

Evolution of the Coordination of Activities Aimed at Building Knowledge in the Wikipedia Community

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Abstract: The first decade of the 21st century spawned the intense development of online communities of practice. The largest knowledge-sharing communities were formed in several dozen language versions of Wikipedia. Defining rules for cooperation was necessary to ensure the desired content quality created by Wikipedians. It was essential to develop the appropriate initiatives, tools, and space for effective activity coordination within the service. Previous research in this area pointed to the role of leadership, group size, and tools facilitating work automation in creating actionable strategies and in the self-organization of work. This paper aims to characterize the variability in creating new concepts of cooperation in selected language versions of Wikipedia and identify the factors of participating in various forms of cooperation. The author assumes that the greater number of initiatives a user enters contributes to an increase in their overall activity. The research conducted was both qualitative and quantitative. A netnographic approach was used, as well as a statistical analysis of user activity records. Thanks to the netnographic research, the stages of Wikipedia's evolution were identified. Quantitative research has shown a correlation between the number of activity areas (a user's affiliation to WikiProjects) and their overall activity (the number of edits made). A change in Wikipedians' activity style was also observed depending on their seniority on the website. The study's conclusions may be helpful for organizations using crowdsourcing to achieve their own goals.

Keywords: coordination of activities, knowledge management, knowledge sharing, variability in online communities, Wikipedia users

1. Introduction

Coordination of actions and synchronization of attitudes and goals is a common phenomenon in human behaviour (Manc-Bogdańska, 2009; Deutsch, Coleman, and Marcus, 2011). It occurs spontaneously in unorganized crowds, which is described as activating 'swarm mode' when individuals satisfy their need to participate in large events (Haidt, 2014). Belonging to the Wikipedia community can also be considered participating 'in something great.' Some researchers stress that Wikipedia is the biggest project ever created by mankind (Jemielniak, 2013).

There is a clear tendency to 'fork' in Wikipedia, as in other free culture movement projects. Over time, multiple variants of solutions emerge and become different technical and social systems. This is similar to biological speciation, whereby distinct clades evolve. In Wikipedia, the isolating factor that leads to the emergence of diverse collaboration forms is not geographical remoteness, but the different cultures from which Wikipedians are recruited (see: Karczewska, Kukowska 2021).

One element differentiating Wikipedia environments is WikiProjects, which take different forms in different language versions. They are dedicated to particular areas of knowledge or specific tasks performed on Wikipedia. Much of the research to date on collaboration between Wikipedians (Wikipedia contributors) has explicitly focused on the analysis of WikiProjects (see: Forte et al., 2012; Morgan et al., 2013; Platt and Romero, 2018). Other work demonstrates the role of technical support, especially bots, in creating a coordination platform in the Wikipedia environment (Gaio et al., 2009; Müller-Birn, Dobusch, and Herbsleb, 2013).

The afore-mentioned authors focus on self-organization processes, the relationship between social factors and work efficiency, and the role of automation in improving collaboration between Wikipedians. However, a synthetic approach showing changes in forms of activity coordination is missing, especially taking language versions other than English into account. This paper aims to present Wikipedia's evolution concerning work coordination and indicate the relationship between Wikipedians' activity and their participation in work coordination through their involvement in WikiProjects. The paper then reviews the literature on work coordination, mainly concerning the functioning of WikiProjects. The methodology covers qualitative and quantitative research, as well as the research hypotheses and data collection method. The research results identify the Wikipedia environment evolution stages and verify the assumed hypotheses.

2. Literature review

When many social initiatives emerged online at the outset of the 21st century, it was assumed that spontaneously forming crowds would become increasingly important in creating and disseminating knowledge. However, it turned out that in Wikipedia, shapeless groups quickly transform into organized communities (see: Dobusch and Kapeller, 2017). Communities, unlike crowds, create networks between users who often interact with each other and consciously build joint action strategies. While openness and transparency foster greater engagement in coordinating the actions of many individuals, they can also lead to increased tensions. In turn, the occurrence or levelling of tensions depends on the fit of the joining novices and configurations of strategizing practices (Felin et al., 2017, p. 172 after Dobusch and Kapeller, 2017). It results in the constant negotiation of action strategies. Some researchers note that a small minority of the most entrenched users control adherence to the rules, which are often unavailable to novices (Shaw and Hill, 2014; Gilbert and Zachry, 2015).

