

Assessment of Strategic Automated Dashboard in Progress Monitoring of Construction Projects Using Power Bi

Ma. Erika Danielle R. Canivel*, Rafael A. Cagungun*, Angelo Verghel L. Adem*,
Ryan Renz R. Almario*, Regina Marie Barbosa*, John Carlo O. Canlas*
Ma. Vannerie Issa S. Eusebio**, John Vincent G. Tongol**

*Student, Department of Civil Engineering, Don Honorio Ventura State University, Villa de Bacolor, Pampanga, Philippines.
Email: canivelerika@gmail.com

**Professor, Department of Civil Engineering, Don Honorio Ventura State University, Villa de Bacolor, Pampanga, Philippines

Abstract:

Construction management has always been regarded as a unique one-time operation designed to ensure adherence to quality standards and a specific set of objectives to accomplish a project. The researchers desired to create a project dashboard designed for construction management to monitor the progress within the construction phase. The application of new technologies and methods to monitor the construction project gives a one-page overview, especially for planning and monitoring the work progress. The project dashboard is a management tool that operates without physical paper. It would help construction project managers control the need to accomplish their projects on time, within the budget, and with a high level of technical quality. In addition, this research aimed to address the shortcomings of traditional monitoring systems and avoid delays in construction projects. The information was gathered from the five (5) construction companies with PCAB licenses within Pampanga using structured questionnaires and actual interviews. Based on that data, the best features were integrated into the Microsoft Excel file to design the project dashboard. Upon conducting a pilot dashboard test, pie charts and algorithms were created to interpret the data collected visually. Implementing the project dashboard would make it easier for construction project managers and the people related to the project to understand the progress of work and data shown using graphical representations. The findings and conclusions were formulated based on the data surveyed by the researchers, and according to the results, the respondents were all satisfied with the operation and performance of the automated dashboard. The automated dashboard's effectiveness, accuracy, and adaptability were tested during the pilot testing without any problem; hence, the automated project dashboard is feasible to implement at any construction interface.

Keywords —Construction Management, Automated Dashboard, Progress Report, Real-time Data, Microsoft Power BI

I. Introduction

In the field of construction, the involvement of various stakeholders including contractors and clients, and utilization of different resources define projects. Monitoring and controlling the increasing complexity and scope of construction management is in need of a systematic observation to achieve quality assurance and timely completion of projects. Monitoring is a major aspect of project management. Enforcing effective project monitoring is of utmost importance to attest that construction projects adhere to preestablished schedules and quality benchmarks [1]. In the area of construction management, project monitoring has been reliant on conventional system, including the use of spreadsheets, paper-based reports and frequent on-site inspections. These monitoring approaches regularly need help delivering timely and up-to-date information. On this account, the construction industry has been prompted to explore

efficient alternatives due to the inherent constraints of traditional systems, such as delays in data compilation and progress tracking [2].

With the growing demand for sustainability, the construction industry uses technology-driven project monitoring as pivotal component in daily management of construction projects. As a means of addressing delays, technology and different platforms that concentrate in construction management has been developed. The emergence of advanced technologies such as BIM, IoT, and AI has facilitated the onset of a novel phase in project monitoring and control. These technologies serve as an innovative option to fundamentally alter methods by which construction projects are supervised. Through this system, comprehensive perspective of construction projects including gathering, evaluating and utilizing vast quantities of data can be facilitated [3]. The usage of project management

application software as solution in an effective project monitoring has its advantages including heightened project visibility and improved communication. It also boosts the capacity to discover and resolve primary concerns proactively by enhanced decision-making from the top management [4].

This research offers significant understanding about the emergence of leading-edge technologies, specifically Microsoft Power BI, as a compelling instrument designed for project managers to effectively monitor the progress of construction activities materializing on-site. Moreover, it creates a promising opportunity to better manage difficulties faced by the modern-day construction industry [5]. This study aims to provide a basis for examination and utilization of the software, Microsoft Power BI, to assess the capabilities of digital intervention applied on construction project monitoring with the interest of enhancing data progress tracking and project efficiency.

II. Methodology

This chapter discusses the methodological framework, research design, research locale, research instrument, sampling size, data collection method, research procedure and data analysis.

2.1 Methodological Framework

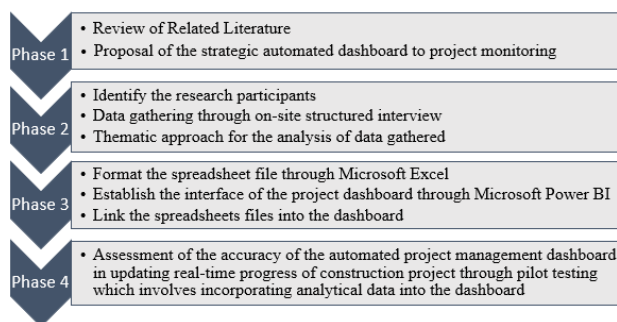


Figure 3. These phases of work illustrate the procedure that the researchers will follow upon conducting the study

In Phase 1, a comprehensive review of existing literature related to the project was conducted. This step ensured a solid understanding of the current state of knowledge in the field of construction project management, identified gaps, and formed the basis for proposing the strategic automated project dashboard.

