How to Improve the Process for Collecting Data

In Construction

Projects

By

Andres Delsol

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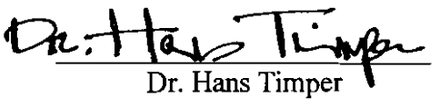

Dr. Hans Timper

The Graduate School

University of Wisconsin-Stout

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The Graduate School
University of Wisconsin-Stout
Menomonie, WI

Author: **Delsol, Andres J.**

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ABSTRACT

The objective of this study was to find an accurate project control process for data collection that could provide realistic bases for performance measurements within construction projects.

Literature review included all relevant information about the standardization of codes and titles of requirements, products and activities in the construction industry; it also explained the data collection process for productivity measurements and key positions involved.

Project control assists project management in:

1. Providing tools to make decisions on corrective actions in a timely manner
2. Mitigating risks by forecasting what is unforeseen
3. Evaluating performance

4. Completing projects on time and on budget.

The researcher gathered information from managers of three companies: Bayer Technology Services, Superior Engineering, and Superior Construction. These managers explained their practices on project measurements and plans to overcome adversities.

This study did not prove what the most accurate process for data collection was, but it did reveal how managers' decisions are based on performance measurements according to the information collected on field records. There is a clear need for new systems that can be sustainable and reliable when measuring progress. The final recommendation for this field problem investigation is that a future study be conducted to further collection data to achieve accurate project control.

The Graduate School

University of Wisconsin Stout

Menomonie, WI

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Chapter I: Introduction

In terms of project control, construction projects are divided in four phases. The first phase (Phase I) is the bidding phase. During this period construction companies estimate all the resources and costs related to the project in order to bid for it.

The second phase (Phase II) is the preplanning phase; it starts after the project contract has been awarded to the company. Contractors take turnover meetings to share information and contribute to the most productive approach for the project. They prepare a detailed schedule and tracking system. During this phase a job site layout is evolved to identify the appropriate location of every element needed on site such as, field office, storage areas and temporary facilities.

The third phase (Phase III) is the construction period; this is where the actual project becomes a reality. It is also known as the implementation phase, where a project undergoes the highest level of activity, contractors commit to the plan, monitor and track progress, and perform status reports. During this period, Construction Managers have two major duties: monitoring and controlling. To monitor performance, they must check labor and equipment productivity, and update project documentation, schedule and job costs reports. The controlling duty focuses on the direct and indirect costs of the project.

Closeout is the fourth (Phase IV) and the last phase of construction development, and refers to the successful accomplishment of the project. This is when an evaluation and a process of acceptance, between the owner of the venture and the contractor take place.

This study will focus on the third phase (Construction Period). The center of attention will be on the project and cost control, and more specifically, on how data is being collected for cost control reports in order to calculate productivity rates.

Statement of the Problem

Because of the complex nature of its process, it is difficult to accurately evaluate the profitability within a construction project. Information always changes during phase III (Construction period); there is, usually, a diversity of document transmissions with different revisions (Hernandez, 2001).

Recording information is essential for budgeting, for ongoing projects and new projects proposal. Estimations are based on project historic rates of performance and productivity (Hernandez, 2001).

A lack of reliability and support of the project's record can bring an inaccurate result on the calculation of productivity rates, and a wrong projection of the total final man hours to complete each activity. These incorrect outcomes could make Project Managers take wrong decisions.

Construction firms could have a decrease in profits during a project, or even lose money if there are:

a) Inaccurate low productivity rate calculations: Project Managers might request an increase in workforce, or equipment, in order to complete work on time, having the company waste more money on resources that they did not need.

b) Excessive high productivity rate calculations: This outcome can limit Project Managers for acknowledging that there is a boost performance requirement, making the company waste valuable time towards the accomplishment of the project's set objectives.

This study will review several problems that may disorient information or make it unreliable when manpower facts are being collected on a daily time card as follows:

1. People (Workers, Foremen, Superintendents, Supervisors, Field Engineers, etc) make mistakes when filling in daily time cards and time sheet reports.
2. Tracking and control becomes complicated when there is a diversity of jobs and tasks for a single individual to perform.

Scope of the Study

Construction companies provide diverse services in different areas like Industrial, Building and Infrastructure. Some of the services can be Architectural, Engineering, Environment, Health and Safety, Consulting, Self-Performed Construction, Project Management and Technology.

