A Survey on Downtime Cost of Equipment Used In a Construction Industry

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Abstract – This paper performed by directing an electronic study inside Indian firms that have no less than 200 representatives. The fundamental outcomes acquired from the examination demonstrate that the evaluated downtime cost constitutes around 23.9 % from the aggregate assembling cost proportion, and 13.3 % from arranged creation time system. Focusly, the hourly cost of downtime, regardless of whether it might arrange or spontaneous exercises, is generally high. Be that as it may, there is a deficiency of efficient models that able to follow the individual cost forced by downtime situations. This need was indicated clearly while 83 % of reviewed organizations they don't have any entire investigation adjusted for evaluating their downtime costs procedure. For the most part, just couple of organizations builds up their cost bookkeeping techniques, for example, activity based costing (ABC) and resource consumption accounting (RCA) to absorb and uncover the genuine costs that work together with arranged and spontaneous stoppages. Still, the general example of downtime cost estimation component dispensed to direct work and lost limit taken a toll in every situations. On the other hand, the endeavors of diminishing downtime occasions and hence expenses depended on timetable upkeep strategies that upheld by overall equipment effectiveness (OEE) instrument, as a pointer for avowing enhancements. By and large, the examination shows the requirement for enhanced support strategies by joining unwavering reliability centered maintenance (RCM) and total productive maintenance (TPM) into organizations upkeep frameworks. The support part of diminishing downtime impacts not very perceived. Moreover, a similar investigation demonstrates the prerequisite for better consequences of execution estimation frameworks is by actualizing all out total equipment effectiveness performance (TEEP). The upside of such device is to give the effect record of arranged stoppages in gear use consider. At long last, the absence of completely coordinated models for surveying the downtime expenses and structures for recognizing the distinction amongst arranged and spontaneous stoppages are the primary explanations for the continuation of cost in rising structure.

Keywords - Downtime Cost, Planned Stoppage, Maintenance Optimization, Performance Measurement Systems.

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I. INTRODUCTION

The opening part predominantly shows the inspiration calculates behind the postulation point and the aim of moving toward such a subject. Facilitate, the presentation setting encased by various constituent components to be specific foundation, issue dialog, objective, examine questions, delimitations, restrictions, lastly a section rundown. The report structure comprises of eight

1.1 Background

In today's aggressive assembling market, generation productivity and viability are among top business needs. In this way, generation gear turning into the focal concentration of enthusiasm as it is the foundation of the assembling procedure and key execution pointer of profitability. The necessities of remarkable execution compel organizations to considerably consider diminishing their machines downtime recurrence and its important costs [Mali Pritam 2015].Equipment downtime happens because of arranged or spontaneous stops. In any case, the impromptu stops brought on by disappointments and unsettling influences event are the most well-known

startling components that have the non-trifling impact on the general efficiency. Additionally, this interrelation between downtime occasions and efficiency lies in significance of monetary implication, in which cost and benefit factors are contrarily relative by methods for diminishing downtime cost and in this manner expanding creation benefit [Mali Pritam 2015]. To this end, with a specific end goal to diminish the downtime cost, reasonable and created costing strategies are expected to compute and follow each and every cost dispensed amid the stoppage crossroads. All exercises and assets that have drained while recovering the generation gear capacity ought to be assigned in light of their genuine expenses. The essential part of costing technique is to highlight ranges with high cost reserve funds, and of which supervisors continue to execute enhancements. For example, one unequivocal exchange off is between costing strategies and upkeep applications. Profitable upkeep makes progress toward limiting downtime occasions and consequently cost. Then again, legitimate costing technique can be of much gainful to upkeep administrators through surveying the productivity of the embraced support approach. In addition, it permits the utilization of arrangement scientific displaying and recreation as a contribution to advancing support procedure, specifically, the preventive upkeep system [Prasannasangeetha 2015]. There upon, a genuine contextual investigation is exceptionally pressing in moving toward this subject in an intelligent way. As indicated by that, Indian assembling industry was decided for this issue as it has seen huge mechanical advance inside generation offices. Additionally, the framework of such advancement depended on the establishment of mechanical frameworks. Never the less, these refined and complex frameworks presented to successive stoppages wherein are some of these stoppages significantly affects generation blackout thus lost benefit [3].The instance of breaking down gear and its rebuilding is exorbitant and requires numerous assets and spending costs. For those specified reasons, Indian assembling industry is viewed as a decent choice to examine particularly the issues that identified with downtime cost and diminishment investigation.

