

Integration of the Triple C Model: Project Management in Philippine Shipyards

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Abstract

Shipyards help produce vessels. In 2015, the Philippines accounted for 2.8% of the world's ship completion based on Gross Tonnage and 1.3% in ship exports (DTI, 2017). With the conclusion made by Pawling (2017), the design spiral proposed by Evans (1950) was found to be misleading. This is evident in the delays and wastage in shipyard processes such as 16.10% unnecessary motion, 15.04% inventory management, and 12.25% waiting activities (Harlan, 2019). Despite technology solutions proposed by Paul (2014) and Sokolov et al. (2022), delays and waste in shipyard processes are still present. This paper investigates the soft side of project management, specifically the integration of the Triple C Model for Project Management by Badiru (2008) and its effects on the variation in shipyard processes. Thematic analysis was used during the coding process of the data gathered from the semi-structured interviews conducted in three departments of a Philippine shipyard: Marine Engineering for planning, Marine Production for project actualization, and Warehouse Division for logistics. The results show that the shipyard prioritizes communication. However, there is a lack of participation from the Warehouse Division in project meetings, a focal point for the integration of the Triple C Model for Project Management. This contributes to delays in material acquisition, incorrect material deliveries, and project implementation. To ease delays, the study found that employees with a longer year of experience tend to integrate the Triple C Model despite the lack of a formal process.

Keywords: project management; Triple C Model; qualitative; shipyards, shipyard process

1. Introduction

As a Naval Architect, one of the constant challenges is the multiple revisions of initial plans due to changes during the production process. This is inefficient and contributes to the delay of a vessel's delivery. Moreover, this can negatively affect the shipyard and its role in the country's economy.

In 2015, the Philippines accounted for 2.8% of the world's ship completion based on Gross Tonnage and

1.3% in ship exports (DTI, 2017). This percentage is attributed to Naval Architects working tirelessly to achieve efficient ship designs for construction as the ship design process requires multiple iterations due to its complexity. Since 1959, the design process has been anchored to the Ship Design Spiral visualized by J. Harvey Evans in his book entitled “Basic Design Concept” which represents the iteration stages in ship design. However, this visualization has been concluded as misleading and an unreliable representation of complex ship design (Pawling, 2017). This misleading ship design process leads to inefficiency in the production process and contributes to a waste of 19.77% defect material, 16.10% unnecessary motion, 15.04% inventory management, and 12.25% waiting activities (Harlan, 2019) and design changes from the owner during construction (Lin, 2011).

The solution for the wastage has been explored by researchers using technology. An accuracy control system in the shipbuilding industry was introduced by Paul (2014). This technology focused on the dimensional accuracy of the production process using a plasma cutting machine. By reducing the variations of the ship designs and the output from the plasma cutting machine, a significant decrease in production time and rework was proven. However, this particular solution is only concerned with the processes that involve the use of a plasma cutting machine and does not take into account other processes such as welding, fitting, and hull erection which are also present during ship construction.

The automation of shipbuilding using the Internet of Ships (IoS) technology was also proposed by Sokolov et al. (2022) which is rooted in the emergence of the Internet of Things (IoT). This solution aims to take into consideration the available Computer-Aided Drafting (CAD) software in the shipbuilding industry and enhance it using robotics, virtual and augmented reality, and artificial intelligence. Through the application of this technology, it was perceived that proper data gathering on shipbuilding processes would lead to the creation of new and efficient ship designs. However, this solution requires a high investment due to its needed equipment and the training necessary to ensure its effective implementation.

Recently, another solution involving the introduction of Computer-Aided Software in the early stages of ship design was introduced by Perez and Perez-Fernandez (2023). The research suggested the use of three-dimensional Computer – Aided Software which would improve the general arrangement of the ship being designed. This would lead to better visualizations and ship calculations by the Naval Architect. This solution has an estimated cost reduction of 15% in the overall design and production stages. However, this solution requires a high investment in upgrading the ship design equipment and also in acquiring the three-dimensional software for its application. Moreover, their research focused only on the ship design process and does not take into account the inputs from the production team which mainly handles the ship construction process.

