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Sewing Section of Apparel Industry

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The Effects of Project Portfolio

Comparative Study on the Performance

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CONTENTS OF THE ISSUE

- i. Copyright Notice
- ii. Editorial Board Members
- iii. Chief Author and Dean
- iv. Contents of the Issue

1. Implementation of Six Sigma to Minimize Defects in Sewing Section of Apparel Industry in Bangladesh. *1-7*
2. The Effects of Project Portfolio Management on Competitive Advantage through Dynamic Capability. *9-24*
3. Conserving Energy through Energy Management by the Facility Managers in India. *25-30*

- v. Fellows
- vi. Auxiliary Memberships
- vii. Preferred Author Guidelines
- viii. Index



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Implementation of Six Sigma to Minimize Defects in Sewing Section of Apparel Industry in Bangladesh

By Jaglul Hoque Mridha, Shah Md. Maruf Hasan, Md. Shahjalal & Forhad Ahmed

Northern University

Abstract- The garments industries which are traditionally operated are facing lots of problems such as low productivity, poor line balancing, high rejection, high defects, unable to achieve lead time. So defects minimization is the first condition of reducing cost and increasing productivity. The work aims to minimize the defect percentage by using DMAIC approach of Six Sigma methodology. The study is carried out in Ananta Apparels Ltd. by using DMAIC methodology of six sigma to minimize the defect rate in sewing section. Five phases of the DMAIC methodology named Define, Measure, Analyze, Improve and Control which indicates some critical defects such as stain, skip stitch, broken stitch, and slip out in the sewing section of Ananta Apparels Ltd. We applied various types of six sigma tools in different phases. The outcome of this study is very significant to implement in the sewing section of the apparel industry.

Keywords: DMAIC, gross domestic product, lean, toyota production system, jit, sipoc.

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Implementation of Six Sigma to Minimize Defects in Sewing Section of Apparel Industry in Bangladesh

Jaglul Hoque Mridha ^α, Shah Md. Maruf Hasan ^σ, Md. Shahjalal ^ρ & Forhad Ahmed ^ω

Abstract- The garments industries which are traditionally operated are facing lots of problems such as low productivity, poor line balancing, high rejection, high defects, unable to achieve lead time. So defects minimization is the first condition of reducing cost and increasing productivity. The work aims to minimize the defect percentage by using DMAIC approach of Six Sigma methodology. The study is carried out in Ananta Apparels Ltd. by using DMAIC methodology of six sigma to minimize the defect rate in sewing section. Five phases of the DMAIC methodology named Define, Measure, Analyze, Improve and Control which indicates some critical defects such as stain, skip stitch, broken stitch, and slip out in the sewing section of Ananta Apparels Ltd. We applied various types of six sigma tools in different phases. The outcome of this study is very significant to implement in the sewing section of the apparel industry.

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I. INTRODUCTION

The ready-made garment (RMG) is one of the most essential sectors in Bangladesh in terms of foreign export earnings, economic advancement, employment, and its contribution to Gross Domestic Product (GDP). It is one of the leading exporting industries in Bangladesh. To achieve the overall objective in minimizing defects and rejection of finished products, it is required to set up a document and maintain a system able to ensure that products are conformance to the standards specifications. Considering the reasons above, that means this study attempts to explore the use of DMAIC (define, measure, analyze, improve and control) methodology of six sigma in a selected garment factory to minimize the defect percentage.

DMAIC methodology of six sigma is a problem-solving method where six sigma tools are used to analyze the process data, and finally, the root causes behind the defects produce in the product are identified.

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Six Sigma is a quality improvement process of the final product by reducing the defects, minimizing the variation and improving capability in the manufacturing process. Six Sigma initiated from the terms associated with statistical modeling of manufacturing processes.

a) Objectives

Quality Management is an operational strategy oriented towards achieving the shortest possible cycle time by eliminating wastes. The term Quality Management is coined to represent half the human effort in the company, half the manufacturing space, half the investment in tools and half the engineering hours to develop a new product in half the time. Any industry can achieve these benefits if they religiously follow this concept in their organization. In simple terms, lean manufacturing is without waste. Thus the objective of this study is to find out how we can use Quality Management to achieve the following:

1. To meet customer demand on time by eliminating nonvalue added work from the process.
2. To minimize the work in process inventory.
3. To create the flexibility of style changeover.
4. To reduce rework percentage.
5. To create a pool of multi-skilled operators who can respond quickly for changing the style.

II. LITERATURE REVIEW

a) Quality management

It is the act of overseeing all activities and tasks needed to maintain a desired level of excellence. Quality management includes the determination of a quality policy, creating and implementing quality planning and assurance, and quality control and quality improvement. Quality management ensures that an organization, product or service is consistent. It has four main components: quality planning, quality assurance, quality control and quality improvement. Quality management is focused not only on product, and service but also on the means to achieve it.

b) Lean

Lean is a systematic approach to identifying and eliminating waste through continuous improvement of the product at the demand of the customer. Taiichi Ohno once said that "Lean Manufacturing is all about

looking at the time line from the moment the customer gives us an order to the point when we collect the cash. And we are reducing that time line by removing the non – value added wastes” (Ohno, 1988). Poor layout (distance), long setup times, incapable processes, poor maintenance practices, poor work methods, lack of training, large batches, ineffective production planning/scheduling, lack of workplace organization generate wastes. By eliminating wastes in the overall process, through continuous improvements, the product's lead time can be reduced remarkably. By reducing lead time organization can obtain operational benefits (enhancement of productivity, reduction in work-in-process inventory, improvement in quality, reduction of space utilization and better organization) as well as administrative benefits.

c) *Lean Approach*

Lean organizations are highly customer focused, providing the highest quality, lowest cost products in the shortest lead time possible. According to the book “Lean Thinking” by James P. Womack and Daniel Jones, the Lean approach summarizes five principles (Womack and Jones, 2003):

Specify what creates value from the customer's perspective - Value should be specified from the customer point of view, not by the perspective of individual firms, functions, and departments. If the customer does not pay for an activity, it is a non-value adding activity and it should eliminate.

Identify all the steps along the process chain – This means identifying the value stream. It can be used to identify activities where the value adds to the product and those do not.

Make those processes flow – The value-added product must flow continuously from start to finish without interruptions, detours, backflows, waiting, scrap and stoppages.

Make what is pulled by the customer – The customer should pull the product from the source as needed rather than process pushing the products onto the customer.

Strive for perfection – After implementing the above steps, the team should continuously remove wastes as they are in uncover condition and pursue perfection through continuous improvement. Lean uses practically proven tools and techniques to systematically eliminate the wastes. If these are correctly applied, it will bring improvements to quality, cost, and delivery of the final product. Those tools help in implementing, monitoring, and evaluating Lean efforts and their results. Without proper understanding of lean approaches, it can spoil Lean efforts in one's organization garment, component or style.

d) *Toyota Production System*

It is a manufacturing system developed by Toyota in Japan after World War II, which aims to increase production efficiency by the elimination of waste. The Toyota production system was invented and made to work, by Taiichi Ohno. While analyzing the problems inside the manufacturing environment; Ohno came to conclude that different kinds of wastes (nonvalue added works) are the main cause of inefficiency and low productivity. Ohno identified waste in several forms, including overproduction, waiting time, transportation problems, inefficient processing, inventory, and defective products.

Pareto Diagram: The Pareto diagram is a graphical overview of the process problems, in ranking order from the most frequent, down to the least frequent, in descending order from left to right. Thus, the Pareto diagram illustrates the frequency of fault types. Using a Pareto, one can decide which fault is the most serious or most frequent offender.

Fishbone Diagram: A framework used to identify potential root causes leading to poor quality.

Histogram: A graph of variable data providing a view of the distribution of data around the desired target value.

Scatter Diagram: A graph used to display the effect of changes in one input variable on the output of an operation.

e) *Just in Time*

Just-in-time manufacturing is a Japanese management philosophy applied in manufacturing. It involves having the right items with the right quality and quantity in the right place at the right time. In general, Just in Time (JIT) helps to optimize company resources like capital, equipment, and labor. The goal of JIT is the total elimination of waste in the manufacturing process. Although the JIT system is applied mostly to the manufacturing environment, the concepts are not limited to this area of business only. The philosophy of JIT is a continuous improvement that emphasizes on prevention rather than correction and demands a companywide focus on quality.

III. METHOD AND MATERIALS

The methodology adopted for this study is a case study and brain storming. The case study conducted on a garment factory named Ananta Apparels Ltd. Located at Narayanganj. At first preliminary investigation was carried out at cutting, sewing, washing, finishing and packing section to identify the area where most of the defects occur. It finds that, the sewing section is highly suffered from defect and rework problems. For this reason, the sewing line is identified to conduct research work. The work

aims to minimize the defect percentage by using the DMAIC approach of Six Sigma methodology. Secondary data of the sewing section collected from the management of the factory. The data collected for polo shirts only. According to our observation and using the end line quality data provided by the management, then we identified some repetitive defects that occur in the sewing section. The information and data collected were arranged so that further study and analysis could perform. The suggestions were made based on the brain storming session which was arranged by the management of the factory. Experts of the factory from different areas were present in that session. Due to time constraint, management could not be able to implement all of the suggestions together. But they implemented some of the suggestions in short time-frame on their pilot line and found some improvement.

a) *Data Collection*

Data sheets collected for garment item such as polo shirt for three months. The data collected by the end line quality inspectors from two production lines of sewing section. We checked 3500 polo shirts, and 470 pieces were found defective.

b) *Application of Six Sigma DMAIC Methodology*

Define Phase: Define is the first phase of the DMAIC methodology of Six Sigma. The purpose of this phase is to define the problem, the goal of the project and the process that needs to be improved to get a higher sigma level. There are different six sigma tools are available for define phase. Here SIPOC tool was applied.

Problem Statement: The garments manufacturer experience high volume of rejections of their products owing to defects.

Goal Statement: To decrease the percentage of the defect to the lowest level and thereby to reduce production cost and increase quality and productivity.

SIPOC: This is a process map that includes Suppliers, Inputs, Process, Outputs and Customers. Quality is judged based on the output of a process. Table 1 shows the SIPOC flow of the selected factory.

Table 1: Shows the SIPOC Flow of Ananta Apparels Ltd

Suppliers	Inputs	Processes	Outputs	Customers
-Acotex Bangladesh Ltd.	Unstitched cloth Machinery	Cutting	T-shirt	-H&M
	Thread	Sewing	Polo shirt	-Tesco
	Needles	Washing	Pant	-ZARA
-Fabian Group	Button	Ironing		
- D.H Fashion	Zipper	Finishing Packaging		
	Label			

Measure Phase: At this phase, the percentage of defects, existing DPMO (Defect per Million Opportunities) and calculation of the Sigma Level of the selected factory indicated in table 2.

Now, Table-2 shows the DPMO and Sigma level of Existing process-

Table 2: DPMO and Sigma level of Existing process

Total Checked pieces	3500
No. of Defectives	470
% Defectives	13.42
DPO	0.1342
DPMO	134285
Sigma level	2.6063

Calculation of the Sigma level by using the following formula in Ms. Excel:

Sigma Level- Normisnv (1-Defects/Total opportunities) + 1.5; Where, Defects- 470, Total Opportunities - 3500, Sigma shift= 1.5.

In the following table the Frequency of Defects of the Inspected polo shirts are given:

Table 3: Frequency of Defects of the Inspected Polo Shirts

Defects	Real Occurrence	Percentage (%) of Occurrence
Skip Stitch	45	9.57
Down Stitch	37	7.87
Broken Stitch	134	28.51
Raw Edge	42	8.94
Joint Stitch	35	7.45
Uneven Stitch	38	8.09
Spot/Oil stain	25	5.32
Hole/Damage	15	3.19
Puckering	39	8.30
Reject	7	1.49
Slanted	5	1.06
Uncut Thread	2	0.43
Reverse	19	4.04
Size Mistake	4	0.85
Process Missing	23	4.89
Total	470	100.00

Analyze phase: Two problem solving six sigma tools used at analyzing phase and these were: Brainstorming and cause and effect diagram.

