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CONSTRUCTION CREW PRODUCTIVITY FOR CONCRETE POURING OPERATIONS

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Abstract : The investigation on productivity of the construction crews during concrete pouring operations is summarized in this abstract. The study's objectives were to pinpoint the elements that affect crew productivity and offer suggestions for improving effectiveness. Analysis was done on a number of variables, including crew size, task distribution, equipment availability, site logistics, weather, and communication protocols. It was discovered that coordination and communication issues were frequent problems causing delays. Productivity-boosting best practices were discovered, including careful planning, expert task distribution, transparent communication channels, and technological integration. Effective crew management tactics, optimal task distribution, training initiatives, technological solutions, and weather monitoring are just a few of the suggestions made for project managers and workers working on construction projects. Stakeholders can increase efficiency, decrease delays, and produce excellent results in concrete pouring operations by putting these guidelines into practice. Further research can focus on evaluating the long-term effects of productivity improvement measures and exploring additional factors that impact concrete pouring operations.

Index Terms - Crew productivity, Concrete pouring

1. INTRODUCTION

This has significant implications for cost efficiency, time management, resource utilization, quality control, and safety Considerations. Construction projects involve substantial investments, and any inefficiencies or delays during concrete pouring can lead to increased costs. By conducting research on crew productivity, we can identify the factors that hinder efficiency and implement strategies to mitigate them, resulting in cost savings and improved project profitability. Timely completion of projects is vital, and poor crew productivity can cause delays, impacting subsequent construction activities. Optimizing crew productivity ensures effective utilization of resources, minimizing waste, and optimizing labor, equipment, and materials. Furthermore, adequate productivity ensures adherence to proper techniques, reducing the risk of defects and ensuring structural integrity. Safety is a paramount concern, and studying crew productivity helps identify practices that contribute to a safe working environment. By conducting comprehensive research in this area, we can develop best practices, guidelines, and measures to enhance project efficiency, cost-effectiveness, quality, and crew well-being.(Matejevic & Zlatanovic, 2018)Concrete, being a widely used building material in the civil engineering industry, is an area of special research focus. Its popularity stems from the availability and affordability of its composite ingredients: cement, aggregate, and water. By carefully determining the water content and the appropriate ratio of components, the desired physical and mechanical properties of concrete can be achieved. Advancements in concrete technology involve the incorporation of admixtures, which enhance its resistance to external factors. Various methods exist for the production and placement of concrete. The process of concreting, starting with concrete production in factories, transportation to construction sites, and placement in structures, is a common practice in a diverse range of building projects. In fact, it can be considered the most prevalent material in modern construction. As of 2006, global concrete production reached approximately 6 billion cubic meters, equivalent to around 1 cubic kilometer per person on the planet. Given the unique characteristics of concrete and the various factors that can influence the concreting process (such as interruptions, downtime, and irregularities), it is crucial to priorities careful planning and execution of such activities.

1.1 Need for study

Understanding and improving crew productivity during concrete pouring operations is crucial for cost efficiency, time management, resource utilization, quality control, and safety considerations. Construction projects require substantial investments, and any inefficiencies or delays during concrete pouring can lead to increased costs. By studying crew productivity, factors hindering efficiency can be identified and strategies implemented to mitigate them, resulting in cost savings and improved project profitability. Additionally, poor crew productivity can cause project delays, affecting subsequent construction activities. Maximizing crew productivity ensures efficient resource utilization by reducing waste and optimizing labor, equipment, and material allocation. Adequate productivity ensures proper techniques are followed, reducing the risk of defects and ensuring structural integrity. Efficient productivity also contributes to a safe working environment, as adherence to safety protocols and effective communication are essential during concrete pouring operations. Comprehensive research on crew productivity enables the identification of best practices, the development of guidelines, and the implementation of measures to enhance project efficiency, cost-effectiveness, quality, and crew well-being.

1.2 Objectives

- To Identify key factors that impact construction crew productivity during concrete pouring operations.
- To determine, analyze and quantify the most influential factors adversely affecting productivity for concrete pouring activity operations on construction sites.
- To develop strategies and best practices to optimize crew productivity during concrete pouring operations.