Despite the advancement of technology, wastage is still present especially in companies that do not have a

large capital to invest in high-end equipment. Badiru (2008) suggested that the soft side of project management, and not only technology, should be improved to achieve higher efficiency and success. However, this involves a challenging task of understanding the complexities of people and how they can be motivated to achieve the company's collective goal. To aid in this, Badiru (2008) put forth the Triple C Model for Project Management which revolves around three main concepts – communication, cooperation, and coordination. With this model, a project's output can be enhanced by integrating steps and procedures that relate to the three main concepts of the Triple C Model for Project Management.

In this study, the researcher investigated the effects of the Triple C Model for Project Management's incorporation in shipyards. The study's main emphasis will be on the qualitative components of project management, specifically those relating to the Triple C Model for Project Management and how they affect the production process in shipyards.

2. Methodology

This study made use of a qualitative research design. This helped gather more in-depth responses from the participants in relation to their work experience. It determined how to a certain extent the Demographic Profile and the integration of the Triple C Model for Project Management (Communication, Cooperation, and Coordination) in shipyard processes affect the project construction variation in terms of vessel drawings, production scheduling, and logistics scheduling.

A semi-structured interview was carried out with the research participants. This type of interview allows flexibility and adaptability while still keeping track on the direction of the study (Mashuri et al., 2022). Although this type of research is rich in in-depth data, it proves to be time-consuming and expensive. Moreover, poor or limited responses may kill the conversation and lead to a substandard quality of data.

2.1. Participants and Sampling Procedure

This study made use of a purposive sampling method. The targeted participants were all employees of the company. These employees were specified due to their commitment with the company and have all undergone orientations at the start of their employment and are considered knowledgeable in the shipyard processes practices of the company. The participants were from the Marine Engineering, Marine Production, and Warehouse Division departments. There was a total of five (5) participants in the study which included a naval architect from Marine Engineering, a Junior Project Engineer and Production Staff from Marine Production, and two Warehouse Man/Clerk from the Warehouse Division.

2.2. Data Gathering Procedure

The researcher submitted a letter of consent to be approved by the adviser, chairperson of the Graduate Studies of the College of Engineering, and the Dean of the College of Engineering. The researcher was granted permission to conduct the study and proceeded to send a letter to the General Manager of Company A for approval.

Once approved, the participants of this study were employees from the Marine Engineering, Marine Production, and Warehouse Division of Company A. Before the semi-structured interview was conducted, the

researcher explained the study's purpose and clarified to the participants that there would be no direct benefits from the participation of the study. The researcher emphasized that the results of the semi-structured interview will be stored and treated with absolute confidentiality and anonymity. Results will only be used throughout the study and only for academic reasons. Only the researcher, their adviser, and panel members will be engaged in the data analysis. In addition, the researcher explained the importance of honesty and openness of the participants to ensure that the gathered data is accurate.

Once the participants had confirmed their willingness to participate, the researcher asked for their most convenient schedule for the conduct of the interview and the location where the participants feel safe and secure to answer honestly. Two out of the five participants felt safer for the semi-structured interview to be conducted at their rented house while the rest preferred to have it inside their offices. Before the conduct of the interview, all participants were given the informed consent form to be reviewed again and signed. After this, all participants showed willingness and openness in answering all questions and no threats or bribery happened between the researcher and participants. The semi-structured interviews took about 30-40 minutes each which were recorded and later transcribed. Transcription took about 1 week while the coding process took them approximately 2 weeks to complete. Lastly, the researcher concluded and recommended the study based on the data gathered.

2.3. Data Analysis

Thematic analysis was adopted to the data gathered from the semi-structured interview. This follows the 6-step framework by Braun & Clarke (2006). During the second step, codes related to the research topic were generated based from the participants' answers. A code is a short representation of a main idea expressed by the participants (Coates, 2021). The codes helped create sub-themes and main themes. Lastly, the transcripts and codes will be rechecked for the purpose of data verification to verify or modify the conclusion that was previously arrived at.

