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Abstract

As online communities are becoming more and more relevant to business, it is critical to understand why individuals are motivated to contribute content longitudinally. In this paper, we draw on existing literature on motivation and technology characteristics to conceptualize a model of longitudinal content contribution. We view longitudinal content contribution phenomenon as a recursive process of interaction between contributors, other participants and IT artifact of online communities. We conclude with the implications of our conceptual model for future research.

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Abstract

As online communities are becoming more and more relevant to business, it is critical to understand why individuals are motivated to contribute content longitudinally. In this paper, we draw on existing literature on motivation and technology characteristics to conceptualize a model of longitudinal content contribution. We view longitudinal content contribution phenomenon as a recursive process of interaction between contributors, other participants and IT artifact of online communities. We conclude with the implications of our conceptual model for future research.

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INTRODUCTION

Online communities¹ are becoming increasingly relevant to business (Parameswaran and Whinston, 2007), and companies begin to use online communities to conduct various business processes, such as online advertising (e.g., Facebook, CIO.com), review and recommendation (e.g., Amazon.com) (Xia et al., 2009), membership upselling (e.g., Flickr or LinkedIn), brand-building, health care (Johnson and Ambrose, 2006), open source projects (Cleland-Huang et al., 2009), and product support (Schindler, 2008). In Amazon.com, individuals post their reviews and discuss products with other customers, which give Amazon.com a “first-mover advantage” (Levinson, 2001). Online communities from Bell Canada allow groups of employees to discuss new products (e.g., ways to cut energy costs) (Lynch, 2007). Texas Instruments (TI) use online communities to build better customer services, where customers and TI employees interact to share best practices and solve technical challenges (Lynch, 2009).

While moving from offline communities (e.g., local group) to online communities potentially improves organizations’ ability to support numerous processes (e.g., knowledge transfer), realizing this benefit depends on the ability of organizations to *develop* and *maintain* online communities where individuals are motivated to participate and contribute (Koh et al., 2007). Therefore, it is important not only to develop online communities, but also to maintain online communities. In online communities, content contribution triggers individuals to visit online communities, view the content and interact with each other (Kankanhalli et al., 2005). Therefore, content contribution is the foundation of online

¹ Previous studies use many terms to refer it, such as social software, social computing, online communities, electronic network of practice, peer networking, and immersive web and web 2.0. In this study, we use online community to refer to all of these terms. In the later part, we will discuss the assumptions underlying this study.

communities. Moreover, content contribution should be viewed from a longitudinal perspective rather than a one-shot activity, given that participants *regularly* consume content contributed (Butler et al., 2002).

While previous research on online communities has identified numerous factors which motivate individuals to contribute content (Kankanhalli et al., 2005; Ma and Agarwal, 2007; Phang et al., 2009; Wasko and Faraj, 2005), these studies do not view content contribution from a longitudinal perspective. A review of online community literature (see Appendix) leaves a void in the understanding of content contribution from a longitudinal perspective, and our paper seeks to address this void in the literature (Figure 1): while previous studies on online communities have studied individuals' motivation to contribute initially, the scope of this study is to examine how contributors' interaction with online communities influences their motivation to contribute longitudinally. Therefore, our research question is:

How are contributors motivated to contribute longitudinally?

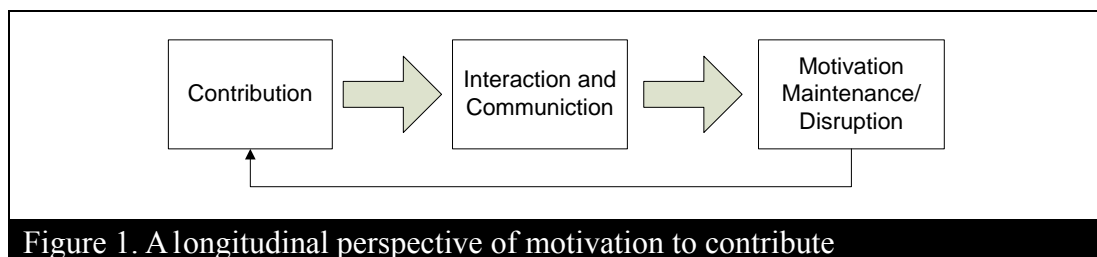
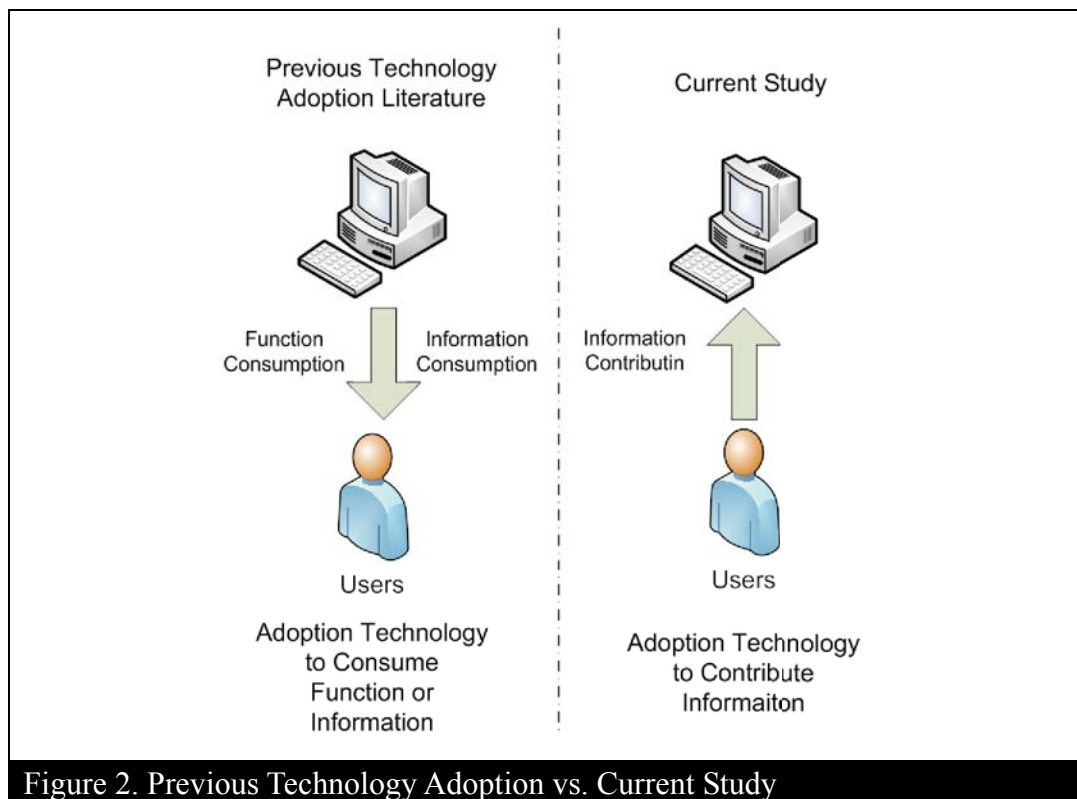


