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International Research Journal of Engineering, IT & Scientific Research Available online at https://sloap.org/journals/index.php/irjeis/ Vol. 8 No. 4, July 2022, pages: 121-131 ISSN: 2454-2261 https://doi.org/10.21744/irjeis.v8n4.2142 121 Analysis of Labor Productivity Level and Time Performance Satisfaction in the SMAN 10 Denpasar Development Project I Nyoman Sutapa a I Made Anom Santiana b I Gede Sastra Wibawa c I Wayan Sudiasa d I Ketut Sutapa e Article history: Abstract Submitted: 27 May 2022 Revised: 18 June 2022 Accepted: 09 July 2022 The project is a series of work that aims to achieve project objectives according to the requirements that have been set at the beginning of the project such as quality, time, and cost requirements. In the current era of globalization, every worker in all sectors including the construction sector is required to have high worker productivity. Productivity is very important for every worker in completing a job, the lack of awareness of the workforce on the importance of productivity is one of the causes of the low work produced. This study aims to determine the level of productivity and satisfaction with time performance. The data used in this study were analyzed by measuring productivity and satisfaction of watuk performance measured by the SPI value. The level of labor productivity in architectural work, Heabel work = 7%, plastering and finishing work = 13%, painting work = 9%, door and window frame installation work (Bengkirai wood) = 29%, scouring brick installation work = 54% , Bali paras stone installation work = 4%, lava rock installation work = 9%, railing installation work = 51%, ceramic installation work = 11% and schedule performance index (SPI) for structural work for SMAN 10 Denpasar project in the 1st week until the 15th week showed an SPI value >1. Keywords: BCWP; BCWS; performance satisfaction; productivity; time; International research journal of engineering, IT & scientific research Corresponding author: I Nyoman Sutapa, Department of Civil Engineering Bali State Polytechnic, Indonesia. Email address: nyomansutapa@pnb.ac.id a Department of Civil Engineering Bali State

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Introduction According to Purnomo (1999), the project is a series of work that aims to achieve project objectives according to the requirements set at the beginning of the project such as quality, time and cost requirements. Meanwhile, according to Dipohusodo (1996), a construction project is a project related to efforts to build an infrastructure building, which generally includes main work which includes civil engineering and architecture. According to Soemardi et al. (2006), that in the process of achieving the goals of a project, there are limitations that must be met, namely the amount of cost (budget) allocated, schedule and quality that must be met. In the current era of globalization, every workforce in all sectors including the construction sector is required to have high work productivity so that they can continue to exist and compete in their fields. Productivity is very important for every worker in completing a job, the lack of workforce awareness of the importance of productivity is one of the causes of the low work produced. (Meliasari & Indrayadi, 2011), (Muchdarsyah, 2003), gives an example in a work unit there are about 75% of the workforce who do not make good use of working time, namely by doing activities that should not be done. The low productivity of the workforce in Indonesia demands an increase in productivity. However, the many factors that affect productivity make it difficult to increase productivity. Performance is an important thing in the sustainability of the project. Performance can be measured if the individual can carry out his duties well. However, in project implementation, sometimes service providers pay less attention to these aspects because service providers want to get more profit and keep operational costs to a minimum. With quality resources, it is hoped that all project management performance activities can be carried out as planned. Project performance is the work achievement achieved in doing the work which is reflected in the final results produced in accordance with the desired quantity

