Investigating the Key Factors Influencing Software Developer Productivity in Developing Regions

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Abstract: Software developer productivity is a critical factor influencing the efficiency and success of software projects. However, understanding the key factors that impact developer productivity remains a challenge, particularly in region-specific contexts such as Bangladesh. This study aims to identify the primary factors affecting developer productivity and analyze how these factors vary across companies and experience levels. To achieve this, a survey was conducted among software developers working in Bangladesh. The survey was sent out to 168 software developers working across 38 different software firms. The survey yield 44 responses. Statistical analysis was employed to determine the the most influential factors. The findings suggest that autonomy in decision-making, task variety, and using the best practices, software and tool are the strongest factors affecting productivity. While some factors, such as task variety, remain consistent across companies, others, such as remote work policies and communication styles, vary significantly. Additionally, beginner developers prioritize learning and tool adoption, mid-level developers face challenges with tight deadlines, and senior developers focus more on leadership, collaboration and decision-making autonomy.

1 INTRODUCTION

Software development plays a crucial role in the global economy these days with productivity being one of the key factors that determines both the individual and organizational success. Over the years the IT sector of Bangladesh has seen significant growth, making developers productivity a critical area of focus. Understanding the factors that affect a developers productivity can help address challenges that are unique to the region and enhance the performance of the industry as a whole. Despite the many studies being conducted to understand and improve the productivity of developers, challenges remain in applying these insights to region-specific contexts like Bangladesh. Developers often face unique challenges related to work environments, emotional well-being, and technical constraints. The surroundings of a developer such as the physical environment, good decoration of the office with furniture, desk space and work area all play a crucial role in determining the productivity of developer and the outcome the organization receives (Johnson et al., 2019).Whether developers are working remotely or on-site their physical environment has a significant impact on their productivity (Bao et al., 2022). Whether the impact is positive or negative depends on many factors such as age of the developer, size of the project, the programming language or tech stack used in the project. Software development is a field that requires creativity and problem-solving abilities and having a positive mindset, emotional well-being and good mental health enhances the productivity of a developer (Girardi et al., 2021). Also, there is a positive correlation between developers perceived productivity and job satisfaction. Developers who are satisfied with their job and feel that they have positive and meaningful contribution on their organization or field of work tend to be more productive (Storey et al., 2019). Establishing an organized process and utilizing appropriate tools and techniques can significantly improve developer productivity (Meyer et al., 2019) (Obi et al., 2024). In recent days we have seen an advancement in AI tools and technologies, there is no doubt these AI tools has also shaped and had a significant impact on the software industry and it's developers. Using AI tools like GitHub copilot helped significantly enhance developers productivity (Smit et al., 2024) (Coutinho

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et al., 2024).

The existing studies primarily focus on global trends and large multinational corporations, leaving gap in understanding how these factors manifest in emerging markets like Bangladesh. Bangladesh is a relatively small country with an growing IT sector, characterized by many small to medium sized software firms. These organizations typically tend to operate with compact teams of 10-15 developers in contrast to a more larger and structured team composition seen in large organizations. Our study aims to identify and analyze the key factors affecting the productivity of software developers in Bangladesh.

To achieve this, we address the following research questions

RQ1: What are the primary factors affecting the productivity of developers in Bangladesh?

The primary objective of this research question is to identify the primary factors that significantly contribute to software developer productivity. By analyzing survey responses, we aim to determine which aspects, such as- skill level, decision-making autonomy, access to tools, and task variety-developers perceive as having the greatest impact on their efficiency and job performance.

RQ2: How do these factors vary across different companies?

This research question aims to examine how productivity-related factors vary across different companies. Organization differ in terms of work culture, team structure, project management approaches, and available resources, all of which may influence developer productivity. By analyzing response from developers working in different companies, we aim to uncover patterns in how company specific environments shape productivity. This insight can help business identify best practices and optimize their internal process to better support developers.

RQ3: What predicts productivity across experience levels?

The goal of this research question is to explore how productivity factors vary across different experience levels. Developers at different career stage may prioritize different aspects of their work, such as skill development, autonomy, or collaboration. This question examines how experience level influences the perception of productivity factors, helping organizations tailor their work environments, training program, and project assignments to meet the evolving needs of junior, mid-level, and senior developers.