The users' knowledge is essential for coordination in terms of what actions to take to adapt their competencies and interests to the current community needs (Forte et al., 2012). In order for this knowledge to be shared effectively, some Wikipedians need to give up content creation in favour of coordinating the activities of others. Collaborative tools are developed globally at the MediaWiki software level, in local Wikipedia language versions, or at the WikiProjects theme level (see: Morgan et al., 2013). Some of them make it easier to perform actions (e.g., adding footnotes), while others facilitate the identification of problematic behaviour (vandalism, spam). They not only contribute to greater efficiency, but become integral to the core user experience (Geiger, 2014; Gilbert and Zachry, 2015).

There are two types of coordination mechanisms in peer production communities. The first concerns the effective communication of social information, e.g., regarding rules and procedures. The second type is algorithmic mechanisms, understood as the transformation of formal or informal rules into algorithmic instructions executed by bots or scripts. Algorithmic mechanisms can be scalable and limit arbitrary behaviour, while social mechanisms can cope with exceptional situations better. Edits performed by automata are generally not challenged by community members (Geiger, 2011; Müller-Birn, Dobusch and Herbsleb, 2013).

Depending on the type of task and the size of the group, the costs of cooperation increase. This can lead to results that are much weaker than expected. According to Brooks's Law, adding manpower to a delayed software project makes it more delayed (Brooks 1975 after Kittur, Lee, and Kraut, 2009). If a task is performed independently of others, an increase in the number of project members does not increase coordination costs, but they become larger as such dependencies increase. In Wikipedia, previous studies have shown that simple tasks attract more people and produce good results for low coordination tasks. In the case of high coordination tasks, the benefits occur for small teams. (Kittur, Lee, and Kraut, 2009).

The issue of community dispersal is also problematic for coordination in online communities of practice. The lack of formal guidelines on how to perform work limits the effectiveness of self-organized groups. Frequent contact between individuals is essential here. However, the dominant forms of communication are asynchronous, leading to misunderstandings. As a result, discontinuity problems are common, and initiatives are abandoned as a result (see: Armstrong and Cole, 2002; Watson-Manheim, Chudoba, and Crowston, 2012; Rezgui and Crowston, 2018).

There is no clear link between belonging to a WikiProject and the type of work carried out - creating content or coordinating the work of others. Only a minority of WikiProjects contain groups of closely cooperating users, often coordinating activities and jointly editing the content of encyclopedia articles concurrently. In most cases, interaction is the responsibility of a small subgroup within the larger WikiProject community, which participates less in terms of creating article content (Morgan et al., 2013).

The collaborative literature lacks a broader view of Wikipedia as an evolving socio-cultural system. Making statements about change occurring is insufficient to accommodate such an approach, but there is also a need to identify what the evolution is acting upon. Concerning management, Nelson and Winter (1982) found that the primary element that would need to be studied in work organization evolution is that of routine activities. Stańczyk-Hugiet, Piórkowska, and Stańczyk (2016) point out that issues concerning optimizing an organization's strategy, life cycle, and adaptation to its environment are also studied in this area. In Wikipedia, it is impossible to easily categorize activities in terms of co-created content. Instead, user activity logs can be used, while also

broken down by type and activity area. In the context of activity coordination, the editing frequency of pages related to the meta-space (where public discussions often take place) and WikiProjects (if there is a dedicated meta-space in a given language version) can be taken into account. Wikipedia pages that are not articles, depending on their function, are located in different namespaces, and their titles have specific prefixes (e.g., Wikipedia: or WikiProject:). In this article, the author focuses on a descriptive account of the evolution of forms of coordination, as well as on a quantitative account of the variation in meta-space and WikiProject space editing by individuals claiming affiliation with WikiProjects.