and quality. Research by (Syahroni, 2019), explains, The factors that influence project stakeholder satisfaction include quality, time, cost, and managerial. In the research of Maulana and Febri, good construction project performance will have good construction project quality as well. The parties (stakeholders) involved directly and indirectly in construction projects are required to have competitive services through creative, innovative, and efficient efforts so that all correctly understand the needs and expectations of project quality at present and in the future (Farr, 1976; Shikdar & Das, 2003; Shehata & El-Gohary, 2011). Problems in the project will always arise, both predictable and unpredictable. If this problem is not managed properly, it will become a conflict or dispute between the elements involved in the implementation of the project. Conflict is a condition of incompatibility with the goals to be achieved in the organization. The conditions that have been stated can affect work efficiency and productivity. Building construction generally has complex problems. The complexity of problems in the construction of commercial building projects usually occurs at the project implementation stage. This requires the contractor who is directly involved in the project to ensure the level of satisfaction offered in the construction project being undertaken. This study aims to analyze the effect of project performance on the level of project stakeholder satisfaction, as well as to determine the project performance factors to influence the level of stakeholder satisfaction (Van Birgelen et al., 2006; Graen et al., 1982; Pemayun & Martini, 2021). 2 Materials and Methods The data used in this study are primary data and secondary data. Primary data is taken by means of observations and surveys in the project work process. Productivity data collection through direct field observation, namely data in the form of observed time, observed rating, standard rating recorded in the observation form using the time study method and for performance satisfaction, the primary data obtained by the authors in this study is the daily project report. The following are the stages of the research: 1) Identification of the problem at this stage, the formulation of the problem from the background that has been stated is then determined by the research topic to be discussed. 2) Study of related literature Based on the existing problems, reviewed the data

related to the topics discussed, namely the risk variables on material resources that affect the cost performance of high-rise building projects. 3) Collecting project data by obtaining data in the form of working drawings, time schedules, daily reports, RKS and RAB. IRJEIS ISSN: 2454-2261 □ Sutapa, I. N., Santiana, I. M. A., Wibawa, I. G. S., Sudiasa, I. W., & Sutapa, I. K. (2022). Analysis of labor productivity level and time performance satisfaction in the SMAN 10 Denpasar development project. International Research Journal of Engineering, IT & Scientific Research, 8(4), 121-131. https://doi.org/10.21744/irjeis.v8n4.2142 123 4) Time calculation in the field uses cumulative calculations or continuous time measurements where the clock starts from the start of the work and the hours are not stopped until all work is finished at 17.00 WITA. Hour readings at the end of each job are recorded and the time obtained by subtraction after that. Ineffective times encountered in observations should be calculated and recorded appropriately. This ineffective time includes rest and relaxation, correcting mistakes, doing unrelated work, idle time and waiting for materials, and waiting for other work, so this ineffective time can be taken as a continuous calculation (Kim et al., 2020; Espinosa-Garza et al., 2017; Yi et al., 2011). 5) Collecting productivity data through direct field observations, namely data in the form of observed time, observed rating, and standard rating recorded in the observation form using the time study method. After that, the data obtained will be processed into standard time, and also record the volume worked per day which will then be used to calculate productivity. 6) Analyzing project time control, and schedule performance index using the SPI value to determine work performance that is able to achieve the planned work target or not. 7) Results and Discussion the results are obtained in the form of the level of work productivity and performance satisfaction. 8) Drawing conclusions from the results and subsequent discussion will validate the findings with adjustments to the literature. 3 Results and Discussions In this study, there are 5 variables that affect the productivity of workers on architectural work projects in the postgraduate building of Bali Polytechnic and Tourism. These factors are shown in the table below, the following is a table of the results of the identification and reference of risk

variables used in this study. Table 1 Material management risk variables used No Influential Variables Source 1 working age Literature study and interview results 2 Field Condition Literature study and interview results 3 Skills and Work Experience Literature study and interview results 4 Wage Match Literature study and interview results 5 Worker Health Literature study and interview results According to Muchdarsyah (2003), productivity is an effective economic resource that requires organizational and technical skills so that it has a high level of use. In the world of construction, labor productivity is the level of labor's ability to produce products or complete a job with a certain volume within a certain time limit under standard conditions and is measured in units of volume/hour. Therefore, in an effort to analyze labor productivity, variables that might affect the level of productivity must be considered. Table 2 The level of productivity Heabel's Job Processing time Earned Volume (days) Working Hours (hours) Productivity Volume/Hour Unit Total Work Volume Length of work Week- Planned Schedule (days) No Number of Workers (person) 1 Foreman From Hours 56.3 8 7,0375 m2 1105,01 20 7th week 21 1 08.00 to Craftsman with clock 7 17.00

