

A Systematic Study on Strategic Cost Management for Success in Construction Projects

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Abstract: Large construction projects are inherently complex and dynamic. Many projects start with good ideas, huge investments and great efforts. However, most of them do not achieve much success. A major contribution to unsuccessful projects is the lack of understanding on scope, time, cost and quality. Projects as powerful strategic weapons when initiated create economic value and competitive advantage. The objective of the research is to explicitly declare the scope of the research to be considering only the scope, time, cost and quality as process success parameters and how specifically the cost element would influence the project success when all other elements or factors other than cost are represented in terms of cost factor along with the contract conditions as basic rules or constraints that drive the strategic cost based on applying the CRASP methodology concept. The concept of benchmarking would provide right meaning of project success when allowing to properly distributing the meaning of customer profitability to the project providers (project owner and contractors).

Keywords: Cost Management, Strategic Cost Management, Project Cost Management, Project success.

1. Introduction

A. General

Development represents one of the essential requirements for all mankind all through the historical backdrop of the world. It devours common assets, both to frame the physical piece of the development, and to aid development as vitality and framework for cases. The common assets that are parts of the physical matter of development, which shapes the fundamental segments, have changed through innovative work, from characteristic stone blocks, to strengthened cement and steel structures. They are mined and handled to fulfill the predetermined attributes, as required by fashioners. Cost administration has been an essential piece everything being equal, since it gives the data required to assess the benefits and misfortunes, previously, amid, and after the activities. Asset administration tends to the accessibility all things considered, which are (Gasiorowski 1995) consumed absolutely or incompletely by the ventures, computed as dry expenses or overheads.

Innovation is advancing exponentially and creations in the

mechanical technology field are opening new possibilities for Artificial Intelligence (AI) and Automation future, where human communication in assembling and development is being diminished and supplanted by machines.

Keeping in mind the end goal to examine profoundly in thoughts identified with the eventual fate of mankind, a few perspectives are investigated to illuminate the vision from a few purposes of perspectives. One of these thoughts is The Venus Project (TVP) which considers a development that depends on three perspectives, Society, Environment, and Technology. Advancing from the current innovative and ecological status, society is relied upon to flourish to the level where humankind can make due without war, destitution and yearning.

B. Project definition

Task as a rule alludes to another undertaking with particular goal and changes so broadly that it is extremely hard to exactly characterize it. A portion of the regularly cited definitions are as per the following. Venture is a transitory undertaking attempted to make a one of a kind item or administration or result. (AMERICAN National Standard ANSI/PMI99-001-2004) Project is an extraordinary procedure, comprise of an arrangement of composed and controlled exercises with begin and complete dates, attempted to accomplish a target affirming to particular necessities, including the requirements of time cost and asset.

Cases of venture incorporate Developing a watershed, Creating water system office, developing new assortment of a product, developing new type of a creature, Developing agroprocessing focus, Construction of ranch building, sting of a concentrated feed plant and so on. It might be noticed that every one of these activities vary in organization, type, extension, size and time.

1) Project Characteristics

Despite above diversities, projects share the following common characteristics.

1. Unique in nature.
2. Have definite objectives (goals) to achieve.
3. Requires set of resources.
4. Have a specific time frame for completion with a

definite start and finish.

5. Involves risk and uncertainty.
6. Requires cross-functional teams and interdisciplinary approach.

2) Project performance dimensions

Three major dimensions that define the project performance are scope, time, and resource. These parameters are interrelated and interactive. The relationship generally represented as an equilateral triangle. The relationship is shown in Fig. 1.

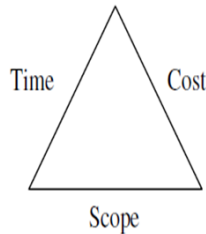


Fig. 1. Project performance dimensions

It is obvious that any adjustment in any of measurements would influence the other. For instance, if the extension is broadened, venture would require more opportunity for culmination and the cost would likewise go up. On the off chance that time is lessened the degree and cost would likewise be required to be diminished. Thus any adjustment in cost would be reflected in degree and time. Effective finishing of the undertaking would require achievement of determined objectives inside planned time and spending plan. As of late a forward measurement, partner fulfillment, is added to the undertaking. Be that as it may, the other school of administration contends that this measurement is an innate piece of the extent of the task that characterizes the details to which the undertaking is required to be executed. In this manner the execution of an undertaking is estimated by how much these three parameters (extension, time and cost) are accomplished.