By addressing these research questions, this study provides valuable insights into how software development productivity is influenced by individual, organizational, and experiential factors. These findings can help companies develop targeted strategies to enhance both developer efficiency and job satisfaction.

Our results suggest that task variety, complex problem-solving, high-skill requirements, using and seeking out the best tools and practices, and allowing developers autonomy in choosing their methods to complete work are the strongest factors influencing the productivity of software developers in Bangladesh. Additionally, our findings indicate that task variety is a common characteristic across all software companies, regardless of size or structure. Moreover, developer priorities evolve with experience. Beginner developers primarily focus on learning and skill development, actively seeking tools and best practices to enhance their efficiency. Mid-level developers face increased pressure from tight deadlines and the complexity of their tasks, balancing growing responsibilities with technical challenges. In contrast, senior developers emphasize leadership, teamwork, and decision-making autonomy, reflecting their greater experience and strategic role in guiding projects and teams.

This study contributes to a deeper understanding of the factors that influence developer productivity in Bangladesh. By analyzing how these factors vary across different career stages, we provide tailored insights that help organizations implement strategies to enhance productivity at each stage of a developer's career.

2 LITERATURE REVIEW

2.1 Work Environment

The physical environment and communication with the team and lead has a noticeable impact on the output and the productivity of a developer (Johnson et al., 2019). Using a mixed method of survey and interviews on 1,159 participants the study found several factors that are important for work environment: room composition and atmosphere, work area and furniture, work-related environmental affordances, personalization and social norms. Working From Home (WFH) has both negative and positive impact on developers (Bao et al., 2022). The study conducted a quantitative analysis on the developers of Baidu Inc, one of the largest IT companies in China. Of the 1103 records submitted by the developers, the findings indicate that work from home (WFH) impacts projects differently based on various characteristics such as programming language, project type, team size, and project age. Developer often work in dynamic team structure, which influences team awarness and makes

it more challenging to assess overall team productivity (Ruvimova et al., 2022). The study examined 624 daily surveys and 2,899 self-reports collected from 25 individuals across five software teams in North America and Europe over a three-month period. The study suggest that how productive a developer feels individually is the best indicator of how productive they think their team is.

2.2 Tools and technical factors

Meetings and interruptions are generally considered unproductive during the development phase, however they play a constructive role during planning, specification and release stages of a project (Meyer et al., 2019). The study conducted a survey with 5971 responses from professional Microsoft developers and only 1.7% of the respondents reported emails as a reason for a bad or unproductive day at work. The study recommended prioritizing process and tools improvements for making productive and good workday typical. Bad days for developers are influenced by both technical and non-technical factors (Obi et al., 2024). Higher levels of satisfaction bring more productivity to the table. The study used a mixed-method approach, including interview, surveys, diary studies and analysis of telemetry data to find out factors that cause "bad days" for developers. The study identified long build times, flaky tests, and excessive meetings as significant factors contributing to bad days for developers. A increase in perceived code quality is often followed by a rise in perceived developer productivity;however, the reverse relation is not observed (Cheng et al., 2022). The study provides strong evidence that code quality affects individual developer productivity. Developers who track their progress and set clear, achievable goals can better manage their time and resources, leading to increased productivity (Meyer, 2018). The author used a mixed-method approach incorporating self-monitoring tools, goal setting techniques and persuasive technology to measure productivity. These techniques are suggested to improve productivity among software developers.

2.3 Emotions and Focus

Emotion affects cognitive skills, for software development which requires creative and problem-solving abilities this is especially true (Girardi et al., 2021). The study provided empirical evidence of a link between emotional and perceived productivity at workplace. The study found a positive correlation between emotional valency and perceived productivity (Storey et al., 2019). The authors conducted a survey within a large software company and got a total of 640 responses. The study found that developers who feel they contribute meaningfully and work in a positive culture report higher job satisfaction.

