

# Dynamic Self-moderation in a Corporate Wiki to Improve Participation and Contribution Quality

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**Abstract.** Contribution to a corporate wiki for the purpose of knowledge transfer can be very low because of continuously pressing tasks, a chronic lack of spare time, and motivational reasons. This is a problem because the wiki fails to achieve its purpose of collecting valuable knowledge, and becomes less attractive through this over time. We present a reputation-based system that socially rewards employees for their contributions, and thereby increases their motivation to contribute to the wiki. In a four months trial of productive use with two work groups, we could show that our concept increases the quantity and quality of articles in the repository, leads to higher activity in general, and draws employees to the wiki who had not contributed before.

## Introduction

Organizational knowledge comprises highly specialized knowledge, insights and experiences about the organization's field of business. Preservation and continuous sharing of such knowledge among workers is essential in knowledge-intensive businesses. Knowledge management helps to avoid redundant work, to reduce employee training times, and to adapt to changing environments. It saves intellectual capital when employees leave, if they become temporarily unavailable, or if they change to a different position (McAdam and McCreedy, 2000). Dynamic corporate information systems like wikis can be deployed to support knowledge management.



## Motivation

This section explains the motivation behind our concept. Starting from a view of the wiki's deployment history, we interviewed users for the problems they see with the wiki, and discuss theoretical backgrounds of the mentioned problems.

### History of the MOKNOWPEDIA

A few years ago, MoKnow and CAPLE decided that a new form of managing knowledge was needed. In a dedicated discussion, it was decided to set up the MOKNOWPEDIA based on the MediaWiki<sup>3</sup> software. One advantage that favored the MOKNOWPEDIA approach was that a free wiki software is cost-saving compared to other commercial software. Furthermore, there is no need for an explicit editorial control. The wiki structure can evolve freely and all kinds of articles are possible. As MediaWiki puts only few restrictions on users and what they write, it provides a work space that enables the vertical and horizontal exchange of knowledge between group leaders and equal colleagues. Additionally, entrance barriers to wiki use are low because users can easily contribute to collaboratively written articles, just by using their browsers. Finally, the success stories of Wikipedia or wikis used by open source software projects clearly voted for the wiki approach. In practice, however, it turned out that MOKNOWPEDIA had some troubles taking off:

Only a few members of the group actively participated in the wiki. Not everybody seemed equally motivated to contribute. There was a higher number of people willing to consume than those willing to produce. "You should write an article about this!" was often heard but rarely done. In the end, the total number of articles remained low; leading to a limited exchange of knowledge through MOKNOWPEDIA. Most information was still conveyed in the old ways like hallway conversations or explicit requests for documentation. Instead, we wanted to achieve that information was provided pro-actively through a central and well-known repository.

Our observations with MOKNOWPEDIA confirm the results in a similar study of knowledge sharing tools and processes by Reichling and Veith (2005).

### An investigation into the users' problems

To qualitatively investigate into the reasons for low contribution, we interviewed all members of the work group. We wanted to know why they themselves or someone else was possibly not actively contributing to MOKNOWPEDIA, and what could be changed to improve this situation and motivate them to contribute. Our interviewees reported various problems. Saying that a good tool would be reward enough to use it, many named mostly shortcomings of the wiki as problems:

Every fifth interviewee answered that the wiki's syntax was too complex to use and learn. This stopped them from using it. Also, it was missing a clear structuring. Half of the interviewees mentioned that there should be someone who creates the

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<sup>3</sup> <http://www.mediawiki.org>



software that determines a means of a user's reputation from his actions. The computed reputation scores can be used to predict future user behavior or be published. A reputation system is a core component in many modern web-based communities, where it serves to promote well-behaving and trust (Jøsang et al., 2005).

In our concept, users earn reputation points by serving their work group with valuable contributions to MOKNOWPEDIA. For example, writing high quality articles earns users a certain amount of reputation points. The users' reputation points are published resulting in appreciation by their peers. This gives users something in exchange for their efforts, and motivates them to systematically collect more points.

Consider the following scenario as a simplified example: Sonny creates a new article in MOKNOWPEDIA. Rico reviews the article with a rating of "average". For his review, Rico receives one point, while Sonny receives ten points for his average-quality article. Later, Gina edits Sonny's article, replacing about one third of the text. The article's ten points are now split proportionally between Sonny (seven points) and Gina (three points). In addition, Rico's review loses timeliness because it applies to a quite different, older revision of the article. Rico only retains 0.7 points for his old review. Gina adds a new review of "good" to the article, giving her an extra point for the review itself. When the voted quality of the article is determined from reviews, Gina's new review weighs more than Rico's old review. Therefore, the average rating of the article is almost "good". Because of its quality, fifteen points (instead of ten) are now distributed among contributors of the article. This leaves Sonny with ten points, Gina with five points plus one for her review, and Rico with 0.7 points. When Rico refreshes his review, he gets the full point again.

