Amalgamation of Project and Business Models to Improve Power Plants life Cycle Management[1]

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Abstract

The continuous rise in carbon emissions over the last 30 years and growing global demand for stable electricity for cooling, heating, and transportation represent a major challenge worldwide. The emergence of renewable technology such as wind, solar, gas and photovoltaic cells has lead to the development of mini-grids which is threatening utilities existence globally. For large power utilities to secure a competitive advantage in the energy sector, improving the efficiency of life cycle management programs must be achieved by the successful execution of projects throughout the power plant existence.

There are different life cycle models considered by utility owners which include project life cycle model (PLCM), asset life cycle model (ALCM), and business life cycle models (BLCM) which all aim to integrate organizational effort to improve or maintain performance. Project and portfolio managers must select projects that provide an adequate return on investment (ROE) and drop those that will not for a firm to maintain a sustainable advantage over its competitors. The need for tools and processes for determining the right projects to pursue and which to terminate increases as project and portfolio management becomes more strategically focused.

The purpose of this paper is to demonstrate how using an integrated business model to make decisions regarding individual projects can improve portfolios of projects and project management by coupling projects to the strategic management of the firm and position it to make decisions in the best interest of the company's shareholders.

Keywords: Business model, plant life cycle management, Project management

Introduction

To ensure that selected projects meet the goal of a firm, project and portfolio tools and processes must take a holistic view of projects which can be achieved by using business models to evaluate the viability of individual projects. Due to changing business models, traditional business models driven by specific plans to ensure adherence to routines that worked in the past are no longer sufficient for future survival mostly as a consequence of technology innovation, and its effect on the business. Today's unpredictable business environment coupled with globalization is characterized by an increasing pace of radical and unforeseen

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changes in the business environment which demands that the same routines and decisionmaking processes must redefine themselves to become inherently pro-active and adaptive. Traditionally utility models require that a life of plant plan is developed summarizing all activities to be performed until the asset is retired. Fossil power plant can live up to 60 years, the rate of innovation and environmental regulations that happens in five years gives a lot of opportunities to consider which normally change priorities of project portfolios as a result of changing business objectives.

In traditional utilities, the objective of the power plant life of plant plan (LOPP) is to ensure the sustainability of future energy supply. Every life of the plant plan project (LOPP) starts with a set of user's requirements which are translated into unique technical specifications for a specific environment for implementation purpose. As a result, the execution of a LOPP project is subject to numerous constraints that limit the commencement or progression of field operations, which invariably have a significant negative impact on overall project performance.

Background of the study

According to the International energy agency (2010-48), the essential challenge of most power utility is to improve the performance of the existing generating plant specifically considering how to evaluate performance in the context of multiple objectives including reliability, availability, efficiency, environmental performance, and flexibility. Ramage and Armstrong (2005-14) understood that project failure or project delays are a global phenomenon and South Africa is not an exception. Baccarin (1999-63) argues that it is significant to differentiate between project success criteria and project success factors because criteria are used to measure success although factors facilitate the achievement of success.

Project management success concentrates on the project management process and in specific on the achievement of the project goals concerning cost, time, scope, and quality. These dimensions designate the degree of the proficiency of project execution, said Pinkerton (2003-334). Project product success concentrates on the properties of the project's end product. Though project product success is unique from project management success, the successful outcomes of both of them are inseparably linked. If the endeavor is not a success, neither is the product (Pinkerton, 2003-344). In power plants, this is done by comparing the unit performance before and after an project focusing on the specific project objectives (Cooper, 1998-12). Due to increasing legislation on environmental and social impacts of power plants on the society and the environment, various driving forces are imaging from government, society and employees influencing power utilities to incorporate sustainable development in their business practices by aligning all internal operations and practices. Developing project management methodologies that consider sustainable project life cycle management effectively addressing social and environmental aspects of sustainable development will position power utilities to better place themselves as an energy source of the future.

System engineers have long recognized environment and social impact that exist due to the interaction of the system and its environment, its effects on the wellbeing of the system throughout the system life cycle. The functional interactions of a system with its environment include its inputs, outputs, and human control interfaces. System engineers design and prioritize the system requirements ensuring that the different system attributes are appropriately weighted when balancing the various technical efforts by deciding which risk is worth undertaking. They also determine if a new approach to the problem is necessary, if the intense effort will accomplish the purpose or weather, the requirements can be surmounted to relieve the problem.