1.3 Scope of work

The information obtained during an investigation may be subjective or quantitative depending on the nature of the research and its goals. Subjective data collection approaches focus on gathering non-numerical information, such as interviews, perceptions, and record analysis, in order to properly study and comprehend complex occurrences. On the other hand, methods for gathering quantitative data, such experiments, surveys, and sensor-based data collection, are designed to gather data that can be statistically analyzed.

1.4 Research gap

Despite the importance of construction crew productivity during concrete pouring operations, there exists a research gap in understanding the specific factors that impact productivity in this context. While some studies have investigated productivity issues in construction projects, there is limited research focusing specifically on concrete pouring operations. Further investigation into the crucial elements that affect crew productivity during concrete pouring is still possible due to this study gap. When establishing productivity levels, factors including staff size, skill levels, equipment accessibility, labor practices, coordination, and communication may all be important. In order to improve productivity and project efficiency during concrete pouring operations, it can be helpful to understand these aspects and how they interact. In order to improve project outcomes and resource utilization, it is possible to close this research gap and create evidence-based suggestions and best practices that can maximize productivity of the construction crew during concrete pouring operations.

1.5 Methodology

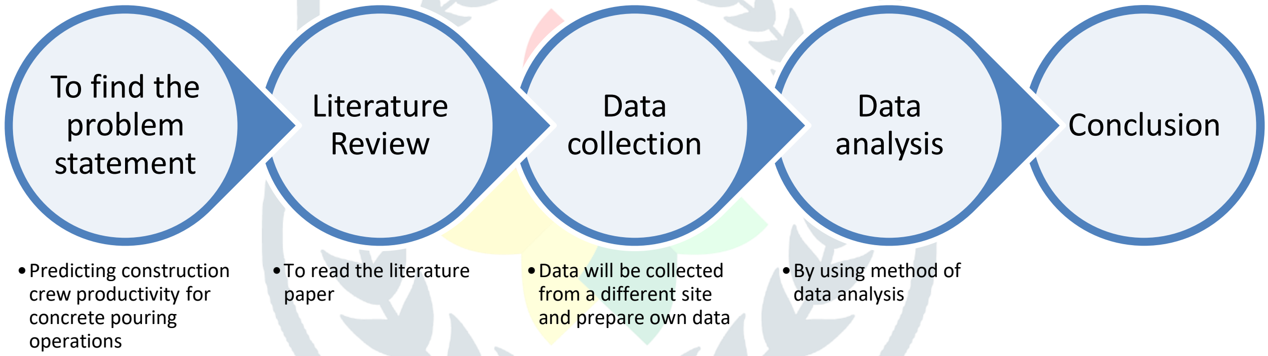


Figure 1 Plan of methodology

2. Literature Review

(Panas et al., 2012) The authors propose using ANNs as a tool for non-linear analysis of concrete pavement construction in this study. Artificial neural networks (ANNs) are computational models inspired by the structure and function of biological neural networks. They can learn complicated patterns and correlations from data, making them ideal for analyzing non-linear systems. According to the report, using artificial neural networks in the analysis of concrete pavement design gives substantial advantages over classic linear models. ANNs' non-linear analysis offers a more comprehensive knowledge of the complicated behavior of concrete materials, resulting in more exact and dependable forecasts. This research advances building processes and aids in the production of more lasting and sustainable concrete pavements.

(Golnaraghi et al., 2019) The relevance of precisely estimating labor productivity in construction operations was recognized by the researchers, as it allows for improved planning, resource allocation, and cost estimation. Conventional forecast approaches frequently rely on historical data, which may not accurately reflect the complex relationships and dynamic nature of the construction environment. By utilizing computational models that mirror the structure and functionality of the human brain, ANNs provide an achievable alternative.

(Orsolya Bokor, n.d.) The study focuses on bricklaying productivity in particular because it is an essential process in building projects and has a direct impact on project timetables and costs. The writers collect information about bricklaying projects, such as the rate of bricklaying, worker composition, weather conditions, and project features. Based on these input data, they create an ANN model to predict bricklaying productivity. The model is trained using the acquired data, and its effectiveness is assessed by comparing predicted productivity values to actual productivity values from the dataset. The authors also compare the performance of the ANN model to standard regression models that are routinely employed in predicting construction productivity.