3. Methodology

To examine the evolution of coordination in Wikipedia, both qualitative and quantitative research methods were used. The qualitative research was netnographic by nature (see: Kozinets, 2010). It included systematic participant observation that has been carried out since 2005, mainly on the Polish-language Wikipedia, and discourse analysis on Wikimedia projects. Regarding forms of coordinating work, the observation also included several of the major language versions. Participation meant taking an active part in editing pages, undertaking and initiating discussions on collaboration issues, as well as co-creating collaboration strategies. In addition, notes were kept on field research, and documentation was collected to track significant changes in Wikimedia (see: Skolik, 2014). This approach made it possible to outline the evolution of coordination forms in Wikipedia and formulate research questions and hypotheses.

The quantitative research was conducted in February and March 2022. The author posed the question as to whether the style of user activities changes with Wikipedia's development. In addition, he wanted to find out whether participation in more WikiProjects translates into overall user activity and user activity related to the activity coordination.

In order to answer the questions put forward, the following hypotheses were formulated:

H1. The more WikiProjects a Wikipedian participates in, the greater their overall activity on Wikipedia. Wikipedians, as volunteers, decide for themselves what they want to do and how often they edit on Wikipedia. Not all active users even belong to WikiProjects. The number of activity areas should therefore not affect the overall activity. However, declaring participation in more WikiProjects may increase intrinsic motivation to edit.

H2. The more WikiProjects a Wikipedian participates in, the higher their activity in WikiProjects relative to their overall activity.

Declaring an activity in a WikiProject may involve more of a commitment to coordination. This generally means higher costs for creating encyclopaedia content due to the need to coordinate activities with other WikiProject members.

H3. Wikipedia editing style changes over time which is evident in the editing statistics of Wikipedians from different "generations."

With the experience of the whole community, new rules of operation are developed, translating into changing forms of cooperation. New solutions may be more attractive to newcomers than people who are used to older arrangements for coordinating work.

People who declared such participation on their own user pages were selected as participants of the WikiProject. An alternative way would have been to choose people who had signed up for a particular WikiProject, but indicating this on one's own page was considered a more straightforward declaration of participation. The number of edits made was taken as an indicator of Wikipedians' activity. Overall activity, in this case, means the number of all edits made by a user. Edits refer to the creation and modification of Wikipedia page content. Changes in the average number of all edits, edits in meta-space and edits in WikiProject space were taken as changes in editing style. Wikipedians who set up their user pages in five-year periods were arbitrarily chosen as the generation, starting with the first to declare themselves as members of WikiProjects. The creation of a user page indicates a stronger connection with the community.

The selection of language versions for the quantitative study was carried out in several stages. First, versions were selected in which declarations of WikiProject affiliation on Wikipedia pages could be easily identified. A particular category existing in 34 language versions (*Wikipedians by WikiProject*) was used for this purpose. In the next step, the language versions of Wikipedia in which a WikiProject space existed were selected: Spanish,

French, Esperanto, Polish, Korean, Japanese, and Romanian. Due to the time-consuming nature of acquiring results, three of them were chosen for further research: Polish (plwiki), Korean (kowiki), and Romanian (rowiki), which belong to different language families. The PetScan tool generated data on user pages containing declarations of affiliation with WikiProjects. For plwiki, there were 2337 users, for kowiki 839, and rowiki 88. The final step in the data collection was to check how many WikiProject affiliation statements were on each user page, how many edits each Wikipedian had made, and to categorize the selected Wikipedians in terms of their affiliation to a 'generation.' XTools was used to count the number of edits made by a given user.

4. Results

Based on netnographic research, including multi-year participant observation, several phases in the evolution of forms of activity coordination on Wikipedia have been identified:

2001 - 2004: solution testing phase. Initially, coordination took place through user pages and external communication channels. Subsequently, meta spaces and discussion pages were assigned to each namespace. Some meta-pages were used to discuss the whole project or specific processes, e.g., discussions on deleting articles. Others were used to develop tutorials, policies, and guidelines, which were copied and used in different language versions. Communities tested the capabilities of wiki software in the context of collaborative work. The first wiki-projects in meta-space were also started (e.g., *Wikipedia:WikiProject Biography*).