Brainstorming: Brainstorming is one of an essential problem-solving tools. The goal of this tool is to identify

the issues, solutions and opportunities. To find out the potential causes of the defects and their respective solutions, we arranged a brainstorming session where they applied the Round Robin method with the presence of the following members that are shown in table 4.

Table 4: Attendants at the Brainstorming Session

Attendants	Numbers
Sewing Floor Manager	1
Industrial Engineer	2
GPQ (Growth, Production, and Quality)	2
End Line Quality Inspector	3
Line Supervisor	3
Sewing Machine Operator	5

Cause and effect diagram: Through brainstorming with sewing operators, line supervisors, end line quality inspectors, engineers, and floor manager, we

recognized various probable causes. Then we identified the potential causes by online inspections and root cause analysis.

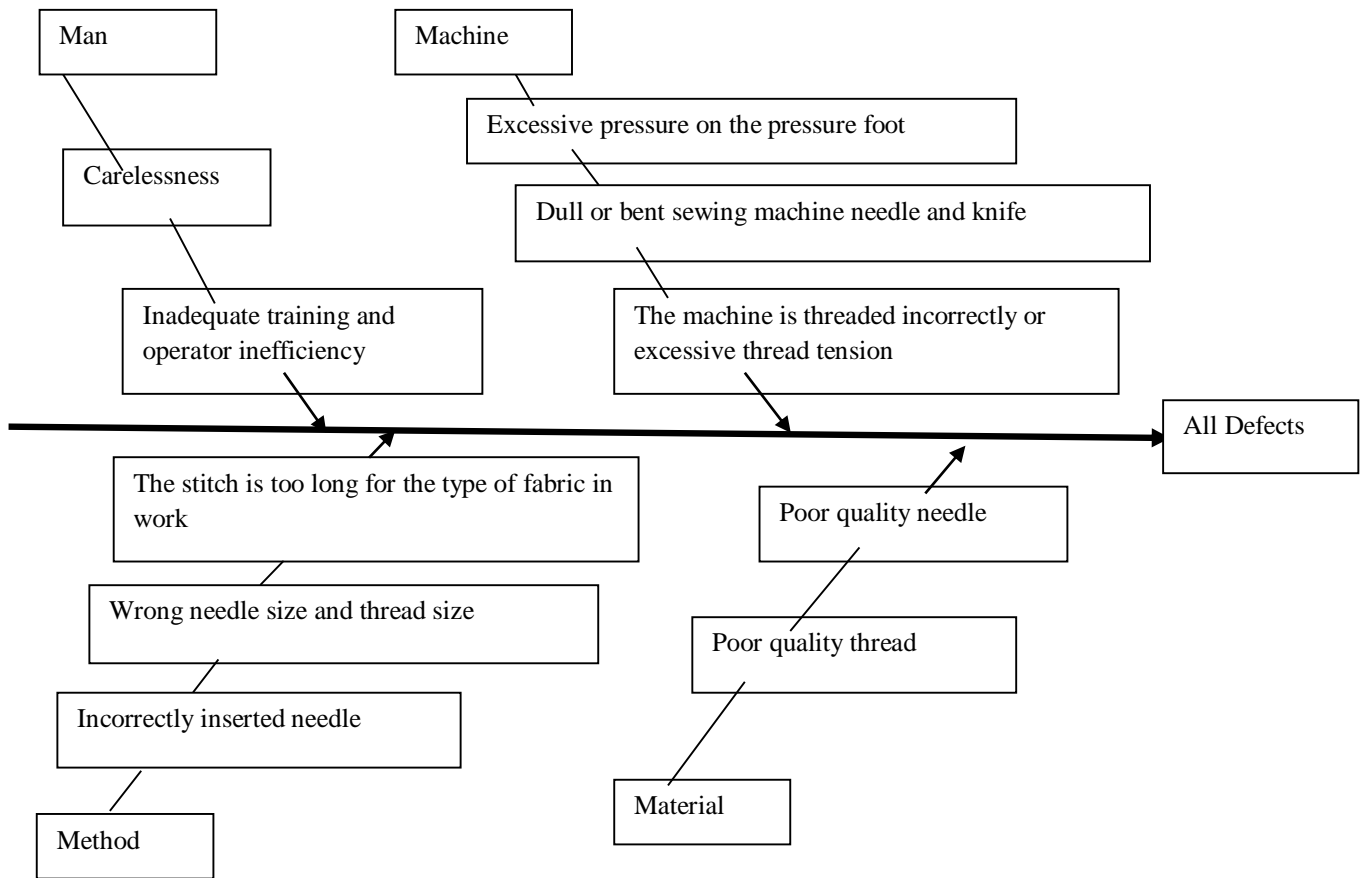


Figure 2: Cause & Effect Diagram for All Major Defects

Improve Phase: The purpose of the DMAIC Improve phase is to discover a solution to the problem that the task aims to address. This improve phase involves brainstorming potential solutions, selection of solutions to test and evaluating the results of the implemented solutions. Often a pilot implementation is conducted before a full-scale rollout of improvements.

Suggested Solutions: This study tried to suggest some potential solutions to minimize the causes of defects through Brainstorming, direct observation and literature review. Table-5 gives necessary solutions with their corresponding causes.

Table 5: Suggested solutions against causes of defects

Areas	Causes	Suggested Solutions
Man	Inadequate training and operator inefficiency	Trained and motivated operators sufficiently
	Negligence	Improved supervision.
Machine	The machine is threaded incorrectly or excessive thread tension	Rethread machine and maintain proper thread tensions.
	Excessive pressure on the presser foot.	Minimize the pressure on the presser foot.
	Bent sewing machine needle and knife.	Replace the needle and knife with a new one.
Method	Incorrect size of the needle and thread for operation	Ensure that the correct thread type and size rightly feeds both the needle and bottom (looper) positions.
	Comparatively long stitch for the type of fabric in work.	Shorten the stitch length using the stitch regulator, especially when sewing fine fabrics

Material	Incorrectly inserted needle	Check that the bobbin winds correctly and no loose threads or loops sticking out.
	Poor quality thread	Using core spun yarn
	Poor quality needle	The needle should have high heat resistance capacity.

c) *Implementation of the Solutions*

Based on the solutions provided by this study, we took some corrective actions mentioned in table-6.

We implemented it into one of their pilot sewing line. The pilot line had a total of 105 sewing machines.

Table 6: Corrective Actions and Its Amount

Corrective Actions	Amount
Replacement of dull or bent sewing machine needles	16 needles
Replacement of dull knives	9 knives
Number of machines rethreaded	17 machines
Correction of needle insertions	15 machines
Replacement of faulty bobbins	3 machines
Training provided	machines 2 hours each day

Control Phase: After the implementation of the solutions, we shared the progressive outcomes with the management. The main defects were recognized and partially reduced in amount. Now the challenge is to withstand the progress and to refine the system continuously. For this purpose, a control plan is prepared.

Control Plan: The management needs to take the initiative on the following obligatory activities to withstand the progress after Six Sigma implementation:

- i. Arrange training continuously for the garments operators on the issue of quality.
- ii. Always use quality threads, needles, and other garment accessories.

- iii. A sound incentive scheme should take for high-quality performance.
- iv. Preventing defects will be given more priority than correcting defects.
- v. Enforce strict quality control in the line.
- vi. The organization should develop a proper Quality Management System.

IV. RESULTS AND DISCUSSIONS

We implemented all the suggested solutions into one of their pilot sewing lines. After the implementation of solutions percentage of defectives, then we calculated DPMO and Sigma Level by using the previous sigma level formula and reported on table 7.

Table 7: DPMO and Sigma Level after Improvement

Total Checked	5450
No. of Defectives	396
% Defectives	7.26
DPO	0.072
DPMO	72660
Sigma level	2.9562

V. CONCLUSION

Minimizing defect is very important for ensuring the quality of products. Manufacturing the quality product is mandatory to sustain in this global

competitive market. This study follows the DMAIC methodology of Six Sigma to find out the major defects, their root causes and then suggests logical solutions to minimize those defects. This study identified some defects (broken stitch, skip stitch, raw edge, uneven

stitch, down stitch, process missing, puckering and joint stitch) those were responsible for more than 80% of total defects occurring in the sewing section of the garment factory for the item of a polo shirt. After finding the major defects, brainstorming tool was used to identify the probable causes and then we identified potential root causes by online inspections and root cause analysis. A significant improvement of the Sigma level found in the industry. So this method is very operative to the minimization of defects. If many garment factories in Bangladesh follow the six sigma concept, then they can minimize most of the defects in the sewing section.

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The Effects of Project Portfolio Management on Competitive Advantage through Dynamic Capability

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Abstract- A business firm needs to respond and adapt to the changing business environment in order to achieve and sustain the competitive advantages in the fast changing and very competitive market of today. Business strategy is an important discipline that provides the guidelines on how to deal with the changing business environment and to develop competitive advantages. The theory development and discussion in the business strategy discipline shows a trend change from the external environment analysis theory by M.E. Porter in the 1980s, to Resource Based View(RBV) in the 1990s, and to the dynamic capability theory in the late 1990s. Another effort by business firms to cope with the changing business environment may be the development and application of project management theories such as project portfolio management.

Keywords: *project portfolio management, project management, dynamic capability, competitive advantage.*

GJRE-J Classification: FOR Code: 291899



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The Effects of Project Portfolio Management on Competitive Advantage through Dynamic Capability

Suk-Hyun Oh ^α, Paul C. Hong ^σ, Min-Jeong Oh ^ρ & Seung-Chul Kim ^ω

Abstract- A business firm needs to respond and adapt to the changing business environment in order to achieve and sustain the competitive advantages in the fast changing and very competitive market of today. Business strategy is an important discipline that provides the guidelines on how to deal with the changing business environment and to develop competitive advantages. The theory development and discussion in the business strategy discipline shows a trend change from the external environment analysis theory by M.E. Porter in the 1980s, to Resource Based View(RBV) in the 1990s, and to the dynamic capability theory in the late 1990s. Another effort by business firms to cope with the changing business environment may be the development and application of project management theories such as project portfolio management.

The objective of this study is to investigate the effects of project portfolio management in the context of the dynamic capability theory on creating the competitive advantages for business firms. This study used the PPP framework by D.J. Teece (1997), which is a representative analysis framework in the dynamic capability theory. Data was collected from the companies in Korea, and analyzed for empirical tests by using statistical methods such as path analysis. The results show that project portfolio management provides substantial and significant cases for the business firms in creating competitive advantages. The results may encourage the reluctant companies to adopt project portfolio management for effective strategy development and implementation by business firms with more confidence.

Keywords: *project portfolio management, project management, dynamic capability, competitive advantage.*

I. INTRODUCTION

Nowadays, business firms are facing challenges in their business environment. The business environment is increasingly changing faster than ever before due to growing uncertainty, mismatch between supply and demand, and shortened product life cycle. If companies do not adequately respond to

these changes, they may fade away to almost nothing in the market. If companies deal with these changes successfully, they may be able to develop and sustain competitive advantages longer than their competitors in the market.

Companies need efficient strategies to deal with the changing world. In the 1980s, the Competitive Forces Model proposed by M. E. Porter(1980) is a dominant paradigm in strategy discipline. It focuses on the external factors of the company's environment to develop the competitive strategies. However, this approach of focusing on the external factors does not explain why some companies are more competitive in the market than others (Teece et al., 1997).

In the 1990s, the Resource Based View(RBV)proposed by J.B. Barney(1991) offers an internally focused approach in order to better clarify the organizational foundation for successfully achieving competitiveness. Valuable, rare, inimitable and non-substitutable resources shape the foundation for sustainable competitive advantage because it is difficult for other organizations to copy or acquire these resources (Barney, 1991).However, according to Eisenhardt and Martin (2000) and Morgan(2009), the RBV has limitations in explaining how companies obtain and maintain competitive advantages in business environment with high level of uncertainty.

The Dynamic Capabilities Theory proposed by D.J. Teece(1997) provides an understanding of the relations between competitive advantage and business performance in the changing business environment in order to overcome the limitations of RBV. According to D.J. Teece(1997), this theory focuses on the processes to integrate, to build and to reconfigure the internal and external competence in order to address the changing environment.