Research problem

The research addressed two hypotheses:

- H1: Business model integration will improve project management decision which will save money and time for utilities.
- H2: There are process optimizations benefits for project organizations which will improve the performance of the project management, product management, and organizational management

Literature review

Different project management scholars consider different factors that affect project success and the overall success of a project. Prabhakar (2008-17) believes that budget compliance and accurate schedules will matter less if the project results do not meet project goals and expectations. According to Kerzner (2001-45), factors that create an environment that ensures that projects are managed successfully consistently are critical. According to Humphrey (2005-67), critical success factors are those factors that will significantly improve the chances of success if addressed appropriately which also require processes and activities to be chosen to address critical success factors.

Project life cycle management

Generally, successful projects would be completed on time, within cost, delivered quality, as promised, meet or exceed stakeholder expectations and maintains a win all situation. Kock (2013-31) said that companies increasingly make use of the project management methodology as a management tool to promote organizational changes. Fortune (2013-41) said that although numerous effects are consequent from the expectations of the stakeholders, aspects that make projects successful are part of the strategic perspective.Saynisch (2010-24) indicated that project management literature has identified some determining factors which include complexity and uncertainty. The table below show project life cycle phases viewed by different authours.

Table 1 Researchers phases description during project life cycle project

Researcher	Number of phases	Phases
Meredith & Mantel (2012)	4	Conception, selection, planning/scheduling/monitoring/control and evaluation and termination
Maylor (2003)	4	Define, design, Deliver, develop a process future use
Callahan, Stetz, and Brooks (2011)	4	Inception, development, execution and finalization
Gray & Larson (2003)	3	Introduction, planning and execution, closeout
Means& Adams (2005)	4	Definition, planning, execution and finalization
Newbold (2000)	4	Introduction, planning, execution, closeout
Levine (2005)	3	conceptualization, planning and execution, closeout
Duncan (1996)	6	Needs analysis, concept definition, demonstration and validation, engineering and manufacturing development, production and deployment, operations and support.
Morris (2006)	4	Feasibility, planning and design, production, turnover and start-up

System/Product life cycle

Every product/project deliverable has a life of its own and goes through cycles. The life cycle refers to the period from the product's first launch into the market until its final withdrawal and during this period significant changes are made in the way that the product is behaving. Since an increase in profits is the major goal of a company that introduces a product into a market, the product's life cycle management is very important. For a company to fully understand the above and successfully manage a product's life cycle, strategies and methodologies must be developed. The table below indicates the product life cycle stages viewed by different authors.

Table 2 Researchers phases description during product life cycle project

Researcher	Number of phases	Phases
Fabryck & Blanchard (1998)	3	Consumer (need), producer (planning, research, design, construct), consumer (evaluation, logistic support)
Blanchard, BS (1997)	4	Design and develop, production/construction, operations and maintenance, Retirement and material disposal
	3	Feasibility, development and operations

Asset life cycles

Asset management is often one of the last options to maximize cost savings in a competitive global economy due to its intrinsic complexity, especially in many developing countries. Asset management in the process industry must consider the commissioning, operational, and end-of-life phases of physical assets when commencing a design and implementation project. However, current asset management models show inefficiencies in terms of addressing life cycle costs comprehensively, as well as other aspects of sustainable development. An asset life cycle management that integrates the concepts of generic project management frameworks and systems engineering with operational reliability to address these inefficiencies is desirable.The table below show asset life cycle model as viewed by different authors.

Table 3 Researchers phases description during asset life cycle management

Researcher	Number of phases	Phases
Van de lei,T., Herder, P and Wijnia (2012).	2	Acquisition and utilization phase
Wilson(2002)	3	Strategy and policy, practical developments, system policies
Lloyd, (2010)	3	Design, construction, operation
Davis (2008)	4	Acquire , commission , operate and dispose
Brinkman (1999)	3	Design, construction, operation
Girsch (2005)	4	Acquire, design , construct and operate

Business life cycle

After establishment, a business undergoes business phases throughout their existence known as the life cycle of a business. If a business adapts successfully to the different challenges at each stage of the cycle, it can avoid the final stage of decline in the cycle. The table below shows the business life cycle model viewed by different authors.

Table 4 Researchers description of asset life cycle management phases

Researcher	Number of phases	Phases
Hart & Baker (1998)	4	Introduction, growth, maturity, decay
Christensen (1999)	4	Intimacy, growth, maturity, decline

Life cycle integration

The business life cycle management covered by the power plant life of plant plan (LOPP) identifies a lot of projects to be executed over a certain period. The asset life cycle result from the project and the product life cycle resulting from the asset has economic, social, and environmental consequences, which are in turn associated with an implemented project. The figure below shows the integrated model.

