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Work From Home On Software Engineer Productivity Analysis: A Case Study Of Batam City

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Abstract

The COVID-19 pandemic has shaken all people in the world and affected all aspects of modern human life. Seeing that there has been a very significant increase in the speed of the spread of the virus, the government is taking part in suppressing the rate of the spread of the plague, one of the ways is by making a remote work policy, or better known as Work From Home (WFH). All companies regardless of business process comply with this regulation. This study uses qualitative and quantitative data comparison analysis methods from interviews and distributing questionnaires conducted to software engineers in the city of Batam regarding their productivity comparison between WFO and WFH during post-pandemic. We used means comparison analysis and SPSS to help analyze the data. The results showed that in the physical workplace environment factors, work-life balance, work flexibility, and collaboration and communication did not have a significant effect from WFH activities on the performance of the software engineer himself. Software engineering and computer-related occupation generally can perform the generally the same productivity regardless of the place of work. Further studies should be done to explore this furthermore.

Keywords: Work From Home, Productivity, Software Engineer, Post-Pandemic.

Introduction

Communities around the world and throughout Indonesia are experiencing complex problems that affect all aspects of modern human life due to the global pandemic of the COVID-19 virus or coronavirus. Many facilities that were easy to use before the pandemic were now very limited (Maria & Nurwati, 2020). Seeing that there has been a fairly drastic increase in Indonesia, the Indonesian government has implemented several policies to control the rate of transmission of COVID-19 in Indonesia. One of the policies set is to work remotely from home or also known as Work From Home (WFH) (Ishak & Mangundjaya, 2020). At the beginning of being publicly implemented, this policy was not easily accepted by all Indonesian people because Indonesia has a lot of diversity. In addition, not all types of work can be done at home, such as online motorcycle taxis, bankers, service providers. And so on (Maria & Nurwati, 2020).

Even though there were many problems at the beginning of implementing WFH, now many companies have allowed their employees to work from home. Even though working from home has applied to some people, many companies are still hesitant to this day. On the grounds of suspicion of abuse of employee freedom over assigned work, which results in a greater risk of negligence when working from home (Deole et al., 2021).

Software engineering is a complex technical job that requires a high level of focus and good inter-team communication. Some software companies believe that there are significant advantages to working in the same environment, some examples of benefits are smooth coordination, increased creativity, faster learning, and more manageable projects (Ford et al., 2022). But in practice, before the pandemic, remote work had already been carried out and it turned out that it also had several advantages, such as work autonomy, reduced interruptions, and a more flexible schedule. Even though software engineers work from home, it is important to know that working from home during a pandemic is not the same as working from home traditionally (before the pandemic). Several new challenges have occurred due to the COVID-19 pandemic. Many people are socially isolated as there is no opportunity to travel to the office and the opportunity to be able to communicate directly with teammates, and new challenges also from those who have children. Since the COVID-19 pandemic, studies on software engineers have found that there are 2 opposing sides regarding their experience of WFH affecting their productivity (Bao et al., 2022).

Batam City is an industrial city that has a strategic route, with a location bordering other countries, namely Malaysia and Singapore. The city of Batam also acts as an international shipping port, so that information technology is very necessary and must be applied to the industrial world in the city of Batam. Communication information technology can connect industries so that they can communicate smoothly (Simanjuntak & Elisa, 2019). Batam City is also said to be the most strategic area in supporting the development of the digital economy area in Indonesia. The governments of Indonesia and Singapore recently built Nongsa D-Town which will become a gathering area for start-up industries. The Software Engineer in Batam said that WFH was an excellent activity implemented in work activities during the COVID-19 pandemic to carry out social distancing which is one way to prevent the spread of COVID-19. WFH also provides flexibility for software engineers, such as working at night, being able to do activities that cannot be done while working in an office and being able to have more time with family. But some also disagree with WFH, because according to some software engineers when WFH they cannot communicate directly with their teammates and have to use online media such as zoom meetings to help coordination between teams, according to a number of software engineers face-to-face meetings are more effective than conducting online meetings and some people also find it easier to be distracted by the activities of other people at home, especially for software engineers who have families.