Project Management (PM) is another efforts used by companies in order to deal with the changing business environment. A project is often used to introduce changes necessary to provide competitiveness to the companies, and project management is a valid countermeasure to respond to the changing business environment. As companies have experienced the effectiveness of project, they have made use of more projects and more project resources

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in order to effectively implement the companies' strategies. In this situation, companies have recognized the importance of linkage between projects and the companies' strategy because they have faced difficulties in management control for efficient resource allocation, project selection and consistency between projects and companies' value.

It is the project portfolio management that help to overcome these difficulties with which companies are faced. This method enables the alignment between projects and companies' strategy in providing corporate competitive advantages as valid strategic means (Dinsmore, 1999; Levine, 2005).

This study uses the Dynamic Capabilities Theory to investigate what factors influence the introduction of project portfolio management for South Korean companies and to find out whether the introduction of project portfolio management can help to achieve competitive advantages for business firms. This study aims to clarify the following research questions: First question is whether the increase in corporate project resources affects the introduction of project portfolio management. Second question is whether project resources influence cooperative competitive advantage improvement through project portfolio management.

To sum up, the purpose of this study is as follows: First, it provides companies with a shift in awareness about the introduction of project portfolio management. It uses a method to demonstrate the need to introduce project portfolio management through dynamic capacity theory. Second, it will enable companies to introduce project portfolio management.

II. LITERATURE REVIEW

a) *Dynamic capability theory*

Dominant strategic approaches in the 1980s have focused on competitive forces model proposed by M.E. Porter (1980). This study concentrates on the external factors in the company's environment to

determine the competitive strategies. However, this external approach does not fully explain why some companies are more competitive in the market than others (Teece et al., 1997). To better clarify the organizational foundation for competitive advantage, the Resource Based View (RBV) (Smith et al., 1996; Wernerfelt, 1995) offers an internally focused approaches. The RBV framework focuses on identifying and determining organizational resources such as tangible and intangible assets etc. in the organization. The RBV presumes that resources are not identical throughout organizations and uses the differences to give explanation of different success rates among organizations. Valuable, rare, inimitable and non-substitutable resources shape the foundation for sustainable competitive advantage, because it is difficult for other organizations to copy or acquire these resources (Barney, 1991). However, RBV does not fully explain how companies can obtain and maintain competitive advantages in business environment with high uncertainty (Eisenhardt and Martin, 2000; Morgan, 2009).

Under this background, Teece et al., (1997) tried to overcome the shortcomings of the resource based view with dynamic capability. They reported about this notion while defining it as the ability to integrate, build, and reconfigure the company's resources and capabilities to compete in dynamic environments. They explained dynamic capabilities through PPP (Processes, Positions, and Path) framework shown in Figure 1. The core of competence capability is deep in the process that specific organization employed, and it is materialized by organization's assets and evolutionary path that they have come through. PPP framework shows the relationship mechanism between resources, dynamic capabilities and achievement. The dynamic capabilities mean organization's routines or processes. For its sustainability, processes have to be based on organizational resource position, organizational decision making which forms the core of dynamic capabilities, and historical, futuristic path that affect organizational learning.

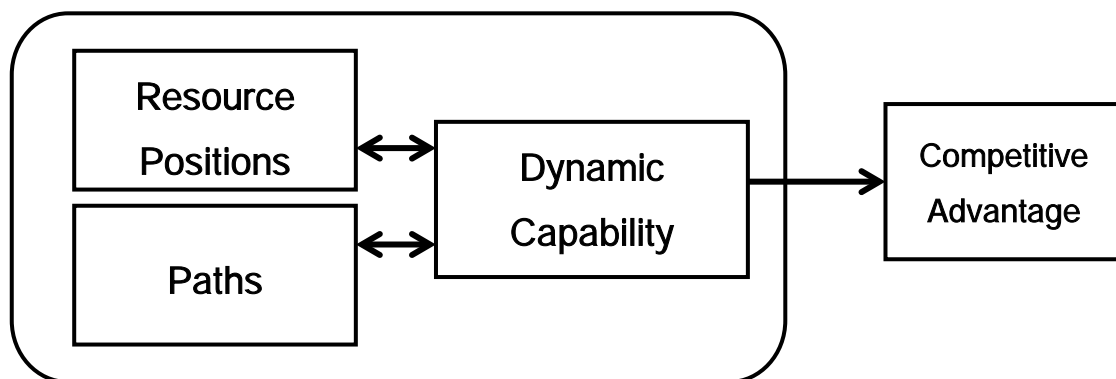


Figure 1: PPP framework by Teece et al. (1997), source: Killen (2010)

The RBV assumed that valuable, rare, inimitable and non-substitutable resources within organization must be difficult to copy or imitate to provide sustainable competitive advantage, but dynamic resources are in rough way easy to copy and acquire (Eisenhardt and Martin, 2000). Eisenhardt and Martin (2000) has defined dynamic capability as a process that utilize, integrate and rearrange resources which brings out market change and reacts to business environment changes. Cho (2010) confirmed practical factors that affect formation of dynamic capabilities in the research against South Korean export companies and suggested an integrated model to analyze the process where resources and dynamic capability affects competence capability. With this model, it was confirmed that sustain input of resources is the main factor of dynamic capability. In the result, it was examined that human resources and dynamic capability directly affect competence capability while physical resources do not have to do with the competence. Dynamic capabilities are obtained through creation and expansion with ordinary competences (Winter, 2003). For higher level of competences, there needs to be investment by corporations which has specific patterns. That is, there is path dependence in capability development. The dynamic capabilities approaches also focus on learning and competence building process (Brady and Davies, 2004; Söderlund et al., 2008). Furthermore, the dynamic capabilities approach has been used to researches on strategic connectivity competence and organizational learning competences (Hel fat, 2000).

Project Management (PM)

According to ISO (2012), project is a set of processes to achieve specific goal which has start and

due dates, while activities are coordinated and controlled. The activities to achieve goals successfully are called project management and ISO (2012) defines Project Management (PM) is to apply method, tools, technology and capability to projects. PM is achieved by process, which are closely related activities. The process can be categorized into project management process, product process and support process. In project management process, decision about how to manage activities selected for the project is made. Product process is flexible depends on the results from previous stage and service. Lastly, support process offers proper, valuable support to PM and various areas such as logistics, finance, accounting and stability.

Resources are necessarily put into project. In this paper, resources put into project procedure are collectively called project resources. Among the project resources there are human resource, raw materials, equipment and fund. Human resource is one of the most important factors where people are categorized depend on their level of knowledge, experience and technology, and given proper work position. Shortage of raw materials can cause critical delay to project schedule. When shipment of raw materials or assembly parts from other companies is delayed, it becomes significant problem. The size or type of equipment can be varied and they can be borrowed from other sources if the project team does not retain them. Fund, also, is one of important resources; fluent cash flow makes project procedure smoother.

According to Korean Agency for technology and standard (2013), organizations offer guidelines of development and opportunity with strategies. And they aim for achieving strategic goals by executing sets of projects. Its relationship is shown on <Figure 2>.

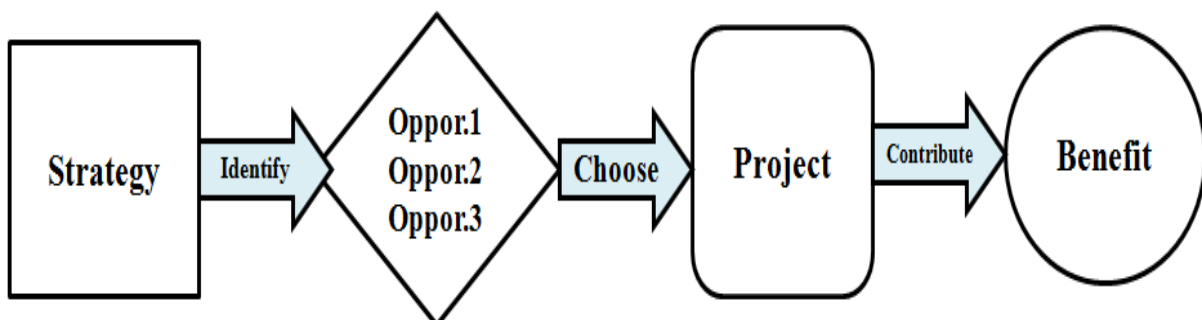


Figure 2: Flow Between Project and Strategy, Source: Korean Agency for Technology and Standard (2013)

As importance of project as a strategic execution method is being emphasized, strategic connectivity becoming more important due to project's increasing scale and complexity (Dins more, 1999). Milosevic and Srivan naboon (2006) suggested the theoretical framework of linked project management and company strategy as methods to evaluate the connectivity level of the strategy. This framework shows

how the 6 factors of the strategy are linked together. Figure 3 shows the frame work.

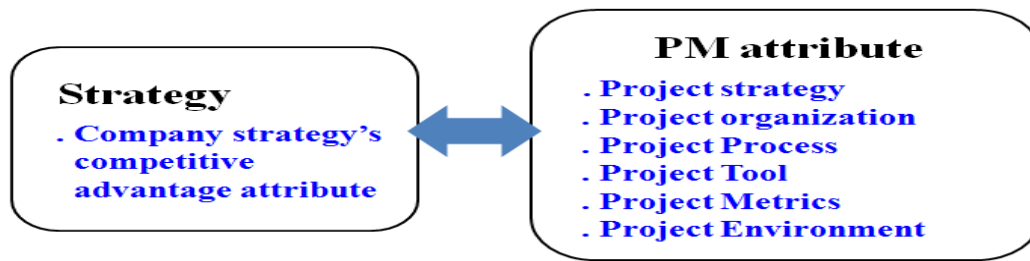


Figure 3: Framework for Alignment between Strategy and Project, source: Milosevic and Srivan naboon (2006)

b) *Project portfolio management*

According to Levine (2005), management control becomes harder as the number of on-going projects increases, and its efficiency against resources-human resources or budget distribution-becomes lower. When there are many proposals for projects, executive office falls in deep thinking about which projects to be selected to meet its strategic goals. In addition, the board room reminds itself that they are responsible for continuous evaluation of project so that it can contribute to strategic goals of their company, that is, successful project result is directly connected to achievement of strategic goals and business performances. In this way, necessity of project portfolio management which controls multiple projects has risen. Dins more(1999) argued that projects and strategies can be effectively arranged through project portfolio management. Therefore, it is fair to say that practical research to build effective link between strategies and projects was led to the birth of this notion.

A project portfolio is an assortment of projects managed collectively to achieve the benefits of the portfolio and to realize the overall strategy of the organization (Y. Petro et al., 2015). Project management institute (2013) defines project portfolio as a set of programs, projects, or operations that managed in group and Association of project management group(2011) defines it as an every investments to changing factors. Regarding project portfolio management, Project management institute (2013) said it is to recognize, prioritize the projects and rearrange input resources for effective control and Association of project management group (2011) defines it as a harmonious collection of strategic processes and decision making that brings equilibrium between organizational change and ordinary business. M.G. Kaiser et al.(2014) defines project portfolio management as a commonly employed technique to align a project portfolio with strategic goals. According to the Project management institute(2013), project portfolio management can be largely divided into 8 parts: the first part is recognition where projects are defined by making lists of on-going or upcoming projects. In categorizing session, recognized projects are grouped with similar projects. The projects in the same strategy category have common goals and

evaluated with same criteria. The third process is evaluation in which projects are compared each other for the next session. In the selection process, projects are listed based on their priorities. The next process is per iodization. In this session, listed projects are prioritized based on its strategic categories, profit against risks, structures and so on. Equalization session includes activities to form up the best portfolio mix where project portfolio gets final confirmation. The processes that mentioned above are summarized as a recognition capability for focusing and selection of projects. The next step is confirmation where the result of the sessions are officially reported to executive officers, and resources such as budget, human resource are distributed from selected portfolio. In this stage, resource arrangement capability is required for efficient distribution of project resources. In the last stage, reviewing, report and strategy rearrangement process, on-going project portfolio's efficiency is reviewed while project itself and resources are rearranged and strategies are changed for better optimization. In this stage, rearrangement capability for projects and process is applied.