In Phase 2, the researchers focused on participant selection for the study. Following this, information was gathered through on-site structured interviews. A thematic approach was then employed to extract and analyse meaningful patterns and insights from the collected data.

In Phase 3, the proposed automated project management dashboard was developed using tools like Microsoft Excel and Microsoft Power BI. Subsequently, spreadsheet files from Microsoft Excel were formatted and linked into the project

dashboard. The dashboard interface was customized and designed using the Microsoft Power BI application.

In Phase 4, the researchers conducted a pilot test to evaluate the performance of the automated project management dashboard. Analytical data were processed into the dashboard to examine the accuracy of the projected real-time data. Moreover, this phase aims to provide well-founded findings and conclusions on the effectiveness of the proposed automated project management dashboard in ensuring an improved project monitoring system in construction management.

2.2 Research Design

This study used an experimental research design to achieve objective and valid results. This design allowed the researchers to focus on assessing the automated project management dashboard using Microsoft Power BI and Microsoft Excel.

2.3 Research Locale

The researchers conducted an on-site interview within the province of Pampanga. The selected construction companies acted as respondents to gather data on the current project monitoring system and the activities practiced in the field of construction.

2.4 Research Instrument

The study was conducted in a way to produce viable results. Structured interviews were utilized. In addition, automation through Microsoft Excel and Microsoft Power BI software was needed to produce real-time update of progress that operates with the use of automated project management dashboard centralizing on project monitoring.

2.5 Sampling Size

Rao soft sampling size calculator was used to determine the target sample size in this study. The researchers identified the minimum number of construction companies required for the analysis rooted in the data obtained from the set of informants. This calculator analyzed the collected information based on the amount of accommodated error, size of uncertainty, sample size and distribution of the responses [31]. The target sample groups of the researchers are the construction firms accredited by PCAB with general building license that fall under AAA category and located within the area of Pampanga.

2.6 Data Collection Method

The researchers utilized purposive sampling method to gather pertinent data from the project manager of the project monitoring team of each company who participated in the interviews to get more insight about the project monitoring system and activities monitored in the construction industry.

2.7 Research Procedure

In this study, the target participants mapped the construction companies that are authorized by PCAB. These firms shall be under the classification of General Building and

category AAA. PCAB license is important to guarantee that a contractor is qualified to undertake construction projects in the Philippines and will not disregard the safety of the public.

PCAB Categorization – Classification Table (Board Resolution No. 201, series of 2017)							
Classification	Category	Minimum Qualification Requirements					
		(1) Financial Capacity		(2) Sustaining Technical Employee (STE) Construction Experience		(3) Overall Credit Points	
		Minimum Networth / Equity (P)	Credit Points	Individual (years)	Aggregate (man-years)		Minimum Credit Points
B. GENERAL BUILDING	AAAA	1,000,000,000.00	10,000.00	10	60	300	10,300.00
GB-1 (Buildings or Industrial Plant)	AAA	180,000,000.00	1,800.00	10	60	300	2,810.00
GB-2 (Sewerage or Sewage System)	AA	90,000,000.00	900.00	10	50	250	1,345.00
GB-3 (Water Treatment Plant & System)	A	30,000,000.00	300.00	7	21	105	471.00
GB-4 (Park, Playground or Recreational Work)	B	10,000,000.00	100.00	5	10	50	175.50
	C	6,000,000.00	60.00	3	3	15	98.50
	D	2,000,000.00	20.00	3	3	15	35.00
	B	10,000,000.00	100.00	5	10	50	165.50
	C	6,000,000.00	60.00	3	3	15	90.50
	D	2,000,000.00	20.00	3	3	15	35.00

Figure 4. PCAB Classification Table

Moreso, the classification and category of a PCAB license indicates the area of operation that a contractor can partake in and if it can meet the pre-determined criteria of PCAB such as financial capacity, equipment capacity and technical experience of the firm including its employees [32]. The researchers focused on the category triple A as such contractor with this license has already a reliable involvement in complex projects in the construction industry which made it a suitable criteria for identifying respondent in data gathering.