The key research question of this study was whether or not working mode difference have correlations and effecting productivity especially among software engineers in Batam City. During pandemic and WFH, work productivity are generally plummet down drastically across all industries except all computer-based industries. Software developers are mentioned in many articles have better or same productivity during WFH and pandemic (Bao et al., 2022; Deole et

al., 2021; Haridas, P R, et al., 2021). However, even industries who use computer regularly in their job e.g sales, trading, and office work do not show the same trends or inconsistent

tendencies, some employees must work longer hour to meet the target (Awada et al., 2021; Chafi et al., 2022; Ravi & Anulakshmi, 2021). Moreover, in one of pilot study report IT Employees also have difficulties in maintaining productivity (Nagarajan Muthukrishnan, 2021). This inconsistency pairing up with post-pandemic condition make us interested to conduct an investigation. The main objective of this study is to analyze the changes in productivity that occurred while working from home (WFH) on post-pandemic condition.

Literature Review

Research by (Haridas, R, et al., 2021) is research that focuses on understanding how WFH impacts employee productivity. The research method used is a quantitative approach by surveying a data sample of 115 IT employees within the age limit of 21-50 years who work in various IT companies in India. This research was analyzed by multiple regression analysis. The results of this study indicate that WFH has two different sides that impact employee productivity. When doing WFH, there will be advantages and disadvantages for employees or the company. IT announced that by 2021, only a quarter of their employees will need facilities while working and the rest will be able to work with WFH.

Research by (Purwanto, 2020) is research that focuses on exploring the impact of WFH on teacher performance during the COVID-19 pandemic, this study uses a qualitative approach with semi-structured interviews with teachers and student guardians. The results of this study are that WFH has advantages and disadvantages for teachers, WFH can be carried out effectively if both parties carry out it responsibly. Both parties must be more aware of the conditions that occur.

Research conducted by (Bao et al., 2022) is research that focuses on measuring the performance of software engineers at the company Baidu, Inc., this study uses a quantitative approach for data collection carried out on 139 software engineers who have WFH and also work on site. This research was conducted by comparing the productivity of software engineers when working at home with working in an office, researchers used several metrics in software development, for example, the number of builds, commits, and lines of code entered/deleted. The results from this study find that WFH has a different impact on different metrics. In addition, researchers also found several factors that influence software engineer productivity when doing WFH, including programming languages, and project type/age/size.

Research by (Wang et al., 2021) is a study that uses a qualitative explorative study approach to obtain the data sources needed in the research, this research collects as many as 39 employees who are the source of interview data conducted through online media (WeChat) which is then codified on the interview transcript. The results of this study indicate that 3 main things affect the performance of workers during a pandemic, namely remote work challenges, virtual work characteristics, and individual factors. And after analyzing these three things, the researchers concluded that this harmed the effectiveness and welfare of workers during a pandemic.

Research by (Narpati et al., 2021) is research that was carried out using a quantitative approach by distributing questionnaires to Bekasi City government employees, housing, residential, and defense areas with 148 employees as respondents and analyzed using SPSS 24, and using the multiple linear regression method as testing the hypothesis of this research.

The results of this study indicate that WFH, the workplace environment has a significantly positive effect on work productivity.

Based on the five literature reviews above, it can be concluded that the summary of the literature review is in table.

Table 1. Literature Review Summary

Author	Summary
Haridas et al. (2021)	This research focuses on understanding how WFH impacts the productivity of IT employees. This study uses quantitative methods in IT companies in India.
Purwanto (2020)	This research is about analyzing the advantages and disadvantages of WFH in workers, especially teachers.
Bao et al. (2020)	This study focuses on measuring the performance of software engineers at Baidu, Inc. This research was conducted by comparing data from software engineers doing WFH with software engineers working on-site.
Wang et al. (2021)	This study uses a qualitative approach to measure employee performance. Data collection was carried out by conducting interviews with 39 employees using online media (WeChat).
Narpati et al. (2021)	This study used a quantitative method by distributing questionnaires to 148 Bekasi City government employees who were then analyzed using SPSS 24 and testing the hypothesis with the linear regression method to show whether WFH affected work productivity.