II. LITERATURE SURVEY

1. Mali Pritam A. "Impact of Construction Equipment on Production In Building Construction Project" International Journal Of Engineering Sciences and Research Technology June 2015 ISSN: 2277-9655 (I2OR), Publication Impact Factor: 3.785

From This Paper I Refer-

The transitory specialist's equipment approach and rigging organization system incredibly influence the advantage of a firm, especially for legally binding laborers with huge enthusiasm for apparatus. The cost of equipment in auxiliary outlining improvement errands can keep running from 25-40% of the total wander cost. In this paper information given about how the orchestrated and fitting upkeep is basic for improvement design for better creation. The data given is month to month outfit utilizes close-by and distinctive purposes behind mishaps being developed equipment creation. Proper organizing, decision, securing, foundation, operation and upkeep of improvement equipment accept basic part in progress being developed endeavors.

2. Prasannasangeetha. A "Hardware Management in Construction Sector" International Journal of Science and Engineering Research (IJSER), Vol 3 Issue 6 June - 2015

From This Paper Refer-

Improvement outfit expect marvelous basic part being developed industry, costs as high as 36% of the total advancement amplify cost, nevertheless, the equipment bolster has not been given appropriate thought and this add to around 40% of total improvement expand cost overpower. The objective of this examination is to ensure that advancement authorities recognize and hold quickly to suitable rigging upkeep technique as effective piece of improvement wander efficiency. For appraisal of components a couple surveys has been prepared using this information and coursed between improvement specialists. Purpose of this paper is to abatement downtime, fulfill perfect rigging use and addition era in any event cost.

3. Amir H. B. "Reproduction Based Evaluation Of Fuel Consumption In Heavy Construction Projects By Moniturıng Equipment Idle Times" Proceedings Of The 2013 Winter SimultionConferance R. Pasupathy, S.- H. Kim, A. Tolk, R. Slope, And M. E. Kudl, EDS

From This Paper Refer-

An orderly way to deal with sit without moving time lessening can altogether support the effectiveness of development gear amid their lifetime, result in higher general efficiency, and eventually secure general wellbeing and the earth. Towards this objective, this paper portrays explore gone for outlining a system for evaluating overwhelming gear sit without moving circumstances amid a development extend. A disseminated sensor system is conveyed to impart and exhibit measurements about sit out of gear times and generation rates and educate extend supervisors and field administrators when sit out of gear time limits are surpassed. The composed UI incorporates a graphical portrayal of the site design to imagine the status of hardware continuously in sup-port of venture administration and basic leadership assignments. Gathered information will be

likewise used to decide vitality utilization and CO_2 emanation levels as the venture gains ground. Utilizing reproduction demonstrating, different operational techniques are assessed from the perspective of gear discharge and sit still circumstances.

4. Rickey A. Cook "A Crane and Heavy Equipment Maintenance Plan for Improving Safety And Efficiency" The Graduate College University Of Wisconsin-Stout December 1999

From This Paper Refer-

The target of this survey was to develop a crane and overpowering equipment upkeep prepare for improving prosperity and profitability. XYZ Construction does not have a systematic technique for keeping up its cranes and significant equipment. Their approach to manage equipment upkeep could make threats to authorities and property. This association comprehends the potential for hardship and thinks improving their upkeep plan will help diminish this issue. In order to complete this, the paper used three phases to develop a bolster arrange

5. IliasNaskoudakis "A Thematic Review Of The Main Research On Construction Equipment Over Recent Years" 47(2), PP. 110-118, 2016 DOI: 10.3311/PPAR.10384 Creative Commons Attribution.

From This Paper Refer-

A broad gathering of composing has been committed to look into mulls over on improvement equipment. Various subjects were discussed and analyzed, and distinctive conclusions have been represented. In any case, ask about papers disseminated as for development equipment, are significantly separated, and there is a nonappearance of exact examination and course of action. Consequently, a whole appreciation of the subject is not improbable, nor is the appraisal of any future research bearing. A Meta examination of the latest journal papers focused on improvement contraption would not simply depict the fields the educational research was centered around however would besides reveal potential hole for future research. In the back and forth movement analyze, through an exact review of the educational written work disseminated over the span of the latest decade, fundamentally recognized by methods for online databases, rule investigate subjects, for instance, upgrade, bolster/downtime, productivity, mechanical self-sufficiency and computerization, overseer capacity, improvement, and condition are settled and discussed, with future research headings prescribed. The consequence of this paper will urge future researchers to develop a grouping of learning of progress on improvement equipment and its potential limits and give future research headings on this issue.

