



INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

APPLICATION OF PRINCE2 (PROJECTS IN A CONTROLLED ENVIRONMENT) METHODOLOGY ON A COMMERCIAL CONSTRUCTION

AMRAPALI M.VANSHIV

student, ME Construction Engineering Management, T.S.S.M'S Bhivarabai Sawant College of Engineering & Research, Narhe, Pune- 411041,

Prof. R. S. Kognole,

Assistant Professor in Civil Engineering Department, T.S.S.M'S Bhivarabai Sawant College of Engineering & Research, Pune 411041

Abstract:- Commercial construction sector is being looked upon as an important investment gate way in the new millennium. A proper project management approach to handle the immense magnitude of work and innumerable activities involved in such construction works, is the need of the hour. While the PMBOK approach, which is popularly used in Indian construction sector, provides a guideline for managing these projects, still the projects get delayed. The stakeholders are required to face a variety of uncertainties which further affects successful completion of the projects. PRINCE2 (Projects In Controlled Environment) technique is one step improvement over the existing approaches and is widely applied to various sectors in UK. The present work attempts to explore the feasibility of applying PRINCE2 technique to commercial projects in Indian context so as to improve the current state of management. Project success is measured by determining the Knowledge Performance Index (KPI) for an elected commercial project in Pune city. Measures to improve successful completion of the project are suggested through careful analysis of parameters affecting project success, meticulous data collection, key observations on the site, and detailed study of PRINCE2 technique. Implementing these measures will certainly help in delivering the project within the stipulated time while not compromising on the cost and quality aspects.

Index Terms - PRINCE2, PMBOK, Key Performance Indicators (KPI), Project Management, Project Performance index (PPI), Project monitoring and coordination index (PMCI).

I. INTRODUCTION

India is a developing country and the development of every nation depends on its infrastructure, commercial and residential sector, great industrial reforms are taking place and also the demand for the commercial and residential spaces is increasing. The commercial sector is emerging one in which each and every building is different and even though most of the activities related to the more similar still the quality is Compromised and there exists a challenge about the success of the project. Successful project not only mean satisfaction of client but also fulfilling requirements such as of time, quality, cost. Though the government has introduced many reforms like RERA in which the project is scrutinized by the government body and also, they have control over the project but even though it is not enough and there needs to be reform to handle these kinds of project. In this new era the investor are looking at the commercial sector as key investment plan as government has launched many new schemes like make in India and also many foreign investments are taking place in the country and this has changed the quality norms and client requirements in the construction sector.

The project under construction sector are multi-dimensional and since number of activities are being carried out simultaneously, the scope of project is really vast and thus an integrated management approach to manage such projects, so that that the project can be successfully completed in stipulated time and project objectives are met is important. As far as Indian construction industry is concerned the PMBOK methodology has been used for managing the construction projects. In order to carry out the managerial roles there needs to be proper guidelines for these projects. The PMBOK is not a methodology but promotes several key components that a good methodology must contain (Karamitsos et al). Even though there still exists uncertainty, there is a need to reform the Indian construction sector.

Many organizations treat their employees as liability but in real life the true power of an organization lies within its organization and so the employees should be treated as assets rather than liability and focus should be given on making the organization strong(Mchugh & Hogan). Multi-faced problems occur on the site a so the project manager has to face all of them and so for this an integrated management approach is necessary which could be explored using the PRINCE2 (Projects IN a Controlled Environment) methodology. The PRINCE2 methodology has been successfully implemented for completion of many projects in UK. Its application on the project has helped the project to meet its objectives and requirements of client. A controlled environment needs to be created for the project and thus the PRINCE2 approach. A comprehensive study of literature on PMBOK and Prince2 was carried out in this research work and the following inferences were made.