Firms in the construction industry can be differentiated by their market category; these are some of them:

1. Design Firm
2. Contractor
3. Construction Management Firm

4. Program Manager Firm

This study will be centered on "Construction Projects", working with firms of some market categories that are willing to share their experience and information, with the purpose of analyzing it and comparing their Field Records, collecting methods, and finding their weaknesses and strengths for productivity rate calculation.

Outcome of the Problem

Construction projects require that companies comprise a faithful mechanism and provide a well trained job site team in order to get the right field records into their project control system.

These are some questions to answer as follows:

1. What tool or mechanism do companies use to collect and control manpower data for their Field Records?
2. Are their "Field Records" accurate and correctly supported?

The main goal to accomplish is to create a friendly and versatile mechanism that improves the procedure of collecting precise manpower data, which can be used to calculate real productivity rates and estimate the correct total final man-hours to complete each activity.

Chapter II: Literature Review

Positions Involved in the Data Collection Process

It is important to identify all management function position involved with the process of collecting productivity data.

In a project management team, there are (Brayton, 2005):

1. Project Manager: His or her major responsibility is to complete and set objectives for the project according to the contract, in terms of on time and costs. Their principal duties are allocated on the overall management of the project.
2. Construction Managers and Superintendents: Their responsibility is to plan and schedule the site resources (materials, equipment, workforce and subcontractors) in order to have efficient activities and generate profit. They must supervise and coordinate foremen's daily activities.
3. Supervisors: They are crew leaders, responsible for providing instructions for skilled craftsmen and apprentices.
4. Field Engineers: They assist the superintendent by providing solutions and overcoming possible engineering-related problems.
5. Planning and Scheduling Engineers: They pool all the data received from the job site to build periodic forecasts of procurement and construction activities.

6. Cost Engineers: They gather and compare all the field data to analyze and forecast the final cost of the project upon completion.
7. Estimators: They calculate overhead costs, evaluate their subcontractor bid proposals and generate the pricing of the company.

Data Collection Process for Productivity Measurements Purposes

Field information or "Field Records" are required to calculate and track payroll, performance, productivity rates and completed percentage of every work activity in the site of the project. This data collection begins from the "Daily Time Cards" of the workforce, within the associated cost code and work description, identifying the hours each employee worked. This information is collected by supervisors and foremen (Brayton, 2005).

Daily time cards are needed for two major reasons; first is to generate payroll and second is to create an "Earned Hour Report". This report provides the amount of work that has had been executed during a certain period; and it's an appropriate document used to track productivity and forecast the total final man hours to complete each activity. This report consists on comparing the actual hours expended to the budget work hours, and could be based on daily or weekly activities. This type of report helps Construction Managers and Superintendents make decisions on the site in order to ensure productivity rates (Brayton, 2005).

CSI MasterFormat

Concept

In the first half of the twentieth century, construction technology became more complex. New materials, conveying electrical and mechanical systems were developed; bringing more specifications that demand additional methods and identification. After World War II, and with the growing competitive market in construction companies, the processes of controlling and organizing specifications were becoming a real problem for the industry. This was one of the reasons why in 1948, The Construction Specification Institute (CSI) was formed, to solve the problem of specifications diversity, and standardize the information into a common format (Rosen & Regener, 2005).

After several changes on the format from 1960 to 1975 "in 1978 the Construction Specification Canada (CSC) joined with CSI to produce the first edition of MasterFormat" (Brayton, 2005). It is a master directory of codes and titles of requirements, products, and activities in the construction industry.

The main purpose of MasterFormat is to organize the information and deliver the best communication among all parties involved in a construction project. This standard information ensures the understanding among architects, engineers, contractors and suppliers, helping them to meet all the requirements, timelines and budgets from the building owner. Although there is a new edition (MasterFormat 2004), some construction firms still use the older edition (MasterFormat 1995).

Changes are not relevant in this study so it will refer to either or both (Rosen & Regener, 2005, CSI & CSC, 2004).

Divisions

The most important concept of these divisions is that everyone involved in the project will identify all the information with the same codes.

The MasterFormat 1995 edition contains 16 divisions and uses five digit numbers with two levels to describe the activities; the first two digits represent the division number (Section headings of activities, or level one) and the rest symbolizes gradually the classification scope of the division (specific detail activity, or level two).

The MasterFormat 2004 edition provides 50 divisions using six digit numbers with three levels to describe the activities; the first two digits still represent the division number, but the next two pair of numbers defines level two and three. If necessary, a level four is added for more detailed information, it can be attached at the end of the six digits number with a "dot". (Rosen & Regener, 2005, CSI & CSC, 2004).