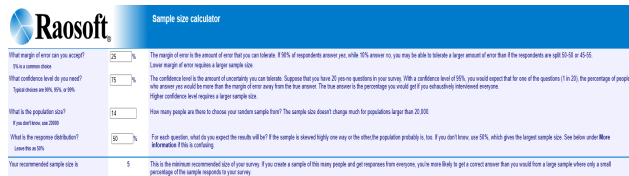


Figure 5. Raosoft Sample Size Calculator

In line with this, the Raosoft sample size calculator was used to determine the minimum sample size intended for the study. Based on the PCAB Portal [33], the total number of companies within Pampanga with PCAB licenses of category AAA under General Building is 14. This was used to calculate the total population using the Raosoft sample size calculator. During the calculation, the researchers used 10% for the margin of error and 90% for the confidence level due to uncertainties and a small population size of 14. As for the response distribution, the researchers left this at 50%, as the Raosoft sample size calculator recommended, because it is the most conservative assumption. With this data, the calculated minimum sample size is five companies from the total population size of 14 companies. The researchers used a minimum sample size of 5 respondents to gather data through interviews.

The selected construction firms were asked a series of structured questions. Through the on-site interview, the researchers gathered information regarding the project monitoring system and monitored the activities of each construction firm. All the data gathered were evaluated through thematic analysis. It is an analytical method commonly used for interpreting qualitative data that searches for recurring ideas, also known as themes. Thematic analysis enables the identification of common perspectives and patterns of ideas across data sets [34]. The researchers utilized this approach to understand further the relationships between the data sets from the interviews. These data served as a guide to see the best features of monitoring activities within a construction project and were incorporated into developing the automated project management dashboard.

Part I: Project Monitoring System
What are the activities or things that are usually monitored in a construction project?
How is communication maintained between different stakeholders regarding project progress?
How frequently do progress reports need to be submitted to the top management?
As an AAA PCAB License holder under General Building, what software does your company use when it comes to monitoring project construction? Is the software that you are using an Excel-based? If not, please specify.
Are you familiar with the Microsoft Power BI? If yes, did you consider it to be used for your construction project monitoring? Why or why not?
Are the projects you handle always progressing according to the planned schedule? Or had there been any unforeseen delays affecting the project timeline? If yes, please specify the primary causes.
Part II: Manpower
Do you accept or hire construction workers who can only work part-time?
What is the standard number of working hours required for your workers every day? Kindly specify both for full-time and part-time workers.
How often do accidents occur on-site from the start of project construction up to its completion?

How do you monitor your manpower during the execution of a huge and complex construction project?
What are the common duties of your manpower during the construction phase of a project? Kindly provide at least ten (10) of these roles.
Part III: Resources/Materials
What are the top five (5) materials that are considered as critical resources throughout the entire construction process, from inception to completion?
How frequently are material inspections conducted on-site?
Is the delivery of resources (materials, machineries, tools and equipment) from suppliers and vendors on schedule? If not, how long the delay of delivery last before the supplies arrived on-site?
Part IV: Cost and Finance
What are the costs included in a construction project? Please provide a breakdown of the costs involved.
Do you adhere to the allotted budget for a project? If not, what are the underlying reasons for incurring additional expenses during the construction process?

Table 1. Structured Interview Questions

Microsoft Excel software created spreadsheet files containing the necessary activities monitored in a project. These files were formatted for automation to achieve the objective of real-time data progress. The spreadsheets were also linked to the project dashboard to show the instantaneous updates through visual presentation. In addition, the dashboard itself was developed through Microsoft Power BI, utilizing its features to create and customize an informative project management dashboard interface.

After developing the automated dashboard, it was subjected to pilot testing to assess its accuracy in producing and delivering real-time data upon inputting analytical figures in the Excel spreadsheets. This test was done to evaluate the overall performance of the automated project management dashboard and collect feedback from construction companies to see the effectiveness of the dashboard in serving its intended purpose of monitoring the progress of construction projects in real-time.

2.8 Data Analysis

For discussion, the information gathered from various sources was subjected to analysis. The process of data gathering involved the participation of a set of key stakeholders through structured interviews. The collected data were evaluated using thematic analysis. The researchers employed this analysis technique to distinguish patterns and key concepts in the interest of better understanding project monitoring in construction management. This analytical approach developed valuable insights by highlighting the appropriate interpretation of the connection of data sets. Suitable computer application software, such as Microsoft

Excel and Microsoft Power BI, were used to program the automated project management dashboard and assess its efficacy as a tool for monitoring the progress of construction projects. In line with this, the researchers conducted a pilot test on the five (5) construction firms to assess the automated project management dashboard's effectiveness in providing accurate real-time data progress.

III. Results and Discussions

3.1 Thematic Analysis

The researchers conducted structured interviews with five (5) construction companies in Pampanga. The said interviews were documented using audio recording. Following this, the collected information was transcribed and subjected to analysis to create codes and themes that appeared in the data actively. Interesting excerpts in the transcripts representing similar meanings were put under the same codes. The codes collated with supporting data or subcodes were grouped into themes. Furthermore, the derived themes, codes, and subcodes from the datasets helped the researchers to easily acquire valuable insights and apply the best features to the development of the automated project management dashboard.