II LITERATURE REVIEW



From the literature it is clear that use of PM methodology increase the chances of project success and also helps in value adding to the organization (shairozenes, 2011). Untrained project manager without the knowledge of PM methodology are unlikely to stay on budget, achieve the quality and goals are compared to certified ones. (Jan de massmekar, 2010). A PMM (Project Management Methodology) should be scalable and should focus on the best practices in industry and also learn from past experience (chin spowage2012). (Mc hugh & Hogan, 2010) concludes that PRINCE2 is a practical approach where as PMBOK is a comprehensive one. They recommended the companies to have an internationally recognized PM (Project Management) methodology because of its benefits in raising the efficiency of an organization. Many researchers have tried to analyze PRINCE2 methodology conceptually as well as the benefits that can be obtained from it. In are search paper by (Rupali Pawar2017) focuses on the 7 principles that define the best practices from the industry, 7 themes that define what needs to be addressed in the project, 7 process define what activities are to be done and by whom. In a research by (stage.IoannisKaramitsos2010) explains the benefits of using the PRINCE2 methodology and after completion of each stage it is checked whether the project objectives are met and according to that the project is taken to next stage. (Kellan dolan 2010) addressed the common causes of the project failure that occur due to improper links between the organization and the PRINCE2 Methodology can be a one-step solution to the problems. In PRINCE2 a special environment is created for the project and it is monitored that the project stays within that environment. Also the methodology focuses on making the organization more strong and learning from our past experiences. PRINCE2 includes all the management areas of PMBOK (ErsinKaraman, Murat Kurt2015). Various different techniques have been used by people to assess the performance of project like PPI (Project Performance Index), PMCI (Project Monitoring and co-ordination index) In order to assess the performance of project the researcher has made the use of KPI (knowledge performance index) in which the various parameters of scope, cost, time, and risk and quality factor have been measured and the project is monitored (Amir Naser Ghanbaripour2017) The PMBOK has been widely used but still the quality is compromised and the success of a project remains a challenge. In order to quantify the effect of specific project management technique we need to first understand what is meant by success of a project.

Many researcher have identified the factors affecting project success with respect to the construction sector. In order to explore the possibility of using PRINCE2 in Indian construction sector we need to analyze the factors affecting the success of any project. (Agnieszka et al, Mariusz et al (2015), Thasenna et al (2017)).

focuses on the 7 principles that define the best practices from the industry, 7 themes that define what needs to be addressed in the project, 7 process define what activities are to be done and by whom. In a research by (stage.IoannisKaramitsos2010) explains the benefits of using the PRINCE2 methodology and after completion of each stage it is checked whether the project objectives are met and according to that the project is taken to next stage. (Kellan dolan 2010) addressed the common causes of the project failure that occur due to improper links between the organization and the PRINCE2. A number of factors/parameters affect the project success.

The various parameters that affect the project delivery in a positive way need to be boosted and the adverse ones need to be controlled. Many researchers have tried to identify specific factors and parameters which affect successful completion of any project. In some of research work an extensive review of literature has been carried out and the factors affecting the project along with their relative importance are listed (Agnieszka et al, Mariusz et al (2015), Thasenna et al (2017)):

1. Underestimated cost / cost overrun
2. Incorrect planning
3. Construction delay
4. Delays in drawings or scope changes
5. Compromised work quality
6. Improper inventory management
7. Financial problems
8. Rework

Although PMBOK has been used to improve project perfect and deliver it successfully there still exists uncertainty. The PRINCE2 methodology is an improvement and has been widely used by the UK government in many projects. The application of PRINCE2 methodology in Indian commercial sector is rarely seen. The present work attempts to apply this methodology in Indian commercial construction sector. A case study has been selected and based on that the PPI to analyze the performance of project is calculated and based on the methodology measures have been recommended based on the methodology.

III RESEARCH OBJECTIVES AND METHODOLOGY

- To identify the major factors affecting the successful delivery of construction projects.
- Understanding the PRINCE2 methodology.
- Estimating the time, cost, and scope delay.
- Analyzing the project performance based on PPI (Project Performance Index) and PMCI (Project Monitoring and Co-ordination Index)
- Comparative analysis of the existing methodology and PRINCE2 methodology and recommending the effective measures to increase the PPI in order to improve project performance and its delivery.