Figure 1. A longitudinal perspective of motivation to contribute

Activities from online communities cannot occur without the IT artifact. Therefore, it is quite relevant to understand how the IT artifact supports various activities in online communities. There are two aspects of the IT artifact: first, the computer-mediated environment in which contributors and other participants interact; second, electronic repositories to which individuals contribute. Both of these aspects are relevant for information systems (IS) discipline. For the first aspect, IT artifact enables online

communities and results in unique structural forms which cannot exist without IT artifact. Therefore, understanding how individuals interact in online communities are “worth of the attention of IS researchers” (Agarwal and Lucas, 2005, p. 381). For the second aspect, the characteristics of electronic repositories can influence contributors’ motivation to contribute. Specifically, contributing content into electronic repositories can be seen as a specific context of technology adoption, which is one of the key issues in information systems (IS) discipline (DeLone and McLean, 1992).



In previous technology adoption literature, the underlying assumption is that individuals adopt technologies to achieve tasks by consuming certain function or information from IT (Venkatesh et al., 2003). Therefore, individuals are usually interested in whether a certain type of IT is useful enough. However, that assumption does not necessarily hold in online communities (Wasko and Faraj, 2005). In online communities, contributors contribute content

into electronic repositories. Here usefulness becomes irrelevant since those individuals do not need to achieve tasks with information or functions from IT (refer to Figure 2). Therefore, we need a new theoretical lens to understand how contributors interact with other participants as well as the IT artifact to motivate individuals to contribute longitudinally.

Before proceeding, it may be useful to clarify some of the *assumptions* of the conceptual model proposed in this paper. While we recognize that many kinds of online communities exist (DeSanctis et al., 2003), here we focus on those online communities the participation of which is voluntary and whose participants are geographically distributed. Especially, we are interested in how contributors' interaction with other participants in a computer-mediated environment and the IT artifact of online communities influences their motivation to contribute longitudinally. If participants of online communities meet each other face-to-face, then other factors (e.g., offline activities (Ma and Agarwal, 2007)) may also influence their online activities and motivation to contribute (Koh et al., 2007). Such participants and/or communities are outside the scope of this study.

The rest parts are organized as follows. First, we review previous literature on motivation and the theoretical perspectives that underlie our model. We then present our model of longitudinal content contribution and develop its key propositions. Finally, we conclude with a discussion of the implications of our model.

FOUNDATION FOR UNDERSTANDING LONGITUDINAL CONTENT

CONTRIBUTION

Nature of Motivation

In the context of content contribution, we value motivation because of its consequences:

motivation produces valuable content (Wasko and Faraj, 2005). Although previous research on online communities pays much attention to individuals' motivation to contribute, the nature of motivation is yet to be clarified. Here we try to clarify the nature of motivation based on social psychology literature. We argue that there are two main attributes of motivation: multidimensional and longitudinal.

Individuals can be motivated to contribute content due to many different factors (Kankanhalli et al., 2005; Wasko and Faraj, 2005). These factors make individuals' motivation vary not only quantitatively (or *level* of motivation, i.e., how much motivation), but also qualitatively (or *orientation* of motivation, i.e., what are the underlying goals or reasons) (Ryan and Deci, 2000a). For example, participants of online communities may be motivated to contribute because they are interested in the content, because they want to get a reward (tangible or intangible), or because they understand the value of contribution. In these examples, the level of motivation does not necessarily vary, but the orientation of motivation certainly does. Therefore, it is vital to adopt a differentiated approach to understand motivation.

Even more importantly, motivation concerns all aspects of activation and intention, such as *energy* and *persistence* (Ryan and Deci, 2000b). The level of motivation can be fostered or disrupted, depending on the surrounding social contextual factors (Tedjamulia et al., 2005). Therefore, it is important to understand what kind of social contextual factors are needed to maintain and foster rather than disrupt individuals' motivation.

The multidimensional nature of motivation emphasizes that we can not treat motivation from a single angle, and the longitudinal attribute of motivation means that contributors need

supportive social contextual factors to maintain and foster their motivation. To understand how to treat motivation multidimensional and longitudinally, we turn to the social psychology literature. Specifically, we apply self-determination theory, which was developed to understand how to maintain and foster different kinds of motivation. Below, we provide a brief review of self-determination theory.

Theory Foundation and the Process of Content Contribution

Self-Determination Theory (SDT; Deci and Ryan, 1985) emphasizes the *evolved* inner-regulation (refer to Table 1 for key concepts; Ryan et al., 1997). SDT investigates individuals' "inherent growth tendencies and innate psychological needs that are the basis for their self-motivation as well as for the conditions that foster those positive processes" (Ryan and Deci, 2000b, p. 68). SDT identifies three psychological needs which are essential to foster individuals' propensities for *growth* and *self-motivation*: the need for competence (Harter, 1978; White, 1963), relatedness (Baumeister and Leary, 1995; Reis, 1994), and autonomy (deCharms, 1968; Deci, 1975).