3.1.1 Discussion of Theme 1

Theme	Code	Subcode
Monitoring System	Supervised construction activities	Scope of works percentage complete
		Schedule of work
		Materials
		Manpower
		Cost
	Progress tracking	Weekly accomplishment report
		Monthly accomplishment report
	Software	Microsoft Excel
		Not familiar with Microsoft Power BI
	Causes of delay on planned schedule	Weather conditions
		Delayed materials
		Low on manpower
		Insufficient budget

Table 2. Monitoring System

This theme focuses on the existing project monitoring system in the construction industry. The codes involved are supervised construction activities, progress tracking, software for creating accomplishment reports, and the causes of delays in the planned schedule. The researchers included a section in the dashboard for the overall accomplishment in terms of the

percentage complete of the scope of works of a project that includes excavation, foundation, structural, masonry, electrical, plumbing, HVAC, exterior finishing, interior finishing, roofing, painting, and waterproofing. This is for the comparison of the actual schedule with that of the planned schedule of construction activities. On that account, contractors can get an overview of the project's overall progress and easily identify whether there are delays affecting the predetermined work schedule. Monitoring a project's progress percentage is a decisive factor in project management. It measures and compares the actual project progress to the baseline dates or schedule and assesses whether the pace of the project is acceptable or not [35].

In line with this, a feature was added into the dashboard to keep an eye on the quantity of materials such as concrete and reinforcing steel bar. The tracking of work progress is observed using weekly and monthly accomplishment report. During the interview with the selected construction firms with AAA PCAB license, the researchers found that the respondents are not yet familiar with the application Microsoft Power BI. The companies create progress report by means of Microsoft Excel which is handed to the top management.

3.1.2 Discussion of Theme 2

Theme	Code	Subcode
Manpower	Man-hour	8 hours a day
	Attendance	Timekeeper
	Job roles of manual workers	Carpenter
		Steel man
		Mason
		Painter
		Tile Setter
		Installer
		Plumber
		Electrician
Helper		
Equipment Operator		

Table 3. Manpower

This theme is about the workforce or workforce within a construction project. The working hours of manual workers consist of eight (8) hours a day. Based on the collected data, the minimum and standard working hours of construction workers who are both full-time and part-time employees are said to be the minimum. The attendance of workers is monitored through the submission of daily reports from timekeepers. A timekeeper is necessary in the construction industry to record and report information regarding workers' labor hours and work rates [36]. Based on the interviews conducted by the researchers, the common roles of manual

workers responsible for physical labor are carpenter, steelman, mason, painter, tile setter, installer, plumber, electrician, helper, and equipment operator. These descriptions were put in an Excel spreadsheet to track workforce attendance based on the rendered number of service days. This was added as a dashboard feature to present the actual numbers of the workforce weekly.

3.1.3 Discussion of Theme 3

Theme	Code	Subcode
Cost Tracking	Material Cost	Cement
		Sand
Gravel		
CHB		
Rebar		
	Labor Cost	Payroll

Table 4. Cost Tracking

Cost tracking involves labor and material costs. The researchers only prioritized these two construction costs based on the data collected from the construction firms. Under labor cost, tracking of workers' payroll, including attendance and work rates depending on the specific services provided, was included and reflected in the dashboard. The materials considered critical from the project's inception to completion are cement, sand, gravel, concrete hollow blocks, and rebars. The monitoring of the material cost of these corresponding resources was formatted using an Excel spreadsheet following a weekly timeline.

The necessary information gathered from the interviews was formed into themes and interpreted, considering how the ideas could be incorporated into the formulation of Microsoft Excel spreadsheets and the different contents and sections of the automated project management dashboard.

3.2 Design of the Dashboard

3.2.1 Formats of Excel spreadsheets

Scope of Work	Quantity	wt(%)	week 1	week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Excavation														
Foundation														
Structural														
Masonry														
Electrical														
Plumbing														
HVAC														
Exterior Finishing														
Interior Finishing														
Roofing														
Painting														
Waterproofing														
	Progress per Week		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Cumulative Progress		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Figure 6.1 Planned Progress based on Overall Accomplishment

Scope of Work	Quantity	wt(%)	week 1	week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Excavation														
Foundation														
Structural														
Masonry														
Electrical														
Plumbing														
HVAC														
Exterior Finishing														
Interior Finishing														
Roofing														
Painting														
Waterproofing														
Progress per Week	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Cumulative Progress	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Delay	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Figure 6.2 Actual Progress based on Overall Accomplishment

This spreadsheet is for the overall progress report of a project. There are two formatted tables dedicated for planned schedule and actual schedule. The contents include the breakdown of the scope of works, the quantity and the weight or equivalent percentage of each activity to complete the construction phase of a project. Weekly progress and cumulative progress are added to monitor the commencement of activities.

