FINAL PROJECT – TI 184833

MENTAL WORKLOAD ASSESSMENT IN TELEWORKERS USING NASA-TLX AND SWAT METHODS BY CONSIDERING INDIVIDUAL DIFFERENCES (CASE STUDY: BAHASA.AI)

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TUGAS AKHIR – TI 184833

PENGUKURAN BEBAN KERJA MENTAL PADA *TELEWORKERS* MENGGUNAKAN METODE NASA-TLX DAN SWAT DENGAN MEMPERTIMBANGKAN FAKTOR *INDIVIDUAL DIFFERENCES* (STUDI KASUS: BAHASA.AI)

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Surabaya 2020

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APPROVAL SHEET

MENTAL WORKLOAD ASSESSMENT IN TELEWORKERS USING NASA-TLX AND SWAT METHODS BY CONSIDERING INDIVIDUAL DIFFERENCES (CASE STUDY: BAHASA.AI)

FINAL PROJECT

Submitted to fulfil the requirements for bachelor degree of industrial engineering
under the Department of Industrial and Systems Engineering
Faculty of Industrial Technology and Systems Engineering
Institut Teknologi Sepuluh Nopember
Surabaya

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SURABAYA, JULY 2020

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PENGUKURAN BEBAN KERJA MENTAL PADA *TELEWORKERS* MENGGUNAKAN METODE NASA-TLX DAN SWAT DENGAN MEMPERTIMBANGKAN FAKTOR *INDIVIDUAL DIFFERENCES* (STUDI KASUS: BAHASA.AI)

Nama : Layla Kurniasari Putri
NRP : 02411640000014
Pembimbing : Anny Maryani, S.T., M.T.

ABSTRAK

Kemajuan teknologi di bidang komunikasi telah membawa perubahan system kerja baru, yaitu *telework.* Telah banyak penelitian dilakukan mengenai pengukuran beban kerja mental namun hanya sedikit yang berfokus pada pekerja *telework* sebagai objek hingga hari ini. Sebuah studi pendahuluan dilakukan sebelum riset ini.Hasilnya menunjukkan 22 dari 30 pekerja *telework* pernah mengalami kelebihan beban kerja yang menyebabkan stres, menurunnya produktivitas, mudah marah, dll. Penelitian ini bertujuan untuk melakukan pengukuran beban kerja mental dan menganalisa hubungannya dengan faktor *individual differences* pada pekerja *teleworker* di perusahaan pengembang aplikasi berbasis *conversational commerce,* bahasa.ai. Penelitian ini menggunakan pendekatan subjektif, yaitu menggunakan metode *National Aeronautics & Space Administration Task Load Index* (NASA-TLX) dan *Subjective Workload Assessment Technique* (SWAT). Pengambilan data dilakukan menggunakan kuisioner online yang diisi bersamaan dengan wawancara secara virtual (online).

Hasil dari penelitian ini menunjukkan bahwa perhitungan nilai akhir beban kerja mental objek amatan memiliki pola hasil yang sama, dengan median 8.4 (tinggi) untuk metode SWAT dan 79.67 (tinggi) untuk metode NASA-TLX. Penambahan jumlah pekerja menjadi rekomendasi yang diusulkan dalam penelitian ini.

Selain itu, dengan menggunakan tes regresi, hasil penelitan ini menunjukkan bahwa tidak ada faktor *individual differences* (usia, kebiasaan berolahraga, dan status pernikahan) yang memiliki pengaruh yang signifikan terhadap hasil pengukuran beban kerja mental pekerja *telework* di bahasa.ai.

Kata Kunci: *Telework,* NASA-TLX, SWAT, *Individual Difference,* Beban Kerja Mental

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MENTAL WORKLOAD ASSESSMENT IN TELEWORKERS USING NASA-TLX AND SWAT METHODS BY CONSIDERING INDIVIDUAL DIFFERENCES (CASE STUDY: BAHASA.AI)

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ABSTRACT

Technology advance in communication has brought a shift on working system into a new system called telework. There have been many researches about mental workload but only few focus on teleworkers as object up to date. A preliminary study was conducted and shows that 22 out 30 teleworkers had experienced excessive workload that causes stress, unproductivity, emotionally unstable, etc.

This study is aimed to assess mental workload by considering individual differences factors of teleworkers in a conversational commerce developer, bahasa.ai. The research uses the subjective workload assessment approach, National Aeronautics & Space Administration Task Load Index (NASA-TLX) and Subjective Workload Assessment Technique (SWAT). The data were taken through an online questionnaire which was filled during the online interview. The results show that both methods generate similar patterns of mental workload global score, in which the median of SWAT method is 8.4 (high) and NASA-TLX method is 79.67 (high). Thus, additional number of teleworkers is recommended.

A linear regression test was also conducted to assess the correlation between the individual differences factors (age, exercise habit, and marriage status) and the mental workload scores of teleworkers in bahasa.ai. The results show that there is an insignificant correlation between both variables.

Keywords: Telework, NASA-TLX, SWAT, Individual Difference, Mental Workload

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PREFACE

Alhamdulillaahirabil'aalamiin, all the praise for the almighty Allah SWT who has given all the strength, ways, health, chances and so that the author can finish the author's final project's research, "**Mental Workload Assessment In Teleworkers Using NASA-TLX And SWAT Methods By Considering Individual Differences (Case Study: bahasa.ai)"**. This final project's research is one of the requirements to gain a bachelor degree in Industrial and Systems Engineering Department of Sepuluh Nopember Institute of Technology.

During the research and final project report writing, the author has received so much love, supports, suggestions, critics, and recommendations so that the author feels very blessed and grateful. Hence, the author would like to thank:

1. The prophet Mohammad SAW who sacrificed many things in his life to enlighten mankind from the darkness of *jahiliyyah* age and had become the greatest role model for all of us eternally.
2. Mr. Sulistiyono and Mrs. Sundari as the author's parents who always put their best effort, efficacious prayers, courage, and infinity affection to support the author in any situation.
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6. Mr. Hokiman Kurniawan, CEO of bahasa.ai who has given the permision for the author to conduct the research in bahasa.ai.
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9. Author's special colleagues, Fitri Annisaulkarimah and Desi Wulansari, who were very supportive as peers of the author in many cases and situations.
10. Also for every person, organizations, or parties who contributed in this research and can not be mentioned one by one.

Last but not least, the author hopes that this final project research can give contribution and benefits for the readers and further reasearchs. The author realized that this final project research is very far from the perfections. Thus, the author is very opened to any critic and suggestions.

Surabaya, July of 2020

Layla Kurniasari Putri

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CHAPTER 1
INTRODUCTION

This chapter will justify the backgrounds of the research and the existing condition in real-life working system. Within this chapter will also be explained about the problem identification, objectives, benefits and scope of the research, and writing systematics of the research's report.

1.1. Background

Technological progress within the industry 4.0 has brought a quite big impact on the communication and computing advancement. Communications barriers such as distance and cost are no longer inhibit people to get connected. The information has become widely accessible 24 hours for everyone across the world.

Along with communication technology development, there is a new term within mankind world, called the virtual world. The virtual world is a depiction of the new form of the world with limitless communication barriers. People can communicate face to face from two different continents or even more at the same time. The virtual world has allowed policymakers, business managers, and many more roles to take decisions very quickly. Scientists are getting easier to enhance and enrich their researches. Students become more limitless to learn anywhere and anytime. The virtual world has also changed the way people do their activities. People can now have more choices to do their works and to choose what and where they want to do. People are not limited to work in any specific place or any specific time. Computers and technology help them get over those traditional problems. Workers in today's era find the new choice of working remotely (Lee, 2012).

Working in a distance, remotely, has become a new phenomenon in the workplace and labor force area. Telework, also known as remote work/work from home, is a new working style that becomes more popular time by time. Telework is the working system in which the work does not require the physical meeting between the stakeholders (Montreuil & Lippel, 2002; Navrátil, Hladká, Duspivová, & Dušánek, 2017). Globally, there was significant growth in the number of teleworkers (in general telework type) from 14% to be around 66% between 2012-

2017 (Future Workplace, 2017). In the United States of America, as shown in figure 1.1, the trend of telework has grown 115% between 2005 and 2017 (Global Workplace & Flexjobs, 2017).

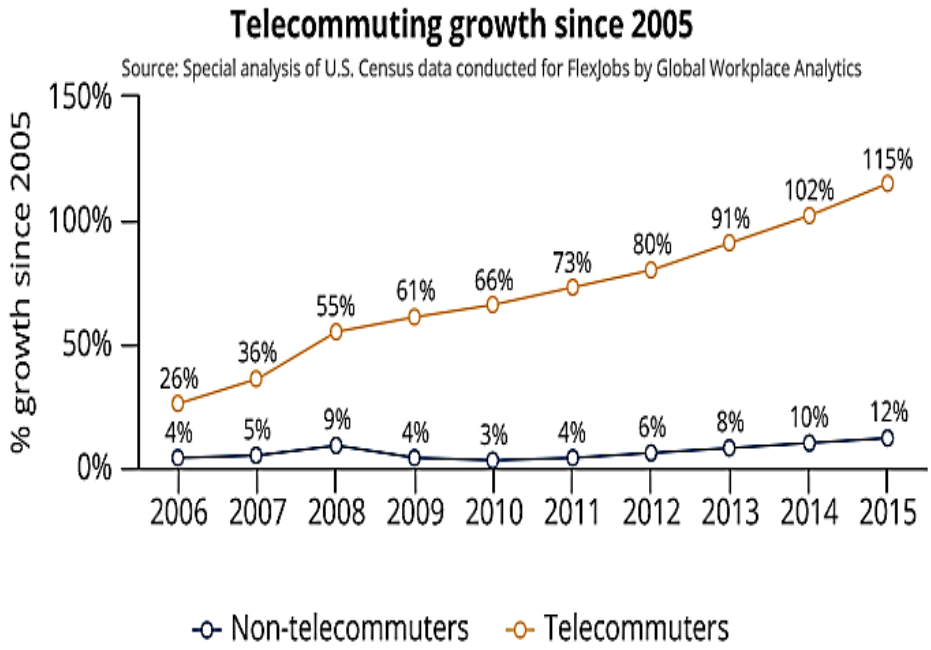

Figure 1. 1 Telecommuting Growth in the USA 2005-2017

Source: (Global Workplace & Flexjobs, 2017)

Figure 1.2 and 1.3 shows the teleworker's statistic in Europe and British. European Commission (2018) reported that the telework system is up to 5%, with the highest percentage is in the Netherlands which is 13.7%.

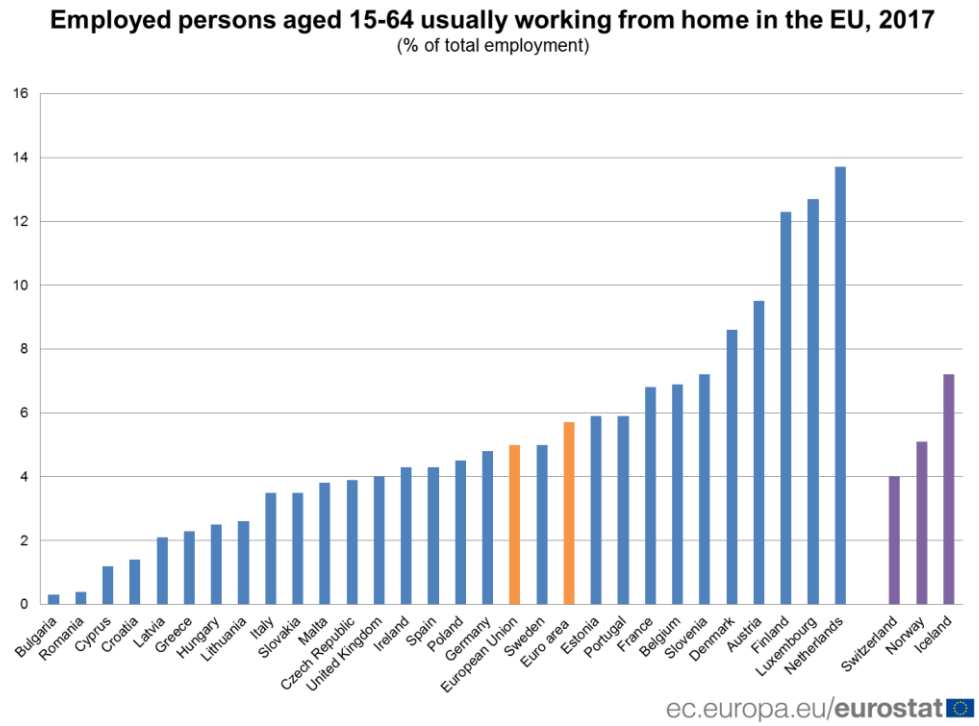

Figure 1. 2 Telework Statistic in European Union

Source: (European Commission, 2018)

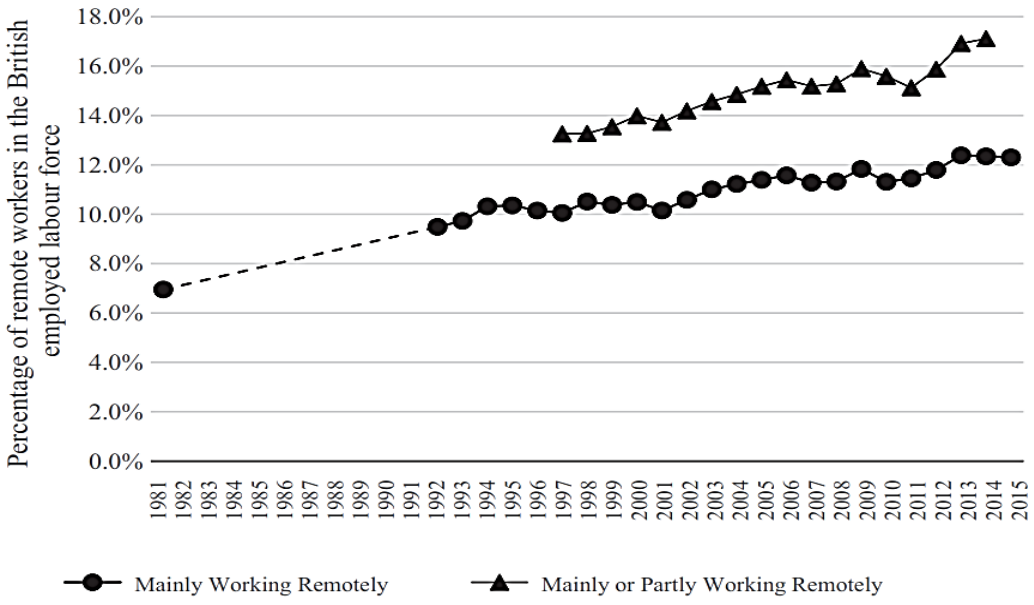

Figure 1. 3 Trends of Telework in UK (1981-2015)

Source: Spring Quarter Labor Force Survey UK (1981-2015) through (Felstead & Henseke, 2017)

According to Nicholas (2014), teleworkers percentage in developing regions are higher compare to Europe and the USA. The USA and Europe have only about 9% teleworkers. While in Latin America, it had 25% teleworkers. In Asia, there are about 27% in Middle East and around 24% in Asia-Pacific. India was even reported to have a higher percentage, which was up to 82% teleworkers (whose work remotely at least once a week) and up to 57% teleworkers (whose work more frequently).

In Indonesia, teleworkers are estimated roughly up to 34% telework (Noviyanti, 2016). A survey by ILO (2017) involved 732 enterprises (67% in service sectors and 33% in the manufacturing sector) reported that the service-sector companies which hire teleworkers are 23% or in around 113 companies.

There are many job types and job position that possible to be done by teleworking. In the USA there are various jobs title that reported to be succeeded done remotely, such as budget analyst, information technology specialist, medical librarian, safety and health compliance officer, voucher examiner, human resources specialist, etc. (The U.S. Office of Personnel Management , 2001). In Indonesia, there are also varied enough job titles offered in telework system, such as helpdesk and dispatch coordinator, customer support staff, marketer, community development coordinator, IT support, business performance and commercial, bilingual curriculum vitae (CV) writer, automation engineer, quality assurance, civil engineering, mobile programmer, etc. (Linked.in, 2020).

There are some of considerations that makes telework become the people's choice in the current working world. From the perspective of the company, telework is one of the alternatives to reduce the operational cost for facilitating their workers in the office, such as electricity, water, and space (if the company rents the office). Other than that, the company or the employer may get a higher quality output (from the workers) since their workers are tent to be more productive and become more innovative. As for the worker, the benefits they may get are having a better life balance between their work and family business. Psychologically, teleworkers are tent to feel more relax as they can choose the work environment on their own. It results in higher productivity and even their health condition. A global telework survey found that 73% of employees surveyed said they eat healthier when working

from home (PGi, 2016). Correlating with the current issue, an epidemic global case of Covid-19 virus or known as Coronavirus, telework might become an alternative for a working network to be done currently (Gardner & Matviak, 2020).

On the other end, however, telework was reported to have some negative effects on the psychological side of the worker. An interview over 2,000 employees and managers from some different regions in the world reported in Harvard Business Review website. The interview showed that two-thirds of teleworkers were not engaged and over a third never get any face time with their team (Schawbel, 2018). Another survey by the Harvard Business Review found that teleworkers often experience of virtual barriers in communicating with their work colleges (Schinoff, Ashforth, & Corley, 2019). Not only that, the low uncertainty level of the telework system may result in various working hours, practically. It may result in the inability for some workers in getting their job done and eventually affect their daily life. That indicates the possibility for teleworkers to experience mental workload (Zulfany, Dewi, & Partiwi, 2019).

A preliminary was conducted before starting this research between the 11th of April – 18th of May 2020. The preliminary study showed that there were 22 out of 30 teleworkers have experienced excessive workload as shown in figure 1.4 below:

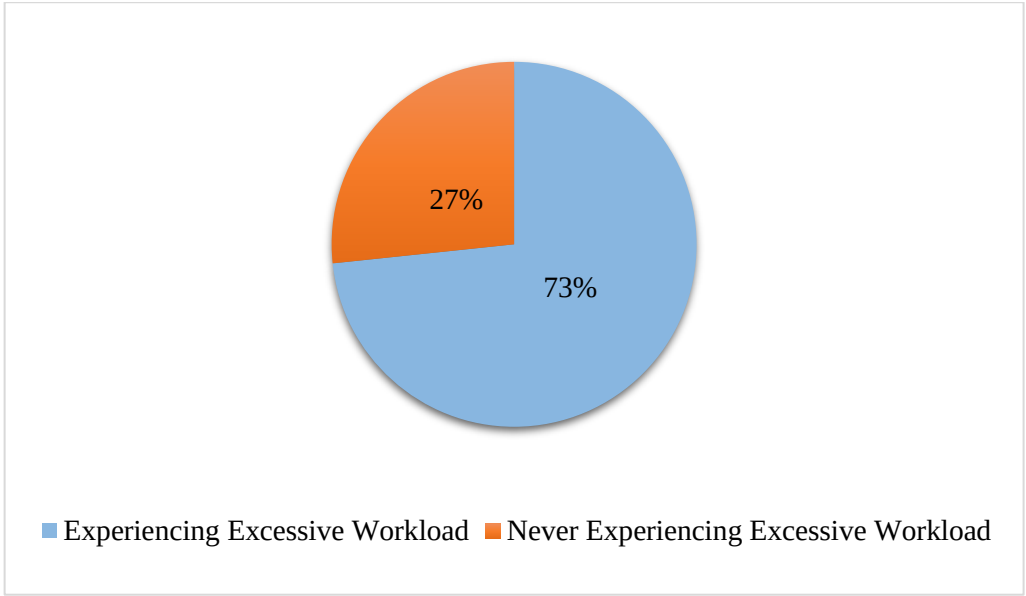

Figure 1. 4 Precentage of the Teleworker Excessive Mental Workload Experience

In consequence, the excessive workload experience has brought negative effects for the teleworkers. 45.5% of teleworkers reported that they feel stress and not productive due to the excessive workload experience. Figure 1.5 below shows more effects due to the excessive workload experience:

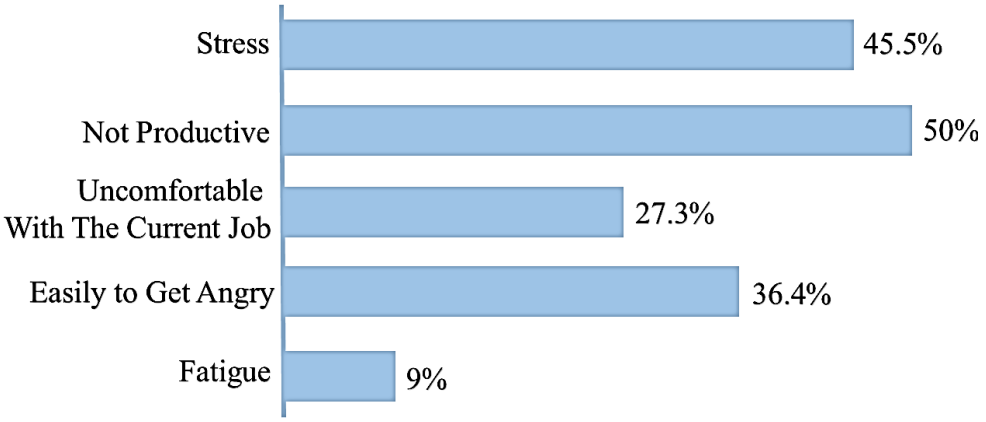

Figure 1. 5 Consequences experienced by the preliminary study's respondents due to excessive workload experience

Hence, this final projects proposed the mental workload assessment topic. However, there have already much research about assessing mental workload, especially to the traditional working system object (the worker who physically attends the office to work). Thus, this research was planned to focus on observing the teleworkers as the object. Whilst, the decision to select bahasa.ai to become the object was according to the statement of bahasa.ai's Project Manager, Mr. Choliq. Choliq (2020) stated that there has never been conducted any mental workload measurement to their employees. The statement was matched the research's topic. It makes bahasa.ai is perfect to become the research's object.

The methods proposed in this research are the SWAT and NASA-TLX methods. These 2 methods were chosen firstly because these methods are subjective methods which more practically related to the research's object (respondent) and can be adjustable to the operational observation. So that the result is expected to be more accurately describing the real situation in the research's object. Not only that, but these mental workload asessment methods were also chosen since the

respondents are all telework. It will be really time-consuming and costly to run physical workload assessment.

NASA-TLX method applies 6 dimensions within its use. Compare to SWAT, NASA-TLX has more dimensions to assess. NASA-TLX assesses the physical demand, performance, and the physical effort aspect that differs this method with SWAT. This means that NASA-TLX can depict wider perspectives in generating mental workload scores. However, NASA-TLX assess the mental workload of the respondents individually. All the ratings are purely based on the individual perspectives and experience without considering any other individual, even if the individuals are in the same environment.

SWAT method is an assessment based on scaling. This is the unique aspect of the method. The scaling generation is based on Spearman's rank-order correlation theory, in which will show the correlation among ordinal data rank (this method uses the 27 SWAT cards to be sorted by the respondents, see further explanation in chapter II). By the scaling system, the SWAT method is able to portray the correlational value between the respondents. In other words, this method considers the respondents' homogeneity in generating the individual score of mental workload.

This final project is also analyzing the correlation between individual differences factors towards the mental workload reception of the teleworkers. The reason for the involvement is because the different this factor affects perceived workload to the respondent (Szalma, Individual Differences in the Stress and Workload of Sustained Attention, 2009). Eventually, this research is expected to be able to show the mental workload measurement of the teleworker in bahasa.ai by using NASA-TLX and SWAT. This research is also expected to be able to put into consideration the factor of individual differences that affect the mental workload assessment.

1.2. Problem Formulation

There is still a limited number of research about mental workload assessment on teleworkers in Indonesia. Whilst, the working system is becoming

more popular and more people start applying it and predicted to be more in the future. The current situation of covid-19 pandemic has proven the shift.

As the system used by more people and more organizations, there must be a different style to maintain the performance of the organization as well as to maintain the welfare of the workers. One of the actions that can be taken is to ensure the workload of the worker is not exceeding. Nevertheless, the preliminary study shows that 22 out of 30 teleworkers have experienced excessive workload. There must be a possibility for the teleworker to experience the excessive mental workload within their job.

Thus, this research was aimed to focus on assessing the mental workload of teleworkers. The research took bahasa.ai as the object since bahasa.ai is applying the telework working system and has never conducted any mental workload measurement.

1.3. Research's Objectives

The objective of this final project research is basically to assess the mental workload of the teleworkers in bahasa.ai. There are also other objectives to achieve at the end of this research. Below are the overall objectives of the research:

1. Teleworkers' mental workload assessment by using the NASA-TLX and SWAT method.
2. Identify the correlation between individual differences factors toward individual teleworker's workload results.
3. Giving recommendation for research's object about the telework working system implementation.

1.4. Research's Benefits

Below are the expected benefits which will be gotten from this final project's research:

1. This final project hopefully to be useful in enriching readers' perspective, especially about teleworkers' mental workload assessment.

2. This final projects may give a new perspective, especially on company objects and any other company which applies remote work system in terms of measuring their teleworkers' mental workload.
3. To the research's object, the this research is hopefully able to help the company optimizing the performance of both their employee and the company itself and employee's admission process (in terms of what criteria should be put in hiring new human resources regarding the current workload result).

1.5. Research Scope

In this subchapter will be explained about the research's scope. The scope includes research's limitations and assumptions.

1.5.1. Limitations

1. This research will only involve the full-teleworkers in bahasa.ai.
2. This data collection is bounded to the range of time limitations from May until July 2020.

1.5.2. Assumptions

1. There are no job description changes for the bahasa.ai employees between May until July 2020.
2. The working system in the research's object (bahasa.ai) remains the same, which is using the telework system.

1.6. Writing System of the Research Report

In this subchapter will be explained the writing systematic of this final project research. Below are a brief explanation about the overall research's report:

CHAPTER I INTRODUCTION

Chapter I explains what issues (background) that drove the problem formulation. Within the chapter, the problem formulation will be explained along with the

research's objectives, research's benefit, research's scope (limitations and assumptions), and the writing system of the research's report.

CHAPTER II LITERATURE STUDY

Chapter II of the research contains literature study short explanation. The explanation includes the theory, methods steps, and other important materials related to this research, such as special terms used in this research. Chapter II also explains the previous researches in the related topics to give the reader further insight in capturing the roadmap of the research.

CHAPTER III RESEARCH METHODOLOGY

Chapter III contains the explanations of the systematic steps that will be done during the research. This research basically was begun with the problem formulation towards an issue/topic and validated by the preliminary study. The step was followed by a literature study, data collection, data processing, analysis, recommendations for resarch's object, and suggestions proposals for future research.

CHAPTER IV DATA COLLECTION AND PROCESSING

Chapter IV explains data collection. In this research, data collection was done totally by virtual media. The data was collected through online interviews and questionnaire distribution. The data was then processed by using NASA-TLX and SWAT method. Data collection also included the data for NASA-TLX, SWAT, and individual factors.

CHAPTER V ANALYSIS AND RECOMMENDATION

This chapter explains about analysis referring to the data processing result in the previous chapter. The analysis is an exploration of how much is the workload perceived by the respondent and considers any related factor to it.

CHAPTER VI CONCLUSION AND SUGGESTION

This chapter presents the research's conclusion and suggestions. The suggestions is given to the research's object and for further research in the future.

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CHAPTER 2
LITERATURE STUDY

In this chapter will be shown and explained the summary of the theories and methods used within this research. The summaries were taken from various sources that re-written into a more concise version to make the reader easily understand.

2.1. Industrial Revolution

Industrial revolution means the shift from the pre-industrial to an industrial society. Until the time of this research submitted, the industrial revolution has happened for 4 times. The first industrial revolution was in Brittain (Mohajan, 2019; Vries, 2008; Easton, Carrodus, Delany, Howitt, & Smith, 2013). The ndustrial revolution was started in around 1750-1760 until around 1820-1840 (Mohajan, 2019). There were no exact event marks on the first industrial revolution, however, it was indicated by the economic growth due to the technology invention. The technology development was impacting several aspects such as the invention of Cyrus McCormick's reaping machine on agriculture, the spinning jenny invention on wool production, the invention of coke (method to bake the coals) on iron production, the invention of telegraph on communication, and the development of steam engine on transportation (Vries, 2008; Easton, Carrodus, Delany, Howitt, & Smith, 2013).

The second industrial revolution happened around the early of 20th century, around 1870-1914. Second Industrial Revolution was indicated by the electrical-powered mass technological technologies. In its technological advancement, the new system added were electrical power and telephone were becoming shift keys (Liao, Loures, Deschamps, Brezinski, & Venâncio, 2018; Mokyr, 1999).

The third industrial revolution was begun around the mids of 1970s, indicated by electronics and information technology advancement (Liao, Loures, Deschamps, Brezinski, & Venâncio, 2018). The indication arose along with it were internet, super information, and molecular biology. Economically, the technology advancement has brought the mega markets trends (Mellers, 2015).

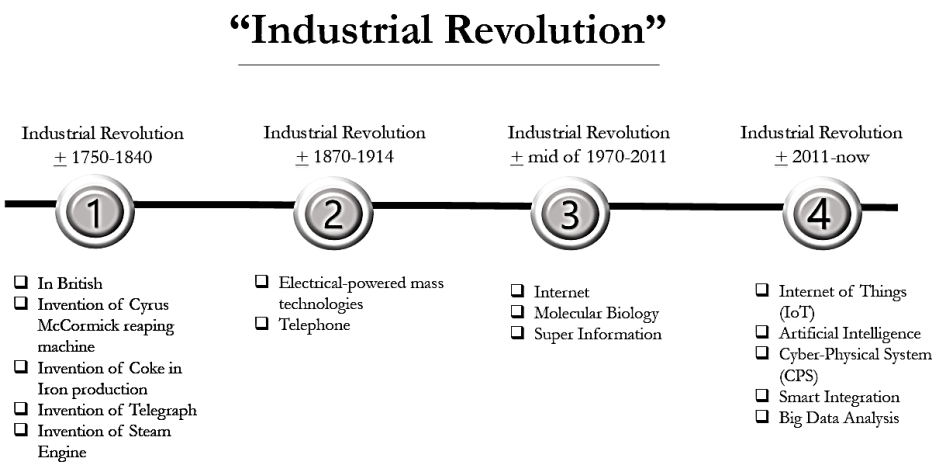

Figure 2. 1 Industrial Revolution Timeline

According to the time of the public policy release year, industrial revolution 4.0 was started in the USA in 2011. While in Asia, it was started to appear in around 2014. It was marked by the increment of research and development on the internet of things (IoT) cyber-physical systems (CPS), and smart machines in increasing the efficiency and effectivity of the production world. Industrial revolution 4.0 is an optimization of industrial 3.0. The more impact in this revolution is the artificial intelligence and the smart integration utilizing the big data analysis (Liao, Loures, Deschamps, Brezinski, & Venâncio, 2018; Atzori, Lera, & Morabito, 2010; Khaitan & McCalley, 2015).