3. Results and Discussion

3.1. Demographic Profile of the Participants

The participants were composed of five (5) employees of the identified research setting, Philippine Iron Construction and Marine Works, Inc. Specific demographic profiles that were asked from the participants were their age, highest educational attainment, department in the company, and years of experience. These are presented in Table 1.

Table 1. Demographic Profile of the Participants

Participant	Department and Position	Age (in years)	Highest Educational Attainment	Years of Experience in Shipbuilding
1	Marine Production, Production Staff	44	College, BS in Commerce - Major in Marketing	18
2	Warehouse Division, Warehouse Man/Clerk	28	College, BS in Energy Systems and Management	1

3	Warehouse Division, Warehouse Man/Clerk	42	Secondary, BS in Architecture (for 2 years only)	3
4	Marine Production, Junior Project Engineer	24	College, BS in Naval Architecture and Marine Engineering	0.75 (9 months)
5	Marine Engineering, Naval Architect	27	College, BS in Naval Architecture and Marine Engineering	4

Most of the participants were aged between 27 to 29 years old, 40% exactly. The remaining 60% were divided equally among the remaining participants, 20% between 24 to 26 years old, 20% between 40 to 43 years old, and 20% belonged to the age group 44 to 46 years old. 80% of the participants were able to graduate college as their highest educational attainment. The remaining 20% were able to graduate their secondary level and pursue two years of their college degree before dropping out. The Marine Production and Warehouse Division (Logistics) employees composed most of the participants, 40% respectively. The remaining 20% came from the Marine Engineering department. The years of experience of the participants ranged from 9 months to 18 years and an average of 5.35 years of experience.

3.2. Integration of the Triple C Model for Project Management

The answers of most participants showed that task dissemination is commonly communicated. This involves the relaying of the project's scope of work and material deliveries. Both are highlighted as essential to project success as stated by Mirza et al. (2013).

A production staff with 18 years of experience states that: "Scope of works are basically shared at the beginning of the project to everyone." Another comment from a warehouse clerk of 3 years mentions that: "They give us information about incoming materials for a project, especially those that are big in size. They entrust the decision to us on where to store the materials. This is to ensure that we know what project delivered materials are for, especially when there are simultaneous projects occurring." Most task dissemination are done through a meeting or relayed by a department's head. A Junior Project Engineer comments that: "In the Marine Production department, we have a meeting every day. This is where we share important information such as tasks and problems encountered during a project." Employees under the Warehouse Division did not have a representative in project meetings and only received information regarding incoming materials for the project. According to Alduais et al. (2022), proper information sharing for common and unique situations can positively influence the decision-making ability of teams. In the case of the Warehouse Division, selective information shared can result in challenges in decision-making.

In addition, all participants are made aware of their importance to a project's success. A statement from a Junior Project Engineer with 9 months experience is a good example. He stated: "I have a big role to play during a project. We have to lead the project, plan the scheduling, assign workers, survey the vessel, and allocate materials according to the schedule." Moreover, all participants agreed that despite not knowing the mission and vision, they understand the financial implications of their tasks to the company's long-term goals. This is highlighted by a comment from a warehouse clerk with 3 years of experience: "I forgot the mission and vision of the company. However, warehouse personnel must be sensitive to the investments of the company. We will not steal the company's investments and secure them. We will take care of the materials to ensure that their quality is the best so that the clients' image of the company will not be negatively impacted." In a similar statement, a Naval Architect with 4 years of experience supports the importance of clients for the company. It says: "To help with long-term plans, the Marine Engineering department can help look for clients for the company to ensure future projects." Projects are considered the lifeline of the company, especially in

terms of their target profits. This is supported by a statement from a production staff with 18 years of experience: “For example, if the company is aiming for a profit or a gross income for five (5) years with a certain amount, the performance of the production staff will greatly affect its success. If production (staff) has a slow performance, then the company will not be able to reach that goal. This is why the production staff must double-time. I think that the heart of the company is with the production department.”

