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Social Influence in Technology Adoption Research – A Scientometric Study over two Decades Behavior

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ABSTRACT

Research on the impact of social influence on the individual Information Systems (IS) user represents one of the major challenges of technology adoption research since the introduction of Technology Acceptance Model in 1989. As several IS researchers still struggle from both a theoretical and an empirical perspective to determine how social influence can be explained and measured, this approach contributes to existing adoption research by providing the findings of a literature analysis of all journal and conference articles of the JAIS journal ranking and the AIS proceedings since 1989. The results based on 149 relevant papers reveal that social influence is more significant using a individualized measurement and more important for the usage of utilitarian IS. Additionally it is shown that the point of adoption (pre-adoption vs. post adoption) and the degree of free decision-making (mandatory vs. voluntary) do not affect the impact of social influence.

Keywords

Social Influence, Scientometric Study, Technology Adoption, Group Comparison.

INTRODUCTION

As zoon politikon, or social being, humans are subject to the influence (pressure) of their social networks (e.g. private: parents and friends; work: colleagues and superiors). This influence can be expressed in different ways: First it can be distinguished in terms of social influence on an individual between pressure exerted directly by other individuals and groups (Sherif, 1935; Asch, 1951). Second the urge individuals feel constantly to adapt their behavior conform with other people's behavior (Festinger, 1954). Third it can be defined as the subjective perception of certain individual social norms and/or cultures which leads individuals to internalize them and identify themselves with them (Kelman, 1958; Fishbein and Ajzen, 1975; Triandis, 1980).

In the field of information systems (IS) research, the investigation of this phenomenon is linked largely to the third form of social influence (Venkatesh et al., 2003; Lee et al., 2006): the perception of subjective norms and/or cultures and their effect on the adoption and use of technology by individuals. Actual use and adoption of technology is of major importance for IS research because information systems usage has been identified as the missing link from IT investments to the business value impact of IT (Lucas and Spitler, 1999; Devaraj and Kohli, 2003). DeLone and McLean examined the importance of individual system usage for organizational success in detail and came to the conclusion that "…*without system use, there can be no consequences or benefits*" (DeLone and McLean, 2003, p.16).

They also identified the social structure and environment of the individual user as a prevalent factor and major determinant for the proliferation of benefits from individual to organizational level. The user's corporate environment could help to gain these organizational net benefits (e.g. reductions in process time and cost) through extensive use; however, it could also lead to inappropriate and ill-informed use which may result in no benefits (DeLone and McLean, 2003).

In order to gain these net benefits of IS use and to prevent ill-informed or denied IS use, both companies and research need to understand how social influence occurs and impacts the potential IS user. Despite already being recognized as major challenge in the development process for the Technology Acceptance Model (TAM) (Davis et al., 1989) and discussed since the beginnings of technology adoption research around 20 years ago, researchers still struggle from both a theoretical and an empirical perspective to determine what factors can be used to explain and measure the influence of an individual's social environment and to what extent this influence impacts an individual's IS usage. Therefore the main goal of this research is to approach social influence from a scientometric perspective in order to analyze how technology adoption researchers have handled this phenomenon over the last two decades. With the help of data collected through an analysis of all journals of the Global Journal Ranking by Paul Lowry (Lowry et al., 2004) and all AIS journal proceedings since 1989 we aim to test four hypotheses on social influence regarding its measurement (cumulative vs. individualized), the degree of free decision-making (voluntary vs. mandatory), purpose of the IS used (utilitarian vs. hedonic) and user's system experience (pre-adoption vs. post-adoption). By discussing the results we aim to provide more knowledge for the research question:

How does social influence affect an individual's IS usage behavior?

The research approach proceeds in the following way. The following section provides the reader with the theoretical background of social influence and its history in technology adoption research as well as the derivation of all four hypotheses. The following methodology section describes in detail the applied research method and the data pool plus details regarding the search process and the database access. The final part of the paper depicts the descriptive scientometric data as well as results evaluated by the analysis, which will be discussed in the closing section.

THEORETICAL BACKGROUND

After the introduction to our research we will use this section to briefly describe the theoretical background of social influence respectively its construct subjective norm in IS research especially in the field of technology adoption, acceptance and usage. Furthermore we introduce the underlying theories and models which include the parameter observed. The derivation of four major hypotheses on social influence concludes this section.

The Term Social Influence

Investigations about the effect of social influence on individual human beings originate in social psychology research back in the early 1950s. Researchers like Asch (1951), Lewin (1952) or Festinger (1954) introduced and experimentally tested the concept of social influence as the pressure of conformity on an individual human being to act in conformity with the behavior of a distinct group or person. This pressure of conformity is manifested in continuous comparison with the behaviors, opinions and actions of other individuals or groups from an individual's point of view (Festinger, 1954). Social influence could then be defined as a change in thinking or feeling in an individual person with regard to a specific behavior due to communication with other individuals.

In 1962, knowledge about this topic was further deepened by Rogers' work on the diffusion of innovations. Within his approach Rogers describes social influence as norms or the roles of opinion leaders and change agents in innovation diffusion in a distinct social system which is defined as "*a set of interrelated units that are engaged in joint problem solving to accomplish a common goal*" (Rogers, 2003, p. 23).

The specific constructs for social influence later used in technology adoption research – subjective norm and social factors – were created about 10 years later and introduced within the competing Theories of Reasoned Action (Fishbein and Ajzen, 1975) and Interpersonal Behavior (Triandis, 1971) for marketing and social psychology research. A first approach which adapted the factor social influence specifically for IS management literature was that of Salancik and Pfeffer in the Theory of Social Information Processing who built a conceptual framework to describe social information processes on an individual's job attitude (Salancik and Pfeffer, 1978).

However a large proportion of articles including social influence could be related to the field of IS adoption. Articles dealt with investigations, extensions and revisions of Davis' Technology Acceptance Model (TAM) (Davis et al., 1989). Most subsequent major approaches, models and theories in technology adoption after the introduction of TAM aimed at explaining an individual's use of technology included a construct for social influence, such as the Model for PC Utilization (Thompson et al., 1991), the TAM II (Venkatesh and Brown, 2001), the Unified Theory of Acceptance and Technology Use (Venkatesh et al., 2003), the Model of Adoption of Technology in Households (Venkatesh and Brown, 2001; Brown and Venkatesh, 2005) or TAM III (Venkatesh and Bala, 2008).

Despite the great importance of TAM for adoption research, in a special volume of the Journal of the Association for Information Systems (JAIS) in 2007 leading researchers suggested that a much more critical approach to the individual elements of the model and their importance for an individual's use of a system is needed (Benbasat and Barki, 2007).

An essential point of criticism in this context is the determination and measurement of social influence in the form of the operationalized construct "Subjective Norm" on an individual's use of a system or systems. "Subjective Norm" was excised by Davis et al. from the basic TAM model on the grounds of insufficient operationalization, even though they were well aware of its importance and expected "*more sophisticated methods for assessing the specific types of social influence (…) to better understand the nature of social influences, and to investigate conditions and mechanisms governing the impact of social influences on usage behavior*" (Davis et al., 1989, pp. 998f.)

Subsequent, preponderantly empirical, research approaches in scientific journals during the two decades up to 2009 were more or less balanced between significant (Thompson et al., 1991; Taylor and Todd, 1995) and non-significant results (Mathieson, 1991; Dishaw and Strong, 1999; Hsieh et al., 2008) for the value "Subjective Norm" in research models. What remained constant, however, were a continuing controversy (Venkatesh et al., 2003) and the demand of numerous researchers that this value, generally accepted as important, be analyzed in more detail (Davis et al., 1989; Agarwal, 2000; Lu et al., 2005; Sykes et al., 2009). Furthermore the reasons for its frequently non-demonstrable influence in or even exclusion from many research models should be worked out (Davis et al., 1989; Yao and Murphy, 2007).

Thus, Agarwal demanded "*additional research that clarifies the precise role of social pressure in technology acceptance*" (Agarwal, 2000, p. 98) of the "*unloved child of technology adoption research*" (Eckhardt et al., 2008, p.1). Similarly Lu and her colleagues argued for "*further research that should study if this factor generate any direct impact on intention to adopt*" (Lu et al., 2005, p. 263). The same conclusions have been reached by other researchers in current approaches who demand analysis of the factor of "Subjective Norm" which will "*fully take into account the social richness of interactions*" (Sykes et al., 2009, p. 372).