In the example, you see that there are two ways for users to collect reputation points: The first one is to provide a quality assessment of an article in form of a rating and a review comment. The quality assessments are used to democratically determine the quality of an article. A fresh review earns the user one point. However, this worth decreases as the review ages due to later changes to the article. The reviewer has to refresh his review to regain the full point. A reviewer cannot have more than one active review per article, but can revise his review at any time. And, to avoid that reviewers are influenced by fear of bad (or expectation of good) consequences for themselves (Elster, 1989), reviews are always submitted anonymously.

The second way to earn reputation points is by contributing to MOKNOWPEDIA articles. The amount of reputation points that are awarded for a contribution to an article depends on three criteria: quality of the article as determined by above democratic review process, importance of the article (e.g. size, page views), and ratio of the contributor's contribution to all contributors' contributions to the article.

While users contribute to articles in the wiki and review them, a reputation system collects information about reputation-relevant interactions between users and MOKNOWPEDIA in the background, gauging the social value of their interactions. The collected reputation data is visualized in three different ways, to make users themselves and other users aware of how much they have done for their group:

- **Levels** — similar to Internet forums, every user is assigned to a level in a hierarchy. Users have to collect a certain amount of points before being promoted



## Software architecture

The software architecture of MOKNOWPEDIA combines two distinct softwares into one integrated platform: CollabReview and MediaWiki.

MediaWiki is one of the most widely used wiki softwares. It is written in PHP and published free under the GNU General Public License (GPL). MediaWiki is easy to use, but has diverse functionalities and is very customizable (Barrett, 2008). The online encyclopedia Wikipedia is operated by the MediaWiki software.

CollabReview (Prause and Apelt, 2008) is a Java-based web application for reputation management in collaboratively written software source code. With multiple developers engaged in developing software code, responsibility for a specific piece of code is difficult to assign. Nonetheless, responsibility is a major factor in achieving quality and preventing code from being developed carelessly. CollabReview statistically acquires per developer per document accountabilities and enables learning and self-monitoring processes within a development team while maintaining anonymity to a certain degree in order to not endanger team spirit.

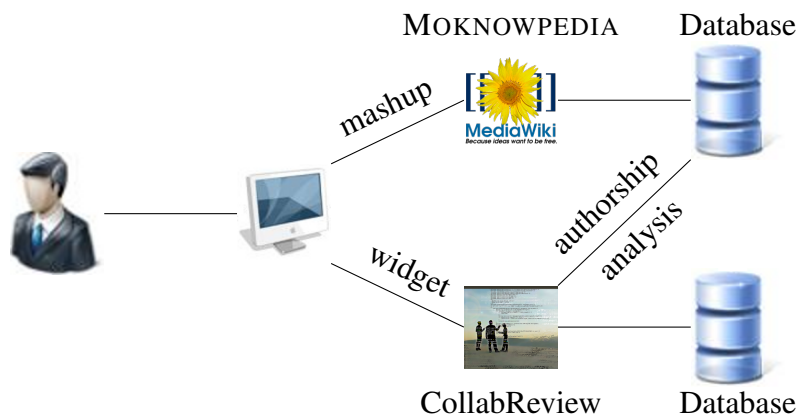


Figure 1. Architecture of the integrated MOKNOWPEDIA platform.

Figure 1 depicts how the MOKNOWPEDIA platform is composed of the sub-systems MediaWiki and CollabReview. Users access MOKNOWPEDIA with their browsers. When logging on to MOKNOWPEDIA, a single-sign-on mechanism ensures that a user is automatically logged on to both sub-systems. All interaction of the user with the MOKNOWPEDIA happens through the user interface of MediaWiki. However, the MediaWiki user interface has been extended with widgets that pass through CollabReview functionality (see Section “User interfaces”).

Apart from the user interface, some necessary communication happens directly between MediaWiki and CollabReview. In order to compute reputation scores, all articles and their revisions are run through an additional processing step by CollabReview. It analyzes articles for authorship and responsibility information, and stores review and quality data in its own database. Additionally, CollabReview’s own user management was removed. CollabReview, directly accesses the MediaWiki user database, instead.