According to Jonas et al.,(2013), maximizing a project portfolio's success implies maximizing the success of all the projects that comprise the portfolio. Their scale uses 'average project success' that is cost, quality and satisfaction of each project in the portfolio. Kopmann et al.,(2015) suggested that project portfolio success can be measured by 'strategic fit', 'synergies' between running projects such as technical or market synergies, 'portfolio balance' which is the adjustment of the portfolio between high and low risks, new and old area and use of new and existing technologies in projects. In addition, Voss and Kock (2013) presented 'overall business success' and 'future preparedness'. Overall business success means about market, commercial, and financial performance of projects results. Preparing for the future reflects the preparedness of the organization and infrastructure for sustainable competitive advantage. These five dimensions of project portfolio success were defined that is constantly updated and revised. By these definitions are the focus of project portfolio management's strategic success.

According to Serrador and Turner (2015) presented between 'project portfolio success' and 'project portfolio efficiency'. The project portfolio success means the realizing the benefits of the short term or long term nature. The project portfolio efficiency means that realized the benefits presented by the organization's objective or enhance the chance of project success using the project management tools and techniques.

The study of Patana kul (2015) attributes that effectiveness of project portfolio management can be realize strategic alignment, adaptability to internal and external environment changes, and expected value.

c) *Grafting dynamic capability theory and project portfolio management*

The dynamic capabilities approach is relatively new, so that more empirical study is necessary to reinforce the framework (Eisenhardt and Martin, 2000; Zahra et al., 2006; Martinsuo and Lehtonen, 2007). For the project portfolio management approach, previous project portfolio management literatures have been a theoretical (Killen, 2010). Killen (2010) finds that the dynamic capability framework is appropriate view point in order to provide a consistent theoretical framework for project portfolio management approach and to explain project portfolio management's mechanisms contributing to competitive advantage.

Killen (2010) applied the 'processes, positions and paths' (PPP) dynamic capability framework by Teece et al., (1997) to structuralize researches on project portfolio management. In research model shown in Figure 4, the process links company strategies and projects with each other and it emphasizes the importance of business model in case of decision making. Also it is directly involved in sustainable competitive advantage and improved business achievements. In other words, the process is a project portfolio management as a dynamic capability. The position refers to the entire organizational resources and competence capabilities, and to be more specific, it means resources (fund, equipment, workforce, knowledge) that distributed to specific project, and supporting resources or capabilities (customers, group culture, management capability) that indirectly affect project activities. In "the path", path dependence is essential factor in realizing project portfolio management capability. The project portfolio management capability develops along with maturity paths of companies, which suggests the fact that company's project portfolio management capability is improved based on previous decision makings, accumulation on experiences and organizational culture. Across the paper, we examined that the project portfolio management capability is a process supported by organization structure and workforces, and it brings competitive advantage to the company at the end.

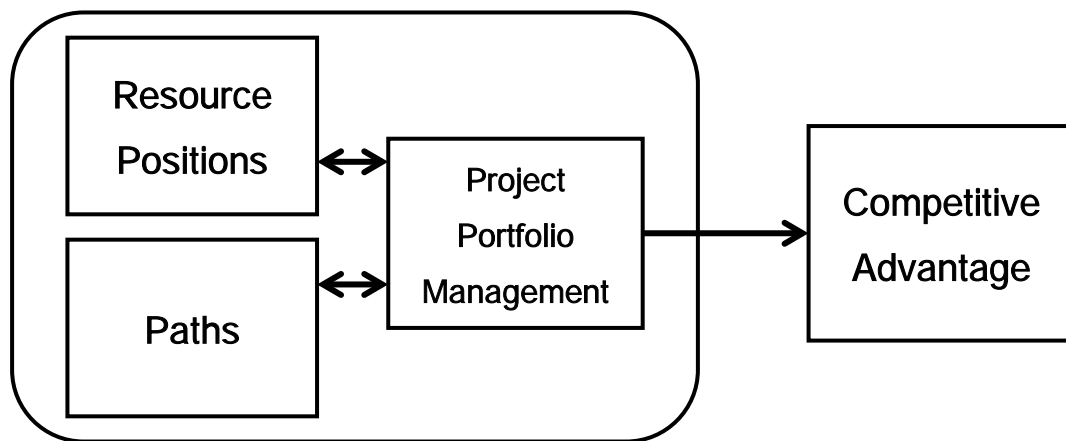


Figure 4: Research model by Killen (2010)

d) *Competitive advantage*

According to Porter (1980), there are three methods for companies to cope with five industry-level forces (entry barrier, threat of substitution, bargaining power of buyer, bargaining power of supplier, and rivalry among industry incumbents) earn higher profit than competitors. The first method is cost leadership, which is lowering price of goods with same utility. The second method is differentiation. The companies offer differentiated products and compensate increased costs by increasing its prices. This attempt makes consumer to recognize the products as unique one

which differentiated from that of competitors. The third, centralization, is a method that brings company resources together into characterized, subdivided market with reduced competition range.

According to other researchers (Hill, 1988; Miller and Friesen, 1986; Phillips, Chang, and Buzzell 1983, White 1986), the combination of strategies may be the best method (Best-cost) of acquiring sustainable competitive advantage by combining cost leadership and differentiation.

III. RESEARCH METHOD

a) Research hypotheses

In this research, based on the research model, hypotheses were established to investigate if project resources influence the application of project portfolio management, and if its application improves strategic connectivity and competence capability by applying dynamic capability theory, project management and project portfolio management theories.

Project resources refer to company resources that support the projects directly or indirectly, and it accompanies qualitative, quantitative expansion of project when the number of on-going projects increases. Project portfolio management is one method to deal with management obstacles about increasing project resources (man power, budget distribution etc.) (Levine, 2005).

The following hypotheses were established based on these theoretical backgrounds.

Hypothesis 1:

H1: Increased financial/physical project resources will positively influence the project portfolio management capability.

Hypothesis 2:

H2: Increased human project resources will positively influence the project portfolio management capability.

Corporate resources make strategic business actions possible, which lead to sustainable competitive advantage. The competitive advantage is created by integration of competitive resources and largely influenced by organization member's knowledge and recognition ability (Rosen bloom, 2000). The increase of project resources offers company the opportunity to carry out more projects which create a unique product, service or result (PMI, 2012) and deliver a desired outcome such as fast time-to-market, high-quality, low-cost products (Milosevic 2006). From this point, hypotheses can be established:

Hypothesis 3:

H3: The increase of financial/physical project resources will positively influence the company's competitive advantage.

H3-1: The increase of financial/physical project resources will positively influence the company's cost advantage.

H3-2: The increase of financial/physical project resources will positively influence the company's differentiation advantage.

Hypothesis 4:

H4: The increase of human project resources will positively influence the company's competitive advantage.

H4-1: The increase of human project resources will positively influence the company's cost advantage.

H4-2: The increase of human project resources will positively influence the company's differentiation advantage.

Dins more (1999) reported a set of situation where the importance of project as a method of strategic execution increases along with the project scale, quantity and complexity, then argued that company's strategies can be arranged through project portfolio management. Based on this, following hypothesis was made.

Hypothesis 5:

H5: Project portfolio management capability will positively influence the project's strategic connectivity.

As company is interested in conducting bigger, more complicated, and a growing number of projects, the project's link with company strategy should be tightened. Under the circumstances, project connectivity can be improved with portfolio management (Levine, 2005). Hypothesis was established based on the fact that portfolio management makes company strategies to be achieved in higher chances which lead to creation of competitive advantage.

Hypothesis 6:

H6: The increased connectivity between project and strategy will positively influence the company's competitive advantage in direct way.

H6-1: The increased connectivity between project and strategy will positively influence the company's cost advantage in direct way.

H6-2: The increased connectivity between project and strategy will positively influence the company's differentiation advantage in direct way.

The project portfolio management was found as a method for efficient distribution of resources, improved connectivity between strategy and project. This method is a means to arrange strategies and project, a tool for strategic execution which affects competitive advantage (Dins more, 1999; Levine 2005).

Hypothesis 7:

H7: The project portfolio management capability will positively influence the company's competitive advantage.

H7-1: The project portfolio management capability will positively influence the company's cost advantage.

H7-2: The project portfolio management capability will positively influence the company's differentiation advantage.

Hypothesis 8:

H8: The project portfolio management capability will bring the positive mediated influence to the relationship between financial/physical project resources and competitive advantage.

Hypothesis 9:

H9: The project portfolio management capability will bring the positive mediated influence to the relationship between human project resources and competitive advantage.

b) Research Model

As shown in <Figure 5>, the research model of this study was designed based on existing model by Teece et al.,(1997) and Killen(2010), which set financial/physical project resources and human resources as “the position”, and put project portfolio management into “the process” section. However, “the path” was removed from the model because it does not match with the study’s goal which is to examine the

reason that project portfolio management has introduced. The previous works on “the path” have determined its meaning as company’s historic and future paths - the maturity of project portfolio management- that is required for dynamic capability- project portfolio management- to gain competitive advantage. Instead, in this research model, strategy connectivity and competence capability were added as dependent variables to closely examine the influence of project portfolio management. So to speak, the goal of this study is to show the process that financial/physical and human resources influence project portfolio management, and the connection between strategy and project is established, and competitive advantage is gained.

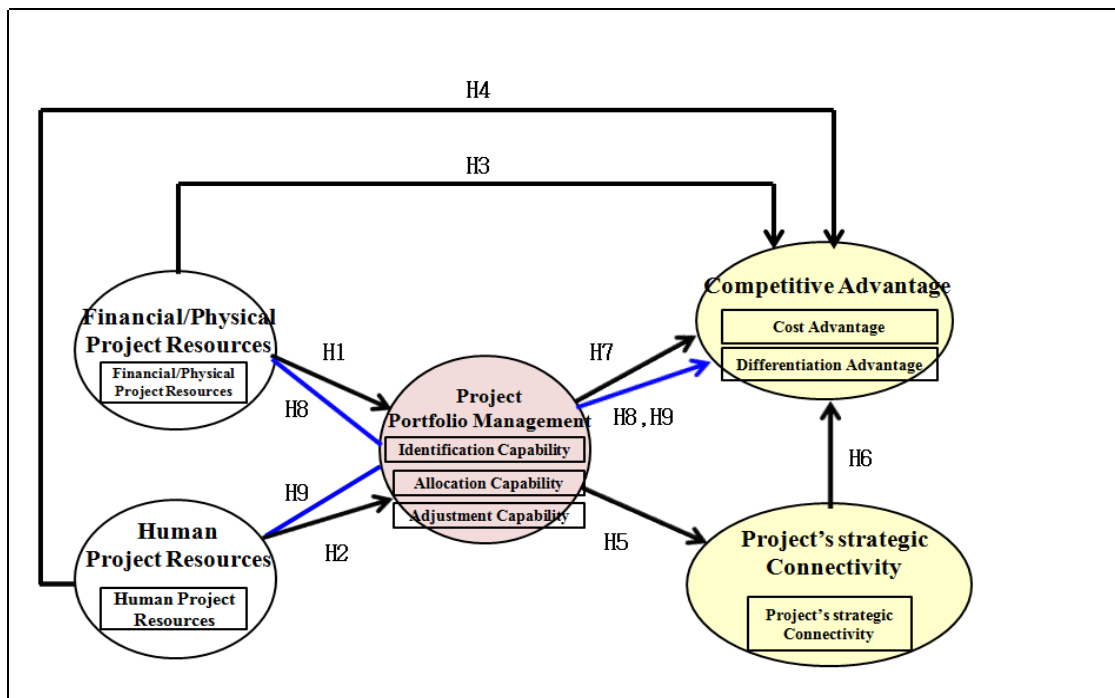


Figure 5: Research Model

c) Questionnaire design

A questionnaire was used for collecting the data needed for the research model. The questionnaire included a specific question for assessing relationships among Project Resources (Financial/Physical and Human), Project Portfolio Management, Project's strategic Connectivity and Competitive Advantage. Overall 26 questions used a 5-point Likert scale to indicate the level of agreement with a statement.

d) Data gathering

This study conducted a survey from Nov. 6 to Oct. 19, 2015, of companies in South Korea. Google Drive was employed as the survey method. A combined 210 questionnaires were collected, of which 203 were deemed relevant and statistically analyzed. Table 1 shows the profiles of the sample. The biggest share of

the population was the age range of 40~49 (43.3 percent), and the majority of respondents were male (93.1 percent). In work experience, the majority (29.6 percent) of informants had been working for 10~15 years. By position, the majority (31 percent) were department heads.