Meta-analyses and literature studies revealed that in the 113 articles in major scientific journals which contained a value for social influence, the construct "Subjective Norm" showed the lowest level of significance in comparison with other determinants of technology adoption or use (Schepers and Wetzels, 2007). An initial response to these results came from Srite and Karahanna, who drew the conclusion "*that social norms need to be conceptualized in a more distinguishing manner to capture the nuances of the social environment*" (Srite and Karahanna, 2006, p. 697).

Leading adoption researchers recommended going back to the underlying theories of adoption research and to focus on the measurement of its related latent variables as a first step towards the direction of a better understanding of social influence on IS usage (Benbasat and Barki, 2007).

All the adoption models are based upon two competing behavioral theories from social psychology research: (1) the Theory of Reasoned Action (Fishbein and Ajzen, 1975) and its extension the Theory of Planned Behavior (Ajzen, 1985) and (2) the Theory of Interpersonal Behavior (Triandis, 1971; Triandis, 1980).

The majority have their origin in the Theory of Reasoned Action (TRA) and the Theory of Planned Behavior (TPB) proposed by Ajzen and Fishbein (Fishbein and Ajzen, 1975; Ajzen, 1985). The antecedents of an individual's behavioral intention are an individual's attitude toward the behavior, perceived behavioral control and social influence (subjective norm). Social influence (subjective norm) is referred to as "*the person's perception that most people who are important to him think he should or should not perform the behavior in question. According to the theory, the general subjective norm is determined by the perceived expectations of specific referent individuals or groups, and by the person's motivation to comply with those expectations."* (Fishbein and Ajzen, 1975, p. 302).

Constructed before TRA, the Theory of Interpersonal Behavior posited by Triandis (1971) has been used equally frequently within the IS context. Within this theory an individual's behavioral intention is, as in TRA, explained among others (e.g. attitude) by the construct social factors, a construct for incorporating an individual's role, self-concept and perceived norms within a specific social network and affects his/her manifest emotions towards the behavior. Nine years later, Triandis expanded this term and called it social factors, that is "*…the individual's internalization of the reference groups' subjective culture, and specific interpersonal agreements that the individual has made with others, in specific social situations*" (Triandis, 1980, p. 210).

Derivation of Hypotheses

With the introduction of social influence as determinant for an individual's behavioral intention within the Theories of Reasoned Action and Planned Behavior Fishbein and Ajzen also indicated how this antecedent needs to be measured

(Fishbein and Ajzen, 1975; Ajzen, 1991). The questioned individuals should agree or disagree to a statement that people who are important to them expect/want them to perform a specific behavior (e.g. using a specific information system). Therewith an individual's whole social private, job or public environment is subsumed in a cumulative construct "important others". Already just after the introduction of the underlying Theories of Reasoned Action and Planned Behavior (Fishbein and Ajzen, 1975; Ajzen, 1991) as well as Theory of Interpersonal Behavior (Triandis, 1971; Triandis, 1980) leading social psychology researchers questioned this collective measurement using "important others" as not distinguishing enough to analyze social influence appropriately (e.g. Ahtola, 1976; Miniard and Cohen, 1983; Liska, 1984). In their opinion is the cumulative perception not adequately as an individual does not feel the pressure of a group of collective important others, but of individual groups as peers or superiors in a working environment respectively friends or parents in a private environment (Eckhardt et al., 2009). Basically this opinion was also confirmed by Fishbein and Ajzen (1975) who assumed that the influence of their developed construct for social influence can be different case-by-case (Fishbein and Ajzen, 1975). As a result, several research approaches using a collective measurement with the generic cumulative classification of "important others" found social influence as an insignificant predictor (e.g. Mathieson, 1991; Pavlou and Fygenson, 2006; Hsieh et al. 2008) or excluded the construct from their research models due insignificance (e.g. Davis et al. 1989; Dishaw and Strong 1999; Ha et al. 2007; Yao and Murphy 2007). Thus, a blanket point of view by the user on his social environment is not possible (Karahanna et al., 1999).

Evidence for the importance of an individualized measurement of social influence, whereas individual measurement applies to specific groups of people (e.g. friends, co-workers, superiors) was brought out in several prior research approaches. For example, research approaches on online gaming discovered that especially the social influence of a user's friends and family is an important predictor for user's intention to play those games while the influence of other collective groups has no significant impact (Hsu and Lu, 2004). Especially the user's environment (e.g. household or workplace) appears to be an important factor. Within an example of CRM system usage at work, one can see that especially the social influence of referents in this environment such as of peers or superiors is crucial for user's system usage (Agarwal et al., 2007).

The importance of an individualized measurement of social influence was also brought out by Yang et al. (2007) in their studies on online discussion forums at the workplace. They investigated that the social influence of peers is a significant predictor for user's usage intention while the social influence of superiors and management remains irrelevant (Yang et al., 2007). Further approaches confirmed the importance of a differentiated situation-related view on social influence. In one case, friends influence user's subjective norm the most (Limayem at al., 2004), in the other are customers and suppliers (Riemenschneider et al., 2003) or mass media (Lopez-Nicolas et al., 2008) the important drivers. While managers are seldom influenced by their peers but of their few supervisors (Hu et al., 2007) other observations show that employees are influenced both by peers and superiors (Lou et al., 2006). The authors summarize that the state of knowledge on how, why and where social influence arises is still far too small (Lou et al., 2006).

Because previous research suggests individual groups of influence (e.g. friends, peers; an individualized measure) are important, we propose these individual measures will have a significant impact over collective measures (e.g. grouping friends, peers, superiors into one generic group of "important others"). Thus, we predict:

H1: Social influence is more significant with an individualized measurement than with the basic collective measurement.

Our second hypothesis is related to voluntariness of use which is defined as "*the degree to which use of the innovation is perceived as being voluntary, or of free will*" (Moore and Benbasat, 1991). In contrast, a mandatory use environment is defined as one in which users are required to use a specific technology or system in order to keep and perform their jobs (Brown et al., 2002). In the beginnings of technology adoption research, most of the empirical investigations assumed that technology use is voluntary (Baroudi et al., 1986). It was argued that solely in a voluntary usage context an individual could bring in her/his perceptions and feelings towards the system. Only then determinants for an individual's behavioral intention (e.g. attitude, perceived behavioral control, subjective norm) could be observed by the researcher. In contrast, a mandatory and binding technology usage implies that there can't be a divergence such as a non-usage. An empirical estimation, if the technology would have been used without obligation is therewith difficult to expose.

The missing variance of the factor was also questioned by Hartwick and Barki (1994) who stated that even when the use of a specific technology is mandatory due to applied pressure by superiors or other influence groups there is still room for discrepancies in the individuals' behavioral actions. They argued that external pressure by groups as superiors could not influence to what extent a technology is used. The influence group does not have complete information and cannot observe if the user is rewarded or punished for his usage behavior (Hartwick and Barki, 1994) and therewith the user could indeed use the system however in an insufficient manner.

Considering that an insufficient system use could lead to failing IS investments it is particular important to analyze the mandated use of a specific technology (Lyytinen and Hirschheim, 1987). Mandatory usage induces the user to use the technology however it could also lead to declining job satisfaction, decreasing loyalty towards the superiors (Zuboff, 1988) or in the utmost way to a destructive behavior or sabotage (Davis et al., 1992).

Within their model TAM2 Venkatesh and Davis stated that social influence is only a significant predictor for intention when the use is mandated (Venkatesh and Davis, 2000). Therewith they confirmed the results of other prior empirical approaches on individual IS adoption. For example Hartwick and Barki (1994) questioned employees of four different corporations about their adoption behavior after new software was implemented. In two companies, the usage was voluntary and in the two others mandatory. The results showed that solely in the two cases with mandated usage social influence was a significant determinant for an individual's behavioral intention (Hartwick and Barki, 1994). Further approaches came to similar results and found a direct relationship between mandatory usage and social influence (Brown et al., 2002). Therefore, we hypothesize that:

H2: Social influence is more important for mandatory than for voluntary IS usage.

Our third hypothesis is related to the purpose of the system researched. In this context, IS researchers have discussed the differences between utilitarian and hedonic systems in numerous studies. In general, utilitarian systems are designed to provide instrumental value to the user (e.g. performing a specific task). Instrumental implies that there is an objective external to the interaction between user and system, such as increasing task performance (van der Heijden, 2004). In contrast, hedonic systems refer to those that provide self-fulfilling value to the user (e.g. enjoyment while playing a computer game) (van der Heijden, 2004). Further example for providing self-fulfilling value are instant messaging (Wang and Datta, 2006) mobile entertainment (e.g., m-gaming, m-music, m-video, and m-betting), or mobile information (e.g., mobile access to sports news, weather forecasts, maps, etc.) (Khalifa and Shen, 2008). The value of hedonic systems is a function of the degree to which the user experiences fun when using the system. Examples of such systems include the internet, systems used at home or leisure environment, games, and game-based training versions of work-related information systems (van der Heijden, 2004).