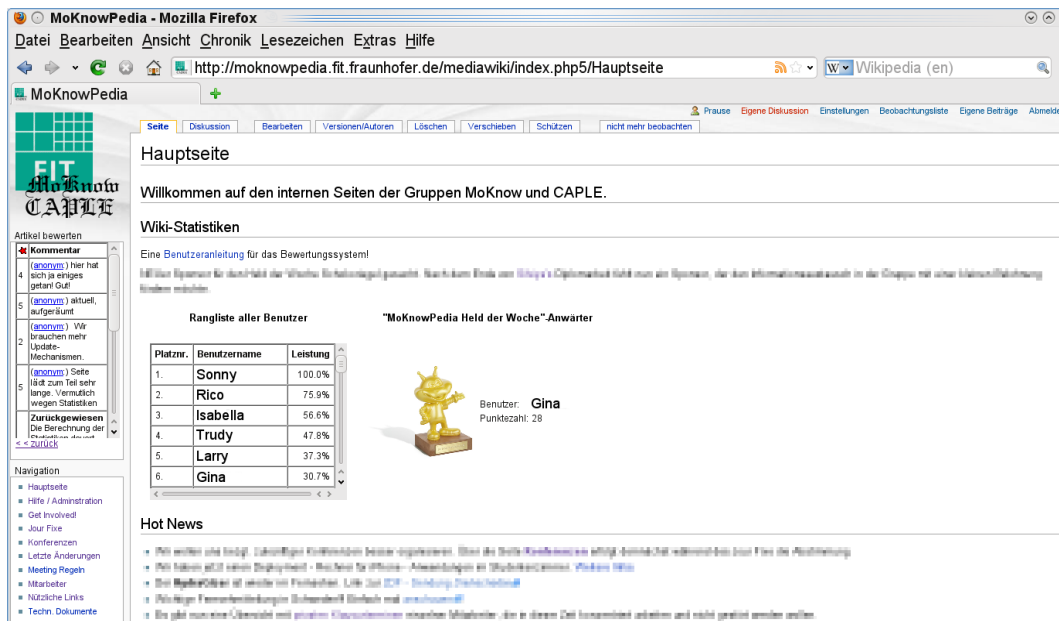


Figure 3. Main page with ranking and hero of the week; review widget shows reviews of article.

users' scores are given as percental value of the top contributor. The right widget shows who has achieved the most points in this week so far, and how many points he has. This is the Hero of the Week aspirant. Any other user that surpasses the aspirant will automatically become the aspirant himself. As long as no user has made at least one point, there is no aspirant.

Once a week, right before the weekly group meeting, the current aspirant becomes the Hero of the Week. The new hero is automatically announced via email on the group's mailing list. Additionally, he receives a chocolate bar during the meeting. After this, the aspirants are reset, so that for the next week everybody has the same chance of being the aspirant and becoming Hero of the Week.

Figure 4 displays a cutout of the MOKNOWPEDIA's user page. This page lists all members of the work group and links to personal introductory pages. Every user entry uses a MediaWiki template to standardize the presentation form. The template has been extended to include a widget that will show each user's reputation level.

## Evaluation

We evaluated our concept in a field-test that would last for several months. This section describes the approach, reports our findings, and interprets results.

### Approach and threats to validity

The evaluation serves the purpose to find out, if enhanced MOKNOWPEDIA satisfies our six goals. However, the focus of our evaluation is explorative, and on qualitative data and human aspects. We obtained a good impression of the impact of the



preclude that the change in behavior we observed during the evaluation, is not due to some other effect.

## Usage statistics

By analyzing the data in databases and server logs, we compare the four months before the review extensions were added to the four months of the evaluation period. Start of the evaluation period was February 18<sup>th</sup>, 2010.

The number of new article revisions raised from 320 to 517, which is an increase of about 62%. As the four pre-evaluation months span Christmas time, we also compared our evaluation phase to the same period in 2009. Here we found 363 new revisions, which still means an increase by 42%. The average number of characters per article in MOKNOWPEDIA grew from 5324 to 6134.

In addition to an increased number of contributions, we also counted an increased number of viewed articles. MediaWiki counted 176 page views in the four months before the evaluation phase, and 258 views during the evaluation. This is an increment of 47%. The number of page views is lower than that of changes because MediaWiki does not count page views that recur in a short period. We attribute this increment to advertising effects of the MOKNOWPEDIA extensions.

Finally, we wanted to know if users used the review tool actively. After the evaluation phase, we counted 237 reviews in the database. 155 reviews (more than half of all reviews) additionally contained sensible comments. In total, these reviews were submitted by 16 different users. Only one user who had participated for the evaluation's full duration had not submitted a single review.

Even after the evaluation phase is over, MOKNOWPEDIA's review facilities keep being used, and new reviews are being added continuously.

