, p. 1) – affects the individual’s behavior. This has been studied, for example, in relation to electronic trading systems (Montazemi et al., 2008) and electronic health software (Venkatesh et al., 2011).

Information systems scholars looking to integrate the structural with the cognitive perspective posited that network externalities (and associated constructs) can exert both normative influence, through the process of compliance, as well as informational influence, through the process of internalization (Lou et al., 2000; Cho, 2011). The underlying rationale is that, as more and more individuals adopt a certain technology, peer pressure to conform increases. Similarly, with increasing diffusion, potential adopters are also more likely to witness the technology in use, which may lead them to believe that it is useful.

3 Methodology: Structured literature review

In order to explore how social influence has been studied in TA research, we build on the methodological frameworks put forth by Tranfield et al. (2003), Webster and Watson (2002), and Leidner and Kayworth (2006) in that we used a keyword-based strategy which was amplified by manual screening and forward and backward integration of additional literature. First, given the broad nature of the TA research field and the frequent occurrence of social influence in many technology acceptance models such as TAM2, UTAUT, and TBP, a key criterion for the initial literature sample was that social influence was an integral constituent in the study and was mentioned in either the title, abstract or keywords. This helped to avoid sampling an unmanageable amount of articles of only tangential relevance. In addition, only academic, peer-reviewed journal articles in English and from 2000 onwards were considered to ensure quality and a manageable sample and capture recent research trends. These restrictions naturally constitute a trade-off between comprehensiveness on the one hand and relevance and replicability on the other, a limitation that must be taken into account when conducting a systematic literature review (Webster & Watson, 2002).

Second, we used a two-step approach to systematically select relevant literature. In line with Li and Karahanna (2015) and Venkatesh et al. (2013), we reviewed papers published in the IS Senior Scholars' Basket of Journals (AIS, 2011) for relevant studies. Then, we conducted a comprehensive search of ABI/INFORM and Business Source Premier using the keywords "technology acceptance," "technology use," "technology adoption," in combination with "social," "social influence," "social norm," "subjective norm," and "social capital." This resulted in a preliminary sample totaling 642 papers. Following an initial screening of title and abstract, 418 papers were excluded due to irrelevance, e.g., because they related to IT use and culture (e.g., Tan et al., 2014) or because their dependent variable was not technology adoption or use (e.g., Sarker et al., 2011). Following Bélanger and Carter (2012), the set of studies was further narrowed down to papers receiving more than 50 citations on Google Scholar. This reduced the sample to 131 papers. Based on a full reading of these papers, a further 44 papers were excluded, and an additional 26 papers added through forward and backward integration (Webster and Watson, 2002). In total, 113 papers were ultimately selected for inclusion in our review.

4 Findings: Overview of extant work and its implications

4.1 Conceptualizations of social influence

Almost all technology acceptance models include, or have been extended to include, some form of social influence as an antecedent to the behavioral intention to adopt a technology. Our review reveals that the construct of social influence takes on many shapes and forms, including social norms, social capital, social network configuration, critical mass, social identity, group norms, and others (see Table 1).

Costruct	Theoretical basis	Definition	# papers by process ^{a,b}		
			CPL	INT	ID
Subjective norm ^c	TRA (Fishbein and Ajzen, 1975), TPB (Ajzen, 1991), TAM2 (Venkatesh and Davis, 2000)	“A person’s perception that most people who are important to him think he should or should not perform the behavior in question” (Fishbein and Ajzen, 1975, p. 302)	70	18	
Social identity	Social identity theory (Tajfel, 1978)	“An individual’s identification with a group based on an understanding of the benefits that come with membership” (Dholakia et al., 2004)			13
Image	Innovation diffusion theory (IDT) (Rogers, 1995; Moore and Benbasat, 1991)	“The degree to which use of an innovation is perceived to enhance one’s status in one’s social system” (Moore and Benbasat, 1991, p. 195)			14
Group norms	Social identity theory and self-categorization theory (Turner, 1991)	“An understanding of, and a commitment by, the individual member to a set of goals, values, beliefs, and conventions shared with other group members” (Dholakia et al., 2004, p. 245)		11	
Support	Theory of interpersonal behavior (Thompson, Higgins, and Howell, 1991; Triandis, 1980)	“The individual’s internalization of the reference group’s subjective culture, and specific interpersonal agreements that the individual has made with others, in specific social situations” (Thompson et al., 1991)		11	
Social network configuration	Social network theory (Granovetter, 1973)	The degree in which the structure of a network – defined by the “pattern and strengths of the interpersonal influences among the members of a group” (Friedkin and Johnsen, 1999, p. 1) – affects the behavioral intention to adopt a technology	9		
Critical mass	Critical mass theory (Markus, 1990), network externalities (M. L. Katz and Shapiro, 1985)	“The point at which enough individuals have adopted an innovation so that the innovation’s further rate of adoption becomes self-sustaining” (Rogers, 1995, p. 313)	20		
Social capital	Capital theory (Bourdieu, 1986; Coleman, 1990; Nahapiet and Ghoshal, 1998)	“Resources embedded in a social structure that are accessed and/or mobilized in purposive action” (Lin, 2001, p. 29); Nahapiet and Ghoshal (1998) classify social capital into three dimensions: structural, relational, and cognitive	5	6	4
Total number of papers			93	70	30