6. D.G. Sayings, G. D. Holt And H. Y. Cheok " Construction Industry Problems: The Views Of Uk Construction Directors" Built Environment Research Unit, School Of Engineering And The Built Environment, University Of Wolverhampton, West Midlands, Uk, Wv1 1SB, Uk.

From This Paper Refer-

Taking after a low down composing review, eighteen normal issues going up against the UK improvement industry are perceived. The earnestness of these issues as opnied by experienced UK advancement association officials, overcome a survey audit, is therefore shown. Revelations reveal that the two severest issues are thought to be the poor picture and reputation of the business, lined up with a predominance of 'steers rustler makers'. Design changes are situated third, trailed by late portions, time limitations and reliance on centered offering strategy. In light of these points of view it is endorsed that the business' need should be towards invalidating degenerate firms in the private repair, upkeep and change zone, in this way driving towards the progression of a more master picture. This should be combined with an attempt by all improvement individuals to demolish the current hostile nature of the business. A whole deal fundamental course of action is required if such non particular broad issues are to be tended to sufficiently in the new thousand years.

7. Urmila A Mahadik "Cost Reduction In Construction Project" International Journal Of Engineering Technology, Management And Applied Science www.ijetmas.com September 2015, Volume 3, Special Issue, ISSN 2349-4476

From This Paper Refer-

The improvement wander can vary from to an awesome degree profitable to hardly defended, in spite of all the inconvenience and all over end up costing the legally binding specialist more than what he or she is getting paid to complete it. Being developed industry the purpose of wander control is to ensure the under takings finish on time, inside spending arrangement and achieving other wander works out. Time and cost are two central concerns which increase essentialness of cost diminishment methodologies. Diminishment of cost of improvement is a predictable goal for advancement industry. One strategy for diminishing advancement cost is to make creative developments and furthermore rationalities to grow productivity. This paper deals with sorts of cost, components affecting cost of endeavors and

moreover trade on achievement of adequate results of time and cost by applying cost diminish procedures.

III. METHODOLOGY

In this chapter, a description of how study was conducted is presented. Moreover, a comprehensive discussion about adopted research method and its strategy is also provided.

1. Research philosophy

The philosophical attitude of qualifying any research work mainly based on arguing the methodology that have been adopted for a particular investigation. The decision of selecting one method rather than another will be assessed individually by researcher's vision, ontologically and epistemologically, that often related to the research questions in hand [Phadatare 2016]. The research paradigms referred to conservative philosophical schools, which known as positivism and interpretivism. Both schools have their impacts of constituting the significant evolve of controversial science [NileshAyane 2015].

Positivism is considered the cofounder of epistemological movement, especially inconnection to social science. The pioneers of this philosophy introduced the argumentative that social world exists externally to researcher, and can be measured directly through observation. This statement implicit properties of which researcher must be restricted. Subjectivity, not any more accepted. Instead, objectivity is the new trend that enables scientific research on a logical basis. In addition, the independence of analysis is neither affected nor affects by the subject of the research [NileshAyane 2015].

The achievement of state of art research in accordance to positivism requires clear mechanism and structured method. This methodology facilitates the process of collecting observations and further quantifying them statistically [NileshAyane 2015]. In contrast, interpretivism approached the interrelation between people and their environment. The debate core here contradicts the essence of positivism custom, see table 1. Interpretivism beliefs are based on merging axiomatically entities, the researcher and social world in one mold. The researcher andhis/her social world cannot be separated. For this reason, the criteria of embracing interpretivism values in research work demanding the methods to emphasize on people. For example, the data collection procedure, usually, preferable with qualitative over quantitative data. In this context, the investigator should make interviews to figure out people behavior in a particular phenomenon [Prajeesh 2016].

