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The Role of Strong and Weak Ties in the Usage Behaviour of Social Media Apps

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Research Paper

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Abstract

Social media apps like TikTok have influenced the daily lives of billions of users. Such apps are forms of network goods and subject to so-called network externalities. They offer a social utility that increases with the number of app users. The social utility can be divided into a strong-tie utility (STU) and weak-tie utility (WTU) as it may emerge from strong ties (e.g. close friends) and weak ties (e.g. friends of friends) respectively. To investigate their influence on the usage behaviour more closely, we develop a research model and conduct an online experiment (N=291) for collecting data for seven popular social media apps. The results prove that strong and weak ties can influence users in two ways: providing utility and exerting social pressure. While the level of these effects varies for the tested apps, the utility has a generally greater influence on the intention to use.

Keywords: Social Media Apps, Social Media Platforms, Social Network Sites, Innovation Diffusion, Network Externalities.

1 Introduction

The rise and popularity of social media eclipses even the success of the internet itself (Lőrincz et al., 2019). Social media has influenced the daily lives of billions of people (Stieger and Lewetz, 2018; Chen and Li, 2017; Statista, 2022e). The influence of social media is not only limited to the individual but also encompasses the organisational and societal levels (Ngai et al., 2015). The vast majority of social media platforms are accessed by mobile devices (Statista, 2022a, 2022b), and social media apps are the most downloaded and frequently used apps on smartphones (Statista, 2022c, 2022d; Chen and Li, 2017; Penni, 2017). Due to the volatile and ever-changing user preferences, the number of social media apps has increased significantly, leading to increasing competition among apps (Sasaki and Langbort, 2022; Wang et al., 2018).

Social media apps are forms of network goods that are subject to so-called *network externalities* or *network effects* (Zhang et al., 2021; Zhou et al., 2020; Hu et al., 2020). Based on this, social media apps offer a utility, which can be divided into different components. First and foremost, social media apps provide a social utility because the benefits of using the app increase with the number of already existing users since these represent potential communication partners who can provide or consume shared user-generated content (Hu et al., 2020; He and Lee, 2020; Zhang et al., 2017; Katz and Shapiro, 1986). Second, social media apps may offer a personal utility, which represents the intrinsic value of the network good that is useful irrespective of whether other users exist in the app (Jing, 2007; Sundararajan, 2004). The social utility can be further divided regarding the source it originates from within the social media app. According to Granovetter (1973), a social network consists of *strong ties* and *weak ties*. While strong ties are directly connected to a focal network participant, weak ties have no or only an indirect connection to him/her within the network. Applied to the social media app context, the offered social utility can therefore be differentiated into a *strong-tie utility* (STU) and *weak-tie utility* (WTU) (Beşer and Lackes, 2021). These represent the magnitude of the utility derived from strong and weak

ties respectively. It is conceivable that for some social media apps the utility drawn from interacting with strong ties might be more important than the interaction with weak ties and vice versa. WhatsApp, for instance, is mostly used for communicating with strong ties (Church and de Oliveira, 2013; Nouwens et al., 2017), indicating a high STU, while Twitter is rarely used for this purpose and rather for interacting with weak ties (Statista, 2019), signifying a high WTU. If STU predominates in an app, it is more important from the perspective of a potential adopter that many of his/her strong ties use the app. Conversely, in apps with a predominating WTU it is more important that many weak ties use the app, i.e. the global adoption rate is more important to potential users than the adoption rate in their personal network. Thus, it can be argued that STU and WTU play an important role in the perception and evaluation of social media apps by (potential) users. For investigating the role of STU and WTU in the usage behaviour of social media apps more closely, it is first necessary to determine their app-specific magnitude. Hence, this paper aims to address the following two research questions (RQs):

RQ1: *What amount of STU and WTU do popular social media apps provide?*

RQ2: *How do STU and WTU influence the usage behaviour of popular social media apps?*

For answering these research questions, we conducted an online experiment (survey design), where we asked participants about the importance of strong and weak ties in popular social media apps (WhatsApp, Facebook, Twitter, Instagram, TikTok, YouTube, and Pinterest) as well as their personal usage behaviour. For this, we developed a research model that draws from the technology acceptance model (TAM), self-determination theory (SDT), and the theory of network externalities. The TAM and SDT are commonly applied theories in the social media context (see next section) due to their high explanatory power (Luo et al., 2021; Chen et al., 2011; Mathieson, 1991; Venkatesh and Davis, 2000). To examine the role of STU and WTU, these theories are used to differentiate between the perceived utility and perceived social pressure in the usage behaviour of social media apps.
This paper is organised as follows. To place the conducted research into the ongoing research on social media apps, Section 2 gives an overview of related literature, where the research gap and contribution are outlined. In Section 3, the research model is developed, from which hypotheses are derived. The conducted experiment is explained in Section 4, and the corresponding results are presented, analysed, and discussed in Section 5. In Section 6, the paper concludes with research and managerial implications as well as a discussion of limitations and future research directions.

2 Literature Review

Social media is a demanding and challenging research subject due to the extent of its diffusion and its interconnectedness with institutions, markets, and different industries (Reuver et al., 2018). In order to obtain an overview of the existing research on the *usage behaviour of social media apps*, this section uses the proven method of systematic literature research according to Webster and Watson (2002). As the search with the explicit term "*social media apps"* alone would have extensively limited the search, other keywords with the same or similar meaning associated with social media were also used in the search term: *("social media apps" OR "social network sites" OR "social network platform" OR "social media platform" OR "social media technology") AND ("network externalities" OR "network effects").* Leading academic databases (ScienceDirect, AIS eLibrary, and Google Scholar) were used for searching for suitable articles, and after conducting a forward and backward search a literature collection of 157 scientific publications was compiled. In the next step, these papers were filtered by carefully examining their content for relevance. A paper was considered relevant in the above-defined context if it incorporated the social network theory of Granovetter (1973) and empirically or computationally analysed the influence of strong/weak ties on the usage behaviour of social media apps. Thereby, the initial set of papers was reduced to 13 publications. Table 1 provides an overview of the filtered literature that can be broadly categorised into two Categories I and II. Papers belonging to Category I conduct empirical research for analysing the reasons behind social media usage. As a research method, mostly survey-based experiments with structural equation modelling (SEM) are conducted where the (continued) intention to use is modelled as a dependent variable. Category II, on the other hand, contains

computational papers that use the theoretical findings from empirical research to investigate how social media adoption on an aggregated level propagates in social networks with different topologies. For this, the papers use various diffusion models and hazard-rate models, which are tested in artificially generated social networks and graphs of real social network platforms.