SDT adopts a differentiated approach to understand motivation longitudinally, by examining what type of motivation is being fostered or disrupted (Ryan and Deci, 2000b). SDT differentiates different kinds of motivation into two types: intrinsic and extrinsic motivation, based on "the different reasons or goals that give rise to an action" (Ryan and Deci, 2000a, p.55).

Intrinsic motivation refers to "doing something because it is inherently interesting or enjoyable" (Ryan and Deci, 2000a, p.55). Intrinsic motivation represents individuals' natural tendency toward mastery, spontaneous interest, and exploration and is a principal source of

enjoyment and vitality (Csikszentmihalyi and Rathunde, 1993; Ryan, 1995). The maintenance and foster of intrinsic motivation require supportive conditions, since it can be easily disrupted (Ryan and Deci, 2000b).

Table 1. Key Concepts of SDT	
Self-Determination Theory (SDT)	A theory to understand human motivation, with the emphasis of the importance of humans' <i>evolved</i> inner-regulation (Ryan et al., 1997).
Intrinsic Motivation	The first kind of motivation which moves individuals to do something because it is inherently interesting or enjoyable (Ryan and Deci, 2000a).
Extrinsic Motivation	The second kind of motivation which move individuals to do something because it leads to a separable outcome (Ryan and Deci, 2000a).
Cognitive evaluation theory (CET)	A subtheory of SDT developed to understand social and environmental factors that foster versus disrupt intrinsic motivation (Ryan and Deci, 2000b).
Organismic Integration theory (OIT)	Another subtheory of SDT which deals with the different types of extrinsic motivation and the contextual factors that foster versus disrupt <i>internalization</i> and <i>integration</i> of the regulation.
Internalization	The process of transforming external regulations into internal regulations (Deci et al., 1994).
Integration	Optimal internalization of regulation, which results in self-determined behavior and further transformation of the regulation into individuals' own value (Ryan and Deci, 2000b).
Introjection	Partial or suboptimal internalization of regulation, which results in internally controlling regulation, without fully accepting it as one' own value (Ryan and Deci, 2000b).
Need for Autonomy	The desire to enable experiencing choice and feel like the initiator of one's own actions (deCharms, 1968).
Need for Competence	The desire to succeed at optimally challenging tasks and being able to attain desired outcomes (Skinner, 1995; White, 1959).
Need for Relatedness	The desire to establish and maintain a sense of mutual respect and care with each other (Baumeister and Leary, 1995; Harlow, 1958).

Cognitive evaluation theory (CET), a subtheory of SDT, is developed to understand social and environmental factors that foster versus disrupt intrinsic motivation (Ryan and Deci, 2000b). There are two main arguments from CET. First, social-contextual events (e.g., feedback, reward) can maintain and foster intrinsic motivation for a certain action if these

events lead individuals toward feeling of *competence* during that action. Second, feelings of competence do not maintain or foster intrinsic motivation unless accompanied by a sense of *autonomy* (an internal perceived locus of causality) (deCharms, 1968; Fisher, 1978; Ryan, 1982). Therefore, tangible reward often disrupts intrinsic motivation because it leads to an external perceived locus of causality. In other words, individuals perceive their action as a result of external control instead of their own determination. In contrast, acknowledgment of feelings can foster intrinsic motivation since it allows individuals a greater feeling of autonomy (Deci and Ryan, 1985). Here the satisfaction of the need for *relatedness* may be important for intrinsic motivation (Ryan and Deci, 2000b). Note that individuals are *intrinsically* motivated only if activities hold intrinsic interest for them. If activities are not novel or interesting, then intrinsic motivation may not apply.

When individuals are not intrinsically motivated, extrinsic motivation applies. Extrinsic motivation refers to “doing something because it leads to a separable outcome” (Ryan and Deci, 2000a, p.55).SDT argues that there are different types of extrinsic motivations, which vary greatly in its relative autonomy. Another subtheory, called organismic integration theory (OIT), deals with the different types of extrinsic motivation and the contextual factors that foster versus disrupt the *integration* of the regulation for these behaviors. Here integration refers to the transformation of the regulation into individuals’ own value so that the regulation emanates from their sense of self (Ryan and Deci, 2000b). Integrated extrinsic motivation is more autonomous and shares many qualities with intrinsic motivation, such as higher performance. However, integrated extrinsic motivation is still extrinsic in that individuals try to achieve a separate goal rather than inherently enjoy the action. OIT proposes that integration of extrinsic

motivation is more likely to happen if contextual factors satisfy individuals' needs for *relatedness*, *competence* and *autonomy*.

Individuals whose extrinsic motivation is integrated (more autonomous and self-motivated) are usually better off than those whose extrinsic motivation is introjected, such as enhanced performance (Deci and Ryan, 1991; Sheldon et al., 1997), heightened self-esteem (Deci and Ryan, 1995) and general well-being (Ryan et al., 1995). That could be the case even when individuals have the same level of perceived competence or self-efficacy (Deci and Ryan, 2000b). Even more important, individuals whose extrinsic motivation is integrated are often highly persistent (Deci and Ryan, 1991; Sheldon et al., 1997). Indeed, when individuals' extrinsic motivation is integrated, they show considerable effort and commitment towards a certain kind of activity, leading to engagement in that activity in future (Coleman, 1990).

Based on discussion above, SDT not only differentiates various kinds of motivation, but also examines motivation from a longitudinally perspective. SDT classifies motivation into intrinsic motivation and different kinds of extrinsic motivation (Ryan and Deci, 2000b). For intrinsic motivation, SDT does not deal with what causes intrinsic motivation; rather, it examines the conditions that maintain or disrupt intrinsic motivation. Therefore, SDT does not view intrinsic motivation as being relatively stable. Instead, SDT acknowledges the developmental nature of intrinsic motivation and tries to understand its changes across time. For extrinsic motivation, SDT examines what factors foster versus disrupt the integration of the regulation, and "this process may occur in stages, over time" (Ryan and Deci, 2000b). Indeed, previous studies found that the regulatory style becomes more internalized over time (Chandler

and Connell, 1987). Therefore, SDT is a valuable theoretical lens to understand longitudinal content contribution.