Table 1: Profiles of sample

Items(n=203)	Range	Frequency	Ratio
Age	20~29	2	1.0%
	30~39	62	30.5%
	40~49	88	43.3%
	50~59	48	23.6%
	Over 60	3	1.5%
	Total	203	100.0%
Gender	Male	189	93.1%
	Female	14	6.9%
	Total	203	100.0%
Work experience	Under 5 years	23	11.3%
	5~10 years	33	16.3%
	10~15 years	60	29.6%
	15~20 years	30	14.8%
	Over 20 years	57	28.1%
	Total	203	100.0%
Job position	Staff	5	2.5%
	Assistant manager	26	12.8%
	Manager	46	22.7%
	Senior manager	37	18.2%
	Head of department	63	31.0%
	Director & Management	26	12.8%
	Total	203	100.0%

In addition, the 203 valid samples were all working for Korean companies and the sectors to which they belonged are below <Table 2>:

Table 2: Industry of sample

Industry	Frequency	Ratio
Defense	109	53.7%
Construction/Plant/Engineering	38	18.7%
ICT	29	14.3%
Machinery/Shipbuilding	7	3.4%
Finance/Service	7	3.4%
Education/Consulting	7	3.4%
Others	6	3.0%
Sum	203	100.0%

The vast majority (53.7 percent) worked for the defense industry, followed by construction, plants and engineering (18.7 percent), ICT (14.3 percent), machinery and shipbuilding (3.4 percent), finance and services (3.4 percent), education and consulting (3.4 percent), and others (three percent).

IV. DATA CONDITIONING

a) Reliability

For resources of financial, physical and human projects, project portfolio management, project's strategic connectivity, and cost and differentiation advantages, the factor analysis results are below in <Table 3>:

Table 3: Reliability

Variables	Factors	Questions	Cronbach α after removal	Cronbach α	No. of question	
Financial/Physical project resources (Independent variable)	Financial/Physical project resources	Financial/Physical resources 1	.850	.858	3	
		Financial/Physical resources 2	.755			
		Financial/Physical resources 3	.795			
Human project resources (Independent variable)	Human project resources	Human resources 1	.890	.810	3	
		Human resources 2	.620			
		Human resources 3	.688			
Project portfolio management (Parameter)	Project portfolio management	Identification capability 1	.936	.941	9	
		Identification capability 2	.935			
		Identification capability 3	.935			
		Allocation capability1	.935			
		Allocation capability2	.932			
		Allocation capability3	.932			
		Adjustment capability1	.934			
		Adjustment capability2	.934			
		Adjustment capability3	.932			
Project's strategic connectivity (Dependent variable)	Project's strategic connectivity	Project status 1	.864	.877	5	
		Project status 2	.846			
		Project status 3	.852			
		Project status 4	.846			
		Project status 5	.849			
Company competitive advantage (Dependent variable)	Cost advantage	Cost advantage1	.617	.773	3	
		Cost advantage2	.694			
		Cost advantage3	.758			
	Differentiation advantage	Differentiation advantage	Differentiation advantage1	.843	.891	3
			Differentiation advantage2	.861		
			Differentiation advantage3	.835		

The resources of financial, physical and human projects were found as independent variables through factor examination, while project portfolio management was found as a parameter and the project's strategic connectivity and cost and differentiation advantages were confirmed as dependent variables. For verification of each factor, Cronbach α was used in which all the factors were deemed reliable since the factor loading was found near 0.8.

b) Convergent validity

As shown in <Table 4>, convergent validity was examined as the next step, in which the AVEs of every six factors were found to exceed 0.5 and CCRs surpassed 0.7, thus validity was verified as being high enough.

Table 4: Convergent validity

Unobserved variable	Observed variable	Unstandardized λ	S.E.	C.R. ^a	Standardized λ	P	AVE ^b	CCR ^c
Financial /Physical Project resources	Financial/Physical resources 1	0.911	0.08	11.450	0.753	***	0.712	0.881
	Financial/Physical resources 2	1.076	0.081	13.346	0.892	***		
	Financial/Physical resources 3	1	-	-	0.816			
Human Project resources	Human resources 1	0.659	0.077	8.544	0.567	***	0.623	0.827
	Human resources 2	0.944	0.064	14.78	0.899	***		
	Human resources 3	1	-	-	0.888			
Project Portfolio Management	Identification capability 1	0.783	0.065	12.094	0.697	***	0.625	0.937
	Identification capability 2	0.759	0.066	11.529	0.676	***		
	Identification capability 3	0.734	0.061	12.130	0.699	***		
	Allocation capability 1	0.794	0.069	11.482	0.675	***		
	Allocation capability 2	0.899	0.067	13.449	0.744	***		
	Allocation capability 3	0.881	0.061	14.353	0.772	***		
	Adjustment capability 1	1.032	0.055	18.910	0.883	***		
	Adjustment capability 2	0.982	0.051	19.401	0.893	***		
Project's strategic Connectivity	Project status 1	0.937	0.089	10.493	0.714	***	0.617	0.890
	Project status 2	1.033	0.09	11.517	0.773	***		
	Project status 3	1.016	0.09	11.316	0.761	***		
	Project status 4	1.092	0.091	12.036	0.802	***		
	Project status 5	1	-	-	0.790			
Cost Advantage	Cost advantage 1	1.645	0.227	7.237	0.881	***	0.582	0.803
	Cost advantage 2	1.322	0.175	7.559	0.700	***		
	Cost advantage 3	1	-	-	0.606			
Differentiation Advantage	Differentiation advantage 1	1.035	0.067	15.480	0.869	***	0.798	0.922
	Differentiation advantage 2	1.136	0.077	14.700	0.835	***		
	Differentiation advantage 3	1	-	-	0.875			

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

a. C. R. (Critical Ratio=z-value)

b. AVE: Average Variance Extracted

c. CCR: Composite Construct Reliability

c) Discriminant validity

As shown in <Table 5>, discriminate validity was examined with AVE values of the factors; to be valid, AVE values must be higher than those of squared parameters. As a result, all AVE values were found to be higher than those of squared parameters.

Table 5: Discriminant validity

Division	Correlation coefficient square						AVE
	Financial /Physical project resources	Human project resources	Project's strategic connectivity	Project portfolio management	Cost advantage	Differentiation advantage	
Financial/Physical project resources	1						0.712
Human project resources	0.307	1					0.623
Project's strategic connectivity	0.195	0.289	1				0.617
Project portfolio management	0.257	0.286	0.441	1			0.625
Cost advantage	0.027	0.012	0.004	0.003	1		0.582
Differentiation advantage	0.233	0.233	0.279	0.288	0.004	1	0.798

In addition, measurement model suitability was verified with χ^2 (CMIN) values among absolute fit indexes. The result was 622.063 with d. f. 279, making CMIN/d. f. 2.230 and verified as validated since the value was smaller than 3. The bottom line of GFI (Goodness of Fit Index) for validation is 0.9, and the result of 0.812 was close to 0.9. In RMR (Root Means Square Residual) and RMSEA (Root Means Square Error of Approximation), lower indexes mean a higher validation level, and this is relevant when RMR values are lower than 0.05 while those of RMSEA are considered validated when within 0.05~0.1. In this

model, no big difference was seen between the standard value and that of RMR (0.062);that of RMSEA (0.078) was confirmed to be proper. In addition, the CFI (Comparative Fit Index) and NFI (Normed Fit Index) are considered validated when their values exceed 0.9, and the result in this model showed a CFI of 0.909 and NFI of 0.849.

d) *Measurement & Research model suitability*

Based on these validation assessments, the conclusion was that the model is validated overall. The results are also shown in <Table 6>.

Table 6: Measurement model suitability

Fit index	χ^2 (CMIN)	d.f.	CMIN/d.f.	GFI	RMR	RMSEA	CFI	NFI
Model	622.063	279	2.230	.812	.062	.078	.909	.849
Standard	-	-	Under 3	Over 0.9	Under 0.05	0.05~1	Over 0.9	Over 0.9

In sequence, the suitability of the research model was verified with χ^2 (CMIN) values among absolute fit indexes. The result was 521.572 and d. f. of 277, thus the CMIN/d. f. was 1.883 and verified as validated since the value was smaller than 3. The bottom line of GFI for validation is 0.9 and the result was 0.84, which is close to 0.9. In RMR and RMSEA, lower indexes mean a higher validation level, and this is relevant when RMR values are lower than 0.05 while those of RMSEA are considered validated when within 0.05~0.1. In this model, no big difference was seen between the standard value and that of RMR (0.057);the RMSEA value of 0.066 was confirmed to be proper. In addition, the CFI and NFI are considered validated when

their values exceed 0.9. The results in this model found a CFI of 0.935 and NFI of 0.873.

Based on these validation assessments, the conclusion was that the model is validated overall. The results are also shown in <Table 7>.

Table 7: Research model suitability

Fit index	χ^2 (CMIN)	d.f.	CMIN/d.f.	GFI	RMR	RMSEA	CFI	NFI
Model	521.572	277	1.883	.840	.057	.066	.935	.873
Standard	-	-	Under 3	Over 0.9	Under 0.05	0.05~1	Over 0.9	Over 0.9

V. RESULTS AND DISCUSSION

Hypothesis 1 to hypothesis 7 were verified by Path analysis according to structural equation model, and hypothesis 8 and hypothesis 9 were analyzed by mediation regression analysis and bootstrap Maximum Likelihood.

Introduction of Project portfolio management (tests of H1-H7)

Hypothesis 1 to hypothesis 7 were verified by Path analysis according to structural equation model, and the result is as below in <Table 8>:

Table 8: Hypothesis testing by structural equation model

Hypothesis	Path	Estimate	S.E.	C.R.	P-value	Adopted or Rejected
Hypothesis 1	Financial/Physical project resources → Project portfolio management	0.352	0.061	5.744	0.000***	Adopted
Hypothesis 2	Human project resources → Project portfolio management	0.340	0.061	5.546	0.000***	Adopted
Hypothesis 3-1	Financial/Physical project resources → Cost advantage	-0.133	0.074	-1.791	0.073	Rejected
Hypothesis 3-2	Financial/Physical project resources → Differentiation advantage	0.171	0.061	2.786	0.005**	Adopted
Hypothesis 4-1	Human project resources → Cost advantage	-0.124	0.074	-1.674	0.094	Rejected
Hypothesis 4-2	Human project resources → Differentiation advantage	0.180	0.061	2.949	0.003**	Adopted
Hypothesis 5	Project portfolio management → Project's strategic connectivity	0.496	0.061	8.121	0.000***	Adopted
Hypothesis 6-1	Project's strategic connectivity → Cost advantage	0.069	0.080	0.869	0.385	Rejected
Hypothesis 6-2	Project's strategic connectivity → Differentiation advantage	0.234	0.066	3.569	0.000***	Adopted
Hypothesis 7-1	Project portfolio management → Cost advantage	0.018	0.089	0.206	0.837	Rejected
Hypothesis 7-2	Project portfolio management → Differentiation advantage	0.295	0.073	4.041	0.000***	Adopted

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

It was confirmed that financial/physical project resources and human project resources affect project portfolio management as hypothesis 1 and hypothesis 2 was examined to be validated. The growth in the number of projects increases the project resources qualitatively and quantitatively. For such an increasing number of project resources, the company experiences difficulties in management control (manpower resource allocation, budget allocation etc.). In order to solve this problem, it is proved through the adoption of hypothesis

1 and hypothesis 2 that companies need to introduce project portfolio management.

Hypothesis 3 and hypothesis 4 were to verify the influence of financial/physical and human project resources on competitive advantage, where it was examined that the resources do not affect cost advantage (H3-1, H4-1) but positively influence the differentiation advantage (H3-2, H4-2), therefore hypothesis 3 and hypothesis 4 were employed. Quantitative and qualitative increases in project

resources provide companies with the opportunity to undertake more projects. This condition gives companies more opportunity to offer differentiated products or services to their customers. This has been proven through the adoption of hypothesis 3 and hypothesis 4 that firms can gain competitive advantage (in particular, differentiation advantage).