The accumulated literature reveals that research has drawn on many diverse theoretical approaches to explain social media usage behaviour, including in particular various approaches from the theories of mass communication, social behaviour, and personal behaviour. Two predictors of social media usage behaviour are given particular attention in the literature: (1) social pressure and (2) network externalities from strong/weak ties that drive the diffusion/adoption of social media.

Aspect (1) is addressed by several survey-based papers in Category I that investigate the role of social pressure and find that it can be used for predicting how intensively social media is used (Mohammed and Ferraris, 2021; Mouakket, 2015; Pelling and White, 2009). These results are underlined by a medical field study conducted by Stieger and Lewetz (2018), who find that perceived social pressure increases during social media absence, showing the important role social pressure plays in the usage behaviour of social media.

Regarding aspect (2), the papers in Category I also reveal that network externalities exist in social media apps, i.e. that the growth of the user base also goes hand in hand with the growth of the perceived utility (Mohammed and Ferraris, 2021; Mouakket, 2015; Pelling and White, 2009). The reason for this is that an existing large user base supports the creation of new social ties and facilitates the maintenance of existing ones (Kauschinger et al., 2022). Lin and Lu (2011) study the effect of network externalities on social media in general without focusing on specific apps and find that strong ties have a greater impact on the perceived utility than weak ties. Zhang et al. (2017) focus on the WeChat platform and also illustrate that strong ties are more important for the spread of the platform. In Category II, this finding is replicated by Katona et al. (2011) who find that strong ties are more important in the adoption process. However, also belonging to Category II, the work of Zhou et al. (2020) shows that in some scenarios weak ties are the main driver of diffusion. From a different perspective, Lőrincz et al. (2019) also show that weak ties are more important by analysing the dropout behaviour of users who are more likely to leave a social media platform if the global adoption rate decreases.

These different research results show that adoption processes cannot be easily generalised as the effects may vary for different social media apps or platforms. The same applies to the perceived social pressure, which can be different for various social media apps as it can originate from strong and/or weak ties. The literature analysis discloses that previous research either looks at social media in general or focuses only on one specific social media app or platform when analysing the impact of strong and weak ties on the perceived utility and social pressure. Note that although the results of studies that investigate a single app (e.g. Mohammed and Ferraris, 2021; Zhang et al., 2017; Mouakket, 2015) could be compared to each other, the research models/frameworks/constructs of the used questionnaires still differ and thus hamper comparability. Hence, this paper contributes to the ongoing research in Category I by analysing various social media apps in a single study, which allows a direct comparison to reveal differences and commonalities of the role of strong and weak ties according to the underlying research model.

This study also contributes to the computational research carried out in Category II where the diffusion of apps is analysed by employing utility threshold models (Zhang et al., 2021; Zhou et al., 2020). By collecting empirical data and calculating the STU and WTU of various social media apps, the results of this study can be used for calibrating diffusion models to the characteristics of real-world social media apps (Beşer and Lackes, 2021). Such diffusion models can then be used in simulation studies to reveal empirically founded differences in the diffusion behaviour of different kinds of social media apps in various social network topologies (e.g. small-world, scale-free, or sub-graphs of real networks).

Cate-gory	Paper	Topic	Theories	Research Method	Key Results
I	Kauschinger et al. (2022)	Investigation of factors influencing the adoption behaviour of social networks	• Technology acceptance model • Network externalities • Social capital theory • Theory of reasoned action • Unified theory of acceptance and use of technology	• Survey (SEM) • N =155	• The strongest predictor of adoption is a large number of weak ties who use the social network • Users assume that network externalities support the creation of new social ties and facilitate the maintenance of existing ones

I	Mohammed and Ferraris (2021)	Factors influencing user engagement on social media (focus: Twitter during the Covid-19 pandemic)	• Theory of planned behaviour	• Survey (SEM) • N = 213	• The hedonic and work/productivity-related utilities have equally positive effects on user behaviour • Local social pressure has a slightly greater effect on user behaviour than hedonic or work/productivity-related utilities
I	Stieger and Lewetz (2018)	Medical study investigating the effects of abstinence from social media	• -	• Field experiment with integrated survey (before and after the experiment) • N = 152	• Participants felt significantly more social pressure from their strong ties to be active on social media during abstinence compared to the baseline situation in which they were actively using social media
I	Zhang et al. (2017)	Investigating the impact of network externalities on the utilities perceived by the user (using WeChat as an example)	• Network externalities • Social capital theory • Motivation theory	• Survey (SEM) • N = 237	• Strong ties are more important than weak ties regarding the perceived utility • Both strong and weak ties have a positive impact on social value
I	Mouakket (2015)	Factors influencing the intention to continue using social media (focus: Facebook)	• Expectation-confirmation model • Theory of planned behaviour	• Survey (SEM) • N = 397	• Work/productivity-related perceived usefulness, satisfaction, habits, hedonic usefulness (entertainment), and subjective norms emerging from strong ties are the biggest influences on user behaviour
I	Lin and Lu (2011)	Integrating network externalities and motivation theory to study the intention to use social media	• Technology acceptance model • Self-determination theory • Network externalities	• Survey (SEM) • N = 402	• Hedonist-driven utility (entertainment) has a greater positive influence on intention to use than work/productivity-related utility • On hedonist-driven utility, global and local (limited to peer group) network externalities have a positive influence • Strong ties have a greater influence on hedonist-driven utility
I	Pelling and White (2009)	Predictors for the intensive use of social media	• Theory of planned behaviour	• Survey (SEM) • N = 233	• Local social pressure emerging from strong ties proved to be a significant predictor of intention to use social media
I	Wang et al. (2005)	Integration of the technology acceptance model with a network externality model to study adoption behaviour (using the example of internet-based instant messaging services)	• Technology acceptance model • Network externalities	• Survey (SEM) • N = 437	• The utility derived from weak ties has a greater influence on the perceived utility of a technology than the personal utility • The perceived utility positively influences the intention to use, which in turn positively influences the actual usage behaviour
II	Kim et al. (2021)	Investigation of the influence of strong ties in the adoption of online social networks	• Network externalities	• Simulation • N = 3080	• The number of strong ties using the platform has a positive influence on the adoption of new users
II	Zhou et al. (2020)	Influence of strong and weak ties on the diffusion process of mobile apps in different network topologies	• Network externalities • Innovation diffusion model • Psychology theory • Evolutionary game theory	• Simulation • N = 100	• Mobile apps where weak tie adoption is more important diffuse faster in random and scale-free networks, while the diffusion speed in small-world networks is significantly lower • If strong ties are more important for the adoption, the diffusion speed in small-world networks is further reduced as compared to the other topologies
II	Zhang et al. (2021)	Influence of strong ties on the diffusion process of mobile apps in different network topologies	• Network externalities • Innovation diffusion model • Bass model	• Simulation • N = 100	• If only strong ties are important for the adoption of the app, the scale-free network achieved the best diffusion result, followed by the small-world network because the social network structures and the evolution of the user groups promoted each other • In the random network, the degree of diffusion was lowest, since the network evolution did not significantly influence the decision-making of the user groups
II	Lőrincz et al. (2019)	Influences on the dropout behaviour of the use of social media	• Network externalities • Social capital theory • Social influence models	• Hazard-rate model • N = 3,762,529 (members of the platform)	• The probability of premature termination of use is greater if the global adoption rate and activity are low
II	Katona et al. (2011)	Impact of local network structure (how are strong ties interconnected) on the diffusion of an online social network	• Network externalities • Network closure theory • Structural hole theory	• Hazard-rate model • N = 250,000 (members of the platform)	• A high adoption rate among strong ties increases the likelihood of adoption (“degree effect”) • The more clustered the local network among strong ties is, the more likely is the adoption (“clustering effect”)