Delay = Actual Cumulative Progress - Planned Cumulative Progress

Furthermore, the delays of activities can also be computed by subtracting the actual cumulative progress to the planned cumulative progress. It displays the status of construction every week whether there is already an existing delay in the operation of activities. The researchers allotted a three (3) months' worth of progress report divided into weeks that the selected companies filled up upon conducting pilot test. The researchers set a limit to the duration of the required schedule of work due to limited time for pilot testing. The project managers at each company may input data within 12 weeks or 84 calendar days. This fixed duration of progress report was applied to the succeeding Excel spreadsheets.

CONCRETE

Target Planned Quantity	1				
Planned Schedule	Planned Quantity	Planned Cumulative Quantity (%)	Actual Quantity	Actual Cumulative Quantity (%)	Discrepancy
Week 1		0%		0%	0
Week 2		0%		0%	0
Week 3		0%		0%	0
Week 4		0%		0%	0
Week 5		0%		0%	0
Week 6		0%		0%	0
Week 7		0%		0%	0
Week 8		0%		0%	0
Week 9		0%		0%	0
Week 10		0%		0%	0
Week 11		0%		0%	0
Week 12		0%		0%	0

Target Planned Quantity	1				
Planned Schedule	Planned Quantity	Planned Cumulative Quantity (%)	Actual Quantity	Actual Cumulative Quantity (%)	Discrepancy
Week 1		0%		0%	0
Week 2		0%		0%	0
Week 3		0%		0%	0
Week 4		0%		0%	0
Week 5		0%		0%	0
Week 6		0%		0%	0
Week 7		0%		0%	0
Week 8		0%		0%	0
Week 9		0%		0%	0
Week 10		0%		0%	0
Week 11		0%		0%	0
Week 12		0%		0%	0

Figure 7. Progress based on Concrete and Reinforcement

This spreadsheet entails the monitoring of materials specifically concrete and reinforcing steel bars or rebars. The contents include the estimated total quantity, planned and

actual quantity as well as the cumulative planned and actual quantity.

$$Planned\ Cumulative\ Quantity\ (\%) = \frac{Estimated\ Total\ Quantity}{Planned\ Quantity}$$

$$Actual\ Cumulative\ Quantity\ (\%) = \frac{Estimated\ Total\ Quantity}{Actual\ Quantity}$$

$$Discrepancy = Actual\ Quantity - Planned\ Quantity$$

The division of estimated total quantity over the planned and actual quantity would result to the cumulative quantity in terms of percentage for both planned and actual. It keeps track on the quantity of materials and shows whether the consumed materials followed the preestablished quantity scheduled per week. In addition, there is a section for monitoring the discrepancy of the materials every week. This checks the variation of materials used, if it is inadequate and did not match the quantity of materials expected to be utilized on a certain schedule.

Schedule	Cement	Sand	Gravel	CHB	Rebar	Others	Cost	Total Cost
Week 1							0	0
Week 2							0	0
Week 3							0	0
Week 4							0	0
Week 5							0	0
Week 6							0	0
Week 7							0	0
Week 8							0	0
Week 9							0	0
Week 10							0	0
Week 11							0	0
Week 12							0	0

Figure 8.1. Progress based on Material Cost

Planned Budget	Actual Budget	Remaining Budget
	0	0
	0	0
	0	0
	0	0
	0	0
	0	0
	0	0
	0	0
	0	0
	0	0
	0	0
	0	0
	0	0
	0	0

Figure 8.2. Progress based on Material Budget

This spreadsheet tracks the cost of materials including cement, sand, gravel, concrete hollow blocks and rebars. These are considered as critical resources from the inception to completion of a construction project based on the data gathered from interviews. The researchers also added a section in the Excel table wherein other materials or particulars can be inputted to cover all the materials that are being consumed together with their individual costs.

$$Remaining\ Budget = Planned\ Budget - Actual\ Budget$$

In line with this, the planned budget, actual budget and remaining budget of materials are reflected on the Excel to monitor the spent expenses for construction materials. The remaining budget can be determined by subtracting the planned budget to the actual budget. This shows the available budget needed for the procurement of materials.

Schedule	Carpenter	Steel Man	Mason	Painter	Tile Setter	Installer
Week 1						
Week 2						
Week 3						
Week 4						
Week 5						
Week 6						
Week 7						
Week 8						
Week 9						
Week 10						
Week 11						
Week 12						

Plumber	Electrician	Helper	Equipment Operator	Total Actual	Total Planned	Labor Cost per Week	Running Expense
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0

Figure 9.1. Progress based on Manpower

Workers	Rate per Worker
Carpenter	
Steel Man	
Mason	
Painter	
Tile Setter	
Installer	
Plumber	
Electrician	
Helper	
Equipment Operator	

Figure 9.2. Labor Rates of Workers

This spreadsheet includes the total number of service days provided every week by construction workers. The duties of the said workers were only determined using on-site interviews and were limited to ten (10) job roles.

$$\text{Labor Cost} = \text{Job of Worker} \times \text{Labor Rate}$$

The work rates of each worker differ from one another. To get the labor cost on a weekly basis, the workers in accordance with their respective positions and labor rates are put into consideration. Moreover, running expenses were included to monitor the accruing amount of cost in terms of labor.