 Server 5 Plastering and Finishing Work 2 Foreman From Hours 243,9 8 30,4875 m2 1951,64 8 Sunday 9 1 08.00 to Craftsman with clock 6 17.00 Server 5 Painting Job 3 Foreman From Hours 354,45 8 44,30625 m2 10043,45 28 Weeks 10,11,16, 31 1 08.00 to Craftsman with clock 8 17.00 Server 4 Door and Window Frame Installation Work (Bengkirai wood) 4 Foreman From Hours 6,5 8 0,8125 m3 15,21 2 Sunday 3 1 08.00 to Craftsman with clock 6 17.00 Server 4 Bricks Laying Work 5 Foreman From Hours 22,8 8 2,85 m2 631,67 28 Sunday 43 1 08.00 to Craftsman with clock 8 17.00 Server 6 Bali Paras Stone Installation Work 6 Foreman From Hours 76,3 8 9,5375 m2 2679,86 35 Week 37 1 08.00 to Craftsman with clock 8 17.00 Server 5 Lava Rock Installation Work 7 Foreman From Hours 32,2 8 4,025 m2 1411,63 44 Sunday 48 1 08.00 to Craftsman with clock 8 17.00 Server 5 Relling Installation Work 8 Foreman From Hours 15,5 8 1,9375 m1 71,8 5 Sunday 7 1 08.00 to Craftsman with clock 1 6 17.00 Server 4

Ceramic Installation Work 9 Foreman From 49,5 8 6,1875 m2 1782,42 36 Weeks 40

 125 Hours 10,11,13, 1 08.00 to Craftsman with clock 7 17.00 Server From Hours 5 08.00 to In the table above, the results of the calculation of productivity for each architectural work in the SMAN 10 Denpasar project are obtained, and then the data is used to calculate the level of work productivity. Table 3 Work productivity Work Productivity Comparison Table No Job Name Plans in the Field Early Realization (Days) Difference (Days) 1 Heabel's Job (day) 6,58 0,45 2 Plastering and Finishing Work 7.03 27,11 3,30 3 Painting Job 30.48 40,50 3,80 4 Door and Window Frame Installation Work (Bengkirai wood) 44.30 0,63 0,18 5 Bricks Laying Work 0.81 1,84 1,01 6 Bali Paras Stone Installation Work 2.85 9,05 0,36 7 Lava Rock Installation Work 9.53 3,68 0,34 8 Railing Installation Work 4.02 1,28 0,65 9 Installation work 1.93 5,57 0,61 From the table of the level of labor productivity on architectural work that is reviewed in the field, the results are like the table above with the formula Productivity Level = (Difference in Productivity / Planned Productivity) x 100% Table 4 Productivity rate No Work Productivity Rate (%) 1 Heabel's Job 7% 2 Plastering and Finishing Work 13% 3 Painting Job 9% 4 Door and Window Frame Installation Work (Bengkirai wood) 29% 5 Bricks Laying Work 54% 6 Bali Paras Stone Installation Work 4% 7 Lava Rock Installation Work 9% 8 Railing Installation Work 51% 9 Installation work 11%

 126 Time performance analysis The basic concept of result value can be used to analyze performance and make forecasts of target achievement, (Atmaja et al., 2020). For this purpose, two indicators are used: BCWS (Budgeted Cost of Work Scheduled) and BCWP (Budgeted Cost Of Work Performance) Analysis (Soemardi et al., 2006). This indicator is the same as the budget for a work package but is structured and linked to an

implementation schedule. So here there is a combination of cost, schedule and scope of work, where each element of the work has been allocated a cost and schedule that can be used as a benchmark in the implementation of the work. BCWS analysis (Budgeted cost of work schedule) Analysis of the amount of budget allocated based on the work plan that has been prepared against time (BCWS). The weekly BCWS value can be obtained based on the weekly weight in the Budget Time Schedule (Syahroni, 2019), calculated as follows: Table 5 BCWS analysis (Budgeted cost of work schedule) Week BAC % Planned cumulative weight BCWS 1 3.552.680.341 0 - 2