Table 1. Related literature in the adoption and usage behaviour of social media apps.

3 Research Model and Hypothesis Development

In information systems research, various theoretical models for the adoption of technologies and (digital) innovations have been extensively tested and validated in studies, including research on social media. For investigating the role of social utility and social pressure emerging from both strong and weak ties in the context of different social media apps, the research model presented in this section draws from three theoretical models: the theory on network externalities, TAM, and SDT. Key aspects and assumptions of these theories are integrated into a research model (cf. Figure 1) for deriving hypotheses regarding the influence of STU and WTU on the usage behaviour of social media apps to address RQ2.

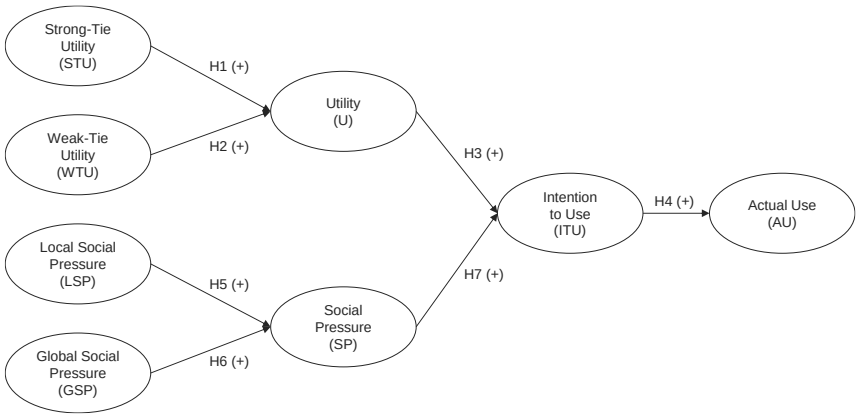

Figure 1. Research model for investigating the usage behaviour of social media apps.

3.1 Theory on Network Externalities

The concept of network externalities, which is also synonymously called network effects, was initiated and became more popular in the 1970s (Artle and Averous, 1973; Rohlfs, 1974) and further developed from the 1980s onwards (Katz and Shapiro, 1986). The foundation of the theory is the assumption that the utility derived from using a product or service is influenced by the number of its consuming users. Therefore, the number of users plays an important role in the spread of the respective product or service. Such products and services that are subject to network externalities are referred to as network goods, which also include social media apps and platforms. (Katz and Shapiro, 1986; Chiu et al., 2013)

Network externalities can be broken down into *direct* and *indirect network externalities*. Direct network externalities represent the phenomenon that benefits and advantages for the entire user base arise as the user base grows, while indirect network externalities explain that the increase in complementary goods and services increases with the number of users of the network. (Katz and Shapiro, 1986)

A typical example of direct network externalities are online gaming platforms. Any increase in new participants would be accompanied by an increase in choices for trading, communicating, or gaming and the associated gain in utility for the existing participant (Chiu et al., 2013, p. 540; Top et al., 2011, p. 1576). In the context of social media apps and platforms, the effect of indirect network externalities can be illustrated by complementary services that could be provided, for instance, by third-party providers who develop services based on the offered application programming interfaces (APIs) of the app. An example of this is WeChat, which provides developers with APIs for developing new in-app services (Plantin and Seta, 2019).

Direct network externalities can further be distinguished between *local* and *global network externalities* with regard to the source of the user community (Zhao and Duan, 2014; Jo and Kim, 2012; Tomochi et al., 2005). We refer to local network externalities if the obtained utility is influenced by one's own social circle, i.e. strong ties like family and friends (Zhou and Yang, 2020). On the other hand, we refer to global network externalities if the total number of users, represented by weak ties, is considered as an influence for the evaluation of the utility (Zhou and Yang, 2020). It should be noted that local and global network externalities only refer to the source the social utility stems from, i.e. strong or weak ties, but do not provide information about the magnitude of the utility drawn from the respective ties (Page and

Lopatka, 1999; Top et al., 2011). The amount of social utility derived from strong and weak ties is represented by STU and WTU respectively (Beşer and Lackes, 2021). As the literature review has shown, both strong and weak ties can have an influence on the social media usage behaviour. We therefore argue that the utilities drawn from strong and weak ties have a positive influence on the total perceived utility of a social media app:

Hypothesis 1: *The perceived weak-tie utility has a positive influence on the perceived utility of a social media app.*

Hypothesis 2: *The perceived strong-tie utility has a positive influence on the perceived utility of a social media app.*

3.2 Technology Acceptance Model (TAM)

The TAM was developed by Davis (1989) to study user acceptance of information systems. It is an adaptation of the theory of reasoned action (TRA), a widely studied model from social psychology that deals with the determinants of consciously intended behaviour (Weerasinghe and Hindagolla, 2018; Lorenzo-Romero et al., 2011). The main goal of TAM is to provide an explanation of the determinants of technology acceptance that is universal and able to explain user behaviour (Davis, 1989). Thus, the core purpose of the model is to provide a basis for tracking the effects of external factors on internal beliefs, attitudes, and intentions that consequently influence the actual use of the technology (Davis, 1989).