2.4 Artificial Intelligence

Using GitHub copilot ultimately led to an increase in developer productivity (Smit et al., 2024). The study suggests that GitHub copilot enhances developer productivity. Generative AI tool has an positive impact on the productivity of Software developer (Coutinho et al., 2024). The study investigates the use of generative AI tools in software development to understand the uses, benefits, challenges and its effects on productivity. The authors conducted a pilot case-study on software practitioners in various roles. The findings suggest that generative AI tools had a positive impact, saved time and enhanced productivity.

3 METHODOLOGY

Our goal was to find the factors that affect the productivity of developers. For this a survey was designed consisting of productivity factors. The reason for going with a survey is because other quantitative methods like measuring the lines of code or the number of bugs fixed, don't always accurately reflect the productivity of a developer, as developers spend more time on meeting and gathering requirements (Storey et al., 2019). Other methods such as literature review, diary review, peer review, interview, use biometric sensors or other machines to monitor emotions and mood also have limitations. Using biometric sensor to monitor developers may not give an accurate picture as the person is aware they are being monitored, which may hinder the actual results. The participant may forget to turn on the biometric sensor or may lose it, and the recognition mode may work differently for everyone, indicating it may need to be trained for each individual (Girardi et al., 2021). With Peer reviews on the other hand there is the possibility of bias being introduced as a productive developer may not be liked by their peers. For interviews and diary studies they can be quite time-consuming and may not be feasible for a very large population. Surveys are straight forward and the most used method to gather information or knowledge. Survey allows more comprehensive analysis making it more suitable and reliable choice for this study.

This study adopts the methodological approach of (Murphy-Hill et al., 2019) due to its robust validation in a large-scale empirical study. Incorporating

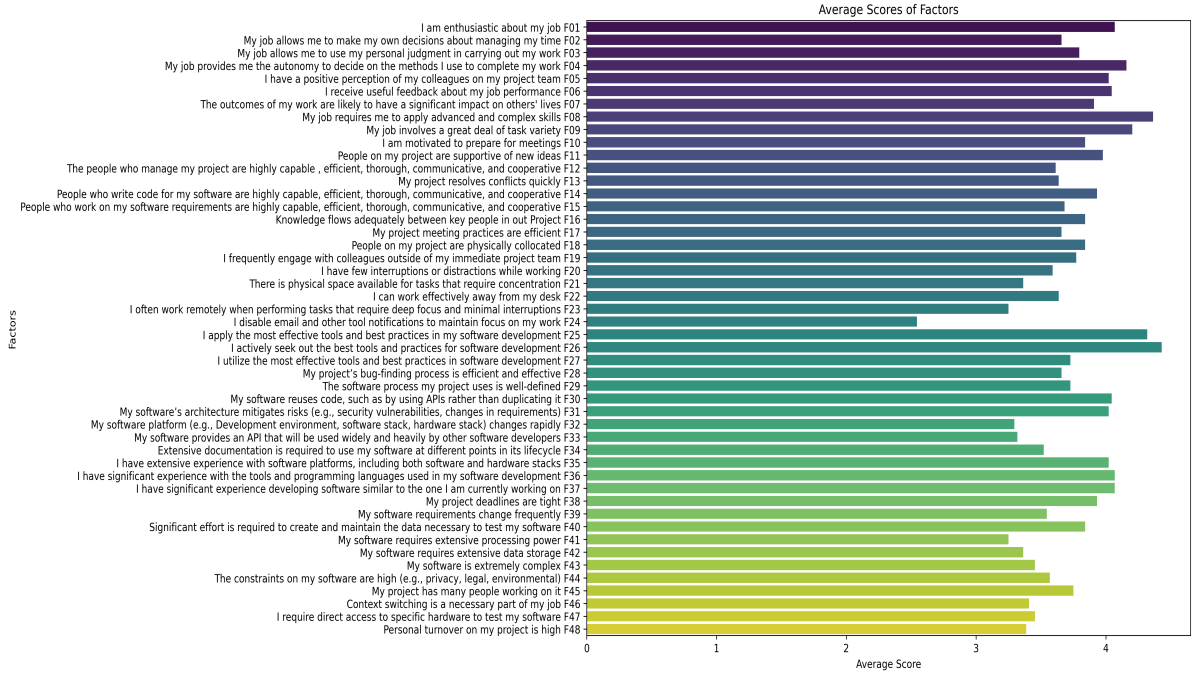

Figure 3: Bar Chart representing average scores of factors influencing software developer productivity