Hypothesis 5 was employed according to the result of examination, and it is fair to say that project portfolio management is involved in the increase of strategic connectivity. Projects are becoming more and more large, complex and accretive. At this time, the project may have difficulty in linking with corporate strategy. In this context, the adoption of hypothesis 5 proves that project portfolio management needs to be introduced in order to effectively align corporate strategies and projects.

Hypothesis 6 was regarding the influence of strategic connectivity on company's competitive advantage. The strategic connectivity of the project does not influence the cost advantage (H6-1), and, on the other hand, it influences differentiation advantage positively (H6-2), therefore hypothesis 6 was employed. As demonstrated in hypothesis 5, project portfolio management enhances the level of linkage between projects and corporate strategy. In this situation, it is more likely that corporate strategy can be achieved more effectively through project implementation. This has been proven through the adoption of hypothesis 6 that the firm leads to securing competitive advantage (in particular, differentiation advantage)

Hypothesis 7 verified the influence of portfolio management on competitive advantage. The project portfolio management was examined to be not involved in cost advantage (H7-1). Meanwhile, it positively affects differentiation advantage (H7-2), so hypothesis 7 was validated. The company introduces project portfolio management in order to link effectively projects and corporate strategy and to allocate efficiently project resources. This enables companies to achieve efficient allocation of resources and effective alignment between corporate strategy and projects. The adoption of hypothesis 7 proves that this situation leads to the achievement of corporate competitive advantage (in particular, differentiation advantage).

Effect of Project portfolio management on Competitive advantage (tests of H8-H9)

Before we examine hypothesis 8 and hypothesis 9, reliability of parameter effect on project portfolio management was verified. To do so, mediation regression was analyzed in the first hand, and bootstrap maximum likelihood was applied. The cost advantage was removed from the analysis, because it has failed to be validated.

Regarding hypothesis 8, it was confirmed that the significant probability of was zero when there was no mediation with portfolio management while the figure has risen to 0.118, which is not relevant, in case of the mediation. Therefore, it was verified that the management has complete mediation effect between the financial/physical resources and the differentiation advantage as it is shown in <Table 9>.

Table 9: Regression analysis for hypothesis 8

Model	Unstandardized coefficient		Standardize d coefficient	t	p
	B	S.E.	B		
1 (Constant)	1.000E-013	.068		.000	1.000
Financial/Physical project resources	.275	.068	.275	4.058	.000***
Regression model F= 16.465, p=.000, R ² = .076, df=202					
2 (Constant)	1.001E-013	.59		.000	1.000
Financial/Physical project resources	.100	.064	.100	1.570	.118
Project portfolio management	.498	.064	.498	7.835	.000***
Regression model F= 41.397, p=.000, Adjusted R ² = .286, df=202					

* p<0.10, ** p<0.05, *** p<0.01

a. Dependent variable: Differentiation advantage

The mediation effect of hypothesis 9 was examined that the beta variable of the human project resource was 0.281 in case of no mediation. However, on the other hand, the variable was decreased to 0.112

when the management was involved. Through this result, it was confirmed that the portfolio management partially mediate the human project resources and differentiation advantage as shown in <Table 10>.

Table 10: Regression analysis for hypothesis 9

Model	Unstandardized coefficient		Standardized coefficient	Model	p
	B	S.E.	B		
1 (Constant)	1.000E-013	.068		.000	1.000
Human project resources	.281	.068	.281	4.147	.000***
Regression model F= 17.200, p=.000, R ² = .079, df=202					
2 (Constant)	1.000E-013	.059		.000	1.000
Human project resources	.112	.063	.112	1.781	.076*
Project portfolio management	.495	.063	.495	7.837	.000***
Regression model F= 41.892, p=.000, Adjusted R ² = .288, df=202					

*p<0.10, **p<0.05, ***p<0.01

b. Dependent variable: Differentiation advantage

Throughout the test, hypothesis 8 and hypothesis 9 were deployed. The increase of the project recourse makes the projects to be executed stably, which leads to achieve of competitive advantage (differentiation advantage). Under the circumstances, ultimately the portfolio management strengthens the competitive advantage by distributing increased resources effectively.

As shown in <Table 11>, the bootstrap maximum likelihood method was used in the test of hypothesis 8 and hypothesis 9 based on structural equation model. To sum up, verification was conducted for hypothesizes that financial/physical project resources and human resources affect project portfolio management, and it was examined to be relevant with 0.004 significant value.

Table 11: Results of bootstrap test for hypothesis 8 and 9

	Financial/Physical project resources	Human project resources	Project portfolio management
Project portfolio management	-	-	-
Cost advantage	.489	.489	-
Differentiation advantage	.004***	.004***	-

*p<0.10, **p<0.05, ***p<0.01

VI. CONCLUSION

Across the thesis, we tried to examine the factors that affect execution of project portfolio management, and how it brings competitive advantage.

First of all, introduction factor of the portfolio management was figured out to be financial/physical project resources and human project resource, which raise the need of integrated control management method (project portfolio management) at organization level as the number of the projects and its resources increases. Secondly, the connectivity between the portfolio management and company strategies was

examined, and we found the relevant link that the centralized control management brings the strategies and the projects together. Thirdly, the influence of financial/physical project resources, human project resource, the connectivity between projects and company strategy and portfolio management on the improvement of competitive advantage were examined, and we concluded that all these factors have to do with the differentiation advantage meanwhile there was no relevant link with the cost advantage. This is because the project is basically the tool for company to offer differentiated products or services. Finally, regarding the mediation effect on the company's competitive

advantage, it was examined that the project portfolio management act as complete mediation for financial/physical project resources, therefore strengthen the competitive (differentiation) advantage. On the other hand, for the human project resources, portfolio management was involved in it as partial mediation. It is fair to say that the attempt to integrate project resources and projects that are individually managed improves company's competitive advantage.

For these results of practical studies, it is encouraged for companies to employ project portfolio management to achieve competitive advantage effectively. This paper is meaningful in the point that it has examined the need of portfolio management through practical research, which has not tried in South Korea yet.

However, it is hard to say that it reflects overall characteristics of every industry since over 50% of the sample was from defense industry. Therefore, there needs to be more varied samples from each industries, also the comparison between the industries has to be done. This study was focused on the execution of project portfolio management, however, in the future research, connection of improved maturity of portfolio management and competitive advantage needs to be examined, and the study on cost advantage, which was not employed in this research and its relationship with portfolio management, should also be done.

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Conserving Energy through Energy Management by the Facility Managers in India

By Shaikh Shamser Ali & Dr. Ruchi Tyagi

Abstract- Facility Management in IT sector is a booming business in India today. IT companies expect the facility should be always ready for use to meet their business operational requirements without any hindrance. Property owner need an external agency to ensure that demand is met at all the times. That is why Facility Management Company is in demand but Energy Conservation is a lost priority as it does not fit into anyone's requirement. If Energy Conservation for operational excellence is made part of the property rental agreement then it will fit into everyone's requirement. Studies have shown the Facility Manager can save energy without any expenditure just by fine tuning the equipment operations as it is one of his major responsibilities. Facility Managers experienced in Energy Management strongly believe that if Energy Conservation is incorporated into the Facility Management activities as part of the contractual obligation then it is very much possible to reduce the total energy requirement to run the facility without compromising with the comfort level / output. This saving in energy cost will directly benefit to all parties concerned.

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Conserving Energy through Energy Management by the Facility Managers in India

Shaikh Shamser Ali^α & Dr. Ruchi Tyagi^σ

Abstract- Facility Management in IT sector is a booming business in India today. IT companies expect the facility should be always ready for use to meet their business operational requirements without any hindrance. Property owner need an external agency to ensure that demand is met at all the times. That is why Facility Management Company is in demand but Energy Conservation is a lost priority as it does not fit into anyone's requirement. If Energy Conservation for operational excellence is made part of the property rental agreement then it will fit into everyone's requirement. Studies have shown the Facility Manager can save energy without any expenditure just by fine tuning the equipment operations as it is one of his major responsibilities. Facility Managers experienced in Energy Management strongly believe that if Energy Conservation is incorporated into the Facility Management activities as part of the contractual obligation then it is very much possible to reduce the total energy requirement to run the facility without compromising with the comfort level / output. This saving in energy cost will directly benefit to all parties concerned. Facility Management Companies will be able to include energy management into their offered services with no extra cost implication and can certainly have an advantage over the competitors. That will help Facility Management Companies to sustain in this competitive market environment.

Keywords: energy management, facility management, energy conservation.

I. INTRODUCTION

Facility Management (FM) was mostly confined to Operations and Maintenance (O&M) before the IT revolution in India. The in-house maintenance team of the organization is responsible for Facility Management (Haiwena et al., 2010). The meaning and applications of Facility Management evolved with the growth in IT operations in India. This growth is accordant with practices in developed countries. Facility Management emerged as a new business opportunity and there came a new breed of professionals called Facility Manager specializing in managing owner's premises for the efficient utilization of the premise by the tenants or occupants of the building as identified by Yang et al. (2012). This is done as a third party mediating between the property owner and property user.

The services provided in the premises are being used by the tenant and rental is being paid for every service that is being provided by the owner. Facility

Management company has the obligation to ensure the timely availability of all the facilities as per the contractual agreement on behalf of the property owner. Everything runs smoothly so long the tenant is not facing any difficulties, owner is getting his rental regularly and facility Management Company is managing without any complain from anywhere. In all these, energy consumption goes unnoticed even though huge amount of money is being paid every month by the tenant either due to ignorance or lack of information according to Fumo et al. (2010).

If the Facility Manager is mandated to Energy Management besides Facility management then not only energy can be saved but also substantial amount of money can be saved every month. According to Azizi et al. (2015) it is easy for the Facility Manager to do so as he is responsible for the complete Operation and Maintenance of the facility and capacitated with necessary manpower and accessories.

II. FACILITY MANAGEMENT

Facility Management Company (FMC) is responsible as per the contractual agreement for daily operations of all equipment / machines in the premise to ensure all facilities / services are available in time at the correct place for the tenant's usage to perform their business without any hindrance. FMC is also responsible for daily housekeeping, landscape up keeping, transport management, safety, security, preventive and breakdown maintenance and coordination with OEM (Original Equipment Manufacturer) for Annual Maintenance Contract (AMC) as mandated in the contract. FM in India does not include Energy Management (EM) and creates a void in operations particularly in energy conservation as identified by Ramesh et al. (2010).

III. ENERGY MANAGEMENT

Efficient utilization of energy to get the best output without compromising with the comfort / output level is energy management in simple term. EM is a scientific process tailor made to suit the operation and can be with no-cost to some cost which can be recovered from the savings in few months to few years' time depending upon the severity of the applications as suggested by Chunekar et al. (2016). A proper EM program will consists of Energy Audit (EA), Energy

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Conservation Measures (ECM) identification, ECM implementation, Measurement and Verification (M&V) and Funding. A typical EM program as proposed by Sapar et al. (2005) will be as below.