(Golnaraghi et al., 2020) The study focuses on the importance of effectively estimating labor productivity in the construction sector, as it plays a critical role in project planning, cost estimation, and overall project performance. Due to the complexity and dynamic nature of building projects, traditional productivity forecast models frequently face obstacles. As a result, the researchers offer an innovative approach that combines the benefits of both lower-upper decomposition and radial basis function neural networks.

(Enshassi et al., 2007) Labor-related factors include the availability and skill level of construction employees. Shortage of skilled workers, absence of training programs, poor education levels, and high turnover rates contribute to decreasing productivity. Management-related factors play a key impact in worker productivity. Poor planning, inadequate monitoring, lack of cooperation among project participants, and inefficient resource allocation significantly affect productivity.

(Alaghbari et al., 2019) Construction workers' productivity is hampered by a lack of access to education and vocational training programmers. To increase production, adequate training and skill development opportunities are required. Inadequate project management practices, such as poor planning, scheduling, and coordination, can cause delays and interruptions, lowering labor productivity. Project management solutions that are effective are critical for increasing productivity.

(Karthick, 2008) The study reveals various elements that impact productivity in concreting activity. These elements include worker skill level, availability of resources and equipment, project planning and coordination, site circumstances, and the utilization of technology and automation. The researcher evaluates these parameters and their influence on the efficiency of concreting operations. Based on the findings, the research presents solutions to boost productivity in concreting operations. These measures encompass offering comprehensive training and skill development programs to workers, ensuring the availability of sufficient resources and equipment, enhancing project planning and coordination, tackling site-related obstacles, and adopting technological advancements in the construction process.

(Kareem, n.d.) The Productivity Estimation Model for Bricklayers in building Projects Using Neural Network created by author presents a data-driven technique to evaluating the productivity of bricklayers, enabling better decision-making and resource management in building projects. The neural network learns from this data and builds a mathematical model that can predict the productivity of bricklayers depending on input factors. The model is then tested and fine-tuned using new data to confirm its correctness and dependability.

(Matejevic & Zlatanovic, 2018) The author’s investigate the effectiveness and efficiency of several areas of concrete production and placing. The article will most likely dig into elements influencing productivity in the concreting process, such as the utilization of equipment, labor, materials, and procedures. However, it is difficult to provide a more detailed description in the absence of additional information.

(Rohit Trivedi, 2016) This study focuses on analyzing factors affecting construction labor productivity in the city of Gwalior. The authors likely conduct a case study to identify and examine various factors that influence the efficiency and effectiveness of construction labor in a developing urban area. The article aims to provide insights into improving labor productivity in the construction industry, specifically in the context of Gwalior. However, without specific details, a more comprehensive summary cannot be provided.

(Akbar et al., 2021) The author’s focuses on identifying and analyzing the factors that influence labor productivity in the construction of pre stressed concrete buildings in Ghana. The authors likely conduct research to investigate various elements that impact the efficiency and effectiveness of labor in this specific construction context. The article aims to provide insights into improving labor productivity in the construction industry, particularly in the construction of pre stressed concrete buildings in Ghana. However, without specific details, a more comprehensive summary cannot be provided.

3.DATA COLLECTION

Data collection for research involves systematically gathering and capturing relevant information or data to address research objectives, test hypotheses, or explore specific research questions. Getting empirical data that can be analyzed and understood to reach meaningful findings and make wise judgements is the goal. Depending on the nature of the research and its objectives, the data gathered during an inquiry may be subjective or quantitative. In order to fully examine and comprehend complicated events, subjective data collecting methodologies concentrate on obtaining non-numerical information, such as interviews, perceptions, and record analysis. On the other hand, quantitative data gathering techniques, such surveys, experiments, and sensor-based data collection, aim to collect numerical data that can be statistically analyzed. Structured surveys are used in this particular data collection process to gather first-hand information from people about the issues they have encountered or their personal experiences. Using Google Forms, a structured questionnaire with problem-focused questions is made. To lay a solid foundation for the main problem statement, some supporting questions are also included.