Although, all cited research above mentions there is a correlation between different working mode and productivity especially among software engineers, the nature of its effect remains unclear. Much uncertainty still exist about the relationship between effect of WFH and Productivity, especially during post-pandemic condition. This current study aim to address this issue by conducting research on the effect of WFH on software engineer productivity in Batam City. This study aims to discuss and explore the issue using conceptual model by (Bao et al., 2022; Haridas, R, et al., 2021; Purwanto, 2020). This study uses a multi-method or qualitative and qualitative approach. Qualitative data collection was carried out by conducting interviews with software engineers in Batam according to research (Wang et al., 2021), then the results of the analysis will be used to become a draft operational definition of the variables to develop questionnaire questions. Meanwhile, quantitative data collection was carried out by distributing questionnaires according to research (Narpati et al., 2021).

Research Methods

This study uses a conceptual model from previous research. This study measures the influence of physical workplace environmental factors, work-life balance, work flexibility, and collaboration and communication on employee productivity.

The results of research that has been carried out previously prove that work-life balance, work flexibility, and collaboration and communication have a significant effect on employee

productivity. Meanwhile, the physical environment of the workplace does not significantly influence employee productivity.

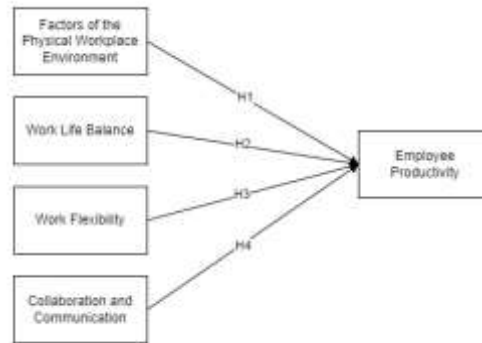


Figure 1. Conceptual Model

Based on the research model above, there are several hypotheses that can be arranged as follows:

H10 : Factors of the Physical Workplace Environment does not significantly affect the Productivity of Software Engineers in Batam

H1a : Factors of Physical Workplace Environmental significantly affect the Productivity of Software Engineers in Batam.

H20 : Work Life Balance does not significantly affect the Productivity of Software Engineers in Batam.

H2a : Work Life Balance significantly affect the Productivity of Software Engineers in Batam.

H30 : Work Flexibility does not significantly affect the Productivity of Software Engineers in Batam.

H3a : Work Flexibility significantly affect the Productivity of Software Engineers in Batam.

H40 : Collaboration and Communication does not significantly affect the Productivity of Software Engineers in Batam.

H4a : Collaboration and Communication significantly affect the Productivity of Software Engineers in Batam.

To obtain quality research material sample data that can be tested, data collection methods need to be known in advance to provide clear navigation or views for us. This research uses qualitative and quantitative data collection methods. For qualitative data gathering, we've interviews 30 software engineers in Batam using questions in table 2.

Table 2. Qualitative Interview Questions

Variables	Questions
Collaboration & Communications (CC)	In terms of communication between teams, are there any problems?
	I do more work during WFH

Work Life Balance (WLB)	During Doing WFH, Have you ever experienced the feeling of never stopping work? During the WFO, will the work that is not finished today be done the next day? I prefer a job that has clear boundaries between working hours and hours outside of work
Factors of the Physical Workplace Environment (PWE)	The hardware / facilities provided at the office are better than those at home Internet facilities provided at the office are better than those at home Internet and hardware facilities provided affect my work performance
Work Flexibility (WF)	My current job provides flexible time off Flexible break time affects my work performance I prefer a job with flexible rest periods I am a person who can have good self-control when I have flexible breaks

Source : (Haridas, R, et al., 2021)

The qualitative data collection will be conducted online using Zoom Meeting, Google meets, or WhatsApp. Semi-structured interviews will be used in the qualitative data collection process, so that the information and understanding obtained from this method can be clearer and deeper. To analyze the data gathered using interview, we codify and count every responses to each questions, then to clarify the results we develop quantitative instruments and share it to more software engineers in Batam City. We then perform comparative analysis by comparing means between all variables and compare it across working mode preference. The data analysis will be conducted using SPSS.