Industrial revolution 4.0 has not only carried its impact on the manufacturing industry but also in the service and agriculture industry (Liao, Loures, Deschamps, Brezinski, & Venâncio, 2018). It is proofed by the policy disclosed by Taiwan's government through its Vice Premier Chang San-Cheng and Minister without Portfolio Yan Hong-Sen who formulated the plan to face the productivity 4.0. The 6 general strategies intensify the smart-supply chain ecosystem, startup encouragement, production and service localization, achieving autonomy in main technologies, generates and develop practical and technical talents, and encourage the industrial policy (Executive Yuan 行政院, 2015). The South Korea Republic introduced the manufacturing industry 3.0 as another indication of industrial 4.0 development has started. The manufacturing industry 3.0 promotes the strategic plan of smartization of integration on IT, software,

services, and new production methods (KEIA & KIEP, 2015; export.gov, 2019; MOTIE of Republic of South Korea , 2014; Liao, Loures, Deschamps, Brezinski, & Venâncio, 2018).

2.2. Teleworking

Telework or called as working from home is one of the flexible forms in the working time organization. In some countries, it is known by some different names. In Czech, it is usually known as home office (Navrátil, Hladká, Duspivová, & Dušánek, 2017). Some other sources also called this working system as work from home, including in Indonesia currently during pandemy. In the USA, it is commonly known as telework.

Figure 2. 2 Telework Illustration
source: (GRDC, 2019)

Tremblay and Le Bot (2001) through Montreuil & Lippel (2002) defined telework as "an employed or self-employed person using a remote computer consultation system within the context of his work. In Europe, the telework system is the working system done by a group of employees. They do it in one central place or in a satellite office (Montreuil & Lippel, 2002).

There is no such a widely-accepted definition for the teleworking system since it is defined and practiced differently in some different regions. However,

there is a common thing among those different terms that represent the telework system, which is flexibility. Some organizations or companies are allowing their employees to have flexible working hours, workday, or even completely remote (they do not meet physically). Bahasa.ai is one example of companies that apply a full telework system in Indonesia (Choliq, 2020).

Telework had been taking an essential role as the technology expands since the mid-1980s (Montreuil & Lippel, 2002). According to Eurofound & the International Labour Office (2017), telework has existed even since the 1970s. However, the massive application was just started lately when the internet and computer become more affordable for households. In around 1970s, the internet and computer could only be accessed by certain limited people.

There are some benefits as well as some concerns for applying this type of working system, both for the company and the workers according to Eurofound & the International Labour Office (2017).

Individual Benefits. There must be reasons for this type of working system to be used by a wider society. Eurofound & the International Labour Office (2017) reported that telework (Specifically in T/ICM or telework and ICT-mobile work) provide benefits of more working time flexibility, better work-life balance, and better productivity.

Company Benefits: Eurofound & the International Labour Office (2017) also reported that this working system is giving a good impact on the company. As worker's productivity raises, company productivity will also be lifted. Not only that, the worker turnover ratio will also become smaller as the individual worker have lessened stress within their work.

2.3. Mental Workload

Workload is part of the ergonomic theory, a theory about how human interaction with their working environmental aspects, such as anatomy, physiology, and psychology (Singleton, 1972). Basically, ergonomic's goal is to provide optimum productivity by considering the human aspect (worker) with the lowest cost as possible (Health and Safety Authority, n.d).

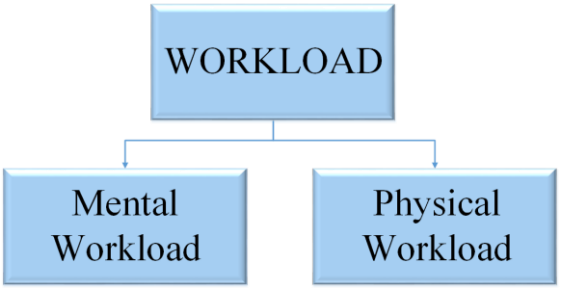

Figure 2. 3 Workload General Classification

Workload can be classified into 2 categories. The first category is the workload which is related to external materiality (can be seen clearly). This category includes physical, chemical, biological, and mechanical aspects. The second category is workload category which is related to internal materiality (can be felt only by the own body), including psychological and psychics (work dangerously rhythm of work, frequency of emergent situations, problem-solving) aspects.

Workload can be measured through 2 different approaches, which are objective and subjective methods (Jex, 1988). The objective measurement method is the physiological approach method. This method will measure aspects such as heart rate, eye-blink interval time, saliva acid content the method examples are biomechanical approach and cardiovascular strain (CVL). While the subjective methods, is the approach referring to the subjective judgment of the respondent (someone who actually does the work). In other words, the task performing experience of the respondent will be assessed to become the measurement variable. The subjective approach examples are SWAT and NASA-TLX (Widyanti, Johnson, & Waard, 2012). Both methods are the most commonly used in assessing mental workload (Rubio, Diaz, Martin, & Puente, 2004).

Mental workload can be defined as a fundamental concept for people in having interaction with any other party, such as technological devices, to other people, or a system. Mental Workload is part of human factor aspects. Mental workload assessment is beneficial for the use of predicting human performance (Longo, 2018).

In literal meaning, according to Oxford Learner Dictionaries (2020), mental means something that is related to the mind or thinking process. For example, a

process of remembering something. While workload refers to the amount of effort must somebody/group does in performing something. It can be implied that mental workload in literal meaning is the amount of effort in putting his/her mind capability in doing a task.

Hart & Staveland (1988) classified components of mental workload as 3 subscales, which are task-oriented scales (e.g. task difficulty), behavior-oriented scales (e.g. user's personal skill), and psychology-oriented scales (e.g. stress). There are many factors affecting the mental workload result. Environment and current condition of the respondent impact the assessment, even if the assessment is on the same task and the same respondent, the result may not be the same (Hart & Staveland, 1988).

2.4. SWAT (Subjective Workload Assessment Technique)

As one of the methods using subjective technique of assessment, SWAT has been developed to be able to measure the respondent's workload burden experience. SWAT is a subjective scaling approach which able to capture the multidimensional nature of the mental workload, which are time load, mental effort, and psychological stress load (Reid & Nygren, 1988).

2.4.1. SWAT Dimensions' Level

This section explains the SWAT dimensions which are divided into 3 levels of difficulty (towards the perceived workload) in which will be explained further in figure 2.4. Below is the explanation of each dimension in the SWAT method:

1. Time Effort

Time effort is the remaining time available within task performance. The tiime effort dimension is basically evaluating how the respondent spends the time in accomplishing a certain task. There are three levels of time load dimension, which often have spare time, occasionally have spare time, and very little spare time (Gawron, 2000).

2. Mental Effort

Mental effort reflects how much conscious mental effort that the respondent must put in performing a certain task. Mental efforts includes the attention, information processing, and concentration (Gawron, 2000).

3. Psychological Stress Load

Psychological stress load refers to how do the task giving impact on the respondent's psychological aspect, such as confusion, frustration, emotion, anxiety, eagerness, etc. Each of the dimension has 3 levels of difficulty, which are 1 (low), 2 (medium), and 3 (high).

Element Level Definition *(Definisi Elemen)*

in SWAT method *(pada metode SWAT)*

Time Load/*Beban Waktu* (T)

Element Level	Definition *(Definisi)*
T (1)	Often have spare time. Interrutprion or overlap among activities occur infrequently or not at all.
T (2)	Occasionally have spare time. Interrutptions or overlap among activities occur frequently.
T (3)	Almost never have spare time. Interruptions or overlap among activities are very frequent, or occur all the time.

Mental Effort Load/*Beban Mental* (E)

Element Level	Definition *(Definisi)*
E (1)	Very little conscious mental effort or concentration required. Activity is almost automatic, requiring little or no attention.
E (2)	Moderate conscious mental effort or concentration required. Complexity of activity is moderately high due to uncertainty, unpredictability, or unfamiliarity. Considerable attention required.
E (3)	Extensive mental effort and concentration are necessary. Very complex activity requiring total attention.

Stress Load/*Beban Stres* (S)

Element Level	Definition *(Definisi)*
S (1)	Little confusion, risk, frustration, or anxiety exists and can be easily accommodated.
S (2)	Moderate stress due to confusion, frustration, or anxiety noticeably adds to workload. Significant compensation is required to maintain adequate performance. *performansi)*
S (3)	High to very intense stress due to confusion, frustration, or anxiety. High to extreme determination and self-control required.

Figure 2. 4 SWAT Dimensions Details (Time Effort)

Source: (Reid et.al., 1989) Through (Society of Automative Engineering of Japan, 2019)

The three levels in each dimension generate the 27 possible combinations (3 x 3 x 3). The use of 27 sort cards is to depict the workload of the performed task (Vidulich & Tsang, 1986; Reid, Potter, & Bressler, 1989). See figure 2.5 to see the visualization of the 27 SWAT cards.

2.4.2. SWAT Procedures

SWAT Method is divided into 2 steps, which are scale development and event scoring stage (Reid, Potter, & Bressler, 1989). Below are the further explanations of the SWAT procedures:

2.4.2.1.Scale Development

Scale development is what differs the SWAT method from another subjective workload assessment. The goal of this phase is to establish the operational definition of mental workload (Reid, Potter, & Bressler, 1989).

Within scale development, there are 2 main steps; the 27 SWAT cards sorting, below are the further explanation and conjoint measurement (including axiom measurement if necessary):

a. Scale development phase 1 (Card Sort Procedure)

The card sort procedure is one of the unique aspects in SWAT. This step is the key step in running the SWAT assessment method. The card sort is according to the overall dimension preference of both group and individuals. The essential goals of the card sorting procedure are, first, to achieve protoyping and scale type development by assessing Kendall's coefficient of concordance (W). The second goal is to perform axiom test in order to show model validity if Kendall'scoefficient of concordance is violated. The third goal is finally to achieve the scaling solution for each of the respondents (Saputra, Priyanto, Muthohar, & Etsem, 2014).

Basically card sort procedure asks the respondent to give their preference in between the 3 dimensions of SWAT in all the 27 possible combinations (3x3x3) available (Vidulich & Tsang, 1986). In other words, this sort card procedure asks the respondent to sort from rank 1 (the most unsuitable combination depicting

respondent’s workload) to rank 27 (the most suitable combination depicting respondent’s workload). The figure 2.5 below will show the list of 27 SWAT cards:

The 27 SWAT Cards

(27 Kartu SWAT)

Example:
Card N = your job requires low time load, low effort, and generate low stress.

No	Card Code	Workload Rating Combination		
		Time (T)	Effort (E)	Stress (S)
1	N	1	1	1
2	B	1	1	2
3	W	1	1	3
4	F	1	2	1
5	J	1	2	2
6	C	1	2	3
7	X	1	3	1
8	S	1	3	2
9	M	1	3	3
10	U	2	1	1
11	G	2	1	2
12	Z	2	1	3
13	V	2	2	1
14	Q	2	2	2
15	ZZ	2	2	3
16	K	2	3	1
17	E	2	3	2
18	R	2	3	3
19	H	3	1	1
20	P	3	1	2
21	D	3	1	3
22	Y	3	2	1
23	A	3	2	2
24	O	3	2	3
25	L	3	3	1
26	T	3	3	2
27	I	3	3	3

Figure 2. 5 The SWAT Cards List

Source: (Krisnaningsih, Anwar, & Dwiyanto, 2019; Reid, Potter, & Bressler, 1989)

Each of SWAT card will be defined (converted) depends on its dimension's level combination value of the corresponding individual. Here is the example of how to define SWAT Card. The card I has dimension combination of 3 for dimension T/time load, 3 for dimension E/mental effort load, 3 for dimension S/Stress Load. It means that card I depict the workload for having high time pressure, high mental effort load, and high-stress load (Euro Control, 2012).

b. Scale development phase 2 (Conjoint/Prototyping Measurement)

The next step in scale development is that prototyping. Prototyping refers to group the respondent (respondents) by its homogeneity in their preference of which dimension in SWAT affecting to their workload reception (relative to the three dimensions level within SWAT). There are 6 possible prototype groups; TES, TSE, ETS, EST, SET, and STE. The selection of these 6 possible groups is based on the highest correlation score between the respondents and the 6 possible groups referring to SWAT cards-rank (Reid, Potter, & Bressler, 1989). Table 2.1 below will be shown the example of the selection:

Table 2. 1 Example of 6 Possible Group Selection for Each Respondent Individual in the SWAT Method

Respondent	TES	TSE	ETS	EST	SET	STE
Respondent 1	0.62	0.65	0.67	0.64	0.7**	0.82*

According to table 2.1, the selected prototype group for the respondent 1 (yellow-highlighted) will be STE as it has the highest value. The SET group as the second-highest will become the alternative possibility for respondent 1. In some cases, there will be a need to change the prototype group. The changes will refer to the second-highest correlation of the respondent.

Kendall's coefficient of concordance can be obtained by the conjoint scaling program or by the following equation (Krisnaningsih, Anwar, & Dwiyanto, 2019):

$$\mathbf{W} = \frac{\mathbf{12}\sum \boldsymbol{Ri^2} - \mathbf{3}\boldsymbol{n^2k}(\boldsymbol{k}+\mathbf{1})^{\mathbf{2}}}{\boldsymbol{n^2k}(\boldsymbol{k^2}-\mathbf{1})} \quad \text{…….. (Equation 1)}$$

Known:

k= number of variable

n = number of respondent

Ri = Number of rank for each variable for all respondent(s)

To give a prior understanding of the further explanation in the conjoint measurement procedure, it is better to know the three conjoint SWAT scales. There is only 1 scale type needed in the SWAT method. Table 2.2 below will show the definition for the three conjoint scales in the SWAT method:

Table 2. 2 SWAT Conjoint Scales

SWAT final scales		
No	**Conjoint Scale**	**Defiintion**
1	Group Scaling Solution (GSS)	The data from all subjects be averaged and will become the conjoint scaling.
2	Prototyped Scaling Solutions (PSS)	The conjoint scale will be derived by each of the three SWAT dimensions and will be grouped by the prototyping result. Each group will have their each SWAT scales.
3	Individual Scaling Solutions (ISS)	Each respondent needs to be analyzed individually. The conjoint scale will be derived for each individual respondent.

Source: (Saputra, Priyanto, Muthohar, & Etsem, 2014)

The use of the 3 scales will be based on Kendall'scoefficient of concordance result. When Kendall's coefficient measurement result is $\geq$ 0.75, it means that the intersubject agreement index in the card sort among the respondents is relatively similar and homogenous. It can be implied that the scale is using group scaling solution (GSS). On the other hand, if Kendall's coefficient value is under 0.75, an axiom test must be conducted to examine the basic additive model of the data (Saputra, Priyanto, Muthohar, & Etsem, 2014).

Axiom test is aimed to examined and validate the model since it is violating Kendall's coefficient rule. Axiom test is applied by checking its independence and joint independence. If the violation value is $\leq$20 it means that the data scale will use the prototyped scaling solution (PSS). In other words, data is considered to be fulfilling the basic additive model criteria. While if the violation is found to be >20,

it means that the data should be assessed using individual scaling solution (ISS). Whilst, the individual axiom test still showing the violation >20, then the regarded individual must be excluded from the data (Saputra, Priyanto, Muthohar, & Etsem, 2014).

2.4.2.2.Event Scoring

Event Scoring is the last step used in using the SWAT method. This phase is the phase to explore the required information and analyze the respondent's workload. The respondent will be asked to rate each dimension of SWAT using the value range from 1 (low) to 3 (high).

The dimension's rating score will later be used in determining the final result of the mental workload assessment. The dimension's rating score will be used as a reference in converting the scale generated by the software.

The final result of the event scoring in SWAT method will be classified as follows in table 2.3:

Table 2. 3 Table of Workload Classification in Swat Method.

No	Classification	Value Range
1	Low	0-40
2	Medium	41-60
3	High	61-100

2.5. NASA-TLX (National Aeronautics & Space Administration Task Load Index)

National Aeronautics & Space Administration Task Load Index or also known as the NASA-TLX method, is a mental workload assessment technique. NASA-TLX was developed and first introduced by Sandra G. Hart from NASA-Ames Research Center and Lowell E. Staveland from San Jose University in 1981 (Arasyandi & Arfan, 2016).

2.5.1. NASA-TLX's Dimensions

NASA-TLX applies 6 dimensions in assessing the mental workload of the users (Euro Control, 2012), which are mental demands, physical demands, temporal

demands, own performance, effort, and frustration (NASA Ames Research Center, 1986; Pradhana & Suliantoro, 2018; Arasyandi & Arfan, 2016).

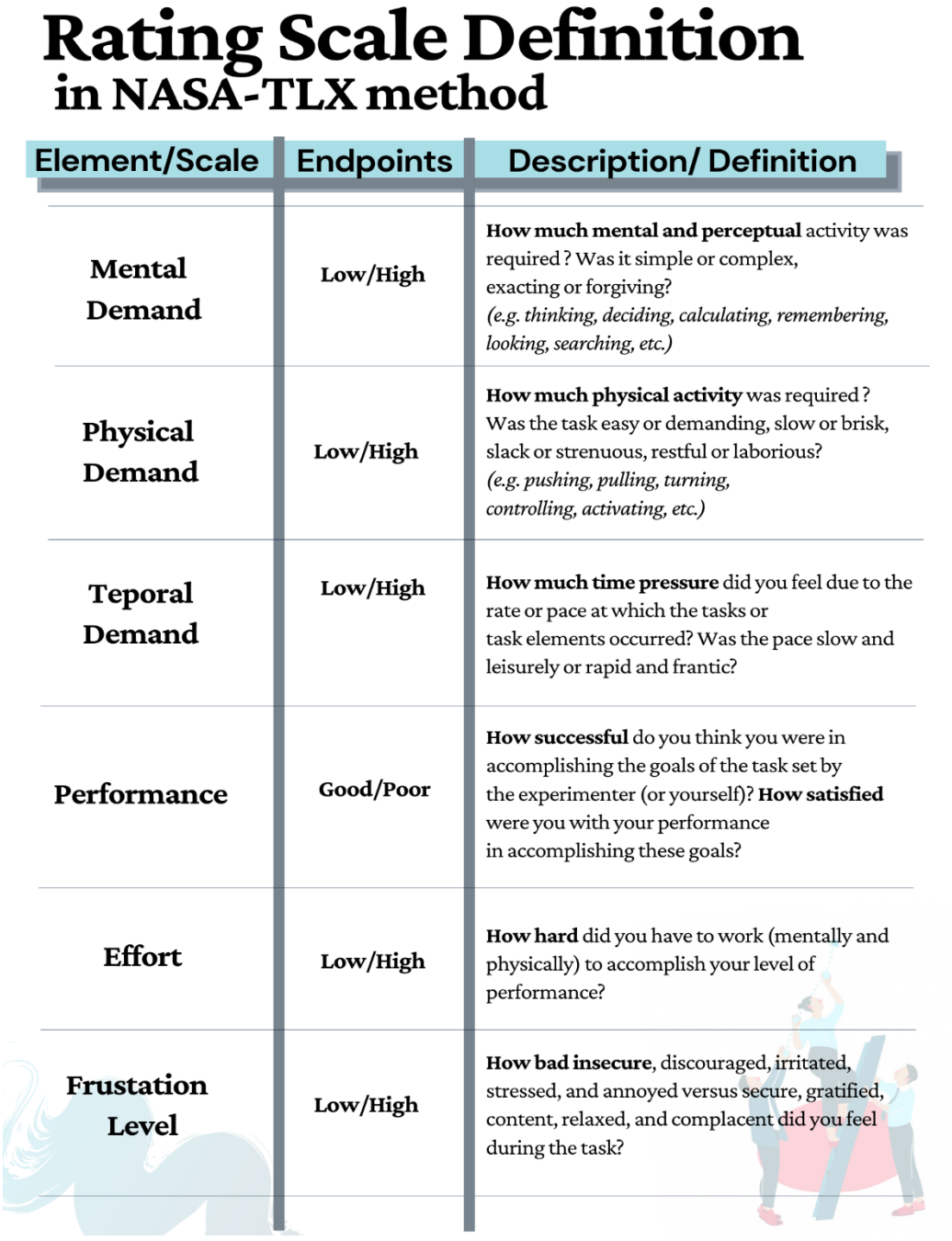

Figure 2. 6 Rating Scale finitions

Source: (NASA Ames Research Center, 1986)

The respondent must understand exactly how to define each dimension in NASA-TLX. This phase is called as familiarization. Familiarization is a very

important point. This phase is aimed to help the respondent in determining their subjectivity in the most affecting dimension in NASA-TLX towards their admission of workload.

2.5.2. NASA-TLX Procedure

NASA-TLX method uses both workload pair-ways comparison cards and the rating sheet. The two instruments are all according to the 6 dimensions. Within this section will be explaining the NASA-TLX by using paper-and-pencil version (manual). Below are further explanations:

2.5.2.1.Dimension Weighting (Pair-ways Comparison Cards Choosing)

In this phase, the respondent will be asked (according to their individual experience in performing a task) to choose which dimension contributes the most towards the mental workload they feel within their job (NASA Ames Research Center, 1986). Figure 2.7 below will be showing the visualizations of NASA-TLX's pair-ways comparison card:

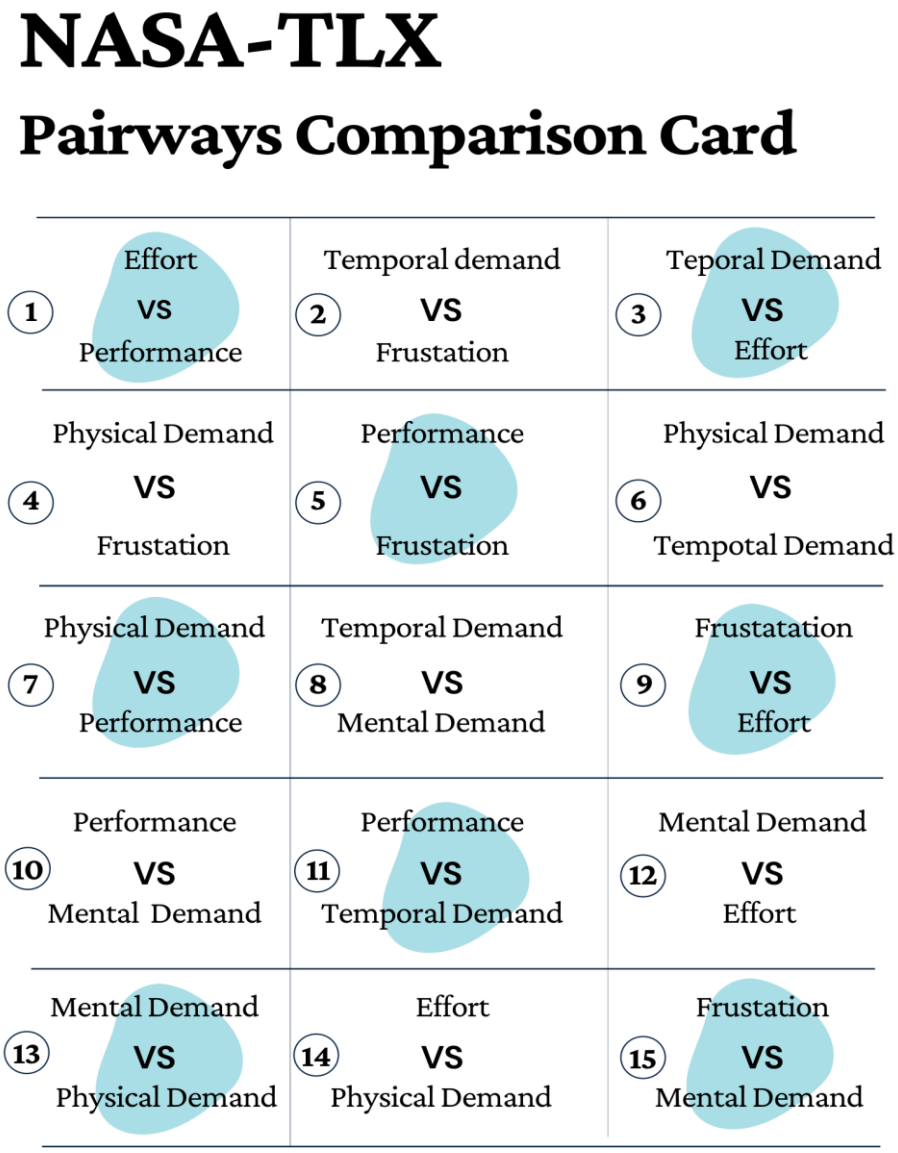

Figure 2. 7 NASA Pair-ways comparison card

Source: (NASA Ames Research Center, 1986)

NASA-TLX pair-ways comparison card was generated by the combination of the 6 NASA-TLX dimensions. The combination is paired between 2 dimensions and it will generate 15 pairs (${}^{6}C_{2} = 15$).

The preference of the respondent (in pair-ways comparison cards) will be recorded in the tally sheet workload source (NASA Ames Research Center, 1986). For example, each time the respondent chooses temporal demand on the pair-

comparison card, the observer should give value 1 on the tally sheet. The total number of the tally in each dimension will become the weight value.

In order to ensure that the tally recording is done right, the total count of the weight (see table 2.4) must be equal to 15 (total number of paired-combination cards) and no weight can a have value greater than 5 (due to paired combination of each mental). Below is how the tally sheet form looked like:

Table 2. 4 Workload Tally Sheet for Nasa-Tlx

Workload Tally Sheet		
Scale Title (Dimension)	**Tally**	**Weight**
Mental Demand		
Physical Demand		
Temporal Demand		
Performance		
Effort		
Frustation		
	Total Count =	

Source: (NASA Ames Research Center, 1986)

2.5.2.2.Dimension Ratings

The rating procedure will require the respondent to score each of NASA-TLX's dimensions. The rating will be between 0 and 100 based on the worker's subjective experience the perceived mental workload. In order to gain the global mental workload score, the rating will score will be multiplied by the weight (which was obtained from the familiarization step. This calculation result will become the adjusted rating value. Below will be shown the rating sheet (figure 2.8) and the adjusted rating value sheet (table 2.5):

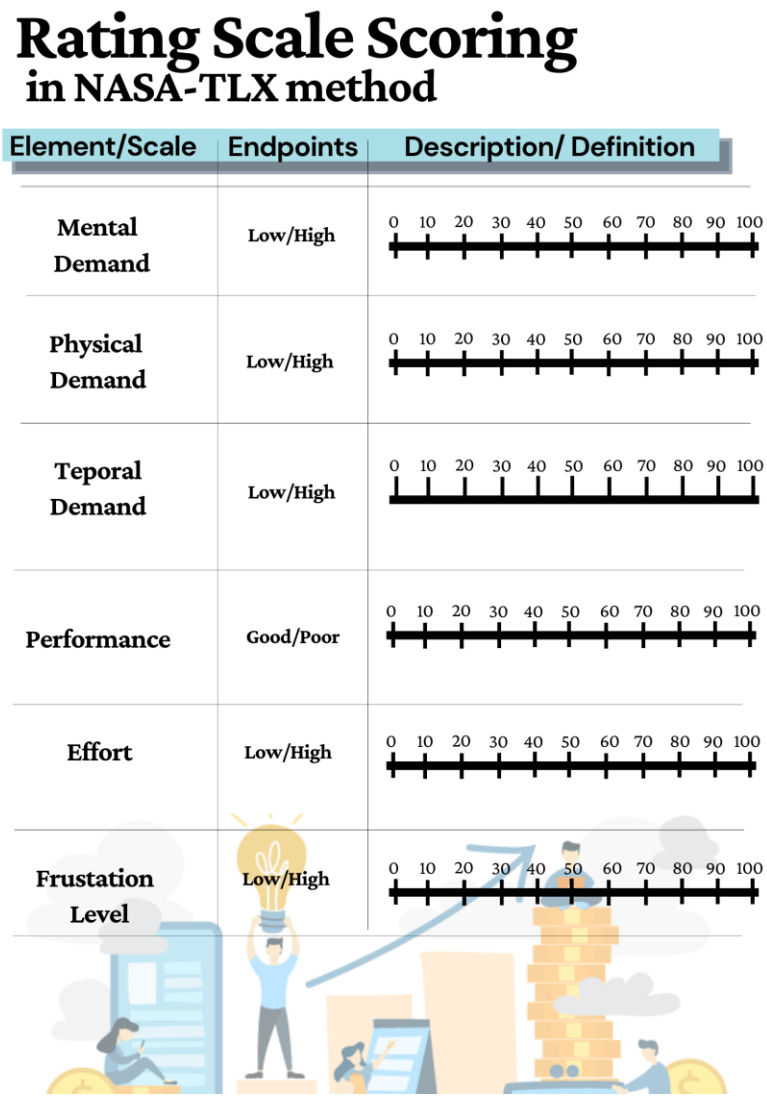

Figure 2. 8 NASA-TLX Rating Sheet

source: **(NASA Ames Research Center, 1986)**

Table 2. 5 Adjusted Rating

Weighted Rating Worksheet			
Dimensions	**Weight**	**Rating**	**Adjusted Rating (weight x rating)**
Mental Demand			
Physical Demand			

Table 2.5 Adjusted Rating (cont.)

Weighted Rating Worksheet			
Dimensions	**Weight**	**Rating**	**Adjusted Rating (weight x rating)**
Temporal Demand			
Performance			
Effort			
Frustation			

Sum of Adjusted Rating = _____

Source: (NASA Ames Research Center, 1986)

2.5.2.3.Weighted Workload (WWL) Calculation

The weighted workload calculation result will be the final/global workload score of NASA-TLX workload measurement. The WWL will require the sum of adjusted rating value from all the 6 dimensions and divide it by 15. Table 2.6 below is the mental workload classification in NASA-TLX:

Table 2. 6 Mental Workload Classification

Mental Workload Classification in NASA-TLX	Score
Low	0-9
Medium	10-29
Moderatedly High	30-49
High	50-79
Very High	80-100

Source: Hart and Staveland (1981) through Pradhana & Suliantoro (2018)

2.6. Individual Differences

Individual differences is one of the branches study in psychology. This theory was theorized between the late of 1940s and mid of 1960s (Revelle, Wilt, & Condon, 2015).

Williamson (2018) defines individual differences is the personal trait that distinguishes an individual from one another. Individual differences is a-vast topic branch in personal trait psychology. It can be varied from various perspectives. Lamos (1988) grouped the individual differences into three general headings; personality traits and behavioral patterns, response strategy, and resource capacity.

Lamos D. L. (1984) argued that the most related to the perceived workload is the personality traits. It is supported by the argument proposed by Mathews and Campbell (1988) through (Szalma, 2002) that personality traits (specifically in coping strategy) have a positive correlation with the perceived workload. Walter Mischel in his book argued that the Big Five model is the reliable personality trait to predict human behavior. He argued that even though variables may come to an unlimited number, there are some factors that adults, in general, would tent to become consistant (Diener, Lucas, & Cummings, 2019).

The suitable personality factor is actually still become a hot topic debated among psychologist. There are other experts who argue that personality factors are more likely to be situational variables rather than coined to certain general variables (Funder, Guillaume, Kumagai, Kawamoto, & Sato, 2012). The debate was even had been published and known as person-situation debate.