Primary Variables in the Model

In developing our theoretical model, we view individuals' satisfaction of three psychological needs as the central piece through which intrinsic motivation is maintained versus disrupted and extrinsic motivation is integrated versus introjected. Next we try to identify relevant factors in online communities which influence individuals' satisfaction of psychological needs. Given that we are only interested in those communities whose participants communicate via IT artifact, we propose that the interaction between contributors, other participants and the IT artifact of online communities leads to an increase or decrease in the satisfaction of three psychological needs. Therefore, we see factors such as interaction characteristics between contributors and other participants, reward characteristics and technology characteristics as having a salient influence on the satisfaction of psychological needs. The satisfaction of psychological needs then impacts individuals' future motivation to contribute. Here SDT and its "family of theories" (e.g., CET and OIT) allow us to focus on how particular factors influence the satisfaction of psychological needs.

According to SDT, whether individuals are *intrinsically* and/or *extrinsically* motivated to contribute in online communities, as long as their needs for competence, autonomy and relatedness are satisfied, they probably maintain their motivation to contribute. To summarize, we unfold the process of longitudinal content contribution in Table 2 (also see Figure 3 for a process-based view² and Table 1 for the definition of key concepts).

² Although we separate the motivation into intrinsic and extrinsic motivation, we do not mean that an individual cannot be both intrinsic *and* extrinsic motivated at the same time. The reason that we differentiate motivation is to better understand

Table 2. The Process of Longitudinal Content Contribution	
Stage	Description
Stage 1	After content contribution, contributors interact with other participants as well as the IT artifact of the online community.
Stage 2	Their psychological needs are (not) satisfied though the interaction.
Stage 3a	For those who are intrinsically motivated, if their needs for competence <i>and</i> autonomy are satisfied, their intrinsic motivation is likely to maintain and foster, and they will probably contribute later. Otherwise, their intrinsic motivation is likely to be disrupted and they probably diminish or even stop future contributions.
Stage 3b	For those who are extrinsically motivated, the more their needs for relatedness, competence <i>and</i> autonomy are satisfied, the more their contribution behavior is integrated. Thus, they will probably contribute later. Otherwise, they may continue contributing because of other factors (e.g., tangible reward). However, the extrinsic motivation of contribution is not integrated. Once those factors do not exist or individuals do not value those factors any more, they will probably stop contributing.

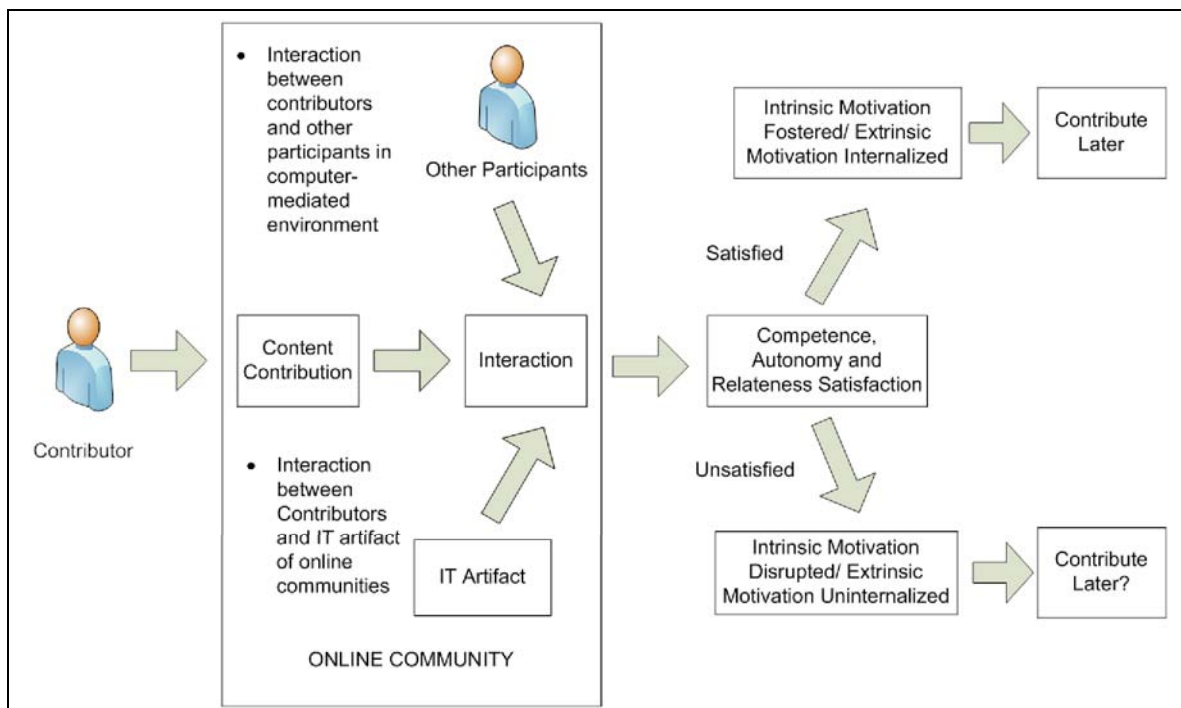


Figure 3. Process of Content Contribution: A Longitudinal Perspective

In the following part, we develop the propositions for longitudinal content contribution model.

A MODEL OF LONGITUDINAL CONTENT CONTRIBUTION

how different types of motivation change across time.

Based on SDT, we argue that individuals' satisfaction of the needs for competence, autonomy and relatedness influences their motivation to contribute in the future (Figure 4). We predict that individuals' content contribution leads to their satisfaction of the needs for competence and autonomy. The social contextual factors and technology factors influence their satisfaction of the needs for competence, autonomy and relatedness. Finally, the satisfaction of the needs for competence, autonomy and relatedness influences individuals' motivation to contribute.