Results and Discussion

The research was started by conducting interviews as a medium for collecting qualitative data, the researchers conducted interviews with 30 software engineers in the city of Batam to conduct interviews. The informant will answer 24 questions related to their work performance during the WFH period. After getting the results from the interview answers, the researcher codified the questionnaire answers, then the results of the codification were made into material for making the questionnaire and distributed to 125 respondents. Based on the results of the questionnaire, 69.6% of the respondents were male and 30.4% female, based on age group, 56% were in the 17-22 year group, 36% were in the 23-28 year group, and 8% were in the >29 year group. By occupation, 20.8% are Full Stack Developers, 15.2% are UI/UX Designers, 12.8% are Back End Developers, 10.4% are Front End Developers, 10.4% are Mobile Developers, 6.4% are QA Engineers, 5.6% are Databases Administrators, 4% are DevOps Engineers, 4% are Graphic Designers, 4% are Data Analysts, 2.4% are IT Support, 1.6% are iOS Engineers, 1.6% are Project Executives, and 0.8% are Game Developers.

After the two data were collected through interviews and questionnaires, the data was used in the next stage, codification.

Table 3. Comparasion Results Table

Dimension	Indicator	Measurement Scale	Average Qualitative Data	Average Quantitative Data
CC1	In terms of communication between teams, are there any problems?	0-1	0.6	0.549
CC2	I do more work during WFH	0-1	0.4	0.549
WLB1	During Doing WFH, have you ever experienced the feeling of never stopping work?	0-1	0.633	0.404
WLB2	During the WFO, will the work that is not finished today be done the next day?	0-1	0.633	0.847
WLB3	I prefer a job that has clear boundaries between working hours and hours outside of work	0-1	0.6	0.908
PWE1	The hardware / facilities provided at the office are better than those at home	0-1	0.467	0.564
PWE2	Internet facilities provided at the office are better than those at home	0-1	0.733	0.839
PWE3	Internet and hardware facilities provided affect my work performance	0-1	0.467	0.893
WF1	My current job provides flexible time off	0-1	0.567	0.862
WF2	Flexible break time affects my work performance	0-1	0.6	0.923
WF3	I prefer a job with flexible rest periods	0-1	0.7	0.923
WF4	I am a person who can have good self-control when I have flexible breaks	0-1	0.683	0.916

Table 4. Open Ended Questions Comparasion Results Table

Questions	Keywords	Usage (Qualitative)	Usage (Quantitative)
What are the advantages of WFH ?	Can do work anytime and anywhere (flexibility).	10	60
	Time and Money Efficiency.	9	26
	Have a calmer work environment.	4	23
	No need to wear formal work clothes.	10	60
	More relaxed at work.	9	26
What are the Disadvantages of WFH ?	Need Good Internet Connection.	4	23
	Communication and coordination between teams is less effective.	3	8
	Requires good supporting facilities.	4	8
How do you overcome the deficiencies that occur	Lots of distractions during WFH.	12	20
	Consult directly with colleagues.	6	50
	Visit a co-working space that has good facilities.	8	27
	Make the working environment as comfortable as possible.	4	28

Questions	Keywords	Usage (Qualitative)	Usage (Quantitative)
when doing WFH ?	Conduct briefings with colleagues before starting work.	5	28