2.7. State of the Arts

In this subchapter will be shown about the prior studies/researches related to the topic in this research, including NASA-TLX and SWAT mental workload assessment method, telework, and individual difference. The prior researches/studies are shown in table 2.7 below:

Table 2. 7 Prior Studies Related to This Research's Topic

No	Research Year	Research Title	Researchers	Topic and Object				
				NASA-TLX	SWAT	Telework	Mental Workload	Individual Difference
1	1984	Subjective Workload and Individual Differences in Information Processing Abilities	Diane Lynn Damos				✓	✓
2	1988	Measuring Mental Workload: Problems, Progress, and Promises	Henry R. Jex				✓	
3	1988	The Subjective Workload Assessment Technique: A Scaling Procedure for Measuring Mental Workload	Gary B. Reid and Thomas E. Nygren		✓		✓	
4	1988	Individual Differences In Subjective Estimates	Diane L. Damos				✓	✓
5	1989	Subjective Workload Assessment Technique (SWAT): User's Guide (U)	Garry B. Reid, Scott S. Potter, Jeine R. Bressler		✓			

Table 2.7 Prior Studies Related to This Research's Topic (cont.)

No	Research Year	Research Title	Researchers	Topic and Object				
				NASA-TLX	SWAT	Telework	Mental Workload	Individual Difference
6	1997	Research Issue for the Comparative Study of Telework	Tasya Castleman and Jacqueline Adie			✓		
7	2002	Individual Differences in the Stress and Workload of Sustained Attention	James L. Szalma	✓				✓
8	2009	NASA-TLX: Software for Assessing Subjective Mental Workload	Alex Cao, Keshaw K. Chintamani, Abhilash K. Pandya, and R. Darin Ellis	✓			✓	
9	2009	Individual Difference in Performance, Workload, and Stress in Sustained Attention: Optimism and Pessimism	James L. Szalma	✓			✓	✓

Table 2.7 Prior Studies Related to This Research's Topic (cont.)

No	Research Year	Research Title	Researchers	Topic and Object				
				NASA-TLX	SWAT	Telework	Mental Workload	Individual Difference
10	2017	Relation Between Mental Workload and Decision-Making in An Organizational Setting	Maria Soria-Oliver, Jorge Lopez, and Fermin Torrano	✓			✓	✓
11	2017	Remote Work Problems and Their Solution for Employees	Mgr. Marcel Navrátil Mgr. Martina Hladká Mgr. David Dušánek and Ing. Kateřina Duspivová, Ph.D.			✓		
12	2018	Experienced mental workload, perception of usability, their interaction and impact on task performance	Luca Longo				✓	

Table 2.7 Prior Studies Related to This Research's Topic (cont.)

No	Research Year	Research Title	Researchers	Topic and Object				
				NASA-TLX	SWAT	Telework	Mental Workload	Individual Difference
13	2019	Analyzing Mental Workload of Remote Worker by Using SWAT Methodology (Case Study: Remote Software Engineer)	Almira H. Zulfany, Ratna S. Dewi, and Sri G. Pratiwi	✓	✓	✓	✓	✓

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CHAPTER 3
RESEARCH METHODOLOGY

Research methodology is a depiction of how the research was done. This chapter will be showing a flowchart of research methodology followed by the explanation for steps that had been done during the research. The whole research was divided into 3 general phases, which are the preliminary phase, the research phase, and the final phase.

To give a brief visual of the whole research methodology, below will be shown the flowchart of the research's steps:

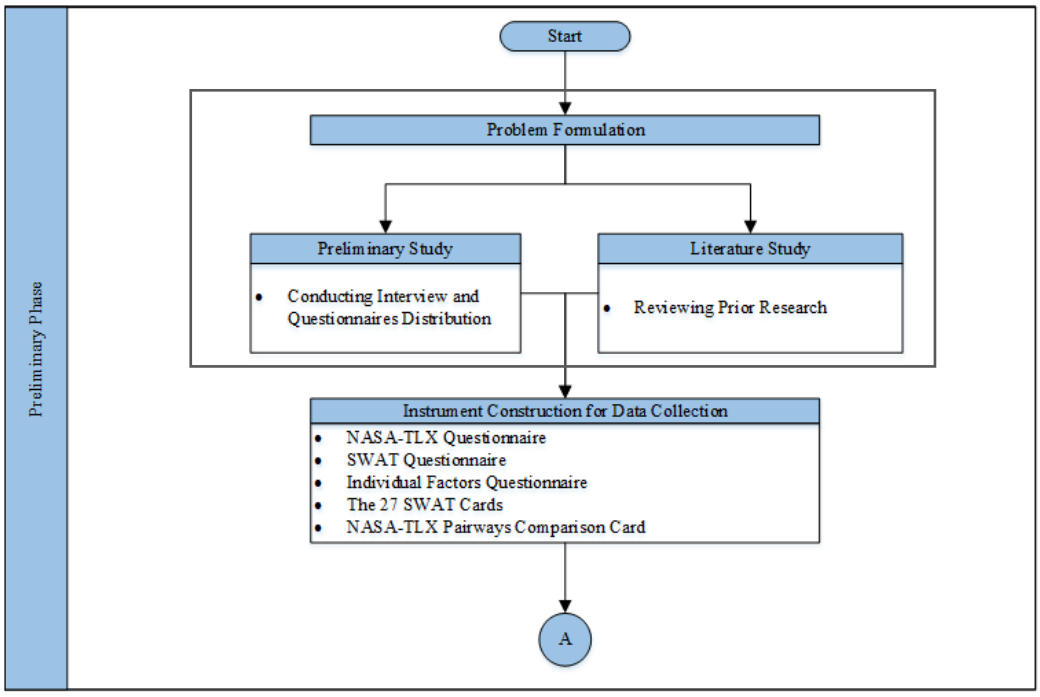

Figure 3. 1 Flowchart of the Research's Methodology

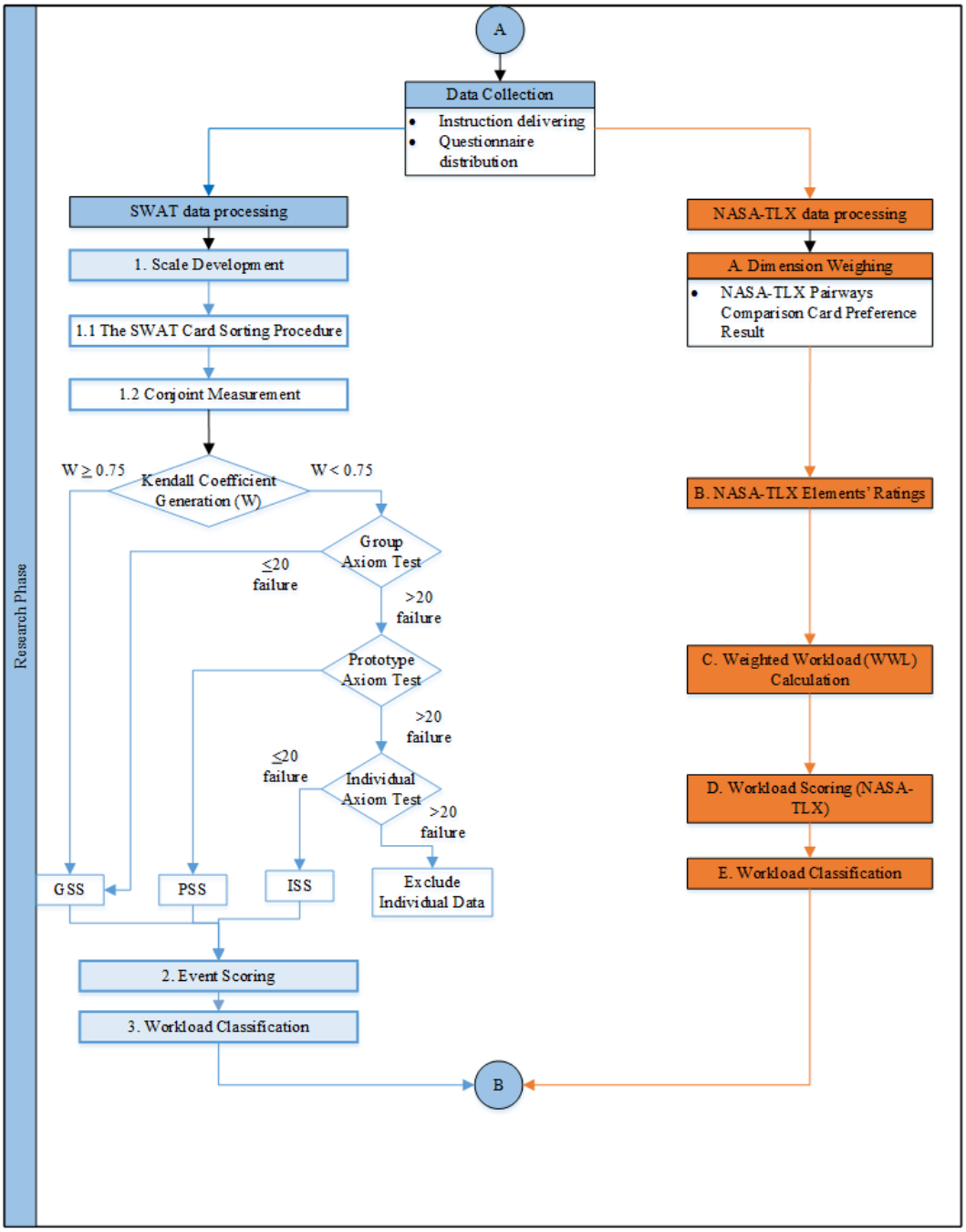

Figure 3. 1 Flowchart of the Research's Methodology (cont.)

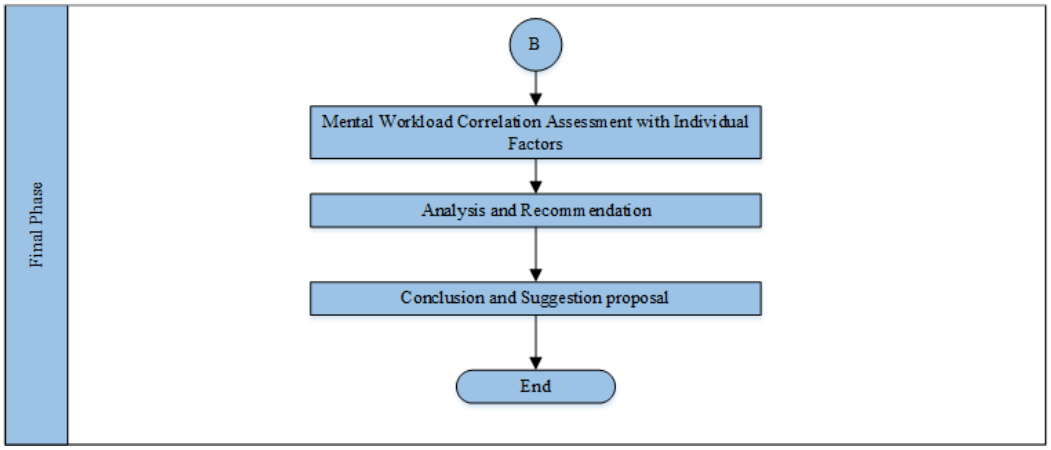

Figure 3. 1 Flowchart of the Research's Methodology (cont.)

3.1. Preleminary Phase

Preliminary phase is a phase need to be done before conducting the research. This phase contains some sub-phases, which are problem formulation, preliminary study, and literature study.

3.1.1. Problem Formulation

This research topic was started with a problem formulation. The problem formulation is a preliminary conjecture over the real and recent topic within the working system, remote working system, or also known as telework. The problem formulation of the research was that the telework might experiencthe excessive mental workload. This problem formulation lead the research to be continued.

3.1.2. Preliminary Study

Preliminary Study is a short exploration to find information from the actual situation. This preliminary study was done by spreading online questionnaires to some teleworkers. There were 30 teleworkers respondents, including from company objects. The goal was to confirm that the problem formulation indeed exist for the research to be continued or not.

The respondents within the preliminary study were between age of 21 and 30 years old. The gender composition of the respondents is 40% female and 60% males. The respondents are distributed in some different areas such as East Java (Jawa Timur), Central Java (Jawa Tengah), West Java (Jawa Barat), Aceh, South

Sumatera (Sumatera Selatan), and etc. Respondents are consisted of diverse professions, such as civil engineer, software engineer, and product developer. 83% of the work as a full-time teleworker and the rest work as partial teleworker.

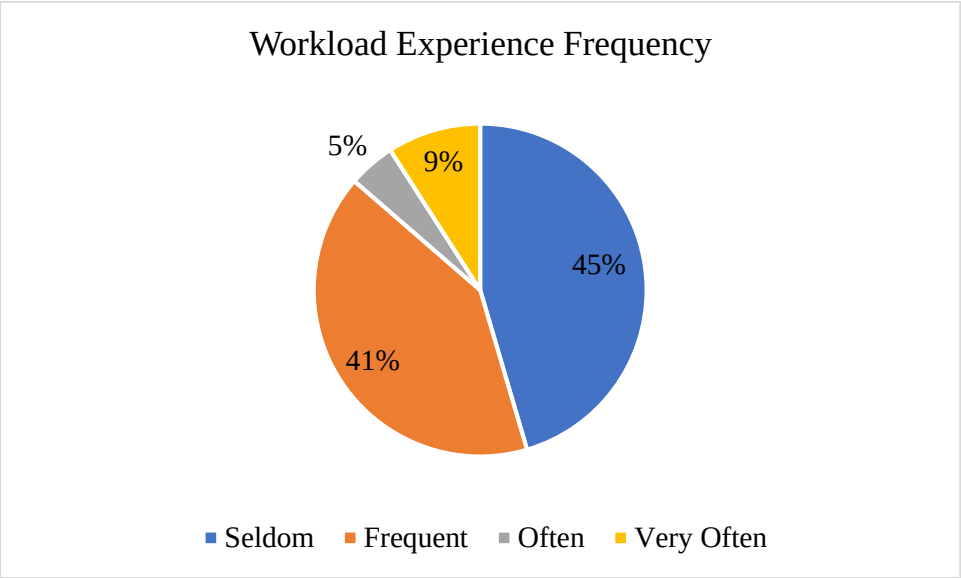

Figure 3. 2 Workload Frequency Experienced by the Respondents.

The result showed that 73% of the respondents had experienced excessive workload. From the total of 73% of that respondents, 41% experienced excessive workload frequently and 9% experienced very often.

3.1.3. Literature Study

Literature study is the phase that is is done concurrently with the preliminary study. Literature study was a phase of reviewing and exploring the existed theories and study cases from books, journals, or reports. The topics that were reviewed and explored were about mental workload, NASA-TLX, SWAT, telework, individual differences, and industrial revolution. This study phase was aimed to acquire the scholastic reference and to ensure that the base of the research is reliable.

3.2. Research Phase

Research phase is the phase in exploring the acquired data and being processed into a research's result and conclusions. This phase is consisted of 4 sub-

phases, which are the questionnaire construction, data acquisition/data collection, data processing, and analyisis.

3.2.1. Instrument Construction for Data Collection

Questionnaire construction is the phase to establish the questionnaire and the other required instruments for the research's data collection, such as the 27 SWAT sort cards and paired-comparison card for NASA-TLX. The most important phase in constructing the questionnaire is determining the most affecting factors toward the teleworker's mental workload. These factors are hypothesized by the author referring to the literature study (about NASA-TLX, SWAT, mental workload, and individual differences) and interviewing a representative from the research's object, bahasa.ai. Further explanations will be shown in chapter IV.

There are 3 main sections of the questionnaires will be established for this research, which are the SWAT, NASA-TLX, and individual differences factors. Besides the main questionnaires, there are another 2 additional instruments for the data collection, which are the 27 SWAT sort cards and the paired-comparison card for NASA-TLX.

3.2.2. Data Collection

Data Collection is the process to acquire the required data. However, in order to ensure the respondent will understand the whole process and questionnaire fulfillment, instruction and assistance will be given in the beginning of the data collection process.

Next, the data is going to be collected fully through online-based media regarding the current pandemic of the Covid-19 outbreak during the timeline of the research. The data will be taken by distributing the questionnaires and conducting the virtual interview (including emails and video calls).

The respondents are particularly the teleworkers in bahasa.ai. Within the time of this research is being conducted, all teleworkers in bahasa.ai are full-time teleworkers. The object was selected as in the research's object has never been conducted a workload measurement for their employees (Choliq, 2020). The research object is also applying the telework system entirely.

The respondents are consisted of varied job positions, such as software engineers, AI engineer, business development officer, etc. Total respondents are 41% of teleworkers in bahasa.ai.

3.2.3. Data Processing

Data processing in this research will be conducted by 2 methods, NASA-TLX and SWAT methods. Data processing will assess the acquired data from data collection.

3.2.3.1.Nasa-TLX Data Processing

The procedure for data processing is cited from NASA Ames Research Center (NASA Ames Research Center, 1986). There are 2 main steps in assessing the mental workload using the NASA-TLX methodology.

a. Dimension Weighting

Familiarization is aimed to help the respondent in determining their subjectivity in the most affecting dimension in NASA-TLX towards their admission of workload. This step will require the respondent to select their preference between the 15 paired-comparison cards. The preferences will be recorded in a tally sheet (see table 2.4).

b. Dimension Ratings

Rating procedure is the process in which requires the respondent to give scores on the rating sheet of NASA-TLX (see figure 2.8). The scoring is ranged between 0 and 100. The rating phase will generate a value named adjusted rating (see table 2.5)

c. Weighted Workload (WWL) Calculation

Weighted workload calculation is the final step. It will process the adjusted rating value into the final/global mental workload value. At the end of the NASA-TLX procedure, the mental workload final score will be classified into 4 classes of workload (see table 2.6).

3.2.3.2.SWAT Data Processing

The SWAT procedure below is cited from Reid, Potter, & Bressler (1989) & Zulfany, Dewi, & Pratiwi (2019). There are mainly 2 main steps in running the SWAT methodology assessment, which are scale development and event scoring.

a. Scale Development

Scale development is the phase to generate scale by involving the subjective factors from the total respondents. The scale development is consisted of 2 main steps, which are conjoint/prototyping and the 27 SWAT card sorting phase.

b. Event Scoring

This phase is the phase of the final mental workload calculation result. The final result assessment will be including the classification of the final mental workload calculation result.

3.3. Final Phase

Final phase is the phase to analyze the research's result, generates recommendation for the company object, provide conclusions, and provide suggestions for future research.

The analysis will include the mental workload assessment result and correlation analysis of the workload and the individual factors. The analysis from the mental workload score and all the information gotten from the online interview sessions. Not only that, the correlation analysis of the mental workload result and the individual difference will also be presented.

The conclusion will be showing the summary points from the data processing result and analysis. This section is written in order to answer the research's objectives.

Recommendation and suggestions will be presented in the different chapters within this report. Recommendation will be presented in chapter V along with the analysis part. Recommendation will be generated to be presented to the research object. Whilst, suggestions will be presented in chapter VI along with conclusions. The suggestions are aimed to be provided for future research.

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CHAPTER 4
DATA COLLECTION AND PROCESSING

In this chapter will be divided into 3 parts, which are the overview of the company object, data collection, and data processing.

4.1. A Brief Overview of bahasa.ai

Bahasa.ai was established by its current CEO, Hokiman Kurniawan together with other 2 co-founders, Fathur Rachman Widhiantoko (CTO) and Samsul Rahmadani (Chief of AI) in August 2017. Bahasa.ai is an IT start-up which focuses on developing the conversational commerce for businesses using artificial intelligence (AI). There are some other similar companies within conversational commerce business in Indonesia, such as Botika, AiChat, Kata.ai, (formerly known as YesBoss), etc. Currently, bahasa.ai is under name of PT Antares Global Teknologi with a mailing address on Ruko BSD Junction Block B39, *Jalan* Pahlawan Seribu, Lengkong Wetan, Serpong, South Tangerang City. Bahasa.ai can also be visited through its website on bahasa.ai. Bahasa.ai is alumni of the accelerator program by Plug and Play Indonesia and won the East Venture funding in 2018.

The main products of bahasa.ai are the chatbot and omnichannel system to help their client communicate to customers more efficiently. Their products also support their clients to be able to provide 24 hours customer service systems. For now (July 2020), they develop chatbot engine in *Bahasa*. In their three years of performance, they have been successfully served some considerable clients, such as Sinarmas, Dana, Smartfren, Kalbe, Panorama JTB, Piniship Logistic, Busan Auto Finance, Equity Life, etc.

Figure 4. 1 Logo of bahasa.ai

4.1.1. Organizational Structure

Bahasa.ai is a start-up which applies the virtual office system. As they run their business virtually, it makes them applies the telework system. Their employees work from different cities including Depok, DKI Jakarta, Bekasi, Aceh, Malang, etc. The start-up has now employed 22 people including the CEO. The team is divided into 6 divisions, which are Project Manager, Administration and Finance, AI Engineering, Operational Engineering (Software Engineering and DevOps Engineering), Product Development, and Business Development. Below is the organizational structure of bahasa.ai:

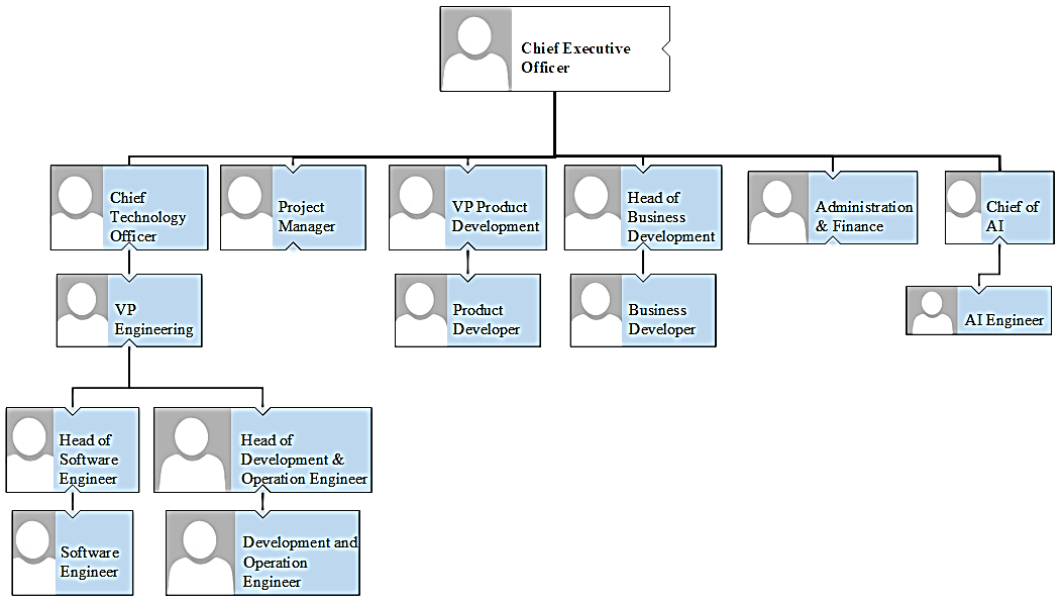

Figure 4. 2 Organization Structure in bahasa.ai

4.1.2. Job Description

This section presents about the job description of each division in bahasa.ai. These job descriptions were collected from some resources explored by the author due to the inexistence of the written job description in bahasa.ai within the observation time. The job description (excluding the board of director member/CEO, CTO, CIAO) will be shown in table 4.1 below:

Table 4. 1 Job Description of Each Division in bahasa.ai

No	Division	Job Description	Number of member
1.	Project Manager	1. Responsible in coordinating and monitoring the team to ensure the project accomplished punctually 2. Provide project timeline and monitor the progress of the project 3. Integrate between internal resources and clients 4. Assist and justify the scope and objectives of the project to the team 5. Measure the project performance 6. Perform risk analysis to minimize any possible failure	1
2	Corporate Finance & General Administrative	1. Compose financial records of the company, maintain accuracy and completeness of ledger and other supporting documents, such as MoU. 2. Ensuring to prepare the required documentation by the company	1
3.	AI Engineering	1. Automate infrastructure (including internal software of bahasa.ai) 2. Transform machine learning models into APIs 3. Test and develop models together with DevOps engineer 4. Develop products based on machine learning 5. Automate processes by utilizing machine learning or any other tools 6. Design machine learning systems 7. Research and implement appropriate ML algorithms and tools 8. Conduct statistical analysis and fine-tuning 9. Conduct the system train and retrain if it is needed	2

Table 4. 1 Job Description of Each Division in bahasa.ai (cont.)

No	Division	Job Description	Number of member
4.	Technical Engineer		
4.1	Software Engineering	1. Run the program/software testing and fixing any bugs 2. Managing the program/software development lifecycle 3. Monitoring program/software's performance 4. Analyzing the provided data from clients 5. Contribute on Software initiatives 6. Coordinating with other divisions for any changes such as in product specs	7
4.2	DevOps Engineering	1. Responsible for achieving automation & orchestration of tools 2. Construct and manage data sources like MySQL, Mongo, Elasticsearch, Redis, Cassandra, Hadoop, etc 3. Maintain the company's IT infrastructure 4. Design and maintain the product's infrastructure to be more scalable	2
5.	Product Development	1. Conduct market research and analyze the result 2. Define product specification 3. Create and improve the company's product 4. Consult the product with the engineers and supervisor	2

Table 4. 1 Job Description of Each Division in bahasa.ai (cont.)

No	Division	Job Description	Number of member
6.	Business Development	1. Contacting the potential clients to establish meetings and cooperation 2. Planning and develop a new marketing strategy 3. Design the company strategy in improving sales 4. Explore any new potential market 5. Compose proposal and quotes for clients 6. Develop goals for the business' growth and strategy on how to accomplish it	2

4.2. Data Collection

The data were collected through the online interviews which were conducted. The online interviews were all using zoom apps. In order to ease the online interviews, the interview were supported by the Google Form online questionnaire guided by the author.

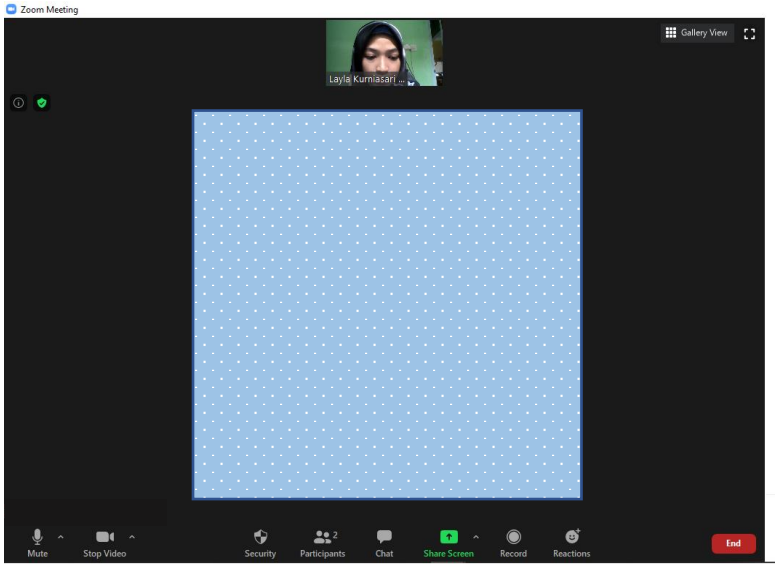

Figure 4. 3 One of the Online Interview Sessions

The online interview were done in July 2020. The time of the online interview were as follow:

Table 4. 2 Online Interview Session

No.	Respondent's ID	Interview Date	Interview Time (UTC+07.00)	Duration
1	ID (1)	21/07/2020	14.30 – 14.55	25 minutes
2	ID (2)	22/07/2020	13.22 – 14.05	43 minutes
3	ID (3)	22/07/2020	14.17 – 14.34	17 minutes
4	ID (4)	22/07/2020	10.55 – 11.30	35 minutes
5	ID (5)	24/07/2020	09.31 – 10.05	34 minutes
6	ID (6)	26/07/2020	13.03 – 14.03	60 minutes
7	ID (7)	28/07/2020	21.00 – 21.38	38 minutes
8	ID (8)	29/07/2020	14.03 – 14.38	35 minutes
9	ID (9)	29/07/2020	17.02 – 17.36	34 minutes

The interview sessions were mostly took about 35 minutes. The longest interview was done for 60 minutes and the shortest was 17 minutes. The shortest time interview was seemed to be very short compare to the average interview time because the respondent ID (3) is a new team member in bahasa.ai. Until the interview time, the respondent ID (3) was holding fewer projects compare to other respondents who have already worked longer in bahasa.ai

The online questionnaire was divided into 4 big parts, which are identity filling (part A), SWAT method filling (part B), NASA-TLX method filling (part C), and the last is individual differences (part D). In most of interviews, the filling time distribution of the respondents are about 10% for each of part A and D, 20-30% for part C, and 50-60% for part B. All of respondents took most times on sorting the 27 SWAT cards due to the virtual media. However, the author (as examiner) has done verbal validation such as re-asking the SWAT dimension and SWAT card definition to the respondent in order to ensure that the respondents understood the instructions and dimensions' deinition very well. All the respondents were confirming understood by giving the right answers for any validation questions that were asked to them.

4.2.1. Individual Factors Affecting Mental Workload Reception

There are some individual factors affecting the mental workload. These factors were gained from some different resources including other prior researches and interviews to the respondent.

Table 4. 3 Individual Factors Affecting Mental Workload

No	Factors	Source
1.	Age	(Murman, 2015; Lumintang, Kawatu, & Warouw, 2017)
2.	Marriage Status	(Choliq, 2020)
3.	Exercise Habit	(Kalis, 2018)

Below are the further explanations of the factors:

a. Age

The factor of age can affect the mental workload reception either physically or mentally. Research about the relationship between age and workload with fatigue

(Lumintang, Kawatu, & Warouw, 2017) shows that the relation of age and work fatigue is linearly positive with a value of r = 0.807 (using Spearman rank). Whilst the relation of work fatigue and workload is also linearly positive with value of r = 0.751 (using Spearman rank).

Murman (2015), stated that age might affect the cognitive ability. Naturally, cognitive ability will decline along with the aging. Clinically, the brain size will be decreased as people get aging, this phenomenon is called atrophy. Even though there is a possibility to be symptomps of brain disease, such as Alzheimer and cognitive stroke.

Within the human's brain, there is a phenomenon called synaptic density. Synaptic density Murman (2015) added that commonly, phenomenon of synaptic density will lower down started from the age of 25.

b. Marriage Status

This factor was generated according to the interview to one of bahasa.ai's telework. Marriage status is taking an important role in affecting the reception of the mental workload of teleworkers. Telework is providing the benefits of having more time to spend with family. However, the married telework compared to not-yet-married ones will have less time to spare to their work. Yet the statement might be argued by another statement of time management ability, however, according to (Choliq, 2020), the availability for urgent cases or demand within company shows on how the married and the not-yet married will be different as telework principles are not tighten formally to specific times like in the traditional working system.

The less availability had by the married teleworker is more often caused by the more roles and responsibilities the teleworker owns. Consequently, married teleworker is likely to have more workload. The reason is that because this teleworker is likely to have more limited time due to the same demands (clients' project) with the not-yet married teleworker.

c. Exercise Habit

Exercising or work-out habit is also another factor which might affect the mental workload indirectly. Prof. Daniel M. Landers, a professor of the School of

Nutrition and Health Promotion, Arizona State University, stated that exercise is not only for physical health but also mental health. He stated 5 benefits of exercising. First, is that exercise can help reducing stress because it helps in controlling anxiety and anger. Second, it also helps increasing the brain strength since it helps to maintain the blood circulation, including to the brain. Third, it helps to delay the aging. The exercise such as walking consistently within 9 weeks will help to keep up the brain functionality. Fourth, exercise habit will help in increasing the alpha wave in the brain. Alpha is the wave that is related to the feeling of relaxation. Fifth, is that exercising may help to increase happiness in humans. Exercise is proven to be increasing the happy hormone such as adrenalin, serotonine, dopamine, and endorphins (Kalis, 2018).