a. Some articles are counted more than once because they contain multiple social influence constructs; b. CPL = Compliance, INT = Internalization, ID = Identification; c. Also commonly referred to as “social factors” or “social norms”

Table 1. Different Conceptualizations of Social Influence

Social influence as a process of compliance

Our review indicates that a compliance-based interpretation of social influence is the most common form (93 papers). The dominant conceptualization is in the form of subjective norm, defined as “the perceived social pressure to perform or not to perform the behavior” (Ajzen, 1991, p. 188). Theoretically grounded in TRA (Fishbein and Ajzen, 1975) and TPB (Ajzen, 1991), subjective norm is posited as a direct determinant of behavioral intention. The underlying rationale for this direct effect is that “people may choose to perform a behavior, even if they are not themselves favorable toward the behavior or its consequences, if they believe one or more important referents think they should, and they are sufficiently motivated to comply with the referents” (Venkatesh and Davis, 2000).

The reviewed literature indicates strong, but not completely consistent, support for this compliance effect. Around 70% of the relevant studies found a significant effect (e.g., Mardikyan et al., 2012; Titah and Barki, 2009; Yang and Forney, 2013). While almost 90% of the papers examined the direct effect of subjective norm on behavioral intention (Brown et al., 2010; Irani et al., 2009; Gao and Bai, 2014), some studies looked at its effect on actual use (Liang et al., 2010; Devaraj et al., 2008) and, in one case, even at user satisfaction with the adoption decision (Chan et al., 2010). The direct effect of subjective norm has been studied both in work (Neufeld et al., 2007) and non-work contexts (Lee, 2009), and with regard to a large range of different technologies, including telemedicine, enterprise software, and online shopping. In addition, whilst originally theorized to only hold in mandatory settings (Venkatesh et al., 2003), there is empirical evidence for positive compliance effects in voluntary settings (Kleijnen et al., 2004; Sun et al., 2013). Interestingly, Sledgianowski and Kulviwat (2009) found a significant negative effect of subjective norm on behavioral intention. This may be an outlier or an indication that compliance may, in voluntary (and non-work) settings, even act as a deterrent.

Notably, over a third of the reviewed studies feature a compliance-only social influence definition, which raises questions regarding the explanatory power of these conceptualizations. A closer look at the empirical results indicate that independent of setting (work/non-work, voluntary/mandatory), only around 60% of papers found a significant social influence effect (e.g., Nysveen et al., 2005b; Sun et al., 2013; Venkatesh et al., 2004). Given that most theoretical models predicate that technology use is embedded in broader social context and inherently subject to social influences, this percentage appears low. The implication is either that social influence may not play as important a role as expected, or that additional social influence processes exist beyond compliance. The empirical inconsistency of compliance-based social influence measures appears to point to the latter explanation.

Social influence as a process of internalization

In contrast to compliance-based definitions of social influence, internalization-based interpretations assume that an individual acts upon a social stimulus based on a congruence in values. A substantial number of studies incorporate such internalization effects of social influence in their technology acceptance models. Scholars leveraged a variety of conceptualizations to this end, most notably the indirect effect of subjective norm, the notion of support, and the construct of group norms.

IS scholars have most commonly studied internalization as an indirect effect of subjective norm on intention through perceived usefulness (as opposed to a direct compliance effect on intention) (Chen et al., 2009; Hong and Kar, 2006; Wang and Chou, 2014). This approach was incorporated into TAM2 primarily as a reaction to the diminishing effects of compliance-based social influence over time, which Venkatesh and Morris (2000) attributed to individuals' tendencies to internalize others' opinions over time and focus on their own judgments. Accordingly, internalization, unlike compliance, is expected to ensue irrespective of whether the context of adoption is voluntary or mandatory. The reviewed literature supports this notion for the voluntary context (Dickinger et al., 2008; Williams et al., 2014), whereas only one of the reviewed studies also took place in a mandatory adoption context (Venkatesh and Davis, 2000). It found that the internalization effect was more pronounced in a voluntary than mandatory context whereas the opposite was true for the compliance effect. Meanwhile, a number of studies found evidence of even more pronounced differences in voluntary contexts, with only the internalization effect of subjective norm being validated and the compliance effect remaining insignificant (Khalifa and Shen, 2008; Lu et al., 2005; Yang, 2013). This highlights the importance of including non-compliance-based influence mechanisms when studying social influence – particularly in voluntary settings. Otherwise, scholars run the risk of missing the true relationship between social influence and TA by “focusing on those aspects that fade over time, and not those that are likely to persist” (Wang et al., 2013, p. 301).