Despite unfamiliarity with the company’s long-term goals, all the participants show a sense of responsibility in carrying out their tasks. However, according to Khan et al., (2020), a company’s mission must be shared properly with all employees as this has a significant impact on their performance. This can be done by actively seeking their involvement in the company’s long-term goals.

Cooperation is the second element under the Triple C Model for Project Management. This is defined as the organization of effective teams to accomplish work (Badiru, 2008). As a main theme, it is connected to the lowest number of sub-themes. Its only sub-theme is the division of labor. All participants in the study expressed that all tasks for the department are divided equally by whoever is part of it. The Marine Production department only has a limited number of Engineers. All projects are equally divided before them as stated by a production staff: “Basically, marine engineering is more on design and quotations. After that, whatever they accomplish will be forwarded to production. This will be divided to the four engineers. Teamwork is essential here.” For the Marine Engineering department, there are also limited Naval Architects present who conduct surveys and create plans. A Naval Architect with 4 years of experience explains how work is divided between them: “There are only two (2) Naval Architects in the Marine Engineering department. During projects, we divide it equally with each other. If there were six (6) projects, then I will three (3) and my colleague will get the other half. Tasks are equally divided in terms of monitoring, survey, plotting, and linkages. If one of us is overloaded, then I can come in and help.” Lastly, a warehouse personnel for 1 year describes their department as a tag-team system: “There are only two of us here in the warehouse division. In projects, we are not directly involved in the division of teams but we offer support in terms of providing the needed materials for a project. In all projects, the two of us create a “tag-team” system especially for busy hours, 8:00am to 10:00am, when all employees are issued their materials.”

Statements from the participants all highlight the importance of teamwork, especially during the absence of a department member. A production staff with 18 years of experience shares that: “Teamwork is essential here. From what I have observed, our department does not usually halt its services because of the absence of one since another person is able to step in for them. The best way forward is teamwork in our department.” This is supported by a statement from a warehouse clerk with 3 years of experience: “Teamwork is important here. Since there are only two of us, we make sure that one of us is always present. If both of us are absent, then the warehouse processes will cease.”

All participants see teamwork as an essential tool for project success. This is necessary due to the limited number of employees under a department. Haq et al. (2020) suggest that workload must be carefully assessed as this adds to work stress which can negatively impact an employee’s productivity. Teamwork is essential but careful assessment of workload must be done to ensure employee productivity.

Coordination is the third and last element of the Triple C for Project Management. Key aspects of coordination are the integration of project phases and the identification of team interfaces (Badiru, 2008). Coordination has 3 sub-themes: Formal Meetings, Technology, and Personal Communication.

All participants stated that their daily coordination efforts with other departments are with the use of Technology. Common are social media platforms, Viber, and phone calls/texts. Using this type of technology can lead to issue solving, building trust, and stakeholder relationships according to Vadhanasin et al. (2017). A production staff with 18 years of experience shared that: “We use Viber but mostly utilize Facebook Messenger for day-to-day communication needs. However, for crucial information, a meeting must be

called.” For a warehouse clerk with 3 years of experience, he says: “Here in the warehouse team, we are part of different group chats. This helps us keep up to date with information.”

Crucial information involves client details that entail privacy. Daily formal meetings are done through a production meeting and involve other department heads when necessary. A warehouse clerk with 1 year of experience shares that: “We are not mostly part of meetings conducted during the discussion of projects. However, the Accounting Head is present and they will share the information from the meeting with us.”

However, a Junior Project Engineer expressed his concern on coordination if data is unstable: “If you have problem with the internet connection, then we give them a call or text. However, if you do not have load, then you will not be able to.” During this, personal communication should be observed if ever this occurs. It is efficient especially when you need details urgently. He says: “We communicate with the Marine Engineering department most of the time. Our tables are in close proximity, about 2 meters away, so we mostly approach them if we have something to ask.” In a similar situation, a warehouse clerk expresses that: “They come here in person or chat in our group chat in Facebook Messenger or Viber.” The participants’ answers suggest that the use of technology such as social media is helpful in terms of coordinating with co-employees which is in line with the study by Cetinkaya & Rashid (2018) which states that the use of social media is found to be positively correlated to an employee’s job performance. This is mainly due to the influence of a faster knowledge transfer between employees (Cao et al., 2016).