According to the 5 statement of Professor Landers, exercise habit helps the person to have better of both physical and cognitive condition. While the cognitive condition is having the relation to the mental workload.

4.2.2. Respondent's Classification

Below will be shown the data classification which was gotten from the interview:

a. Age

The majority of the respondents were between 21-25 years old. There was only 1 respondents under 21 years old and 1 other respondent between 26-30 years old.

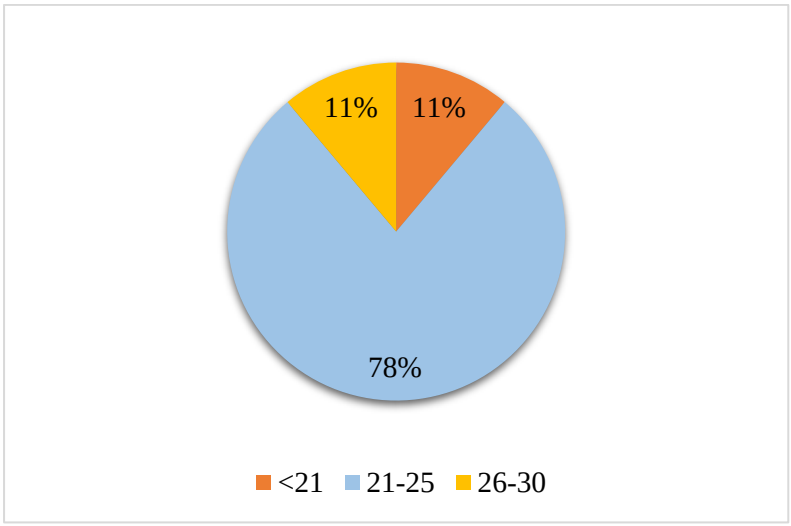

Figure 4. 4 The Respondent's Age Distribution

b. Gender

Respondents are mostly males. Not only within the sample population, even in actual structures (all population), there are only 33% female teleworkers in bahasa.ai.

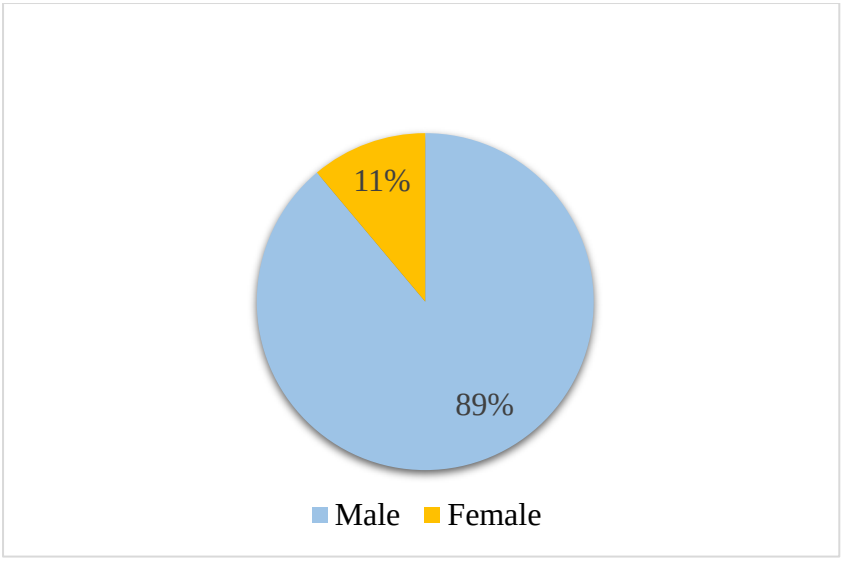

Figure 4. 5 The Respondent's Type of Gender

c. Marriage Status

The majority of respondents are not in married status. According to the interview, there were only 11% of the respondents that have already married.

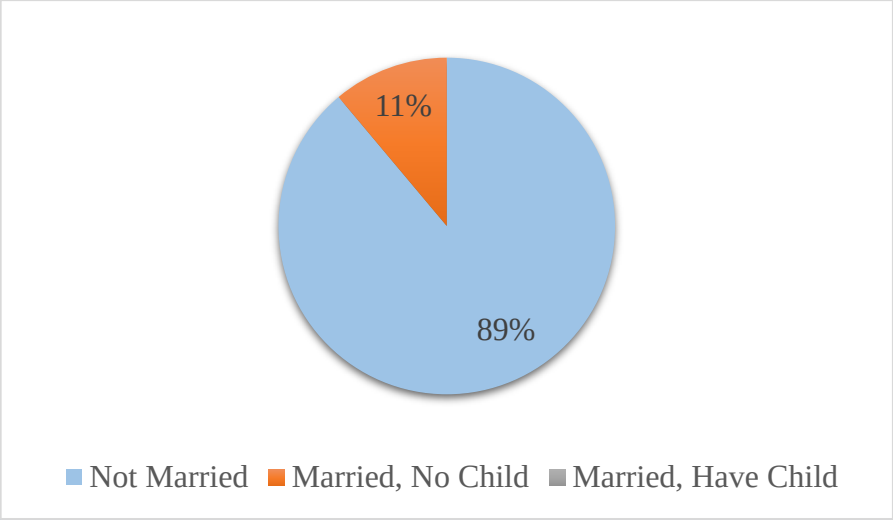

Figure 4. 6 Respondents' Marriage Status

d. Exercise Duration

Figure 4.7 below shows the total duration in a week for the respondents to take physical exercise. The majority of the respondents are taking between 181 and 240 minutes in a week or equal to about 3 to 4 hours a week to exercise.

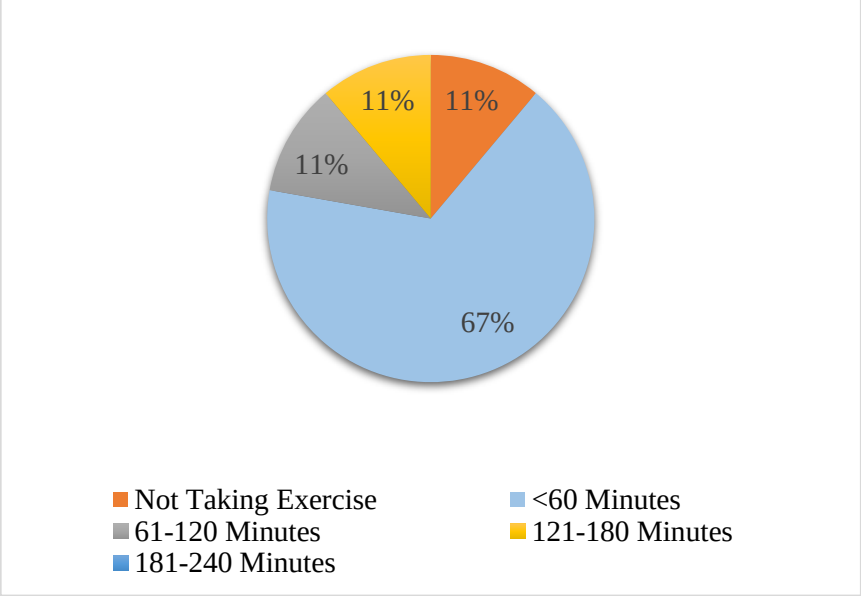

Figure 4. 7 Respondent's Exercise Duration within a Week

e. Hours of work within a day

Most of the respondents stated that they dedicate their time more than or equal to normal working hours. The working hour begins and ends flexibly, there are no such formal rules about it.

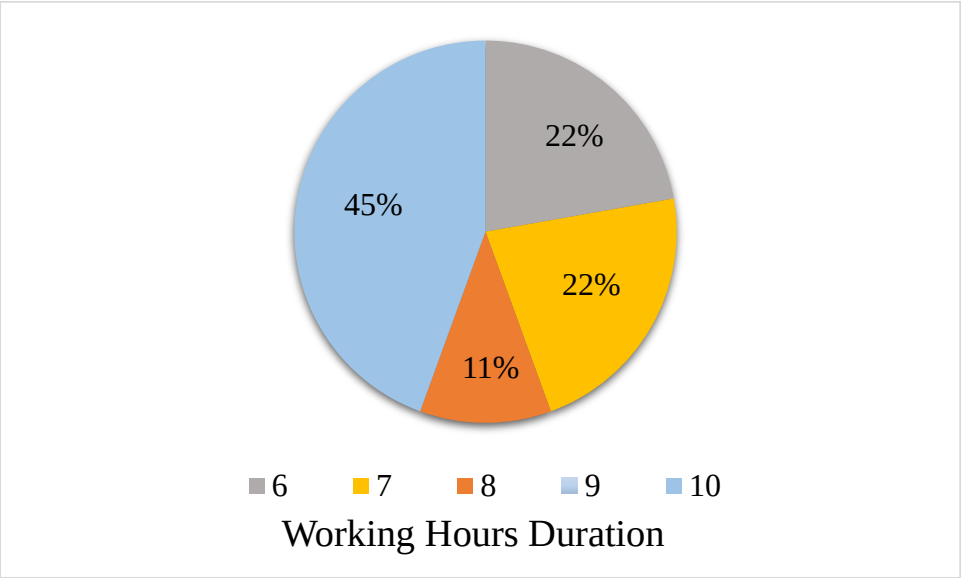

Figure 4. 8 Daily Working Hours of Respondent

f. Job Division

Below will be shown the each respondent's division. ID (1) until ID (9) shows the respondent's ID regardless of the division they are sitting in.

Table 4. 4 Respondent's Division

Respondent's ID	Division
ID (1)	Business Development
ID (2)	Corporate Finance & General Administrative
ID (3)	Software Engineer
ID (4)	Software Engineer
ID (5)	Software Engineer
ID (6)	AI Engineer
ID (7)	Project Manager
ID (8)	Software Engineer
ID (9)	DevOps Engineer

4.2.3. SWAT Interview Result

Table 4.5 and 4.6 shows the interview result of using SWAT method. There are 2 main raw data taken for data processing. The raw data consist of the SWAT dimension rating and the sort-card data of the 27 SWAT cards.

Table 4. 5 Respondent's Score for Each of SWAT Dimension

No	Respondent's ID	SWAT Dimension		
		Time Load	Effort	Stress Load
1	ID (1)	2	1	3
2	ID (2)	2	2	2
3	ID (3)	2	1	1
4	ID (4)	2	2	2
5	ID (5)	2	2	2
6	ID (6)	2	2	2
7	ID (7)	3	2	3
8	ID (8)	2	3	2
9	ID (9)	2	3	2

Table 4.5 shows the rating preferences of the respondents towards each of the SWAT dimensions. The rate is ranged in between 1 (low) to 3 (high).

Table 4. 6 Respondent's SWAT Cards Sort Result

SWAT Card Codes	Respondents								
	ID (1)	ID (2)	ID (3)	ID (4)	ID (5)	ID (6)	ID (7)	ID (8)	ID (9)
N	13	11	16	2	1	7	1	17	1
B	23	12	15	4	18	13	10	14	3
W	22	13	14	6	15	12	19	13	2
F	24	24	18	8	20	11	7	18	16
J	20	26	17	10	22	23	16	16	18
C	26	22	13	12	21	22	25	15	17
X	27	23	19	14	14	10	4	11	19
S	25	25	20	16	19	21	13	19	21
M	17	21	10	18	12	20	22	12	20
U	2	14	12	20	24	6	2	22	4
G	10	15	11	22	25	15	11	10	6
Z	12	19	7	24	13	14	20	9	5
V	15	18	23	26	26	9	8	25	22
Q	7	17	25	27	27	27	17	26	24

Table 4.6 Respondent's SWAT Cards Sort Result (cont.)

SWAT Card Codes	Respondents								
	ID (1)	ID (2)	ID (3)	ID (4)	ID (5)	ID (6)	ID (7)	ID (8)	ID (9)
ZZ	16	16	26	25	17	26	26	23	23
K	19	20	27	23	16	8	5	24	25
E	21	27	24	21	23	25	14	27	27
R	18	10	9	19	11	24	23	21	26
H	14	9	8	17	6	1	3	1	7
P	11	8	6	15	7	2	12	2	9
D	8	7	4	13	8	4	21	3	8
Y	9	6	5	11	10	5	9	5	10
A	4	5	3	9	9	19	18	7	12
O	6	4	2	7	3	18	27	4	11
L	3	3	22	5	5	3	6	6	13
T	5	2	21	3	4	17	15	8	15
I	1	1	1	1	2	16	24	20	14

4.2.4. NASA-TLX Interview Result

Table 4.7 shows the records of the tally sheet and dimensions's rating data from the respondent (respondents). The weight was taken by using the NASA-TLX pair-ways comparison card. While for dimension' rating, the respondents were asked to give the rate for each dimension in between 0-100.

Table 4. 7 Tally Sheet Records and NASA-TLX Dimension's Rating

No	Respondent's ID	Weighted Rating Worksheet		
		Dimensions	Weight	Rating
1	ID_1	Mental Demand	3	74
		Physical Demand	0	43
		Temporal Demand	2	76
		Performance	4	94
		Effort	4	95
		Frustation	2	83
2	ID_2	Mental Demand	3	100
		Physical Demand	0	0
		Temporal Demand	4	70
		Performance	4	90
		Effort	2	85
		Frustation	2	30

Table 4. 7 Tally Sheet Records and NASA-TLX Dimension's Rating (cont.)

No	Respondent's ID	Weighted Rating Worksheet		
		Dimensions	Weight	Rating
3	ID_3	Mental Demand	5	50
		Physical Demand	2	1
		Temporal Demand	2	74
		Performance	1	85
		Effort	3	80
		Frustation	2	66
4	ID_4	Mental Demand	2	65
		Physical Demand	0	50
		Temporal Demand	4	70
		Performance	4	60
		Effort	3	70
		Frustation	2	66
5	ID_5	Mental Demand	1	70
		Physical Demand	0	50
		Temporal Demand	4	90
		Performance	5	80
		Effort	3	85
		Frustation	2	48
6	ID_6	Mental Demand	3	90
		Physical Demand	1	10
		Temporal Demand	3	80
		Performance	0	50
		Effort	3	85
		Frustation	5	85
7	ID_7	Mental Demand	5	80
		Physical Demand	0	20
		Temporal Demand	3	85
		Performance	3	70
		Effort	3	90
		Frustation	1	85
8	ID_8	Mental Demand	5	90
		Physical Demand	0	50
		Temporal Demand	1	70
		Performance	4	80
		Effort	3	90
		Frustation	2	80

Table 4. 7 Tally Sheet Records and NASA-TLX Dimension's Rating (cont.)

No	Respondent's ID	Weighted Rating Worksheet		
		Dimensions	**Weight**	**Rating**
9	ID_9	Mental Demand	5	95
		Physical Demand	0	10
		Temporal Demand	1	50
		Performance	3	70
		Effort	4	80
		Frustation	2	70

The data were taken through online interviews along with online questionnaire filling. The respondents were explained about the definition and then asked to fill the pair-ways comparison cards (to become the weight) and give dimension rating to each element in between 0 (low) to 100 (high).

4.3. Data Processing

This section shows the data processing calculation and process by using the methods of SWAT and NASA-TLX.

4.3.1. SWAT Data Processing

The data proessing will be done by using a conjoint scaling program. The input data of this conjoint scaling program is from the card sort of all respondents. Later, the input will be processed and produce scales to be used in converting the SWAT dimension's weighting into the final workload result.

4.3.1.1.Group's Kendall's Coefficient of Concordance (W)

In this phase, all the data (the SWAT cards sort data from all respondents) are input into the software. The results

Kendall's Coefficient of Concordance W= .4287							
Subj.#	TES	TSE	ETS	EST	SET	STE	Suggested Prototype
1	-.71	-.73	-.13	.03	-.04	-.24	E
2	-.69	-.74	-.12	.02	-.12	-.31	E
3	-.31	-.47	.16	.17	-.28	-.44	E
4	-.06	-.06	-.03	-.02	-.02	-.02	S
5	-.52	-.53	-.23	-.15	-.18	-.28	E
6	-.11	-.08	.34	.53	.62	.47	S
7	.25	.41	.28	.46	.95	.94	S
8	-.34	-.42	.16	.25	.01	-.16	E
9	.15	.00	.71	.75	.29	.10	E

= Highest correlation score

Figure 4. 9 Group's Kendall's Coeffcient of Concordance Result

Taking a look into the result of Kendall's Coefficient of Concordance or W (see figure 4.14), the Kendall's coefficient of concordance of the group is 0.4287. The result violates the criteria within the SWAT method (criteria should be more than or equal to 0.75). This result indicates that data processing requires further investigation by running the group axiom checking.

4.3.1.2.Group's Axiom Violation Checking

In this section shows the process of violation investigation within the data. The result below shows that the axiom violation exceeds the criteria of a maximum of 20. The result shows the dimension E and S within the independence correlation value are consecutively 26 and 28. Thus, prototype scaling (PSS) must be conducted to see if it is possible to generate scale value by grouping the respondent's data per each of SWAT dimensions.

Group Axiom Violation Checking

INDEPENDENCE			
T Independent of Eand S	=	0	Failures out of 108 Tests
E Independent of T and S	=	26	Failures out of 108 Tests
S Independent of T and E	=	28	Failures out of 108 Tests
DOUBLE CANCELLATION			
Double Cancellation in T x E	=	0	Failures out of 1 Tests
Double Cancellation in E x S	=	0	Failures out of 2 Tests
Double Cancellation in S x T	=	0	Failures out of 1 Tests
JOINT INDEPENDENCE			
T x E Independent of S	=	12	Failures out of 108 Tests
E x S Independent of T	=	18	Failures out of 108 Tests
S x T Independent of E	=	18	Failures out of 108 Tests

Violating Score

Figure 4. 10 Group's Axiom Violation Checking Result

4.3.1.3.Prototype's Axiom Violation Checking

Prototype scaling is basically generating the scale for each prototype (Time, Effort, and Stress). However, to be able to use the prototype scaling, the data within each of the prototype group must be assessed. The assessment is to see if there is any axiom violation within this scaling method.

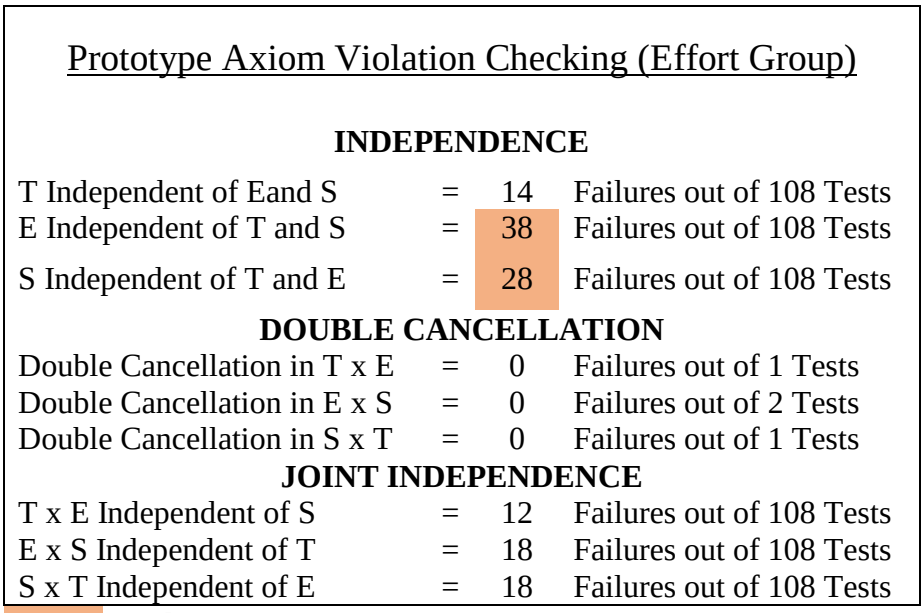

Figure 4. 11 The Protype Axiom Violation Assessment (Group of Effort Prototype)

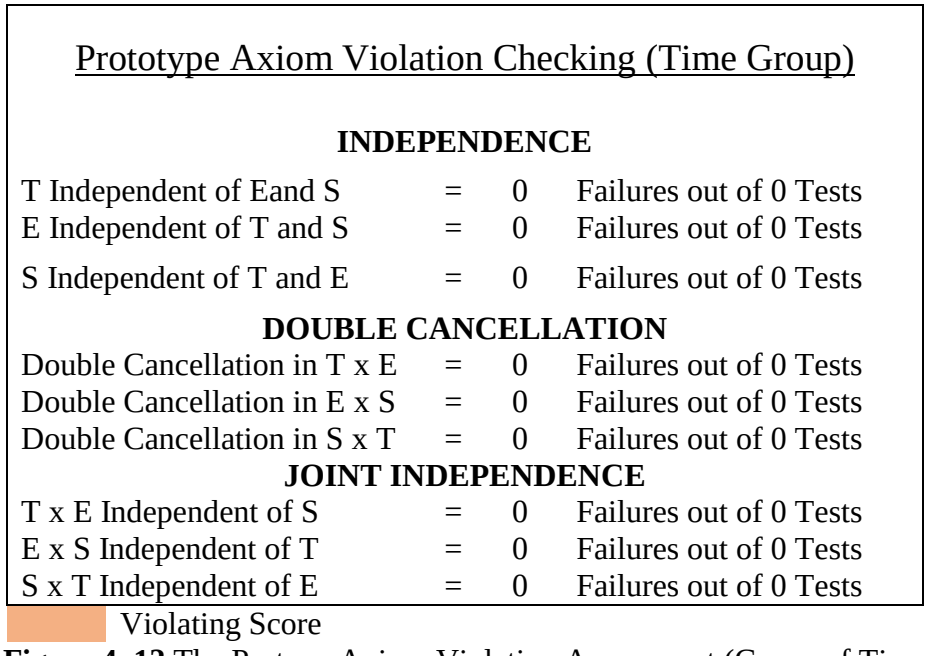

Figure 4. 12 The Protype Axiom Violation Assessment (Group of Time Prototype)

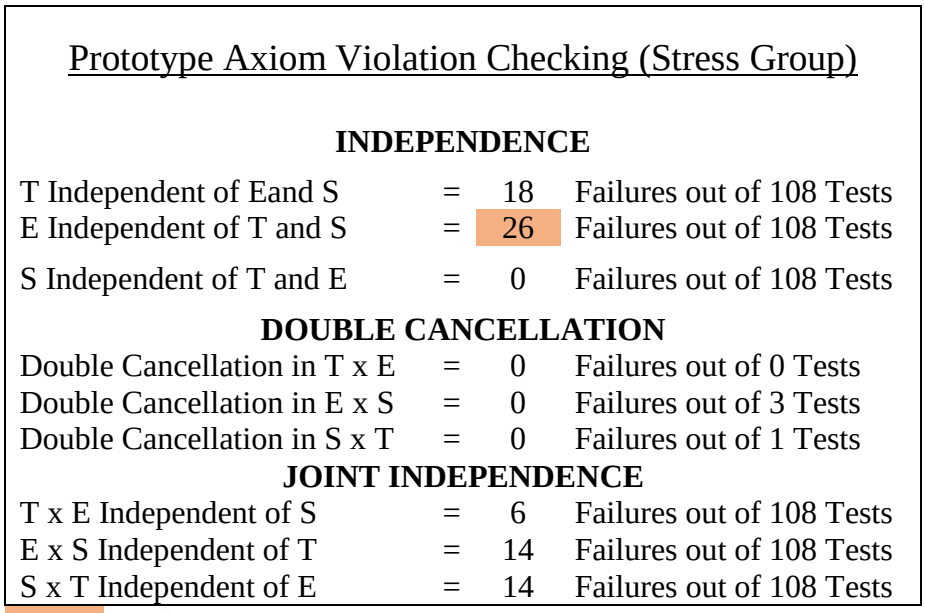

Figure 4. 13 The Protype Axiom Violation Assessment (Group of Stress Prototype)

The result shows there is only two prototype groups generating the value for axiom violation checking, which is effort and stress prototype groups. There should be 2 possibilities, first, is that the prototype group of time is perfectly correlated (no axiom violation) and second is because in the phase of generating Kendall's coefficient of concordance, the data are all suggested prototype are only effort and stress group. According to the result of Kendall's coefficient of concordance result, the reason this this phenomenon in this research is caused by the second reason. Figure 4.14 shows that the suggested prototypes for this group are only stress and effort.

The axiom violation in both of the stress and effort prototype group is violating the criteria. In effort prototype group, the violation is indicated by the value of the dimension effort and stress within the independence correlation. Both values exceed the criteria of axiom violation checking, which is 38 for dimension E (independent of T and S) and 28 for dimension S (independent of T and E). Other violations are in the dimension of T x E and S x T in joint indepence. Both value are 28 and 22. While the violation in prototype group of stress is only in dimension E of the independence correlation test.

Regarding the violation, individual axiom test must be conducted (only) for the violated prototype groups, the effort and stress prototype groups' members. Whilst the other prototype group remains to use the prototype group scale. However, in this research, the only suggested prototype is the prototype of the time dimension. So the individual axiom checking will be conducted to all respondents' data. The goal is to find out if it is possible to generate the individual scale (ISS) for each of respondents' data.

4.3.1.4.Individual's Axiom Violation Checking

Below will be shown the result of individual axiom violation checking:

Individual Axiom Violation Checking (Respondent 1)

INDEPENDENCE			
T Independent of Eand S	=	30	Failures out of 108 Tests
E Independent of T and S	=	58	Failures out of 108 Tests
S Independent of T and E	=	60	Failures out of 108 Tests
DOUBLE CANCELLATION			
Double Cancellation in T x E	=	0	Failures out of 1 Tests
Double Cancellation in E x S	=	0	Failures out of 2 Tests
Double Cancellation in S x T	=	0	Failures out of 2 Tests
JOINT INDEPENDENCE			
T x E Independent of S	=	28	Failures out of 108 Tests
E x S Independent of T	=	56	Failures out of 108 Tests
S x T Independent of E	=	36	Failures out of 108 Tests

Violating Score

Figure 4. 14 Individual Axiom Violation Checking for Subject 1/Respondent ID (1)

Subject 1 or Respondent ID (1) is violating the individual axiom test. The indication is clearly shown within independence correlation and joint independence. The violations are all higher than 20.

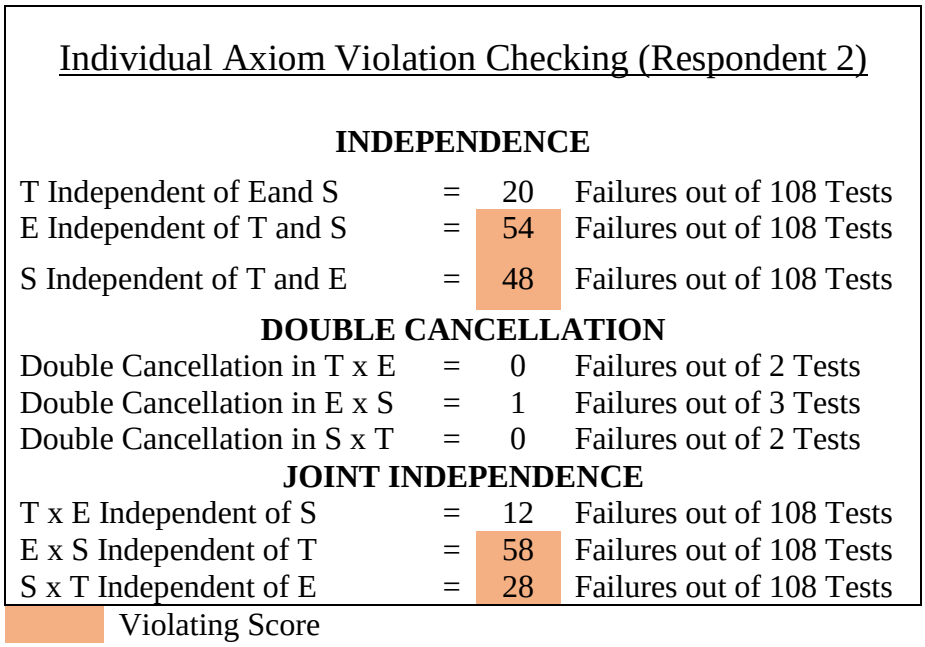

Figure 4. 15 Individual Axiom Violation Checking for Subject 2/Respondent ID (2)

The same thing goes to individual 2. Even though the violation is not in all correlation, however, there are still violations in some points, which are 54, 48, 58, and 28.

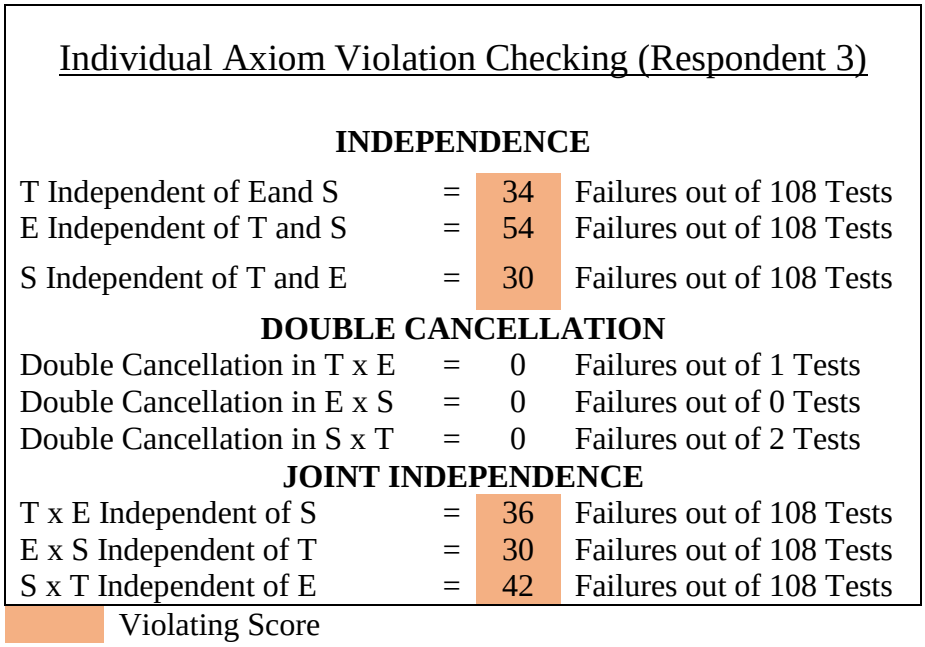

Figure 4. 16 Individual Axiom Violation Checking for Subject 3/Respondent ID (3)

Individual data of subject 3 (see figure 4.21) are all violating the axiom checking criteria. None of them are below or equal to 20. The lowest is 26.