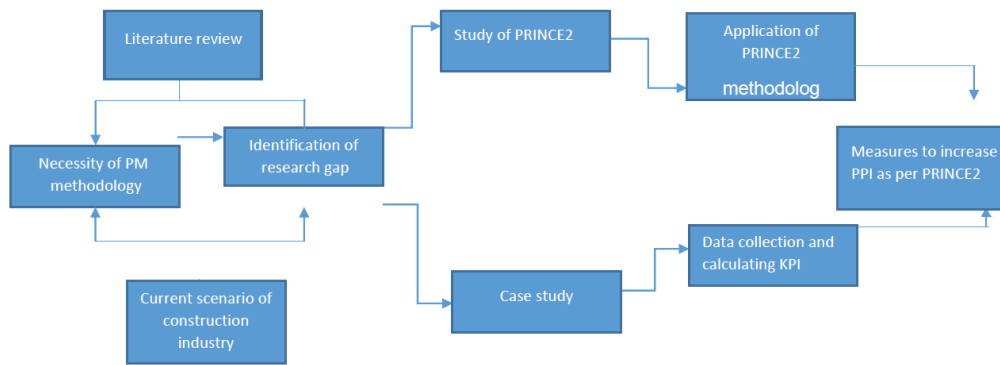


Figure 1. Flow diagram of research methodology.

The factors affecting the project delivery have been studied from the literature and based on that observations are made. To assess the suitability of the methodology a commercial project in Pune city has been undertaken and the project delivery success factors are calculated. Different technique such as field observation, collection of authentic documents, Personal interviews and also form survey, the data is collected .Existing data of project completion is based on the conventional PM technique used on site. This data is analyzed, quantified and a comparative analysis of this data is done against completed and the planned work in terms of scope, cost, time, quality, and the risk expected. The recommendation are made based onthePRINCE2 methodology.

IV CONCEPTUAL MODEL OF PRINCE2

The PRINCE2 model consists of 7 Themes, 7 Principles and 7 Process. The 7 Principles are the best practices from the industry, the theme represent what needs to be addressed in the project continuously, and the process define when and what needs to be done and who is responsible for carrying the activities. This method talks about learning from the past,it has been seen that the project manager is the person who has Starting up a project(SU)is the first stage in the Pre- project phase in which whether the project is worth doing or not (i.e. desirable, viable and achievable) is checked. It has a shorter duration compared to the rest of timescale of the project. After this stage, the Initiating project phase occurs in which the important strategy documents regarding Quality, Risk, Communication and Safety are made and they are kept as a standard in each and every stage. Identify the Quality requirements from the client's point of view and also make a risk management strategy with the help of risk register (It has all the past and possible risks that could arise and possible remedial measures to mitigate them are described) which has all the risks ranked in order of its probability and impact. Also, the sequence of the activities are decided, the manpower and the materials requirements are understood and accordingly the materials are procured. After all this has been thoroughly studied in the execution phase there is a controlling stage in which the project manager does most of his day to day work which means allocating work to all employees and continuously reviewing the stage i.e. comparing planned VS actual schedule .Also, examine if any risks handled a lot of project or a person with a vast experience and the methodology states that by making a register of all the past problems that have occurred on the site, possible measures could be applied at the start of project to over come any future problems. The product that is expected from the team is made very much clear by this method. The PRINCE2 methodology suggests dividing the work into small manageable pieces and into different parts. The whole project is divided into 4phase i.e. Pre-project, Initiation, Execution stage and closure stage.

Have occurred and then take corrective measures to escalate them. In directing project(DP)stage, various quality meetings and reviews are done and the team is made aware of the quality requirements of the client and also help from various experts to guide the team into inculcating various quality and safety aspects into the project and help in rectifying the defects if any. In managing product (MP) is the stage where the work package are allocated to each and every task and at the end of each stage the work packages are checked against the ones planned in the beginning. After end of every stage the reports are presented to the board of directs and it's feasibility is checked whether the projects is still worth doing or not if yes then a go is given to the team and if not various measures are suggested so that the problem can be escalated and the work is again resumed smoothly. The last stage or closing stage is the one in which the project closes, the expected returns are compared with the planned ones and so are various risks that have been occurred are noted and used for the further task if any might occur. All the documents are handed over to the director and after their approval the project is closed.