C. Assumptions

For a progressive research such as this one, some assumptions are introduced, based on the Resource Based Economy model.

- a) Construction is robotized and machines are worked to assemble different machines that are utilized in development exercises.
- b) Natural assets are a typical legacy everything being equal, paying little respect to the area of these assets, and they are to be transported unreservedly over the planet.
- c) Data is accessible for logical research and handled by cutting edge PCs for basic leadership.
- d) The attributes of materials, despite the fact that they contrast from one outline to the next, are expected consistent to encourage the exhibition of the model.
- e) The vitality utilized amid generation, assembling, transportation and development is dismissed amid this

exploration. The vitality incorporates; human work, power, fuel, and so on.

- f) The materials utilized for the assembling the machines are neglected amid this examination. The materials incorporate; steel, concrete for production lines and other subordinate machines.
- g) Data is put away in server farms, which are associated universally and refreshed as new destinations are found and their amounts overviewed.

D. Objectives of the study

The goal of this study is to analyze ways to improve the efficiency of project cost management. To achieve this goal, it was necessary to solve the following objectives:

1. To analyze the main components that affect the cost of the project.
2. To analyze the main risks of construction and investment projects in a crisis.
3. To identify the benefits of using BIM technologies in project cost management

2. Literature review

Renata Stasiak-Betlejewska, Marek Potkany et al., (2015) Solid appraisals of development expenses and calendars introduced by contemporary development organizations, their specialists and providers at the season of undertaking endorsement are critical for legitimizing a task on monetary ground and for arranging the methods for financing it. The monetary effect of a development cost invade is the conceivable loss of the financial legitimization for the undertaking

Tatyana Simankina, Jasmina Četković, NataliaVerstina, Evgeny Evseev et al., (2017) Economy emergency altogether influences fundamentally the undertaking cost administration. The article thinks about the issues of task administration in the field of lodging under states of economy emergency. Venture spending plans are lessened, their common impedance develops and structure of dangers changes. Evidently, particular methodologies are required to be created to improve the costs and certification the task usage inside the affirmed spending plan. There is viewed as residential and remote involvement as far as task cost administration with association of BIM advances.

Simon Ville, Olav Wicken et al., (2013) Australia and Norway have accomplished present day levels of improvement as asset based economies, accordingly keeping away from the purported asset revile. Their capacity to accomplish this laid vigorously on rehashed enhancement into new asset items and ventures. These procedures depended to a great extent on development, affirming the nearby ties that have existed between assets based businesses and learning creating and spreading parts of society. We build up an asset based expansion show that investigations the connection between "empowering Sectors" and asset businesses and apply it to the authentic experience of the two nations.

Flore bridoux et al., (2010), this paper broadens the asset based perspective of the firm to give a review of the associations amongst assets and rivalry. In particular, it builds up a calculated structure clarifying upper hand and execution that consolidate the asset based perspective of the firm and Porter's way to deal with aggressive condition. Based on this structure, it indicates how firms go after assets and may utilize their assets to contend.

3. Construction project management in India

The Indian development industry is known to be wasteful and profoundly impervious to change. Indeed, even with a changing business sector and expanding rivalry, there are no conspicuous indications of similar changes in techniques and approach. Undertaking administration, then again, appears to offer what is required as far as devices and strategies to raise industry principles. Little is known about the degree to which venture administration as a train exists in India. A little poll review is accounted for that was led in mid-2007. Following a pilot think about, the principle review instrument was messaged to in excess of 150 members and associations. This created an example of 51 respondents from four distinctive development industry disciplines i.e. modeler, design, venture work force and building surveyor. The reactions and proposals given by the profits are contemplated and evaluated. These demonstrate that the Indian development industry is developing and a large portion of its experts know about the presence venture administration. Hindrances for the use of task administration learning do exist, with 45% of the respondents demonstrating an abnormal state of impediments.

