

The Effects of Wikis Characteristics on Performance Quality: The Role of User Motivations

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Recently, wiki technology has emerged as a promising way for people to share knowledge as they collectively work toward a common goal (see [15 and 22]). It has been observed that wiki mass collaboration projects purportedly create valuable outcomes despite the apparent lack of centralized coordination and control [21]. Wikis and mass collaboration projects are an essential component of Web 2.0. Although wiki is a generic application, corporations have started to use wikis as portals, knowledge repositories, and ways to facilitate knowledge-based innovation [10, 16 and 23]. Essentially, wiki-based projects are examples of socio-technical systems where the borders between people and technology are often blurred. For instance, processes such as quality control and conflict resolution could be supported by either technology or people. Thus, effective use of wikis requires both systems be considered in the design process. This paper will focus on the “people” side of the design equation. Specifically, we adopt the Design Science methodology that advocates grounding system design in theoretical foundations [24 and 11]. In this paper we describe and test a model that links wiki-task characteristics to user motivations and performance quality, with the aim of facilitating effective design.

Very little is known about how wiki characteristics impact the motivations of users, and how these motivations affect successful knowledge sharing and utilization. Some of this will be due, of course, to the newness of the technology itself. We contend, however, that our understanding of how mass collaboration tools shape behavior has been hampered by the fact that research has tended to proceed in the absence of strong behaviorally-based theoretical frameworks (for a more detailed discussion, see [18]). In this study we draw on several organizational-behavior theories and test a limited-scope model that links wiki characteristics, participant motivation, and performance. Establishing how wikis work should assist managers who have to implement these tools in their project teams and will inform system designers who seek to customize these applications.

Research on mass collaboration, and specifically on wiki applications, is in its infancy and limited in scope. [23] and [10] use case methodology to illustrate corporate wiki applications in various contexts. [16] surveyed 186 individuals at a wiki conference from a diverse set of firms, and found that corporate wiki user motivation was driven by making work easier and helping the organization achieve its goals. Although several other studies have also addressed the issue of user motivations (e.g., [1, 3 and 18]), we are unaware of any prior work that has specifically linked user perceptions of wiki characteristics to motivation and behavior. After describing our proposed theoretical model, the results of a field study are presented and discussed.

1. Literature Review and Model Specification

Wiki-Task Attributes

To help us identify psychological properties of wiki tasks that have implications for participant motivation and performance, we drew heavily on job-characteristics theory [9]. According to this model a task or a collection of related tasks (i.e., a job) can be viewed in terms of five core dimensions or characteristics. Skill variety refers to the extent to which the task affords an opportunity to use a variety

of skills and talents during performance. Tasks that have a strong identity are those where participants experience completing a unit of work, from beginning to end. We can also assess tasks with respect to their significance on the experiences of others. According to [9], the attributes of skill variety, task identity and task significance are particularly important for helping work take on personal meaning for the person who performs it. Another attribute, autonomy, reflects the degree to which the task provides substantial freedom, independence, and discretion in scheduling and deciding work procedures. As autonomy increases, individuals tend to feel more personal responsibility for successes and failures that occur on the job and are more willing to accept personal accountability for the outcomes of the work [9]. Finally, the attribute of feedback refers to the information provided by the job (and others) about one's effectiveness (i.e., one's sense of how they are doing). These attributes are typically assessed from the perspective of the participant, and the effects of each attribute can be analyzed separately or the attributes can be combined into an overall index that indicates the motivational potential of the focal task or job. In the present study we used participants' perception of these five task characteristics as indicators of a wiki's motivational potential.

Wiki-Task Attributes and Performance Quality

Proponents of job-characteristics theory argue that tasks with higher rather than lower levels of the five core attributes are more likely to create conditions that encourage increased internal motivation, job satisfaction, and higher job performance [9]. The validity of the job-characteristics model have been affirmed by meta-analytic reviews of literature (e.g., [7 and 6]). Across people, tasks, and organizational settings, the average correlation between overall job scope (i.e., the unweighted additive index of the five core characteristics) was .74, .66 and .27, respectively, for job satisfaction, intrinsic-motivation and job-performance criteria (Fried and Ferris, 1987). In a follow-up meta-analytic study, [6] found positive correlations between the task characteristics and both satisfaction ($r = .32$ to $.71$; see [14]) and work performance ($r = .09$ to $.22$). In the present study, our focus was on information quality of wiki content. Based on theory and the body of empirical work, we expect a low-to-moderate positive relation will be evident between wiki-task attributes and performance quality. Participants who perceive wiki tasks to possess higher rather than lower levels of the core attributes should experience higher quality outcomes. Assuming that a positive relationship exists between wiki-task attributes and performance quality, our question is whether this relation is direct or mediated by motivation states.