0,31 Rp 11.003.309,06 3 0,62 Rp 22.016.618,11 4

1,17 Rp 41.556.359,99 5 3,4 Rp 120.781.131,59 6

7,04 Rp 250.098.696,01 7 20,06 Rp 712.657.676,40 8

37,93 Rp 1.347.521.653,34 9 51,6 Rp 1.833.173.055,96 10

62,87 Rp 2.233.560.130,39 11 73,6 Rp 2.614.762.730,98 12

87,31 Rp 3.101.835.205,73 13 95,97 Rp 3.409.497.323,26 14

99,3 Rp 3.527.801.578,61 15 100 Rp 3.552.670.341,00 BCWP Analysis (Budgeted cost of work performance) Analysis of the number of costs incurred in accordance with the work that has been completed (BCWP). The weekly BCWP value can be obtained based on the schedule data for the implementation of the work progress or the weekly project report, calculated as follows: Table 6 BCWP Analysis (Budgeted cost of work performance) Week BAC % Actual cumulative weight BCWP 1 3.552.680.341

0,46 Rp 16.332.329,57 2 4,34 Rp 154.176.326,80 3

13,96 Rp 495.944.175,60 4 24,1 Rp 856.185.962,18 5

34,07 Rp 1.210.388.192,18 6 45,06 Rp 1.600.827.761,65 7

56,28 Rp 1.999.438.495,91

 8 60,04 Rp 2.133.019.276,74 9 68,33 Rp 2.427.536.477,01 10 79,82 Rp 2.835.739.448,19 11 84,38 Rp 2.997.741.671,74 12 91,83 Rp 3.262.416.357,14 13 97,77 Rp 3.473.445.569,40 14 99,81 Rp 3.545.920.248,35 15 100 Rp 3.552.670.341,00 Table 7 Analysis of deviations against time (SV) Schedule Varian SV Analysis Week- BCWP BCWS SV SV (%) 1 Rp 16.332.329,57 Rp - Rp 16.332.329,57 0,46 2 Rp 154.176.326,80 Rp 11.003.309,06 Rp 143.173.017,74 4,03 3 Rp 495.944.175,60 Rp 22.016.618,11 Rp 473.927.557,49 13,34 4 Rp 856.185.962,18 Rp 41.556.359,99 Rp 814.629.602,19 22,93 5 Rp 1.210.388.192,18 Rp 120.781.131,59 Rp 1.089.607.060,58 30,67 6 Rp 1.600.827.761,65 Rp 250.098.696,01 Rp 1.350.729.065,65 38,02 7 Rp 1.999.438.495,91 Rp 712.657.676,40 Rp 1.286.780.819,51 36,22 8 Rp 2.133.019.276,74 Rp 1.347.521.653,34 Rp 785.497.623,40 22,11 9 Rp 2.427.536.477,01 Rp 1.833.173.055,96 Rp 594.363.421,05 16,73 10 Rp 2.835.739.448,19 Rp 2.233.560.130,39 Rp 602.179.317,80 16,95 11 Rp 2.997.741.671,74 Rp 2.614.762.730,98 Rp 382.978.940,76 10,78 12 Rp 3.262.416.357,14 Rp 3.101.835.205,73 Rp 160.581.151,41 4,52 13 Rp 3.473.445.569,40 Rp 3.409.497.323,26 Rp 63.948.246,14 1,80 14 Rp 3.545.920.248,35 Rp 3.527.801.578,61 Rp 18.118.669,74 0,51 15 Rp 3.552.670.341,00 Rp 3.552.670.341,00 Rp - 0,00 From the calculation results above, it can be seen that the 1st to 11th week of SV value is very high, this result indicates that the implementation of the work is faster than the planned schedule and the work productivity is very high (Lim & Alum, 1995; Panach et al., 2015; Mulawarman, 2022; Laksono, 2007). In the 11th to the 15th week, the SV value also increased, but not as significant as the previous week, the SPI value in the 1st to 15th week of the SPI value was > 1, meaning that the project implementation was faster than planning. For the calculation of the SPI the week before

and after, in the same way as above, see the table Table 8 Schedule performance index SPI analysis Schedule Performance Index SPI Analysis Week BCWP BCWS SPI (%) 1 Rp 16.332.329,57 Rp - 16,79 2 Rp 154.176.326,80 Rp 11.003.309,06 14,01 3 Rp 495.944.175,60 Rp 22.016.618,11 22,53 4 Rp 856.185.962,18 Rp 41.556.359,99 20,60 5 Rp 1.210.388.192,18 Rp 120.781.131,59 10,02 6 Rp 1.600.827.761,65 Rp 250.098.696,01 6,40 7 Rp 1.999.438.495,91 Rp 712.657.676,40 2,81 8 Rp 2.133.019.276,74 Rp 1.347.521.653,34 1,58 9 Rp 2.427.536.477,01 Rp 1.833.173.055,96 1,32 10 Rp 2.835.739.448,19 Rp 2.233.560.130,39 1,27 11 Rp 2.997.741.671,74 Rp 2.614.762.730,98 1,15