A specific issue is the absence of consolation from the development associations. A noteworthy contrast was additionally seen between people in general and private areas, with huge numbers of the respondents guaranteeing that undertaking administration are conceivable on a huge scale in the private division however not in the general population part. The explanations behind this distinction are government arrangements, for example, over the top organization, poor execution of undertakings, bargains on quality and norms, individual interests, low straightforwardness and debasement. Likewise, a vast dominant part of respondents concurred that the development business does not have a structure or example; that apparatuses, for example, venture administration can give the structure required; and with the assistance of this structure the business ought to have the capacity to defeat the issues associated with expanded modernization and straightforwardness and be better arranged for future difficulties.

A. Development project management in India

After China, India is the second most crowded nation on the planet, with an aggregate populace of 1,027 billion at the 2001 statistics (Indian Child 2007). It is likewise one of the densest, with 324 individuals for every square hectare (Indian Child

2007). Its economy includes conventional town cultivating, present day horticulture, crafted works, an extensive variety of current ventures, and a huge number of help administrations (Chiang et al 2005). The development business is the second biggest in India and goes about as a vanguard and sets pace for development of every single other area (Ranavive and Gaikward 2006). It utilizes more than 32 million individuals, or 16% of the working populace (Chiang et al 2005), expanding at more than 1 million every year (Majie and Punia 2004), contributes 5.7% of GDP (Chiang et al 2005) and constitutes 40% of interest in India (Ranavive and Gaikward 2006). Scarcely 25% of its laborers had even some sort of simple preparing got from their organizations or their folks (Chiang et al 2005: 15). Indeed, even those laborers required some retraining to have a well-rounded information of the development exchange that they take after. In addition the level of proficiency was low (Chiang et al 2005: 15). Thus, the development forms have a tendency to be basic and straightforward and take after a conventional approach that has been predominant for a long time.

In the five years before 2004, Indian development was between INR 20,000 and 30,000 million yet with an ongoing sudden development to around INR 200,000 (Majie and Punia 2004). With the sudden development in development movement in the nation, the greater part of the real associations have generous ventures to execute. With globalization, expanding rivalry and consciousness of customers, there is a necessity to convey extends effectively and develop the associations (Ahuja 2007).

There has been some exploration in regards to the condition of the Indian development industry however next to no is identified with venture administration as a whole. These incorporate Koehn and Ganapathiraju (1996), who talk about the status of the business, especially as far as the development forms in creating nations, for example, India being work concentrated activities, with the most recent and propelled development innovations just accessible to not very many temporary workers. As far as wellbeing most mischances in the Indian development industry happen because of poor instruction and preparing, and carelessness and obliviousness with respect to the specialist and administration (Koehn et al. 2000).

The discoveries of the study directed by Iyer and Jha (2005), then again, give some sign of the elements influencing the cost execution of Indian development ventures, including the degree of: unfriendly climatic and financial conditions; troublesome task particular characteristics; top administration bolster; checking, input, coordination, strife and information of the undertaking members; and hesitance to settle on convenient choices. Of these, coordination among venture members was observed to be the most huge all things considered, impacting cost execution.

B. The survey (Method)

The poll was steered with two partners from the Indian

development industry – a Senior Architect and a Planning and Project Control Manager - to check the pertinence of the inquiries solicited and from any trouble in understanding and noting them. This prompted some minor changes in the poll concerning some uncertainty in inquiries and revamping of inquiries. The last form was sent to an accommodation test of 150 associations and potential members for reaction by means of email. The potential respondents comprised of different undertaking chiefs, designers, specialists, surveyors and advisors as of now dynamic in the business in India and thought about skilled to giving the required criticism.

A sum of 51 (34%) reactions were gotten – a sensible rate for this kind of poll (Cavana et al. 2000:245). The explanations behind non-reaction are thought to be the bustling calendar and absence of time for potential members to finish the poll as opposed to any conceivable wellspring of inclination.

The respondents involve 21 planners, 9 venture directors, 2 surveyors and 19 engineers. All are as of now dynamic in the business, with at least 5 years work involvement, and are all around qualified experts, with at least a lone wolves' degree capability. For the investigation, the reactions were isolated into three helpfully estimated gatherings of: modelers, engineers and other (venture chiefs/surveyors) respondents. With one exemption, respondents were requested to score to the different inquiries on a size of 1 ("low") to 5 ("high").