Two Motivational States

According to job-characteristics theory, the most effective way to motivate someone is to arrange the properties of tasks in such a way so that performance of those tasks satisfies higher-order growth needs. The focus of the job-characteristics theory is very much limited to predicting internal or intrinsic motivation. Self-determination theory (e.g., [19]) is a more contemporary need-satisfaction model that distinguishes between autonomous and controlled motivation (see [8]). Intrinsic motivation is an example of autonomous motivation whereby people choose to perform an activity because they find it interesting, and because it satisfies their needs to feel competent, related and self-determined ([19]). In contrast, controlled motivation involves feelings of pressure to engage in an activity with the intention of obtaining a desired outcome or avoiding an undesired consequence. When motivated for these reasons, people feel externally regulated rather than self-determined.

It would seem that the psychological properties of wiki-based tasks have implications for both intrinsic (autonomous) and extrinsic (external regulation) motivation. To the extent that wiki-based tasks satisfy our needs to feel competent, relate to others and be self-determined, we expect intrinsic motivation to be very high, which, in turn, will have a positive effect on performance. However, the very novelty and "social" nature of the wiki process may elevate concerns about appearing competent in front of others. Although these tools may be appealing, an enriched wiki experience (i.e., higher rather than lower

score on the core attributes) may do more to clarify among participants' relative effort levels, project-relevant knowledge and skills, values, interests, and work attitudes. That is, enriched wiki experiences may also increase feelings of external regulation ("control") and perhaps performance anxiety, which, in turn, should lower self-efficacy and performance (see [18]). Although controversy exists (see [5]), we propose, as have others [4 and 8], that the performance benefits of high intrinsic motivation may be offset or diminished by these feelings of external control.

Proposed Process Model

To test our study hypotheses, we specified and tested a hypothetical model with actual employee data. The model was specified as follows. First, causal paths were specified between wiki-task attributes and intrinsic and extrinsic motivation, and between wiki-task attributes and performance quality. Second, causal paths were specified between the two motivation concepts and the outcome. Evidence of partial or complete mediation will be evident if the direct effect of wiki-task attributes on performance quality is attenuated or eliminated, respectively, when the mediators are included in the model [12].

2. Method

We tested our model using a sample of wiki users at IBM. To our knowledge this is the first study to observe wiki behavior in a corporate environment. IBM is a global organization with over 350,000 employees that designs hardware, develops software, and engages in professional services.

	Factor Loadings
Wiki-Task Attributes	
JCM1: I have considerable opportunity for independence and freedom in how I do my wiki work.	0.49
JCM2: I regularly get feedback about my wiki contributions.	0.56
JCM3: The wiki requires me to use a number of complex or high-level skills	0.36
JCM4: The wiki gives me a sense that I am performing a whole piece of work from start to finish.	0.69
JCM5: A lot of people are affected by the quality of my wiki contribution.	0.65
Extrinsic Motivation Attributes	
EM1: When participating in the wiki I think about the possible risks of not performing my duties adequately.	0.66
EM2: When using the wiki, I'm very aware of the consequences of not performing effectively.	0.89
Intrinsic Motivation Attributes	
IM1: I enjoy using the wiki.	0.72
IM2: I feel engaged in my work activities when I am able to use the wiki.	0.78
Wiki-Quality Attributes	
Q1: I find the information on the wiki to be accurate.	0.73
Q2: My wiki peers would agree that my wiki contributions are of high quality.	0.67
Q3: The content on the wiki is of high quality.	0.78
Q4: I find the information on the wiki to be up-to-date.	0.78
Q5: Information on the wiki provides good coverage of the topics under discussion.	0.69

Figure 1: Survey Questions with CFA Loadings

This corporation was a particularly appropriate research site given that IBM has a very large and growing group of early wiki adopters. IBM wikis have experienced extremely rapid rates of growth. Wikis were introduced in IBM in 2004, and after an experimentation period, a new wiki architecture was launched on November 2005. As of December 2005, IBM's new wiki architecture reached 5,000 pages. Sixteen months after this initial milestone, IBM's wiki user base consisted of 18,000 active users, 9,385 distinct applications and 142,000 pages experiencing 920,000 revisions. Late in 2006, a web-survey that contained the study measures was administered to early adopters and wiki user communities. An announcement regarding the survey appeared in the wiki desktop that all 18,000 active users could have seen, but the exact number of active wiki users to read the announcement is not known. This mass

announcement would be similar to an advertisement in an industry magazine asking for survey participants. In total, we had complete data for 433 users on the measures reported in this study. The users represented 486 distinct wikis (5% of the IBM wiki sites), and were drawn from a variety of functional areas, including services, operation, sales and distribution, software development, and information technology an administration. For each survey item respondents were asked to express their agreement on a 5-point scale (1=strongly disagree, ..., 5=strongly agree). The measure of wiki-task attributes was drawn from five established job- characteristics scales [9]. Our measures of extrinsic and intrinsic motivation were drawn from scales developed previously [17]. Our measure of wiki-quality attributes was developed for this study. The results of a confirmatory factor analysis, estimated using LISREL 8.54 [13], revealed that the fit of the proposed four-factor model to the data was superior to one-factor or null models. The items and loadings are presented in Figure 1.

