A Review of Knowledge Contribution Measurement in Online Communities

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Ariel D. Wigdor
University of Massachusetts Amherst
awigdor@isenberg.umass.edu

Traci J. Hess
University of Massachusetts Amherst
thess@isenberg.umass.edu

Yi Zou
University of Massachusetts Amherst
yzou@isenberg.umass.edu

Abstract

Scholars have long studied the genesis of knowledge in organizations and communities. These entities are increasingly being superseded by virtual counterparts, leading to the emergence of online communities. While the information systems (IS) literature covers many aspects of how and why online community members contribute knowledge, less attention has been paid to the nature and rigor of its measurement. In response, this study reviews the empirical literature on knowledge contribution in online communities with the aim of assessing the current state of its measurement. Insights into direct and indirect measurement approaches are evaluated and three primary categories of measures are identified—*volume*, *quality*, and *other*. A typology of online communities is proposed to investigate measurement differences between community types. We find evidence that different theoretical perspectives inform measurement in different types of online communities. The paper concludes by outlining limitations and future research directions.

Keywords

Online communities, knowledge contribution, empirical measurement, literature review.

Introduction

Today's world is largely driven by tech-savvy problem solvers and knowledge workers who use information and communications technologies to create value for society. To that end, society's structures and entities are becoming increasingly digital and virtual. One such virtualized entity—the online community—is the focus of this literature review. An *online community* is a sociotechnical information system where a group of individuals with common interests assembles in a virtual space to collaborate, socialize, and exchange knowledge (Chiu et al. 2006; Ridings et al. 2002). Essentially, an online community serves as the virtual counterpart to a physical community. *Knowledge contribution* in an online community occurs when individuals share or exchange knowledge on the community's platform (Phang et al. 2009; Wasko & Faraj 2005).

In the empirical literature, constructs embodying knowledge contribution in online communities are measured in various ways. For example, knowledge contribution has been measured as the frequency of posts, the quality or length of posts, and with self-reports of general participation (e.g., Ma & Agarwal 2007; Wasko & Faraj 2005). Thus, this research area comes with its share of measurement ambiguity and leaves room for improvement. For instance, no comprehensive attempt to assess the empirical measurement of knowledge contribution in online communities currently exists. In response, this literature review seeks to evaluate measurement practices and provide insights into the development of improved empirical measures. These efforts will help to create valid and reliable measures of knowledge contribution. The following research questions guide our inquiry:

RQ1: How is knowledge contribution measured in the IS literature on online communities?

RQ2: Does measurement differ by type of online community?

This paper is structured as follows. First, the methodology and literature review are presented. Next, findings and research gaps are identified. Finally, limitations and future research avenues are discussed.

Methodology

The method for this literature review follows the guidelines of Machi and McEvoy (2016) and vom Brocke et al. (2015). Fourteen peer-reviewed journals were selected for the search, including the IS scholars' basket of eight journals, and six other peer-reviewed IS journals (*Communications of the AIS*, *Decision Sciences*, *Decision Support Systems*, *Information & Management*, *Information & Organization*, and *Management Science*). These six IS journals were selected based on the quality of the journal and the number of IS articles published. First, an initial list of keywords guided an exploratory scan of the literature, including *construct* keywords: content creation, knowledge collaboration, knowledge contribution, knowledge creation, and knowledge sharing; and *context* keywords: online community, virtual community, electronic community, knowledge community, community of practice, and network of practice. Next, combinatorial searches were executed by pairing construct-related keywords with context-related keywords, resulting in 714 manuscripts. Titles, abstracts, and manuscripts were scanned and each article classified as relevant, not relevant, or potentially relevant, if it met two criteria: (1) the study had empirically measured some form of knowledge contribution, and (2) the context was an online community. Finally, articles that were previously labeled relevant or potentially relevant were reassessed. The final number of articles found to empirically measure some form of knowledge contribution in an online community was 39.

Literature Review

Typology of Online Communities

To investigate if and how measures vary across types of online communities, several classification schemas of communities were considered (e.g., Armstrong & Hagel 1996; DeSanctis et al. 2003; Fang et al. 2018). Using these classification schemas enable us to examine how measurement of knowledge contribution may differ by type of online community. Four general types of online communities are identified: online communities of practice, open collaboration communities, online organizational networks, and online social networks, as described below.

Online communities of practice (CoPs) are practice-focused virtual collectives united by common interests or purposes (Brown & Duguid 1991; DeSanctis et al. 2003; Zou 2015). Examples of CoPs include discussion-based online communities and electronic networks of practice (Wasko & Faraj 2005; Wasko et al. 2004). *Open collaboration communities (OCCs)* are collaboration-focused collectives that engage in innovation and co-production of public goods (Levine & Prietula 2014). Here, openness is a key facet that entails self-organization around informal knowledge work (Arazy et al. 2016), with examples including open source software (OSS), Wikipedia, and certain crowdsourcing initiatives (Love & Hirshheim 2017). *Online organizational networks (ONs)* are privately run network-based platforms with access restricted to employees and stakeholders. Examples of ONs include employee portals (Urbach et al. 2010), interactive knowledge management systems (He & Wei 2009), and company platforms such as enterprise social media (Bulgurcu et al. 2018) and enterprise social networks (Recker & Lekse 2016). *Online social networks (SNs)* are collectives driven by relationships that bridge globally distributed users over a virtual medium. Examples of SNs include social media and social Q&A communities.