Interestingly, based on a closer look at how social influence is operationalized in the reviewed literature, the notion of support emerges as a distinct conceptualization of social influence. Support is understood to act as encouragement rather than expectation and hence cause an individual to internalize a reference group's subjective culture rather than comply with it (Venkatesh et al., 2003). Grounded in the definition of social factors proposed by Thompson et al. (1991) and later integrated into the social influence construct of the UTAUT model (Venkatesh et al., 2003), support is typically used to complement compliance-based items rather than operationalized as a standalone construct (e.g., Chatterjee et al., 2015; Gupta et al., 2008). While this approach is empirically supported by sufficient levels of internal consistency within the reviewed sample, it unfortunately does not allow for the effects of internalization and compliance to be disentangled and studied individually. What is striking is that support has been measured disproportionately often within work settings, both with regard to mandatory (Al-Gahtani, 2004; Venkatesh and Zhang, 2010) and voluntary adoption (Elie-Dit-Cosaque et al., 2012; Liang et al., 2010). It would thus be interesting to extend the construct's application within the consumer sphere, where peer or family support have also been found to play influential roles in TA (Thakur and Srivastava, 2013; Hsieh et al., 2011).

A recent, standalone representation of internalization processes on TA are group norms (Shen et al., 2010; Tsai and Bagozzi, 2014). Group norms aim to capture social influence determined by an individual's understanding of, and commitment by, shared values or goals with a group (Bagozzi and Lee, 2002). Consequently, group norms have been primarily studied with regard to group action and social

technologies, where they have consistently been found to predict behavioral intention (Dholakia et al., 2004; Shen et al., 2013). While most studies examine group norms as an antecedent of behavioral intention (Gallivan et al., 2005) or attitude (Tsai and Bagozzi, 2014), one interesting stream of research has explored how group interaction affects the formation of group norms and group valence with regard to IT adoption (Sarker et al., 2005; Sarker and Valacich, 2010). Analogous to the findings on social identity, the empirical results of several studies suggest that group norms are a better predictor of adoption and use behavior than subjective norm when it comes to group-based technologies (Shen et al., 2013; Shen et al., 2010; Tsai and Bagozzi, 2014; Dholakia et al., 2004). As an increasing share of technologies become social and IT is increasingly used collaboratively, the aspect of group norms within TA research may warrant additional attention.

Social influence as a process of identification

Moreover, around 30 of the reviewed studies treated social influence as a process of identification. They predominantly drew on two types of constructs: those related to social identity (e.g., Papadopoulos et al., 2013) and those related to image (e.g., Williams et al., 2014).

Anchored in social psychology research, social identity captures an individual's self-awareness of his or her membership in a group and the emotional and evaluative significance of this membership (Tajfel, 1978). In extant TA research, social identity is typically measured as the perceived degree of overlap between an individual's personal identity and the identity of the group it associates with. In most cases, social identity is hypothesized to have a direct effect on behavioral intention to adopt a technology (Bagozzi and Dholakia, 2006; Shen et al., 2013) or a mediated effect via an individuals' attitude (Faullant et al., 2012; Tsai and Bagozzi, 2014). Almost all studies in the reviewed sample found a significant, positive effect (Datta, 2011; Chiu et al., 2006). Social identity was typically studied in conjunction with subjective norm and group norms in the context of models that aimed to explicitly test and validate all three social influence processes (Dholakia et al., 2004; Shen et al., 2010). Interestingly, a number of studies found evidence that social identity (and group norms) are better predictors of adoption and use behavior than subjective norm (Tsai and Bagozzi, 2014; Shen et al., 2013; Shen et al., 2010; Bagozzi and Dholakia, 2002). These studies have in common that they examined TA in the context of explicit group environments, such as virtual communities and social network-facilitated team collaboration. Their findings support the notion that TA is subject to different, distinct social influence processes and suggest that the explanatory power of identification-based processes may exceed those of compliance in group-based environments.