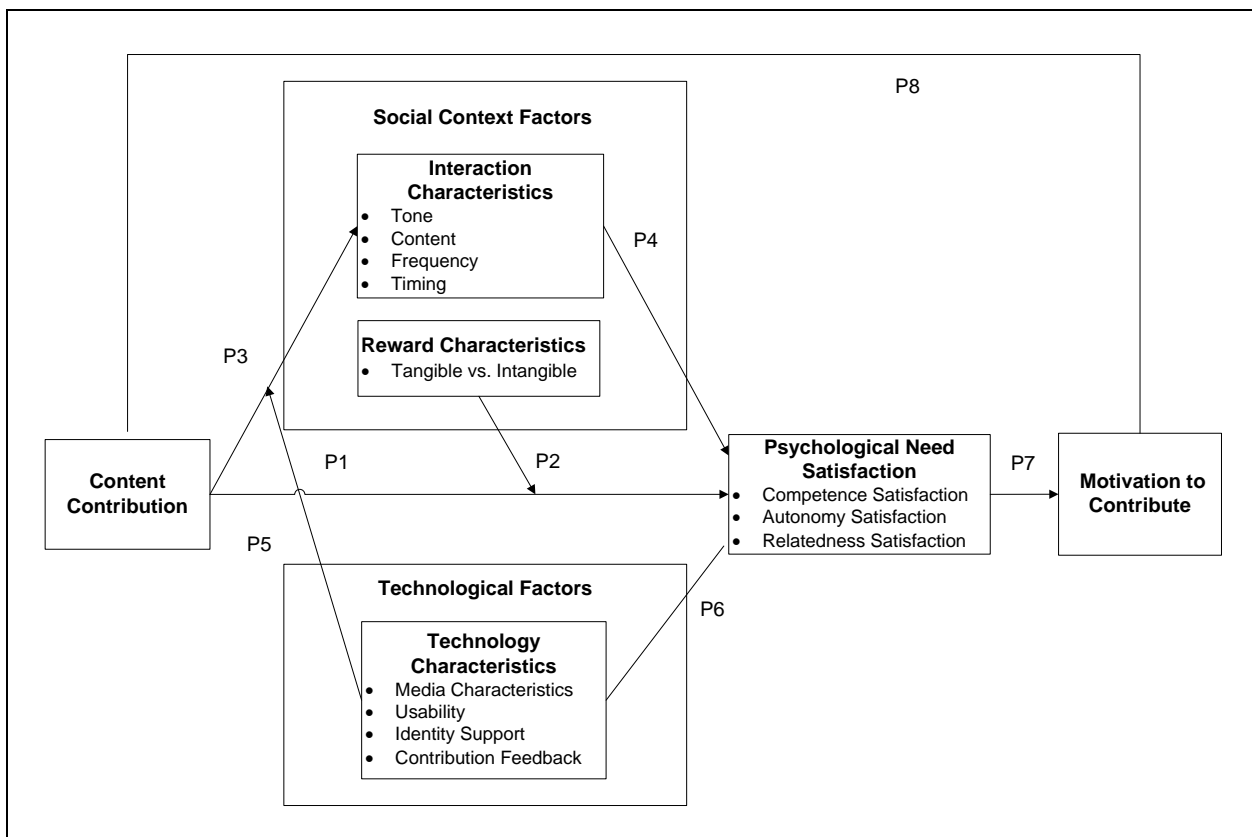


Figure 4. Longitudinal Content Contribution: A SDT Perspective

Content Contribution, Reward Characteristics and the Satisfaction of Psychological Needs

According to SDT, the need for competence concerns the desire to succeed at optimal challenge and being able to attain desired outcomes (Skinner, 1995; White, 1959; Zhang, 2008a). When individuals contribute content, they codify knowledge from their mind into

content and put the content into electronic repositories of online communities (Massey and Montoya-Weiss, 2006). The process is often challenging and requires much effort (Kankanhalli et al., 2005). Therefore, after individuals contribute content, their desired outcomes achieve and their needs for competence are probably satisfied. The need for autonomy concerns experiencing choice (deCharms, 1968). In online communities, individuals choose whether to contribute, and what to contribute, and their needs for autonomy are probably satisfied. Thus, we propose that:

Proposition 1: Individuals' content contribution will positively influence their satisfaction of psychological needs.

However, not all contribution is fully due to individuals' choice. Previous research finds that tangible (or extrinsic) reward often undermines intrinsic motivation (Bartol and Srivastava, 2002; Deci et al., 1999; Osterloh and Frey, 2000; Kluger and DeNisi, 1996). Once the reward is removed, the rate of contribution probably decreases (Garud and Kumaraswamy, 2005). According to SDT, contributors view extrinsic reward as controllers of behavior. Therefore, extrinsic reward leads to a more external perceived locus of causality and prohibits individuals' satisfaction of the needs for autonomy (deCharms, 1968). Some online communities offer tangible reward to encourage contributing. Here contributors may view content contribution forced by online communities. Thus, they face fewer or no choice, and their satisfaction of the needs for autonomy is lowered. Therefore, we argue that:

Proposition 2: Contribution reward will moderate the influence of content contribution on the satisfaction of psychological needs.

Content Contribution and Other Participants' Interaction with Contributors

After individuals contribute content, they add new resources to online communities (Wasko et al. 2004). These resources provide benefits for other participants, as increased information and social support (Butler, 2001). Therefore, online communities can better attract other participants and allow them to interact with each other. When participants interact with contributors, the content contributed serves as a topic for individuals to discuss. Other individuals interact with contributors by commenting, giving feedback, expressing appreciation, and so on, depending on the exact content contributed (Butler, 2001). This leads to the following:

Proposition 3: The content contributed influences how other participants interact with contributors.

Other Participants' Interaction with Contributors and the Satisfaction of Psychological Needs

We identify four characteristics of interaction: tone, content, frequency and timing: tone concerns whether the interaction is positive, neutral or negative; content represents the exact information exchanged between contributors and other participants; frequency concerns how often other participants interact with contributors; timing refers to when other participants interact with contributors.