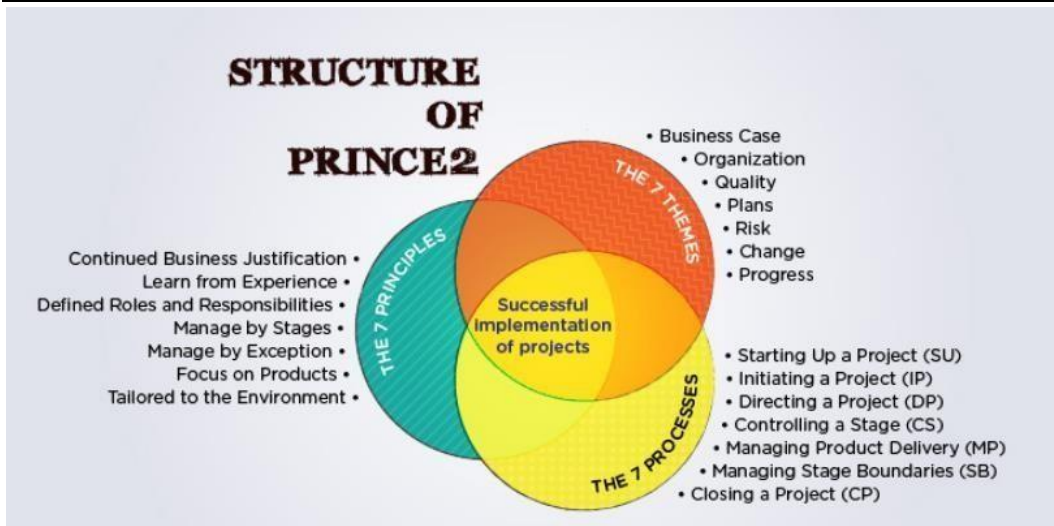


Figure 2- Conceptual model of PRINCE2

V CASE STUDY

A Basic information

- Identified project – ‘S’ at Hingne
 - Type of building- Commercial building. 17 storied building (G+16 with one basementb1)
 - Total Area of project-1,004,200sq.ft.
 - Start date of project- 5th October2020.
 - Planned finish date -30thNovember 2022.
 - Cost of project –42.5cr
 - The scope of project includes only construction of RCC frame work for the building.
- The land on which the work is to be done has been excavated by the client and also water proofing has been done by client.

B. Problem observed on the site

- Entry and exit ramps not proper and so danger of accidents
- Higher underground water table
- Unstable soil mass leading to collapse
- Raft breakage leading to water percolation
- Not enough space for movement heavy vehicle
- Material wastage as it is stored near the road thus leading to wastage
- Scope change

C. Data collection and analysis

1. *Data procured from the site:*

In order to meet the requirements of project, the data that has been collected is Good for Construction (GFC) drawings, the Bill of Quantities (BOQ), the schedule with baseline and tracking, Minutes of meeting (MOM), 1standard operating procedure (SOP) of quality and risk and also the quality review report of the site. The project has been tracked in the month of December According to the researcher whatever has been shown in the GFC drawings has to be achieved for the successful completion of project and so it is defined as the scope of the project.

Expected value	Actual value
Scope of project- 15%	Scope of project-12.6%

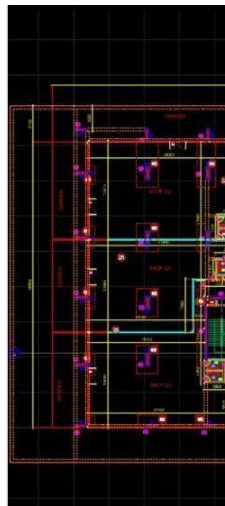


Figure 3- GFC drawing of the building

Also the time parameter has been measured using the detailed schedule of the work. The cost parameter has been identified using the BOQ and also the cash flow reports generated. The quality has been measured as Per the quality review report and also by MOM. Risk has been identified based on the challenges and as per the NC (non- conformance) being generated.