Existing research on the user technology acceptance often emphasizes the utilitarian aspect of information systems, while hedonic systems are different from utilitarian ones in terms of the relative importance of perceptual factors such as perceived usefulness and perceived ease of use in forming behavioral intention. For example, existing empirical evidence indicates that perceived enjoyment has stronger impact on behavioral intention for hedonic systems (van der Heijden, 2004, Atkinson and Kydd, 1997). Furthermore it should be noted that the boundary between utilitarian and hedonic systems is not as apparent as their names suggest. This is especially true for mixed systems, which can be used for both utilitarian and hedonic purposes. For example, it is hard to say whether the internet is a utilitarian or a hedonic system as user can perform various tasks such as searching for a job (utilitarian) or simply surf the net for fun (hedonic) (Sun and Zhang, 2006). As a consequence (Sun and Zhang, 2006) suggest that the distinction is task dependent. They define a system as utilitarian when "*it is aimed mainly at outcome-oriented tasks, in other words, when its users are mainly driven by an external locus of causality*" (p. 622). On the other hand hedonic systems "*support tasks focusing mainly on the process and users have an internal locus causality*" (p.622). When a system can be used for both purposes the nature of the tasks should be taken into account.

According to the relationship between the provided value of the system in question and the factor social influence a first reference point was made by Hsu and Lu (2004) in their work on online gaming. They built up a research model based on TAM (Davis, 1989) but integrated in contrast to TAM a predictor called social factors (Triandis, 1980) to measure social influence. They argued that for a hedonic system as online gaming social influence could depict an important factor (Lascu and Zinkhan, 1999; Hsu and Lu, 2004).

According to the relation between the impact of social influence and the use of a distinct utilitarian technology Lucas and Spitler discovered in their observation of broker workstations that social influence and the type of the technology observed were even more important than basic utilitarian constructs as users' perceived usefulness (Lucas and Spitler, 1999). As the use of hedonic systems is generally more driven by an individual's intrinsic motivation with an internal locus of causality one might think that social influence is more important for the use of utilitarian systems as user's external locus of causality and therewith extrinsic motivation is easier impressionable through external influences such as the opinion and behavior of the social environment.

Therefore, we hypothesize:

H3: Social influence is more important for the use of utilitarian IS than for the use of hedonic systems.

A few empirical studies in IS adoption have observed the impact of social influence on an individual's IS usage intention over time. These approaches showed a strong significant impact of social influence on behavioral intention in the pre-

adoption phase however the impact lowered over time. Within the post-adoption phase social influence has only a small or no significant impact on intention to use IS. Technology adoption research explains this phenomenon with users' increasing system experience and a shift of the usage determinants. For example antecedents as attitude or perceived usefulness gain importance while others as social influence fade into the background (Karahanna et al., 1999; Hsu and Chiu, 2004: Hartwick and Barki, 1994; Hu et al., 2003; Venkatesh and Bala, 2008; Lee et al., 2006; Hsieh et al., 2008).

During the introduction of a new technology users feel uneasy because he is not able to assess the expected consequences arising through the use of the technology (Jensen, 1982). By gathering the opinion of other individuals the user gets an idea about possible consequences of the technology usage. Therewith the factor social influence represents for the user a guidance to reduce uncertainty (Hsu and Chiu, 2004). Through the following system usage after the pre-adoption phase the user could gather experience to minimize uncertainty towards possible consequences. In this context, Venkatesh and Davis (2000) found out that the more experience a user gets in using a system over time the less he attaches great importance to information on system usage coming of his social environment. Therewith the impact of social influence diminishes more and more over time (Venkatesh and Davis, 2000).

While adopting a new technology the user continuously falls back to the advice of his social environment (Lee and Kozar, 2005). The importance of system implementation's point of time is also elucidated in the analysis by Hsu and Chiu (2004) who explained the insignificance of their construct for social influence by the point of time of their investigation, as they observed the individual IS adoption in the post-adoption phase (Hsu and Chiu, 2004).

In addition, to the time factor and user's changing experience some IS research approaches observed a shift within the referent groups. For instance Karahanna et al. (1999) showed a strong significant impact for the social influence of top management in the pre-adoption phase which continuously decreased with user's increasing experience. As time passed top management's influence is spelled by the influence of internal IS consultants. This group supports the user in better realizing system benefits which leads to a higher importance of system related factors as Perceived Usefulness and a steady decrease of social influence in the post-adoption phase (Karahanna et al., 1999). Within their Unified Model of Acceptance and Use of Technology (UTAUT) Venkatesh et al. (2003) seized these results and integrated a hypothesis that assumed a higher importance of social influence for users with less system experience than for users with broad system experience (Venkatesh et al., 2003). Therefore, we hypothesize for our literature analysis that:

H4: Social influence is more important in the pre-adoption phase than in the post-adoption phase.

We will address our hypotheses using a scientometric approach as explained by the following section.

RESEARCH METHODOLOGY

Within this section we describe our applied research method and search behavior.

Research Method

We chose scientometrics as research method for our literature review on social influence due to its adequacy for our approach as it answers particular questions about the way and form IS researchers publish their contents. Other researchers defined scientometrics as the quantitative study of research (Davis, 2001) or the scientific study of the process of science (Lowry et al., 2004). Hunter et al. (1982) outlined how this research method differs from regular surveys. While a survey is used to collect data about people's behavior, opinion or background, scientometrics focus on the article itself and not the observed individual (Hunter et al., 1982). With employed tools as citation analysis or meta-analysis scientometrics observe the affiliations of authors, paper abstracts and texts or references and appendices. Especially for the field of IS research Straub (2006) considered scientometrics to become very important and highly valued (Straub, 2006).

Data Pool and Included Publications

If you conduct a scientometric analysis the major question a priori is: How far do you want to go? In order to provide meaningful results as comprehensive as possible, we included all major peer-reviewed IS journals and proceedings in our study. As there is a broad range of journals and proceedings in the IS field at present with different foci we decided to use the well established and extremely comprehensive (Mbarika et al., 2005) JAIS ranking by Lowry et al. (2004). This ranking is one of the most cited IS journal rankings and part of the MIS journal rankings of the Association for Information Systems (AIS) and the proceedings of the major AIS conferences; ICIS, ECIS, AMCIS and PACIS. Therewith we included 48 journals and the proceedings of four conferences. We pulled in our approach articles published over the last twenty years and searched through every single journal issue and conference proceeding between, 1989 and spring 2009. Therefore we researched more than 21,000 articles overall. We accessed the journal issues and conference proceedings via literature online

databases and electronic libraries. These sources were in alphabetical order: ACM Digital Library, AIS Library, Business Source® Complete, Elsevier, Emerald, IEEE Xplore, JSTOR, Palgrave Macmillan, ScienceDirect and Wiley InterScience. Outlets which were not accessible via one of these databases or libraries were retrieved with the help of experienced colleagues in other universities worldwide. The actual search process with its related inclusion criteria will be described in the following subsection.

Database Search Process

In general, the respective databases or e-libraries provided two main search techniques, "General Search and the "Advanced Search", both including the Boolean operators ("AND"+"OR") to facilitate the search with more than one search item. Alike the procedure in other literature research approaches (e.g. Williams et al., 2009) we mainly used the "General Search" allowing us a continuing procedure with consistent results and without any confusion. The research team included three graduate researchers.

Inclusion Criteria

For the purpose of identifying all relevant articles, the following we inclusion criteria had to be fulfilled:

1. The study had to include some form of social influence or related terms already found in literature (Karahanna et al., 1999; Lewis et al., 2003: Lee et al., 2006; Kim et al., 2007) and used in other meta-analyses (Schepers and Wetzels, 2007) such as "Subjective Norm", "Normative Beliefs", "Social Norm", "Social Pressure", "Social Exchange", "Peer Group Influence", etc.
2. The study had to be empirical, based on survey data. Conceptual models or research approaches using other research methods, such as social network analysis (e.g. Sykes et al. 2009) were excluded beforehand.
3. The study had to include an endogenous variable measuring system usage or the intention to use a particular information system as in basic technology acceptance models (e.g. Davis et al. 1989; Venkatesh and Davis 2000; Venkatesh et al. 2003).
4. The study had to be published in the Global Journal Ranking of the Journal of the Association for Information Systems (Lowry et al. 2004) or in the proceedings of ICIS, ECIS, AMCIS and PACIS. This means that articles published in conference proceedings of MCIS (Mediterranean Conference on Information Systems) or ACIS (Australasian Conference on Information Systems) were not integrated in the overall sample.
5. The study had to be published between the introduction of Technology Acceptance Model in August 1989 (Davis et al. 1989), respectively September 1989 (Davis 1989) and the first issue of 2009.