The other main conceptualization of the identification process takes the form of constructs related to image (Gounaris and Koritos, 2008; Chan and Lu, 2004). In IS research, the notion of image is rooted in Innovation Diffusion Theory (Rogers, 2003) and TAM2, which integrates image into the original TAM to capture the identification effect of social influence (Venkatesh and Davis, 2000). According to TAM2, image is influenced by subjective norm and, in turn, influences perceived usefulness, while subjective norm is expected to also have a direct effect on perceived usefulness and behavioral intention. Closely related constructs examine prestige associated with IT adoption or use (Chan and Lu, 2004; Riquelme and Rios, 2010), as well as social outcomes, e.g., the change in status that coincides with an adoption decision (Venkatesh and Brown, 2001). The impact of image and its related constructs have been primarily explored in relation to behavioral intention (Plouffe et al., 2001; Foon and Fah, 2011) and perceived usefulness (Chan and Lu, 2004; Lu et al., 2005; Williams et al., 2014). The empirical evidence predominantly supports the hypothesized relationships regarding image, while some contingency effects emerge with regard to subjective norm: a number of studies found sustained support for the effect of image on perceived usefulness, while subjective norm was only validated in mandatory, short-term settings (Venkatesh and Davis, 2000) and for potential adopters but not users (Chan and Lu, 2004). This suggests that TA decisions are influenced by identification processes and that these operate independently of contingencies such as voluntariness and experience.

Multi-processual conceptualizations of social influence

In addition to the constructs discussed so far, which operate through only one distinct social influence process, there are also a number of social influence conceptualizations that are theorized to operate through multiple processes. These include critical mass/network externalities, social network configuration, and social capital.

Twenty of the reviewed studies explore social influence through the lens of (perceived) critical mass or (perceived) network externalities (Strader et al., 2007; Wattal et al., 2010). The two concepts are connected, as the presence of network externalities forms and influences critical mass, which in turn affects TA (Hsu and Lu, 2004). The reviewed literature finds strong empirical support both for a direct effect of critical mass on behavioral intention (Sledgianowski and Kulviwat, 2009; Cheng, 2011) and an indirect effect, mediated by perceived usefulness (Lee, 2006; Rauniar et al., 2014). The direct effect is theorized to operate as a normative, compliance-based process, whereby an individual's perception that a large number of its social referents are using a technology may influence TA behavior without necessarily altering his internal belief structure (Cho, 2011). The indirect effect, in turn, is predicated on the notion that the intrinsic value of a technology with network externalities increases as more users adopt it, thereby affecting an individual's instrumental beliefs through internalization (Lou et al., 2000).

Interestingly, almost half the studies incorporated perceived critical mass alongside subjective norm (e.g., Cheng, 2011; Kim et al., 2007). While all these studies were able to validate direct or indirect critical mass effects, almost none found significant support for a compliance-based subjective norm effect (Van Slyke et al., 2007). Two studies did, however, find evidence of internalization effects of subjective norm (Lee, 2006; Wang and Chou, 2014). This suggests that complementarities and interactions may exist between the subjective norm and perceived critical mass constructs. IS scholars may benefit from empirically testing these interactions in order to determine how the constructs are related. In addition, a number of studies incorporated notions of 'visibility' (Gounaris and Koritos, 2008; Plouffe et al., 2001) and 'descriptive norms' (Yang and Forney, 2013; Yu, 2012; Foon and Fah, 2011) that are very similar to the notion of critical mass, both conceptually and in operationalization.

Nine of the reviewed studies draw on social network configurations to study how social influence manifests itself in TA. The configuration on an individual's social network is theorized to affect the information and norms that flow through that network, which in turn impact individual and collective behavior through internalization and compliance (Magni et al., 2013). Social network studies typically gauge social influence in terms of network size, centrality, and density (e.g., Guzzo et al., 2014; Sykes et al., 2009). A number of studies further differentiate by type of network, e.g., supportive versus informational (Bruque et al., 2009) or intra- versus inter-team connections (Magni et al., 2013), while others differentiate by type of agency, e.g., cognitive versus relational (Montazemi et al., 2008) or absorptive versus disseminative capacity (Peng et al., 2014). Social network constructs have, for instance, successfully been used to study peer effects on digital inequality (Agarwal et al., 2009; Venkatesh and Sykes, 2013), e-health adoption (Peng et al., 2014; Venkatesh et al., 2011), and electronic trading systems (Montazemi et al., 2008). Almost all reviewed articles reveal significant, positive effects of network characteristics on adoption and use behavior (Bruque et al., 2009; Venkatesh and Sykes, 2013). Sykes and colleagues (2009, p. 390) even find evidence that "social network constructs [...] explain variance in system use over and above the predictors from the individual TA perspective (i.e., behavioral intention and facilitating conditions)."