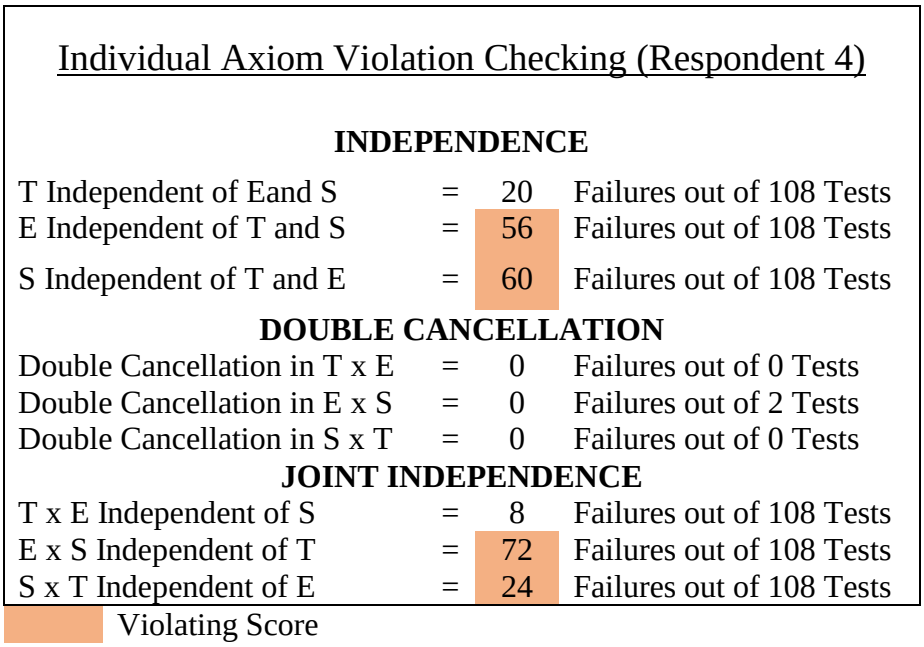

Figure 4. 17 Individual Axiom Violation Checking for Subject 4/Respondent ID (4)

The only non-violating score within axiom assessment for individual analysis of respondent ID (4) are T dimension within independence test and dimension T x E joint independence to dimension S. Both scores in consecutive are 20 and 8. (See figure 4.22).

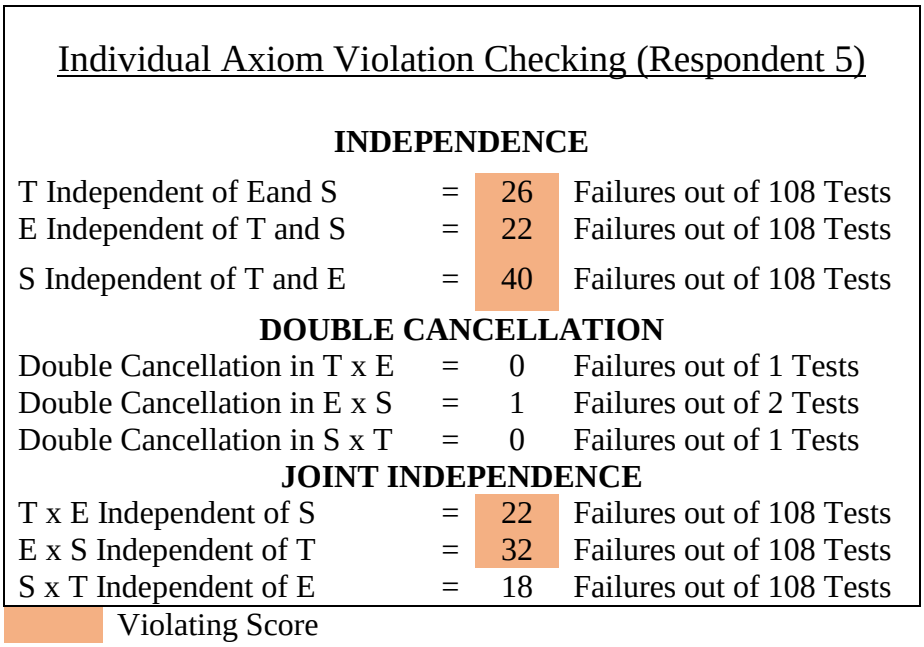

Figure 4. 18 Individual Axiom Violation Checking for Subject 5/Respondent ID (5)

The axiom violation for respondent ID (5) is presenting another violation. Even though the violation is not too high (except for dimension T x E of joint independence to S and dimension E independent of T and S within independence result).

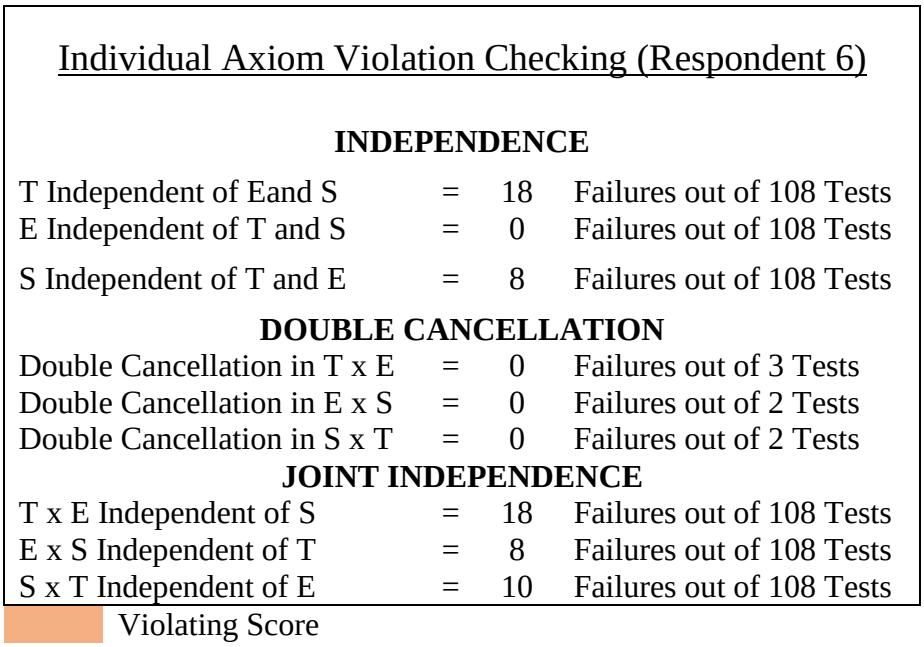

Figure 4. 19 Individual Axiom Violation Checking for Subject 6/Respondent ID (6)

Individual axiom test analysis for respondent ID (6) and (7) show that the both subjects are not showing any violation. Respondent ID (6) has only 18 as the highest axiom failure score in both independence and joint independence assessment. Whilst for respondent ID (7) shows no axiom failure at all (see figure 4.25).

Individual Axiom Violation Checking (Respondent 7)

INDEPENDENCE			
T Independent of Eand S	=	0	Failures out of 108 Tests
E Independent of T and S	=	0	Failures out of 108 Tests
S Independent of T and E	=	0	Failures out of 108 Tests
DOUBLE CANCELLATION			
Double Cancellation in T x E	=	0	Failures out of 0 Tests
Double Cancellation in E x S	=	0	Failures out of 3 Tests
Double Cancellation in S x T	=	0	Failures out of 3 Tests
JOINT INDEPENDENCE			
T x E Independent of S	=	0	Failures out of 108 Tests
E x S Independent of T	=	0	Failures out of 108 Tests
S x T Independent of E	=	0	Failures out of 108 Tests

Violating Score

Figure 4. 20 Individual Axiom Violation Checking for Subject 7/Respondent ID (7)

Individual Axiom Violation Checking (Respondent 8)

INDEPENDENCE			
T Independent of Eand S	=	22	Failures out of 108 Tests
E Independent of T and S	=	34	Failures out of 108 Tests
S Independent of T and E	=	50	Failures out of 108 Tests
DOUBLE CANCELLATION			
Double Cancellation in T x E	=	0	Failures out of 0 Tests
Double Cancellation in E x S	=	2	Failures out of 3Tests
Double Cancellation in S x T	=	0	Failures out of 0 Tests
JOINT INDEPENDENCE			
T x E Independent of S	=	20	Failures out of 108 Tests
E x S Independent of T	=	38	Failures out of 108 Tests
S x T Independent of E	=	28	Failures out of 108 Tests

Violating Score

Figure 4. 21 Individual Axiom Violation Checking for Subject 8/ Respondent ID (8)

Opposite to the respondent ID (6) and (7), the respondent ID (8) and ID (9) are all showing the violation. Even though respondent ID (9) only has 2 violated

scores, however, this data is still considered to be violating the axiom assessment criteria.

Individual Axiom Violation Checking (Respondent 9)

INDEPENDENCE			
T Independent of Eand S	=	36	Failures out of 108 Tests
E Independent of T and S	=	54	Failures out of 108 Tests
S Independent of T and E	=	30	Failures out of 108 Tests
DOUBLE CANCELLATION			
Double Cancellation in T x E	=	0	Failures out of 3 Tests
Double Cancellation in E x S	=	0	Failures out of 3 Tests
Double Cancellation in S x T	=	0	Failures out of 1 Tests
JOINT INDEPENDENCE			
T x E Independent of S	=	36	Failures out of 108 Tests
E x S Independent of T	=	30	Failures out of 108 Tests
S x T Independent of E	=	36	Failures out of 108 Tests

Violating Score

Figure 4. 22 Individual Axiom Violation Checking for Subject 9/Respondent ID (9)

According to the results above, the only non-violating data for individual axiom checking are data for respondent ID (6) and ID (7). The rest of the individual data are exceeding the criteria, above 20 (see table 4.8 below).

The action needs to take is to exclude the violating data and only using the non-violating data. However, the currently accepted scale is the individual scale and only for respected individual data. It can not be used to be a single scale for all respondents. The data processing needs modification and will be explained further in section 4.3.1.5.

Table 4. 8. Recapitulation Table of All Individual Axiom Checkings

Axiom Correlation Analysis	Respondent's ID								
	ID (1)	ID (2)	ID (3)	ID (4)	ID (5)	ID (6)	ID (7)	ID (8)	ID (9)
Independence Correlation									
T independent of E and S	30*	20	34*	20*	26*	18	0	22*	36*
E independent of T and S	58*	54*	54*	56*	22*	0	0	34*	0
S independent of T and E	60*	48*	30*	60*	48*	8	0	50*	0
Joint Independence Correlation									
T x E Independet of S	28*	12	26*	8	22*	18	0	20*	0
E x S Independent of T	56*	58*	30*	72*	32*	8	0	38*	0
S x T Independent of E	36*	28*	42*	24*	18	10	0	28*	36*

* Violating score

4.3.1.5.Modification of the Data Prototype

The data shown in section 4.3.1.4 are showing that there are only 2 non-violating individual data. In this case, the rule within the SWAT method is that if individual axiom assessment has performed, but the violation is still generated, the data must be excluded from the scaling generation process.

It means that there will only 2 individual scale left. The problem is that individual scales is only for the corresponding individual (respondent). It can not be used for general data. The possible choice is that, re-conducting the prototype axiom test after the violating data are excluded. Figure 4.28 will show the exclusion and new Kendall's coefficient of concordance.

Kendall's Coefficient of Concordance (after Modification)							
W= .4287							
Subj.#	TES	TSE	ETS	EST	SET	STE	Suggested Prototype
1	-.71	-.73	-.13	.03	-.04	-.24	L
2	-.69	-.74	-.12	.02	-.12	-.31	L
3	-.31	-.47	.16	.17	-.28	-.44	L
4	-.06	-.06	-.03	-.02	-.02	-.02	L
5	-.52	-.53	-.23	-.15	-.18	-.28	L
6	-.11	-.08	.34	.53	.62	.47	S
7	.25	.41	.28	.46	.95	.94	S
8	-.34	-.42	.16	.25	.01	-.16	L
9	.15	.00	.71	.75	.29	.10	L

= Highest correlation score

Figure 4. 23 New Kendall's Coefficient of Concordance after Prototype Modification

Figure 4.28 shows the violating data exclusion. The exclusion is done by changing the suggested prototype letter (suggested prototype) with the letter of "L." To be noted, the only group which is modified is the time prototype group since all suggested prototypes in Kendall's coefficient of concordance generation were all T (time).

4.3.1.6.New Prototype's Axiom Violation Checking

Modification's result improved Kendall's coefficient of concordance. The result is fulfilling the criteria, which is 0.8268 ($\geq$ 0.75). Next is to assess the prototype's axiom violation. The axiom violation checking for the new prototype group is presented in figure 4.29 below:

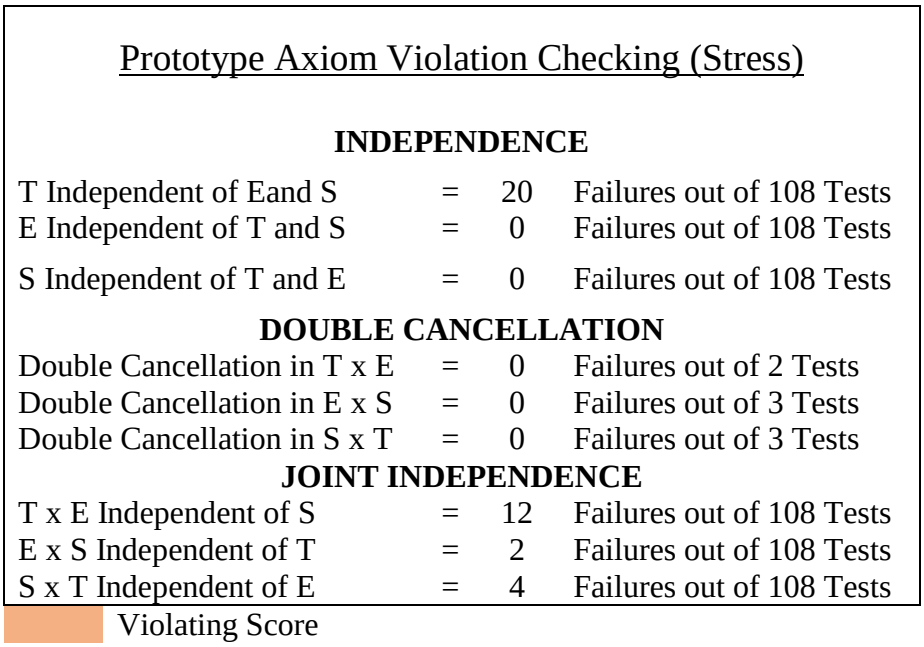

Figure 4. 24 Axiom Assessment for the New Prototype Group (Stress Group)

The new prototype axiom violation checking has shown that there is no failure exceeding the axiom checking criteria ($\leq$20). It indicates that a new prototype scale can be applied for the scaling conversion for all data.

4.3.1.7.Prototype's Scaling Solution

This section will show the scaling solution generated by the new prototype group (see figure 4.30). The scales below will be used to convert the data of dimension rating to become an individual workload score.

Scaling Solution

Dimension Weighing Choice			Mental Workload Scales Result
(T)	**(E)**	**(S)**	
1	1	1	8.2
1	1	2	45.2
1	1	3	61.2
1	2	1	42.1
1	2	2	79.0
1	2	3	95.0
1	3	1	32.6
1	3	2	69.6
1	3	3	85.6
2	1	1	13.2
2	1	2	50.1
2	1	3	66.2
2	2	1	47.0
2	2	2	84.0
2	2	3	100.0
2	3	1	37.6
2	3	2	74.5
2	3	3	90.6
3	1	1	0
3	1	2	36.9
3	1	3	53.0
3	2	1	33.8
3	2	2	70.8
3	2	3	86.8
3	3	1	24.4
3	3	2	61.4
3	3	3	77.4

Figure 4. 25 Scaling Solution for New Prototype Group

4.3.1.8.Final Workload Result Using SWAT Methods

Below in table 4.9 is shown the final result of the mental workload assessment using NASA-TLX. The score was gotten from the scale generation in 4.3.1.7. The scales were converting the dimension preference rating (see table 4.5) into a single mental workload score.

Table 4. 9 The table result of the SWAT Assessment

No	Respondent's ID	SWAT Elements			Final Result	Classification
		Time Load	Effort	Stress Load		
1	ID_1	2	1	3	66.2	High
2	ID_2	2	2	2	84	High
3	ID_3	2	1	1	13.2	Low
4	ID_4	2	2	2	84	High
5	ID_5	2	2	2	84	High
6	ID_6	2	2	2	84	High
7	ID_7	3	2	3	86.08	High
8	ID_8	2	3	2	74.5	High
9	ID_9	2	3	2	74.5	High

From the results aove in table 4.9, the median of the mental workload results of teleworkers in bahasa.ai is 8.4, which is considered as high.

4.3.2. Nasa-TLX Data Processing

Table 4.10 below shows the final result of mental workload assessment using the NASA-TLX method. The results are ranged from 57.33 as the lowest score until 86.4 as the highest score.

Table 4. 10 Final Result of the Workload Assessment Using NASA-TLX Method.

No	Respondent's ID	Adjusted Rating (AR) (weight x rating)	Sum of AR	Final Result	Workload Classification
1	ID_1	222	1296	86.4	Very High
		0			
		152			
		376			
		380			
		166			

Table 4. 10 Final Result of the Workload Assessment Using NASA-TLX Method (cont.)

No	Respondent's ID	Adjusted Rating (AR) (weight x rating)	Sum of AR	Final Result	Workload Classification
2	ID_2	300	1170	78	High
		0			
		280			
		360			
		170			
		60			
3	ID_3	250	857	57.13333	High
		2			
		148			
		85			
		240			
		132			
4	ID_4	130	992	66.13333	High
		0			
		280			
		240			
		210			
		132			
5	ID_5	70	1181	78.73333	High
		0			
		360			
		400			
		255			
		96			
6	ID_6	270	1200	80	Very High
		10			
		240			
		0			
		255			
		425			
7	ID_7	400	1220	81.33333	Very High
		0			
		255			
		210			
		270			
		85			

Table 4. 10 Final Result of the Workload Assessment Using NASA-TLX Method (cont.)

No	Respondent's ID	Adjusted Rating (AR) (weight x rating)	Sum of AR	Final Result	Workload Classification
8	ID_8	450	1270	84.66667	Very High
		0			
		70			
		320			
		270			
		160			
9	ID_9	475	1195	79.66667	Very High
		0			
		50			
		210			
		320			
		140			

4.3.3. Correlation Test between Mental Workload Result and Individual Difference

This section shows the respondents' data processing to test the correlational relationship between the workload score and individual differences factors. Figure 4.31 below shows the summary analysis of the correlational relationship between workload score and individual factors. All P-values in the summary analysis are higher than 0.05. It means that all of the factors are insignificant towards the workload score. While the R-squared (R-Sq) is 40.95% and adjusted R-squared/R-Sq (Adj.) is reaching negative. It shows that the model (see in Attachment I) is not fit to the data.

```
Coefficients

Term                                Coef  SE Coef         T      P
Constant                         160.595  87.7199   1.83077  0.209
Work Duration (h)                 -8.590   8.9066  -0.96440  0.437
Marriage Status
  0                              -18.349  24.1876  -0.75861  0.527
Exercise Habit
  0                               -5.303  16.9577  -0.31272  0.784
Exercise Duration_<60 menit
  0                               -3.693  15.1019  -0.24453  0.830
Exercise Duration_121-180 menit
  0                              -12.493  21.1239  -0.59140  0.614
Age (21-25 yo)
  0                               -5.846  17.8132  -0.32818  0.774


Summary of Model

S = 23.1400  R-Sq = 40.95%    R-Sq(adj) = -136.21%
PRESS = *    R-Sq(pred) = *%
```

Figure 4. 26. Statistical Analysis for the Correlation between the Mental Workload Result and the Individual Factors.

CHAPTER 5
ANALYSIS AND RECOMMENDATION

This section presents the analysis according to the result of the data processing in chapter 4. The analysis includes the analysis for NASA-TLX, SWAT, and the correlation of both results with individual differences factors determined in this research.

5.1. Analysis of the NASA-TLX Assessment

Section 5.1 will presents the analysis of the NASA-TLX mental workload assessment. The analysis will be including dimension analysis and analysis per job description.

5.1.1. NASA-TLX Dimensions Analysis

Dimension analysis shows the overall respondent's NASA-TLX 6 dimensions distribution. The analysis is based on the median score of all respondents in all elements. The median was done to know the central tendency of all respondents' NASA-TLX results. The median was selected to avoid any bias possibility instead of using average.

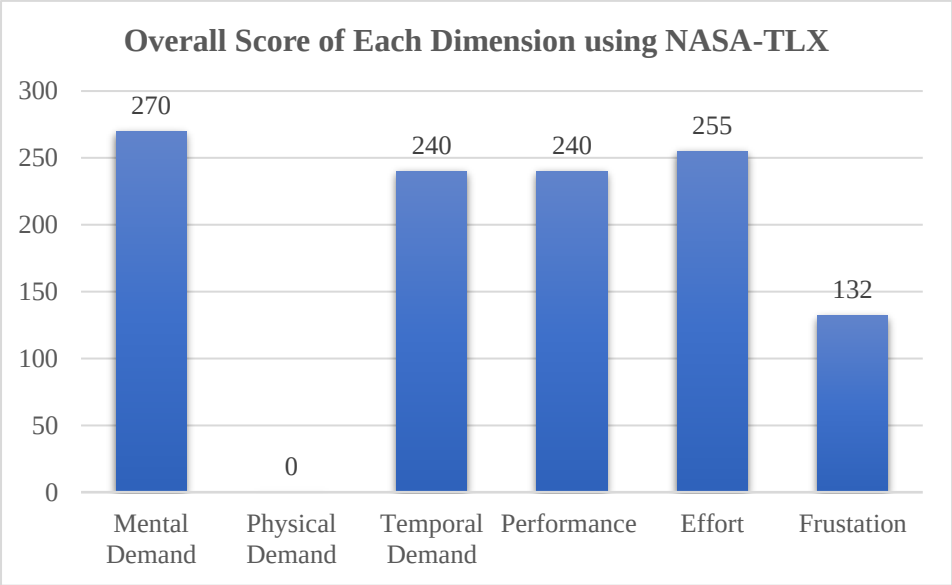

Figure 5. 1 Median Score of Overall Mental Workload Assessment Using NASA-TLX Method

The result shows that dimension in NASA-TLX which was depicting the most teleworkers in bahasa.ai is the mental demand dimension. Most of the workers work by utilizing mental (cognitive) ability within their jobs such as thinking, memorizing, analysing, etc. This is the reason why the mental demand dimension has the highest score among the 6 dimensions. The opposite reason goes to the physical demand dimension. Most of the respondents do not consider any physical activity within their work. According to the working system applied in bahasa.ai, teleworkers are required very little physical activities for doing their job descriptions. Most of the tasks are cognitive tasks. It fits the result for this dimension to be the lower score.

The second-highest dimension is the effort dimension. According to the online interviews, effort dimension was defined as the effort that the respondents put in performaing their job. Most of the times, their clients have varied requests can criteria within their order. It makes the team should learn new materials, upgrade knowledge, and design the product as soon as possible. The respondents added that even most of clients had different requests and features.

The dimension of temporal and performance are in the third-highest rank. The company applies the projectize system, in which the team is given specific

targets in certain time duration. This make the team need to manage their timeline very well-arranged. Many of their clients changed the timeline in the middle of the production process, when the team is doing their products using the timeline they had agreed in the beginning. The timeline's change require the team to be able to finish the product punctually. The timeline shift also felt harder when the clients had many criteria and features requirements within their products.

Serving the big companies requires them to achieve their work in the best result. Within three years of running, the company's clients were mostly big and firm companies with vast market segmentation, such as Dana, Smartfren, Piniship Logistic, Busan Auto Finance, Kalbe, etc. It becomes the reason for the dimension of performance also scores high.

Even not becoming the lowest score, frustration surprisingly becomes the second-lowest dimension. Yet the score is barely reach 50%. It means that the frustration is not the main demanding dimension compare the other dimensions. The respondents worked for 6 to 10 hours a day but the timing is not tighten into any specific start and finish time. Instead, the teleworkers are allowed to work more flexibly based on their time availability. Even though work with such high demand, the teleworkers can, at least, adjust and manage their working time better. Other reason fot this dimension to be scored lower than other dimensions is because the company program about refreshing program. Prior to the covid-19 pandemic, the company has the program to play sport together (especially for the teleworker within jabodetabek) once in a month. The company also had conducted a teams' tour together once in a year. This refreshment program might have helped the respondents in conquering the frustrations rate.

5.1.2. Workload Analysis per Job Division

This section explains the analysis of mental workload analysis per job descriptions. NASA-TLX was designed to ask the respondents depicting their work situation according to the determined time, which was between May-July 2020.

5.1.2.1.Project Manager

Project manager in bahasa.ai has some job descriptions to be done. Project manager basically is the one who responsible to ensure the projects can be accomplished punctually and also helping the team to communicate to clients.

The score of mental workload assessment using NASA-TLX for the project manager is 81.33. According to table 2.6, 81.33 is considered to be very high (the highest level of workload classification). Below (figure 5.2) shows the score for each dimension of the project manager.

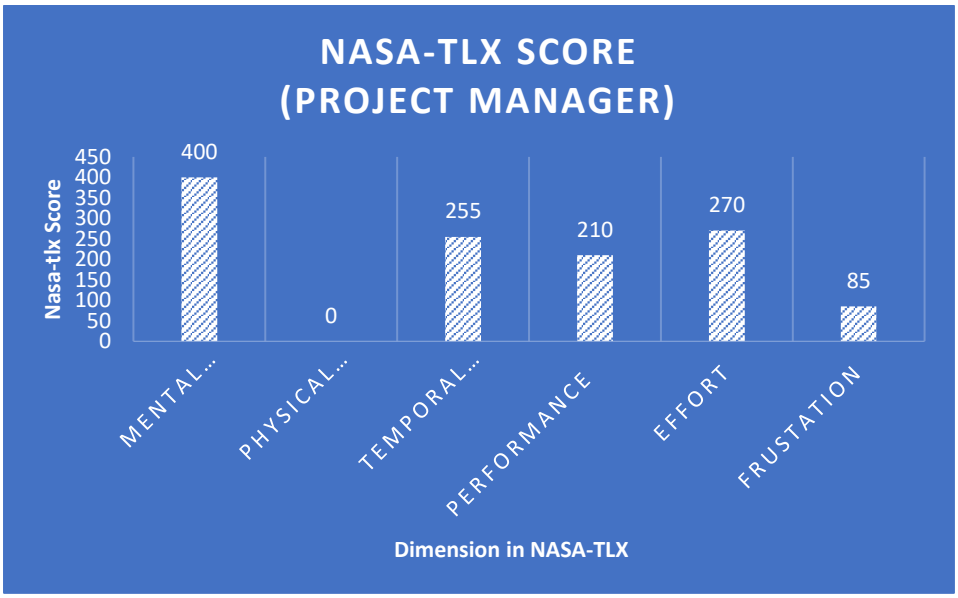

Figure 5. 2 NASA-TLX's Assessment Result of Project Manager

The highest score goes to mental demand, while the lowest is for physical demand. According to the job descriptions and the online interviews, the project manager required to perform many cognitive activities, such as thinking, analysing, calculating, etc. The project manager needs to be able to consider complex aspects in managing the team in doing any projects. Not only that, the project manager required to be able to perform verbal communication skills and negotiation skills. These requirements are needed to face the clients, especially when the team has the struggles in achieveing the deadlines due to the timeline shift.

Basically, project manager's job is about dealing (such as communicate and manage) with people, especially clients. Project manager must be able to manage

both customers (clients) and their own team members. Manging team remotely is additional challenge for the teleworkers, including the project manager of bahasa.ai. It makes the project manager to put additional effort in monitoring and planning the flexible timeline for the team. According to the online interview the project manager also take part in product prototype making with the product team. Even sometimes, the project manager need to handle the prototype making by itself. Since the background major of the project manager is not from IT major, so the project manager need to put another efforts to learn about making product prototype.

The temporal demand is also taking place in high rank, which is the third-highest rank. According to the online interview, the project manager is not only working in bahasa.ai. The respondent confirmed that he/she has another job to be handled. This situation cause the time pressure wor the work to be increased.

The physical demand is done infrequently. The main physical activity of the project manager (related to the job description) is to have meetings with clients (if the clients ask). The respondent explained that the meetings was the reason for them to score physical demand eventhough their company applies telework system

5.1.2.2.Corporate Finance and General Administrative

Based on the NASA-TLX assessment, the final score for corporate finance and general administrative is 78. According to dimensional assessment (figure 5.3), the highest mental workload score is the performance dimension. According to the job descriptions of the corporate finance and GA, this position is required to be able to perform very high accuracy and focus. This reason is also tightly related to the mental demand dimension. The corporate finance and GA tasks are mostly requires cognitive skills. The mental demand scores as second-highest as the work requires the respondent to perform it intensely.

Besides the high accuracy and focus, this job is only handled by 1 teleworker. The respondent need to achieve the targets punctually by itself. This becomes the reason for the temporal demand scores as the third-highest rank.

This job still requires the physical activities, even though only take very little portion. The physical activity of this job is such going to the tax office.

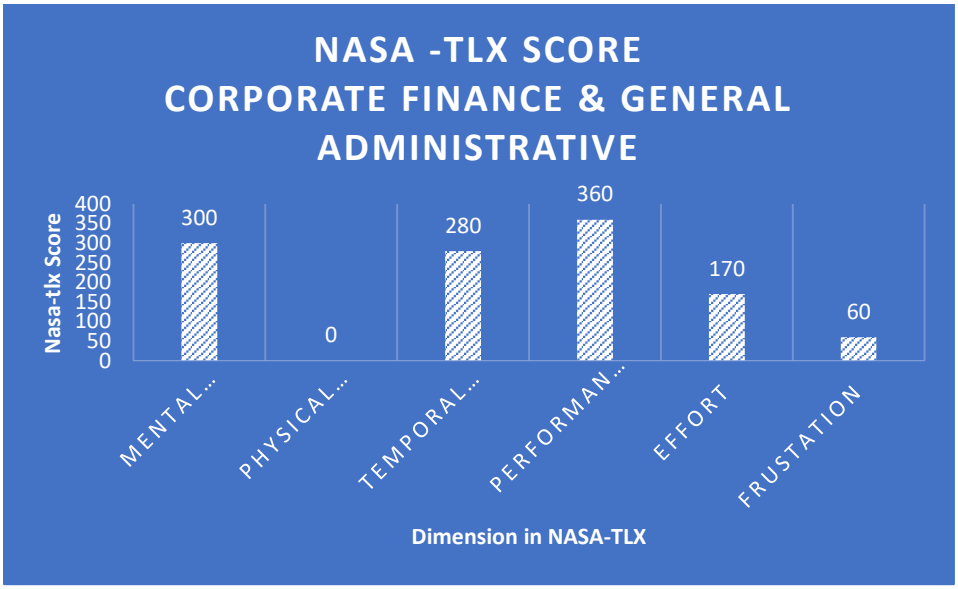

Figure 5. 3 NASA-TLX's Assessment Result of Corporate Finance and General Administrative

5.1.2.3.AI Engineer

The overall score of AI engineer is 80. The work of this job is mostly requires hard skills which more involving cognitive skills, such as analytic thinking. This becomes the reason for the dimension of mental demand scores as second-highest.

AI engineer also takes part in almost all projects since they are handling the main feature within company products. AI engineer does not only work for the clients but also maintain the company's working platform. However the team member of this division is only 2 people. With the work demand in the prior paragraph, this becomes reasonable for the frustration dimension to score as the highest.