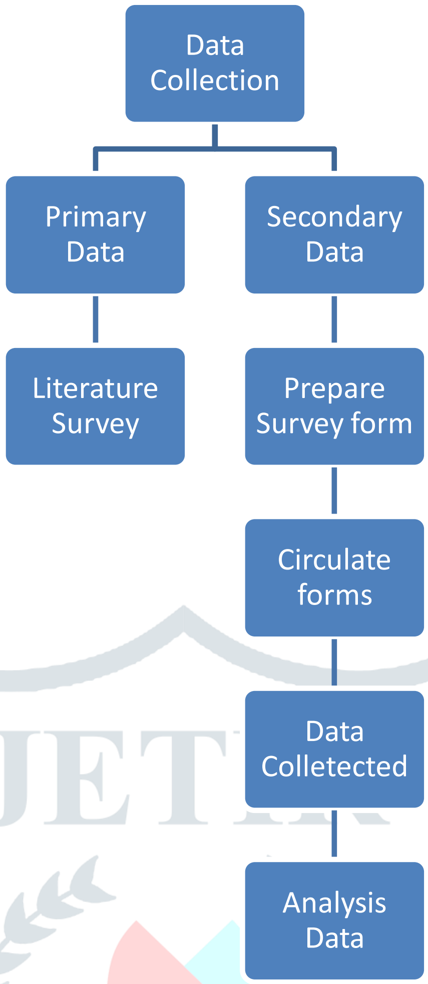


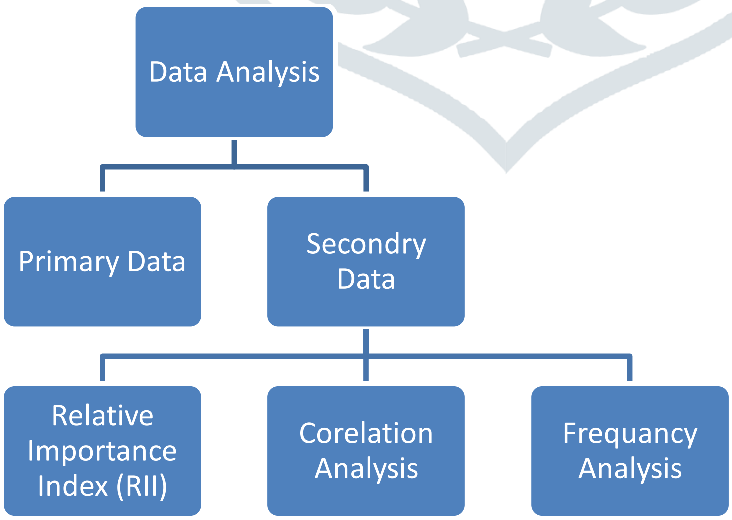
Figure *2* Data collection process

3.1 Questioner design

Table 1 Measure Scale

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
5	4	3	2	1

4. Data Analysis



4.1 Data Analysis by Relative importance index

After all the information has been acquired, it is categorized in accordance with the various project categories. The key causes are then determined, along with how much of an influence they will have on project delays and cost overruns. In the end, suitable answers to these problems are found.