 12 Rp 3.262.416.357,14 Rp 3.101.835.205,73 1,05 13 Rp 3.473.445.569,40 Rp 3.409.497.323,26 1,02 14 Rp 3.545.920.248,35 Rp 3.527.801.578,61 1,01 15 Rp 3.552.670.341,00 Rp 3.552.670.341,00 1,00

The BCWP is the total cost incurred on the weight of the work that has been carried out. BCWS is the sum of the planned costs on the planned work weights. Figure 1. Comparison of BCWS And BCWP From the comparison picture, the BCWS and BCWP values show that the BCWS value is below the BCWP value in the 1st week to the 15th week. This shows that the weight of the realization of the work is in line with even progressing with what has been scheduled or planned. In controlling time, the results of the calculation of variance show the project conditions that occur every week. A negative variance indicates that there is a delay in the project against the plan (schedule underrun). Zero indicates the work is carried out according to schedule. While a positive number means that the project is accelerating against the plan. The SV value can be seen in the following figure. Figure 2. Analysis schedule varian SV The picture above shows that the schedule variance value at week 1 to week 15 is positive, it means that the project

performance is in accordance with the plan. In project time control, the schedule performance index which shows that the SPI value is less than one means that the work performance is not as expected because it cannot meet the planned targets (Abma, 2016). When the performance index figures are reviewed further, the following will be seen (Meliasari & Indrayadi, 2011).

 a) The performance index number is less than one, meaning that the work performance is not as expected because it is unable to achieve the planned work target. b) The performance index number is more than one, meaning that the work performance is better than planned. c) The greater the difference from number 1, the greater the deviation from the basic planning or budget. Even if the number is too high, which means that the performance of the work is very good, it is necessary to study whether it is possible that the planning is actually unrealistic. Figure 3. Analysis schedule performance index SPI Comparison of SPI values can be seen that the SPI value in the 1st week to the 15th week shows a value greater than 1, which means the work performance is better than planned / the project is progressing. This is because the contractor accelerated by adding overtime hours of work. However, due to the overtime hours, the contractor will also have to bear the project's profits which will decrease. To measure the level of satisfaction with the performance of the implementation time, the author uses the method of measurement scale with the following indicators: SPI < 1 = Dissatisfied (TP) SPI = 0 = Quite Satisfied (CP) SPI > 1 = Satisfied (P) Table 9 Satisfaction with the performance Week- SPI (%) Indicator 1 16,79 (P) 2 14,01 (P) 3 22,53 (P) 4 20,60 (P) 5 10,02 (P) 6 6,40 (P) 7 2,81 (P) 8 1,58 (P) 9 1,32 (P) 10 1,27 (P) 11 1,15 (P) 12 1,05 (P) 13 1,02 (P) 14 1,01 (P) 15 1,00 (P)

 So based

on the analyzed data, it can be concluded that the time performance of the SMAN 10 Denpasar project structure work has reached satisfaction because the SPI every week is greater than one. 4 Conclusion Based on the results and discussions described in the previous chapter, the following conclusions can be drawn: 1) The level of labor productivity in architectural work, Heabel Works = 7%, Plastering and Finishing Works = 13%, Painting Works = 9%, Door and Window Frame Installation Work (Bengkirai wood) = 29%, Brick Installation Work = 54%, Bali Paras Stone Installation Work = 4%, Lava Rock Stone Installation Work = 9%, Railing Installation Work = 51%, Ceramic Installation Work = 11%. 2) The schedule performance index (SPI) of the SMAN 10 Denpasar project structure in the 1st week to the 15th week shows an SPI value > 1, where the project implementation is faster than the planning Conflict of interest statement The authors declared that they have no competing interests. Statement of authorship The authors have a responsibility for the conception and design of the study. The authors have approved the final article. Acknowledgments We are grateful to two anonymous reviewers for their valuable comments on the earlier version of this paper.

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