3.2.2 Sections of the Dashboard

The project dashboard was automated using Microsoft Excel and Microsoft Power BI. The spreadsheets created by the researchers can be accessed through Google Sheets. There are two versions of Google Sheets. The first is where project managers can insert data directly into a web browser. The second one is the published version of the original file. When changes are made to the original document, updates will be reflected in its published version. Automatic updates in the published file happen every five (5) minutes. Moreover, an internet connection is needed to access both spreadsheets; otherwise, inputting data is unlikely to work [37].

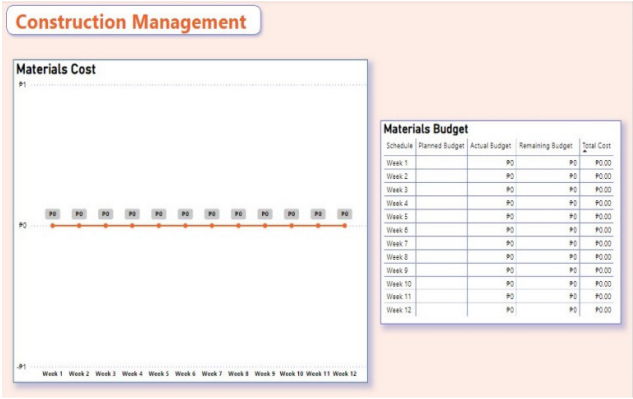


Figure 10. First tab of the automated project dashboard

The first tab displays the table for material budget and the graph for material cost. The running cost of materials is shown using a line and stacked column chart. In this section of the dashboard, the end-user can oversee the status of the planned budget, actual budget, and remaining budget allotted for construction materials.

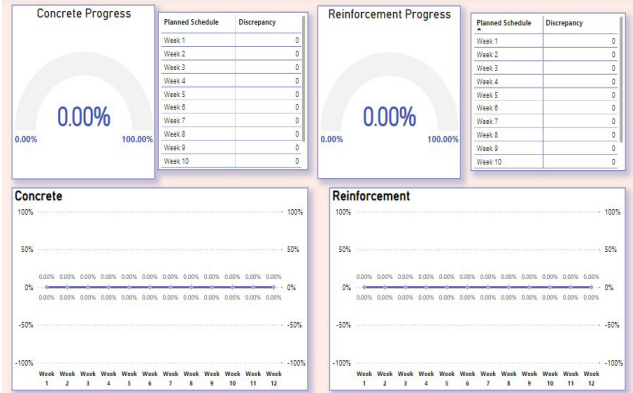


Figure 11. Second tab of the automated project dashboard

The second tab of the dashboard is composed of the progress monitoring for concreting and reinforcing steel bars. The upper part presents the percentage complete of concrete and reinforcement using gauge chart. There is also an indication of planned schedule and discrepancy of materials every week on the right section of each gauge chart. In addition, the utilization of line chart illustrates the progress comparison between the planned cumulative quantity and actual cumulative quantity of both concrete and reinforcement at the lower part of the dashboard interface.

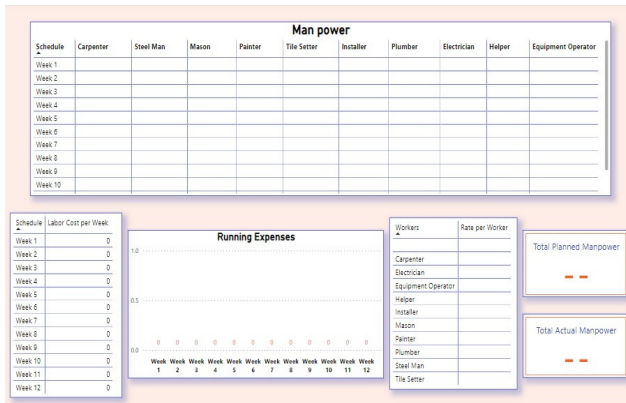


Figure 12. Third tab of the automated project dashboard

The third tab of the dashboard includes the table for manpower monitoring as well as the labor cost following a weekly schedule. Sections for labor rates of construction workers and running expenses are laid out for progress tracking. Furthermore, chart cards for total planned manpower and total actual manpower is included in the dashboard to view the total number of workers present in the project construction.