Project Documentation

Construction companies usually operate with two functional offices, front-offices and a back-office. Front offices are on each site of the multiple parallel projects that a construction firm is working on; they are responsible for the

construction project execution, while the back-office is responsible for accounting, engineering, contracting, and other procurement functions. Information is valuable for decision making, and must be recorded and shared between these two offices by accurate project documentation (Shi & Halpin 2003).

These are the most common documents that must be tracked in a construction project for productivity measurements purposes (Brayton 2005):

- *Daily Job Diary:* Is created by supervisors or foremen after daily supervision of the construction site accounting each day's activities, labor, equipment work hours spent and material quantities. This document also records conversations about conflicts within crew coordination; technical problems like changes in drawings, specifications or construction problems and their solutions. Safety recommendations involving subcontractors, suppliers, or the architect, are as well described too; it explains the potential hazards and plan of action. Daily Job Diaries can be used as admissible evidence for possible disputes and claims between the parties involved in the project (Owner, Architect, Engineer, Contractor, Subcontractors, and Suppliers); it is important to sign every daily entry indicating job title and date.

- *Daily Construction Report:* Is created by superintendents accounting each day activities. This document is used to share site project information with the back-office; it provides weather conditions, tasks completed and in progress,

amount of people working at site, materials used and received, equipment at site ,visitors and meetings

- *Job Site Records:* These are groups of records collected on site (front-office) and sent to the home office (back-office). This information is needed for tracking progress and project control; it allows payroll calculations, productivity rates and percentage to complete. These records are also used to compare actual progress with planned progress estimated on the project schedule. It could be organized in these subgroups:
    A. Construction Report
    B. Job Diary
    C. Time Cards

Software for Construction Business Management

People from research and development (R&D) at information technology (IT) firms are in continuous improvement and innovation, providing the market with several construction management programs. Currently there is a wide scope of IT products for all the industries with an extended diversity of choices and applications, making it a challenge to choose the right program; taking into consideration if it could fit in the company organization, and its effect on boosting productivity and enhancing competitive advantage. How accurate is the

implementation phase of a chosen IT package is also an important concern; it is a risky period because it could deeply affect the company's operations performance.

The construction industry has several areas where innovations have made improvements; there are new materials that make structures lighter, with better usage performance, more resistance for weather conditions phenomena such as hurricanes & earthquakes, and lower environmental impact (like green construction).

Innovation has also advanced with latest techniques and equipments that shorten costs and time on projects, but one of the most important improvements is within construction and project management.

New trends on gathering information have changed the managerial minds, forcing them to look for a better approach on IT, for accounting and cost control purposes within a lifecycle of a construction project.

Among several alternatives, this study will explain specific software, which is based on roots similar to Enterprise Resource Planning (ERP) systems.

Enterprise Resource Planning:

Enterprise Resource Planning (ERP) system is not just a common software; "It is the information technology (IT) backbone of the corporate infrastructure" (Bechler 1997). The creation of ERP systems came as a result of the production-oriented system, integrating financial, procurement, human resources and other applications, in order to boost management within all business operations across

the enterprise (Shi & Halpin 2003). The origins of Enterprise Resource Planning (ERP) came from manufacturing and production planning systems (Fitzgerald 1992). Frequently, IT projects have disappointed on meeting business value and return of investment leading to a frustration question on "What more can be done?" (Bennett 2007).

Implementing an ERP system requires reengineering of the corporate strategies and capital investment (Shi & Halpin 2003). Companies usually make mistakes when they try to implement an ERP system that will improve their operations, and give practical warnings to reduce the risks on implementing it. Technical, operational and legal considerations are the three mayor categories to ensure success on the implementation phase (Grossman & Walsh 2004).

In time of recessions, construction companies can raise new competitive advantages, improving their performance and redefining their business. To guarantee success; solutions can be found on their management and on how they implement their continuous improvements; not only on the culture of their corporation or leadership practice, but also on innovative IT applicable within their business. Effective business management software, like ERP or customer relationship management (CRM), could be a great approach for timely and insightful business decisions (Microsoft Dynamics 2008).

Professional Service Automation:

Because of the complexity of the construction industry, it had been difficult to implement and have benefits from ERP software for "Architecture, Engineering and Contractor" (A/E/C) firms. To meet all their needs of information technology (IT), software companies developed a new tool called "Professional Services Application" (PSA) (Hernandez 2001).