C. Results

With the exception of one architect and the two surveyors, all respondents have heard of project management.

The respondents were asked to rate the economic state of the Indian construction industry on a scale of 1 ("slump") to 5 ("booming"). Fig. 1 shows the average responses of the three professional groups, indicating a near consensus that the industry is very buoyant. Also shown in Fig. 1, is the average annual turnover of the respondents' organisations, measured on a scale of 1 (up to USD 11k) to 5 (over USD 11,000k), where 1 USD = 38 Rs., and indicating the respondents' organisations to be typically quite large.

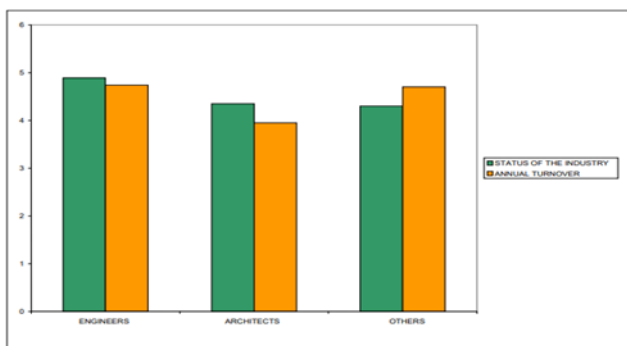


Fig. 1. Status of industry and annual turnover

Respondents were also asked to rate the importance of the various phases for the successful completion of projects. As it can be seen from Fig. 2, (overall average for concept phase

4.05, develop phase 4.2, construction phase 3.8 and termination phase 3.8), all are quite important and with little differences between the various professions involved.

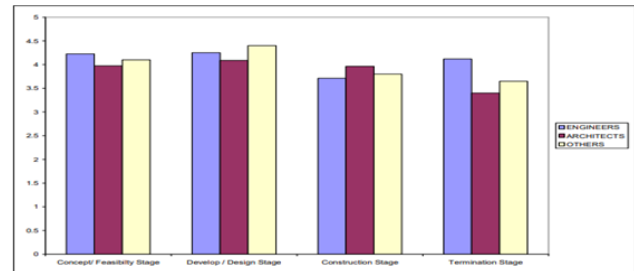


Fig. 2. Different professions mean scores of the importance of various phases of a project

Fig. 3, provides the averaged responses for different project success criteria. These include profit, efficiency, cost, time, quality, safety, satisfaction of users and clients, satisfaction of team members, and structure or pattern while executing projects. As it can be seen (overall averages for engineers 3.9, architects 3.8 and others 3.8 against all the success criteria), there is uniformity and understanding of the importance of the different success criteria.

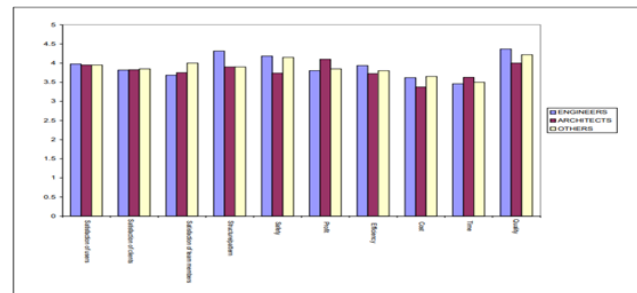


Fig. 3. Success criteria and different professions

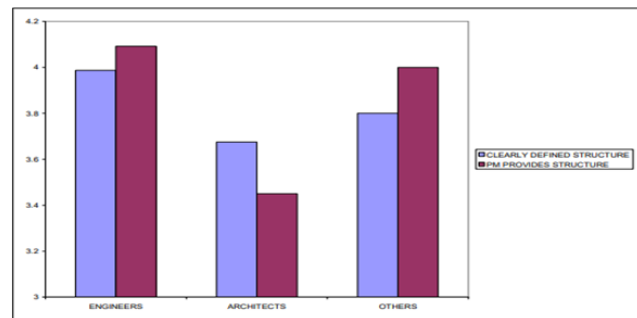


Fig. 4. Need for clearly defined structure and extent to which pm can provide structure

Fig. 4, provides the averaged responses concerning the need for a pattern or structure in the industry and the extent to which it is thought that project management can provide that structure. Here the pattern referred to is an organized and planned model or structure to execute the various and interlinked phases of a project. As Fig 4 shows, all the professions agree that the industry does not have the structure required for executing

projects but, with some variation in opinion, this can be provided by project management.