Acknowledgement from other members increases an individual's motivation to contribute (Hertel et al., 2003; Stasser et al., 1995; Thomas-Hunt et al., 2003). CET also shows that positive feedback maintains and fosters intrinsic motivation (Ryan and Deci, 2000a). Contributors hold a certain level of self-esteem, and have a need for competence. The positive feedback and comment from other participants can satisfy contributors' needs for

competence by acknowledging their achievement. Therefore, the tone and content of other participants' feedback probably influence contributors' needs for competence.

Feedback from other participants also shows that they care about what contributors "say". Since the need for relatedness concerns *establishing* and *maintaining* a sense of mutual respect and care with each other (Baumeister and Leary, 1995; Harlow, 1958), frequent and timely feedback from other participants probably satisfy contributors' needs for relatedness, especially when they are extrinsically motivated (Clark and Brennan, 1991; Ryan and Deci, 2000b).

When one participant responds to another's posting, a social tie is created (Wasko and Faraj, 2005). The frequency and timing of feedback influence the relational strength of ties (e.g., obligation), which in turn mediates the influence of structure of ties on contribution motivation (Wasko et al., 2004). However, when feedback is too frequent, the strength of social ties may be too strong. In such contexts, individuals may face too much commitment, which results in lower satisfaction of the needs for autonomy and motivation to contribute (Wasko and Faraj, 2005). Therefore, the frequency and timing of interaction between contributors and other participants influence contributors' needs for autonomy.

These arguments lead to:

Proposition 4: The way in which other participants interact with contributors in online communities influences contributors' satisfaction of psychological needs.

Technology Factors and the Satisfaction of Psychological Needs

As discussed before, there are two aspects of IT artifact from online communities: computer-mediated environment and electronic repositories. Based on previous literature, we

identify four technology characteristics which are potentially important to understand longitudinal content contribution phenomenon: *Media Characteristics*, *Identity Support*, *Usability*, and *Contribution Feedback* (Table 3). The first two concern the computer-mediated environment in which individuals interact, and the latter two deal with electronic repositories. Note that the technology characteristics and sub-characteristics identified aim to exemplify relevant technology characteristics and raise future discussions, rather than try to list all of the relevant technologies. Besides, technology characteristics (and sub-characteristics) probably function differently in various contexts.

Media Capabilities: As opposed to traditional communities in which individuals interact face to face, interaction in online communities is mediated by electronic media. Therefore, media characteristics influence how individuals' interact with each other (Dennis et al. 2008), which in turn influences their satisfaction of psychological needs. Previous literature has found that media characteristics moderate the relationship between social influence and groups' valence toward a technology (Sarker and Valacich, forthcoming). One reason is that individuals experience different results of social presence in different media, which in turn affect individuals differently. Therefore, media characteristics moderate the relationship between content contribution and the way in which people interact. Media Synchronicity Theory (MST) characterizes media with five traits, which are symbol sets, transmission velocity, parallelism, rehearsability and reprocessability (Dennis et al., 2008).

Electronic environments suffer from lessened cues (Rice, 1984). However, higher symbol variety can give individuals more freedom to choose the symbols, and therefore affect the content of their interaction. When media enables immediate feedback, individuals are able to

interact with short response turnover. Thus, feedback immediacy influences the frequency and timing of interaction. When media enables multiple simultaneous channels (higher parallelism), individuals are able to interact with many other participants simultaneously. Thus, the frequency and timing of interaction are probably different compared to that when individuals only interact with one participant. Next, when rehearsability is high, participants are able to better polish a message before sending, which potentially results in finer content. However, in such context, participants may take more time to compose content, which potentially leads to lower frequency. Finally, when reprocessability is high, individuals can refer back to archival records. Thus, they are likely to pay more attention to the content they post, which affects their tone and content during interaction. Again, reviewing back previous message creates delay, which may also lead to lower frequency. To summarize, media characteristics moderate the relationship between content contributed and the way in which individuals interact.

Identity Communication Support: Accurate communication and verification of identity motivate individuals to contribute (Ma and Agarwal, 2007). In online communities, individuals need identity support to express ones' identity while interacting. According to self-verification theory, individuals are more likely to build a relationship when their identities are confirmed by others (Swann, 1983; Swann et al., 1989). Therefore, with identity support, individuals can interact more effectively and build strong relationships (Jensen et al., 2002). Thus, identity support is likely to facilitate the interaction between contributors and other participants, and results in more positive and frequent interaction. To summarize,

identity support moderates the relationship between content contributed and the way in which individuals interact.

Usability: Another important technology characteristic is usability. Usability refers to the degree to which individuals can use an IS easily and effectively to contribute knowledge (Shackel, 1991). In the context of online communities, we refer the usability as the degree to which individuals can use electronic repositories to contribute. Previous research finds that codification effort is negatively associated with content contribution (Kankanhalli et al., 2005). When usability is high, individuals probably face less codification effort to contribute, and their needs for competence are more likely to be satisfied; when usability is low, individuals face increasing difficulties to contribute and they may feel they are not competent to be able to contribute content. Therefore, usability influences individuals' satisfaction of psychological needs.

Contribution Feedback: From an SDT perspective, positive feedback is an intangible reward. While tangible rewards (e.g., money) often disrupt individuals' satisfaction of the needs for autonomy, intangible rewards usually make individuals feel what they are doing is important and valuable, which satisfies their needs for competence (Ryan and Deci, 200b). HCI (Human-Computer Interaction) literature also identifies the promise of “timely and positive feedback” as a positive design principle (Zhang, 2008a; Zhang, 2008b). Essentially, individuals want to become competent and sense that what they are doing is valuable. When individuals engage in tasks with optimal challenge, they feel the strongest interest of the needs for competence (Zhang, 2008a). After individuals achieve these tasks, they would like to know their performance, and feedback can provide such an evaluation. In online

communities, content contribution often requires much effort and skill to achieve (Kankanhalli et al., 2005), and individuals would like to know the outcome of their contribution. Many online communities provide contribution feedback after contributors contribute content. When the feedback is positive and timely, contributors probably perceive that their competence is accepted and online communities care about what they contribute. Therefore, their needs for competence and relatedness are probably satisfied.