2005 – 2008: phase of increasing diversity. In some language versions, a separate namespace was created for the WikiProjects (e.g., *Wikiprojekt:Biografie* in the Polish-language version). This was a time of intensive development of many areas of collaboration and recruitment of new Wikipedians. Forking tendencies were more prevalent in different collaboration rules, policy modification, specialized guidelines, and locally created tools (e.g., scripts). Such trends were also apparent in different patterns of collaboration within WikiProjects.

2009 - 2012: stagnation phase. Wikipedians had previously created new initiatives assuming that they would be sustainable. After 2008, the rapid growth in the number of edits and users broke down, and a phase of stagnation ensued. There were far fewer new initiatives, and some of the old forms were being phased out. In addition, it became more challenging to modify previously adopted rules, even if the communities admitted that they were flawed.

2013 - 2017: institutional support phase. There was the institutionalization of procedures for recruiting and motivating participation. Cooperation with external cultural and educational institutions for knowledge sharing became more frequent. Volunteers recruited from such institutions joined task forces that were poorly integrated into the Wikipedia communities. The gradual disappearance of activity in WikiProjects could be observed. Previously initiated spontaneous and short-term actions to develop a given area of knowledge turned into cyclical events.

From 2018: Formalization phase of the cooperation strategy. An institutional selection of initiatives that could receive further support from the Wikimedia Foundation, which looks after the projects, became apparent. There was some sustainability for those initiatives that had previously been explicitly formalized, e.g., in the form of interface changes. A global strategy for the Wikimedia movement began to emerge and values characteristic of corporate cultures began to be adopted. At the same time, spontaneous grassroots actions began to disappear.

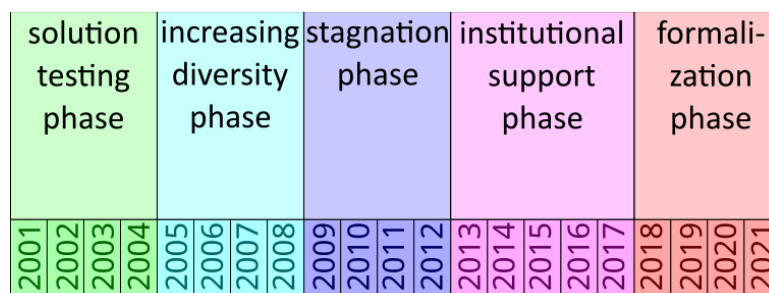


Figure 1: Timeline of the evolution of forms of activity coordination on Wikipedia

In parts of the quantitative research, the assumed hypotheses were verified. Data was collected from three language versions with a separate namespace for WikiProjects. It was also possible to identify Wikipedians

declaring participation in WikiProjects on their user pages. In plwiki, the namespace for WikiProjects was separated in 2007, while categories for WikiProject participants were created in 2006. In kowiki, the corresponding years were: 2011 and 2014, and in rowiki: 2007 and 2012. During the course of data collection, it was noticed that in the Polish and Korean language versions after 2010, WikiProjects created for cooperation with educational institutions appeared several times. Relatively many participants were enrolled in them, but their activity was low.