3.3. Variation challenges in project implementation

The most common challenge in variations during project implementation is in relation to project materials. This mainly involved the delayed and incorrect deliveries caused by the company’s suppliers. This finding is supported by studies conducted by Abdellatif & Alshibani (2019) and Carvalho et al. (2021). A warehouse clerk with 3 years of experience expresses that: “Some suppliers do not follow the scheduled date and time of delivery. Most of their reasons revolve around their vehicle encountering problems. We cannot control this.”

During a similar situation, a Naval Architect shared that: “There is a timeline for when materials are expected to be delivered. However, we have encountered that the materials delivered are not what was expected. For example, what we needed were MS Plate 8mm and 10mm, the supplier delivered MS Plates 16mm and 25mm. Although they are part of the list of materials, they are still needed further down the scheduling.” These deliveries greatly impact the Marine Production department which leads to overtime. This is stated by the Junior Project Engineer: “We do not have a choice when delays occur especially relating to materials. Work will become stagnant. When deliveries are delayed, it greatly affects my position. This causes changes in our production scheduling and leads to overtime work.” These overtime schedules contribute to long working hours which have been found to have an adverse effect on employees’ health (Wong et al., 2019) which can also lead to a negative effect on their performance (Chang, 2024).

Another cause for the delay is the electrical outage in the shipyard. This halts the processes in the Marine Engineering and Marine Production departments. A Naval Architect with 4 years of experience expresses that: “This halts production and also our work since we rely on our computers to finish drawings and paper works. During this, there is not much we can do but wait for the generator to start.” In support of this statement, a Junior Project Engineer shares that: “One of the main concerns here is electricity. It is not reliable. When there is no electricity, production operations will halt.”

To cope with challenges related to the delays, some participants borrow materials from other projects. A Junior Project Engineer explains this in his statement: “If there are multiple projects that are done simultaneously, we also ask the Owner’s Representative if we can borrow materials. This happens if two (2) vessels have the same MS plates. During this agreement, a document is signed by the Owner’s Representative and also the Department Head. Borrowed materials will then be given back once the MS plates are delivered.”

Other aspects that are factors for challenges during project implementation are the lack of familiarity with processes in the shipyard and project schedules. Both of these mainly revolve around the Marine Engineering and Marine Production departments. The statement of a warehouse clerk supports this finding. It says: “We are challenged in terms of making sure that there are always stocks available. Since we do not have direct access to the production scheduling, we do not know what specific operations are done for a specific day.” On the side of Marine Engineering and Marine Production, both also do not have access to the logistics scheduling chart and rely on follow-ups regarding deliveries. A Junior Project Engineer supported this and stated that: “For added supply, we create a purchase request. Another department will monitor it and it is up to them on how to make sure that it gets delivered on time. We then ask for the scheduled delivery to help with updates on the production scheduling.” All participants convey a lack of information on other departments which hampers the transfer of knowledge between them. Knowledge transfer is a significant factor in employee performance (Cao et al., 2016). Information that is incomplete or not easily available can pose as a challenge in meeting project objectives.

3.4. Relationship between demographic profile, integration of the Triple C Model for Project Management and variation in the shipyard processes

Most participants highlighted that their years of experience has helped their decision-making skill. This helps them to coordinate with others properly and choose the correct solutions to avoid reworks. A production staff with 18 years of experience supports with their statement. It says that: “Because of my experience in different departments, I am able to create important documents more efficiently. Due to my learnings about being flexible, I can navigate myself properly in different situations to help reduce delays in a project.” Moreover, those with less than a year of experience see the value of good connections that you make through work. A Junior Project Engineer with 9 months of experience is a good example. He stated that: “With my nine (9) months experience, it is very important for you to find good connections with the people around you. This is how you can ask for help with regards to materials. There are also services that are not offered by the company. It is possible for some processes to be done outside the company. You can even propose for additional manpower. I learned this from my connections here at the company. This really helps especially in case of delays; I can apply them and hopefully catch up to the schedule.” These statements are in line with the results from the study of Rivaldo & Nabella (2023) wherein experience is significant to a worker’s performance.