Empirical Measurement of Knowledge Contribution

The review of empirical literature reveals two approaches to measuring knowledge contribution in online communities: direct and indirect. *Direct measures* are obtained archivally and may involve coding content and/or assessing users' online activities. *Indirect measures* are obtained perceptually as self-reports in a survey or questionnaire. Among the 39 empirical studies capturing this construct, 24 use only direct measures (61.5%), 12 use only indirect measures (30.8%), and three use both (7.7%), as shown in Table 1.

To address RQ1, empirical measures were coded into three categories: volume, quality, and other. *Volumetric measures* capture the objective frequency of knowledge contribution (i.e., *how much/often?*), and *quality measures* capture the subjective quality of knowledge contributed (i.e., *how good?*). An "other" category emerged to categorize measures that did not fall into either bucket, including those with volume

and quality lumped together as well as measures tapping a different aspect of knowledge contribution, such as its magnitude. Altogether, 30 articles include a volumetric measure (76.9%), eight include a qualitative measure (20.5%), and 15 include a measure categorized as "other" (35.8%).

Due to the large proportion of volumetric measures, subcategories of general and specific were created. General volumetric measures are broader and provide lower granularity; for example, Nov et al. (2012) measure *meta-knowledge contribution* on Flickr, an online community for photo-sharing, as "the number of unique tags each user has assigned to all photos" (p. 122). Specific volumetric measures are narrower and provide higher granularity; for example, Faraj et al. (2015) measure *knowledge contribution* in Usenet newsgroups through content analysis by coding forum posts into four knowledge contribution behaviors and creating individual scores. Among the 30 studies that used volumetric measures, 21 applied a general version (70%), five applied a specific version (16.7%), and four applied both versions (13.3%).

Among the quality measures, five are direct and three are indirect. Direct measures of quality assess content characteristics using proxy variables, such as helpfulness, innovativeness, readability, and usefulness. Indirect measures of quality assess perceptions of knowledge contributed using multiple scale items. Measures in the "other" category are split between nine indirect and six direct. In nearly all cases, "other" direct measures involve an assessment of the length of knowledge contributions (e.g., number of words per discussion forum post) and capture a structural aspect of the content, versus its quality. From a perceptual approach, the "other" category took a different twist, assessing perceived engagement or participation rather than a self-reported account of one's total volume or frequency of knowledge contributions.

Analysis and Findings

RQ1 addresses the state of knowledge contribution measurement in the empirical literature. This review shows that 77% of studies measured volume of knowledge contribution, 21% measured quality of knowledge contribution, and 38% measured another aspect of knowledge contribution. The large "other" category raises questions about construct validity and definitional clarity. This is a potential concern if the measure does not align with a clearly defined part of the knowledge contribution construct. To avoid convolution, volume and quality of knowledge contribution should be measured separately. An exemplar is Wasko and Faraj's (2005) seminal article in *MIS Quarterly* in which the scholars write, "we examined two independently measured dependent variables based on message postings: (1) the helpfulness of contribution and (2) the volume of contribution" (p. 45). In total, only five of the reviewed studies (12.8%) measure volume and quality of knowledge contribution separately in this fashion.

RQ2 addresses whether and how measurement of knowledge contribution differs based on the type of online community. No substantial differences are observed between community types, apart from the trend that most online collaboration community studies use direct volumetric measures. In examining the theory informing each study by community type, we find that a main driver of measurement variation is the theoretical perspective. Overall, the prevailing theoretical foundations are social capital theory, social exchange theory, and social cognitive theory. A key observation was that studies of online communities of practice and online social networks leverage more theories from social psychology. In online collaboration communities and online organizational networks, more innovation and collaboration theories are applied.

Online communities of practice are the context for 16 of the reviewed studies (41%). Here, construct measurement ensues primarily in the form of general volumetric direct measures. The three main social theories are often used conjointly to inform the operationalization of knowledge contribution. *Online collaboration communities* are present in 10 studies (25.6%), all of which apply direct measures with one exception. In this community type, direct measures include a specific assessment of volume (i.e., "S" or "GS" as shown in Table 1) in five out of nine studies–a greater frequency of specific volumetric measures than in any other community type. Studies focusing on online collaboration communities most commonly draw upon theories of innovation and collaboration, as well as knowledge creation theory. *Online organizational networks* appeared in nine studies (23.1%) and used a mix of mostly direct, general volumetric measures, with several indirect measures in addition. Notably, the more system-oriented online communities within this type (i.e., KMS, interactive system, and employee portal) apply indirect measures, whereas the enterprise social media/network communities almost exclusively leveraged general volumetric measures of knowledge contribution. Studies focusing on online organizational networks draw upon theories less common in the set of reviewed articles (e.g., IS continuance, IS success, etc.). *Online social networks* arise

in only four studies (10.3%) and show a relatively equal mix of direct and indirect approaches to measurement, and parity between volume, quality, and "other" measure types. In studies focused on online social networks, there is heavy reliance on the three primary social theories.