Our scientometric search was limited to these inclusion criteria and incidences of any of these chosen search terms appearing in the body, abstract or title of the respective article.

This search style resulted in the extraction of 2,493 articles providing topics and content related to social influence in technology adoption research. All 2,493 were then manually crosschecked on their relevance for the overall study. Within the next step, findings were categorized due to their title, author, year of publication, outlet, research subject, context, place and point of time of data collection, technology observed, number of survey participants, etc. Most important the individual role of the construct for social influence was investigated, concerning its beta value, significance (t-value), measurement and impact (f^2) on other exogenous and endogenous variables. Duplicate articles (e.g. first published in conference proceedings and afterwards in a journal) were reduced to the journal publication. Afterwards all results were stored and coded within a database. To ensure validity of the results and to avoid biased findings each identified article was crosschecked and coded by at least two researchers. The inter-rater reliability percentage was above 95 per cent overall. After the coding process, 149 articles containing empirical evaluated research models were included for our study.

RESULTS

After discussing the theoretical background of our hypotheses and our applied research method this subsection provides a short extract of descriptive scientometric statistics for the identified 149 articles.

Further descriptive scientometric results are illustrated in the appendix. In addition, the evaluation of the four hypotheses is presented by providing t-tests for the mean values of the scientometric data. For this purpose we used the same analytical technique as applied in several other studies (e.g. Laumer et al. 2010, Dwivedi et al. 2011).

General Results

With regard to the overall significance of social influence as determinant for IS usage in the articles observed in 72.5 per cent of all social influence is a significant and in 27.5 per cent of all cases a not significant antecedent for the intention to use an information system.

An important part of a scientometric study is to analyze where the articles observed were published. In general, 101 were published in journals and 48 in one of the proceedings of the four conferences observed. As one can see in Figure 1 more than two of ten relevant articles including a parameter for social influence were published in Information & Management. 13.9 per cent were within an issue of MIS Quarterly while 6.9 per cent of all articles observed were publicized in Communications of the ACM. Each 5.0 per cent were printed in DATA BASE and Information Systems Research. The journals with at least 2.0 per cent of the articles published are depicted in Figure 1.

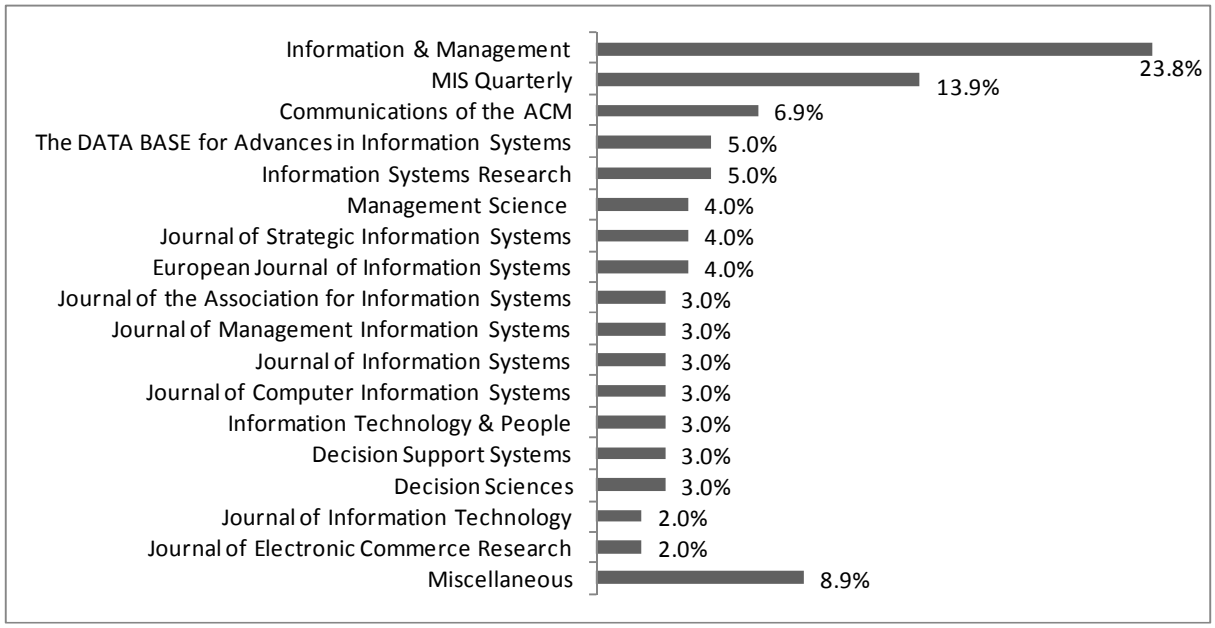

Figure 1. Journals where articles observed were published

With regard to the articles published in conference proceedings Figure 2 shows that 41.7 per cent of the relevant articles were published in the proceedings of AMCIS. More than a quarter was part of the ICIS proceedings. 16.7 per cent were printed in the proceedings of PACIS and 14.6 per cent in the proceedings of ECIS.

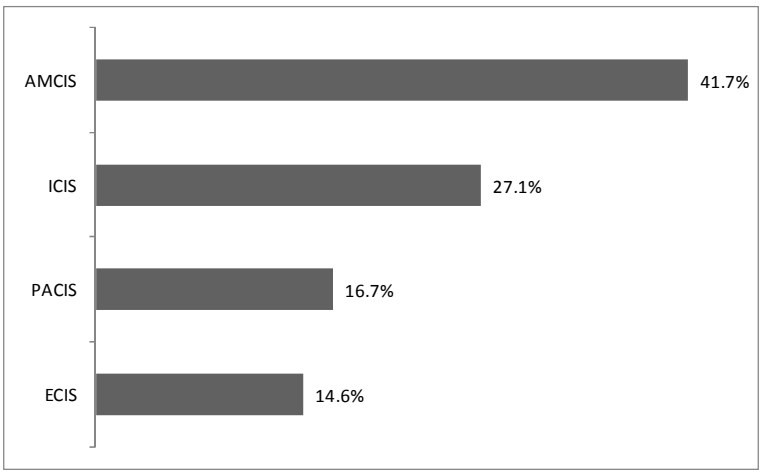

Figure 2. Proceedings where articles observed were published

In the following, subsections the results regarding the four developed hypotheses are presented.

Social Influence Measurement

According to the indicator measurement for social influence as depicted in Figure 3 in total 41.0 per cent of all cases authors used the basic measurement items by Fishbein and Ajzen (Fishbein and Ajzen, 1975; Ajzen, 1991). 28.2 per cent of those approaches were significant and 12.8 per cent were not significant. 28.7 percent of the identified approaches (22.0 percent significant; 6.7 per cent not significant) used workplace referents (e.g. peers, superiors), 27.6 per cent private referents (e.g. family, friends) and 2.7 per cent public referents (e.g. expert opinion, government) as measurement items for social influence.