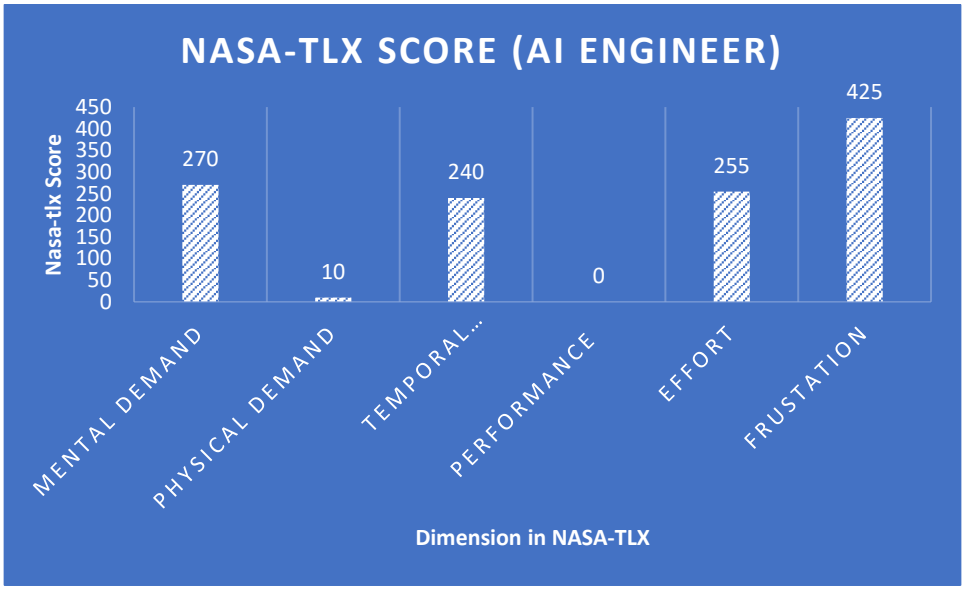

Figure 5. 4 NASA-TLX's Assessment Result of AI Engineer

5.1.2.4.Software Engineer

Below will be explained further analysis on the software engineer's NASA-TLX mental workload result.

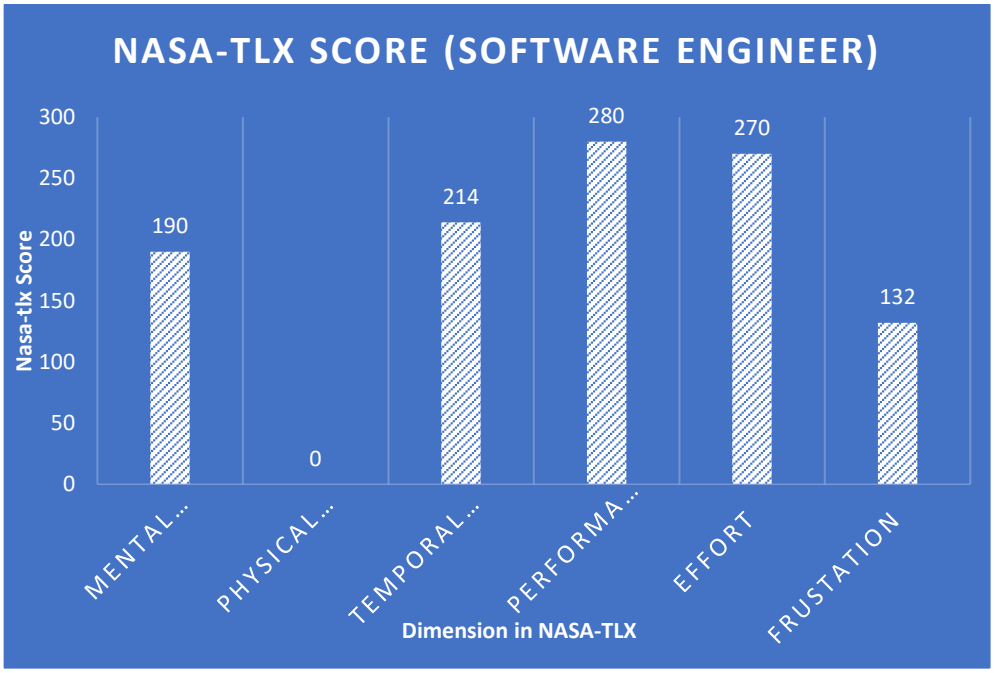

Figure 5. 5 NASA-TLX's Assessment Result of Software Engineer

Figure 5.5 shows that the highest score is for performance dimension. Through this result, respondents are depicting that this job requires to achieve the targets very well. As the technical engineers, this job is taking part in establish the product of the company. Since the clients are considered as big firms, the performance rate must be excellence so that the customer satisfaction will be achieved.

In many times, the clients have varied requirements. The clients required many new features. According to the online interview, the new features implementation requires the sotware engineers to learn many new perspectives and coding formulation research. Even though the background of the respondents in this division are from IT major, however the some clients requires the additional features in the middle of product making. Whilst, the timeline is running. This requires big efforts. Not only that, as for having the highest team members, the software engineer team is also faced to the challenge in remote coordination. The team is required to be able to communicate very quickly (responsive) and intensely for any changes in product establishment process. They have to make sure that there is no slack information so that their work can be achive high efficiency.

The pressure that was explained in the prior paragraph shows that temporal demand takes roles in this job. Figure 5.5 shows that temporal demand scores as the third-highet dimension.

5.1.2.5.DevOps Engineer

According to figure 5.6, it shows that DevOps engineer score mental demand as its highest score. In other words, mental demand is the most dominating dimension within this job. All the job descriptions of the DevOps engineer are all requiring cognitive skills.

DevOps engineer requires to make the program is reliable and scalable to be used by the clients. They are required to monitor the work from product testing until the product is even used by the clients. Similar to AI engineer, DevOps engineer are involved in almost all projects done by bahasa.ai. while the team member are also consisted by 2 members. This becomes the reason for the dimension of effort scores as second-highest dimension.

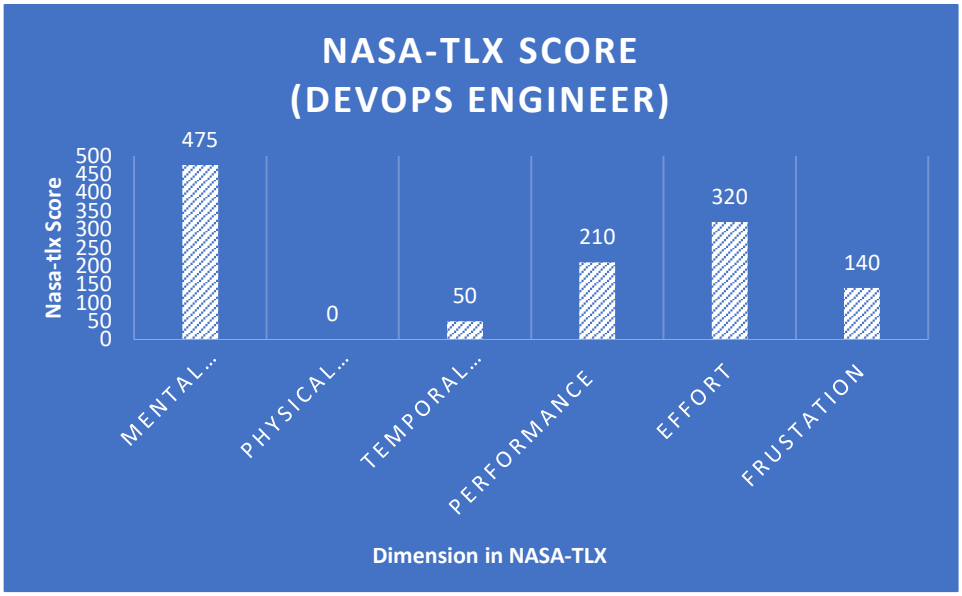

Figure 5. 6 NASA-TLX's Assessment Result of DevOps Engineer

5.1.2.6.Business Development

Figure 5.7 below shows the NASA-TLX result for business development division.

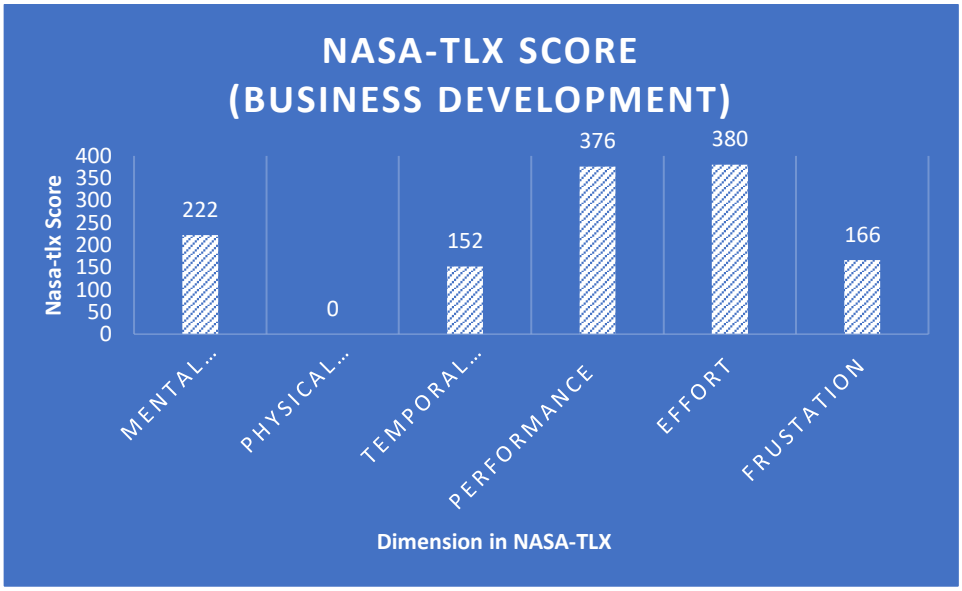

Figure 5. 7 NASA-TLX's Assessment Result of Business Development

Business development team is the frontier for the company to gain customers. This is why the score of performance dimension becomes the second-

highest dimension. Negotiation and communication skills is very important within the job. The satisfaction and achievements rate are very important points to be achieved by this job.

According to the interview, this job requires a high effort to gain new customers and achieve deal state. Complex analysis and marketing plan make them are required to get through the market and catch the opportunity. This becomes the main reason for the effort dimension scores highest.

5.2. **Analysis of the** SWAT Assessment

This section presents the analysis of mental workload result generated by the SWAT methods. This section is divided into 3 subsections, which are analysis of SWAT dimensions, analysis of overall workload result, and analysis of Kendall's coefficient of concordance.

5.2.1. Analysis of SWAT Dimensions

At the beginning of the interview, respondents were asked to rate the 3 dimensions of the SWAT method. The rates were recapitulated in table 4.5 and visualized in figure 5.8 below. Most of the respondents rate 2 for time load. It can be defined that time load is moderated within the most of respondents' jobs.

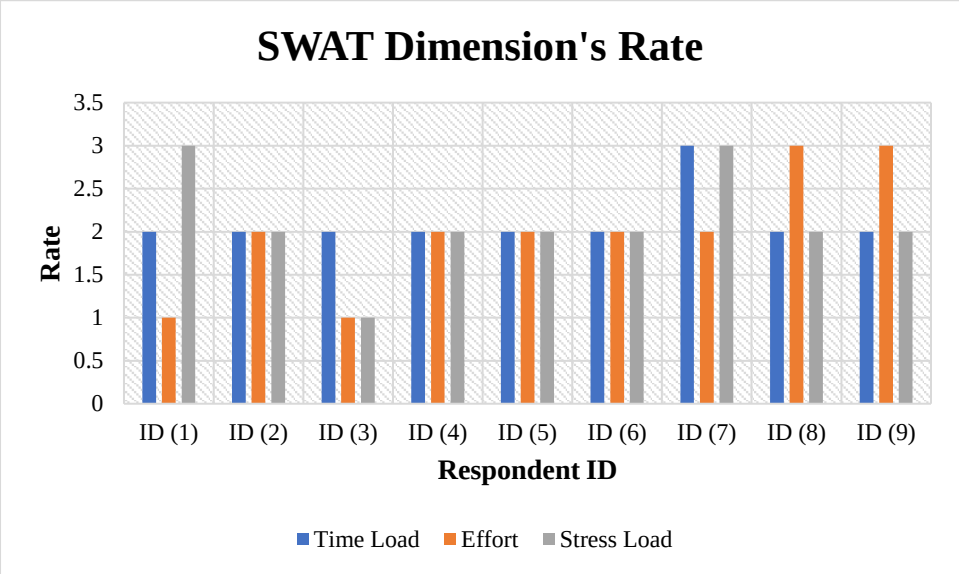

Figure 5. 8 SWAT Dimension's Rate

Effort is also mostly rated as 2. There are two respondents rated the effort with a score of 1. The respondents are respondent ID (1) and ID (3). At a glance, these results are seemed contrast with the effort result of both respondents in NASA-TLX measurement. Within NASA-TLX, both respondents ID (1) and ID (2) scores effort dimension for 74 (high) and 80 (very high). However, both methods have different scales in their usage. The SWAT apply scales between 1 and 3, while NASA-TLX range from 0 to 100. The SWAT method has shorter range compare to NASA-TLX method.

There is only 2 repsondents rate this dimension by 3, which are a software engineer and DevOps engineer. Corresponding to these score differences, there must be a reason causing the differences. According to the interview, their hard skill (for each corresponding job description) and working experience may help them to work, not to mention to be very easy, effortlessly and vice versa.

For stress load dimension, the only high rate (3) are given from the respondent ID (1) and (7). Take a look on the job description, both respondents are in managerial positions. According to the online interview, the targets of the managers are very stressing. Not only working based on targets, but they also responsible to coordinate both of their team members and clients.

5.2.2. Analysis of Overall Workload Result

The SWAT results (see in table 4.9) have similar pattern to the NASA-TLX results (see figure 5.9). Even so, both methods surely generate different results. The reason is that the SWAT uses a scale to generate workload score. Taking a look back to the SWAT data processing, the process was shown that the data was not too depicting the homogeneity of the individuals' preference in sorting the 27 SWAT cards. Another possible reason is in the SWAT card sorting process of the respondents. According to the table 4.2, most of interviews were conducted in weekdays and within working hours. Fragmented focus (with their works) and time limitation that the respondents gave may affect the sorting results. Most of respondents informed that they were in between their projects deadlines during the interview sessions.

5.2.3. Analysis of Kendall's Coefficient of Concordance

Kendall's coefficient of concordance result for the original data and prototype (without prototype modification) is quite low compare to the minimum criteria. This is showing that the homogeneity of the original data (card sorts of the respondents) are quite low. This means that all respondents have quite different preferences in depicting the job through the card sorts. There are some possibilities that might cause the case.

First is that the respondents had difficulties to perform the sorting of 27 SWAT cards. In their limited time in attending the interview sessions, they were asked to sort all the 27 cards by considering 3 dimensions. The difficuly was that they had to fill without any repeatation rank number while the online questionnaire screen required them to scroll right and down to check all the sort results (see figure A.4). Not only that, the other challenge in giving instruction virtually is the time limitations that the respondent provided to attend the online interview session. Most of the respondents provided the time for online interview session within weekdays in between their work. Lately, the respondents informed that in between the online sessions, the company is doing a project. It comes to the right sense if limitation time reason.

5.3. Analysis of Factors Affecting the Mental Workload

This section will focus to discuss about the correlation of individual factors and the mental workload scores of respondents.

5.3.1. Analysis of Combined Workload Result (Median Score of NASA-TLX and SWAT Methods)

Figure 5.9 below shows the comparison mental workload result between NASA-TLX and SWAT method. The median value between the 2 data result was generated to show the disparities between both the NASA-TLX and SWAT towards the central tendency. The result shows as follows:

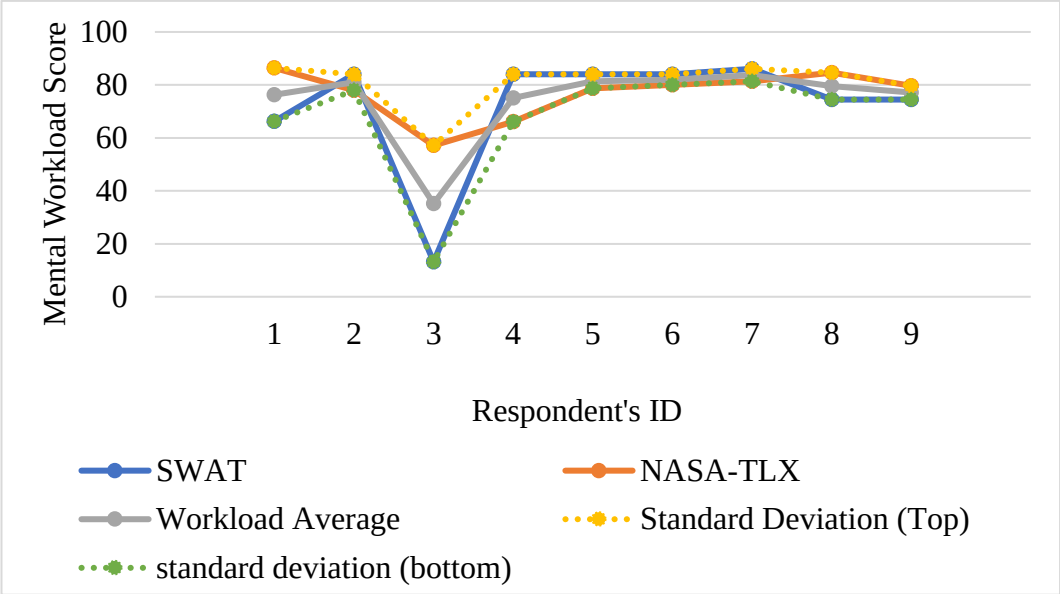

Figure 5. 9 Comparison Plot of Mental Workload Score between NASA-TLX, SWAT, and Average of Both.

The result of both NASA-TLX shows similar pattern one another.It means that the result shows both method depicts the similar situation regarding respondents' mental workload. The difference of the results are affected by some factors. Theoretically, NASA-TLX applies all individual scoring process without considering any other individual's dimension rating. The result of NASA-TLX is purely according to the respondent's individual subjectivity. While, for SWAT is using the universal scale from Kendall's coefficient of concordance. The scores generated using SWAT method consider other individuals' pereferences. So it is reasonable for any different range of mental workload result among the two methods.

Taking a look in figure 5.9, both shows that resopondent ID (3) generates lowest mental workload scores in both methods. According to the online interview, the respondent ID (3) is new team member in bahasa.ai. The projcets that this respondent handled were considered to be fewer compare to other respondents.

5.3.2. Analysis of the Correlation between Combined Mental Workload Result and Individual Factors

In the prior section of chapter IV, there have already shown some factors which are likely to affect the result of mental workload assessment. This section will explain how the factors correlated to the mental workload result statistical assessment (see figure 4.31).

The correlation between the mental workload result and the individual factors were assessed statistically by using regression test with the level of confidence 95% (α=0.05). The result shows insignificant result. According to figure 5.9, the insignificance is shown by the P value for all individual factors are much higher than the α. The goodness of the model also shows that of the Adjusted R-squared (R-Sq Adj.) which has value of -136.21%, which means that the model is unreliable and make the regression test can not be reffered to assess the correlation.

Taking a further look within the data, there are some logical reasons towards the statistic assessment result. For instance, in factor of exercise duration, the respondent ID (2) and ID (3) take exercise for less than 60 minutes in week. Nevertheless, both mental workload score are quite far apart to each other. The respondent ID (2) scores 81, while respondent ID (3) scores 35.17 for the mental workload.

Referring back to the explanation in section 4.2.1 (a), dimension age is scientifically proven affecting either physical or mental aspect of human. However, this normal declining is usually start happening from age 25, while the respondents of this research are mostly in between 21-25 or under 21. This factor seemed to be insignificant due to this reason. Same reason happen for factor of marriage status, there is only 1 respondent who has got married.

There are also some other statistical reasons causing the insignificant correlation. First, the data model might be fit to another type of model other than linear model. Secondly, the data is insufficient so that the certain model can not be clearly depicted. When the number of the data increases, there is possibility for the model to be fit. However, further statistical analysis should be conducted to check the model's reliability. Third, the individual factors determined in this research may

not be a consistent factor that can be used to predict the mental workload reception. The individual factors within this research is likely to be person-situation factors in which may not be the same in different situation (in this research is corresponding to the different projects done within observation time of this research).

5.4. Recommendation for Research's Object

According to the data processing result, the mental workload score for all respondents are likely to be potrayed in similar pattern. Both shows that the most mental workload score, especially for NASA-TLX assessment, are considered to be high. Not to mention there is one respondent who scores much lower than any other respondents, the big picture is still clear.

Recruiting new team members can be the one of the alternatives to respond the situation from the perspectives of mental workload measurement. During the research, the company object tent to have a slender team in which only have few number of member. Correspond to the high individual mental workload score, the recommendation is seemed to be fit in. the high individual mental workload score indicates the needs to reduce the job description with other individuals.

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CHAPTER 6
CONCLUSION AND SUGGESTION

In this chapter will be presented the conclusion of the final project research. There also will be shown some suggestions for future research.

6.1. Conclusion

According to the result of the data processing in chapter 4 and analysis in chapter 5, below are conclusions can be drawned:

1. Both NASA-TLX and SWAT shows the similar pattern on depicting the mental workload of the respondents, which are the teleworkers in bahasa.ai. The reason for both method has different results' value is due to the different theory approach they use within the measurement. NASA-TLX is purely measuring the individual assessment without considering the other individuals even if they are under the same circumstance. While SWAT generates the mental workload scores by considering the other individuals in form of a scale.
2. Correlation of the determined individual factors within this research (age, exercise habit, and marriage status) shows insignificant correlation to the mental workload scores of the respondents. However the statistical model of regression is still unreliable (indicated by the R-Sq (adj.) equals to -136.21%).

6.2. Suggestion

There are some suggestions given out for further research based on some findings within this final project research:

1. The individual differences factors interrelationship need to be assessed to see how much is the factors affecting each other.
2. For the further research, the individual difference aspect is better to be assessed with the certain personality traits model which has been proven to be consistant and or reliable as behavioural predictors. So the

result can depict more behavioral relationship between individual characters towards the workload reception.

3. Providing more ergonomical and simpler card sort interface for virtual data colletion is really important to make the respondents feel easier in doing the sorting process.

REFERENCE

Arasyandi, M., & Arfan, B. (2016). *Analisa Beban Kerja Mental Dengan Metode NASA-TLX Pada Operator Kargo di PT. Dharma Bandar Mandala* (PT.DBM). *ejournal3 UNDIP*. Retrieved from https://ejournal3.undip.ac.id/index.php/ieoj/article/viewFile/14100/13635

Atzori, L., Lera, A., & Morabito, G. (2010, May 31). *The Internet of Things: A Survey. Comput. Netw*. doi:10.1016/j.comnet.2010.05.010

Choliq, A. (2020, February 8). bahasa.ai. (L. Putri, Interviewer)

Diener, E., Lucas, R. E., & Cummings, J. A. (2019). *Personality Traits. In J. A. Cummings, & L. Sanders, Introduction to Psychology.* Saskatoon: University of Saskatchewan Open Press. Retrieved August 07, 2020, from Open Press University of Saskatchewan: https://openpress.usask.ca/introductiontopsychology/chapter/personality-traits/

Easton, M., Carrodus, G., Delany, T., Howitt, B., & Smith, R. (2013). In*dustrial Revolution. In M. Easton, G. Carrodus, T. Delany, B. Howitt, & R. Smith, Oxford Big Ideas Geography/History 9* (pp. 269-313). Oxford University Press Australia. Retrieved from https://www.oup.com.au/__data/assets/pdf_file/0017/58031/Oxford-Big-Ideas-Geography-History-9-ch5-Industrial-revolution.pdf

Euro Control. (2012, October 22). *Subjective Workload Asessement Technique (SWAT).* Retrieved from HP Repository: https://ext.eurocontrol.int/ehp/?q=node/1588

Eurofound & the International Labour Office. (2017). *Working Anytime, Anywhere: The Effects on the World of Work.* Publications Office of the European Union, Luxemburg and the International Labour Office, Geneva. doi:10.2806/372726

European Commission. (2018, June 20). *Working From Home in the European Union.* Retrieved from Eurostat: https://ec.europa.eu/eurostat/web/products-eurostat-news/-/DDN-20180620-1

Executive Yuan 行政院. (2015, July 23). P*roductivity 4.0 to Pilot Industrial Transformation, Upgrade: Premier. Press Release*. Taipei, Taiwan: Executive Yuan 行政院, Republic of China (Taiwan). Retrieved May 3, 2020, from https://english.ey.gov.tw/Page/61BF20C3E89B856/ef482c50-5a64-48d4-aa99-51d17843b1f1

export.gov. (2019, August 8). *Kore-Mfg Tech-Smart Factory*. Retrieved from Export.gov: https://www.export.gov/apex/article2?id=Korea-Manufacturing-Technology-Smart-Factory

Felstead, A., & Henseke, G. (2017). Assessing the Growth of Remote Working and Its Consequences for Effort, Well-Being, and Work-Life Balance. *New Technology, Work and Employment, 32*(3), 195-212. Retrieved May 9, 2020, from https://orca-mwe.cf.ac.uk/104239/8/Felstead%20and%20Henseke_NTWE_2017.pdf

Funder, D. C., Guillaume, E., Kumagai, S., Kawamoto, S., & Sato, T. (2012, April). *The Person-situation Debate and the Assessment of Situations. Japanese Journal of Personality*.

Future Workplace. (2017). *Remote Work: Navigating the Flexible Workplace.* California: Future Workplace. Retrieved from https://workplacetrends.com/wp-content/uploads/2017/11/Remote-Work-eBook.pdf

Gardner, H. K., & Matviak, I. (2020, March 05). *Harvard Business Review*. Retrieved March 14, 2020, from Leading time: Coronavirus Could Force Teams to Work Remotely: https://hbr.org/2020/03/coronavirus-could-force-teams-to-work-remotely

Gawron, V. J. (2000). Subjective Workload Assessment Technique. In V. J. Gawron, *Human Performance Measures Handbook* (pp. 142-149). Mahwaw, New Jersey: Lawrence Erlbaum Associates.

Global Workplace & Flexjobs. (2017). *2017 State of Telecommuting in the US Employee Workforce.* Retrieved from https://cdn.thepennyhoarder.com/wp-content/uploads/2017/06/30140000/State_Of_Telecommuting_U.S._Employee_Workforce.pdf

GRDC. (2019, March 26). *https://graftonrdc.org/*. Retrieved April 23, 2020, from Grafton Regional Development Corporation: https://graftonrdc.org/events/joining-the-remote-workforce-explore-the-pros-cons-of-working-from-home/thumb_woman-laptop-cat/

Hart, S. G., & Staveland, L. E. (1988). *Development of Nasa-TLX (Task Load Index) Result of Empirical and Theoritical Research.* (P. A. Hancock, & N. Meshkati, Eds.) *Human Mental Workload*, 139-183.

Health and Safety Authority. (n.d). *Ergonomics in the Workplace.* Retrieved from https://www.hsa.ie/eng/Publications_and_Forms/Publications/Occupational_Health/Ergonomics.pdf

ILO. (2017). *Indonesia Jobs Outlook 2017: Harnessing Technology for Growth and Job Creation.* International Labor Organization (ILO). Jakarta: International Labor Organization 2017.

Jex, H. R. (1988). *Measuring Mental Workload Problems, Progress, and Promises*. (P. A. Hancock, & N. Meshkati, Eds.) *Human Mental Workload*.

Kalis, G. S. (2018, September 26). *Manfaat Olahraga Bagi Kesehatan Mental*. (D. Team, Editor, & PT Media Kesehatan Indonesia) Retrieved July 30, 2020, from Dokter Sehat: https://doktersehat.com/manfaat-olahraga-bagi-kesehatan-mental/

KEIA & KIEP. (2015). *Korea's Economy* . Korea Economic Institute of America & Korea Institute for International Economic Policy. KEIA & KIEP. Retrieved May 3, 2020, from http://keia.org/sites/default/files/publications/kei_koreaseconomy_atkinson_0.pdf

Khaitan , S. K., & McCalley, J. D. (2015). *Design Techniques and Applications of Cyber Physical Systems: A Survey*. *IEEE Systems Journal, 9*(2), 350-365. doi:http:dx.doi.org/10.1109/JSYST.2014.2322503

Krisnaningsih, E., Anwar, K., & Dwiyanto, S. (2019, January-June). P*engukuran Beban Kerja Mental Operator Control Room Menggunakan Metode Subjective Workload Assessment Technique (SWAT)*. *Jurnal InTent, 2*(1).

Lamos, D. L. (1984). Subjective Workload and Individual Differences in Information Processing Abilities. *SAE Transaction, 93*, 277-280.

Lamos, D. L. (1988). *Individual Differences in Subjective Estimates of Workload.* (P. A. Hancock, & N. Meshkati, Eds.) *Human Mental Workload*.

Lee, K. R. (2012). *IBM Research.* Retrieved from IBM Research Zurich: https://www.zurich.ibm.com/

Liao, Y., Loures, E. R., Deschamps, F., Brezinski, G., & Venâncio, A. (2018). T*he Impact of the Fourth Industrial Revolution: A Cross-country/Region Comparison*. *Production, 28*(e20180061). doi:10.1590/0103-6513.20180061

Linked.in. (2020, March). *LinkedIn*. Retrieved March 14, 2020, from Remote Work in Indonesia: https://www.linkedin.com/jobs/remote-work-jobs/?originalSubdomain=id

Longo, L. (2018, August 1). *Experienced Mental Workload, Perception of Usability, Their Interaction and Impact on Task performance*. (S. Federici, Ed.) *PLoS ONE, 13*(8). Retrieved from https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0199661

Lumintang, M. F., Kawatu, P. A., & Warouw, F. (2017). *Hubungan Antara Umur dan Beban Kerja dengan Kelelahan Kerja Pada Montir Perbengkelan di Desa Kiawa, Kecamatan Kawangkoan Utara, Kabupaten Minahasa*. *Universitas Sam Ratulangi Manado, 9*(3), 1-9.

Mellers, D. (2015). *The Third Industrial revolution*. SAS Institute. Retrieved from https://www.sas.com/content/dam/SAS/en_au/doc/events/Presentations/the-third-industrial-revolution-david-mellers.pdf

Mohajan, H. K. (2019). *The First Industrial Revolution: Creation of a New Global Human Era*. *Social Sciences and Humanities, 5*(4), 377-378. Retrieved from https://www.researchgate.net/publication/336675822_The_First_Industrial_Revolution_Creation_of_a_New_Global_Human_Era

Mokyr, J. (1999). *The Second Industrial Revolution,* 1870-1914. In V. Castronovo, *Storia dell'economia Mondiale* (pp. 219-245). Rome, Italy: Laterza.

Montreuil, S., & Lippel, K. (2002, October 1). *Telework and Occupational Health: A Quebec Empirical Study and Regulatory Implications*. *Safety Science, 41*, 339-358.