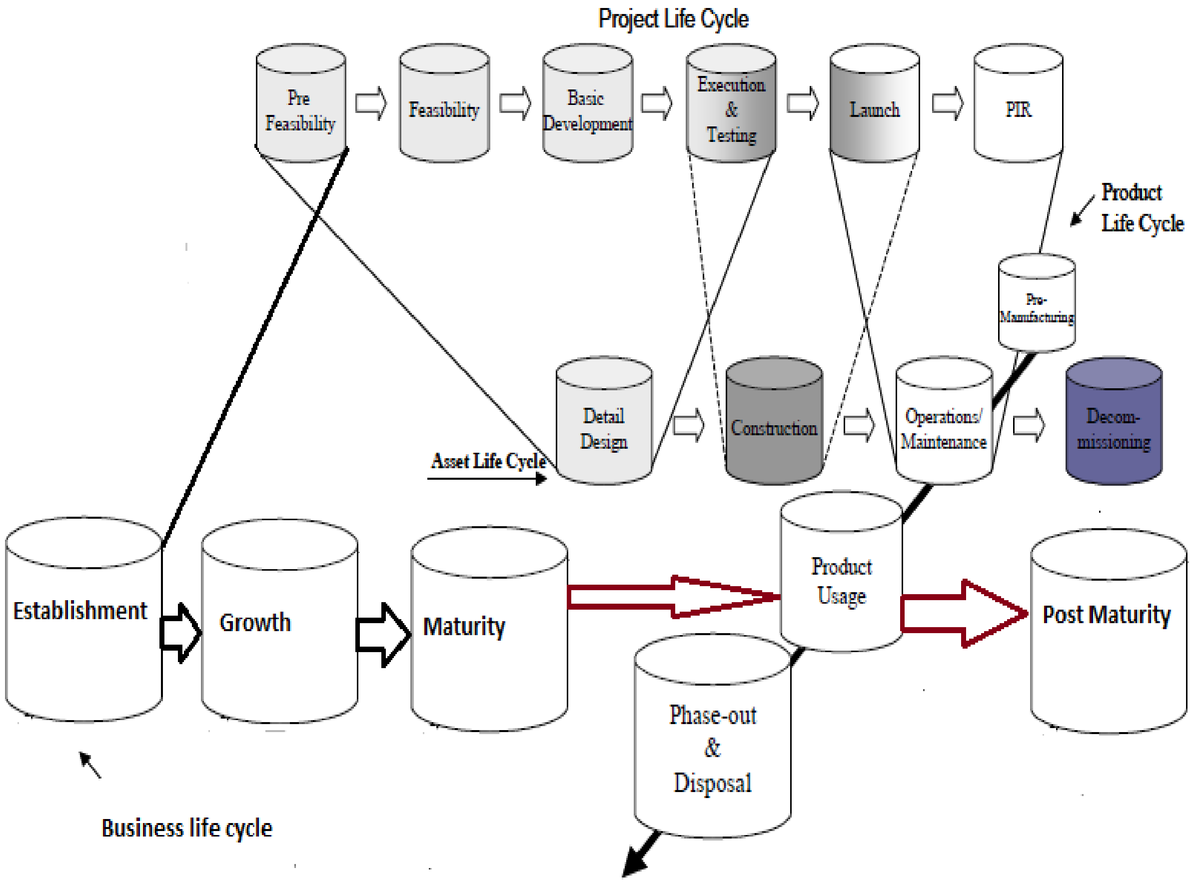

Figure 1 Integrated life cycle management model

According to Daft (2007-17), organizations like any other living organism follow a very predictable path overtime and most common patterns include that they are all born, they also leave and they eventually die afterward. The major difference is that some organization lifespan is very short (Less than 2 years) while others are very long (More than 200 years). Looking at the international space, it is also evident that the life of a firm is also impacted by the level of competition, opportunities, regulation, and government control over time. The three organisational models are:

- Resources Models - According to Negrusa (2007-9), the time when an organization is founded plays a role in its organizational structure (Social resource model). This means that the social resources of the organization largely determine the organizational structure and culture
- Crisis Models - The situational confrontational model argues that key issues the organization faces determine the stages at which the organization is at, not so much by size, age, market share, or management sophistication, said Negrusa (2007-10).

- Decline and Inertia Models - The decline and inertia models focus more on the organizational decline stage and argue that organizational growth through creativity, direction, delegation, coordination, and collaboration.

Success Factors

Nguyen (2004-407) alleged that project success factors can be grouped into one of four components which are:

- Comfort – warranting that leadership determinations are well aligned for the implementation of the project
- Competence – Having appropriate technology, experience, specialty available for the project
- Commitment – Ensure that parties concerned and all levels in the management hierarchy of each participating organization are willing to manage, plan, design, construct, and operate the facility harmoniously.
- Communication – Clarify and disseminate all necessary project information and status to all internal and external project stakeholders

Salvador, Grobler, Pariff ,Guvens & Coyle (1992-102) directed that using the model below, the success and performance of a project can be examined. The absolute value of the rating is indicative of the client's perception of the performance and success of the project. Chan (2002-25) reviewed Sanvido's work on empirical studies from management journals to develop a conceptual framework on critical success factors resulting in five groups of independent variables identified which are project related, procurement-related, project management related, and project participant related.