Table 1. The comparison between positivism and interpretivism

	Positivism	Interpretivism
Reality	Objective, External	Subjective, Internal
Type	Survey, Experimental, Quantitative	Phenomenology, Qualitative
Purpose	Generalize, control	Interpret, Understand

1.1 Research philosophy of this study

The philosophical discourse on the subject of this study has been taken to a large extent the positivism manner, as a base for approaching downtime costing issues in Indian manufacturing companies. Moreover, this study claims the objectivity through investigating topic problem, i.e., information, data, and all types of obtained results were presented as given without any biased subjective influence. According to positivism, any problem must be taken into considerations of numerical assessment and can be realized throughout customizedmeasurement tool. Therefore, this study utilized web-based survey as a tool for collecting data and further creating a database for content analysis. The enumerated analytic techniques such as, descriptive statistic was adopted to discern the central tendency of population. Furthermore, this type of analysis enables to generalize results and spotlights interrelated factors.

Nevertheless, the distinction between positivism and interpretivism and in relation to best research philosophy is quite difficult. They have interchangeable characteristics in which any separate selection may lead to impairment of research quality. In my opinion, they are somehow linked in one way or another but at different levels and their causality based on the nature of matter that under study. Consequently, this relative relationship between those two concepts will be pointed-out during the display of upcoming chapters, for instance while firms calculate their downtime costs. They exclude the cost of planned stoppages as routine that entrenched to mindset and organizational cultural aspects.

2. Research approach

One of the essential crucial elements in research is to specify which method is being applied. There are two wellknown approaches dedicated to research

namely, inductive and deductive. In the inductive approach, the researcher strives for collecting the data that considered relevant to the topic of interest. Then, the next step starts with analyzing these data in purpose of finding patterns, and afterward developing a theory that could interpret such patterns. Hence, if research trending towards the inductive paradigm the driven factors might be attached to set of observations, and indeed must transit from particular experiences to more general set of propositions about those experiences. In a paradox with inductive concepts, deductive approach enforces researcher to start with existing theories and then attempting to tests its inferences with data. In general meaning, deductive characteristics constrained the work procedure to be into scientific investigation category as labelled by positivism. The investigator must review what others have done in the field and that in ease of drawing hypotheses that emerges from studied materials.

2.1 Research approach of this study

The scientific approach of this study is deductive in nature and that because the project idea created after wide review of existing theories. Those reviews are the literatures that associated with downtime cost in production systems. For instance, the proposed methods and models to quantify the downtime cost, the difference between planned and unplanned stops, identification of cost drivers, and the maintenance strategies to increase reliability and thereby minimize downtime cost. The study primarily included articles published in prestigious scientific journals, conference proceedings, books, theses and any other relevant reports that may considered important and fulfill the level of scientific research standards.Afterthought, the step was to formulate research inquiries in the form of research questionsfrom what have been reviewed and then begins with collecting and analyzing the obtained data in order to answer the research questions. Finally, the compiled results and conclusions will either confirm or reject the proposed research hypothesis.

3. Research methods

The best chosen method for gathering data has been disputed between qualitative and quantitative audiences. In general principle, any selected method either quantitative orqualitative based will be considered appropriate as long as it guides the anticipated research. Hence, the nature of given research determines the method that needed to accomplish better results.Qualitative method explores attitudes, behavior and personal vision through interviews orfocus groups. It attempts to obtain opinions from specified participants in which few people take part in the research. In a paradox, quantitative method generates statistics through use of survey accompanied by the assistance of questionnaires. This type of methods reaches many participants, and the contact is much quicker than it is in qualitative.

The main differences between qualitative and quantitative research methods explained into following points:

- Quantitative data collection is more closeended in comparison with qualitative data collection that is based on more open ended.
- Quantitative data analysis used the statistical theories as background; Qualitative data analysis count on text or image analysis.
- Quantitative reporting has a set structure, as it grounded on mathematical elaboration; Qualitative data reporting is more flexible and may contain additional conscientiousness.

3.1 Research method of this study

The study of downtime cost analysis in Indian manufacturing companies required large size of active participants in order to achieve good results. Therefore, a quantitative method based on survey was adopted and considered effective over qualitative because the target is to assimilate many responses in limited duration. Moreover, the acquired data might be easier to standardize in numeric form for later comparison than data obtained through qualitative methods.The choice was not easy though, because topic like downtime cost evaluation it might contain more investigations about human and machine interactions. In other meaning, the qualitative analysis could magnify the problem from different angles. However, the proposed survey wasincluded semi structured questionnaires in which allows participants to present their opinions to some extent.

4. Research strategy

Research strategy defined as the way that relied on logic and set of procedures with the aim of answering research questions in particular. There are many listed strategies used by research work such as, survey, experiment, case study, grounded theory and so on [Urmila A Mahadik 2015]. In spite of the variety of available strategies, this work feasibly implements the survey strategy as a tool for answering research questions. Thus, the following parts introduce only elements that shaped such strategy and omitted others for its unsuitability to this study.