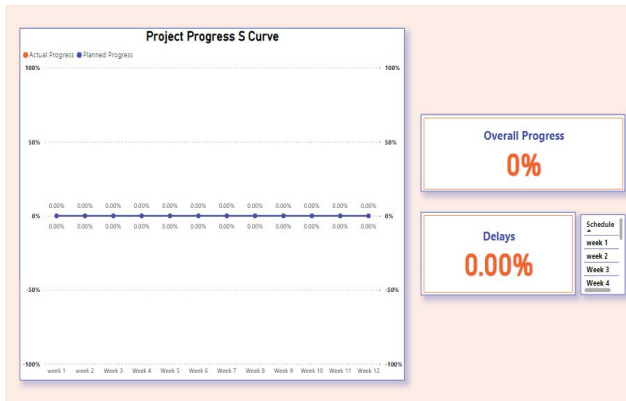


Figure 13. Fourth tab of the automated project dashboard

The fourth tab of the dashboard consists of the visual presentation of data of the overall progress of the project scope of works using an S-curve. It is a comparison between the overall planned progress and overall actual progress plotted against time. Beside the S-curve graph, the overall progress and delay can be seen in terms of percentage using chart card. The end-user can view the weekly delays by clicking specific weeks in the schedule section right beside the delays.

The four (4) tabs of the automated project management dashboard are divided into different sections. The components of the dashboard interface highlight the key information from the analyzed data sets. This dashboard aims to actively monitor in real-time the progressive data of a construction project, keeping track of the activities and tasks commencing on-site with utmost priority to prevent any complication in the completion of a project.

3.3 Assessment of the Dashboard

The automated project management dashboard developed by the researchers underwent pilot testing at each of the five (5) construction firms to evaluate the contents and performance of the dashboard especially in terms of delivering real-time inputs.

The information included in the Excel spreadsheets are clear and understandable.

Strongly Agree Agree Neutral Disagree Strongly Disagree

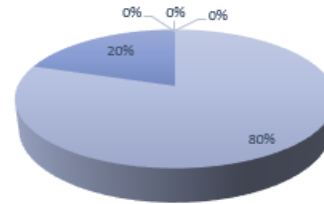


Figure 14.

This pie chart shows that 4 out of 5 construction companies that completed the survey questionnaires strongly agreed that the information in the Excel worksheets are clear and understandable. These include the spreadsheets for the manpower, materials and overall progress of a project.

The formats of the tables in Excel are easy to use.

Strongly Agree Agree Neutral Disagree Strongly Disagree

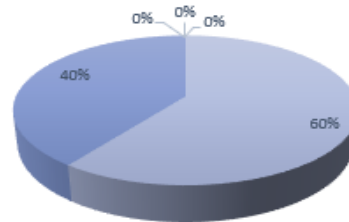


Figure 15.

Based on the result of this pie chart, 60% of the respondents strongly agreed that the formatted Excel tables are easy to utilize. Upon pilot testing, the companies experienced little to no difficulty in filling in the needed data in each Excel table.

The design of the automated project dashboard is pleasant.

Strongly Agree Agree Neutral Disagree Strongly Disagree

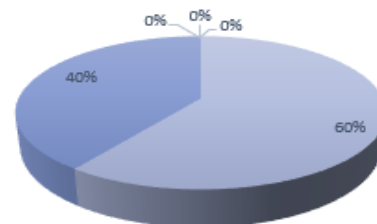


Figure 16.

As shown in Figure 16, 3 out of 5 participants strongly agreed that the design of the dashboard created by the researchers was designed appropriately. This entails that the said dashboard looked presentable to the project managers of each company.

The sections of the automated project dashboard are well-organized.

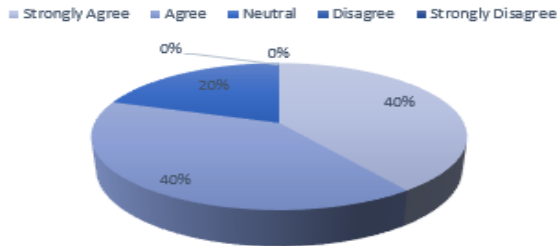


Figure 17.

This pie chart indicates that the selected construction firms were 40% strongly agreed, 40% agree and 20% neutral with regards to the arrangement of the sections of the automated project dashboard. Thus, the sections of the dashboard are quite organized but at the same time there is a need for improvement.

The automated project dashboard covers the important activities to monitor in a construction project.

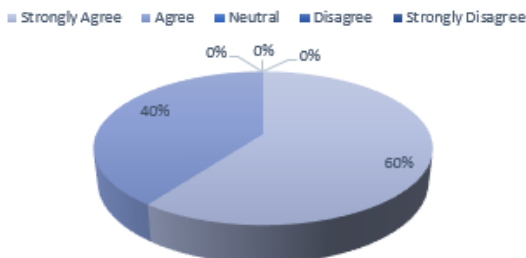


Figure 18.

From the information in this pie chart, 60% of the respondents strongly agreed that the dashboard mapped the necessary activities needed to monitor a project's progress. The important activities include the scope of work, schedule of work, and the comparison between the planned and actual progress of operating activities commencing on-site.

The automated dashboard is easy to learn and comprehend.