The Fig. 5, gives the outcomes concerning the impediments that obstruct putting venture administration standards into training and the consolation or bolster that is should have been given by the associations. Respondents were additionally gotten some information about the degree to which the execution of PM is/will be valued by customers, end-clients and partners level of increase by customers, partners and clients of undertaking administration by and by and general acknowledgment of venture administration by industry by and large. The outcomes show an abnormal state of increase by customers, partners and clients (by and large normal estimation of 3.9) however some decent variety regarding acknowledgment of undertaking administration (3.75) by the Indian development industry by and large. What's more, respondents were solicited to rate the sum from exertion as of now being consumed in the business to enhance its present picture and readiness for future difficulties. The outcomes are promising, with a general normal estimation of 3.8.

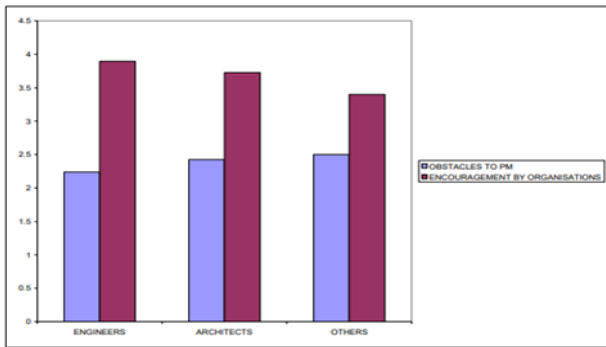


Fig. 5. Obstacles to PM and encouragement required from organizations

In terms of importance given to various project aspects while executing projects, including time, cost, risk, quality, communication, human resources, project procurement and project scope, Fig. 6, (overall averages for engineers 4.1, architects 3.85 and others 3.9 against all the project aspects) indicate a uniformity and understanding of their importance.

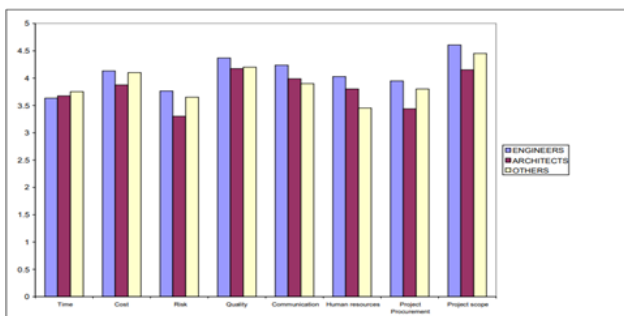


Fig. 6. Various project aspects and different professions

At long last, Fig. 7, gives the outcomes concerning the numerous difficulties confronting the business including

developing rivalry, expanding profitability and proficiency, giving structure and example to the business, giving straightforwardness and a superior picture to the business, modernization and fulfilling developing requests. On a size of 1 to 7, these propose (with by and large normal estimations of 4.54 for engineers, 4.69 for modelers and 5.21 for others) that there is an acknowledgment in the business about these issues and consequently an inspiration to change the manner in which the different procedures inside the business are seen.

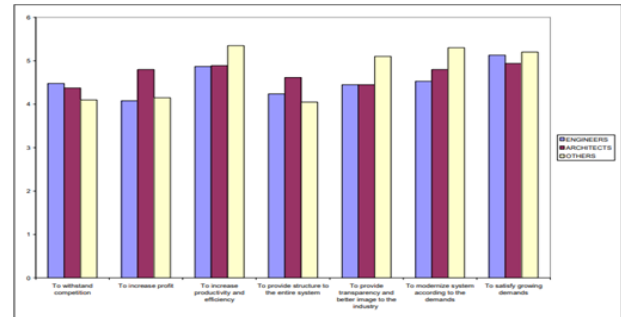


Fig. 7. Reasons to change and different professions

4. Methodology

According to Project management Book of Knowledge issued by Project Management Institute (PMI) there are four processes in project cost management knowledge area.