Finally, a number of studies drew on the concept of social capital. Theoretically grounded in capital theory, social capital refers to the "resources embedded in a social structure that are mobilized in purposive action" (Lin 2001), such as relatives, friends, and social institutions. Social capital has attracted a lot of research attention in sociological and organizational research (Borgatti and Foster, 2003; Baker, 1990; Adler and Kwon, 2002), but has so far featured less prominently in TA research. Thematically, social capital has been primarily studied in relation to digital inequality (Kvasny and Keil, 2006; Hsieh et al., 2011) and participation in virtual (knowledge sharing) communities (Chiu et al., 2006; Wasko and Faraj, 2005; Liao and Chou, 2012). Others applied social capital, for example, in the context of tourism TA (Lee et al., 2013). Conceptually, almost all of the reviewed studies leverage Nahapiet and Ghoshal's

seminal notion of social capital as a combination of structural, relational, and cognitive dimensions (1998). Through these dimensions, the social capital construct captures compliance, internalization, and identification effects of social influence. Correspondingly, a number of studies have used social capital as a complement to subjective norm in order to attain a better representation of social influences (Liao and Chou, 2012; Lee et al., 2013) and found empirical support for both constructs. Extant research has validated both the construct's direct effect on use or intention to use (Hsieh et al., 2011; Chiu et al., 2006) as well as its indirect effect mediated by attitude (Liao and Chou, 2012) and instrumental beliefs (Lee et al., 2013).

Reflections on social influence conceptualizations in TA research

Reflecting on how social influence has been conceptualized in TA research, a number of insights emerge. On the one hand, compliance-based definitions centered on the construct of subjective norm dominate. Over 80% of the reviewed papers include a compliance-based measurement of social influence and 30% do so exclusively, meaning that no other social influence process is accounted for. This observation can be explained by the research domain's theoretical foundation on technology acceptance models, such as TAM2, and their associated conceptualizations of social influence.

On the other hand, a wide range of alternative conceptualizations of social influence exist that have so far not garnered as much attention in TA research. This is likely due to the fact that these conceptualizations are not anchored in the established technology acceptance models that characterize this research stream, such as TAM or UTAUT. Structural constructs related to critical mass and social network configurations are fairly established in their own right, while others, like group norms and social identity, are more recent additions aiming to fill the void left by compliance-based constructs with regard to the wider social contexts of decision making (Bagozzi, 2007). The empirical support found for these alternative conceptualizations in the reviewed literature highlights the importance of including constructs that account for internalization and identification effects. Extant studies already show that the explanatory power of constructs like group norms and social identity exceed that of subjective norm in voluntary, group-based social technology environments (Tsai and Bagozzi, 2014; Shen et al., 2013). As TA becomes increasingly consumer-driven and social, the importance of accounting for all types of social influence processes will only grow. Future IS research stands to benefit from leveraging alternative social influence conceptualizations.

When doing so, scholars should remain aware of methodological concerns stemming from the multifaceted nature of social influence. Some scholars have noted a tendency for different social influence constructs to be "lumped together" under the term 'social influence' or 'social norms', although the underlying motivations, decision rules, and social processes differ both conceptually and theoretically (Cho, 2011, p. 284; Kraut et al., 1998). For instance, the social influence construct in the UTAUT – in an attempt to account for different social influence processes – is composed of subjective norm (Ajzen, 1991), social factors (Thompson et al., 1991), and image (Moore and Benbasat, 1991). It thereby combines items related to an individual's perception that other people think it should use a new technology, the perception that others support its use of a new technology, and the perception that use of the technology is associated with a higher societal status. It appears unlikely that the combination of such disparate items can reflect a single psychometric construct (Van Raaij and Schepers, 2008). Similarly, problems plague the measurement of the direct (normative) and indirect (informational) effects of subjective norm and perceived critical mass, which are "conceptually distinct, but empirically entangled, types of social influences" (Kraut et al., 1998, p. 437) and typically operationalized using the same scale. Future research may benefit from disentangling such mixed constructs and testing the subordinate constructs separately to properly establish if and how they are interrelated.

4.2 Levels of analysis

We found all four levels of analysis that are common in behavioral research (DeLone and McLean, 1992; Markus and Robey, 1988; Klein et al., 1994) in the reviewed literature: individual, group, organizational, and societal levels of analysis. Some studies used multiple levels of analysis simultaneously.