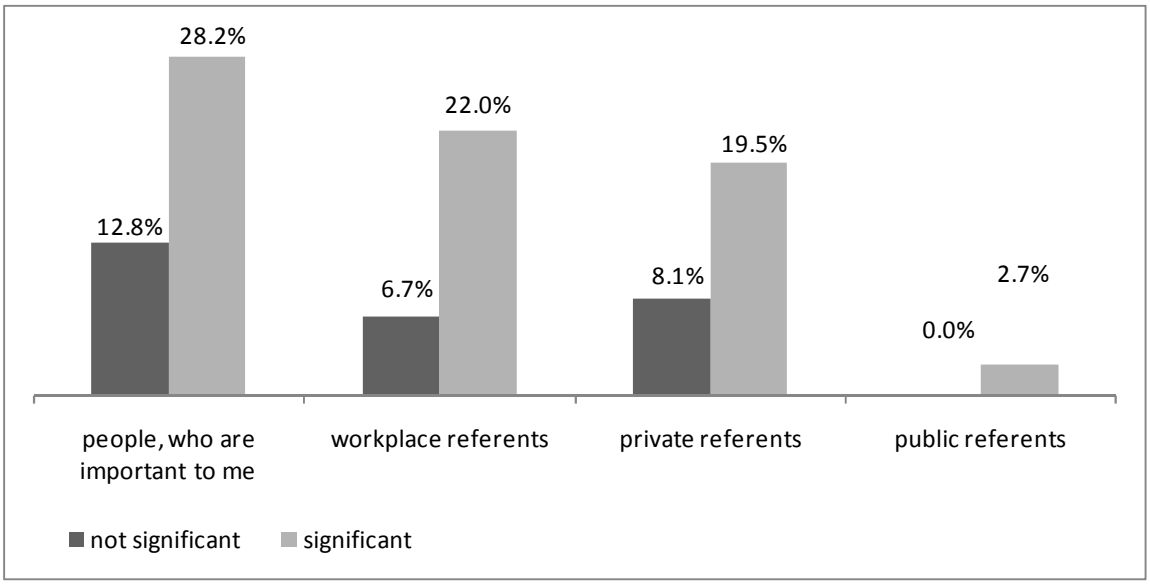

Figure 3. Significance of social influence on IS adoption according to variable measurement in the articles observed

In addition to Figure 3, Table 1 illustrated the results of t-test for mean difference of β-coefficients used regarding the measurement variable in the respective study. The mean for workplace referents is 0.2655, for private referents 0.1944 and for important others 0.1885. There is a statistically different mean between using workplace referents or important others as a measurement model for social influence. In addition, there is a weak statistically different mean for those studies using private and workplace referents and those using important others. The mean of private and workplace referents is 0.2414.

Group	N	MEAN (β)	STD.DRV.	Sig.(2-sides)
workplace referents	43	0.2655	0.1993	0.047***
important others	61	0.1885	0.1795	
private referents	41	0.1944	0.2665	0.903
important others	61	0.1885	0.1795	
private and workplace referents	87	0.2414	0.2433	0.119*
important others	62	0.1873	0.1783	

Table 1: t-Test results for measurement variables used

Freedom of Decision Making

Inserting a table in the text can work well. See Table 1 below. The text of tables will format better if you use the special Regarding the degree of free-decision making as addressed in hypothesis 2 Figure 4 visualizes that the usage context in the articles observed was predominately voluntary. If system usage was voluntary social influence was a significant determinant in 51.7 per cent of the cases observed (not significant 20.1 per cent). If the usage was mandatory social influence remained significant in 21.5 per cent of the cases observed and not significant in 6.7 per cent.

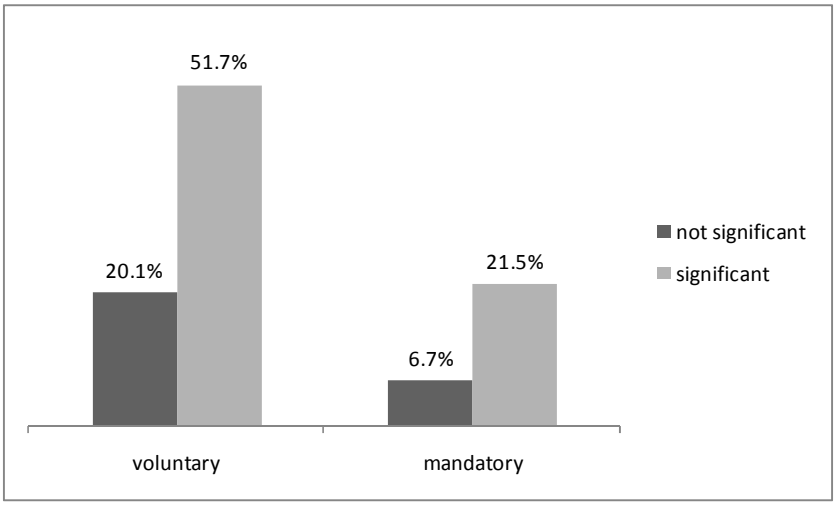

Figure 4. Significance of social influence on IS adoption according to degree of free decision-making in the articles observed

In addition, the conducted t-test resulted in no statistically different mean β-coefficients for mandatory and voluntary use of technology (see Table 2). The mean for mandatory usage is 0.2515 and for voluntary 0.2044.

Group	N	MEAN (β)	STD.DRV.	Sig.(2-sides)
mandatory	40	0.2515	0.2180	0.249
voluntary	106	0.2044	0.2199	

Table 2: t-Test results for degree of decision making

System Characteristic

In respect of the IS used, the following Figure 5 presents that in almost seven of ten cases the system purpose was utilitarian. If the system observed had a utilitarian purpose social influence was a significant determinant in 50.3 per cent and a not

significant determinant in 18.1 per cent of the cases observed. If the system had a hedonic purpose social influence depicts a significant antecedent in 22.1 per cent of all cases (not significant: 9.4 per cent).

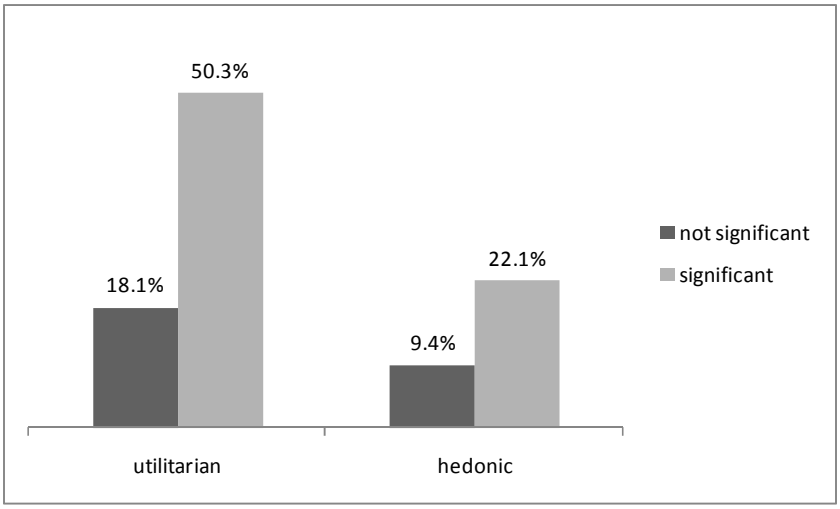

Figure 5. Significance of social influence on IS adoption according to purpose of the IS used in the articles observed

In addition to Figure 5, Table 3 illustrates the results of the conducted t-test for mean difference. The mean for studies investigating utilitarian systems is 0.2485 and for hedonic ones 0.1474. The conduced t-test reveals that there is a statistically different mean of β-coefficients comparing utilitarian and hedonic system studies.

Group	N	MEAN (β)	STD.DRV.	Sig.(2-sides)
utilitarian	102	0.2485	0.2199	0.009***
hedonic	45	0.1474	0.2070	

Table 3: t-Test results for system characteristics

Pre- and Post-Adoption

The following Figure 6 visualizes that 71.4 per cent of the relevant articles addressed an individual's technology adoption in the pre-adoption phase. In 49.6 per cent of all cases, social influence was a significant predictor in the pre-adoption phase (not significant: 21.8 per cent) and in 21.1 percent of all cases a significant antecedent in the post-adoption phase (not significant: 7.5 per cent).

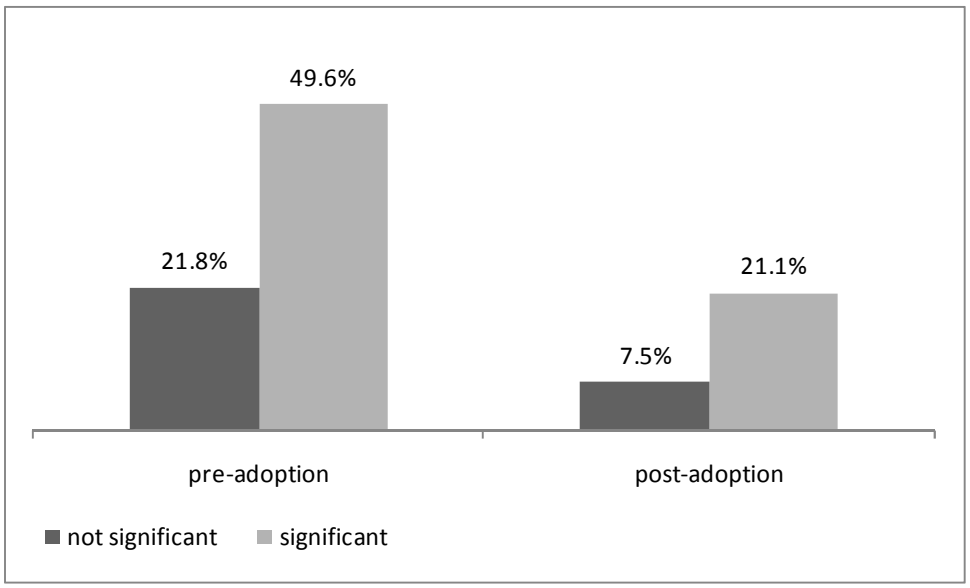

Figure 6. Significance of social influence on IS adoption according to user's system experience in the articles observed

As Table 4 illustrates is the mean for post-adoption studies 0.2149 and for pre-adoption ones 0.2168. In addition, Table 4 shows the results of the conducted t-test which indicate that there is no statistically different mean for post- and pre-adoption studies.