MOTIE of Republic of South Korea . (2014). *Manufacturing Innovation 3.0 Strategy for the Creation of Economy.* Ministry of Trade, Industry, and Energy of Republic of South Korea. Sejong CIty: MOTIE of Republic of South Korea .

Murman, D. L. (2015, August). *The Impact of Age on Cognition. Semin Hear 36(03):, 36*(3), 111-121. doi:10.1055/s-0035-1555115

NASA Ames Research Center. (1986). *Nasa Task Load Index (TLX) Paper and Pencil Package.* Retrieved from National Aeronautics and Space Administration: https://humansystems.arc.nasa.gov/groups/tlx/downloads/TLX_pappen_manual.pdf

Navrátil, M., Hladká, M., Duspivová, K., & Dušánek, D. (2017). *Remote Work Problems and Their Solution for Employees.* Zlín: Trexima.

Nicholas, A. J. (2014). *Research Gate*. Retrieved from Research Gate: https://www.researchgate.net/publication/271444557_Management_and_Telework

Noviyanti, S. (2016, 02 13). (Latief, Editor, & Kompas) Retrieved March 14, 2020, from Kompas.com: https://tekno.kompas.com/read/2016/02/13/05270007/Kerja.Tanpa.Nganto r.Efektifkah.?page=all

Oxford Learner Dictionaires. (2020). *Oxford Larner Dictionaries*. Retrieved April 22, 2020, from Definition: https://www.oxfordlearnersdictionaries.com/definition/english/mental_1?q=mental

PGi. (2016). Retrieved from Global Teleworks Survey: https://img03.en25.com/Web/PremiereGlobalServices/%7B28aa453d-300f-4292-ab54-7e925397de79%7D_2016_Global_Telework_Survey.pdf

Pradhana, C. A., & Suliantoro, H. (2018). *Analisis Beban Kerja Mental Menggunakan Metode NASA-TLX Pada Bagian Shipping Perlengkapan di PT. Triangle Motorindho.*

Reid, G. B., & Nygren, T. E. (1988). *The Subjective Workload Assessment Technique: A Scalling Procedure for Measuring Mental.* (P. A. Hancock, & N. Meshkati, Eds.) *Human Mental Workload*, 185-218.

Reid, G. B., Potter, S. S., & Bressler, J. r. (1989). *Subjective Workload Assessment Technique (SWAT): A User's Guide (U).* Harry G. Armstrong Aerospace Medical Research Laboratory , Human System Division. Ohio: Wright-Patterson Air Force Base. Retrieved from https://apps.dtic.mil/dtic/tr/fulltext/u2/a215405.pdf

Revelle, W., Wilt, J., & Condon, D. M. (2015). *Individual Differences and Differential Psychology: A Brief History and Prospect.* In T. C. Premuzic, S. V. Stumm, & A. Furnham (Eds.), *The Wiley-Blackwell Handbook of Individual Differences (HPIZ - Wiley- Blackwell Handsbooks in Personality and Individual Differences).* Willey Blakckwell.

Rubio, S., Diaz, E., Martin, J., & Puente, J. M. (2004). *Evaluation of Subjective Mental Workload: A Comparison of SWAT, Nasa -TLX, and Workload Profile Methods*. *Applied Psycology: An International Review, 53*(1), 61-86.

Saputra, A. D., Priyanto, S., Muthohar, I., & Etsem, M. B. (2014). *Analisis Pengaruh Waktu Terbang (Phases of Time) Terhadap Beban Kerja Mental Pilot Pesawat Terbang Dengan Menggunakan Metode Subjective Wokrload Assessment Technique (SWAT)*. *FSTPT International Symposium Jember University*, 1335-1349. Retrieved from jurnal.unej.ac.id

Schawbel, D. (2018, November 15). *Harvard Business Review*. R*etrieved from Personnel Policy (Survey: Remote Workers Are More Disengaged and More Likely to Quit)*: https://hbr.org/2018/11/survey-remote-workers-are-more-disengaged-and-more-likely-to-quit

Schinoff, B., Ashforth, B. E., & Corley, K. (2019, November 22). *Harvard Business Review*. Retrieved March 14, 2020, from Collaboration : How Remote Workers Make Friends: https://hbr.org/2019/11/how-remote-workers-make-work-friends

Singleton, W. (1972). Introduction to Ergonomics. Geneva: World Health Organization. Retrieved from

https://apps.who.int/iris/bitstream/handle/10665/37137/Introduction-to-Ergonomics-1972-en.pdf;jsessionid=3AFB8FB4E8B2DC50EA553A4E99DA591B?sequence=1

Society of Automative Engineering of Japan. (2019). *Handbook of Automotive Human Factors.* (M. Akamatsu, Ed.) Boca Raton, Florida, USA: CRC Press.

Szalma, J. L. (2002). *Individual Differences in the Stress and Workload of Sustained Attention. Human Factors and Ergonomics Society 46th Annual Meeting*, (pp. 1002-1006).

Szalma, J. L. (2009). Individual Differences in the Stress and Workload of Sustained Attention. *Personality and Individual Differences*, 444-451. doi:10.1016/j.paid.2009.04.019

The U.S. Office of Personnel Management . (2001). *Teleworks: A Compendium of Success Stories.* The U.S. Office of Personnel Management (Office of Merit System Oversight and Effectiveness).

Vidulich , M. A., & Tsang, P. S. (1986). Techniques of Subjective Workload Assessment: A Comparison of SWAT and the Nasa-Bipolar Methods. *Ergonomics, 29*(11), 1385-1398.

Vries, P. (2008). The Industrial Revolution. In P. N.Streans, *Encyclopaedia of the Modern World* (pp. 158-161). Oxford University Press. Retrieved from https://www.researchgate.net/publication/282572543_The_Industrial_Revolution

Widyanti, A., Johnson, A., & Waard, D. d. (2012, February). *Pengukuran Beban Kerja Mental Dalam Searching Task dengan Metode Rating Scale Mental Effort (RSME). J@ti UNDIP: Jurnal Teknik Industri, V*(1), 1-6. doi:10.12777/jati.5.1.1-6

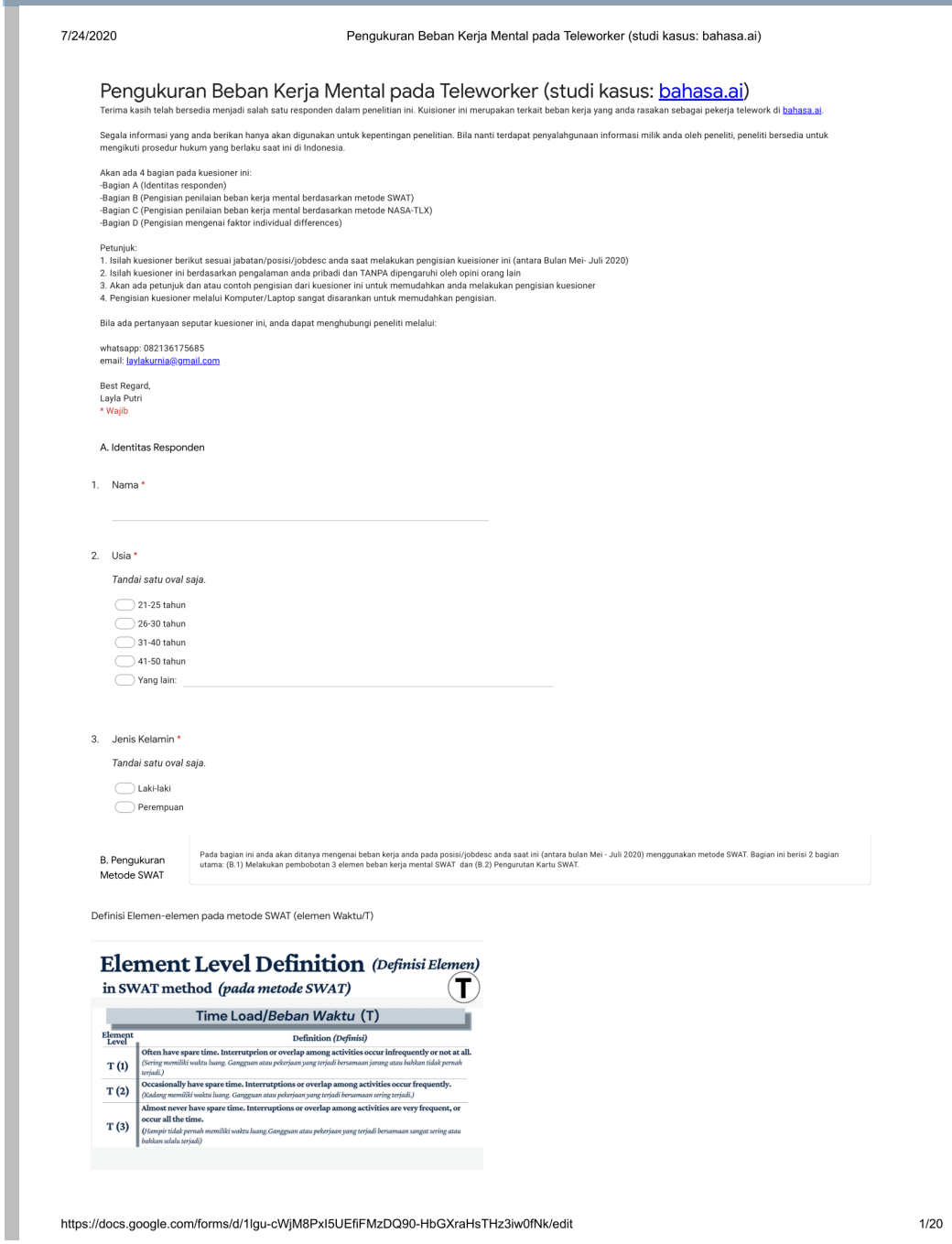
Williamson, J. M. (2018). *Teaching to Individual Differences in Science and Engineering Librarianship.* Chandos Publishing. Retrieved from https://www.sciencedirect.com/topics/psychology/individual-differences

Zulfany, A. H., Dewi, R. S., & Partiwi, S. G. (2019). Analyzing Mental Workload of Remote Worker by Using SWAT Methodology (Case Study: Remote

Software Engineer). *Annual Conference on Industrial and System Engineering (ACISE) 2019.* Semarang: IOP Publishing. doi:10.1088/1757-899X/598/1/012008

ATTACHMENTS

Attachment A Research's Instruments (Questionnaire by Google Form)



7/24/2020 Pengukuran Beban Kerja Mental pada Teleworker (studi kasus: bahasa.ai)

Pengukuran Beban Kerja Mental pada Teleworker (studi kasus: bahasa.ai)

Terima kasih telah bersedia menjadi salah satu responden dalam penelitian ini. Kuisioner ini merupakan terkait beban kerja yang anda rasakan sebagai pekerja telework di bahasa.ai.

Segala informasi yang anda berikan hanya akan digunakan untuk kepentingan penelitian. Bila nanti terdapat penyalahgunaan informasi milik anda oleh peneliti, peneliti bersedia untuk mengikuti prosedur hukum yang berlaku saat ini di Indonesia.

Akan ada 4 bagian pada kuesioner ini:
-Bagian A (Identitas responden)
-Bagian B (Pengisian penilaian beban kerja mental berdasarkan metode SWAT)
-Bagian C (Pengisian penilaian beban kerja mental berdasarkan metode NASA-TLX)
-Bagian D (Pengisian mengenai faktor individual differences)

Petunjuk:
1. Isilah kuesioner berikut sesuai jabatan/posisi/jobdesc anda saat melakukan pengisian kueisioner ini (antara Bulan Mei- Juli 2020)
2. Isilah kuesioner ini berdasarkan pengalaman anda pribadi dan TANPA dipengaruhi oleh opini orang lain
3. Akan ada petunjuk dan atau contoh pengisian dari kuesioner ini untuk memudahkan anda melakukan pengisian kuesioner
4. Pengisian kuesioner melalui Komputer/Laptop sangat disarankan untuk memudahkan pengisian.

Bila ada pertanyaan seputar kuesioner ini, anda dapat menghubungi peneliti melalui:

whatsapp: 082136175685
email: laylakurnia@gmail.com

Best Regard,
Layla Putri
* Wajib

A. Identitas Responden

1. Nama *

2. Usia *

Tandai satu oval saja.

- 21-25 tahun
- 26-30 tahun
- 31-40 tahun
- 41-50 tahun
- Yang lain:

3. Jenis Kelamin *

Tandai satu oval saja.

- Laki-laki
- Perempuan

B. Pengukuran Metode SWAT

Pada bagian ini anda akan ditanya mengenai beban kerja anda pada posisi/jobdesc anda saat ini (antara bulan Mei - Juli 2020) menggunakan metode SWAT. Bagian ini berisi 2 bagian utama: (B.1) Melakukan pembobotan 3 elemen beban kerja mental SWAT dan (B.2) Pengurutan Kartu SWAT.

Definisi Elemen-elemen pada metode SWAT (elemen Waktu/T)

Element Level Definition *(Definisi Elemen)*
in SWAT method *(pada metode SWAT)* **T**

Time Load/*Beban Waktu* (T)

Element Level	Definition *(Definisi)*
T (1)	**Often have spare time. Interrutprion or overlap among activities occur infrequently or not at all.** *(Sering memiliki waktu luang. Gangguan atau pekerjaan yang terjadi bersamaan jarang atau bahkan tidak pernah terjadi.)*
T (2)	**Occasionally have spare time. Interrutptions or overlap among activities occur frequently.** *(Kadang memiliki waktu luang. Gangguan atau pekerjaan yang terjadi bersamaan sering terjadi.)*
T (3)	**Almost never have spare time. Interruptions or overlap among activities are very frequent, or occur all the time.** *(Hampir tidak pernah memiliki waktu luang.Gangguan atau pekerjaan yang terjadi bersamaan sangat sering atau bahkan selalu terjadi)*

https://docs.google.com/forms/d/1lgu-cWjM8PxI5UEfiFMzDQ90-HbGXraHsTHz3iw0fNk/edit 1/20

Figure A.1 Online Questionnaires for the Data Acquisition (Page 1/20) (Designed using Google Form)

Definisi Elemen-elemen pada metode SWAT (elemen Beban Mental/E)

Element Level Definition *(Definisi Elemen)*
in SWAT method *(pada metode SWAT)* **E**

Mental Effort Load/*Beban Mental* (E)

Element Level	Definition *(Definisi)*
E (1)	**Very little conscious mental effort or concentration required. Activity is almost automatic, requiring little or no attention.** *(Hanya membutuhkan sedikit konsentrasi, kebanyakan aktivitas sudah dilakukan secara otomatis dan hanya membutuhkan sedikit atau bahkan tanpa perhatian khusus)*
E (2)	**Moderate conscious mental effort or concentration required. Complexity of activity is moderately high due to uncertainty, unpredictability, or unfamiliarity. Considerable attention required.** *(Membutuhkan konsentrasi sedang. Pekerjaan yang bersifat kompleks, tidak terprediksi, atau tidak familiar cukup sering terjadi. Pekerjaan membutuhkan perhatian yang cukup dalam pelaksanaannya)*
E (3)	**Extensive mental effort and concentration are necessary. Very complex activity requiring total attention.** *(Konsentrasi menyeluruh sangat dibutuhkan. Tingkat kompleksitas pekerjaan sangat membutuhkan perhatian khusus dalam pelaksanaannya.)*

Definisi Elemen-elemen pada metode SWAT (elemen Beban Stres/S)

Element Level Definition *(Definisi Elemen)*
in SWAT method *(pada metode SWAT)* **S**

Stress Load/*Beban Stres* (S)

Element Level	Definition *(Definisi)*
S (1)	**Little confusion, risk, frustration, or anxiety exists and can be easily accommodated.** *(Pekerjaan menimbulkan sangat sedikit atau bahkan tidak menimbulkan kebingungan, resiko, frustasi, kegelisahan pada operator. Bilagan timbul, hal-hal tersebut di atas dapat diatasi dengan mudah)*
S (2)	**Moderate stress due to confusion, frustration, or anxiety noticeably adds to workload. Significant compensation is required to maintain adequate performance.** *performansi)* *(Pekerjaan cukup menimbulkan kebingungan, frustasi, dan kegelisahan, sehingga menambah tingkat beban kerja. Membutuhkan usaha/perhatakan tambahan untuk meningkatkan performansi)*
S (3)	**High to very intense stress due to confusion, frustration, or anxiety. High to extreme determination and self-control required.** *(Pekerjaan menimbulkan kebingungan, frustasi, dan atau kegelisahan yang sangat tinggi, sehingga menimbulkan stres yang sangat tinggi. Tekad yang kuat dan pengendalian diri yang tinggi sangat diperlukan)*

4. (BAGIAN B.1) Setelah memahami definisi elemen-elemen SWAT di atas, berilah penilaian beban kerja mental pekerjaan anda saat ini untuk setiap elemen SWAT di bawah ini. *

Tandai satu oval saja per baris.

	1	2	3
Time Load (beban waktu)	◯	◯	◯
Mental Effort Demand (beban usaha mental)	◯	◯	◯
Psychological Stress Load (beban tekanan psikologis)	◯	◯	◯

Figure A.2 Online Questionnaires for the Data Acquisition (Page 2/20) (Designed using Google Form)

(BAGIAN B.2) Berikut adalah The 27 SWAT cards. Dengan 27 SWAT cards ini, anda akan diminta untuk mengurutkan kartu menggambarkan beban kerja yang anda rasakan saat bekerja pada posisi dan jobdesc(s) yang anda kerjakan saat ini (antara bulan Juni-Juli). Urutan ke-1 = kartu yang paling sesuai, urutan ke-27 = yang paling TIDAK sesuai). Pastikan untuk tidak memilih pilihan yang sama 2 kali berturut-turut.

The 27 SWAT Cards
(27 Kartu SWAT)

Example:
Card N = your job requires low time load, low effort, and generate low stress.

No	Card Code	Workload Rating Combination		
		Time (T)	Effort (E)	Stress (S)
1	N	1	1	1
2	B	1	1	2
3	W	1	1	3
4	F	1	2	1
5	J	1	2	2
6	C	1	2	3
7	X	1	3	1
8	S	1	3	2
9	M	1	3	3
10	U	2	1	1
11	G	2	1	2
12	Z	2	1	3
13	V	2	2	1
14	Q	2	2	2
15	ZZ	2	2	3
16	K	2	3	1
17	E	2	3	2
18	R	2	3	3
19	H	3	1	1
20	P	3	1	2
21	D	3	1	3
22	Y	3	2	1
23	A	3	2	2
24	O	3	2	3
25	L	3	3	1
26	T	3	3	2
27	I	3	3	3

Figure A.3 Online Questionnaires for Showing the SWAT Cards Visualization (Page 3/20)

(Designed using Google Form)

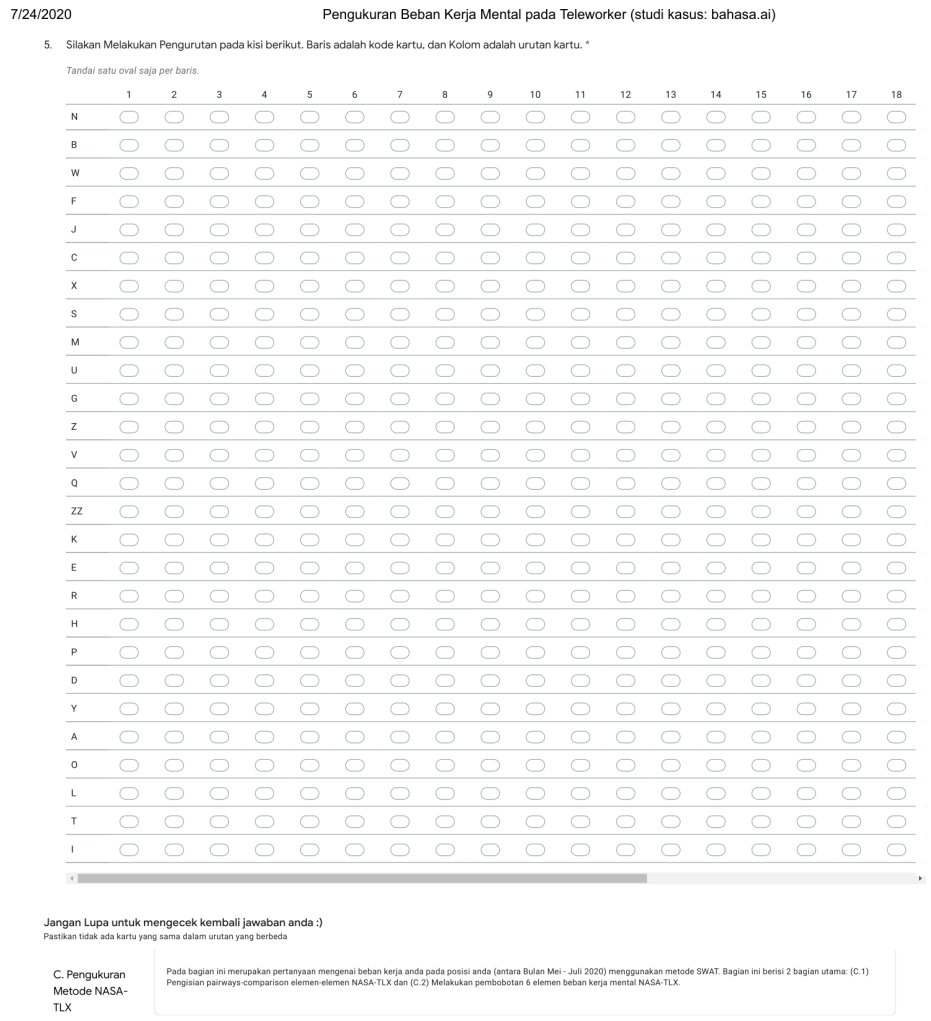


Figure A. 4 Online Questionaire for 27 SWAT Cards Sorting Process in Full Version, Not The Screen Version. (Page 4/20)

(Designed using Google Form)

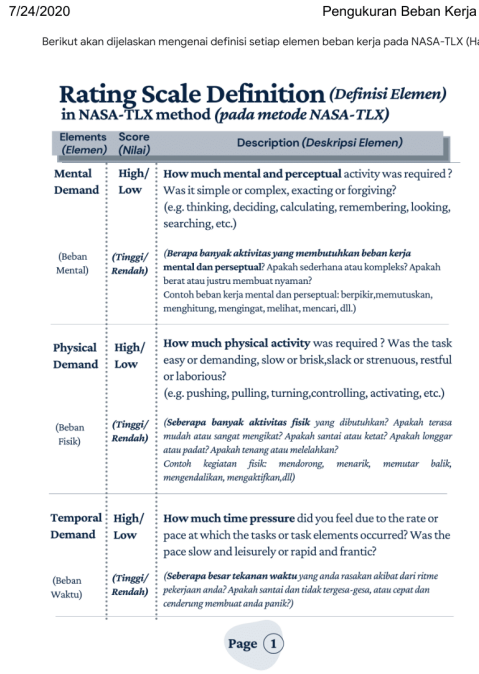


Figure A. 5 Online Questionnaires for the Data Acquisition (Page 5/20) (Designed using Google Form)

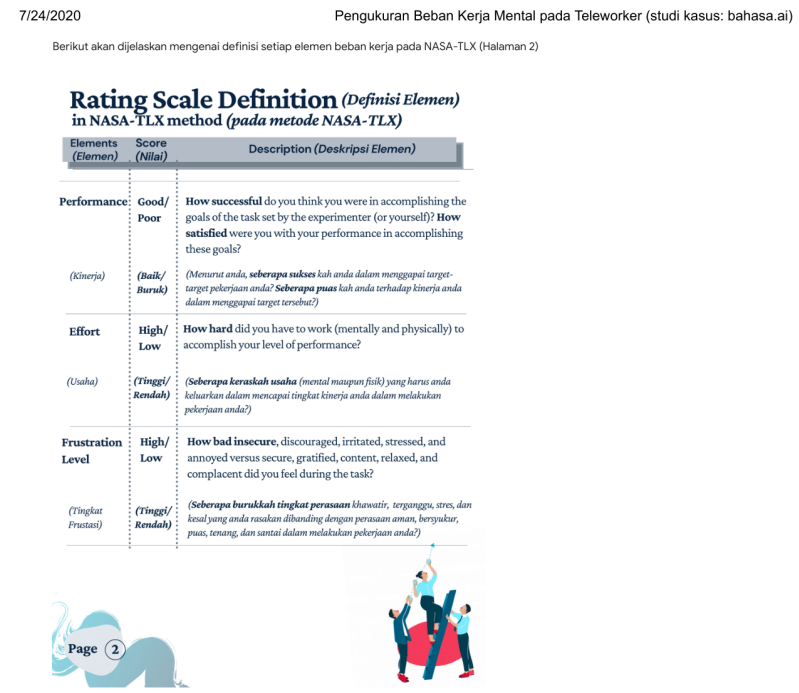
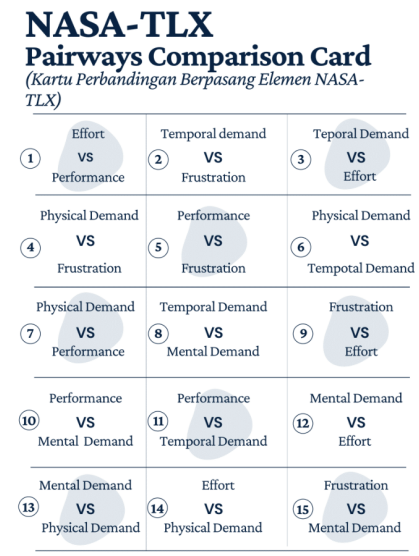


Figure A. 6 Online Questionnaires for the Data Acquisition (Page 6/20) (Designed using Google Form)

(Bagian C.1) Setelah memahami definisi masing-masing elemen, pertanyaan selanjutnya adalah memilih salah satu elemen dari setiap pasangan elemen di bawah ini. CONTOH: dalam pekerjaan anda (antara bulan Mei-Juli 2020) lebih banyak menyita waktu daripada beban usaha anda, maka di antara temporal demand VS effort saya memilih TEMPORAL DEMAND



NASA-TLX
Pairways Comparison Card
(Kartu Perbandingan Berpasang Elemen NASA-TLX)

1 Effort VS Performance	2 Temporal demand VS Frustration	3 Teporal Demand VS Effort
4 Physical Demand VS Frustration	5 Performance VS Frustration	6 Physical Demand VS Tempotal Demand
7 Physical Demand VS Performance	8 Temporal Demand VS Mental Demand	9 Frustration VS Effort
10 Performance VS Mental Demand	11 Performance VS Temporal Demand	12 Mental Demand VS Effort
13 Mental Demand VS Physical Demand	14 Effort VS Physical Demand	15 Frustration VS Mental Demand

Pair-ways (1) Effort VS Performance

Figure A. 7 Online Questionnaires for the Data Acquisition (Page 7/20) (Designed using Google Form)

6. Pair-ways (1) Effort VS Performance, yang mana lebih menggambarkan beban kerja posisi/jabatan anda saat ini? *

Tandai satu oval saja.

- Effort
- Performance

Pair-ways (2) Temporal demand VS Frustration

7. Pair-ways (2) Temporal demand VS Frustration, yang mana lebih menggambarkan beban kerja posisi/jabatan anda saat ini? *

Tandai satu oval saja.

- Temporal Demand
- Frustration

Figure A. 8 Online Questionnaires for the Data Acquisition (Page 8/20) (Designed using Google Form)

Pair-ways (3) Temporal demand VS Effort

8. Pair-ways (3) Temporal demand VS Effort, yang mana lebih menggambarkan beban kerja posisi/jabatan anda saat ini? *

Tandai satu oval saja.

- ◯ Temporal Demand
- ◯ Effort

Pair-ways (4) Physical Demand VS Frustration

https://docs.google.com/forms/d/1lgu-cWjM8PxI5UEfiFMzDQ90-HbGXraHsTHz3iw0fNk/edit

Figure A. 9 Online Questionnaires for the Data Acquisition (Page 9/20) (Designed using Google Form)

9. Pair-ways (4) Physical Demand VS Frustration, yang mana lebih menggambarkan beban kerja posisi/jabatan anda saat ini? *

Tandai satu oval saja.

- Physical Demand
- Frustration

Pair-ways (5) Performance VS Frustration

10. Pair-ways (5) Performance VS Frustration, yang mana lebih menggambarkan beban kerja posisi/jabatan anda saat ini? *

Tandai satu oval saja.

- Performance
- Frustration

Figure A. 10 Online Questionnaires for the Data Acquisition (Page 10/20) (Designed using Google Form)

Pair-ways (6) Physical demand VS Temporal Demand

11. Pair-ways (6) Physical demand VS Temporal Demand, yang mana lebih menggambarkan beban kerja posisi/jabatan anda saat ini? *

Tandai satu oval saja.

- Physical demand
- Temporal Demand

Pair-ways (7) Physical demand VS Performance

https://docs.google.com/forms/d/1lgu-cWjM8PxI5UEfiFMzDQ90-HbGXraHsTHz3iw0fNk/edit

Figure A. 11 Online Questionnaires for the Data Acquisition (Page 11/20) (Designed using Google Form)

12. Pair-ways (7) Physical demand VS Performance, yang mana lebih menggambarkan beban kerja posisi/jabatan anda saat ini? *

Tandai satu oval saja.

- Physical demand
- Performance

Pair-ways (8) Temporal demand VS Mental Demand

13. Pair-ways (8) Temporal demand VS Mental Demand, yang mana lebih menggambarkan beban kerja posisi/jabatan anda saat ini? *

Tandai satu oval saja.

- Temporal Demand
- Mental Demand

Figure A. 12 Online Questionnaires for the Data Acquisition (Page 12/20) (Designed using Google Form)

Pair-ways (9) Frustration VS Effort

14. Pair-ways (9) Frustration VS Effort, yang mana lebih menggambarkan beban kerja posisi/jabatan anda saat ini? *

Tandai satu oval saja.

- Frustration
- Effort

Pair-ways (10) Performance VS Mental Demand

Figure A. 13 Online Questionnaires for the Data Acquisition (Page 13/20) (Designed using Google Form)

15. Pair-ways (10) Performance VS Mental Demand, yang mana lebih menggambarkan beban kerja posisi/jabatan anda saat ini? *

Tandai satu oval saja.

- ◯ Performance
- ◯ Mental Demand

Pair-ways (11) Performance VS Temporal Demand

16. Pair-ways (11) Performance VS Temporal Demand, yang mana lebih menggambarkan beban kerja posisi/jabatan anda saat ini? *

Tandai satu oval saja.

- ◯ Performance
- ◯ Temporal Demand

Figure A. 14 Online Questionnaires for the Data Acquisition (Page 14/20) (Designed using Google Form)

Pair-ways (12) Mental Demand VS Effort

17. Pair-ways (12) Mental Demand VS Effort, yang mana lebih menggambarkan beban kerja posisi/jabatan anda saat ini? *

Tandai satu oval saja.

- ◯ Mental Demand
- ◯ Effort

Pair-ways (13) Mental Demand VS Physical Demand

https://docs.google.com/forms/d/1lgu-cWjM8PxI5UEfiFMzDQ90-HbGXraHsTHz3iw0fNk/edit

Figure A. 15 Online Questionnaires for the Data Acquisition (Page 15/20) (Designed using Google Form)

18. Pair-ways (13) Mental Demand VS Physical Demand, yang mana lebih menggambarkan beban kerja posisi/jabatan anda saat ini? *

Tandai satu oval saja.