Item of work	Quantum as compared to total work
Approvals from authorities and site mobilization	Constitutes 5% of total work
Plumb concrete	3%
Raft	3%
Footing	5%
RCC work	85% (approx. 5% for each floor i.e. 1% for each pour)

Table 1- Item of work and its quantum to total work.

VI Data analysis Quality comparison

In order to rate the quality of work 6 sigma technique has been used in order to rate the quality of Work

1. RCC work

The major portion of work where quality needed to be Maintained is the RCC work and the total amount of RCC for the pour 1 and 1A which is under study is about 102.6m³ out of which a defective work is about 5.7m³ and 6.7m³ has been considered as possible wastage.

$$\% \text{defective work in terms of RCC} = \frac{6.7m^3}{102.6m^3} = 6.53\% \text{ of defective work observed.}$$

The above work is executed at 3 sigma level.

2.NC generation

Also in the month of January a total of 12 NC been generated for quality and 3 for safety out of which none of them have been closed. Loss of slurry in the column has been observed and also the slurry is sometimes dumped on the formwork leading to possible wastages.

$$\% \text{defective work} = \frac{\text{No of non-conformities}}{\text{total no of frequencies}} * 100$$

$$= \frac{12}{92} * 100$$

$$\% \text{defective work} = 13\%$$

So the above item is executed at sigma 2.5 level

1. Concrete cube strength:

Also the number of cubes casted so far there none of them has been found as defective one, in fact the 70% of the strength was achieved on the 5th day itself. So they are executed at 5 sigma level.

2. Material quality:

$$\text{And also from the steel testing the number of steel bars tested to the no of defective ones} = \frac{0}{3} * 100$$

None have been found defective so it can be concluded that the material is of good quality.

Which is executed at 5 sigma level?

Schedule of project- 96	Schedule of project- 118 days
Cost of project- 26.34%	Cost of project- 27.12%

Table 2- Comparison of the expected and planned values.

Project performance is based on key performance indicators (KPIs). The KPI are measurable and used to determine PPI. The PRINCE2 suggest 6 parameters that should be considered for any project and based on those the KPI have been identified and used. The KPI that have been identified are scope, time, cost, risk, quality and benefits
PMCI (project monitoring and coordinating index)

$$= \frac{\text{total no of Nc generated}}{\text{total Nc resolved}}$$

$$= 5/15=0.33$$

It can be said that the project is averagely monitored as very few NC are being closed but the work is satisfactorily carried out
Project delivery success ((PDS)) = $\frac{3 \times 3}{CTR}$(Ghanbaripour A N 2017)

Where *s* = scope, *C* = cost, *T*= time, *R*= risk, *QF*= quality factor

$$PPI = \frac{\left\{ \left(\frac{12.6}{15} \right)^3 * \left(\frac{4.5}{6} \right) \right\}}{\left\{ \left(\frac{118}{96} \right) * \left(\frac{27.12}{26.84} \right) * 0.30 \right\}}$$

PPI = 1.18 In this case the value of PPI >1 then the project is said to be success in view of researcher and when the ratio is <1 then the project is considered as a failure.

VII Discussion

The project mandate which is the part of the project brief is the trigger to start the project and has all the scope and the requirements of the client. The project manager also maintains daily dairy in which he keeps a record of discussions, comments from stakeholders for future reference.

PRINCE2 mainly focuses on the learning from the past so the information about technique used before and all the vendors that are involved and also the reason for possible failure of project needs to be identified and accordingly a lesson log has been prepared. The roles of the team and the PM have been correctly defined and a document has been prepared stating the same. Decision related to the type of work to be done and the methodology to be applied has been identified at the start and thus it was decided to make the use of jump-form technique for casting of lift panels and also in order to save time the Peri- formwork has been clubbed together as per the dimension of the column and so that the productivity could be increased.

The steel has been provided by the client and only 3% has been allowed as the possible wastages and so a special bar bending schedule has prepared in which the cutting length of the bars is arranged in such away to have minimum wastage.