these factors ensures methodological rigor, enhances reliability, and provides a relevant framework for analyzing developer productivity in Bangladesh. By leveraging these well-established factors, the survey aligns with academic standards while addressing the unique characteristics of the target population. A total of 48 factors were incorporated into the survey titled Factors Impacting Software Developer Productivity, using a five-point Likert scale ranging from ”Strongly Disagree” to ”Strongly Agree”. Additionally, an open-ended question was included at the end of the survey, allowing respondents to highlight any factors that may have been overlooked.

A total of 168 invitations was sent to software developers across 38 different software firms, with 3-4 developers invited from each organization. The survey remained open for approximately one month. The survey description explicitly mentioned that all the information provided, including any identifiable details, will remain completely confidential and will be used for research purposes and that the participation is entirely voluntary. Initially the survey started with Participants name, Primary role, Mode of Employment, Years of professional experience, followed by the 48 factors on a five-point scale, from Strongly disagree to Strongly agree. At the end of the survey, an open-ended question allowed respondents to highlight any additional factors that may be overlooked. The Primary Role question, included predefined options such as Software Engineering, Front-end Developer, Back-end Developer, Full-Stack Developer, DevOps Engineer and an ”Other” option for additional roles.

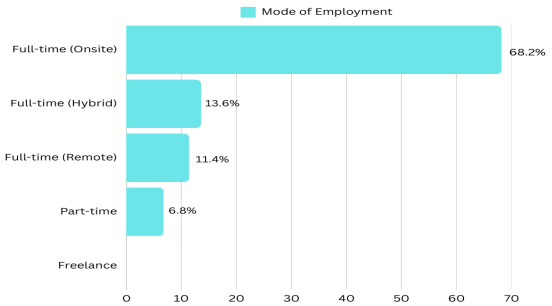

Figure 1: Distribution of respondents mode of employment

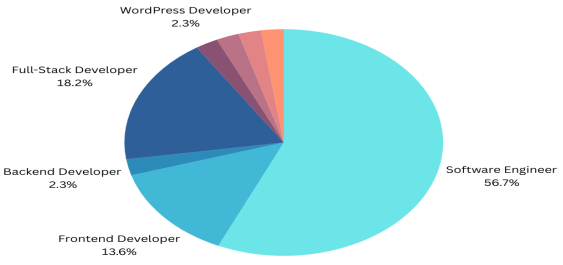

Figure 2: Distribution of respondents primary roles

The mode of Employment question includes Full-

time(on-site), Full-time(Hybrid), Full-time(Remote), Part-time, Freelance and "Other" option. For profession experience respondents chose from the following ranges: 0-2 years, 3-5 years, 6-10 years, 11-15 years, 16+. A total of 44 responses were collected. The response rate is 26% which is in line with the response rate of software engineering productivity survey (Johnson et al., 2019). From the 44 collected responses, 45.5% of the software developers have 0-2 years of experience, 29.5% have 3-5 years of experience, 13.6% have 6-10 years of experience, 9.1% have 11-15 years of experience and 2.3% have 16+ years of experience. Figure 1 illustrates the responses for mode of employment in a horizontal bar chart and Figure 2 illustrates the distribution of the primary role in a pie chart.

4 RESULTS

The survey data was systematically analyzed to address each question, followed by a discussion of the findings. To ensure data reliability, Cronbach's Alpha was used for validation, yielding a value of 0.931, which indicates excellent reliability. In Figure 3, the left-hand side presents the factors as statements shown to developers, while the right-hand side displays the mean value of each factor. The mean was calculated by summing the responses of each factor and then dividing by the total number of responses. Factor are labeled (F1, F2, F3 and so on).