Aside from their years of experience, most participants highlighted the contribution of their college degree. They expressed their challenges starting out but coped by coordinating with their colleagues within and outside their assigned departments. A warehouse clerk with 1 year of experience shared that: “So far, it has been okay despite working in a position that is far from the degree that I finished. When I started, everything was new to me. I did not know what to do so I did a lot of observations of the tasks to be done. I also asked for advice from my colleague.” Work alignment to an employee’s degree has a significant effect on their job performance. Mismatched tasks and qualifications can limit the positive effect of the educational level of an employee (Kasika, 2015).

From another perspective, some participants gave acknowledgment to their college degree which helped them have prior knowledge before working. A Naval Architect with 4 years of experience stated: “Overall, it is easier to work with others when you have previous knowledge from school and previous jobs.”

4. Conclusion

The objective of this study was to investigate the effects of the Triple C Model for Project Management's incorporation into the variation in shipyard processes. Based from the findings, there are improvement opportunities in the integration of the Triple C Model for Project Management within the processes related to the Marine Engineering, Marine Production, and Warehouse Division of the identified company. Communication was found to be most integrated, however, there is a huge improvement opportunity in its practice most especially in involving all departments during meetings where project details are shared. This is followed by coordination and cooperation. The effects of this integration can be observed through the challenges encountered by the participants. Most of the challenges revolve around the cooperation and coordination aspect between the Marine Engineering, Marine Production, and Warehouse Division.

According to Badiru (2008), communication is the first and foremost element as this sets up how well the next elements of the Triple C Model for Project Management will be practiced. Due to the exclusion of the Warehouse Division employees in project meetings, important details such as the scope of work and timeline of the project were not relayed to them. This caused Warehouse Division employees to feel a gap between them and other departments. However, they understand the importance of coordinating with other departments and seek advice personally from Marine Engineering and Marine Production employees with regards to common supplies used in projects.

Moreover, despite multiple coordination tools, the employees do not have a clear and direct access to the production and logistics scheduling. This creates a challenge in understanding what tasks are to be expected for a given day and what roles are needed to accomplish these tasks which lead to delays especially in terms of materials acquisition.

Although cooperation within a department is present, there are improvement opportunities in the cooperation between departments. Four participants from the Marine Production and Warehouse Division all agreed that they are not well-versed in terms of the work of the Marine Engineering department. Considering that the project scope, cost estimates, and bill of materials originate from the Marine Engineering department, other departments should be knowledgeable on how these tasks are accomplished. In addition, there are no specified project teams which involve employees from all three departments. This is attributed to the low number of employees per department: 2 Naval Architects in Marine Engineering, 4 Project Engineers and 1 Production Staff in Marine Production, and 2 Warehouse Man/Clerk in the Accounting Department – Warehouse Division.

Lastly, there is a strong relationship between years of experience and the integration of the Triple C Model for Project Management. All participants agreed that the years of experience help them coordinate better with others especially in unforeseen circumstances. Moreover, participants with longer years of experience support that communication and understanding the roles of different departments is vital for project success.

The results of the study will provide shipyards with similar departments a soft approach into addressing variations in the project implementation stage. This study implies that shipyards with improvement opportunities in the integration of the Triple C Model for Project Management encounter delays in project implementation.

The findings and conclusion of this study result to the following recommendations to shipyards:

- May create a project team which is composed of representatives from the three departments: Marine Engineering, Marine Production, and Warehouse Division.
- Can revisit hiring plan to ensure that the number of employees will accommodate for the creation of project teams.
- May reiterate the long-term goals of the company, its mission and vision, to all employees to ensure

that individual goals are aligned to that of the long-term goals of the company.

- Project Meetings may include a representative from the three (3) departments: Marine Engineering, Marine Production, and Warehouse Division.
- Programs and activities may be established to ensure teamwork between the three (3) departments: Marine Engineering, Marine Production, and Warehouse Division.

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