In order to save time and cost of steel couplers have been used whose cost is not included in the tender, but to save time and cost they are being used.

Plum concrete which composes of 60% of stones and 40% concrete has been used instead of Plain cement concrete (PCC) for surface leveling. This was decided later as lots of stones were discovered at time of excavation, thus reducing the cost. The continuous water percolation form the ground was a great challenge and so by inserting precast pipes the running water was collected and used for concreting and also can be used in the life phase of building.

Delays occur due to late drawing and delay in material. In a survey conducted many people have stated improper communication as major reason for delays. For effective management a communication mail system has been adopted and also walkie talkie has been given to all the employees but still delays occur. Also scope changes have led to delays and rework. It has been observed that due to delay in communication some work already has been progressed as the execution team wasn't aware about the change. The labour productivity has been calculated by amount of work done by labour in 1 month and accordingly the work has been scheduled. To cope with the project speed the formwork has been clubbed together and then used so that the labour cost is saved. After carrying out the extensive study of the existing methodology and determining the project success by calculating the PPI which is way of monitoring the project success and PMCI which tells about how concerned the management is about the issues/problems and NC. But lesser PMCI does not mean that the management is not concerned about the issues. It has been observed that even the PMCI value is low the work is excellently carried out and even the stakeholders are happy.

The project mandate is made at the start of the project which focuses on the cost required for the project and according to that the feasibility of the project is determined and at the later stage documents related to quality, cost , scope are added to it. Also a risk register is prepared for all the activities addressing the risk and possible solution to mitigate them. The quality expectation form all the parties involved are undertaken and work is carried out efficiently. By setting objectives such as minimum number of NC

generation, increasing the overall vendor pool, minimum wastage etc and by forming a committee dedicated to these work can be made.

By conducting mock drill every quarterly and setting budget for safety, the safety can be improved At the time of concreting the RMC truck was stuck in the soil and thus the entire concrete to be carried using another truck. The problem of such was forecasted before, had the necessary precautionary measured been applied at the start, the problem wouldn't have occurred.

VIII. CONCLUSION:

Many project management methodologies are available and selecting the one which suits the organization is important as the strength of any methodology lies in how does the organization implement the methodology and how concerned is the management about adapting new techniques. As far as Indian sector is concerned PMBOK has been widely used still uncertainties exist. The PRINCE2 methodology is one step improvement and has been widely used in other countries for successful project completion. The present study tries to implement the PRINCE2 methodology in Indian commercial construction sector in pune to improve the project performance. The PRINCE2 methodology talks about management by exception in which the project can still be managed even if parameters of time, costs and scope escalate.

The PRINCE2 methodology was studied in detail and the problems occurred on the site were studied. The PPI was measured and compared as per the planned cost, time, scope and quality and recommendations are made based on the methodology to increase the project performance.

NC is a major factor affecting the project success and thus they need to be resolved. It was observed that a number of NC was raised but the work was carried out effectively and the project is performing. The PRINCE2 technique recommends that a possible remedial measure can be suggested at the time of raising the NC so that it can be closed and the defect could be resolved. It is further proposed that weekly or fortnightly review of the NC should be carried out so as to avoid duplication of such errors in the future. And finally a risk register should be included on the site which would contain all these details so that it will not affect the project completion.

Delays in drawings and their approvals affect The project delivery due to lack of communication between the stakeholders and the office staff and the execution team could possibly be tackled by keeping a perfect communication strategy and having a short meeting in the morning to highlight the daily objectives and proper allocation of target. Cost escalation is major factor affecting the project success and doing things right the first time should be the goal of the organization. The methodology suggest that by understanding the quality requirements from the clients side the work could be modified so as to meet the clients requirements. Concrete constitutes the major amount of work and also a lot of cost is included, the excess concrete after the work is completed could be made into blocks which could be used for labour hutment etc .and by appropriately measuring the quantity of material needed the concrete could be produced. Also the concrete could be used for shot cretin so that the falling soil could be retained thus saving the cost.