4.1 RQ1: What are the primary factors affecting the productivity of developers in Bangladesh?

The strongest predictions of the factors affecting productivity are the statements with the highest absolute mean estimates and the weakest factors affecting productivity are those with the lowest absolute mean estimates. To determine which factors have the strongest impact on productivity, the factors with the highest mean score value were chosen. The top five factors affecting developer productivity are as follows:

- My job provides me the autonomy to decide on the methods I use to complete my work (F04)
- My job requires me to use a number of complex or high-level skills (F08)
- My job involves a deal of task variety (F09)
- I actively seek out the best tools and practices to develop my software (F26)
- I utilize the most effective tools and best practices in software development (F27)

Discussion: The results of this study are consistent with expectations. The top three factors (F04, F08, F09) are task-related, whereas the remaining two (F26 and F27) are technical factors. The first primary factor F04 allows developers high autonomy and flexibility which enhances their productivity and efficiency. The second and third factor focuses on the complexity, task variety and challenges a developer encounters. Software development is a highly creative field that requires complex problem-solving skills and varied project requirements. Companies continuously assign new project with varying and unique requirement which makes developers actively engaged and intellectually stimulated. Technical factors F26 and F27 highlight the importance of modern tools in developer efficiency. Developers constantly seek out and utilize tools such as integrated development environments (IDEs), browser extensions, and automation framework to streamline workflows, reduce repetitive tasks and enhance productivity. In addtion to the five primary factors there are other factors with high mean values, including F01(I am enthusiastic about my job), F36 (I have significant experience with the tools and programming languages used in my software), F37 (I have significant experience developing other software similar to the one I am working on).

The findings somewhat align with (Murphy-Hill et al., 2019), which identified that task variety and job enthusiasm as strong factors of developers productivity. Task diversity decreased boredom and enhances productivity for software developers and analyst (Murphy-Hill et al., 2019). Similarly, our results highlight task variety (F09) and job enthusiasm(F01) as key contributors to productivity. However, there are notable differences. (Murphy-Hill et al., 2019) study found that remote work was a strong factor in improving productivity, whereas the findings of this study indicate only a moderate impact. This could be due to differences in company management and work cultures. Developers working on local software firms in Bangladesh mostly work on-site. Additionally, F24 (I shutdown email and tool notification to concentrate on my work) had the lowest mean score indicating that developers do not consider notification and emails as distraction. This contrast with (Murphy-Hill et al., 2019) findings as it suggest interruption can have a significant negative impact, particularly during programming tasks, and notes that developers often face challenges in resuming work after such interruptions. To enhance developer productivity, organizations should provide greater autonomy in choosing methods to complete tasks.

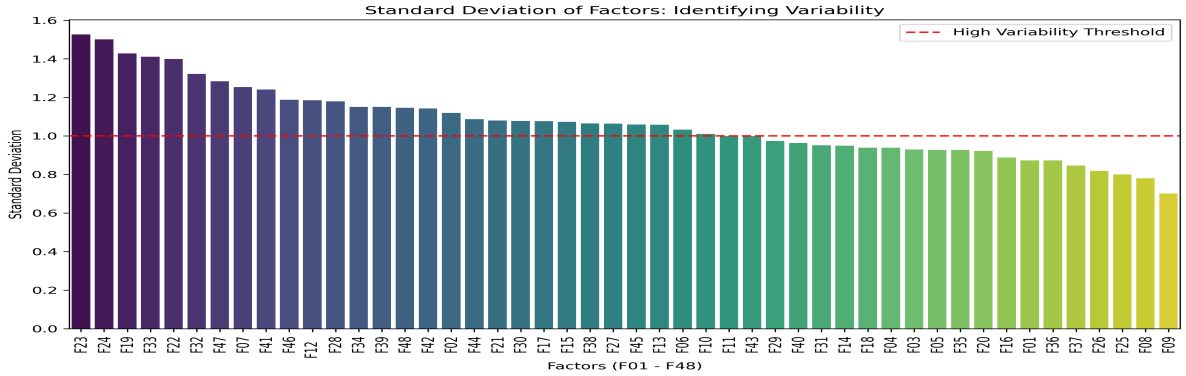

Figure 4: Standard Deviation of factors influencing software developer productivity

4.2 RQ2: How do these factors vary across different companies?

To answer this question, we can look at the standard deviation of the estimated across all the companies. Standard deviation of all the factors are shown in Figure 4. The three factor that exhibited the least variance were the most stable across various companies:

- I apply the most effective tools and best practices in my software development (F25)
- My job requires me to use complex or high-level skills (F08)
- My job involves a great deal of task variety (F09)

And the three factors that exhibited the most variance were the least stable across various companies:

- I often work remotely when performing tasks that require deep focus and minimal interruptions(F23)
- I disable email and other tool notifications to maintain focus on my work (F24)
- I frequently engage with colleagues outside of my immediate project team (F19)

Discussion:

F25 (Using best tools and practices) having low variability is likely because small IT firms with limited resources prioritize efficiency and tool adoption to meet deadlines. Similarly, F08 (High-level Skills Requirement) and F09 (Task Variety) were consistent across companies, as software development is a field that requires problem-solving, logical thinking and frequent exposure to diverse tasks. The consistency across these three factors suggests that despite company difference developers face complex challenges and varied task requirement.

F23 (Remote work for focus) having high variance suggest that remote work policies differ across organizations, with some allowing flexible work arrangements while other restrict them. The high variance in F24 (shutting down email and notification for focus) suggest that notification management is a personal preference, influenced by individual habits and company policies. Similarly F19 (Talking to people besides team members) has high variance suggesting that some developers may actively engage in conversations while others may refrain from unnecessary conversation. It's a personal preference, also company polices may restrict or encourage cross-team communication. Compared to (Murphy-Hill et al., 2019) study which found F25 (Using best tools and practices) has high variance, this study found it stable indicating regional difference within Bangladeshi firms focusing more on technical efficiency. Similarly this study found F23 (Remote work for focus) having high variability but (Murphy-Hill et al., 2019) study found it stable indication this difference could be due to regional and cultural difference in remote work adoption.

4.3 RQ3: What predicts productivity across experience levels?

To answer this question, developers were categorized based on their years of experience. Developers with 0-2 years were classified as beginner, developers with 3-5 years of experience as mid-level and developers with more than five years as senior developers. The mean response for each factor was calculated across these experience level and visualized using heatmap(Figure 7). The strongest factors for beginner developer are:

- I apply and use the most effective tools and practices to develop my software (F26/F25)
- My job requires me to apply advanced and complex skills (F08)

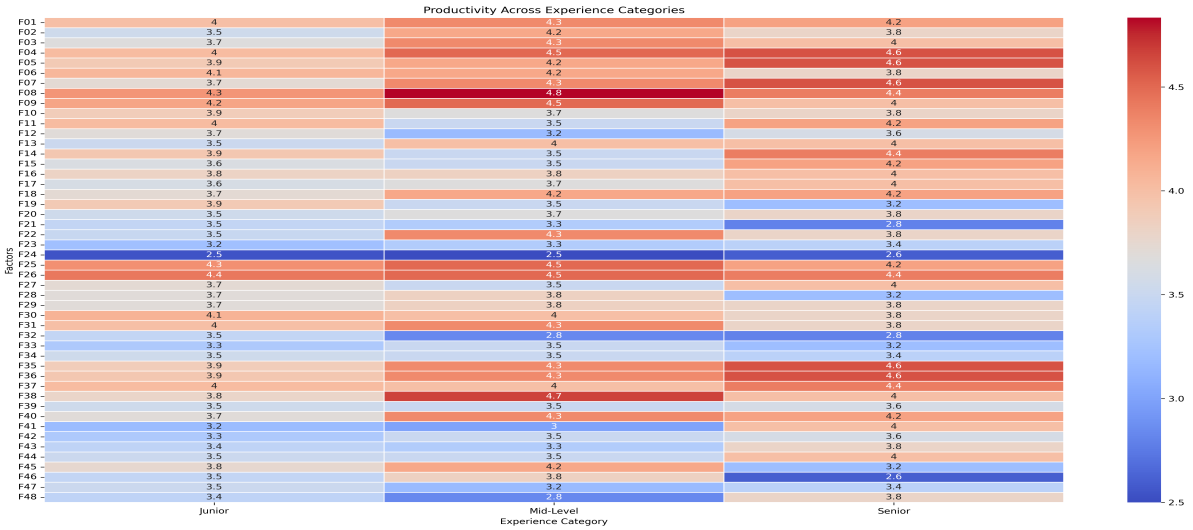

Figure 7: Heatmap showing the mean scores of productivity-related factors across different experience level