The perceived usefulness of a technology, which can be equated to its utility (Nusair et al., 2013), reflects the extent to which the purpose of the technology can be fulfilled beneficially by the use of that very technology. In work/labour-related contexts, perceived usefulness answers the question of the extent to which the technology increases work performance and makes the fulfilment of tasks more efficient (Davis, 1989). Social media, on the other hand, has a hedonic concept of use and primarily serves to provide entertainment, joy, and pleasure to users (Sledgianowski and Kulviwat, 2009). Therefore, perceived utility in this context describes the extent to which the app is able to fulfil the needs of a user and comply with his/her expectations. For this reason, perceived utility leads to an increase in the intention to use, as can also be seen in the TAM. On this basis, the following hypothesis can be formulated in the context of social media apps:

Hypothesis 3: *The perceived utility of a social media app has a positive influence on the intention to use.*

The intention to use describes the pure intention to use the technology/app. Since not every person who has the pure intention to use a technology/app actually uses it, the intention to use has to be differentiated from the actual use of the technology/app (Chang and Cheung, 2001). The intention to use, as a construct, is believed to describe the goal-directed nature of human beings (Ajzen, 1998). It captures the motivational factors that shape an individual's behaviour and is thus an indicator of the degree to which people are inclined to perform an action and how much effort they expend to perform a goal-directed behaviour (Ajzen, 1998). Hence, we formulate the following hypothesis in the social media app context:

Hypothesis 4: *The intention to use has a positive influence on the actual use of a social media app.*

3.3 Self-Determination Theory (SDT)

The first explanation of SDT, which deals with the components of motivation, dates back to the 1970s, with its further research having gained wide acceptance since the 1980s (Moller et al., 2006). In order to interpret the behaviour of individuals in accepting technologies, previous research made extensive use of motivation theory (Lin and Lu, 2011). Motivation is about energy, persistence, direction, and equivalence, which are all aspects that influence a person's intention and activity (Ryan and Deci, 2000b). Ryan and Deci (2000a) describe the state of being motivated as being moved to perform an activity. Accordingly, a person who is stimulated/activated to achieve a goal is declared to be a

motivated person, while a person who feels no drive/inspiration to act is called unmotivated (Ryan and Deci, 2000a).
SDT distinguishes between different variations of motivation based on different reasons and goals. One of these basic differentiations is the distinction between intrinsic and extrinsic motivation (Deci and Ryan, 2008). In intrinsic motivation, an action is performed for the sake of inner satisfaction and not because of any external consequences other than the activity itself. This means that when someone is intrinsically motivated, s/he acts because the activity is inherently fun/entertaining or because of the challenges involved. In contrast to intrinsic motivation, extrinsic motivation relates to actions that are performed with the intention of achieving a definable result. That is, the action is performed because of its instrumental value. (Ryan and Deci, 2000a; Luo et al., 2021)
This is an externally controlled effect that is not limited to tangible rewards but extends to other external forces such as imposed instructions, social expectations, or threats (Ryan and Deci, 2000b). The example of extrinsic motivation, in turn, which is dealt with in this paper is social pressure (Reinecke et al., 2014). Social pressure is an influencing factor of an individual's behaviour that finds its place in many theories. Cialdini et al. (1991) call it an *injunctive norm*, which determines how an individual should behave according to the behaviour that is generally approved or disapproved of by a society/community. Such norms stimulate directed actions by incentivising through social rewards and discouraging through punishments like social rejection. The injunctive norm is distinguished from the *descriptive norm*, which refers to an imitated behaviour through an internalisation process. Here, the behaviour exhibited by the majority of a (local) society is observed and seen as evidence that the behaviour in question is an effective and appropriate activity. (Cialdini et al., 1991)
Social pressure is also a component of the TRA, which the TAM is based on as mentioned in the previous subsection. The term *subjective norm* is also used synonymously with social pressure. The definition conforms to the injunctive norm, except that the focus here is on the influence exerted by expectations/pressure from important/significant people in the life of the individual like family, friends, and life partners. (Ajzen, 1991)
In this paper, social pressure is divided into two components for analysing the effects of its origins for different social media apps: (1) local social pressure (LSP) that represents the social pressure exerted on an individual by his/her strong ties and (2) global social pressure (GSP) that represents the social pressure exerted by weak ties. Based on these assumptions, we formulate the following hypotheses:

Hypothesis 5: *The perceived local social pressure has a positive influence on the perceived social pressure for using a social media app.*

Hypothesis 6: *The perceived global social pressure has a positive influence on the perceived social pressure for using a social media app.*

Hypothesis 7: *The perceived social pressure has a positive influence on the intention to use a social media app.*

4 Experiment

4.1 Setup

The target group of the present study are active users of social media apps. To test the formulated hypotheses, a questionnaire was developed for an online experiment. In the questionnaire, after a short introduction, participants were first asked to select up to three social media apps that they intensively use from a pre-defined list that included WhatsApp, Facebook, Instagram, YouTube, Pinterest, TikTok, and Twitter. This limit was set in order to reduce the cognitive burden of participants and obtain more robust results. The questionnaire consisted of closed single-choice questions about the usage behaviour of the selected social media apps with predefined answer options. As a response format, a five-point Likert scale was used (*do not agree at all*, *rather disagree*, *neither agree nor disagree*, *rather agree*, *completely agree*). To make the questionnaire user-friendly, it was divided into separate topic blocks. After choosing frequently used social media apps, subjects were first asked about their usage patterns on these apps, which included the year of joining, usage frequency, and average activity time per day.