Many problems arise on site due to rework and bad quality which could be addressed by carrying out a root cause analysis. Based on the data and the observation made on the site, the cost gets escalated due to rework. It is observed that major defects arise when concreting work is carried out during night so by deploying more work force and carrying out the concreting in easy shifts the problems could be avoided.

The risk register can be modified and the focus should be given on maintaining a diary of all the issues and disputes. A possible solution could be found out by brainstorming thus making sure that similar problems don't arise in future again.

Also in PRINCE2 the procurement management is not being covered but the problem could be addressed by making a pool of vendor from the past project and rating them arterial quality and thus they arterial could be procured accordingly. Based on analysis of PRINCE2 method and the problems faced currently by the construction sector in India it can be said that the application of PRINCE2 methodology is likely to increase the project performance which will lead to successful completion of project in parameters of time, cost ,scope, and quality .Careful observation on the site and discussion with the working staff to find an appropriate solution to boost the project performance have been stated and its application helps in increasing the perform.

IX ACKNOWLEDGEMENT

I, a student of ME, Construction Management under T.S.S.M'S Bhivarabai Sawant College of Engineering & Research, Nahre, Pune- 411041, am bringing to your notice that this work is completely my own work and not being copied from anywhere else.

I am highly obliged and grateful to all those who have helped me in the development of this document and encouraged me to go ahead with my research work.

IT is my pleasure to present this paper entitled "Application of PRINCE2 (Projects IN a Controlled Environment) methodology on a commercial construction project". Since the time I started

Working on this topic I had to acquire knowledge by reading different journals and from World Wide Web.

I thank our respected principal, Dr. G .A. Hinge for providing a wonderful learning along with the necessary research atmosphere.

I also thank our respected Program Head, Dr R.S. Karale for supporting me. Last but not the least I would like to thank all the web communities and paper publication which helped in preparation of this article.

I take this opportunity to thank my respected ME project guide and coauthor of this research paper Prof. R.S. Kognole without whose constant support, guidance and encouragement, this endeavor wouldn't have been possible.

X REFERANCES

- [1] Ioannis, K., and Charalampos, A., (2010) "Benefits Management Process Complements Other Project Management Methodologies" SciRPsept.
- [2] Mc Hugh, O., and Hogan, M., "Investigating the rationale for adopting an internationally- recognized project management Methodology in Ireland:The view of the project manager", International Journal of Project management, Elsevier, Vol.1.No. 1240.Pp.10,
- [4] Rozenes, Sh., (2011) "The Impact of Project Management Methodologies on Project Performance", Rupp in Academic Center, International Journal of Information Technology Project Management, Vol.2, No.2, pp.64-73.
- [5] Messemaeker, J., (2010) "Adoption of structured project management methodologies: a project manager's gain? " Vrije Universiteit Brussel.
- [6] Chin, C.M.M., and Spowage, A.C., (2010) "Defining & Classifying Project Management Methodologies" PM World Today, Vol.7,No.5.
- [7] Pawar, R., and Mahajan, k., (2017). "Benefits and Issues in Managing Project by PRINCE2 Methodology" IJARCSSE Volume 7, Issue 3, March 2017.
- [8] Ioannis, K., Charalampos, A., Moteb, B.,"Benefits Management Process Complements Other Project Management Methodologies
- [9] Dolan,K.,(2010)"Addressing Project Failure through PRINCE2"
- [10]Karaman, E., and Murat, K., (2015) "Comparison of project management methodologies: prince 2versus PMBOK for it projects" IJASER Vol. 4, Issue4.
- [11]Ghanbaripor, A., and Craig, L., (2017) "Implementation of 3D Integration Model for Project Delivery Success: Case study"ASCE
- [12]Dziadosza, A., Mariusz, R., (2015) "Risk analysis in construction project - chosen methods".ELSEVIER
- [13]Thaseena, T., and Vishnu, K., (2017). "Analysis of cost overrun in highway construction projects using multi regression and artificial neuralnetwork"
- [14]Frank, T., et al., (2010). "The PRINCE2 Training manual "version1