- ◯ Mental Demand
- ◯ Physical Demand

Pair-ways (14) Effort VS Psychical Demand

19. Pair-ways (14) Effort VS Psychical Demand, yang mana lebih menggambarkan beban kerja posisi/jabatan anda saat ini? *

Tandai satu oval saja.

- ◯ Effort
- ◯ Physical Demand

Figure A. 16 Online Questionnaires for the Data Acquisition (Page 16/20) (Designed using Google Form)

Pair-ways (15) Frustration VS Mental Demand

20. Pair-ways (15) Frustration VS Mental Demand, yang mana lebih menggambarkan beban kerja posisi/jabatan anda saat ini? *

FRUSTRATION = How bad insecure, discouraged, irritated, stressed, and annoyed versus secure, gratified, content, relaxed, and complacent did you feel during the task? MENTAL DEMAND = How much mental and perceptual activity was required (e.g. thinking, deciding, calculating, remembering, looking, searching, etc.)? Was simple or complex, exacting or forgiving?

Tandai satu oval saja.

- ( ) Frustration
- ( ) Mental Demand

Figure A. 17 Online Questionnaires for the Data Acquisition (Page 17/20) (Designed using Google Form)

(BAGIAN C.2) Pada pertanyaan selanjutnya mengenai pemberian nilai pada ELEMEN-ELEMEN Nasa-TLX berdasarkan APA YANG ANDA RASAKAN pada PEKERJAAN ANDA (antara Bulan Mei-Juli 2020). Nilai TIDAK HARUS berupa bilangan bulat, bilangan-bilangan seperti 68, 73, 95 diperbolehkan untuk diberikan.

21. Pemberian Nilai elemen (1) MENTAL DEMAND *
MENTAL DEMAND = How much mental and perceptual activity was required (e.g. thinking, deciding, calculating, remembering, looking, searching, etc.)? Was simple or complex, exacting or forgiving?

22. Pemberian Nilai elemen (2) PHYSICAL DEMAND *
PHYSICAL DEMAND = How much physical activity was required (e.g. pushing, pulling, turning, controlling, activating, etc.)? Was the task easy or demanding, slow or brisk, slack or strenuous, restful or laborious?

23. Pemberian Nilai elemen (3) TEMPORAL DEMAND *
TEMPORAL DEMAND = How much time pressure did you feel due to the rate or pace at which the tasks or task elements occurred? Was the pace slow and leisurely or rapid and frantic?

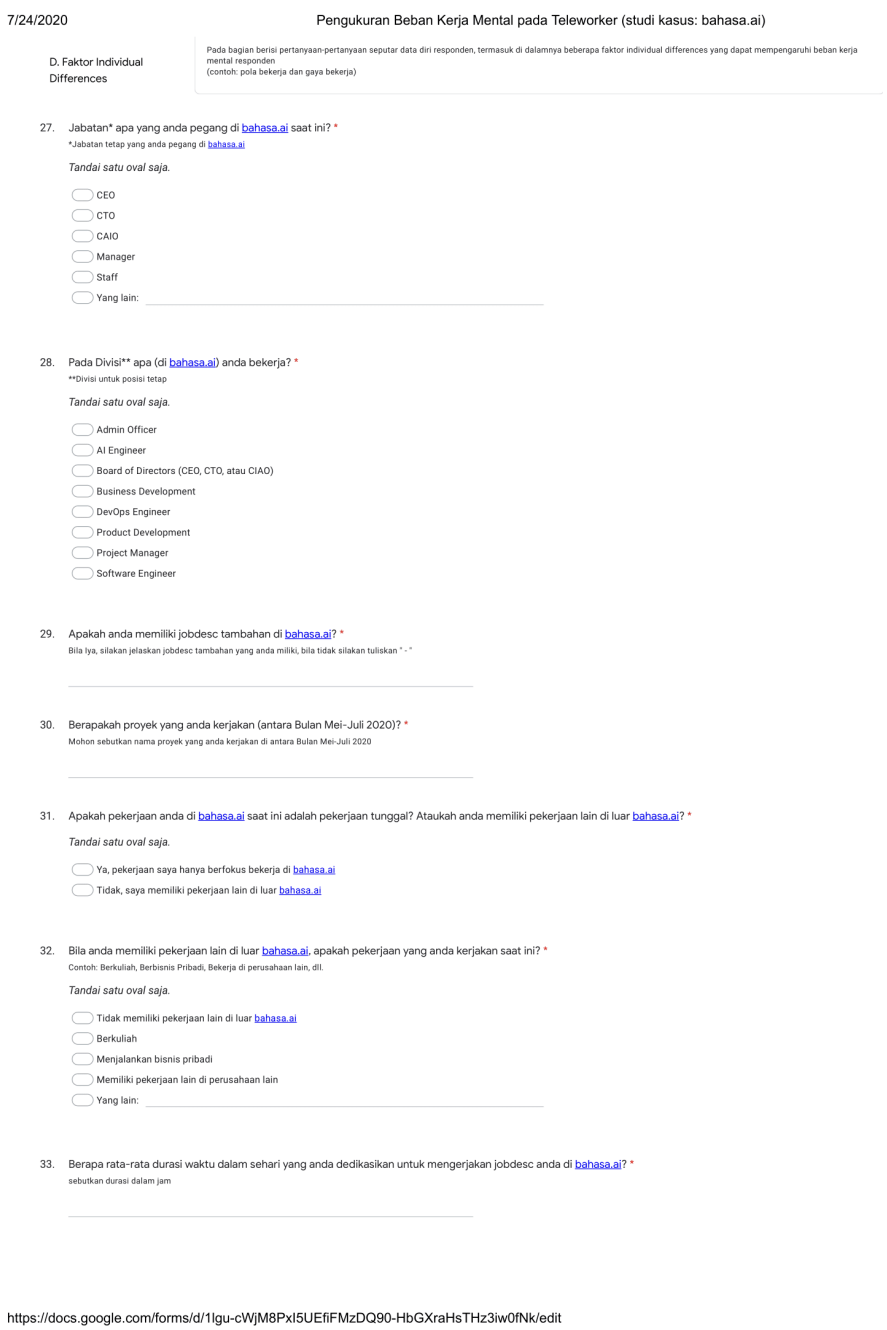
24. Pemberian Nilai elemen (4) PERFORMANCE *
PERFORMANCE = How successful do you think you were in accomplishing the goals of the task set by the experimenter (or yourself)? How satisfied were you with your performance in accomplishing these goals?

25. Pemberian Nilai elemen (5) EFFORT *
EFFORT = How hard did you have to work (mentally and physically) to accomplish your level of performance?

26. Pemberian Nilai elemen (6) FRUSTRATION LEVEL *
FRUSTRATION LEVEL = How bad insecure, discouraged, irritated, stressed, and annoyed versus secure, gratified, content, relaxed, and complacent did you feel during the task?

https://docs.google.com/forms/d/1lgu-cWjM8PxI5UEfiFMzDQ90-HbGXraHsTHz3iw0fNk/edit

Figure A. 18 Online Questionnaires for the Data Acquisition (Page 18/20) (Designed using Google Form)



7/24/2020 Pengukuran Beban Kerja Mental pada Teleworker (studi kasus: bahasa.ai)

D. Faktor Individual Differences

Pada bagian berisi pertanyaan-pertanyaan seputar data diri responden, termasuk di dalamnya beberapa faktor individual differences yang dapat mempengaruhi beban kerja mental responden
(contoh: pola bekerja dan gaya bekerja)

27. Jabatan* apa yang anda pegang di bahasa.ai saat ini? *
*Jabatan tetap yang anda pegang di bahasa.ai
Tandai satu oval saja.
- CEO
- CTO
- CAIO
- Manager
- Staff
- Yang lain: _____

28. Pada Divisi** apa (di bahasa.ai) anda bekerja? *
**Divisi untuk posisi tetap
Tandai satu oval saja.
- Admin Officer
- AI Engineer
- Board of Directors (CEO, CTO, atau CIAO)
- Business Development
- DevOps Engineer
- Product Development
- Project Manager
- Software Engineer

29. Apakah anda memiliki jobdesc tambahan di bahasa.ai? *
Bila Iya, silakan jelaskan jobdesc tambahan yang anda miliki, bila tidak silakan tuliskan " - "
_____

30. Berapakah proyek yang anda kerjakan (antara Bulan Mei-Juli 2020)? *
Mohon sebutkan nama proyek yang anda kerjakan di antara Bulan Mei-Juli 2020
_____

31. Apakah pekerjaan anda di bahasa.ai saat ini adalah pekerjaan tunggal? Ataukah anda memiliki pekerjaan lain di luar bahasa.ai? *
Tandai satu oval saja.
- Ya, pekerjaan saya hanya berfokus bekerja di bahasa.ai
- Tidak, saya memiliki pekerjaan lain di luar bahasa.ai

32. Bila anda memiliki pekerjaan lain di luar bahasa.ai, apakah pekerjaan yang anda kerjakan saat ini? *
Contoh: Berkuliah, Berbisnis Pribadi, Bekerja di perusahaan lain, dll.
Tandai satu oval saja.
- Tidak memiliki pekerjaan lain di luar bahasa.ai
- Berkuliah
- Menjalankan bisnis pribadi
- Memiliki pekerjaan lain di perusahaan lain
- Yang lain: _____

33. Berapa rata-rata durasi waktu dalam sehari yang anda dedikasikan untuk mengerjakan jobdesc anda di bahasa.ai? *
sebutkan durasi dalam jam
_____

https://docs.google.com/forms/d/1lgu-cWjM8PxI5UEfiFMzDQ90-HbGXraHsTHz3iw0fNk/edit

Figure A. 19 Online Questionnaires for the Data Acquisition (Page 19/20) (Designed using Google Form)

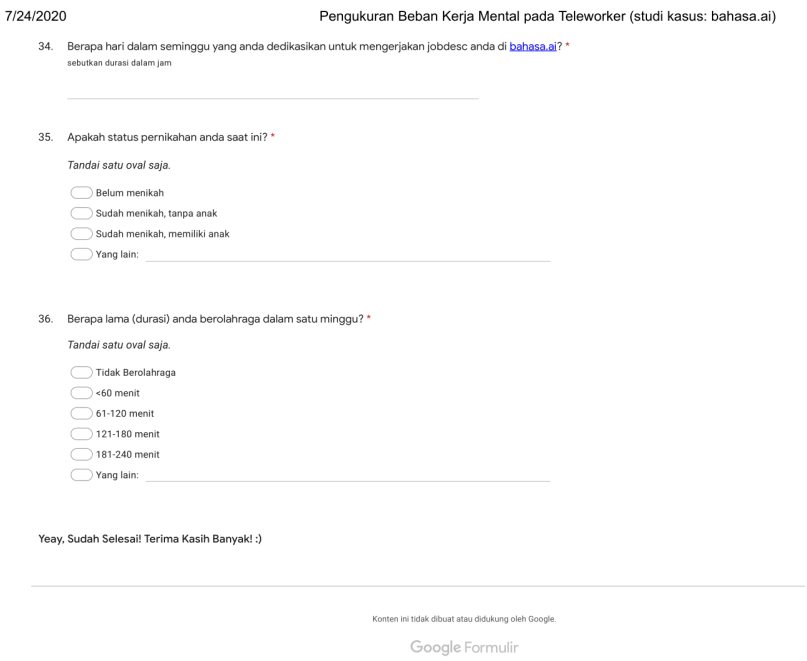


Figure A. 20 Online Questionnaires for the Data Acquisition (Page 20/20) (Designed using Google Form)

Attachment B Interview Documentation

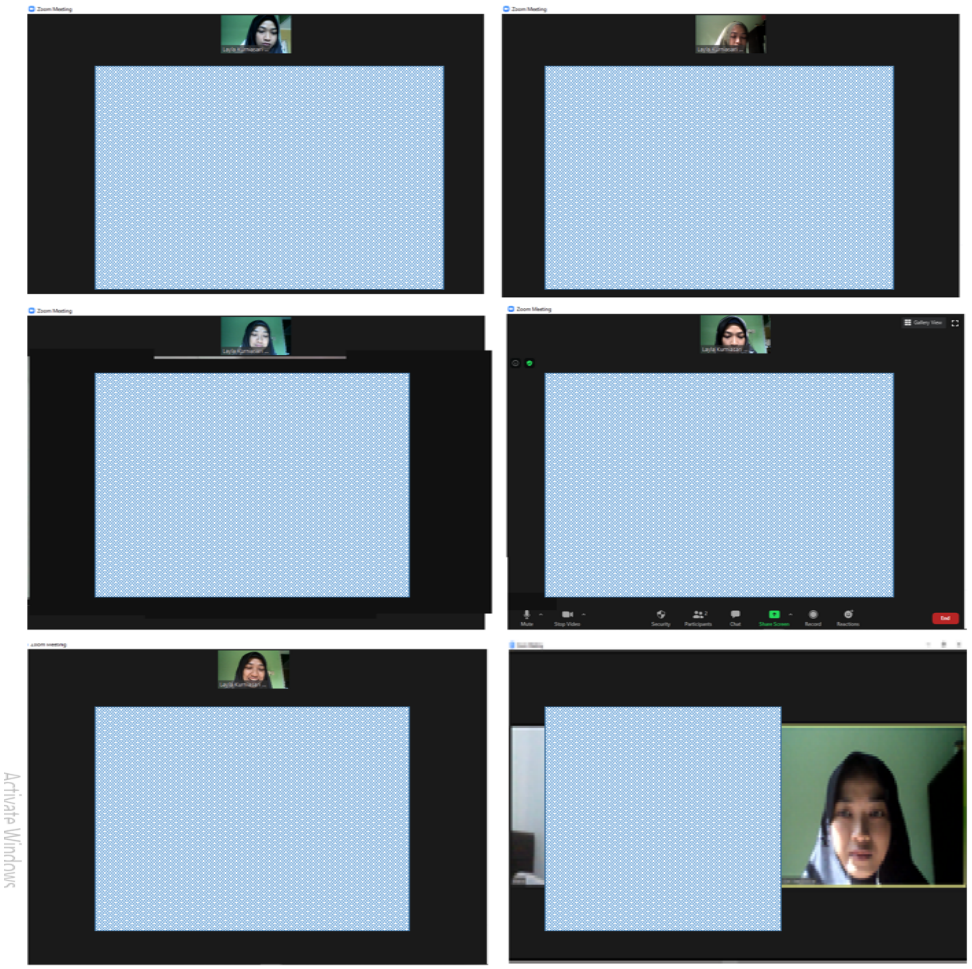


Figure B. 1 Online Interview Documentation (1)

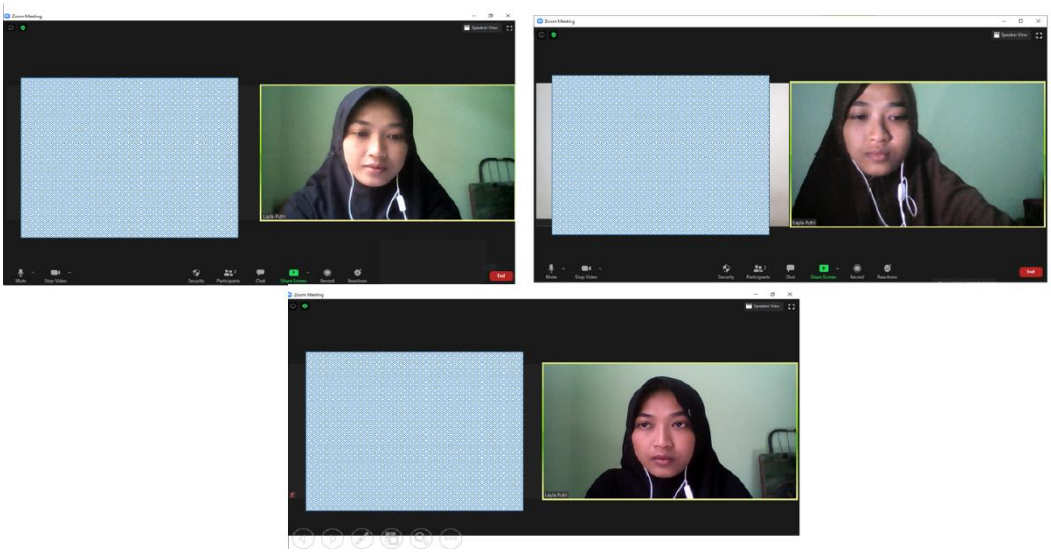


Figure B.1 Online Interview Documentation (cont.)

Attachment C Preliminary Study Recapitulation

In this attachment section will be presented the recapitulation graphics of the preliminary study. The preliminary study was conducted from April 11th until May 18th 2020. The study was done by distributing the online questionnaires to teleworkers including teleworkers in bahasa.ai. Below are the recapitulation graphics of age distribution, gender distribution, telework type distribution, geographical distribution, and professions of the respondents in prelimnary study.

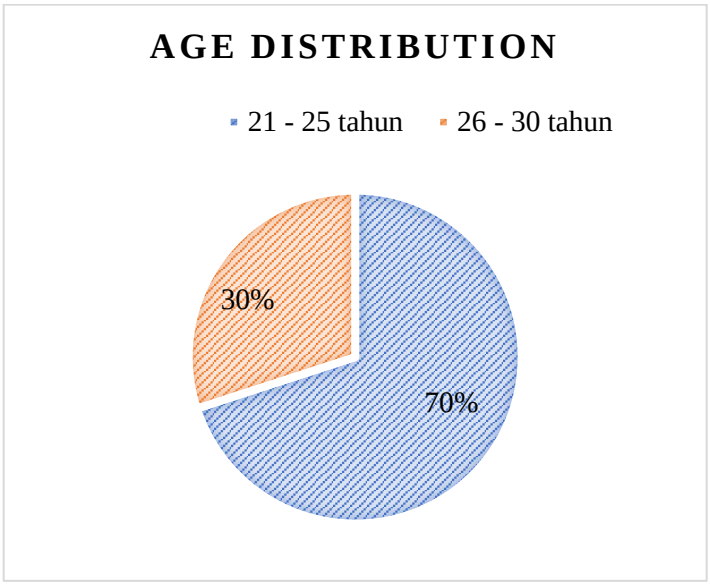


Figure C. 1. Age Distribution of Preliminary Study Respondents

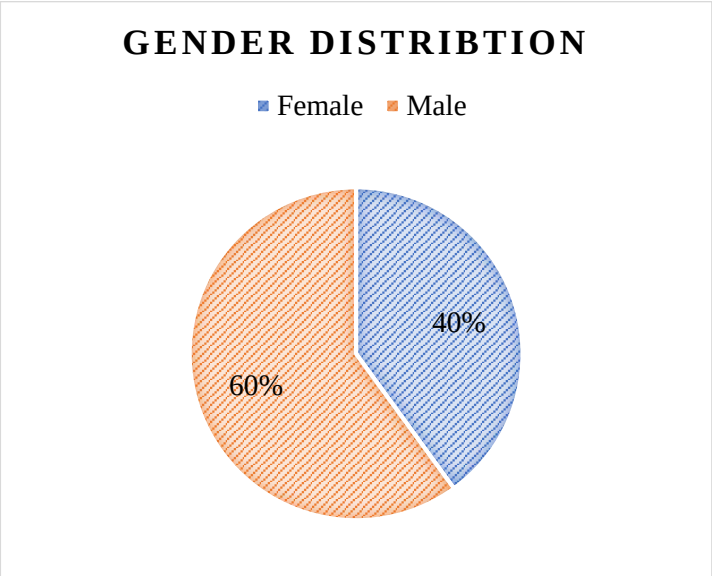


Figure C. 2. Gender Distribution of the Preliminary Study Respondents

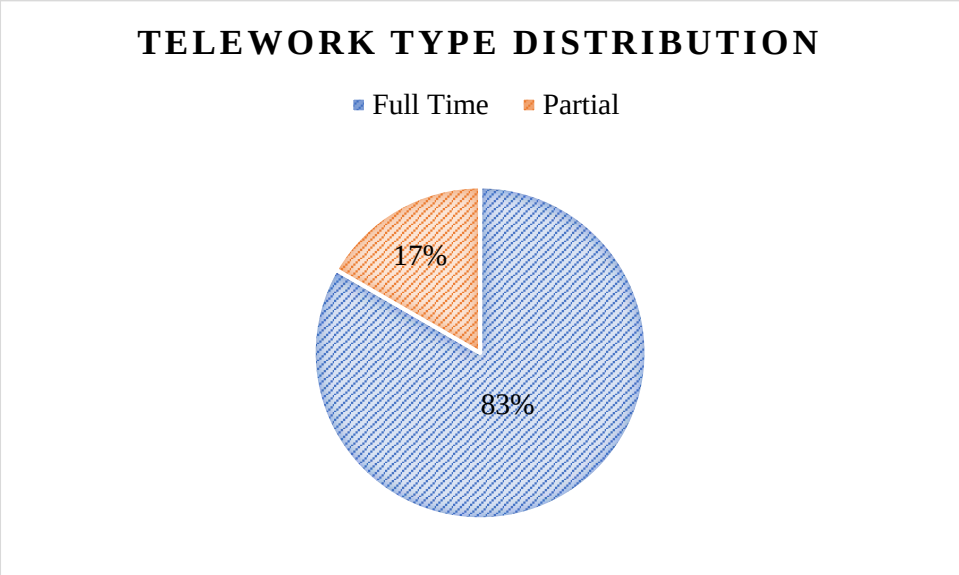


Figure C. 3. Telework Type Distribution of the Preliminary Study Respondents

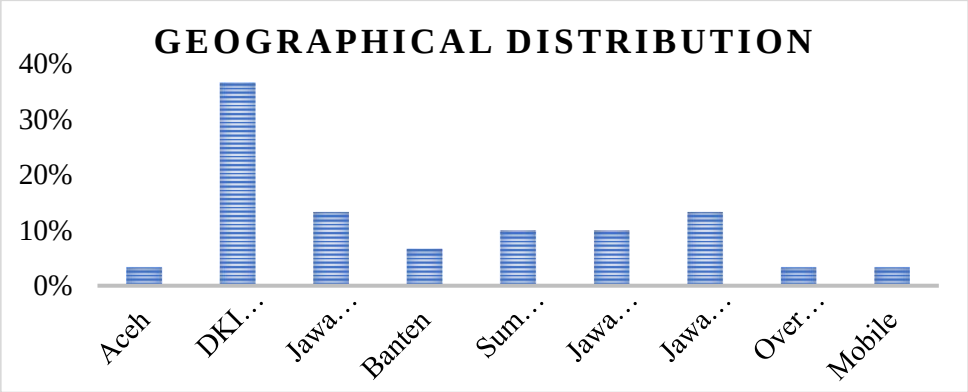


Figure C. 4. Geographical Distribution of the Preliminary Study Respondents

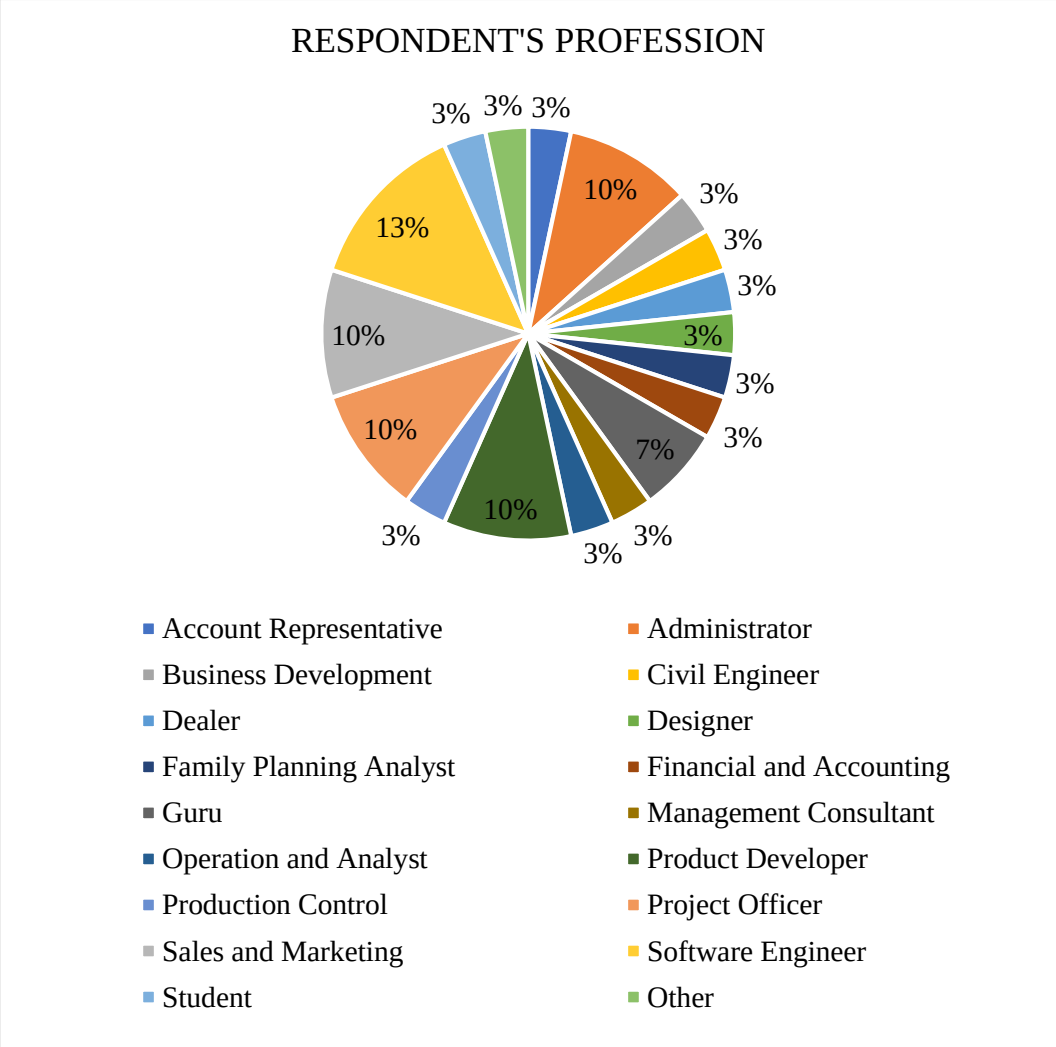


Figure C. 5. Profession Distribution of the Preliminary Study Respondents

Attachment D Correlation Test Result Detail Information

In this section will be shown the model of the workload equation and ANOVA analysis details:

```
                    Exercise     xcercise          Age
Marriage  Exercise  Duration_<60  Duration_121-180  (21-25
Status    Habit      menit         menit             yo)
0         0          0             0                 0       114.912 -
8.58951 Work
                                                             Duration
(h)

0         0          0             0                 1       126.604 -
8.58951 Work
                                                             Duration
(h)

0         0          0             1                 0       139.897 -
8.58951 Work
                                                             Duration
(h)

0         0          0             1                 1       151.589 -
8.58951 Work
                                                             Duration
(h)

0         0          1             0                 0       122.298 -
8.58951 Work
                                                             Duration
(h)

0         0          1             0                 1       133.99 -
8.58951 Work Duration
                                                             (h)

0         0          1             1                 0       147.283 -
8.58951 Work
                                                             Duration
(h)

0         0          1             1                 1       158.975 -
8.58951 Work
                                                             Duration
(h)

0         1          0             0                 0       125.518 -
8.58951 Work
                                                             Duration
(h)
0         1          0             0                 1       137.21 -
8.58951 Work Duration
                                                             (h)

0         1          0             1                 0       150.503 -
8.58951 Work
                                                             Duration
(h)
```

Figure D. 1. Model of Workload Equation with Individual Factors as Predictors

Marriage Status	Exercise Habit	Exercise Duration_<60 menit	xercise Duration_121-180 menit	Age (21-25 yo)	
0	1	0	1	1	162.195 - 8.58951 Work Duration (h)
0	1	1	0	0	132.904 - 8.58951 Work Duration (h)
0	1	1	0	1	144.596 - 8.58951 Work Duration (h)
0	1	1	1	0	157.889 - 8.58951 Work Duration (h)
0	1	1	1	1	169.581 - 8.58951 Work Duration (h)
1	0	0	0	0	151.61 - 8.58951 Work Duration (h)
1	0	0	0	1	163.302 - 8.58951 Work Duration (h)
1	0	0	1	0	176.595 - 8.58951 Work Duration (h)
1	0	0	1	1	188.287 - 8.58951 Work Duration (h)
1	0	1	0	0	158.996 - 8.58951 Work Duration (h)
1	0	1	0	1	170.688 - 8.58951 Work Duration (h)
1	0	1	1	0	183.981 - 8.58951 Work Duration (h)

Figure D. I. Model of Workload Equation with Individual Factors as Predictors (cont.)

Marriage Status	Exercise Habit	Exercise Duration_<60 menit	xcercise Duration_121-180 menit	Age (21-25 yo)	
1	0	1	1	1	195.673 - 8.58951 Work Duration (h)
1	1	0	0	0	162.216 - 8.58951 Work Duration (h)
1	1	0	0	1	173.908 - 8.58951 Work Duration (h)
1	1	0	1	0	187.201 - 8.58951 Work Duration (h)
1	1	0	1	1	198.893 - 8.58951 Work Duration (h)
1	1	1	0	0	169.602 - 8.58951 Work Duration (h)
1	1	1	0	1	181.294 - 8.58951 Work Duration (h)
1	1	1	1	0	194.587 - 8.58951 Work Duration (h)
1	1	1	1	1	206.279 - 8.58951 Work Duration

Figure D. 1. Model of Workload Equation with Individual Factors as Predictors (cont.)

Analysis of Variance

Source	DF	Seq SS	Adj SS	Adj MS	F
Regression	6	742.61	742.61	123.77	0.231143
Work Duration (h)	1	185.09	498.01	498.01	0.930062
Marriage Status	1	252.68	308.15	308.15	0.575491
Exercise Habit	1	57.07	52.37	52.37	0.097797
Exercise Duration_<60 menit	1	57.16	32.02	32.02	0.059796
xcercise Duration_121-180 menit	1	132.94	187.28	187.28	0.349750
Age (21-25 yo)	1	57.67	57.67	57.67	0.107704
Error	2	1070.92	1070.92	535.46	
Lack-of-Fit	1	20.58	20.58	20.58	0.019590
Pure Error	1	1050.35	1050.35	1050.35	
Total	8	1813.53			

Source	P
Regression	0.931340
Work Duration (h)	0.436599
Marriage Status	0.527296
Exercise Habit	0.784086
Exercise Duration_<60 menit	0.829618
xcercise Duration_121-180 menit	0.614195
Age (21-25 yo)	0.773947
Error	
Lack-of-Fit	0.911471
Pure Error	
Total	

Figure I. 2. Details of ANOVA (Analysis of Variance)

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Layla Putri is an undergraduate student of Industrial and System Department of Sepuluh Nopember Institute of Technology (ITS). Author went to Mranti 2 dimensionary school (2003-2009) and continued her study in Junior High School 2 Purworejo. During her highscool, author went to an international public school SMAN Sumatera Selatan in Palembang (2012-2016). The author was one of participant in Kennedy-Lugar Youth Exchange and Study in Texas (2014-2015).