To summarize the discussions above, we argue that:

Proposition 5: Technology characteristics (e.g., media capabilities and identity communication support) will moderate the relationship between content contributed and the way in which individuals interact.

Proposition 6: Technology characteristics (e.g., usability and feedback function) will influence contributors' satisfaction of psychological needs.

Table 3 Technology Characteristics and Sub- Characteristics

Characteristics	Brief Definition	Sub-Characteristics	Brief Definition of Sub-Characteristics
Media Capabilities	“the <i>potential</i> structures provided by a medium which influence the manner in which individuals can transit and process information.” (Dennis et al. 2008, p583)	Symbol Sets	“the number of ways in which a medium allows information to be encoded for communication.” (Dennis et al., 2008, p585)
		Transmission Velocity	“the speed at which a medium can deliver a message to intended recipients.” (Dennis et al., 2008, p584)
		Parallelism	“the number of simultaneous transmissions that can effectively take place.” (Dennis et al., 2008, p585)
		Rehearsability	“the extent to which the media enables the sender to rehearse or fine tune a message during encoding, before sending.”(Dennis et al., 2008, p587)

		Reprocessability	“the extent to which the medium enables a message to be reexamined or processed again, during decoding, either within the context of the communication or after the event has passed.” (Dennis et al., 2008, p587)
Identity Communication Support	The degree to which ICT support individuals’ effort to express and present their identity to others with the goal of achieving a shared understanding (Ma and Agarwal, 2007).	Virtual Copresence	“Artifacts that induce a subjective feeling of being together with others in virtual environment.” (e.g., Chat room; Ma and Agarwal, 2007, p49)
		Persistent Labeling	“The use of a single label to present (identify) oneself.” (e.g., User ID; Ma and Agarwal, 2007, p49)
		Self-presentation	“The means by which the focal person presents herself online. (e.g., signature; Ma and Agarwal, 2007, p49)”
		Deep profiling	“The digital organization of social information with which community members can identify the focal person.” (e.g., ranking; Ma and Agarwal, 2007, p49)
Usability	The degree to which individuals can use an IS easily and effectively to contribute knowledge (Shackel, 1991).	N/A	N/A
Feedback Function	Online communities’ response to individuals’ contribution	Public vs. Private	Response to one individuals or to a group of individuals
		Graph vs. Number	The way in which the response is resented.
		Timing	Time between contribution and feedback.
		Tone	The affect in feedback (e.g., positive, neutral or negative)

The Satisfaction of Psychological Needs and Motivation to Contribute

We posit that the satisfaction of three basic psychological needs (the need for competence, autonomy and relatedness) influences an individual’s motivation to contribute.

When individuals are intrinsically motivated to contribute, CET argues that the satisfaction of the needs for competence and autonomy are necessary to maintain and foster intrinsic motivation. In addition, intrinsic motivation is more likely to be maintained with a sense of relatedness. Therefore, the satisfaction of the needs for competence, autonomy and relatedness probably maintains and fosters intrinsic motivation. In online communities, when intrinsically motivated contributors' psychological needs are satisfied, they probably keep contributing.

When individuals are extrinsically motivated to contribute, the need for relatedness becomes even more important. Since extrinsically motivated activities are usually not interesting, the reason that individuals initially engage in these activities is probably because the activities are valued or prompted by others who they care about (Ryan and Deci, 2000b)³. Therefore, OIT argue that when individuals are extrinsically motivated, the need for relatedness is centrally important to integrate extrinsic motivation. To integrate an extrinsic motivation, individuals must feel efficacious with the activity, fully understand its meaning and synthesize that meaning with their own value. Such deep processing is facilitated by a sense of choice. (Individuals can choose not to do the activity before they fully accept its meaning). Therefore, support for competence and autonomy also facilitate integration. In summary, the satisfaction of the needs for competence, autonomy and relatedness probably facilitates integration of extrinsic motivation. In online communities, when extrinsically motivated contributors' psychological needs are satisfied, they are more likely to fully accept the value of contribution (motivation integration) and keep contributing. This leads to the

³ This process is similar to social influence, which is defined as "the degree to which an individual perceives that important others believe he or she should use the new system" in IS discipline (Venkatesh et al., 2003, p. 451).

following:

Proposition 7: The satisfaction of psychology needs will positively influence individuals' motivation to contribute.

Motivation to Contribute and Content Contribution

Motivation is one of the most important factors to influence individuals' content contribution (Wasko and Faraj, 2005). Higher level of motivation usually means higher level of energy, and more autonomy-oriented motivation is often related to longer persistency (Ryan and Deci, 2000b). Higher level of energy and longer persistency usually results in more production. Therefore, we propose that:

Proposition 8: Individuals' motivation will positively influence their subsequent content contribution.

DISCUSSION AND FUTURE DIRECTION

Previous research on content contribution has investigated the factors leading toward initial contribution (Ma and Agarwal, 2007; Kankanhalli et al., 2005; Wasko and Faraj, 2005); however, this focus ignores the ongoing contribution of individuals. In this paper, we develop a theoretical model to understand how to sustain online communities and motivate individuals to contribute longitudinally. Using self-determination theory as the umbrella, we identify relevant social-contextual and technological factors which influence individuals' satisfaction of psychological needs. The satisfaction of psychological needs maintains and fosters individuals' future motivation to contribute.