4.1 Internet-based survey

Survey defined as a measurement process through asking questions, and that in the aim of collecting information from selected group of interest to be representative of a larger population. In fact, this procedure known as a sample survey and its importance allows generalizing results even though not the whole population is tested. There are two types of surveys, questionnaire and interview. The questionnaires mainly handed out through different ways, electronically, by asking online questions and by sending private emails or throughout physical distribution by post. On the other hand, the interview associated with face to face meetings or via phone [Tsado 2014].According to Cohen et al., internet based survey is becoming commonplace in many branches of science because of its accessibility of features over other methods. Some of those features can be summarized as following listed points:

- Automated data entry
- Lower costs
- Wider distribution
- Faster turnaround times

4.2 Research strategy of this study

The success of this work required an accurate sample from large existing population. Although, the time and expenditure factors also a paramount concern while planning any survey. For this reason, internet based survey was considered a right choice to get fast responses with high rate participants, in addition to the advantages that arise for both surveyor and contributor by flexible data entry. This method has its positive impacts on the planned budget as well, since there is no much work done manually and no paper work included through distributing questionnaires. In the light of these benefits, the environmental facets have been likewise influenced in a safe manner.

5. Data collection tool - Questionnaire

One of the techniques that commonly used in collecting data is well-defined.

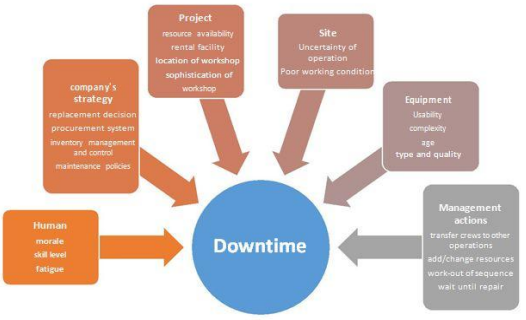

Figure 1. The generic factors and processes that related to Downtime eventSource: Nepal and Park [Mali Pritam 2015]

Downtime occasions are dynamic in nature and however results. Particularly, the downtime that subordinates its events to spontaneous stops, for example, machine breakdown that goes on for developed periods and this machine considered basic in which any characteristic disappointment prompts add up to creation end. In this way, the effect of such occasions are exceptionally serious on the grounds that it disperses the proficiency of the generation procedure, thus make a kind of easygoing circle. For example, once the machine ended up noticeably inaccessible the principal recognizable impact is the asset inaction administrators and gear and along these lines the venture advance (requests satisfaction) log jam in addition to the expanding weight on work routine. In the greatness to this repercussion, the supervisors may ended up noticeably diverted from appropriate control of the circumstance and swing to hurried upkeep. This impedance tends to deliver low nature of upkeep, which on the other hand prompt downtime occasion et cetera, in other significance, making the awful strengthening circle [Mali Pritam 2015]. Another imperative issue is the cost point of view of downtime, as the recurrence of each specified element there is an amassed fetched went with. [Amir H. B. 2013]. Once in a while, the incessant downtime can interfere with the first succession of work.

IV. CONCLUSION

Indian assembling firms know about the potential effects that hardware downtime creates on their item cost and accordingly benefits. Notwithstanding, the effect that stretch out to creation proficiency and adequacy. For instance, this mindfulness shows up clearly while supervisors assess the downtime cost proportion from aggregate assembling cost. Also, the downtime impact on arranged generate on time, downtime hourly cost, and the requirement for social change and attitudes. These progressions meant to incorporate the arranged stoppage taken a toll into their appraisal strategies, "this kind of cost ought not

be ignored". Despite the fact that, the larger part of reviewed organizations (83 %) don't have any efficient model for surveying and following the individual costs that related with arranged and startling stoppages. They legitimize that by the many-sided quality of such models and the time span and noteworthy costs required for usage. For example, the costs that went with preparing and learned individuals. Then again, just couple of organizations receive finish models, for example, action based costing and asset utilization representing measuring downtime costs, yet in low rate of combination, as indicated by poll comes about. Rather, those organizations underscored on the immediate work and lost limit taken a toll as the principle cost related to impromptu stoppage, and calendar upkeep as the primary cost driver for arranged stoppages.

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