Thereafter, the constructs listed in Table 2 were presented in blocks to the participants. The final questions addressed demographic data. The items for the constructs of the research model are largely based on items and definitions from existing literature, which were adapted to the context (cf. Table 2). To minimise the dropout rate, it was ensured that the processing time would not take longer than approx. 15 minutes (Bhattacherjee, 2012). In order to test the technical functionality of the completed questionnaire and the processing time, as well as to eliminate ambiguities and other types of distortions in the wording of the questions, several pretest runs were carried out (Bhattacherjee, 2012). The goal was to generate approx. 100 responses for each of the above-listed social media apps. Thus, when this number was reached for an app, it was removed from the list and could not be selected by new participants anymore.

Construct	Items		Based on
Strong-Tie Utility (STU)		**Utility through interaction/communication with strong ties**	Awais et al., 2019; Sledgianowski and Kulviwat, 2009; Rauniar et al., 2014; Qin et al., 2011; Gil de Zúñiga and Valenzuela, 2011
	STU01	The app is useful for communicating with my close contacts.	
	STU02	The app makes it easier for me to connect with friends, acquaintances, and family members.	
	STU03	The app allows me to get in touch with people who are close to me.	
	STU04	I often network on this app with people I know personally.	
		Utility through interaction with the user-generated content of strong ties	
	STU05	I use the app to access content (photos, videos, etc.) from friends and family.	
	STU06	The app is useful for sharing content with close contacts.	
	STU07	I spend time with the app to see what content my close contacts have created.	
	STU08	I find it inspiring to see photos, videos, and other content from friends and family through this app.	
Weak-Tie Utility (WTU)		**Utility through interaction/communication with weak ties**	Lin and Lu, 2011; Kwon and Wen, 2010; Qin et al., 2011; Gil de Zúñiga and Valenzuela, 2011
	WTU01	The app is useful for communicating with any users outside my close circle of contacts.	
	WTU02	The app makes it easier for me to connect with other users I don't know personally.	
	WTU03	The app allows me to get in touch with many people outside my circle of friends/acquaintances.	
	WTU04	I often network on this app with people I don't have a personal relationship with.	
		Utility through interaction with the user-generated content of weak ties	
	WTU05	I use the app to access the content (photos, videos, etc.) of people I don't know.	
	WTU06	The app is useful for viewing content from around the world.	
	WTU07	I like to spend time with the app to see what content other people have created.	
	WTU08	I find it inspiring to see photos, videos, and other content from other people through this app.	
Utility (U)	U01	I find the app contains useful functions.	Qin et al., 2011; Kwon et al., 2014
	U02	I think this app provides useful services and information for me.	
	U03	I think that using the app serves its purpose.	
	U04	I find the app generally useful.	
Local Social Pressure (LSP)	LSP01	Many people close to me expect me to use this app.	Choi and Chung, 2013; Reinecke et al., 2014; Dickinger et al., 2008; Park and Lee, 2009
	LSP02	I feel pressure from my friends/family to use this app.	
	LSP03	It is important for people in my close social circle that I use this app.	
	LSP04	My family and friends would be disappointed if I stopped using this app.	
	LSP05	Due to the expectations in my circle of friends/family, I would have a guilty conscience if I didn't use the app.	
Global Social Pressure (GSP)	GSP01	I think there is a general expectation in my age group to use this app.	Choi and Chung, 2013; Reinecke et al., 2014; Dickinger et al., 2008; Park and Lee, 2009
	GSP02	I feel social pressure to use this app.	
	GSP03	Many people who are not part of my close circle of friends/family think it is important to use this app.	
	GSP04	In general, it would lead to disappointment in my age group if people stopped using this app.	
	GSP05	Due to the expectations in society, I would feel guilty if I did not use the app.	
Social Pressure (SP)	SP01	I am expected to use the app.	Park and Lee, 2009
	SP02	There is an expectation that this app should be used.	
	SP03	It would cause disappointment if I did not use the app.	
Intention to Use (ITU)	ITU01	I intend to use the app.	Kwon et al., 2014
	ITU02	I would like to use the app as often as possible.	
Actual Use (AU)	AU01	I spend a lot of time in the app.	Sledgianowski and Kulviwat, 2009
	AU02	I use the app frequently.	

Table 2. Operationalisation of the constructs.

4.2 Data Collection

The data collection was carried out using an online survey tool in the period from 25th April to 7th June 2022. Participants for the study were acquired via different channels. Multiple circular emails were sent out to undergraduate Business and Economics students at TU Dortmund University. Additional participants were acquired on SurveyCircle, SurveySwap, and various social media platforms such as Instagram and WhatsApp. The participation in the study was not financially compensated. The participants were German-speaking individuals, with the sample consisting predominantly of students (61%). In total, there were 565 responses of which 293 were complete and 272 incomplete. We used SPSS to clean the collected data by examining data gaps, possible outliers, and irregular response patterns that included straight and diagonal lining patterns. Based on this, of the 293 complete responses, four responses had to be deleted resulting in 289 valid responses. In the set of incomplete responses, two responses could be utilised because all questions had been answered except for the demographic

questions. Thus, in total the dataset consisted of 291 valid responses that were distributed across the tested apps: WhatsApp (N=108), Facebook (N=101), Instagram (N=105), TikTok (N=101), Twitter (N=101), YouTube (N=104), and Pinterest (N=98). The average age across all apps was 27 years, with no significant outliers between the different apps. TikTok had the lowest average age of 24 and also the lowest maximum age of 48, which could be related to the fact that TikTok is known to be used more by young people, as it is particularly used to gain recognition among peers (Genoveva, 2022). According to the collected demographic data, 70% of the participants were female and 29.3% male. Twitter has the smallest difference between male and female participants with 59% female and 41% male test subjects. TikTok has the highest difference with 83% female and 16% male respondents.