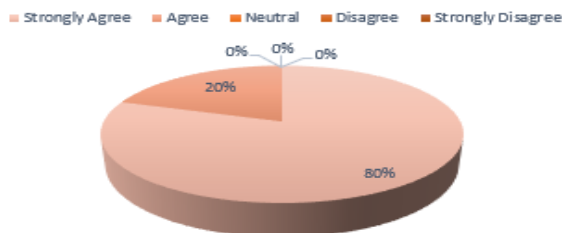


Figure 19.

The results of this pie chart illustrate that most of the participants strongly agreed that the project dashboard is software that is not complicated to learn. In line with this, only a minority of the participants answered agree regarding the level of comprehension needed to use the automated project dashboard.

The representation of data in the dashboard interface matches the data inputted in Excel.

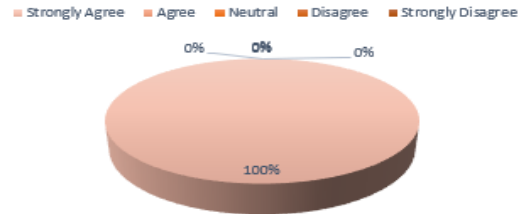


Figure 20.

Based upon the information gathered from survey questionnaires, all the five (5) selected construction firms strongly agreed on the way the data inserted in the individual Excel worksheets matched the data that were reflected in the interface of the automated project dashboard. The project managers were satisfied to see that all the data was accurately shown onto the automated dashboard.

The automated project dashboard responds quickly to inputs.

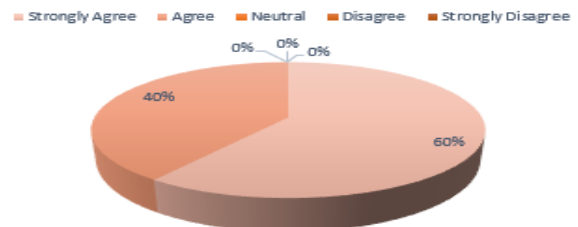


Figure 21.

This pie chart shows that 60% of the participants answered strongly agree with regards on how fast the dashboard loads inputs from Excel spreadsheets. There was no extreme lag present, thus, the dashboard had a quick response to all the data inputted during pilot testing.

The automated project dashboard is accurate when it comes to real-time data updates.

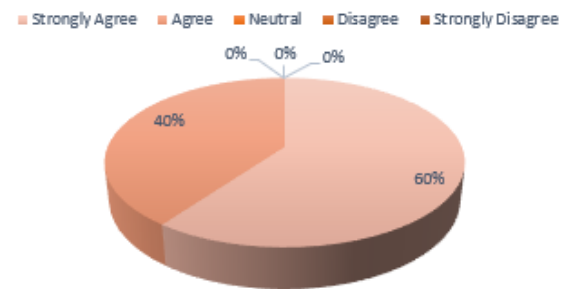


Figure 22.

As seen in Figure 22, that 3 out of 5 respondents strongly agreed to the accuracy of the dashboard in projecting real-time data whenever there are new inputs inserted in the formatted Excel tables linked into the system of Microsoft Power BI. Most of the companies agreed that the real-time operation of the project dashboard is correct and precise.

The overall operation of the automated project dashboard in providing real-time data progress is effective.

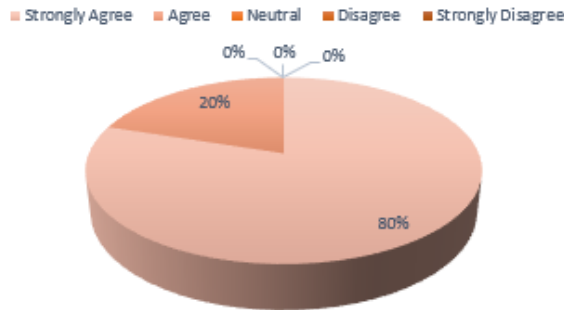


Figure 23.

As a result of the collected data from survey questionnaires, nearly all the five (5) construction firms answered strongly agree that the overall performance of the automated project dashboard during the pilot test is effective. For this reason, the dashboard developed by the researchers is proven to be effective in processing real-time sets of data based on the progress reports from ongoing construction projects and can be adapted as a tool in monitoring the progress of a project during its construction phase.

IV. Conclusions

4.1 Conclusion

The automated project dashboard is accurate enough to be used in project monitoring and easy for anyone to learn. Respondents acknowledged the automated dashboard because of its response to data inputs showcasing real-time project progress updates. The automated dashboard is helpful for construction companies because of the features applied in the project management dashboard, which was gathered using structured interviews and programmed using Microsoft Excel and Microsoft Power BI. The overall automated project management dashboard is reliable regarding its effectiveness, adaptability, and real-time progress updates. During pilot testing, no error or technical problem was encountered due to the dashboard's proper and smooth operation.

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