$$RII = \Sigma w / A \times N$$

Equation 1 RII Analysis RII Analysis

Where W is the weighting as assigned by each respondent

$$RII = \frac{5\,n5+4\,n4+3\,n3+2\,n2+1\,n1}{AxN}$$

Equation 2 Relative Importance Index Method

n5 = Number of Respondent for scale 5

n4 = Number of Respondent for scale 4

n3 = Number of Respondent for scale 3

n2 = Number of Respondent for scale 2

n1 = Number of Respondent for scale 1

A = (Highest weight) = 5

N (Total Number of Respondent) = 57

4.1.1 Factors and Responses

Table 2 Data collected from questioner

Sr no.	Questions	Rating 5	Rating 4	Rating 3	Rating 2	Rating 1
1.	Crew experience and skill level	10	12	12	20	3
2.	Task scheduling and coordination	10	11	22	12	2
3.	Weather conditions	8	14	21	8	6
4.	Crew coordination and collaboration	11	16	12	15	3
5.	Availability of equipment	9	14	17	15	2
6.	Availability of concrete mix or supply	11	17	15	11	3
7.	Workflow and task sequencing	11	16	15	12	3
8.	Training on concrete pouring techniques and best practices	10	17	12	10	8
9.	Non-value-added activities (e.g., waiting for materials, equipment setup)	9	15	11	13	9
10.	Communication and collaboration among crew members	8	20	15	5	9
11.	Manpower availability	9	15	17	9	7
12.	Use of technology or specialized tools	11	14	11	16	5
13.	Safety protocols and measures	7	23	11	13	3
14.	Changes in project plans or specifications	11	13	16	6	11

4.1.2 Factor Relative Importance Index Rank

Table 3 Result of RII method

Sr no.	Factors	RII	Rank
1.	Crew experience and skill level	0.621053	13
2.	Task scheduling and coordination	0.652632	5
3.	Weather conditions	0.635088	11
4.	Crew coordination and collaboration	0.659649	4
5.	Availability of equipment	0.645614	6
6.	Availability of concrete mix or supply	0.677193	1
7.	Workflow and task sequencing	0.670175	2
8.	Training on concrete pouring techniques and best practices	0.638596	8
9.	Non-value-added activities (e.g., waiting for materials, equipment setup)	0.607018	14
10.	Communication and collaboration among crew members	0.645614	7

11.	Manpower availability	0.635088	9
12.	Use of technology or specialized tools	0.635088	10
13.	Safety protocols and measures	0.663158	3
14.	Changes in project plans or specifications	0.624561	12

4.2 Correlation Method Statistics

The correlation method allows researchers to examine relationships between variables without having to alter or control them. It is disclosed to what extent and how two or more variables are associated. The correlation method is very useful for determining the relationships between various phenomena.

Table 4 Statics from SPSS software

No	Question	Mean	Std. Deviation	N
1	Crew experience and skill level	3.39	1.161	57
2	Task scheduling and coordination	3.26	1.094	57
3	Weather conditions	3.18	1.167	57
4	Crew coordination and collaboration	3.30	1.210	57
5	Availability of equipment	3.23	1.118	57
6	Availability of concrete mix or supply	3.39	1.161	57
7	Workflow and task sequencing	3.35	1.172	57
8	Training on concrete pouring techniques and best practices	3.19	1.315	57
9	Non-value-added activities (e.g., waiting for materials, equipment setup)	3.04	1.336	57
10	Communication and collaboration among crew members	3.23	1.268	57
11	Manpower availability	3.18	1.241	57
12	Use of technology or specialized tools	3.18	1.283	57
13	Safety protocols and measures	3.32	1.121	57
14	Changes in project plans or specifications	3.12	1.377	57
15	Crew experience and skill level	3.39	1.161	57

5. Conclusion

The results of this study will close the knowledge gaps now present in the sector and lay the groundwork for decision-making based on evidence in construction projects. At the newfound knowledge, project managers will be better equipped to plan and carry out concrete pouring operations with greater efficiency and on schedule.

Further, case studies will be used to assess how well the suggested solutions were put into practice in actual construction projects. Additional proof of the success of the tactics in raising crew productivity and project performance will be provided by the examination of these case studies.

Construction organizations will ultimately benefit from increased efficiency, decreased costs, and improved project outcomes as a result of the effective implementation of the research findings. By providing project managers and other industry professionals with the information and resources required to maximize crew efficiency during concrete pouring operations, this research proposal seeks to make a substantial contribution to the construction industry.

6. Acknowledgment

Research has revolutionized the traditional landscape of science and technology, bringing about profound transformations. It has broadened our perspectives, unveiled new possibilities, and illuminated the enigmatic aspects of the universe. Every achievement is the culmination of countless efforts, and these efforts are made fruitful by the helping hands that smooth the path. I extend my heartfelt gratitude to all those individuals who supported me throughout my work.

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