## Results from pre- and post-evaluation interviews

Before and after the evaluation period, the users were interviewed with questionnaires. The next two sub-sections discuss the results of the interviews to evaluate

1. if contents improved, and if the reviewing extensions were accepted,
2. and to gather future design recommendations.

### Quantitative feedback: effects on MOKNOWPEDIA and acceptance

The pre- and post-test questionnaires contained twelve statements to which users should express their degree of agreement on a Likert scale: "fully agree", "agree", "neutral", "disagree", "absolutely disagree". Items 1 to 8 concerned the effect that reviewing extensions had on the Wiki contents. The remaining four items related to the reviewing extensions themselves. Detailed agreement is presented in Figure 5.

Assigning one ("absolutely disagree") to five points ("fully agree") to each user's agreement, an average agreement score is computed. The average agreement of first and second interview can then be compared to see how agreement has



#	Statement	Pts.	Chng.
1	MOKNOWPEDIA is generally attractive	4.0	+0.73
2	The articles in the wiki are substantial	3.6	+0.53
3	The total number of articles is satisfactory	3.3	+0.27
4	The articles are interesting to read	3.5	+0.60
5	The wiki contains important and useful information	4.5	+0.20
6	Article core information is comprehensible and easy to find	3.9	+0.53
7	The treated topics are diverse	4.0	+0.60
8	It is worth using MOKNOWPEDIA	4.1	+0.47
9	A reward motivates me to use the wiki more actively	3.0	+0.47
10	A mechanism to rate the quality of articles is valuable	3.9	+0.53
11	It makes sense to invest time in reviewing and commenting	3.6	+0.80

Table I. User agreement to items in post-test questionnaire.

changed. The texts of the different statements, translated into English, and the associated agreement scores — absolute and relative change between first and second interview — are listed in Table I. The answers substantiate that MOKNOWPEDIA and its contents improved during the evaluation. In the second interview, users disagreed with the positive statements about MOKNOWPEDIA in only seven cases, as compared to 22 before. Many users that were previously undecided, later agreed to positive statements.

Four statements regard the reviewing extensions themselves (see Table I). Before the test, there were several users that were not sure of whether rewards would motivate them (Item 9). Through the test, these users changed to agreement. Also, the number scepticists decreased so that afterwards a slight majority was in favor of the reviewing extensions. However, this statement is still the one with most objection. Similarly, most users initially did not think that they would invest time in writing reviews (Item 11). This has clearly changed towards acceptance: the number of agreeing users grew from four to ten, and disagreeing users decreased from six to two. Although the majority of users agreed from the start that reviewing would make sense, after the test even more agreed (Item 10).

We wanted to know, if the acceptance of the reviewing system was especially high among profiteers. But we found only weak correlations (Spearman rank) between the Items 9 to 11, and the user’s position in the ranking list. The strongest correlation we found was  $r_{Item11} = 0.25$  for Item 11 ( $r_{Item9} = 0.14$ ,  $r_{Item10} = -0.06$ ): Profiteers might be more willing to do reviewing work than others. Yet none of the correlations is significant due to the size of the test set. It could be that there is no relation between profiting from the review extensions and advocating them.

The last depicted item was mixed into the statements as an indicator of a possibly changing response bias. It was intentionally formulated diffuse (*The integration of a reward system into the wiki is interesting.*). The intention was that it could reveal a bias towards giving more positive feedback in the second interview. We observed only a small change in feedback behavior (3.7 points, +0.2), so it seems



## Observations during evaluation phase

This section describes observations that either we ourselves or designated confederates made during the evaluation phase. It is a collection of episodes that clarify the reception of MOKNOWPEDIA in the work group.

**Curiosity** Trudy had missed the meeting in which the MOKNOWPEDIA extensions were introduced. She was curious and went to her colleagues to ask them how she could try the extensions. As the extensions were already installed in MOKNOWPEDIA, she could start using them without problems.

**Missing comment** Gina goes to one of the administrators of MOKNOWPEDIA and complains that somebody gave her article a bad review rating without writing a comment. The administrators themselves could not do anything about it, but after this incident we updated MOKNOWPEDIA to allow rejecting of seemingly unjustified reviews. Yet there were no further incidents like this one.

**First activity** Lou, who was registered in MOKNOWPEDIA but had never written an article before, started to regularly write and review articles. Within one week, he made it from zero points to the fifth position in the rankings. He announced that the extensions motivated him to start contributing to MOKNOWPEDIA.

**Frustration** During the evaluation, Izzy became Hero of the Week several times in a row. This frustrated other users. They complained that there must have been something wrong with MOKNOWPEDIA. As a consequence of this, Izzy deliberately chose to contribute less to give others a chance to earn the title, too.

