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Contributors to Open Collaboration Communities: The Role of Content's Quality Signals

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Abstract

Open collaboration communities (OCCs) allow diverse contributors to participate in creation, management, and use of content that is freely accessible. While OCCs have been critical to enterprise and consumer software, recent advancements in large language models that are supported by data from OCCs further highlight their importance. Research on OCCs have considered the influence of multiple factors (such as individual motivations and external factors) on number of contributors to OCC. However, the influence of OCC contents' quality signals on contributors is unknown. This research considers three related but distinct questions: (a) how does improvement signals influence the number of contributors to OCCs? (b) how does deficiency signals influence the number of contributors to OCCs? (c) how does quality signals of improvements and deficiencies influence the number of contributors to OCCs? We use data from GitHub to create a yearly panel with more than 1 million year-project observations. We find that (a) improvement signals are positively related to the number of contributors, (b) deficiency signals are positively related to the number of contributors, and (c) improvement and deficiency signals interact to negatively influence the number of contributors. This study contributes by considering the effect of OCC contents' signals on the number of contributors. We conclude with discussion of findings' implications for practice and research in open collaboration communities.

Keywords

Open collaboration community, peer production, open source software, GitHub, quality signals, panel data

Introduction

Contributions by individual contributors are critical to sustain and build OCCs' resilience (Boh et al., 2023). Prior work has considered multiple factors that influence contributions to OCCs. However, the role of contents' quality signals on contributors' contribution is unclear. Our study addresses this gap by considering three related but distinct questions: (a) how does improvement signals influence the number of contributors to OCCs? (b) how does deficiency signals influence the number of contributors to OCCs? (c) how does quality signals of improvements and deficiencies influence the number of contributors to OCCs?

Theory and Hypotheses

We adopt a signaling perspective (Lerner and Tirole 2002; Setia et al. 2020; Spence 1973) to understand how OCC content addresses the information asymmetry between contributors and the projects. The signaling perspective suggests that market participants use signals to reduce information asymmetry (e.g., a high-quality prospective employee may distinguish themselves in the job market via higher education—a signal). In case of OCC platforms, content artifact use signals to differentiate themselves from other content on the platform.

OCC signals can broadly be classified as static and dynamic. Static signals are content characteristics that seldom change such as topic, inception, or owner characteristics, among others. Dynamic signals change with content's evolution to demonstrate content's state and progress dynamics.

Examples of dynamic signals include quality issues, improvements that lead to content maturity, among others.

We focus on two types of dynamic signals that OCC content emits: improvement signal and deficiency signal. *Improvements* to OCC content signal progress towards the final goal. For example, in case of question and answer platform, candidate answer(s) signal progress towards identifying the desired solution. Deficiencies in OCC content signal challenges associated with convergence to the final solution. For example, in case of open source software projects, issues logged by platform users suggest bugs and/or feature requests that need to be addressed.

Hypotheses

Signals of improvement and deficiencies are hypothesized to influence contributors to OCC content in the following way.

Hypothesis H1: In open collaboration communities, improvement signals are positively related to the number of contributors.

Hypothesis H2: In open collaboration communities, deficiency signals are positively related to the number of contributors.

Hypothesis H3: In open collaboration communities, signals of improvement and deficiency are negatively related to the number of contributors.

Method

Data, Variables and Results

We collect data from GitHub, a popular platform to host open source software (OSS) projects, for yearly contributors to OSS projects. The unbalanced panel dataset consists of 1.04 million project-year observations spread across years 2015 to 2019 (inclusive of both years). Our unit of analysis is the OSS project. We measure the dependent variable **Contributors** as the unique number of users on the GitHub platform that contribute *code* to a focal OSS project. We consider two key independent variables. First, **improvement signal** is measured as the number of releases by the focal OSS project in a year. Second, we measure **deficiency signal** as the number of issues that are identified for the focal project.

	(1)	(2)
	Contributors	Contributors
Releases (<i>Improvement signal</i>)	0.0425*** (0.00120)	0.0661*** (0.00137)
Issues (<i>deficiency signal</i>)	0.0191*** (0.000234)	0.0206*** (0.000247)
Releases x Issues		-0.00166*** (0.0000621)
Watchers	0.000629*** (0.000106)	0.000537*** (0.0000684)
Organization Owner		
Original Project		
Constant	0.217*** (0.000521)	0.212*** (0.000542)
R^2	0.1555	0.1592
F-statistic	6482.07***	5131.66***
Observations	1,028,727	1,028,727

Table 1. Results

Discussion

Findings and Contributions

Our study has two main contributions to the study on OCC. First, prior work on contributions to OCC content has identified numerous factors that influence contributors' decision to contribute. Broadly, these factors are classified as internal and external factors. Internal factors relate to the contributor's intrinsic and extrinsic motivations to contribute (Von Krogh et al. 2012; Wasko and Faraj 2005), whereas external factors relate to events such as economic shock or health-related challenge (Kummer et al. 2020; Malgonde et al. 2022) that have an influence on the focal contributor. Our research contributes to the external factors by highlighting the role of OCC content's quality signals on contributors' decision to contribute. Specifically, although we find that improvement and deficiency signals increase contributors, interaction between these signals may lead to decrease in contributors.

Second, our theorization related to the effect of quality signals on contributors is supported by data from two OCC platforms—OSS projects and technical question and answer platform. In addition to generalizability of our findings, consistent results across these platforms highlight the nuanced effect of quality signals on contributors. Specifically, the lifecycle of a technical question (few days) is likely to be shorter in comparison to OSS projects (few years). Our empirical results (Tables 3 and 6) suggest a larger effect of quality signals on technical question platform in comparison to the OSS platforms. Consequently, the dynamics of OCC content's quality signals play out quicker in OCC contexts with shorter duration. These findings have important implications for research on OCC where a portfolio of factors interact with context specific attributes to determine contributions.

Conclusion

With its rich history of supporting enterprise and consumer systems, and knowledge exchange, OCC platforms have gained further prominence with their importance for recent innovations related to large language models. A central tenant of OCC platforms is contributions by community members. This research highlights the role of OCC content's quality signals on contributors. With empirical support from two OCC platforms, we find that improvement signals are positively related to the number of contributors, deficiency signals are positively related to the number of contributors, and improvement and deficiency signals interact to negatively influence the number of contributors.

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