Julian (2008-44) indicated that project control and monitoring tools are based on expert judgment and parametric tools. Projects are how companies implement their strategies. Pinto and Slevin (1987-27) whispered that some determining factors identified in project management literature are increasingly becoming evident as projects become more complex, stakeholders play an important role in project development success, and projects are always surrounded by uncertainty with continuous changes. Shenhar, Dvir, Levy, Maltz (2001-45) held that a fact that expert judgment is an important tool in project management is limited because resources are mostly limited. High complexity and accuracy make it difficult to apply the expected judgment required in projects.

Rodriguez, Setchi, and Salmeron (2007-558) believed that, the application of artificial intelligence algorithms to the prediction of project success brought up a wide selection of objectives and can be divided into predicting project success and identifying critical success factors. According to Holland (1975-6), the algorithms based on artificial intelligence applied to project success are neural networks, fuzzy cognitive maps, genetic algorithms, Bayesian model, and bootstrap aggregating neural networks and adaptive boosting neural networks.

According to Holland (1975-12), statistical models were used as an initial approach but had not been able to answer project management needs but with artificial intelligence, researchers have found tools and algorithms which address better complex environments and project uncertainty during normal projects development with algorithms addressing specific goals which include critical success factors identification and project success prediction.

Atkinson (1999-341) supposed that, the project status model (PSM) is used to monitor and show changes in project status through constant updates during the project and at a certain point after it ends assisting the project manager on how the project is going and its results. The six PSM criteria are time scale, cost/budget, scope, deliverable and product, benefits, quality, and risks.

DeLone and McLean (2003-24) proposed a compressive model for project success by merging the success dimensions from project management streams and information systems believing that these will assist project managers to assess the likely success early in the development stages. Four aspects that make DeLone and McLean model appropriate incorporation into a project success model are simplicity, acceptability, similarity of intensions, and reusability.

Research design

According to Blaikie (2000-5) research design refers to the overall strategy chosen to integrate the different components of the study in a comprehensible and coherent way, ensuring that the research problem is effectively addressed. The figure below shows the research design for this study.

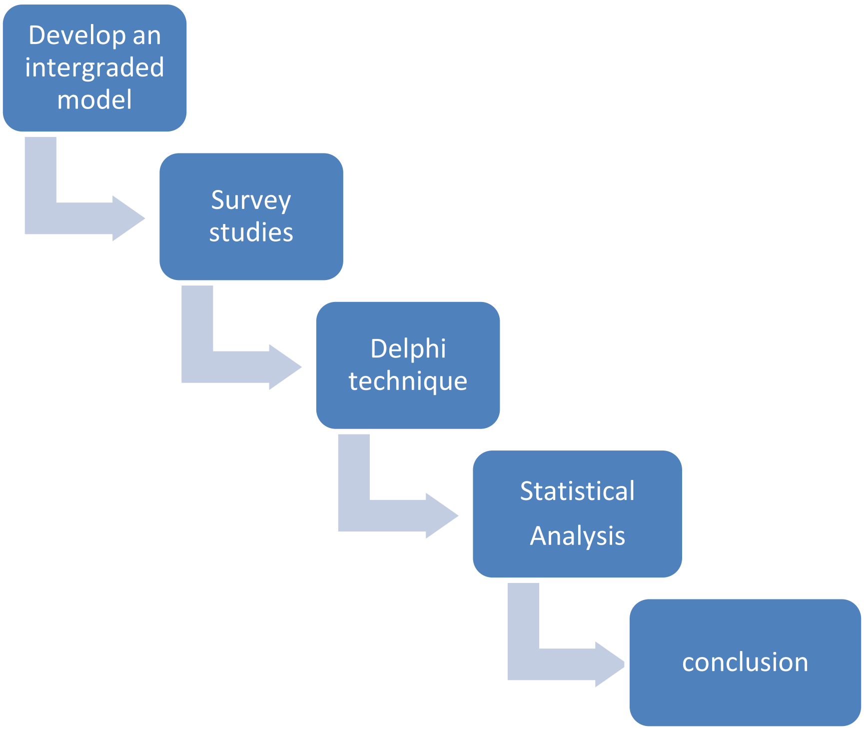

Figure 2 Research design process

Questionnaire design

A survey (primary data source) was conducted on a randomly sampled group in the population to investigate the objectives of this study of which findings will be used to draw conclusions and make recommendations. The questionnaire was designed to measure elements of success and its requirements.