5 Results

5.1 Operationalisation of STU and WTU

To compare the STU and WTU across the tested apps, at first the utility values of these constructs need to be calculated. For calculating them, the items of the constructs have been subjected to a reliability and validity test. For determining indicator reliability, we calculated the outer loadings of the items. They are considered acceptable if their value is higher than 0.7. If an external load has a value lower than 0.4, it should be removed from the measurement of the construct. A loading that is between 0.4 and 0.7 should only be eliminated if it leads to an increase in internal consistency or average variance extracted (AVE) (Hair et al., 2017; Secka, 2015). After checking convergence validity in this way, some items were eliminated (*WhatsApp*: STU07, STU08, WTU01, WTU05; *Instagram*: STU08, WTU04, WTU5; *TikTok*: STU03, WTU01, WTU04, WTU06; *Twitter*: WTU01, WTU04, LSP02; *YouTube*: STU06; WTU02, WTU3, WTU4, WTU5, WTU6; *Pinterest*: STU08, WTU01, WTU02). The remaining items met the minimum requirement. After the items were removed, it was reassured that the content validity of the constructs was still maintained. For calculating the utility values, we propose to use the outer loadings of the validated items to weigh the participants' answers to the questions. The response format of the deployed five-point Likert scale was graded in the following way: 1 = *do not agree at all*, 2 = *rather disagree*, 3 = *neither agree nor disagree*, 4 = *rather agree*, 5 = *completely agree*. Based on this, the STU and WTU for an app were calculated according to Equation (1) where n and i are indices that represent the participants and valid items of the construct respectively:

$$\{STU, WTU\}_{app} = \frac{1}{N}\sum_{n=1}^{N}\sum_{i=1}^{I}\frac{loading_i \cdot answer_{i,n}}{\sum_{i=1}^{I} loading_i}, \qquad STU_{app}, WTU_{app} \in [1,5] \tag{1}$$

To determine to which extent STU or WTU predominates in an app (i.e. the relation between them), we calculated the difference between them and divided it by the maximum possible difference: $(STU_{app} - WTU_{app})/4$. A resulting value of +1 means that STU is seen as highly important by participants while WTU is assigned no importance at all. The opposite case applies for a value of -1. The more equal the ratings of STU and WTU are, the closer is the app to 0. This procedure was carried out three times. In the first case (i), all valid items were included in the calculation. In the second (ii) and third case (iii), only the valid items that focus on communication and user-generated content respectively (cf. Table 2) were included. The calculated values are listed in Table 3, and the relations are plotted in Figure 2.

	Case (i): Focus on Communication and User-Generated Content			**Case (ii): Focus on Communication**			**Case (iii): Focus on User-Generated Content**		
	STU	**WTU**	**Relation**	**STU**	**WTU**	**Relation**	**STU**	**WTU**	**Relation**
WhatsApp	4.542	1.835	0.677	4.653	2.160	0.623	4.259	1.523	0.684
Facebook	2.999	3.090	-0.023	3.042	3.258	-0.054	2.956	2.975	-0.005
Instagram	3.515	4.036	-0.130	3.437	3.796	-0.090	3.636	4.251	-0.154
TikTok	2.257	3.540	-0.321	2.154	2.898	-0.186	2.347	3.936	-0.397
Twitter	1.856	3.816	-0.490	1.839	3.622	-0.446	1.879	3.906	-0.507
YouTube	1.392	3.500	-0.527	1.331	2.067	-0.184	1.476	4.102	-0.656
Pinterest	1.457	3.658	-0.550	1.392	2.053	-0.165	1.538	4.053	-0.629

Table 3. Calculation of STU, WTU, and their relation in popular social media apps.

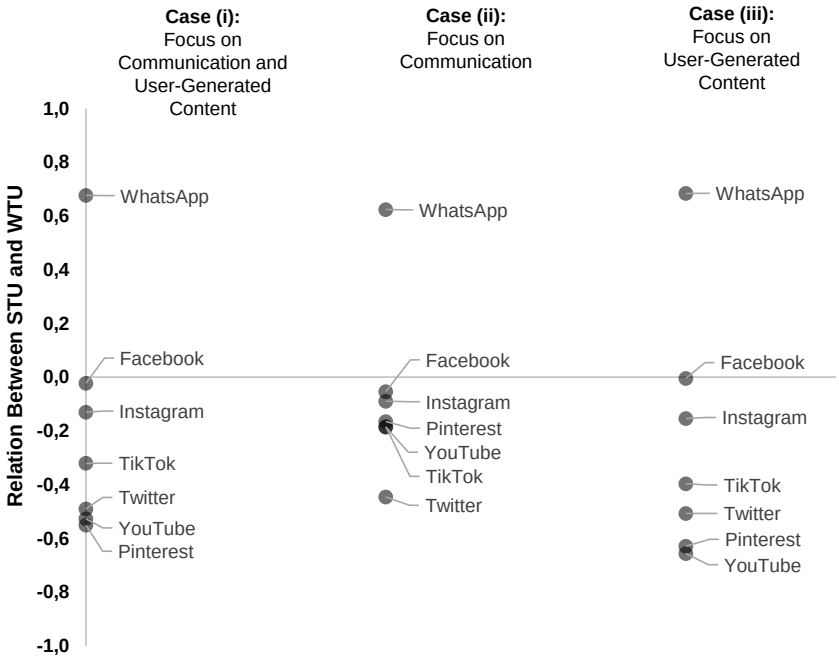

Figure 2. Relation of STU and WTU of popular social media apps.

The data from the first case (i) reveals that WhatsApp is perceived by its users as an app where STU predominates WTU, while Twitter, YouTube, and Pinterest are WTU-predominating apps. In Facebook and Instagram, STU and WTU are rather balanced out, while TikTok shows a slight WTU predomination. Similar results can be observed for the third case (iii) regarding the interaction with user-generated content, where YouTube is the app with the highest WTU predominance in relation to STU. In the second case (ii), where communication is in the focus, strong and weak ties are approximately of equal importance for most apps except for WhatsApp and Twitter. Twitter shows a relatively high WTU predomination in this case which might result from the fact that Twitter users attach more weight to interaction with people outside their circle of friends/acquaintances (Statista, 2019).

5.2 Hypothesis Tests

The research model was tested using SEM based on the partial least squares (PLS) method. The evaluation of the reflectively specified measurement model includes the testing of internal consistency reliability, convergent validity, and discriminant validity. For evaluating these, we used measures that are listed in Table 4 for the constructs of all tested apps.