In order to fulfill the IT demands of the construction industry, this software provides applications in customer relationship management, project planning, employee time and expense reporting, and human-resource management. The project planning module could be able do automation for evaluating, budgeting and balancing project allocations, providing an automatic forecast of work hours and costs (Hernandez 2001).

Construction Enterprise Resource Planning:

Repetitive model is one of the most important characteristics of Lean Manufacturing. Simple supply chain spreadsheets are not enough when there is a thorough production configuration and complex supply operations. That is why ERP becomes a great tool, when lean manufacturing requires more development; it facilitates the forecasting of every need and resource to overcome any difficulty, allowing being more efficient, saving time on gathering information, making it more accessible to any individual that needs it (Bartholomew 2006).

To understand how similar Construction and Lean Manufacturing are, it is important to define these two industries. First, Construction could be well defined as "The process of transforming materials and permanent equipment into finished facility" (Peurifoy 1996); and Lean Manufacturing is the process of producing services and products eliminating all the waste, at the lowest operational cost and optimum inventory level (Rooney 2005).

The manufacturing industry developed their own mass production method of Lean Manufacturing and created effective systems like "Manufacturing Resource Planning" (MRP) and ERP, allowing higher productivity and more efficiency into their business.

As the manufacturing industry, the construction community forces researchers to develop their own science platform for the sustainability of the industry; for that reason "Construction Enterprise Resource Planning (CERP) systems need to be studied and developed" (Shi & Halpin 2003). As ERP, CERP should have basic principles to be useful for construction operations.

Shi and Halpin (2003), describe the basic fundaments for CERP as:

1. Project Oriented: Each project must be a final product complying with time according to its budget.
2. Integrated: Usually construction companies have two types of functional offices; first, the front-offices involved with estimating costs and operations (construction project execution); and second, the back-offices responsible for accounting, engineering, contracting, and other

procurement functions. These two functional offices depend on one another, sharing valuable information and interacting on decision making for ongoing projects or for pursuing new ones.

3. Paralleled and distributed: Companies in the construction business generally have numerous offices with several managers, working concurrently so the system must fulfill multiples tasks and requests, functioning at the same time.
4. Open and expandable: There are multiple types of software with several applications for different needs. For engineering, there are softwares like Autocad or Revit; for scheduling and cost control there are Primavera P6, Sure Track, or Microsoft Project; and for estimating there is Timberline; so it is imperative that the system interacts with all these applications.
5. Scalable: As it was stated before, the implementation phase is a risky period that could affect operation performance. This phase could be the key to ensure the success on boosting productivity, and also it could be a platform to allow growth within a company. Construction companies must start on the accounting and project management department and then move forward, step-by-step, on the other different areas, allowing new users into the system, in that way failure can be controlled. CERP should be implemented as an ERP system with a "Proven Path"; this methodology consists on a sequence of steps that ensures successful implementation; it

integrates three main elements: people, data and computer (Wallace, 2001).

6. Remotely accessible: In general, sites are far away from the head offices; a remote accessibility allows managers to follow up and track any information needed in a better way.
7. Transparent: It is difficult to change peoples' work habits within the industry; this is one of the reasons why the system should be friendly and easy to understand; there must be a self-explanatory mechanism in order to capture user's interest and enhance their involvement in the system.
8. Reliable and Robust: The system must ensure that the data is accurate and well supported. Information could be used for several purposes; one of the most important requirements is for decision making support. For example, data can be used for estimating new projects based on past performance records; with an unreliable history, estimators could have a lack of productivity rates, making project managers unable to reach their expectations about project performances and forcing them to make wrong decisions.

Microsoft Dynamics GP Advanced Management:

In this new era of IT competition the best adaptable, accurate and easy to use and implement software is Microsoft. It offers the best competitive advantage above other ERP vendors. For the past decade, people became used to their Windows systems (Microsoft Excel spread sheets, Microsoft Project, and so

forth); so it could be friendlier for new ERP system users; especially in the construction industry where it is difficult to introduce innovation and make changes in people's working habits.

The growing complexities of supply chain management, and the diversity of global suppliers and contract manufacturers, are increasing the global market for ERP. SAP leads the chart of the "Top 20" with 735 millions in revenues on 2006; leaving Microsoft in number 15 on the chart with 72 millions (Trebilcock 2007).