The strongest factors for mid-level developers are:

- My project deadlines are tight (F38)
- My job requires me to use complex and high-level skills (F08)

The strongest factors for senior developers are:

- I have significant experience with software platform, including both software and hardware stacks (F35)
- I have significant experience with tools and programming language used in my software (F36)
- I feel positive perception of my colleagues on my project team (F05)
- The outcomes of my work are likely to have a significant impact on others lives (F07)
- My job provides me the autonomy to decide on the methods I use to complete my work (F04)

Discussion: For beginners developers the emerging key factors are the F26/F25(using best tools and practices) and F08(handling complex tasks) suggesting that beginners prioritize learning and skill development. They actively seek tools and methods to improve their skills and efficiency. For mid-level developers F08(complex tasks) an F38(tight deadlines) are the strongest factors suggesting that as developers gain experience and transition into mid-level roles, companies often increase their workload, assigning more complex project and stricter deadlines. For Senior developers, the strongest factors reflects experience, leadership and autonomy in decision-making. Since they have spent years mastering tools, programming languages and software platforms, F35/F36(experience with software platform and programming languages) indicate their deep technical expertise. Senior developers often lead projects and make key technical decisions, which aligns with F04(decision-making autonomy). F05(Strong collaboration with the team) suggests that senior developers value strong collaboration with their teams. Additional, F07(impact of their work on other lives) highlight the fact that senior developers are likely to mentor other junior developers and decide method and strategies for an organization. These insights can help organizations tailor their management strategies to better support developers at different stages of their careers.

4.4 Open-Ended Responses on Additional Productivity Factors

At the end of the survey, respondents were given an open-ended response to share any additional factors they believed significantly influenced the software developer productivity but were not covered in the structured survey response. The responses were legacy systems and outdated tools, flexible working hours, communication gap between clients and developers , work-life balance, toxic work environments, managing multiple projects simultaneously , overtime and burnout. Organization can use this response to enhance developer well-being, improve collaboration and ultimately improve developer productivity.

5 LIMITATIONS

While this study provides meaningful insights into the factors influencing software developer productivity, several limitations must be considered. Firstly this study is region specific and focuses only on developers in Bangladesh. Another limitation is the reliance on self-reported data, which introduces the possibility of subjective bias. Since responses are based on personal perceptions, they may be influenced by factors such as mood, memory recall, or social desirability bias. Furthermore, this study does not account for variation in job roles. Productivity factors may differ based on developers specialization, whether they are working as front-end, back-end, full-stack development, or DevOps. Moreover software development practices may vary across industries such as gaming and enterprise productivity. Our study primarily focuses on internal factors such as experience, skill-level and decision-making autonomy. However, external elements such as economic condition, company policies, work-life balance and burnout levels could also play a crucial role in developers productivity. Future studies can address these limitations and strengthen the validity and findings, allowing a better understanding that shapes developers productivity.

6 FUTURE WORK

This study provides a valuable snapshot of how job satisfaction and productivity factors vary across experience levels. Future studies could conduct a longitudinal study on developer growth, track developers over time to examine how their priorities, challenges, and productivity factors evolve as they gain experience. Furthermore, this study relies on self-reported data, which introduces the possibility of subjective bias. Future studies could mitigate this limitation by incorporating objective productivity metrics such as commit frequency in GitHub or code quality assessments or bug resolution rates to complement self-reported data. Also, in this study we did not incorporate job roles, we leave that for future studies to explore the relation between job variance (front-end, back-end, DevOps) and developer productivity. Additionally, this study provides a limited analysis of the influence of remote work. Future studies could investigate how remote and hybrid work arrangement would impact developer productivity. Finally the impact of AI on developer productivity is an emerging area of interest. With the rise of AI powered tools such as GitHub Copilot and ChatGpt, it is essential to investigate what affect AI has on developer productivity. Overall, these areas of research could build on the current study findings, providing a more comprehensive understanding of the evolving nature of software development productivity.