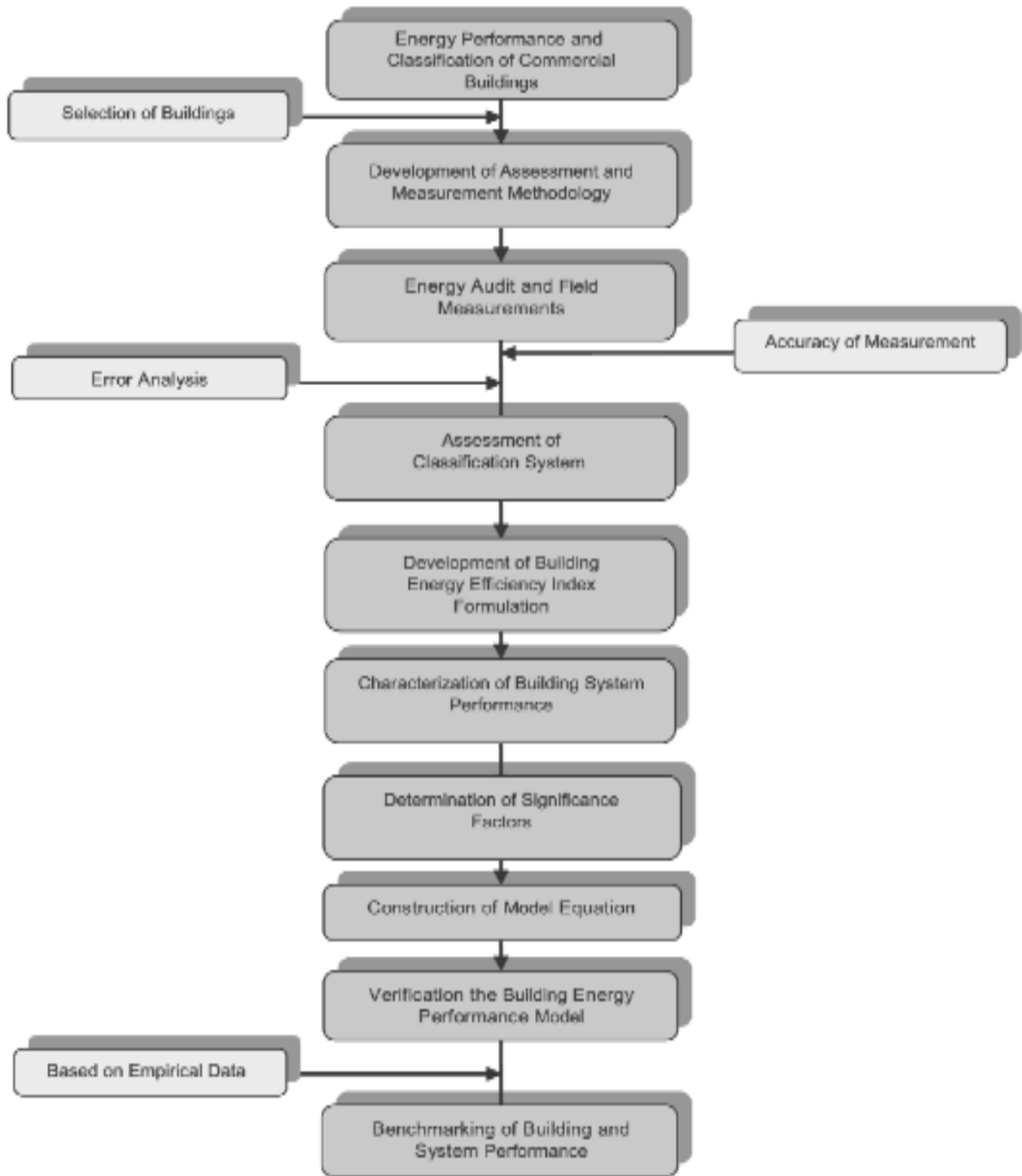


Fig. 1: Energy Management Program

Detailed Energy Audit (EA) is a step by step methodical approach to collect both historical data and operational data for a scientific analysis and evaluation

as suggested by Gago et al. (2013). A typical Energy Audit plan as proposed by Sapar et al. (2005) will be as follows.

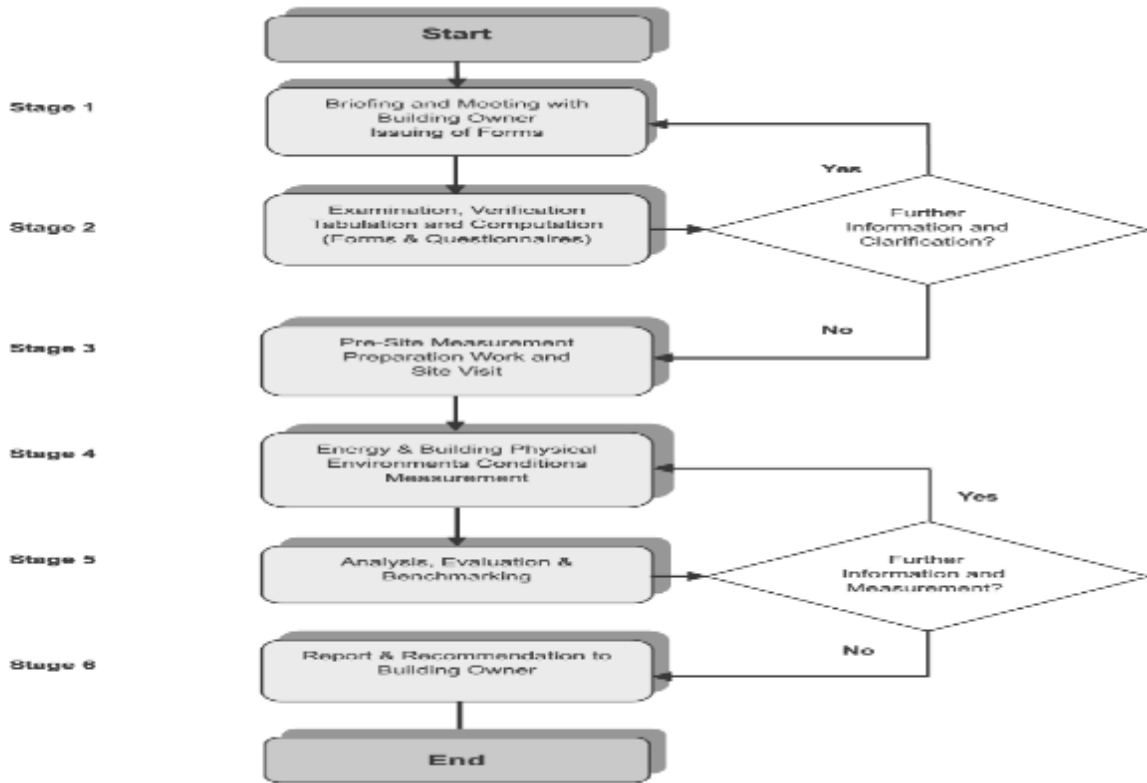


Fig. 2: Energy Audit Flow Chart

Once the energy audit is done then the building energy index can be derived from the collected data and

energy efficiency curve of the premise can be drawn as shown below by Sapar et al. (2005).

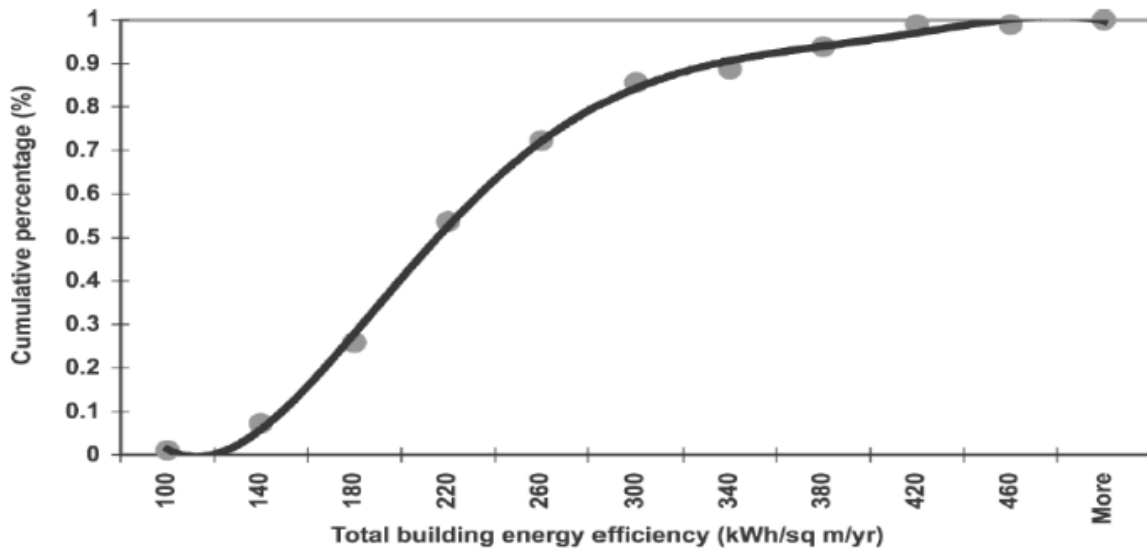


Fig. 3: Total Building Energy Efficiency Curve

a) Application of Energy Management

Energy Management (EM) can be applicable to any premise as suggested by Azizi et al. (2015) and with any kind of FM agreement. According to Liu et al. (2010) EM can be incorporated with FM for operational excellence and the savings in energy bill can be utilized to offset the total FM contractual budget. It is a concept that is worth exploring particularly the No-Cost ECMs

implementation to tap the low hanging fruits as suggested by Jamaludin et al. (2013) and Jones et al. (2013).

IV. METHODOLOGY

Loganthurai et al. (2012) suggest same equipment doing similar job in different locations will consume different amount of energy mainly due to

human intervention. If we change the attitude of the people by some means towards their energy usage habit and make them aware about their negligence then it is possible to reduce energy consumption free of cost

or at a minimal cost. Knowledge, Attitude, Behavior and Practices (KABP) model is one such approach advocated by Khan and Halder (2016) in application specific to Bangladesh.

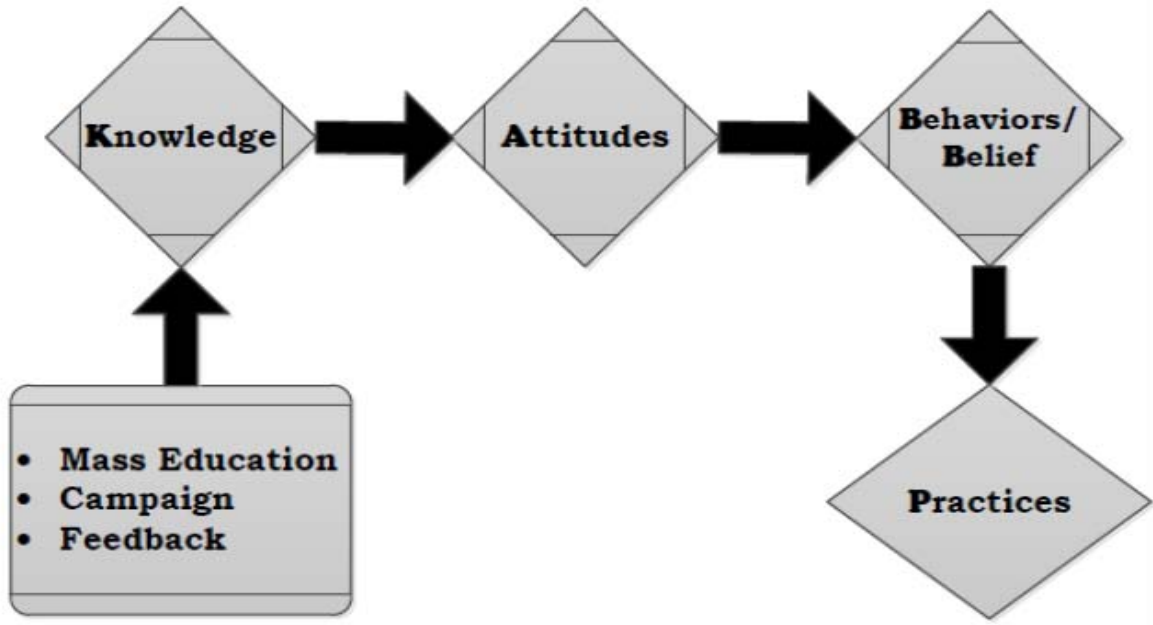


Fig. 4: Knowledge, Attitude, Behavior and Practices (KABP) model

Human behavior has many dimensions and can influence energy consumption in many ways. There can be many such similar approaches with innovative ideas

which will lead to better energy management as identified by Khan and Halder (2016).