Limitations and Future Research

Several limitations are present as opportunities for improving this research. One is expanding the scope of the literature search through conferences and non-IS journals, and searching for additional empirical studies of underrepresented community types (e.g., social networks and social media). Further, few articles measured quality, limiting our ability to make inferences about quality measurement best practices.

Future research can address these limitations. First, the current state of measurement calls for development of theory-driven direct and indirect scales to evaluate knowledge contribution in online communities. By building upon prior work (e.g., Ma & Agarwal 2007; Wasko & Faraj 2005) measures can be developed and validated to assist researchers in more rigorously operationalizing the knowledge contribution construct. Such measures can be designed to address different quality characteristics and the actual use of contributed knowledge, depending on the desired theory, context, and level of analysis applied. Another beneficial research direction is the investigation of antecedents and outcomes to construct nomological networks of knowledge contribution. Finally, elements that received little attention in this paper include the structure and design of community platforms, the underlying technological features, and the diverse roles enacted by online community members. Studying the technology and mechanisms rooted in different types of online communities as well as the behavioral patterns exhibited by different types of members are prospective research avenues for grasping further nuances of knowledge contribution measurement.

Table 1. Empirical Measures of Knowledge Contribution Per Reviewed Study			Direct Measures			Indirect Measures		
Article	**Theory**	**Type**	**Vol.**	**Qual.**	**Oth.**	**Vol.**	**Qual.**	**Oth.**
Arazy et al. (2016)	Organization, structural role	OCC	S					
Bulgurcu et al. (2018)	Legitimate peripheral participation, reader-leader	ON	G					
Chen and Hung (2010)	Social cognitive, social exchange	CoP				G		
Chiu et al. (2006)	Social capital, social exchange	CoP	G				C	
de Valck et al. (2009)	Interpersonal influence, word-of-mouth recommendation	CoP				G		
Eryilmaz et al. (2018)	Cognitive load, individual learning	CoP	S					
Eseryel (2014)	Knowledge creation, open innovation	OCC	S					
Fang et al. (2018)	Social capital, social exchange	CoP	G		L			
Faraj et al. (2015)	Social capital	CoP	GS					
Ganley and Lampe (2009)	Organization, social capital	CoP	G					
Ghapanchi (2013)	Competency rallying	OCC	G					
He and Wei (2009)	Cognitive integration, IS continuance, TPB, TRA, UTAUT	ON						E
Huang et al. (2018)	-	ON		H				
Jin et al. (2015)	Social capital, social cognitive, social exchange	SN	G	U				
Kane et al. (2014)	-	OCC	S					
Kettles et al. (2017)	Agency, contingency, deterrence, motivation crowding, self-determination	ON	G					
Kim et al. (2018)	Knowledge collaboration, online community membership	ON	G					
Kudaravalli and Faraj (2008)	Technology-enabled collaboration	CoP	GS		L			
Licorish and MacDonell (2017)	Coordination, evaluation apprehension, group interaction, task difference	ON	GS		L			
Lin and Chang (2018)	Media synchronicity, social capital, social cognitive, social exchange	SN						E
Ma and Agarwal (2007)	Attribution, self-presentation, self-verification, social identity	CoP						E
Majchrzak and Malhotra (2016)	Group innovation, knowledge creation	OCC	GS	I				
Marett and Joshi (2009)	Social capital, social identity, self-determination	CoP						E
Nov et al. (2012)	Knowledge contribution, social capital, social cognitive	SN	G					
Okoli and Oh (2007)	Social capital	OCC	G		C			
Ou et al. (2016)	Communicative ecology, guanxi	ON						E
Phang et al. (2009)	Social exchange	CoP				G		
Ransbotham and Kane (2011)	-	OCC	G	R	L			
Ray et al. (2014)	Engagement, self-verification	CoP						E
Recker and Lekse (2016)	Ideal-type	ON	G					
Ridings et al. (2002)	Trust	CoP						E
Santos et al. (2013)	Social movement	OCC	S					
Stanko (2016)	Experiential learning, innovation diffusion	OCC	G					
Urbach et al. (2010)	IS success	ON				G	C	
Wasko and Faraj (2005)	Collective action, social capital, social exchange	CoP	G	H				
Wasko et al. (2009)	Collective action, social exchange	CoP	G					
Xu and Li (2015)	Self-determination	OCC				G		E
Zhang et al. (2013)	Cognitive elaboration, motivated information processing	CoP	G					E
Zhao et al. (2016)	Attribution, TPB, TRA, self-determination	SN			C		C	
Legend *Volume:* G = General, S = Specific *Quality:* C = Composite, H = Helpfulness, I = Innovativeness, R = Readability, U = Usefulness *Other:* C = Composite, E = Engagement, L = Length								

Table 1. Empirical Measures of Knowledge Contribution per Reviewed Study

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