The longitudinal aspect of the model explains how individuals' motivation change overtime. According to our model, individuals' motivation can either be maintained or

disrupted, depending on whether their basic psychological needs are satisfied. For example, after someone contributes content, if other participants actively discuss the content and provide positive feedback, that person's need for competence and relatedness are likely to be satisfied, and they are likely to continue contributing. Otherwise, if no one discusses it or online communities do not provide feedback, the contributor's need for competence and relatedness may not be satisfied. Thus, their motivation may not be integrated if they are extrinsically motivated, or their motivation may be disrupted if they are intrinsically motivated. They may still contribute because of other factors (e.g., tangible reward). However, once they do not value that reward any more or that reward disappears, they are likely to stop contributing.

Our model complements Wasko et al. (2004)'s model of electronic network of practice on the feedback path from knowledge contribution to individual motivation. We provide an alternative explanation of their model to explain the maintenance of online communities. While we agree that increases of membership do increase online communities' potential resource, that resource does not necessarily become accessible and change the network structure. Because the rate of online community failure is quite high⁴ (Schindler, 2008), we know that contribution effort is likely to diminish in some contexts. We do agree with their idea that online communities are more likely to be sustained if they can support "productive exchange" between individuals (Wasko et al., 2004, p. 506). However, we argue that the underlying reason for productive exchange to be valuable is that it leads to individuals' satisfaction of psychological needs. We also take a step further to include others participants

⁴ Although the success of online communities is hard to define, the size of membership can be used to represent their success. One study finds that 35% of the online communities examined have less than 100 members (Reed, 2008).

and IT artifact of online community and examine the value generated from their interaction.

Our model has implication for both online community development and online community maintenance. According to Critical Mass Theory (Markus, 1987), high-interest and high resource individuals among the early users can facilitate the number of users to exceed the critical mass and help achieve universal access of a certain medium. Therefore, when online communities just start, high-value contributors are welcome and high-interest content are desired, so that other individuals can be attracted and trigger the interaction among contributors and other participants. When online communities become mature, we argue that contributors' various psychological needs should be satisfied regularly, so that they can maintain their intrinsic and/or extrinsic motivation to contribute. Otherwise, contributors may stop contributing, and participants may begin to leave online communities, even after the number of community participants exceeds a certain critical mass (Markus, 1987).

Our model also answers why tangible rewards to promote knowledge contribution may actually be detrimental to the sustainability of online community (Gallivan et al., 2003). We argue that when individuals are intrinsically motivated, their achievement (content contribution) does not satisfy their needs for competence if their needs for autonomy are not satisfied. When tangible rewards are present, individuals experience fewer choices and shift the locus of causality to online communities (or whoever provides the reward). Therefore their needs for autonomy are not satisfied. For those who are intrinsically motivated, their motivation is disrupted; for those who are extrinsically motivated, their motivation is not integrated. In such context, individuals may still continue contributing because of a tangible reward, but their motivation cannot be sustained and online communities will probably.

Our model assumes that higher motivation probably leads to higher rate of content contribution, and online communities benefit from more contributed content. In other words, the more, the better. In reality, more content does not necessarily lead to more public good, and some content may be detrimental to online communities (Schindler, 2008). Future studies can focus on how to improve the quality of contributed content when individuals are motivated or how to deal with content with low quality.

CONCLUSION

Rooted firmly in existing literature on content contribution and social psychology (self determination theory) literature, this paper tries to develop a theoretical model toward providing an understanding of what motivate individuals to contribute longitudinally in online communities. The theoretical model contains both social context factors as well as technological factors. At the core of the model are individuals' three psychological needs. We argue that the satisfaction of these needs influences individuals' wellbeing and subsequent motivation to contribute. Much research remains to be done to operationalize the key constructs in the model, as well as identify if there are other types of factors important and relevant in certain context. By proposing key constructs and developing clear proposition, we have offered an agenda for future research on longitudinal content contribution. Moreover, we hope the framework provided here is an initial step for the IS discipline to further understand how to foster and sustain online communities.

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APPENDIX: A Brief Overview of Previous Theories

Theory and its Brief Description	References	Understand Content Contribution
<p>Collective Action Theory and Social Capital Theory - the structural links created through the social interactions between individuals are important to predict their collective action.</p>	<p>Kankanhalli et al. (2005); Phang et al. (2009); Wasko and Faraj (2005).</p>	<p>Explains how some social capital fosters individuals' motivation to contribute. Does not explain how motivation changes as the strength of structural links increase (or decrease). For example, too strong structural links (e.g., commitment) may disrupt motivation.</p>
<p>Expectancy theory - incentives influence individuals' expectation, which in turn affects their level of performance. Individuals' personality characteristics determine their expectation.</p>	<p>Tedjamulia et al. (2005).</p>	<p>Explains how some individuals' characteristics (e.g., expertise) can influence their motivation. Does not explain how incentives change overtime.</p>
<p>Self-Presentation Theory – individuals have a need to explain themselves to others regarding their identity before achieving other goals together.</p>	<p>Ma and Agarwal (2007).</p>	<p>Explains how identity support communication influences perceived identity support, which in turn influences individuals' motivation to contribute. Does not explain how motivation is changed after.</p>
<p>Social Exchange Theory - individuals engage in social interaction based on an expectation that it will lead in some way to social rewards such as approval, status, and respect.</p>	<p>Kankanhalli et al. (2005); Wasko and Faraj (2005); Phang et al. (2009).</p>	<p>Explains how some reward (e.g., reputation) can foster individuals' motivation to contribute. Does not differentiate various kinds of reward; does not explain the change of motivation after a certain kind of reward is received by contributors.</p>
<p>Theory of Reasoned Action – intentions to contribute are affected by beliefs regarding the contribution and subjective norms.</p>	<p>Bock et al. (2009).</p>	<p>Explains how the intentions are formed initially. Does not explain how beliefs regarding the contribution change after conducting contribution (consistent with TAM research).</p>
<p>Value Theory – different individuals may attach different value to an object or an action based how it can satisfy their needs.</p>	<p>Phang et al. (2009).</p>	<p>Explains how some technology characteristics (e.g., usability) can meet individuals' need and play different roles in different contexts (knowledge seeking vs. knowledge contributing). Does not explain how motivation to contribute changes after their needs are satisfied.</p>

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