1. *Plan Cost Management*: "The process that establishes the policies, procedures, and documentation for planning, managing, expending, and controlling project costs."
2. *Estimate Costs*: "The process of developing an approximation of the monetary resources needed to complete project activities."
3. *Determine Budget*: "The process of aggregating the estimated costs of individual activities or work packages to establish an authorized cost baseline."
4. *Control Costs*: "The process of monitoring the status of the project to update the project costs and managing changes to the cost baseline."

A. Introduction

Street asphalt is a critical piece of transport framework, which by and large exhibits the personal satisfaction. It is finished by an arrangement of techniques and is controlled by details, which varies from one issuing expert to the next. In this examination, the rate of use of the regular assets is researched, as per the fundamental territories of street development; new development, and streets recovery.

The black-top blend (or black-top solid) comprises of evaluated totals, tie together with bitumen, in the matter of strong surface. Roadways and runways are cases of utilities that require high caliber. The outline takes after particular systems to decide the sorts, proportions, and attributes of the information materials, keeping in mind the end goal to guarantee the required advantage.

Street development utilizes the sufficient kinds of materials that can be utilized as a model, as they are partitioned into normal assets that are handled in various ways. Sand is utilized as an immediate contribution to the street materials, while pounded stones must be pulverized into various sizes. Then again, bitumen is a concentrate from raw petroleum, which is utilized for a few different materials generation, for example, gas, the base required measure of bitumen for black-top will be assessed, with the familiarity with the overabundance, and its destiny.

The contextual investigation strategy is most reasonable for this exploration, because of its reasonableness in inspecting procedures and models. Ventures are the essential focal point of task administration, and development is for the most part performed on venture hierarchical level. Notwithstanding that, the contextual analysis will encourage the reiteration of the structure among other development and recovery extends, including and changing the contributions as indicated by the materials utilized and their regular assets.

The final result of the system is a cost administration show that records for the characteristic assets that structures the volume of the development as the primary dry cost. Vitality isn't presented as dry cost, yet as a free asset, since innovation is getting towards free vitality. Additionally with the computerization of development being under innovative work, it is relied upon to include least human communication inside development forms. For straightforwardness, the layers and the plan blend are introduced on a general scale, and the amounts of materials and normal assets are evaluated generally.

B. Cost management model

The model is separated into four procedures, same as in PMBoK, arranging, estimation, planning, and control. The cost administration plan has the systems and procedures that will be taken after to oversee development costs.

The level of exactness in such a model relies upon the affectability of the sensors introduced for estimations. For instance, the heaviness of totals that are partitioned into three unique sizes shows the blend weight, and therefore the entire black-top blend can be estimated or computed all the more precisely.

The revealing arrangement is the database stage utilizing huge information innovation to store, dissect and recover live information. The account is finished with the exactness said above. The work breakdown structure (WBS) focuses where the expenses will be estimated is set up as per the accessible sensors innovation to the date. The best is to quantify every one of the WBS, for example, the correct amounts of bitumen, sand, water, and so forth utilized amid the development procedure.

The units of measure are metric. Basic units are meter, square meter, cubic meter, liter, ton, and so forth. The level of accuracy will be four decimals for recording and preparing, and two decimals for detailing.

Utilizing the Building Information Modeling (BIM), amounts are overviewed and coded to coordinate and explore

the accompanying assignments done by machines. The Management Information System (MIS) points of interest the procedures and their mapping, experiencing the examination of the plan, and assessing the required characteristic assets, to the execution and recording of the used amounts.

Following is put away on a cloud database, prepared to add to it information from every single other wellspring of data. At that point the control procedure can precisely be performed, utilizing the Reserve Analysis strategy for instance.

The database is worldwide and situated on the web. From this model, the measure of common assets devoured by street development activities can be ascertained, and followed back their starting points.