Research results

To reduce the number of success factors, the highly-rated success factors were selected per group from the general survey and the list was used for Delphi round 1 as per the table below.

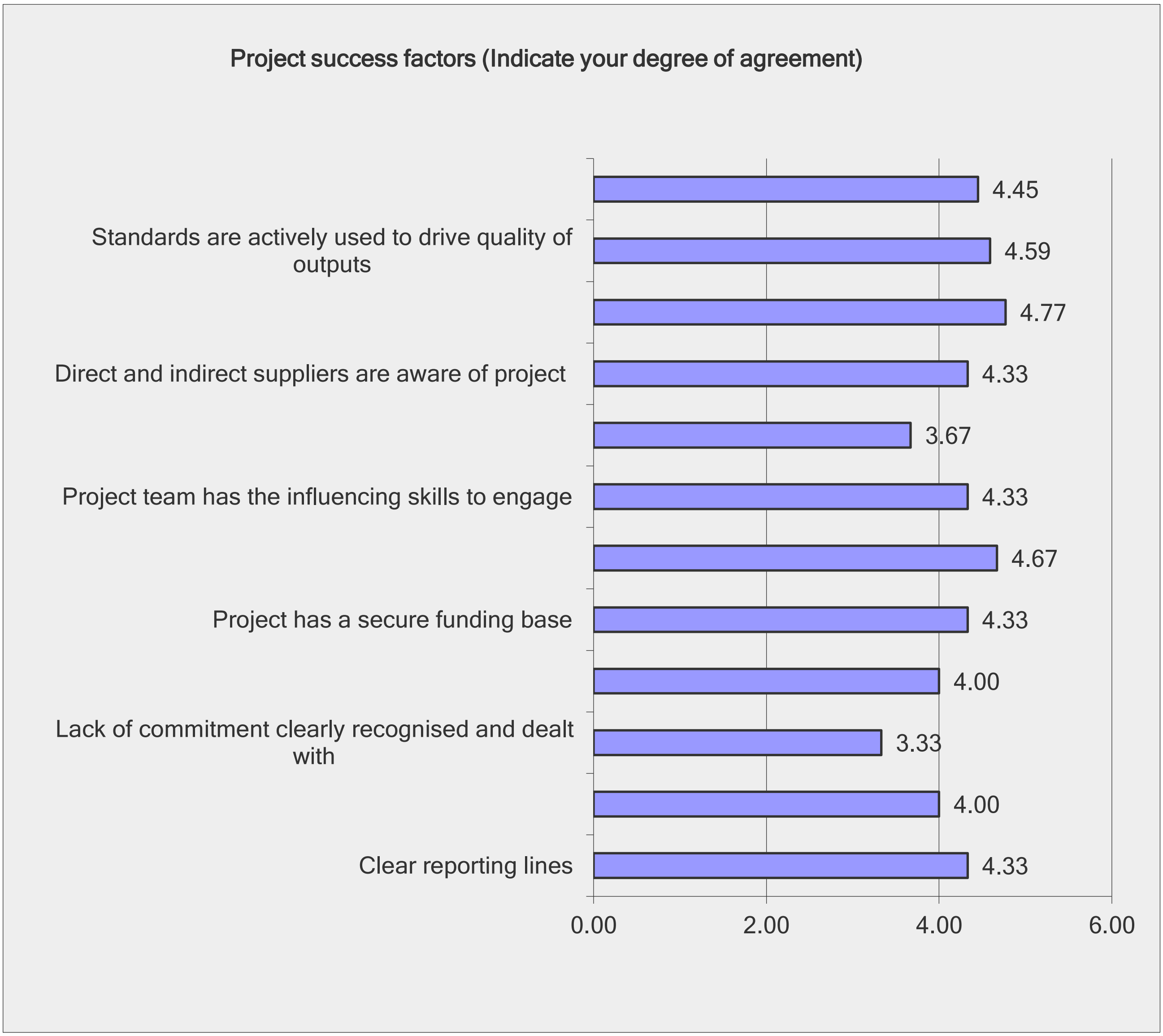

Figure 3 Project success factors

Project product success

The highly-rated success factors were selected per group from the previous general survey and the list was used for Delphi round 1 as per the table below.