The majority of the sampled research on social influence on TA was conducted at the individual level (87 papers). This is not a surprising finding, since TA overall has traditionally been studied primarily at this level (Venkatesh et al., 2003; Delone and McLean, 2003). Behavioral research is inherently founded on individual attitudes and actions, and essentially all conventional behavioral antecedents in the IS field, such as perceived usefulness or perceived ease of use, are at the individual level (Sarker et al., 2005). Even the social influence construct, meant to account for the social aspects of decision-making and arguably implicitly predicated on a group level or higher, is generally analyzed at the individual level from the perception of the focal individual, via indicators such as perceived social pressure or perceived overlap between individual and group norms (Sarker and Valacich, 2010). While this approach is the standard methodology, some scholars criticized that it measures social influence in a unidirectional sense (Bagozzi, 2007) and relies solely on the perception of the focal individual without verifying the actual influence exerted by the social reference group (Burton-Jones and Gallivan, 2007).

Only 14 of the sampled papers explore social influence and TA at a group, organizational, or societal level. At the group level, some scholars theorized about how to best measure TA by groups and developed methodological individualist and non-reductionist models centered on the concept of group valence (Sarker et al., 2005; Sarker and Valacich, 2010; Klein et al., 1994). Others investigated multi-group adoption. Plouffe et al. (2001), for instance, investigate the adoption of an electronic payment system by different groups of consumers and retailers, and find that social influence processes differ by group. At the organizational level, scholars examined the importance of social influence on knowledge transfer in health information technology systems (Peng et al., 2014) as well as open source software adoption in SMEs (Macredie and Mijinyawa, 2011) and found significant, positive effects. At a societal level, the sampled studies investigate either the applicability of technology acceptance models and social influence processes within non-Western contexts (Datta, 2011; Al-Qeisi et al., 2015) or undertake cross-cultural comparisons (Venkatesh and Zhang, 2010; Choi and Geistfeld, 2004; Yang et al., 2012). Given the limited number of papers that fall into the non-individual category, it is difficult to reach a conclusion regarding the social influence processes studied, although it is apparent that internalization seems to play a particularly prominent role at the group level of analysis.

Twelve papers pursued a multilevel approach, most notably through the combination of individual and group levels of analysis. One stream of research pursuing this approach centers on the concept of “we-intention,” defined as “a collective intention rooted in a person’s self-conception as a member of a particular group [...], with action conceived as either the group acting as a unit or the person acting as an agent of, or with, the group” (Bagozzi, 2007). We-intentions have been studied extensively in small-group based virtual communities (Tsai and Bagozzi, 2014; Dholakia et al., 2004; Bagozzi and Dholakia, 2006) and social-network facilitated teams (Shen et al., 2010; Shen et al., 2013). Another stream of research focused on incorporating specific group-level characteristics into individual-level acceptance models, such as team climate (Liang et al., 2010), co-worker influence (Gallivan et al., 2005; Wang et al., 2013), and team internal closure (Magni et al., 2013). Noteworthy is the underlying social network method of data collection, as proposed by Fulk (1993), whereby co-worker/team variables were measured as an average of the actual responses of the social referents rather than from the perception of the focal individual. Our review further suggests that multilevel research is more likely to account for the full range of social influence processes.

Extant research presents ample opportunity for future research, particularly at the group and organizational level. At the group level, IS scholars should examine in greater detail how group dynamics and interactions – manifestations of social influence – affect group attitudes toward TA. Sarker and Valacich (2010) provide a good example of this type of research. They explore how majority opinion, intra-group conflict, and opinion of high-status individuals during a group exercise influence individual members’ a priori attitudes toward the technology as well as the group’s joint decision to adopt the technology. At the organizational level, similar considerations hold. In order to study social influence phenomena within the context of organizational TA, IS scholars may particularly benefit from integrating two streams of research: the structural perspective centered on social network configurations and innovation diffusion (e.g., Peng et al., 2014) and the behavioral perspective centered on issues such as peer influence, organizational culture, and support that foster or impede adoption (Brown et al., 2010). In the

adjacent field of knowledge management, social capital frameworks incorporating both structural (network ties) as well as relational and cognitive social capital (i.e. social trust, reciprocity, shared vision, peer influence) were fruitfully used to study knowledge sharing in intra-organizational contexts (Adler and Kwon, 2002; Chow and Chan, 2008; Inkpen and Tsang, 2005). Initial studies on TA confirm that, taken together, social network constructs can significantly enhance the understanding of system use over and above behavioral predictors (Sykes et al., 2009).

Finally, a multilevel approach presents TA researchers with the opportunity to study social influence in a manner that extends beyond the focal individual's perception. To do so, scholars should further validate and extend the measurement items developed in extant multilevel research in order to corroborate their validity and reliability. So far, for instance, the social network method has been primarily used to collect data on social referents' actual behaviors. It would be very interesting to extend this to include social referents' beliefs and perceptions on group norms as well, as partially implemented by Gallivan et al. (2005). This would enable researchers to evaluate the degree of convergence between an individual's beliefs and behaviors and that of social referents.