**Playful competition** Incited by the fact that a colleague had overtaken him in the rankings, Larry went to several colleagues, asking them for hints on how he could quickly gather some more points. They gave him the advice that an easy way to get some points was to write reviews. Within a few hours, Larry reviewed dozens of articles until he had again overtaken said colleague. For the next weeks, he kept an eye on the rankings, watching to remain ahead of that colleague. Although he reviewed articles primarily to get the points, his reviews were fair and contained valuable review comments.

**Anti-hero** Caitlin had been a minor contributor, only contributing what she had explicitly been requested to. She never submitted a review and for a long time none of her articles had received a review, leaving her with zero points. She was proud of being the last one in the reputation ranking with zero points. One day, however, she received a number of points; not because she had done something recently, but because one of her older articles had received a good review. So she came to our office and asked if she could rate her own articles down to get her old position back. We told her that she then would get points for the reviews, what she did not like.



everyone without exceptions, our concept can be considered successful at drawing additional users to MOKNOWPEDIA (G3).

The additional cost of operation of our extensions is negligible. All that is needed is a little more computing power, and a small reward for the Hero of the Week (G4). By its design, our reputation mechanism does not prescribe users what to do; in our implementation, no one is forced to comply and there is no threat or punishment involved (G5). Similarly, we did not record any events that would suggest the existence of undesirable phenomena like rat races, or bullying (G6). Instead, we observed that the reputation system was perceived as fun.

We acknowledge that all six goals are closely related to the subjective value of reputation for the individual. The more reputation is worth, the more efforts will users invest to attain a high reputation (Jøsang et al., 2005). For example, by relying on coercion or higher rewards, and thereby giving up on goals G4 or G5, the value of reputation can be increased. This will lead to greater successes in goals G1, G2 and G3, but at the cost of risking destructive effects (G6).

## Related Work

In social media and the Internet, *quality* is often interchangeably used with trust and credibility. Reputation systems are central to these communities (Jøsang et al., 2005; Resnick et al., 2000). Ordinary wiki software like MediaWiki offers no integrated reputation system. However, the demand for such systems has pushed researchers and practitioners alike to research and develop extensions. Freely available extensions for the MediaWiki software are, for instance, *Review*<sup>4</sup>, which lets logged in users decide if an article is ready to be printed, or *AjaxRatingScript*<sup>5</sup>, where quality ratings from different users are collected and averaged. This approach is quite similar to how we determine article quality, except that it does not consider ageing of reviews.

Wiki extensions that compute reputations for authors are much fewer. The social rewarding extension of Hoisl et al. (2007) is similar to our approach. They determine a score for every author in order to recompense users investing their time and effort contributing to the wiki. However, their approach differs from ours in the way how reputation is computed. They do not make a distinction between article quality and article importance. Also, they calculate responsibility for articles from size differences and passed time instead of considering the authorship of the article's text. Next, they rely on only one social reward: displaying reputation in a ranking list. In their concept, reviewing is not a valued contribution. However, as they have automatic means of assessing article quality, it is not so important for them, too. Hoisl et al. did not test their tool with users, and do not provide experience or evaluation data.

Adler et al. (2008) present a system that computes trust values for articles of the

<sup>4</sup> <http://www.mediawiki.org/wiki/Extension:Review>

<sup>5</sup> <http://www.mediawiki.org/wiki/Extension:AjaxRatingScript>



The idea is that if authors are given something in exchange for high reputation scores, then they will — to further raise their reputation score — try to contribute high quality articles, increase the quality of existing low quality articles, or provide hints for improvement. For the MOKNOWPEDIA, three different social rewarding mechanisms are simultaneously fueled by the reputation scores: a ranking list, a Hero of the Week award, and a level hierarchy. Of these three, the ranking list seems to be the most effective rewarding mechanism.

After installing the reputation system extension in MOKNOWPEDIA, we evaluated its use for several months with two work groups. The goal of the evaluation we conducted was to gather first experiences with such a system. The focus was on qualitative feedback from observations in the field and interviews with users. However, we also collected some hard usage numbers.

All in all, the evaluation results are promising. Not only have the employees accessed the wiki more often, but they have also read more articles, and made more contributions. The quality and quantity of the articles in MOKNOWPEDIA increased. Most users accepted our extensions and enjoyed using them. Some users even made their first contributions because of our system. The trial allayed our initial fear that the system might be misused as a tool for bullying, or be confronted with total rejection.

Besides showing the overall good success of our concept, we inform the design of similar future systems with the findings from our evaluation. The usage observations provide a vivid picture of the social processes. These are complemented by improvement hints gathered through the final interviews.

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