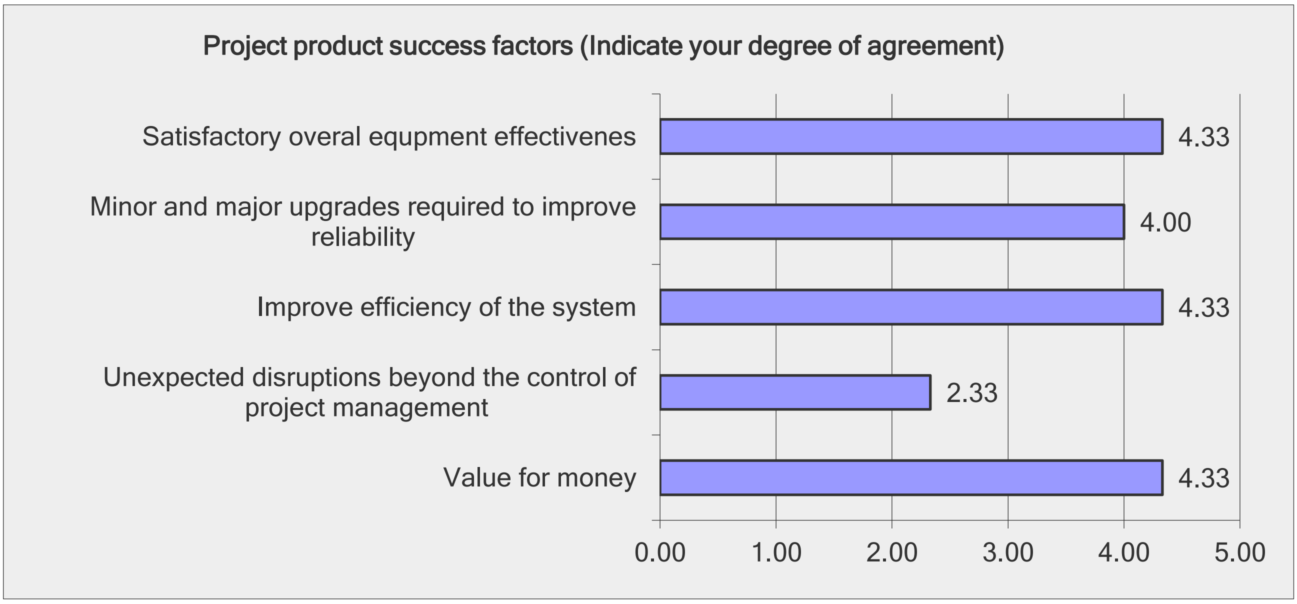

Figure 4 Product/deliverable success factors

Organizational Success

The highly-rated organizational success factors were selected per group from the previous general survey and the list was used for Delphi round 1 as per table below.

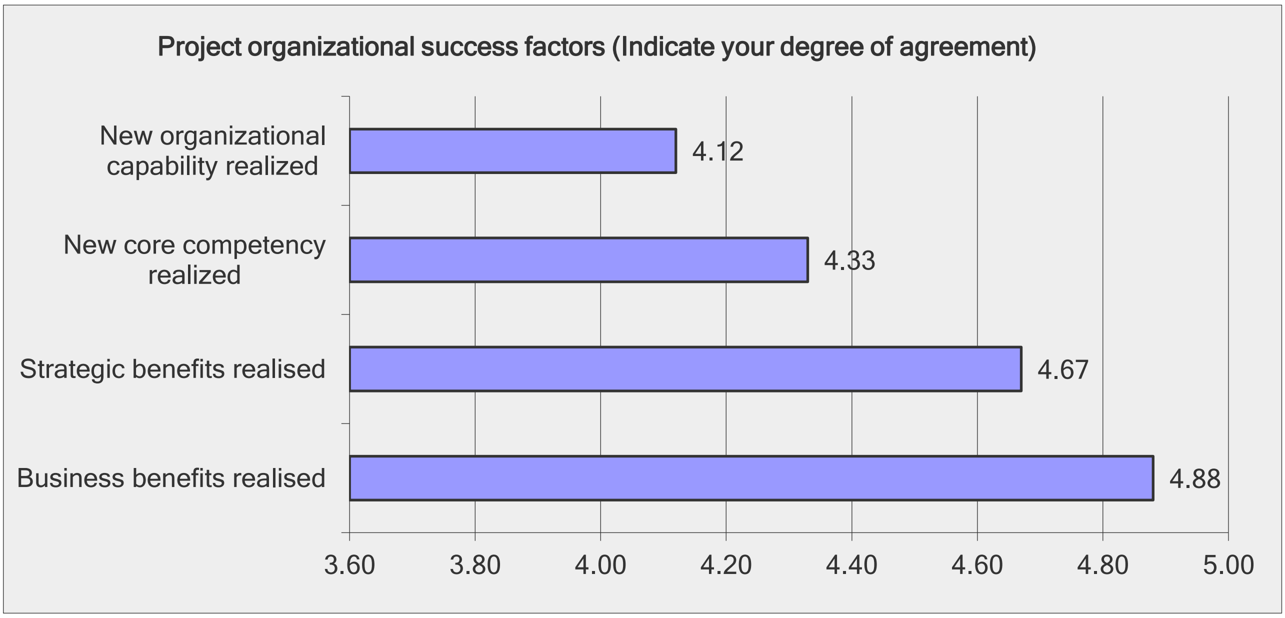

Figure 5 Organisational success factor

Delphi Methodology: Ranking critical factors

The three-stage Delphi method was designed to encourage a true debate, independent of personalities because no one knew who else was participating. A panel of experts in power plant life cycle management and project management was identified utilizing personal characteristics, professional experience, a concept identified and topic to be investigated. The stage three Delphi results are summarized at the table below.