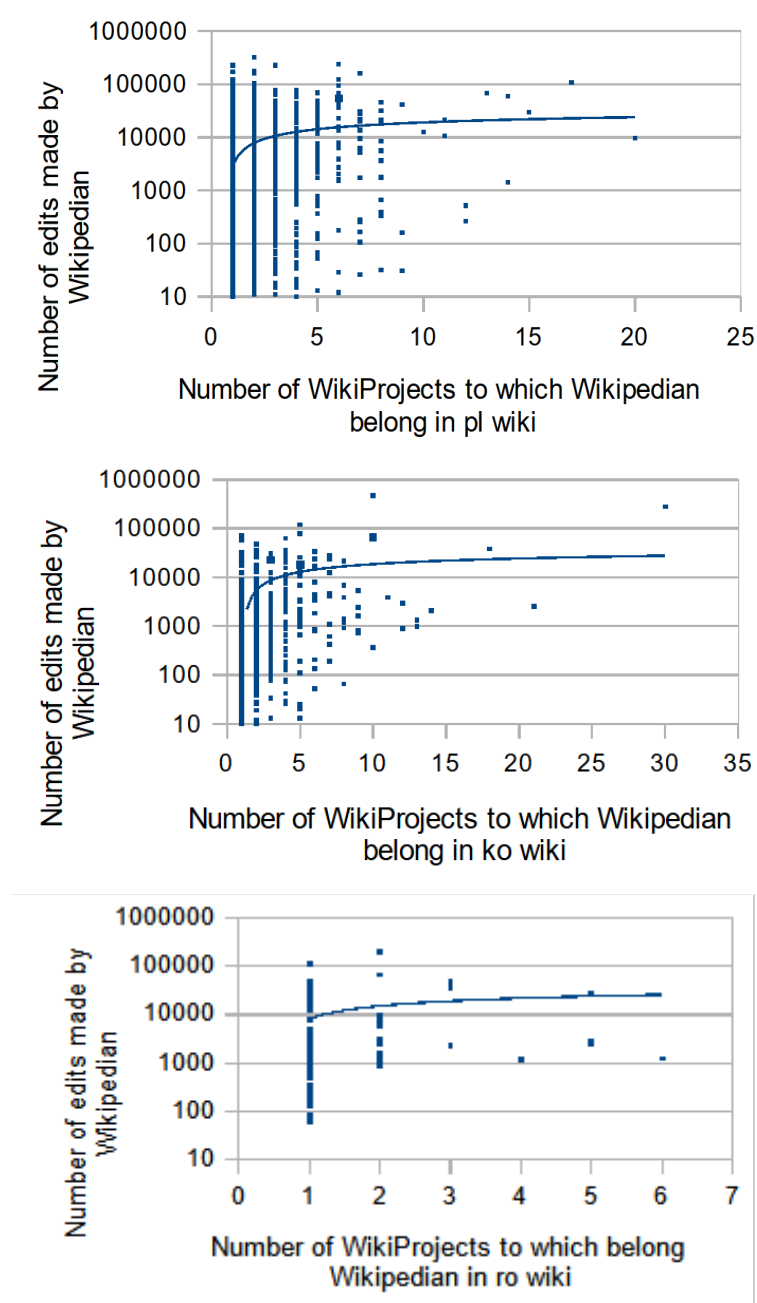


Figure 2: The relationship between the number of WikiProjects to which Wikipedians belong and the number of edits they have made. The data refers to users who have made a minimum of 10 edits in plwiki and kowiki (top two graphs) and a minimum of 50 edits in rowiki (bottom graph)

To verify H1, the correlation between the variables was calculated: (1) the number of WikiProjects to which Wikipedians belonged according to declarations on user pages and (2) the number of all edits made by them that were not deleted. As expected, there was a positive correlation between these variables for $p < 0.05$, verifying H1. In plwiki, Spearman's rho correlation equals 0.327 for all users surveyed, 0.325 for those who made a minimum of 10 edits, and 0.325 for Wikipedians with a minimum of 50 edits. In kowiki, these values were 0.410; 0.393 and 0.350 respectively. In rowiki, the correlation's strength was the highest at 0.640 for all surveyed users

and 0.400 for Wikipedians, with a minimum of 50 edits. It is noticeable that the strength of the correlation was moderate and decreased as Wikipedians' activity increased. The logarithmic regression curves for these variables are shown in Figure 2.

To verify H2, the author examined the correlation between the variables: (1) the number of WikiProjects to which Wikipedians belonged, according to declarations on user pages, and (2) the ratio of the sum of edits they made in the WikiProject space and in the WikiProject discussion space to the number of all edits they made. Significant correlations were found only in the Romanian-language version of Wikipedia. In this case, Spearman's rho correlation equals 0.642 for all subjects and 0.302 for Wikipedians who made at least 50 edits. No statistically significant correlations were obtained for participants in the Polish and Romanian language versions of WikiProjects. In spite of the significant correlation between variables, in rowiki H2 was rejected. Declaring participation in a more significant number of WikiProjects may therefore affect the total number of edits made, but does not necessarily translate into greater involvement in coordinating activities.