To validate the internal consistency, we calculated Cronbach's α and the composite reliability (CR). The Cronbach's α requirement ($\alpha>0.7$) could be achieved for almost all constructs except for the intention to use and the WTU construct of YouTube. However, since it is known that Cronbach's α underestimates the internal consistency and the CR of the constructs of all apps exceeds the minimum value of 0.7, these constructs are retained (Guide and Ketokivi, 2015). For measuring the convergent validity, we use the average variance extracted (AVE) that represents the mean of the squared loadings of the items. The AVE values of the constructs of all apps were able to meet the minimum requirement (AVE>0.5). The discriminant validity measures the extent to which the items of one construct differ from the items of another construct so that the construct can be classified as empirically independent (Hair et al., 2017). Fornell and Larcker (1981) developed a procedure for testing discriminant validity, which states that this can be assumed if the AVE of the respective construct is higher than all squared correlations with other constructs. All constructs were also able to fulfil the requirement of this procedure.

Additionally, Table 4 includes the coefficient of determination (R^2) for all dependent constructs, which reached the minimum threshold of 0.19 (Schloderer et al., 2009) except for the utility and intention to use constructs of YouTube. It should be noted that the explanatory power of the model is only limited

by the low variance explanation (Secka, 2015). Therefore, the constructs can be retained to explain the relationship between the dependent and independent constructs.

	Constructs:	STU	WTU	U	LSP	GSP	SP	ITU	AU
WhatsApp	**α**	0.831	0.847	0.826	0.870	0.852	0.859	**0.377**	0.841
	CR	0.877	0.885	0.884	0.907	0.894	0.914	0.761	0.925
	AVE	0.546	0.562	0.657	0.661	0.628	0.780	0.615	0.861
	R^2	-	-	0.378	-	-	0.680	0.269	0.330
Facebook	**α**	0.926	0.866	0.872	0.910	0.841	0.861	**0.622**	0.910
	CR	0.939	0.895	0.910	0.934	0.888	0.915	0.839	0.957
	AVE	0.657	0.549	0.716	0.739	0.614	0.782	0.723	0.917
	R^2	-	-	0.236	-	-	0.700	0.339	0.426
Instagram	**α**	0.837	0.816	0.854	0.862	0.847	0.862	**0.525**	0.877
	CR	0.878	0.862	0.901	0.901	0.891	0.916	0.804	0.941
	AVE	0.509	0.512	0.695	0.646	0.621	0.783	0.674	0.888
	R^2	-	-	0.262	-	-	0.666	0.196	0.236
TikTok	**α**	0.887	0.789	0.843	0.879	0.836	0.836	**0.609**	0.956
	CR	0.903	0.853	0.894	0.912	0.884	0.902	0.836	0.979
	AVE	0.573	0.537	0.679	0.675	0.606	0.755	0.719	0.958
	R^2	-	-	0.208	-	-	0.688	0.403	0.355
Twitter	**α**	0.931	0.803	0.900	0.906	0.837	0.872	**0.612**	0.882
	CR	0.892	0.857	0.930	0.934	0.885	0.922	0.837	0.944
	AVE	0.523	0.500	0.769	0.779	0.608	0.797	0.720	0.895
	R^2	-	-	0.355	-	-	0.625	0.387	0.513
YouTube	**α**	0.866	**0.530**	0.761	0.846	0.841	0.813	**0.379**	0.916
	CR	0.889	0.761	0.848	0.890	0.888	0.890	0.763	0.960
	AVE	0.537	0.517	0.582	0.620	0.615	0.730	0.616	0.923
	R^2	-	-	**0.129**	-	-	0.546	**0.179**	0.258
Pinterest	**α**	0.865	0.805	0.890	0.849	0.837	0.812	**0.575**	0.881
	CR	0.884	0.859	0.924	0.892	0.885	0.889	0.823	0.944
	AVE	0.535	0.524	0.752	0.624	0.607	0.727	0.700	0.893
	R^2	-	-	0.439	-	-	0.688	0.276	0.503

Table 4. Reliability and validity of the measurement model (critical values highlighted in bold).

For testing the hypotheses formulated in the research model, we used the bootstrapping procedure in SmartPLS. By applying the PLS algorithm, the estimates for the relationships in the structural model are mapped in the form of standardised path coefficients. The results for the hypotheses of all apps are shown in Table 5. The apps are listed in the table depending on their relation of STU and WTU where apps with a predominating STU are listed first according to the first case depicted in the previous subsection. Hypothesis H4 regarding the positive influence of the intention to use on the actual use is moved to the bottom.

Hypothesis	WhatsApp	Facebook	Instagram	TikTok	Twitter	YouTube	Pinterest
H1 (STU → U)	0.600***	0.380***	0.344***	0.112^{ns}	0.147^{ns}	-0.270^{ns}	-0.172^{ns}
H2 (WTU → U)	-0.117^{ns}	0.207^{ns}	0.298***	0.431***	0.578***	0.333***	0.621***
H3 (U → ITU)	0.376***	0.475***	0.409***	0.594***	0.584***	0.328**	0.472***
H5 (LSP → SP)	0.496**	0.323***	0.393***	0.305**	0.202*	0.155^{ns}	0.207^{ns}
H6 (GSP → SP)	0.384***	0.596***	0.505***	0.610***	0.669***	0.641***	0.687***
H7 (SP → ITU)	0.278***	0.273**	0.126^{ns}	0.214**	0.235**	0.274**	0.313***
H4 (ITU → AU)	0.577***	0.654***	0.489***	0.598***	0.717***	0.511***	0.710***

*** = p<0.001, ** = p<0.01, * = p<0.05, ns = not significant

Table 5. Results of the hypothesis tests.

The results show that the effect of STU on the perceived utility (H1) is insignificant in apps with a predominating WTU. A reverse trend can be observed for the effect of WTU on the perceived utility (H2), where the effect becomes insignificant with increasing STU predominance. The effect of the utility on the intention to use (H3) is significant in all app cases. However, the effect appears to be smaller for

WhatsApp and generally greater for WTU-predominating apps. Particularly in the cases of TikTok and Twitter, the perceived utility has a large effect on the intention to use. The effect of local social pressure on the perceived social pressure (H5) increases with increasing STU predominance in an app and is insignificant for extreme cases of WTU-predominating apps. The effect of global social pressure on the perceived social pressure (H6) could be confirmed for all apps. When compared to the results of H5 this means that regardless of whether STU or WTU predominate in an app, the global social pressure always has a significant influence on the perceived social pressure, while local social pressure does not affect WTU-predominating apps. The effect of the social pressure on the intention to use (H7) and the effect of the intention to use on the actual use (H4) could be confirmed for almost all apps.