Microsoft developed their ERP products with Microsoft Dynamics GP Advanced Management. This system was created in order to have a better relation "between business process automation and the way people really work" (Microsoft Dynamics GP 2007).

Some of the biggest assets that this system owns are the easy integration with Microsoft Office system applications and the facility on sending documents through Office Outlook. Tracking and routing can be done through their "Office SharePoint Server 2007", allowing people to search and recover data within their system (Microsoft Dynamics GP 2007).

Microsoft also developed a "Business Portal" for Microsoft Dynamics; it is a centralized web-based portal that facilitates even more integration between different areas, allowing information-sharing by "Windows SharePoint Services", with a security-enhanced extranet operation (Microsoft Dynamics GP 2007).

AccuBuild Construction Software:

AccuBuild is an integrated construction accounting software developed in 1987. With this package, project and construction managers are able to access work-in-progress schedules and detailed reports; they can also keep track of changes in orders. Payrolls can be processed with any union requirement, or other unique situation. It also provides a document management system for electronic storage, recovery and information-sharing (AccuBuild 2005).

Chapter III: Methodology

Because the complex nature of their processes, it is hard to obtain accurate indicators to evaluate the profitability within a construction project. Information always changes during phase III (Construction Period), there are usually a diversity of document transmissions with different revisions (Hernandez, 2001).

Recording information is essential for budgeting ongoing projects and new project proposals. Estimations are based on project's historic rates of performance and productivity (Hernandez, 2001).

A lack of a project's record reliability and support can bring an inaccurate result on the calculation of productivity rates, and a wrong projection of the total final man-hours to complete each activity. These incorrect outcomes could influence Project Managers to make wrong decisions.

Data required

Field information, or "Field Records", is required to calculate and track payroll, performance, productivity rates and percentage of every work completed, as well as, activity of the job site. This data collection starts from the "Daily Time Cards" of the workforce, within associated cost code and work description, identifying the hours each employee worked. This information is collected by supervisors and foremen (Brayton, 2005).

This study was focused on how to improve data collection for productivity measurement purposes; driven for a search of the information regarding construction companies and their business management.

Methods

Managers at Bayer Technology Service, Superior Engineering and Superior Construction were interviewed, gathering all the information about the quantity of personnel on site and their systems on collecting data to calculate earned work hours and performance.

The professionals interviewed were two Project Managers, and One Construction Manager. The main topics discussed were:

- Company background information
- Methods for planning and scheduling
- Computer software for planning, scheduling and cost control

The main reason for these interviews was to determine how companies collect productivity data.

Chapter IV: Results

Analysis of the Data:

The first person interviewed was Carlos Barrios, a "Project Manager" at Bayer Technology Services in charge of developing capital projects for the company and its major subsidiaries in America.

Mr. Barrios explained that Bayer Technology Services is an "Engineering and Procurement Construction Management (EPCM) department for Chemical Plants and Facilities". He added, they have "around twenty-five projects per year with approximately three hundred millions US dollars on investment".

The most important challenge that Mr. Barrios encounters as a "Project Manager" is to "Plan and execute projects on time and on budget, complying with the highest standards on quality and safety"; He also explained that he overcame challenges by "selecting the right resources and the right tools to do the job, as well as, keeping an outstanding leadership practices".

Mr. Barrios explained that the way they track their performance project was by using "Standards Key Performance Indicators (KPI's) per the Project Management Institute (PMI) and the Association for Advancement of Cost Engineering (AACE)".

At Bayer Technology Services, they use Enterprise Resource Program (ERP) systems to support their expended labor hours; Mr. Barrios clarified that "Project management hours throughout the Engineering monthly reports are taken from SAP CADO (time sheet module); and the Construction Man-hours or contractor Man-hours are taken from TRACK (system that interfaces the gate/badge database with SAP purchase orders/contracts) or the individual contractor progress report".

In this Company they also use ERP systems to collect labors information; Mr. Barrios stated that "Every employee enters their previous week time in SAP throughout the timesheet module call CADO".

When I inquired about how they track shared labor resources in different tasks, Mr. Barrios respond that "for Engineering and Procurement is easy because each individual enters their time in SAP every Monday and allocate the hours to each project/assignment; but the Construction labor, which is not controlled in office but in the field, has to be tracked either by the gate/badge reading system, or individually, by contractors (specialty companies) in the field using timekeepers".