In summary, three key findings emerge. First, social influence on TA has been studied at various levels of analysis, but the large majority of studies have been at the individual level. Second, studies that extend beyond the individual level of analysis are more likely to incorporate social internalization and identification effects to account for non-compliance based group processes. Third, multilevel research emerges as an interesting avenue. Future research stands to profit by engaging in more multilevel and group-level analysis of TA in order to achieve more proximate representations of social influence.

5 Integration and conclusion: An integrated perspective on social influence in TA research

The review reveals that TA research on social influence is characterized by considerable variation in the types of concepts studied and evidence of multiple social influence processes operating under different conditions. Two central implications emerge from these findings. First, IS scholars should reject a monolithic conceptualization or one-sided theorization of social influence processes (Cho, 2011; Merton and Sztompka, 1996). The review shows that multiple theoretical ways of social influence can coexist and complement each other. A normative, compliance-based perspective on social influence has characterized early TA research and is still the dominant conceptualization today, but IS scholars are increasingly incorporating additional social influence processes and conceptualizations in their research and thus introduce some of the interdisciplinary pluralism of social influence to the field of TA. This contributes to a richer understanding of social influence. Therefore, rather than suggest the development of a single perspective on social influence in TA research, this paper echoes the sentiment expressed by Scott (1987, p. 493) that "further improvement and growth...is dependent upon [scholars] dealing more explicitly with these differences." In this vein, we encourage future IS researchers to adopt a multi-theoretical approach and to actively elaborate on the distinct theoretical mechanisms by which different social influence processes can affect TA.

Second, our review of the literature suggests that scholars not only need to consider how to conceptualize social influence but also fundamentally challenge how social influence should be positioned within the nomological framework of TA. Leading IS scholars have repeatedly identified limitations in the field's current conceptualizations of social influence and called for a better representation of social change processes (Legris et al., 2003; Bagozzi, 2007). Building upon the findings of our review, we attempt to address some of these limitations by developing a framework to guide the further development of social influence research in IS.

Inspired by Leidner and Kayworth's (2006) tripartite definition of IT-culture conflict and Burton-Jones and Straub's (2006) conceptualization of system usage as a function of user-system-task, we propose a multidimensional view of social influence (Figure 1). Specifically, we posit that social influence in TA research should be viewed as the multi-level interaction of three dimensions: user, social referents, and technology. The interaction between the focal user and their social referents determines the direction of

social influence, which may be reciprocal and multidirectional rather than just unidirectional. The interaction between user and technology, in turn, determines the extent of social influence as technology evolves from a tool level to a social level. Finally, the interaction between technology and social referents influences the nature of social influence – whether it is supportive or dismissive. These interactions can take place at various levels of analysis, from individual to societal. The following paragraphs describe each proposed interaction in greater detail.

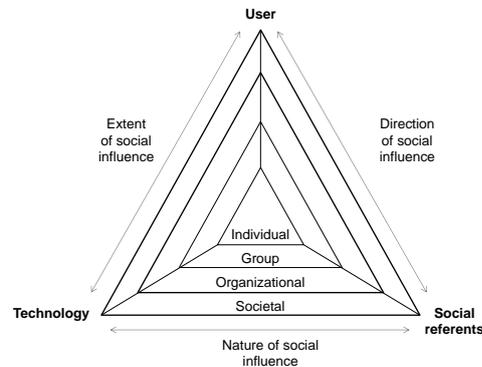


Figure 1. Multidimensional view of social influence in technology adoption

First, IS scholars need to consider the interaction between (potential) users and their social referents. The majority of current social influence conceptualizations are predicated on a unidirectional view that sees the individual as a target of social behavior, but not as an initiator of social interactions toward others (Junglas et al., 2013; Bagozzi, 2007). Norm-based definitions typically portray individuals at the receiving end of others' expectations and posit a relationship characterized by dependence (Cialdini and Trost, 1998). While they do not presume that individuals necessarily comply with or accept the expectations, these definitions remain mute on how the focal individual itself may affect and influence the social sphere that it is part of. As real-world social behavior is inherently reciprocal and based on multidirectional rather than unidirectional, interactions among individuals or groups (Moscovici et al., 1985), we concur with Mason, Conrey, and Smith (2007) and propose that models seeking to contextualize social influence processes with regard to TA should incorporate reciprocal and multidirectional influence pathways. Network-based conceptualizations (e.g., social network configuration) provide a good basis since they account for multiple actors and multidirectional influence pathways. However, they generally center on aggregate outcomes such as innovation diffusion rather than the social psychological processes driving behavioral intention. As such, a promising research avenue for IS scholars may be to study the social cognitive processes at the individual level through which multidirectional network effects drive TA. At the group level, in turn, a better understanding is needed of how group interactions and dynamics influence individual and collective intentions to adopt or use a technology. Extensive conceptual and empirical research on these topics exists by social psychologists, and IS scholars would do well to leverage it (see Mason et al., 2007 for a review).