5.3 Discussion

The values of STU and WTU calculated in Section 5.1 reveal the relative importance users attach to strong and weak ties in today's popular social media apps. The data depicted in Figure 2 shows that the importance of strong and weak ties can be altered depending on whether the focus is on communication (ii) or user-generated content (iii). Interestingly, some apps like TikTok show a high WTU predominance regarding user-generated content, but a rather balanced out relation between STU and WTU regarding communication. This indicates that users of such apps attach more weight to consuming content from weak ties but at the same time consider the communication with strong ties as similarly important as the interaction with weak ties. An explanation for this is, for instance, that users of apps like TikTok can view user-generated content like short videos from arbitrary weak ties and forward these to their strong ties in direct messages in order to talk about them.

The results of the hypothesis tests in Section 5.2 prove that social ties can be the origin of two influences that have an effect on the intention to use a social media app: utility and social pressure. The results reveal that a utility emerges from strong ties only in app cases with an STU predominance (WhatsApp) or selected cases where STU and WTU are rather balanced out (Facebook and Instagram). In contrast, the social pressure emerging from strong ties is also significant in some app cases with WTU predominance (TikTok and Twitter). These results show that strong ties more often take on the role of social pressure disseminators than providers of social utility in the context of social media apps. Regarding the role of weak ties, similar observations can be made. While the utility emerging from weak ties is mostly significant in apps with WTU predominance, they exert a significant social pressure in all app cases.

However, it cannot be concluded from these observations that social pressure is more important for the adoption of social media apps than the utility derived from strong and weak ties. A comparison between the data of H3 and H7 reveals that the perceived social utility always has a greater influence on the intention to use. To put it differently, the social pressure coming from strong and weak ties might be an important consideration factor for the usage behaviour of social media apps, but the perceived utility plays a more important role in the decision-making. Also note that the perceived social pressure has almost the same effect size on the intention to use in all app cases. Thus, it can be argued that the relation of STU and WTU does not influence the size of the social pressure but only its constitution.

6 Conclusion

6.1 Summary

Today, social media and social media apps play an increasingly important role in the everyday life of billions of users (Statista, 2022e). The aim of this study was to investigate the role strong and weak ties play in the usage behaviour of popular social media apps. For this, we formulated two research questions. RQ1 concerned the amount of utility drawn from strong and weak ties in today's popular social media apps, and RQ2 dealt with how these utilities influence the usage behaviour of those apps. To answer these research questions, we developed a research model based on the theory on network externalities, TAM, and SDT, from which we derived hypotheses. For testing the hypotheses and calculating the perceived STU and WTU of different social media apps, we conducted an online

experiment and asked users about their perception of utility and social pressure emerging from both strong and weak ties. As an answer to RQ1, the accumulated data shows that the amount of utility derived from the activity of strong and weak ties differs from app to app. For instance, as hypothesised in the introduction section, the data proves that WhatsApp is indeed an app where STU predominates WTU, while Twitter and YouTube are apps where WTU is more pronounced. In other social media apps like Facebook and Instagram, STU and WTU are rather balanced out, indicating that the activity of strong and weak ties is equally important to users of these apps. For answering RQ2, we tested the measurement model for reliability/validity and carried out hypothesis tests using the PLS method. The hypothesis tests show that STU and WTU have an impact on the perceived total utility of a social media app, whereby the significance of the effects correlates with the relation of STU and WTU (e.g. if STU predominates in an app, it is more likely that the effect of STU on the total utility is significant). The hypothesis tests also reveal that the perceived utility has a greater influence on the intention to use than the perceived social pressure from strong/weak ties.

6.2 Research and Managerial Implications

Within the framework of this study, several theoretical implications could be obtained that can be seen as a stimulus for critical reflection and directional insights. The integration of constructs coming from the theory of network externalities, TAM, and SDT yielded valid results for most of the tested constructs and cases. The newly created model can be used in future research for testing other popular social media apps such as Snapchat. Furthermore, it can be used as a basis for further extension by other constructs that could be relevant to the usage behaviour of social media users.

The results and developed research framework of this study allow the deduction of managerial implications for social media app operators. For instance, start-ups that want to introduce a new social media app to the market can use the questionnaire presented in Table 2 for estimating the STU and WTU of their app, e.g. by sending it to early adopters or beta testers for asking them about their experience and perception. Thereby, similarities and differences to consisting social media apps can be disclosed, which, in turn, could help to better assess the market potential of the new social media app. Furthermore, depending on whether STU or WTU is higher valued by the initial users, the operator can develop more appropriate marketing strategies. If, for instance, STU predominates in a new social media app, its operator should implement functionalities that facilitate/incentivise the invitation of strong ties to the app. If WTU predominates, the operator might be better off investing in marketing activities that aim for increasing the global user base of the app instead of bringing the peer network of users to the app.

6.3 Limitations and Future Research Directions

When interpreting the important findings on the factors influencing the usage behaviour of social media apps and services, limitations identified in the course of the work should be taken into account. One limitation of the study concerns the characteristics of the respondents. In this case, 61% of the respondents were students and 70% of the respondents were female. Future research could try to balance the gender ratio by increasing the sample size. A second limitation to be considered is that the study did not draw a sample across different countries and cultures, as the online survey was conducted in Germany. As the importance of strong and weak ties could differ in countries with a collectivistic or individualistic culture, future research could integrate the cultural dimensions defined by Hofstede (1980) as independent variables into the research model for investigating their (moderating) effect on the presented constructs of social utility and social pressure. Finally, a promising avenue for future research is the investigation of possible interrelationships between STU and WTU. In Section 5.3, we point out that for some kinds of apps like TikTok WTU is predominant if the focus is on user-generated content. When the focus is on communication, WTU and STU are rather balanced out. As discussed, this might be because TikTok users enjoy consuming content from weak ties which they forward to their strong ties on the app for discussion/entertainment reasons. This would mean that STU depends on WTU: the higher WTU is, the higher is STU, indicating a moderating effect, which should be analysed in greater depth in future research.

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