Group	N	MEAN (β)	STD.DRV.	Sig.(2-sides)
post-adoption	95	0.2149	0.2224	0.965
pre-adoption	38	0.2168	0.2264	

Table 4: t-Test results for user experience

Limitations

Due to the research design our approach is limited. We might have found not all articles including social influence in our scientometric study because of the search mode we applied within the literature databases. Additionally, the results might be limited as almost a third of the 149 articles found are proceedings which are not subject of a comprehensive reviewing procedure of up to five rounds of review as usually conducted in top journals of the IS field. The scientometric study focused on the IS field, however this might limit the results as approaches in other research domains were neglected observing social influence as predictor for an individual's behavioral intention. This could have created some bias in the instrumentation of variables due to the different research environments. Furthermore, the results might be influenced by a different number of cases compared as well as several external factors like publication politics as the "*file drawer problem*" (Rosenthal 1979).

DISCUSSION

We started our literature analysis with the objective to enhance the overall understanding of social influence in technology adoption research as demanded by several other researchers during the last twenty years (Davis et al., 1989; Agarwal, 2000; Lu et al., 2005; Sykes et al., 2009) and came out with a confirmation for two of the four hypotheses tested. These results provide some interesting implications for further research in this field.

Concerning the item measurement of the latent variable social influence we examined as hypothesized that a specific individualized item measurement using groups of an individual's workplace or private social environment leads to higher significance of the determinant. As some social psychology (e.g. Ahtola, 1976; Miniard and Cohen, 1983; Liska, 1984) and

IS researchers (Karahanna et al., 1999; Agarwal et al., 2007; Pee et al., 2008) assumed the basic measurement of social influence provided by Fishbein and Ajzen (1975) in the underlying Theory of Reasoned Action using a cumulative construct of "important others" seems to be not distinguishing enough to capture all facets and nuances of an individual's social environment. The classification in groups of an individual's job and private environment as applied in this research could be even more differentiated by comparing the precise impact of small groups or even individuals in the respective environment on an individual's environment as proceeded in just few approaches so far (Lewis et al., 2003; Pee et al., 2008; Eckhardt et al., 2009) or the use of different research method such as social network analysis as applied by Sykes et al. (2009). Despite still being frequently used, IS researchers in the adoption field might reconsider to use the basic cumulative measurement of "important others" for their future research models including a social influence variable.

Although hypothesized on the results of several prior research approaches (Hartwick and Barki, 1994; Venkatesh and Davis, 2000; Brown et al., 2002) it could not be confirmed that social influence is more important in mandatory than in voluntary settings. This might be explained by several external factors which arose throughout the last twenty years of technology adoption research. In general, an increasing degree of IT supported processes and IT maturity might have led to both a higher acceptance as well as knowledge on users' side. Therewith the effect of external mostly hierarchical pressure to use a specific system is significantly weakened. Additionally a number of publications in the last five years started to focus on individual technology adoption in households (Brown and Venkatesh, 2005) outside corporate and therewith mandatory settings. Predominately hedonic IS (van der Heijden, 2004) are used in this household context due to user's intrinsic motivation and an internal locus of causality which is less incorporated by external social influences as also hypothesized and confirmed within this research. The confirmation of H3 indicates the importance of observing the general purpose of system usage. If the individual seeks to fulfill a distinct purpose based on extrinsic motivation social influence appears to be more important than if a system is used to provide a self-fulfilling value. Thus, it seems that social influence seems to be more important for the use of work systems, as the use of these systems pursues a more tangible, extrinsic value than the use of a hedonic system such as online gaming.

Finally no evidence was found for the fourth hypothesis that social influence is more important in the pre-adoption phase than the post-adoption phase as for example confirmed within the Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003). Alike the situation for the mandatory setting an increasing and maturing user knowledge seem to have come up over the last years in such a way that the effect of user's uncertainty of new technology has lowered. With regard to the workforce in general more and more young employees leave school and university with at least a little knowledge of computers and IT provided through computer classes in their education. Compared to the situation twenty and even ten years ago the situation has dramatically changed as the internet started to become an important information channel since the 1990ties for almost everybody in daily life.

In addition to the observation of the four hypotheses tested, this scientometric information provides information on how IS researchers measure and integrate the latent variable social influence in their adoption research and where they publish these results. Further interesting approaches might follow this research by using variables like adopters' gender or cultural background of the research (see appendix). A first step towards this direction was made by Lacity et al. (2008) who investigated a strong impact of social influence on IT professionals' turnover intention in India. Furthermore, testing the collected data in a meta-analytic structural equation model, as conducted by Joseph et al. (2007) in IT turnover research, might bring up a better understanding on how social influence was and can be used in technology adoption research.

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APPENDIX

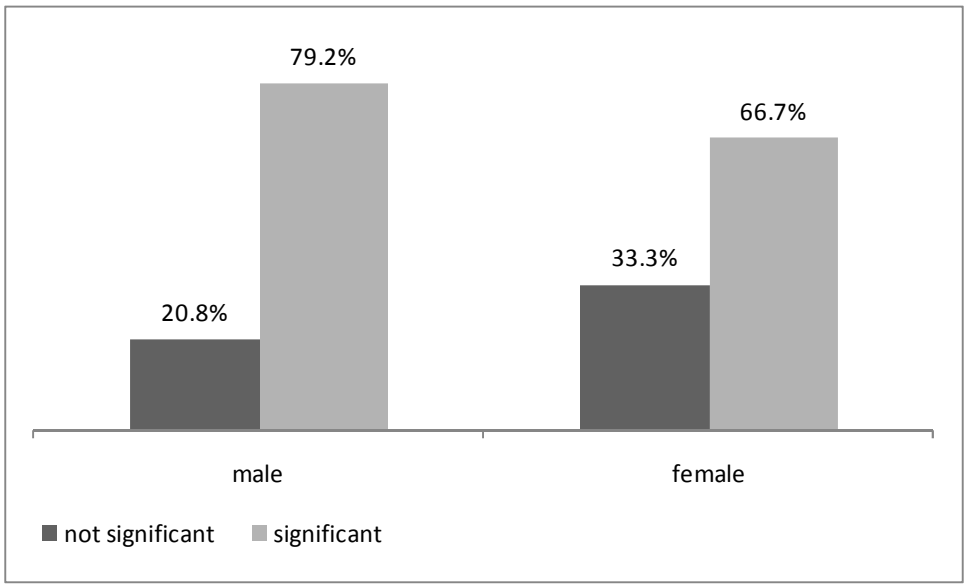

Figure 7: Significance of social influence on IS adoption according to gender

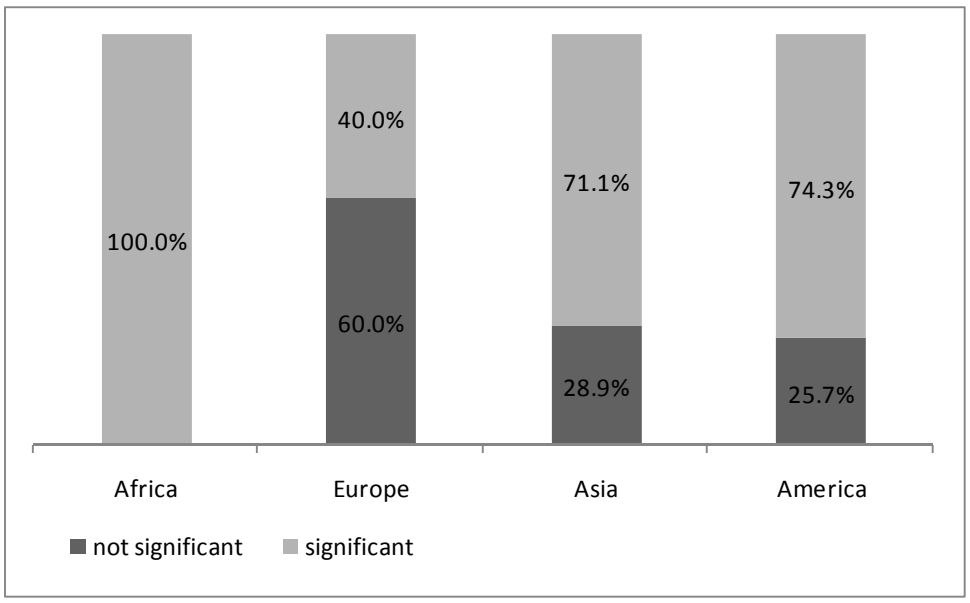

Figure 8: Significance of social influence on IS adoption according to place of data collection