Second, future IS research should consider the extent of interaction between users and technology. A number of scholars have criticized current TA models for being limited to a "one-to-one interaction between a user and an information system" (Junglas et al., 2013, p. 589). The user is typically seen as a "solitary information processor" (Sproull and Faraj, 1997, p. 38) whose interaction with the system is restricted to the "tool level," i.e. the technology (Wand and Weber, 1995). This reductionist perspective neglects the social component of IS technologies – the social interactions embedded within the use of a technology – and, in turn, limits our understanding of the social dynamics at play. For instance, an individual considering if and how to use a social technology such as Facebook will not only be influenced by social impulses before or after use, but also by social impulses experienced while using the technology. The same applies to a group using a collaborative technology. The social influence processes at play may be similar to the ones already discussed, such as identification and internalization,

but they may include additional factors such as community feedback (Wattal et al., 2010), social interaction (Lee, 2009), and sociability (Junglas et al., 2013), which result from the user's interaction with others members using the technology. As technology use becomes increasingly social, the extent of social influence on users will increase. This creates the need for further research to deepen our understanding of how social components of technology use affect continued use.

Third, the relationship between social referents and the salient technology needs to be considered. The nature of this interaction is likely to determine whether the social influence to use a technology is, for example, supportive or dismissive. In extant research, the nature of social influence is typically measured as function of others' opinions as perceived by the focal individual, or through the manifestation of social referents' use of the technology (e.g., critical mass). This leaves room and a need for more comprehensive representations of social referents' actual beliefs and behaviors toward a technology. A number of studies began to address this issue and, for instance, incorporated measures of co-workers' IT self-efficacy, perceived usefulness, and experience (Gallivan et al., 2005; Brown et al., 2010). In doing so, they aimed to capture social referents' salient beliefs toward a technology more fully and objectively. At a collective level, the construct of group norm has been proposed to engender the group's shared beliefs toward a technology (Bagozzi and Lee, 2002). Future IS scholars should build on these ideas and ponder how they can be developed further to better account for variations and nuances in social referents' beliefs.

Combining all these dimensions allows us to move from an insulated to an integrated perspective of social influence on TA. We thus hope that future conceptualizations will view TA not as a one-to-one interaction between a user and a system but as an interaction between a user and other users, mediated through technology – and set within a social sphere. Social influence research in IS already benefits immensely from its position at the interface of multiple research fields. Future scholars seeking to substantively advance our understanding will benefit from leveraging this pluralistic, interdisciplinary foundation and actively pursuing a richer, more holistic conceptualization of social influence that accounts for the interactions between user, social referents and technology in an integrated manner.

6 Summary: Recommendations and research agenda

If there is one dominant insight that has emerged from this review, it is that social influence is a complex concept with ample potential for future research. Recommendations for future research have already been made throughout the paper, but Table 2 summarizes the most promising ones by clustering them into four categories, providing a concise high-level research agenda for social influence in TA research.

Current limitation	Recommendation	Examples
Studies tend to focus on one, or few, isolated conceptualizations of social influence	Pursue an integrated, multi-theoretical understanding of social influence	Incorporate non-compliance-based social influence processes and conceptualizations Acknowledge and leverage multi-theoretical foundation of social influence research Further develop and validate measures of internalization and identification, e.g., group norms/social identity, in different contexts Test how different social influence conceptualizations interact Account for interactions between user, social referents, and technology (multi-directional social influence, social components of technology use, variance in social referents' beliefs/behaviors)
Studies tend to focus on the individual level of analysis	Move beyond the individual and explore other levels of analysis	Expand in particular on group-level research, for instance by leveraging process theory to study to how group dynamics and interactions manifest themselves as social influence and affect group attitudes toward TA Consider multiple levels of analysis to achieve more proximate representations of social influence
Studies tend to neglect context	Study contingency effects	Test variance in contingency effects for different social influence constructs and processes Test moderating impact of focal technology, i.e. social/non-social
Studies employ measures that conflate constructs or are prone to bias	Improve construct measurements	Avoid confounding conceptually and theoretically distinct social influence constructs – test subordinate constructs separately to properly establish interrelation Avoid common method bias from survey-based, self-report data by capturing social referents' actual beliefs/behaviors directly where meaningful

Table 2. Recommendations and Research Agenda

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