Based on the data has been grouped into 2 groups, namely qualitative and quantitative data. the data collection resulted in a comparison of the results obtained on the collaboration and communication variables, the qualitative data showed 1 positive sentiment, namely on the indicator "when WFH experienced problems in terms of communication between teams", and also got 1 negative sentiment, namely on the indicator "when WFH do more work." Meanwhile, the quantitative data shows 2 positive sentiments on both indicators. On the work-life balance variable, the results of the qualitative data show 3 positive sentiments, namely the indicator "During WFH, have you ever felt the feeling of never stopping work", the indicator "during WFO unfinished work will be done the next day", and the indicator "I am more choose a job that has clear boundaries between working hours and hours outside of work. Whereas the quantitative data shows negative sentiment on the indicator "During WFH, have you ever experienced the feeling of never stopping work?" and shows 2 positive sentiments on the indicators "during WFO unfinished work will be done the next day", and "I prefer work that has clear boundaries between working hours and hours outside of work." On the variables of physical environment and workplace factors, the results of the qualitative data show 1 positive sentiment and 2 negative sentiments, the indicator "internet facilities provided at the office are better than those owned at home" gets positive sentiment, while the indicator "hardware / facilities provided at the office better than what I have at home", and the indicator "internet facilities and provided hardware affect my work performance" gets negative sentiment, while the quantitative data results show 3 positive sentiments for the three indicators above. On the work flexibility variable, the results of the qualitative data show 4 positive sentiments towards the indicator "My current job provides flexible rest periods", "Flexible rest times affect my work performance", "I prefer a job with flexible rest periods", and "I am a person who can have good self-control when I have flexible rest periods", and the quantitative data also shows 4 positive sentiments towards the four indicators above. Using SPSS we compare means among four variables which are Communication & Collaborative (CC), Work Life Balance(WLB), Factor of Physical Work Environment (PWE), and Work Flexibility (WF). The result shown in table 5.

Table 5. Statistical Results

Working Mode		CC	WLB	PWE	WF
WFH	Mean	.5076	.7424	.6793	.9053
	Std. Deviation	.38772	.18300	.20737	.19983
WFO	Mean	.5632	.6772	.7596	.8224
	Std. Deviation	.31150	.26721	.29746	.27202
	Difference (Mean)	.556	.652	.803	.829
	Difference (Std. Deviation)	.7622	.8421	.9009	.7219

Statistical result show there are no significant difference between all variables and all working mode, means comparison analysis shown at maximum 15% difference at PWE and 10% for others variables (CC,WLB,WF). From the results of the research above, the Null Hypothesis 1 (H10) proves that the physical environment of the workplace does not significantly affect the

productivity of software engineers in Batam. The Null Hypothesis 2 (H20) proves that work-life balance does not significantly affect the productivity of software engineers in Batam. Null Hypothesis 3 (H30) proves that work flexibility does not significantly affect the productivity of software engineers in Batam. And the Null Hypothesis 4 (H40) proves that collaboration and communication do not significantly affect the productivity of software engineers in Batam.

Conclusions

The COVID-19 pandemic is a disaster that befalls all of humanity so that activities that are usually carried out well can suddenly no longer be carried out. Work From Home (WFH) is one of the policies set to reduce the speed of the spread of the virus outbreak, however, not all companies can accept this policy. This study uses a qualitative and quantitative approach, conducted to find out what influences the productivity of a software engineer during WFH activities, this study involved 30 software engineers who were used as interviewees, and 125 respondents used Google Forms media to fill out questionnaires related to experience during WFH. After the qualitative and quantitative approaches have been implemented, all data is collected and analyzed using codification, both qualitative data and quantitative data, after codification, the results of the two data will then be compared to draw a conclusion that WFH does not have a significant impact on software engineers in terms of job performance. Software engineering and work directly related to using a computer can generally be done anytime and anywhere and will still produce the same performance regardless of where the work is.

This study is unable to encompass the entire condition between working condition, working mode, and productivity. The readers should bear in mind that the study is focused on finding correlation between working mode and productivity of software engineers in Batam City. Suggestions that can be given for future researchers are related to further research that can be carried out to obtain broader results and can also be investigated using case studies in different areas as well, then data dissemination can also be carried out into an even larger scope to get more diverse results to be studied in the future.

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