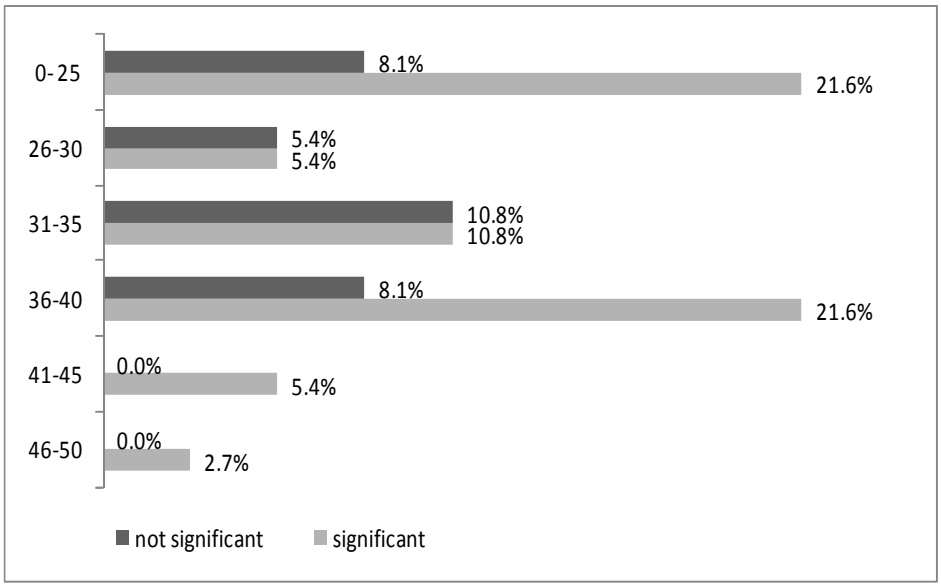

Figure 9: Significance of social influence on IS adoption according to participants average age

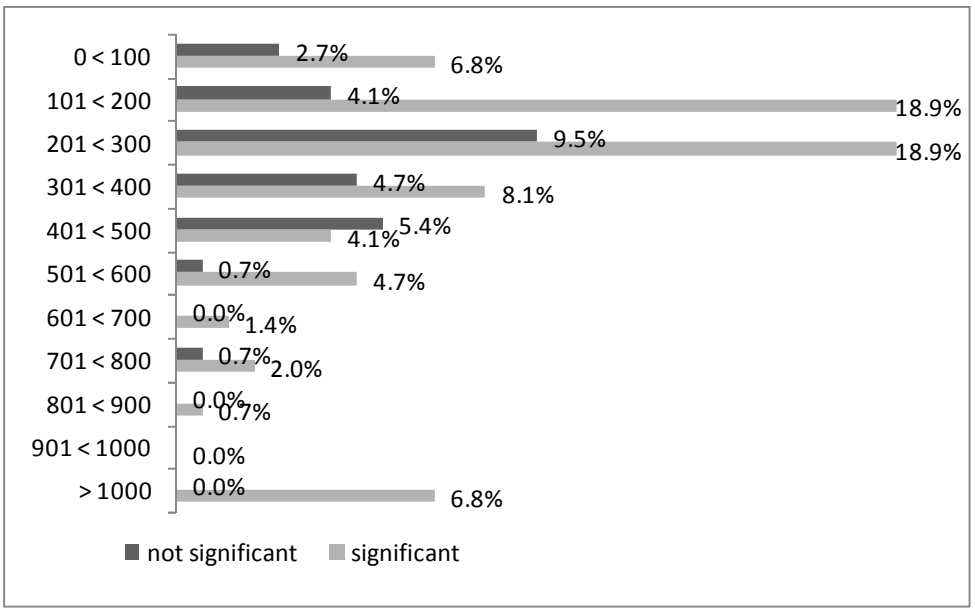

Figure 10: Significance of social influence on IS adoption according to number of participants