Table 5 Delphi stage 3 results summary

Project critical success factors	**Mean**	**RII**	**Rank**
S1: Project management techniques are applied	4.166667	0.774803	1
S2: Standards are actively used to drive the quality of outputs	4.3	0.770079	2
S3: Regular and careful progress monitoring	4.088889	0.765354	3
S4: Pre-project planning is thorough and considered	4.066667	0.754331	4
S5: Direct and indirect suppliers are aware of the project	4.077778	0.741732	5
Product (deliverable) critical success factors	**Mean**	**RII**	**Rank**
P1: Value for money	4.011111	0.748031	2
P2: Improve the efficiency of the system	4.066667	0.762205	1
P3: Satisfactory overall equipment effectiveness	3.733333	0.746457	4
P4: Minor and major upgrades required to improve reliability	3.6	0.705512	5
P5: Unexpected disruptions beyond the control of project management	3.777778	0.730709	3
Organizational/corporate critical success factors	**Mean**	**RII**	**Rank**
Q1: Business benefits realized	3.905512	0.781102	1
Q2: Strategic benefits realised	3.850394	0.770029	3
Q3: New core competency realised	3.92126	0.784252	2
Q4: New organizational capability realized	3.606299	0.72126	4

Statistical Analysis

Statistical analysis was done for each category of collected data using statistical analysis software (SPSS). The following statistical instruments were used in this study.

Person correlation coefficient

Correlation between sets of data is a measure of how well they are related. We can categorize the type of correlation by considering as one variable increases what happens to the other variable:

- Positive correlation – the other variable tends to also increase;
- Negative correlation – the other variable tends to decrease;
- No correlation – the other variable does not tend to either increase or decrease.

The starting point of any such analysis should thus be the construction and subsequent examination of a scatterplot. In this study, r was used to measure the strength and direction of the relationship between ratings of critical factors. The following are the correlation results:

- The value of R is 0.989. This is a strong positive correlation, which means that high Project success variable scores go with high product success variable scores (and vice versa). The value of R2, the coefficient of determination, is 0.9781.

- The value of R is 0.9352. This is a strong positive correlation, which means that high project success variable scores go with high organization success variable scores (and vice versa). The value of R2, the coefficient of determination, is 0.8746.

- The value of R is 0.8882. This is a strong positive correlation, which means that high product success variable scores go with high organizational success variable scores (and vice versa). The value of R2, the coefficient of determination, is 0.7889.

Independent T-test

In this research, the significance is evaluated based on the p-value value where a low p-value indicates that the test is significant and the conclusion can be drawn. The following results were attained as per table above:

- The relationship between project success factors and product success factors achieved Bottom of Form t-value of 2.00312. The p-value is 0.040064. The result is significant at $p < .05$.

- The relationship between project success factors and organizational success factors achieved a t-value of 0.34093. The p-value is 0.37097. The result is not significant at $p < .05$.

- The relationship between project product success factors and organizational success factors achieved a t-value of -1.01989. The p-value is 0.168815. The result is not significant at $p < .05$. Bottom of Form

Verification and validation using Design of experiment (DOE)

To determine the effects of the variables inputs on project, product and organisational performance and variation, an experiment was used to study the performance of project processes and system represented by a model. The process is visualized as a combination of operations, machines, methods, people, and any other resources that will be used to transform input to output that has observable response variables. The desired model in this stage proves the interdependency of factors and the impacts they have towards success of project, product and organisational. The same factor has an impact on variation experiments in different input-output combinations. The table below shows the three inputs that will be experimented to see their effects on the outputs.

Table 6 Desired model input

Phase	Low level (%)	Factorial low	Mid to high (%)	Factorial high
Project management success (PMS)	< 0.7 or 70%	-1	> 0.7 or 70%	1
Project product success (PPS)	< 0.7 or 70%	-1	> 0.7 or 70%	1
Organisational success (OS)	< 0.7 or 70%	-1	> 0.7 or 70%	1

Data envelope analysis makes it possible to use the different variables with different measuring units by calculating individual efficiencies and that the factors linked to these processes were evaluated before and the table below links the above processes to these factors.