In order to verify H3, descriptive statistics were compared for four variables concerning an arbitrarily selected four 'generations' of Wikipedians. These variables were as follows: (1) the number of total edits made by individual Wikipedians, (2) the number of edits made by them in total in the WikiProject space and in the WikiProject discussion space, (3) the number of edits made by individual Wikipedians in the meta-space, and (4) the proxy of edits in the WikiProject relative to the total number of edits made by individual Wikipedians. The edits of Wikipedians declaring affiliation to Polish and Korean language WikiProjects were analyzed. The differences between the number of edits in subsequent generations are presented in box plots (Figures 3 and 4).

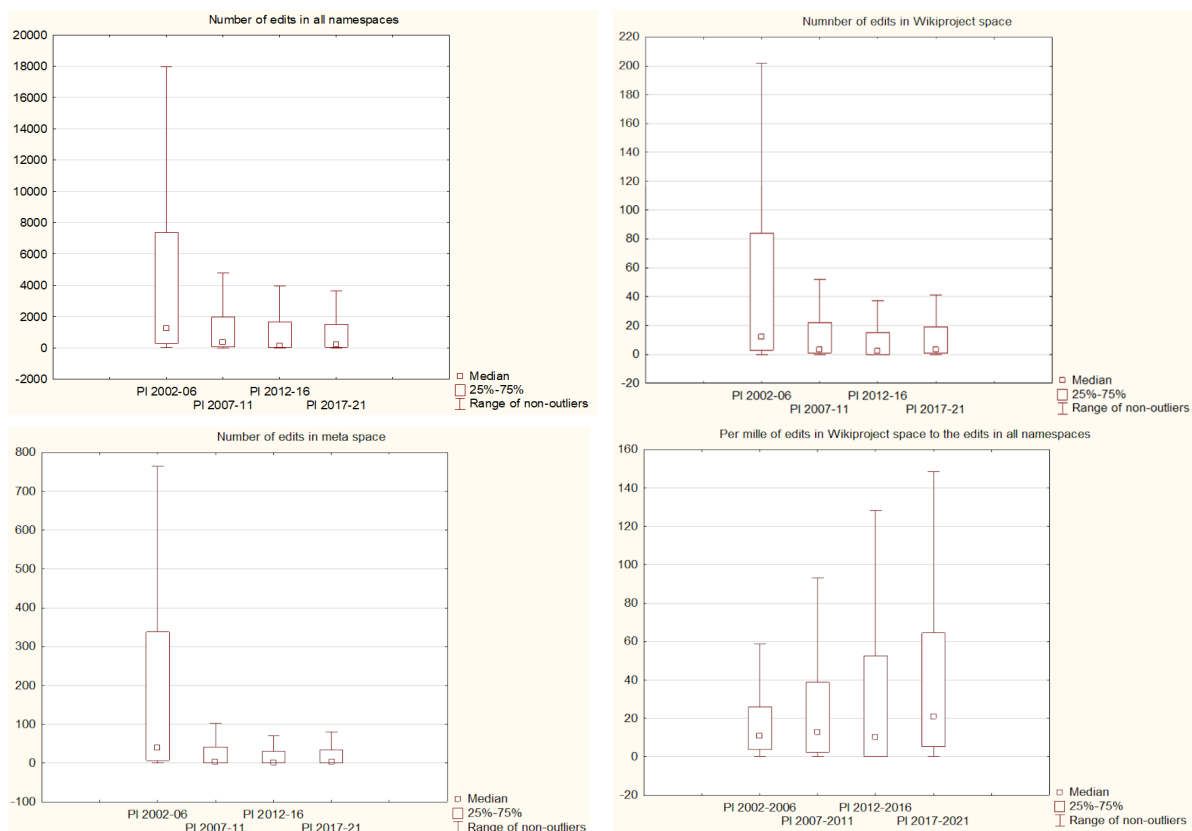


Figure 3: Changes in editing style across generations of plwiki users. Box plots show the total number of edits, the number of edits in WikiProjects, the number of edits in meta-space, and the number of edits in WikiProjects.