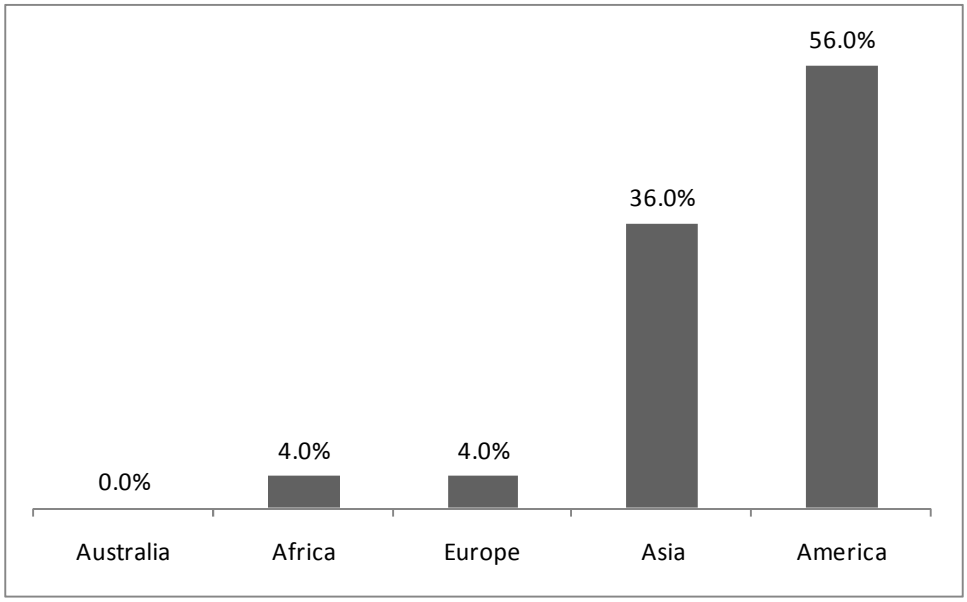

Figure 11: Origin and place of data collection

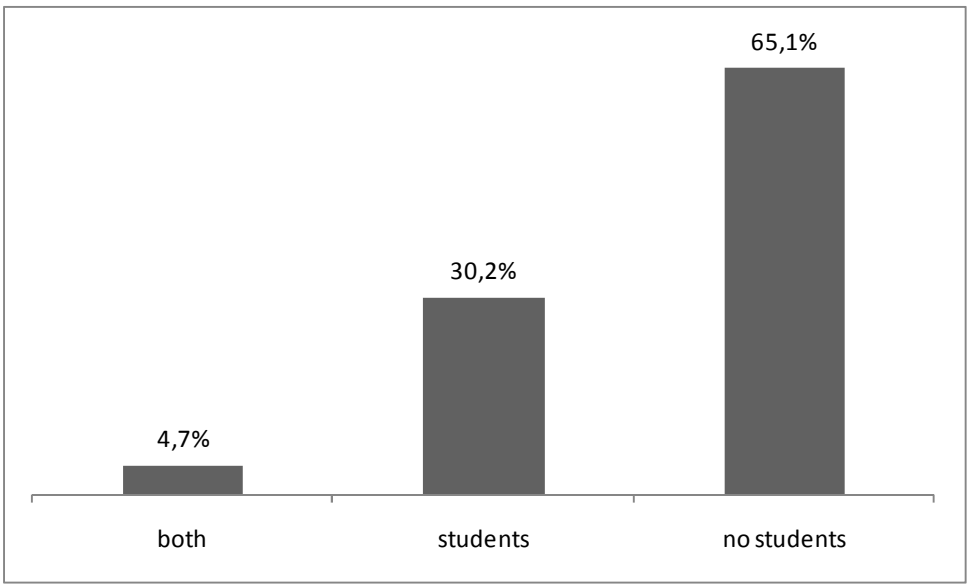

Figure 12: Group of survey participants

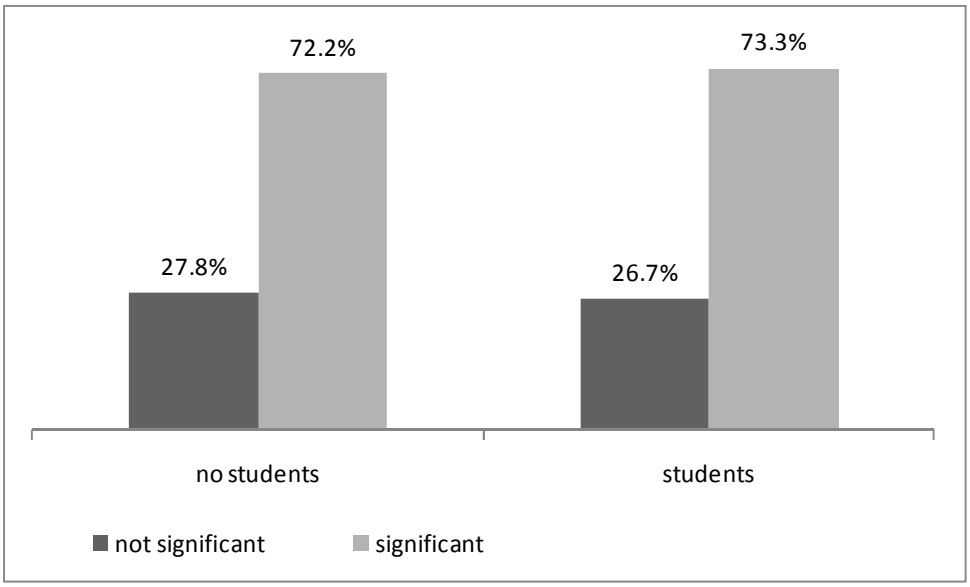

Figure 13: Significance of social influence on IS adoption according to group of survey participants

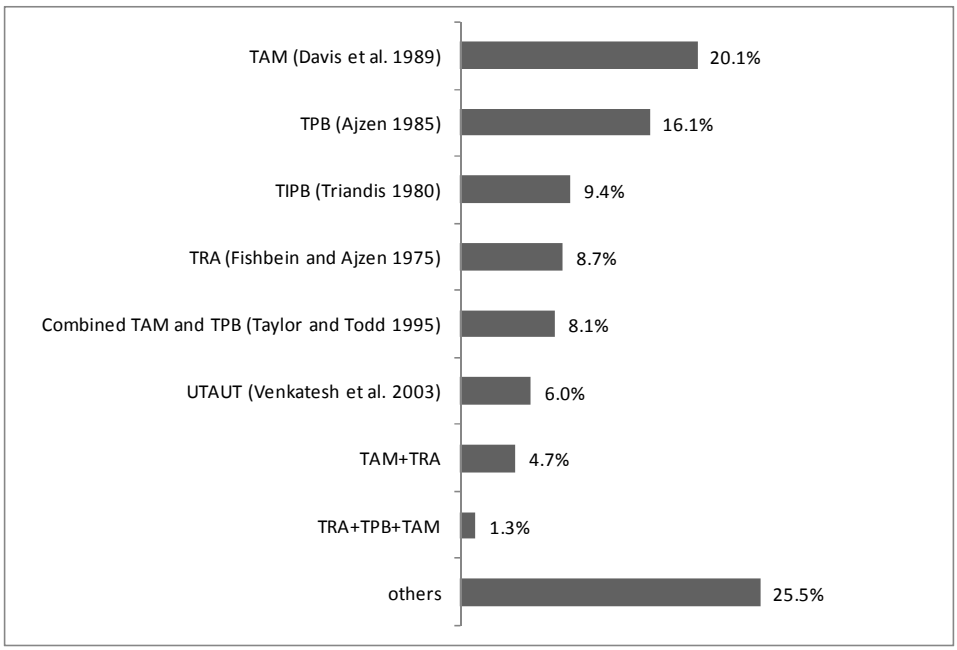

Figure 14: Underlying theories in articles observed

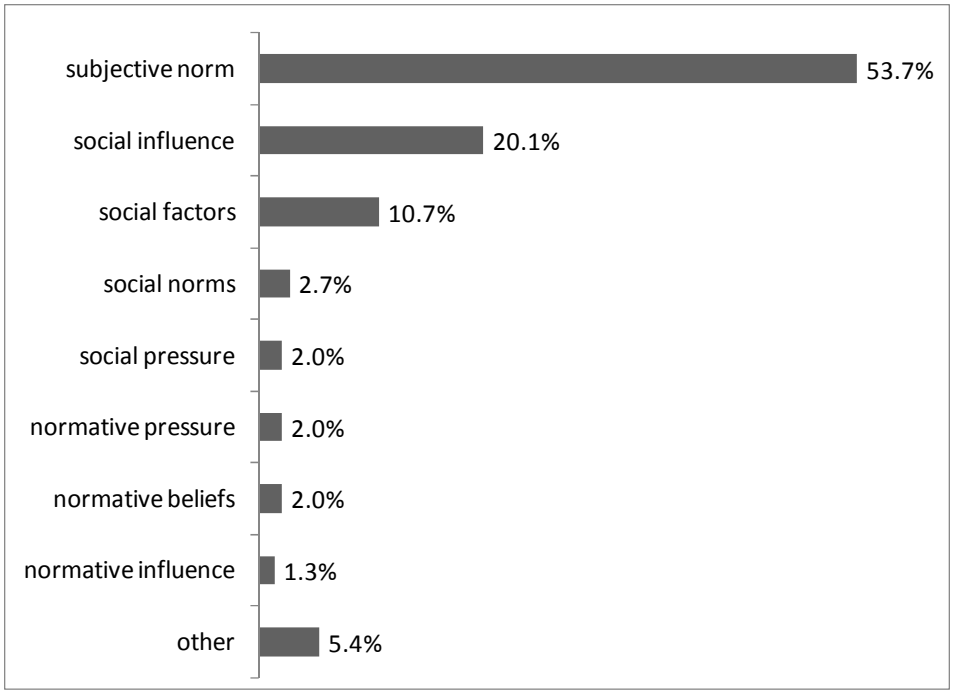

Figure 15: Term for social influence in articles observed

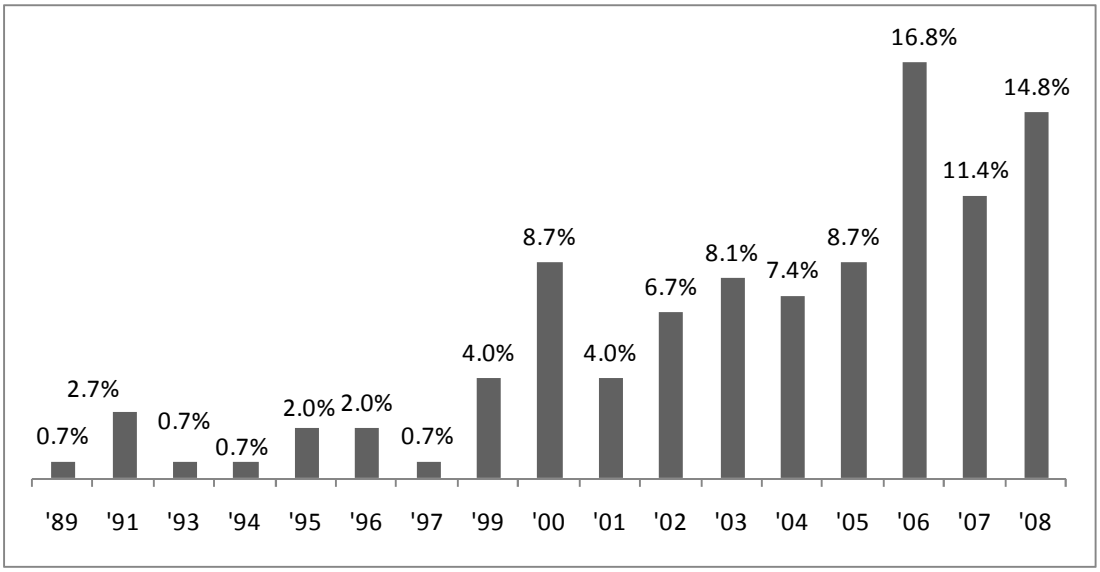

Figure 16: Date of publication of articles observed