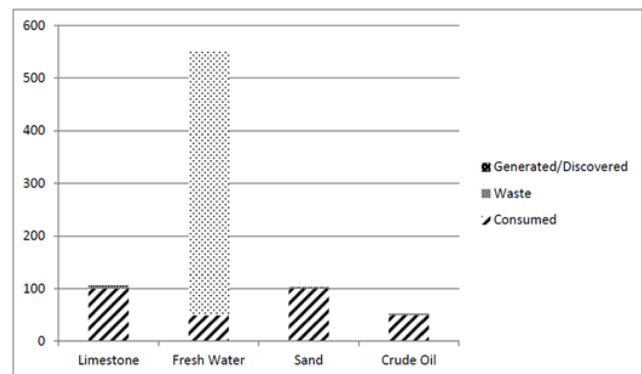


Fig. 8. Database

The database has the following lists:

1. Natural resources list
2. Origins of natural resources
3. Products decomposition
4. Bill of Quantities
5. Machines list

5. Findings

A. Future of the current road construction method

1) Different materials

There are several products in use that has been made to decrease the use of precious natural resources, and there are others under trial and in laboratories. The technology of construction materials employs thousands of experts, and companies around the world are racing to provide effective solutions for their clients.

Some examples include a Netherlands Company Introducing Plastic Roads That Are More Durable, Climate Friendly than Asphalt. Other companies are introducing a composite material to increase the sand characteristics for road constructions.

2) Investment Planning

Figure demonstrates the difference between the amounts of barrels as natural resources using the current road technology, against the future technology which suggests the usage of fewer resources.

In addition, when considering the rate of renewal of natural

resources, it is the opposite of the inflation in the monetary system, as the value of natural resources increases when used later than now. In the monetary system, and due to inflation, money loses its value that is one reason, it is better to use the money now than later, which in return means using more resources now than later.

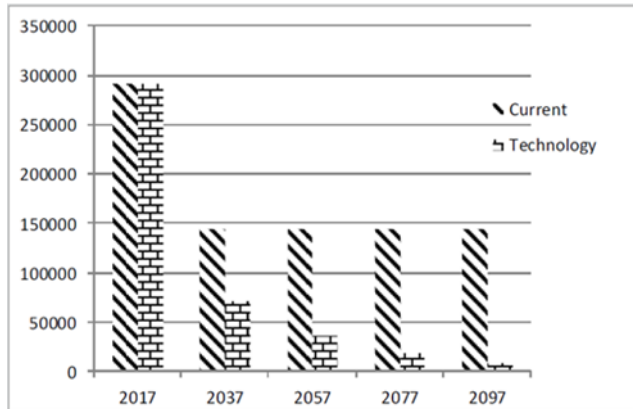


Fig. 9. Current Technology vs. Required Technology

While in resource based economy, when the resources are left for the next generations, they increase, either by the rate of renewal, or the discovery of new resources.

B. SWOT analysis

Strengths

1. Control the natural resources
2. Forecast the where shortages come next, in order to find an early solution or replacement
3. Increase in natural resources globally
4. Fair distribution of materials

Weaknesses

1. Long time to implement.
2. Lack of researches regarding RBE.

Opportunities

1. Increasing number of volunteers.
2. UN support to establish the first city.

Threats

1. Current economic system domination, which makes the awareness process of this model more difficult.

6. Conclusion

From the above findings, and comparisons, it is concluded that,

1. Resource Based Economy can be applied to the cost management model.
2. If it is treated as a national project, The Venus Project can be the starting point to a new socio-economical system that is suitable to all people, where the natural resources are maintained, and the supply exceeds the demand.
3. The analysis of the energy efficient investment costs should include not only simple costs estimation, but it should contain also a comparison of the investment costs and maintenance costs that are decisive element in taking decision process on the construction technology choice.
4. It is driven by European regulations on energy performance of buildings, what constitutes an element of the sustainable development policy.
5. It should be noted, that for every building there is an optimum combination of elements shaping its energy standard depends on: architectural form, structure, function, utility, type of materials used, and location. Building a house, there are crucial elements which do not significantly raise the investment costs, but have a big impact on reducing energy consumption what create national energy policy.

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