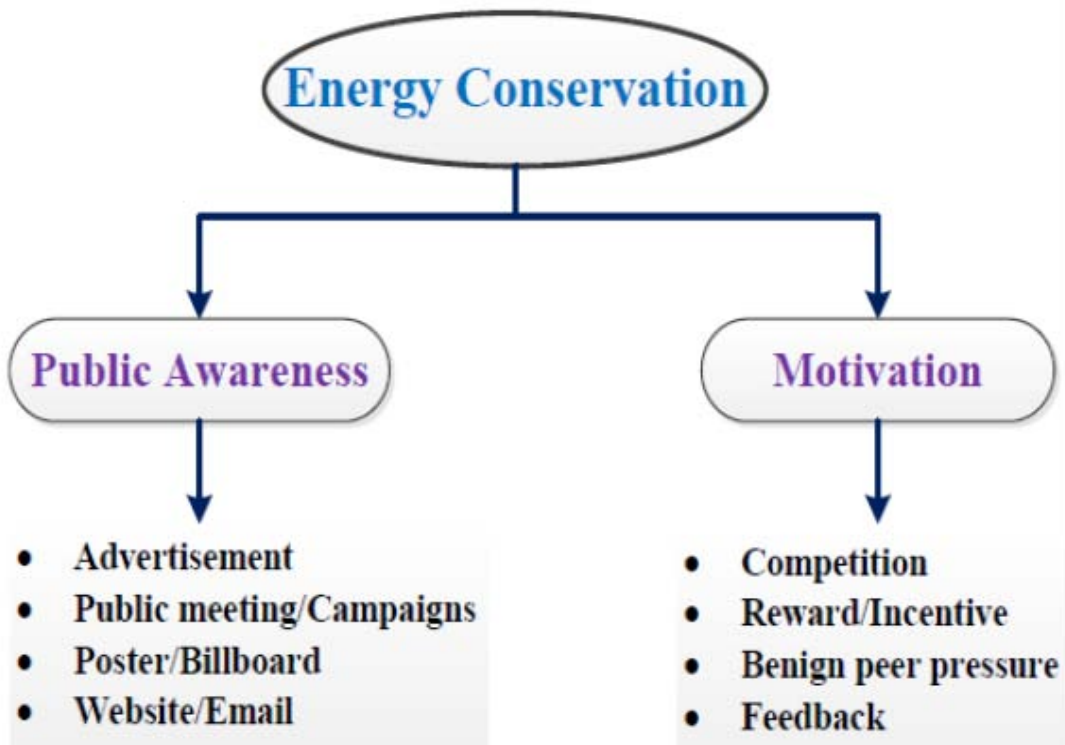


Fig. 5: Innovative Ideas for Energy Management

V. FINANCIAL BENEFITS

Mariotoni et al. (2005) suggested saving in energy bill will have direct impact to the building occupant / tenant [7]. The tenant is billed for every service based on actual amount of consumption and the unit rates are quite high. Per unit electricity cost ranges from Rs. 10 to Rs. 15 depending upon in which city the property belongs to and what kind of source the electricity is drawn from. Monthly energy bill for any mid-size IT company runs to millions of rupees. Biswas et al. (2013) found No-Cost ECM can save up to 5% in energy bill and other ECMs have the potentials to save 20 – 25 % of the energy bill. When the monthly energy bill runs in

millions such savings can make decisive impact on any business operations.

a) Energy Efficiency Leads to Better Managed Buildings

Energy efficiency will lead to efficient functioning of the machines that will lead to optimal performance, less breakdown and more productivity. Fewer breakdowns mean reduction in spares, maintenance cost and safe working condition. Building energy index will improve and can be used to compare between IT offices of the same organization located in different cities for bench marking. A typical benchmarking flow chart is suggested by Sapar et al. (2005) as shown below.

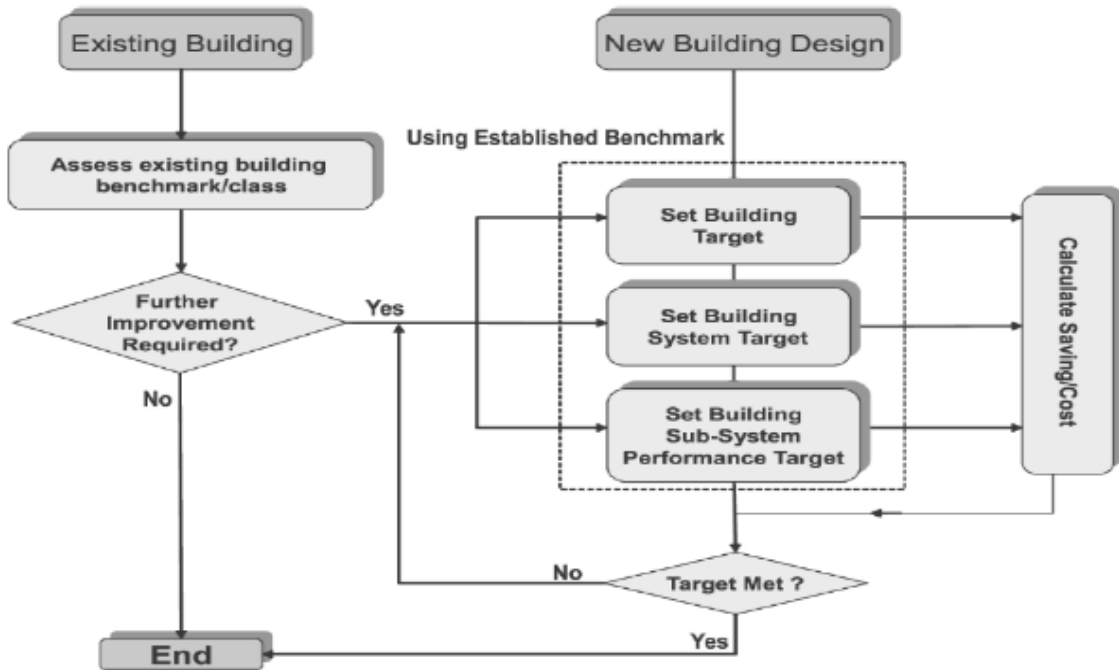


Fig. 6: Benchmarking Application Flow Chart

b) Use of Energy Management in India

FM operations is slowly graduating in India and there is huge scope for improvements. Incorporating EM with FM is one such scope which can be effectively used by FM Company to outbid the competition and Property owner's to offer a competitive rate to the occupants / tenants as suggested by Ishak et al. (2016). Property owner can also utilize the savings in energy bill to self-finance any energy conservation project as funding such projects in India is a problem due to L1 (lowest Quoted Price) concept of procurement.

VI. CONCLUSION

As the Facility Management business grows in India, particularly for the IT sector, the need to incorporate energy management into FM services will become mandatory. Competition will grow but only those FMC

will be able to survive who will be able to give better value for money to both the property owner and the tenants. Facility Managers will have to up skill their capability on energy conservation to meet the growing demands. Till now the FMCs have concentrated mainly on soft services like housekeeping, security and transportation etc. in the name of better services, but the time has come for energy conservation as the tenants are forced to look into opportunities to reduce the operational cost due to recession in IT business. IT industry has passed its peak and sustainability in this business is becoming challenging with passing days. Management in every IT company is forced to cut corners to maintain the profitability. Under this circumstance one of the easy ways to reduce the operating budget can be through reduction in energy cost that can easily be implemented with FM Operations

at no extra cost implication. HVAC (Heating, Ventilation and Air-Conditioning) constitute major portion of the energy bill in India and experience through various studies show FM team can easily control the temperature at different locations inside the building, depending upon the occupation of the offices by the people, from control desk with the help of BMS (Building Automation System). One of the preferred modes is to offset the room set temperature by 1 -2 Degree Centigrade that will increase the compressor cut-off time leading to energy conservation.

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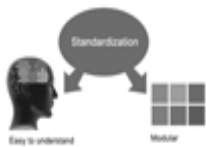
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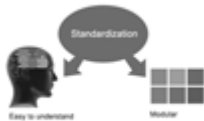
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It may take the discovery of only one important paper to steer in the right keyword direction because, in most databases, the keywords under which a research paper is abstracted are listed with the paper.

Numerical Methods

Numerical methods used should be transparent and, where appropriate, supported by references.

Abbreviations

Authors must list all the abbreviations used in the paper at the end of the paper or in a separate table before using them.

Formulas and equations

Authors are advised to submit any mathematical equation using either MathJax, KaTeX, or LaTeX, or in a very high-quality image.

Tables, Figures, and Figure Legends

Tables: Tables should be cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g., Table 4, a self-explanatory caption, and be on a separate sheet. Authors must submit tables in an editable format and not as images. References to these tables (if any) must be mentioned accurately.



Figures

Figures are supposed to be submitted as separate files. Always include a citation in the text for each figure using Arabic numbers, e.g., Fig. 4. Artwork must be submitted online in vector electronic form or by emailing it.

PREPARATION OF ELETRONIC FIGURES FOR PUBLICATION

Although low-quality images are sufficient for review purposes, print publication requires high-quality images to prevent the final product being blurred or fuzzy. Submit (possibly by e-mail) EPS (line art) or TIFF (halftone/ photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Avoid using pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings). Please give the data for figures in black and white or submit a Color Work Agreement form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution at final image size ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs): >350 dpi; figures containing both halftone and line images: >650 dpi.

Color charges: Authors are advised to pay the full cost for the reproduction of their color artwork. Hence, please note that if there is color artwork in your manuscript when it is accepted for publication, we would require you to complete and return a Color Work Agreement form before your paper can be published. Also, you can email your editor to remove the color fee after acceptance of the paper.

TIPS FOR WRITING A GOOD QUALITY ENGINEERING RESEARCH PAPER

Techniques for writing a good quality engineering research paper:

1. Choosing the topic: In most cases, the topic is selected by the interests of the author, but it can also be suggested by the guides. You can have several topics, and then judge which you are most comfortable with. This may be done by asking several questions of yourself, like "Will I be able to carry out a search in this area? Will I find all necessary resources to accomplish the search? Will I be able to find all information in this field area?" If the answer to this type of question is "yes," then you ought to choose that topic. In most cases, you may have to conduct surveys and visit several places. Also, you might have to do a lot of work to find all the rises and falls of the various data on that subject. Sometimes, detailed information plays a vital role, instead of short information. Evaluators are human: The first thing to remember is that evaluators are also human beings. They are not only meant for rejecting a paper. They are here to evaluate your paper. So present your best aspect.

2. Think like evaluators: If you are in confusion or getting demotivated because your paper may not be accepted by the evaluators, then think, and try to evaluate your paper like an evaluator. Try to understand what an evaluator wants in your research paper, and you will automatically have your answer. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

3. Ask your guides: If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

4. Use of computer is recommended: As you are doing research in the field of research engineering then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

5. Use the internet for help: An excellent start for your paper is using Google. It is a wondrous search engine, where you can have your doubts resolved. You may also read some answers for the frequent question of how to write your research paper or find a model research paper. You can download books from the internet. If you have all the required books, place importance on reading, selecting, and analyzing the specified information. Then sketch out your research paper. Use big pictures: You may use encyclopedias like Wikipedia to get pictures with the best resolution. At Global Journals, you should strictly follow [here](#).



6. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right? It is a good habit which helps to not lose your continuity. You should always use bookmarks while searching on the internet also, which will make your search easier.

7. Revise what you wrote: When you write anything, always read it, summarize it, and then finalize it.

8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10. Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.

Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.



21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium through which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

INFORMAL GUIDELINES OF RESEARCH PAPER WRITING

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.

Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.

- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.



Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.



Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."

Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.



Approach:

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

THE ADMINISTRATION RULES

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CRITERION FOR GRADING A RESEARCH PAPER (COMPILATION)
BY GLOBAL JOURNALS

Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals.

Topics	Grades		
	A-B	C-D	E-F
<i>Abstract</i>	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
<i>Introduction</i>	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
<i>Methods and Procedures</i>	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
<i>Result</i>	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
<i>Discussion</i>	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
<i>References</i>	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring



INDEX

A

Auspicious · 39

B

Bijjective · 48, 49

Bootstrap · 30, 32, 34

C

Capsularis · 39

Chaotic · 48, 50, 52

Conjugacy · 48

Corchorus · 39

Cronbach · 26

E

Encyclopedia · 42, 43

Enhances · 32

G

Ganizations · 18

Gemunden · 36

L

Lehtonen · 21, 36

U

Uncertainty · 16, 18

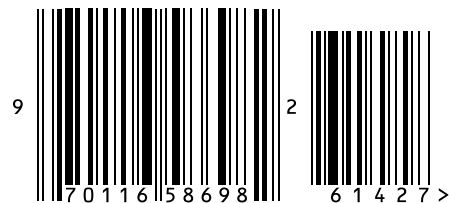


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