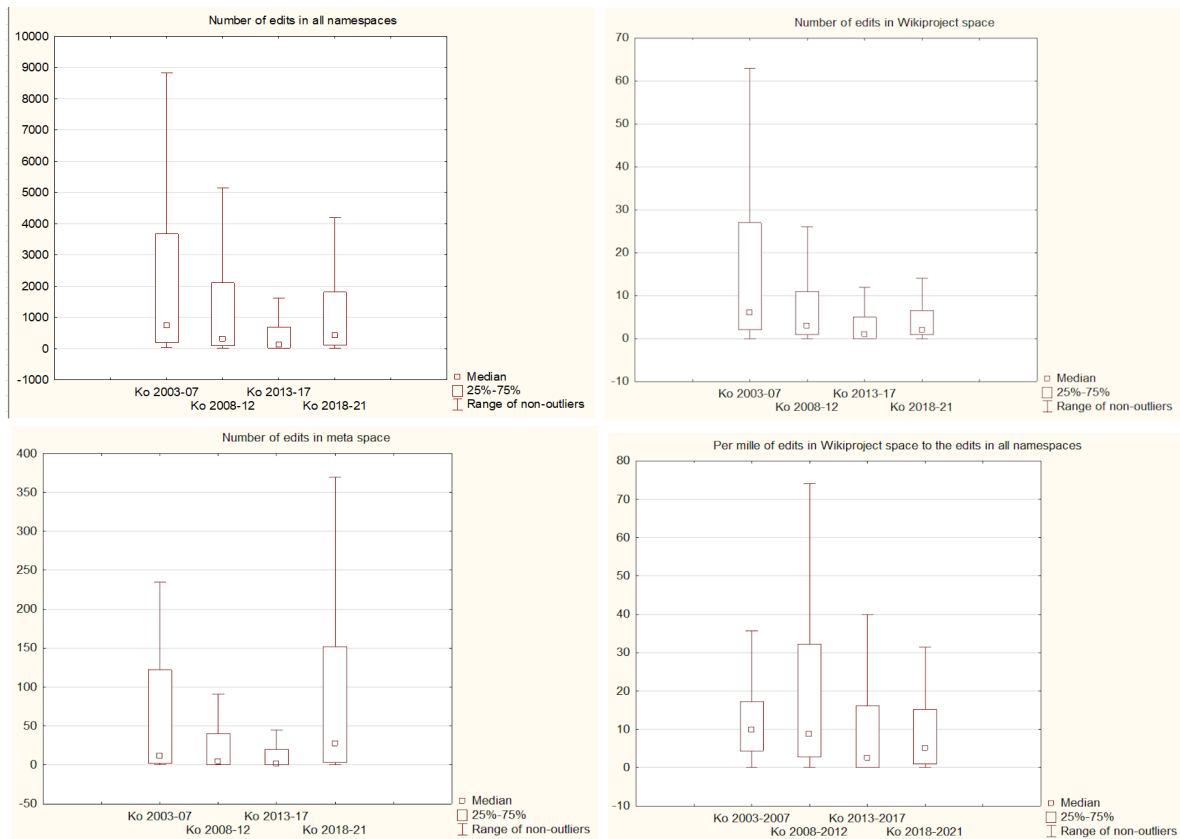


Figure 4: Changes in editing style across generations of kowiki users. Box plots show the total number of edits, the number of edits in WikiProjects, the number of edits in meta-space, and the number of edits in WikiProjects.