3. Results and Discussion

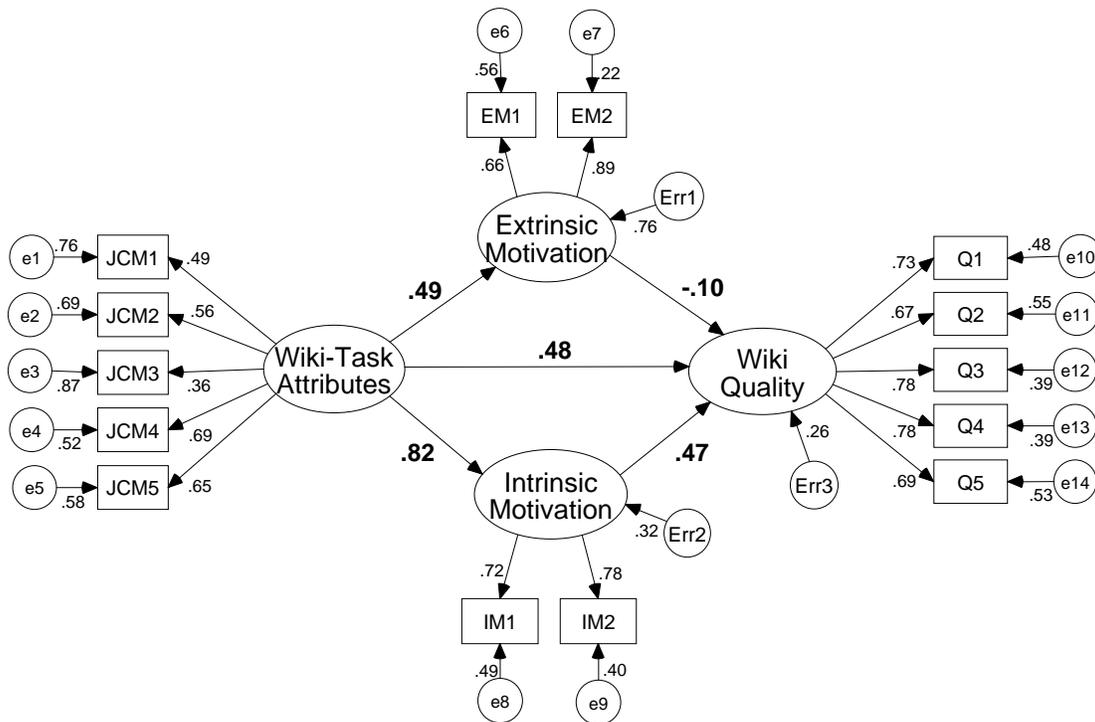


Figure 2: Completely Standardized Solution

The fit of the proposed process model to the data was estimated using *LISREL 8.54* [13]. The standardized path coefficients for the measurement and structural model are summarized in Figure 2. Two fit indices are reported. The root mean square error of approximation (*RMSEA*; [20]) is an absolute fit index that assesses how well an a priori model reproduces the sample data. The value of the *RMSEA* was .079 indicating a reasonable fit. The comparative fit index (*CFI*; [2]) is a relative or incremental fit index that reflects the improvement in fit by comparing the target model with a more restricted baseline model, such as the null model in which all of the observed variables are assumed to be uncorrelated. The value of the *CFI* was .97 indicating a good fit. Moreover, the model accounts for 24%, 68% and 74% of the variance, respectively, in extrinsic motivation, intrinsic motivation, and performance quality. All of

the proposed paths in the structural model were significant ($p < .05$), supporting a partial mediation model.

We find evidence for the partial mediation of both intrinsic and extrinsic motivation on wiki quality (see Figure 2). As expected there was very strong link between wiki-task attributes and intrinsic motivation, which, in turn, had a positive effect on performance quality. Our findings also confirmed the role of extrinsic motivation for wiki projects, especially in the early adoption phase. What our findings suggest is that this technology, in addition to increasing intrinsic motivation, also increases the salience of external contingencies which, in turn, may undermine performance.. It remains to be seen if this effect continues as wiki-facilitated tasks become more routine and formally disseminated throughout the organization.

Following the Design Science approach [24 and 11], we provide theoretical grounding for wiki design. Wikis are examples of a socio-technical system, and effective deployment of wiki systems depends greatly on organizational design (i.e., setting corporate procedures and incentives to induce desired wiki behavior). Our findings suggest that an unintentional byproduct of mass collaboration tools in corporate environments might be elevated feelings of external regulation, defined in this study as concerns about performing well (see Figure 1). How these user motivations affects performance, or the context of these effects, is a subject for future research. That said, our most striking finding was that wiki users in corporate environments appear to really enjoy using these tools, and that extrinsic motivational controls can have the unintended consequence of reducing user-perceived wiki quality. Implications for technical design include increasing ease of use, allowing anonymous postings, modifying system transparency, and decentralization of quality control processes.

4. References

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