According to Mr. Barrios, when a negative scenario occurs, where a project is behind schedule, the best practice to overcome this problem "depends in which phase the project is". He outlined the three cases as follows:

First, "Engineering Phase", he explained, "Brings the project team/disciplines together and reveals where the bottleneck is, and the reason for the delay, and then creates a change order to add resources and meet schedule. If a money-budget is the issue, he will try Value Engineering".

Second, if it's "Procurement", he suggested, "Re-visit schedule and modify critical path if possible, then review the contract agreements to claim potential penalties to vendors".

And third, if it's "Construction", Mr. Barrios said, "Analyze critical path and perform constructability reviews"; he also stated that, "If reason for delay is due to unpredictable changes, create a change order and use contingency allowances to add resources". Another remark he declared was, "If the reason for delay is due to predictable changes, search for the guilt and take correctives actions".

A second person was interviewed. Steve Vernengo, a "Project Manager" at Superior Engineering LLC, an Engineering consulting firm member of Superior Group.

Mr. Vernengo stated that "Our Company has a wide variety of clients. A majority of our clients are in the heavy industry (Steel Mills, Steel Processing, and Oil Refineries). In addition, we have many institutional clients such as universities and hospitals". He said that they have "Total revenue of approximately $35Million per year. Of this cost approximately 80% are Oil Refineries (BP and Exxon) and Steel Mills (Arcelor Mittal and US Steel). In a year, Superior will be awarded approximately 300 new projects."

The most important challenge that Mr. Vernengo endures as a "Project Manager" is, to find and retain quality people. He also commented that "At Superior Engineering we tend to give people more responsibilities to let them know they are making a contribution and are significant to the success of the company".

Mr. Vernengo explained that they track their performances by three mayor matrixes: scope, schedule, and cost. They measure scope deviations, milestone dates in the schedule and compare actual costs with earned value calculations.

They use EHP (Engineering Hours Progress) report. Mr. Vernengo said that "This report will tell the Project Managers who charged hours, what day, and how many; also will track the total charged".

Mr. Vernengo said that at Superior Engineering the cost control engineer is responsible for collecting labors information.

This company uses Excel Spreadsheet to track shared labor resources in different tasks. Mr. Vernengo explained that, "The shared labor is tracked by the individual department heads". He also said that they track workload and project assignments for each person in their department".

Finally when I threw in a negative scenario, that revealed that a project is behind schedule and asked about his best practice to overcome this problem is, and where to begin the corrective actions, Mr. Vernengo responded that "When a project is behind schedule, there are a limited number of options; the first thing is to prioritize the work. The Project Manager should confer with the client to determine what needs to be done first. A second option is to look at overtime to meet the schedule".

Another person was also interviewed. David Rainford is a "Construction Manager" at Superior Construction, a division of Superior Group that provides services as a General Contractor, fulfilling Industrial and Heavy Highway Construction. Mr. Rainford stated that the most challenging aspect of his job was the different corporate culture within his organization and the clients. He commented that, "Communication is key in overcoming discrepancy among the parties involved on the project". To keep track of Project performance, he said that they follow "Cost based on historical data of quantities installed". He also explained that, to keep track of shared labor resources in different tasks, they use an ERP system called COINS (Construction Industry Solutions). When a project is behind schedule, he mentioned that his best practice to correct it is to add more manpower, by extending the shift or adding additional shifts.

Chapter V: Discussion

Conclusion:

Information within the construction industry has been organized and standardized with well known clear codes and divisions (MasterFormat), known by all parties involved in the projects, enabling a better communication and ensuring understanding among architects, engineers, contractors and suppliers.

There are several alternatives that could fit into the data automation for construction management. This study shows some good examples on how construction is moving ahead on finding a better approach to gather information and data sharing.

This study revealed the need, and importance, of data collection for measurements of Project Performance. There is a wide range of systems and programs providing extended opportunity to improve the tools for Project Management and Project Control practices. However, this study did not prove which process is the best for accurate data collection and Project Performance measurements.

Recommendations:

Construction companies can raise new competitive advantages, improving their performance and redefining their businesses. Companies can enhance success by implementing continuous improvements through the application of Information Technology (IT) innovation. Effective business management software like Enterprise Resource Planning (ERP), or Customer Relationship Management (CRM), could provide a positive approach for timely and insightful business decisions (Microsoft Dynamics 2008).

Finally, the researcher recommends further study on what can be implemented to improve the data collection process to make performance measurements more reliable.

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