Most of the participants in the WikiProjects belonged to the second generation. In plwiki, it was 1225 people, while in kowiki 363, which represented almost half of the respondents in both cases. In contrast, people from the first generation were the most involved. They made the most edits, including edits in meta-space and in WikiProjects. However, this did not translate into the proportion of edits related to coordinating activities. In the Korean version, the ratio of edits in WikiProjects to the total number of edits was slightly higher in the first two generations. In plwiki, it increased with each generation. The accepted hypothesis can be verified positively, however partially. In plwiki, there is a clear difference between the involvement of the first and subsequent generations. In kowiki, there is a downward trend and a renewed increase in commitment in the last generation.

5. Discussion

Performing quantitative research using a netnographic approach allowed the author to capture the relationship between diversity and engagement. Less variety in the forms of collaboration may have weakened the motivation to act among users. The increase in the number of WikiProjects to which Wikipedians belonged encouraged their greater activity. At the same time, the creation of new forms of collaboration decreased from 2009 onwards, with some initiatives subsequently dying out.

Greater diversity may initially have been associated with spontaneity in creating new initiatives. Over time, the technostructure expanded, and the personal stake in engaging internet users to collaborate shifted to automated and templated messages. Gaio et al. (2009) hypothesized that template messages posted to articles and prompting people to edit were a fundamental coordination mechanism. However, they were often treated as unnecessary embellishments outside the English language version and were gradually eliminated in some language versions. Similarly, the assumption of Müller-Birn, Dobusch, and Herbsleb’s (2013) that bot edits are not challenged because adverse reactions to their actions are not visible would have to be rejected. This is more a result of trust in the bot operators rather than the bots themselves, which by default are not visible in the changelogs. On more than one occasion, however, users expressed a lack of trust in particular bot operators.

Stagnation was associated with the habits of using developed forms of collaboration. Thus, tensions between newly joining users and practices developed by active users (Dobusch and Kapeller, 2017) are not unique to describing coordination problems. Furthermore, the emphasis on facilitating activities for newcomers leads to changes in such practices and interface changes, which creates tensions between active users and the initiators of such changes.

The reduced activity among the next generation of Wikipedians surveyed may have been related to the problem of control over the results of activities in individual WikiProjects. The need for greater control necessitated spending more time on preparation and, as a result, dampened enthusiasm for the tasks. Over time, regular campaigns with simple, easily controlled tasks became more popular than regular WikiProjects. When several actions were organized simultaneously, only a few people participated in each of them. This resulted in lower efficiency as Kittur, Lee, and Kraut (2009) showed that simple tasks work better when more people are involved.

Limiting activity among subsequent generations of the surveyed Wikipedians may have been associated with the problem of controlling the results of activities in individual WikiProjects. Newcomers have to master rules that were created by previous generations. Goldspink (2009) argued that user engagement is less influenced by reputation and more by identification with the community and values. Nevertheless, these observations applied to Wikipedians who were active until 2009 and participated in creating the rules. After that, it was more common for users to use their own pages to brag about their achievements, which fostered competition rather than cooperation.

The quantitative research results presented here concerned a narrow scope of activity. It concerned editing pages dedicated to coordination activities, namely WikiProjects and meta pages. Not every such edit had to be associated with a coordination activity, and coordination itself may also manifest itself in undertaking discussions in other namespaces. The hypotheses adopted require further verification, involving more language versions of Wikipedia.

6. Conclusions

Based on the research conducted, a conclusion may be drawn about the relationship between the diversity of coordination forms and motivation to work. If the total number of edits increases with the number of projects to which a Wikipedian belongs, a decrease in the number of active WikiProjects may contribute to a reduction in the motivation to work. A large variety of choices of work to be done may engage people more effectively in the action at hand.

Although the non-professional knowledge workers on Wikipedia are volunteers, over time, they may develop an inner compulsion to continue what they have started or even a form of editing addiction. Routine activities may compensate for the lack of spontaneous approaches to co-creation that characterized the early stages of the project's development when there was a high level of approval for testing. When a systematic approach is widespread, it is easier to impose rules close to those of formalized organizations.

The hypotheses posed have been partially verified and are insufficient to generalize conclusions in terms of the entire population. Their confirmation in a larger number of language versions would require much more time for data collection and analysis, but also the involvement of social experts operating in different language versions of Wikipedia.

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