7 CONCLUSION

This study examined the key factors influencing software developer productivity in Bangladesh, focusing on three main aspects: the strongest productivity factor (RQ1), how do these factors vary between different companies (RQ2) and how productivity factors differ across experience levels (RQ3). This study found that task variety (F09), seeking out and using the best tools and practices in development (F26 and F27), allowing developers to chose their method to complete work (F04) and high-level skill and complex problem solving (F08) as the primary factors affecting developer in Bangladesh. We analyzed how productivity factors vary across different companies and this study found task variety (F09) as the most stable factor. Finally we investigate how productivity factors evolve with experience. Beginner developers prioritize learning and skill development, actively seeking out best practices and modern tools. Mid-level developers, on the other hand, face increasing pressure from tight deadlines and the complexity of their tasks. Senior developers emphasize leadership, teamwork, and decision-making autonomy, suggesting that experience shifts priorities from technical execution to strategic contribution and collaboration. Understanding what makes software developer productive is crucial for both individual career growth and organizational success. By identifying key productivity factors and analyzing how they differ across companies and experience levels, this study provides actionable insights that can help improve developer efficiency, job satisfaction, and workplace policies in Bangladesh's growing software industry.

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REFERENCES

Bao, L., Li, T., Xia, X., Zhu, K., Li, H., and Yang, X. (2022). How does working from home affect developer productivity?—a case study of baidu during the

covid-19 pandemic. *Science China Information Sciences*, 65(4):142102.

Cheng, L., Murphy-Hill, E., Canning, M., Jaspan, C., Green, C., Knight, A., Zhang, N., and Kammer, E. (2022). What improves developer productivity at google? code quality. In *Proceedings of the 30th ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering*, pages 1302–1313.

Coutinho, M., Marques, L., Santos, A., Dahia, M., França, C., and de Souza Santos, R. (2024). The role of generative ai in software development productivity: A pilot case study. In *Proceedings of the 1st ACM International Conference on AI-Powered Software*, pages 131–138.

Girardi, D., Lanubile, F., Novielli, N., and Serebrenik, A. (2021). Emotions and perceived productivity of software developers at the workplace. *IEEE Transactions on Software Engineering*, 48(9):3326–3341.

Johnson, B., Zimmermann, T., and Bird, C. (2019). The effect of work environments on productivity and satisfaction of software engineers. *IEEE Transactions on Software Engineering*, 47(4):736–757.

Meyer, A. N. (2018). Fostering software developers' productivity at work through self-monitoring and goal-setting. In *Proceedings of the 40th International Conference on Software Engineering: Companion Proceeedings*, pages 480–483.

Meyer, A. N., Barr, E. T., Bird, C., and Zimmermann, T. (2019). Today was a good day: The daily life of software developers. *IEEE Transactions on Software Engineering*, 47(5):863–880.

Murphy-Hill, E., Jaspan, C., Sadowski, C., Shepherd, D., Phillips, M., Winter, C., Knight, A., Smith, E., and Jorde, M. (2019). What predicts software developers' productivity? *IEEE Transactions on Software Engineering*, 47(3):582–594.

Obi, I., Butler, J., Haniyur, S., Hassan, B., Storey, M.-A., and Murphy, B. (2024). Identifying factors contributing to bad days for software developers: A mixed methods study. *arXiv preprint arXiv:2410.18379*.

Ruvimova, A., Lill, A., Gugler, J., Howe, L., Huang, E., Murphy, G., and Fritz, T. (2022). An exploratory study of productivity perceptions in software teams. In *Proceedings of the 44th International Conference on Software Engineering*, pages 99–111.

Smit, D., Smuts, H., Louw, P., Pielmeier, J., and Eidelloth, C. (2024). The impact of github copilot on developer productivity from a software engineering body of knowledge perspective.

Storey, M.-A., Zimmermann, T., Bird, C., Czerwonka, J., Murphy, B., and Kalliamvakou, E. (2019). Towards a theory of software developer job satisfaction and perceived productivity. *IEEE Transactions on Software Engineering*, 47(10):2125–2142.