Table 7 Factors alignment using DEA

Process	Technical Performance measure	Description	DEA measurements
Project management success	Interdependency	Efficiency	Efficiency
	Scope	Work packages	Efficiency
	Time	Days	Efficiency
	cost	Rand	Efficiency
	Quality	Compliance	Efficiency
	Risk	Mitigation	Efficiency
Project product success	Availability	Percentage	Efficiency
	Reliability	Percentage	Efficiency
	Capability	Percentage	Efficiency
	Maintainability	Percentage	Efficiency
Organizational success	Life cycle cost	Rand	Efficiency
	Benefits (ROE)	Rand	Efficiency

The objective of this experiment is to determine which variables are most influential on the response y, determine the maximum and minimum points to determine the nominal point, identify how to control inputs to reduce output variability and to determine where influential X must be controlled so that the effects of the uncontrollable variable are minimized. The results of running all combinations of chosen factors at two levels (high and low) are shown in the table below. The order was randomized to offset any lurking variable to the process.

Table 8 Experiment for performance and variation

Project	PMS (X)	PPS(Y)	OS(Z)	Performance(PS)	Variation(V)
1	-1	-1	-1	28.26	3.99
2	1	-1	-1	36.49	2
3	-1	1	-1	38.09	1.58
4	1	1	-1	50.09	0.58
5	-1	-1	1	41.01	0.94
6	1	-1	1	58.46	0.18
7	-1	1	1	65.15	0.02
8	1	1	1	87.09	0.01

Coded factor levels indicated by mathematical symbols minus plus are used to depict actuals levels respectively. The following formula is used to calculate the effects per input variables.

$$Effects\ (Y1\ or\ Y2) = \frac{\sum X(+)}{n} - \frac{\sum X(-)}{n}$$

In this experiment, the effects of the one three-factor (X, Y, Z), three two factor interaction (XY, XZ, YZ), and one three-factor interaction (XYZ), which gives a total of seven effects. To estimate the overall mean, one degree of freedom was used to estimate the overall mean. The table below indicates the calculated effect on the output (y) by each input combination (X). The main effects and interaction impacts on the output can be observed.

Table 9 Project input variables interdependency

Project	**X**	**Y**	**Z**	**XY**	**XZ**	**YZ**	**XYZ**	**Performance(PS)**	**Variability(V)**
1	-1	-1	-1	1	1	1	-1	28.26	3.99
2	1	-1	-1	-1	-1	1	1	36.49	2.00
3	-1	1	-1	-1	1	-1	1	38.09	1.58
4	1	1	-1	1	-1	-1	-1	50.09	0.58
5	-1	-1	1	1	-1	-1	1	41.01	0.94
6	1	-1	1	-1	1	-1	-1	58.46	0.18
7	-1	1	1	-1	-1	1	-1	65.15	0.02
8	1	1	1	1	1	1	1	87.09	0.01
Effects (PS)	23.53	19.05	98.78	2.07	4.79	7.34	0.18	50.58	
Effects (V)	-0.94	-1.23	-7.00	0.44	0.56	0.69	-0.06		1.16

Predictive equation modeling response

This is a good place to provide details of PSLCM tested in the analysis of variance (ANOVA) because this model is a mathematical equation used to predict a given response using the linear model equation below:

$$\gamma = \beta_0 + \beta_2 X_2 + \beta_3 X_3 + \beta_{23} X_2 X_3$$

Where:

Y = Predicted response
β_0 = intercept
β_1 = Model co-efficient for the input factor
X = Input factors

Fitted model for project performance with three factors which are project efficiency, system effectiveness, and return on organizational benefits, in coded form is:

$$Performence\ (Y1\ (pred)) = 50.58 + 11.8(X\ ) + 9.525\ (Y) + 12.35(Z)$$

The actual performances are compared to the predicted performance and depict the residual value. The figure below indicates predicted performance and residual values for each performance (difference between actual and predicted)

Table 10 Actual vs predicted values for performance

Project	X	Y	Z	Actual(PS)	Predicted (PS)	Residual
1	-1	-1	-1	28.26	16.9	11.36
2	1	-1	-1	36.49	40.5	-4.01
3	-1	1	-1	38.09	36	2.09
4	1	1	-1	50.09	59.3	-9.21
5	-1	-1	1	41.01	42	-0.99
6	1	-1	1	58.46	62	-3.54
7	-1	1	1	65.15	60.7	4.45
8	1	1	1	87.09	84.25	2.84

Variation fitted model code:

$$Variation(V\ pred) = 1.16 - 0.47(X\ ) - 0.615\ (Y) - 0.876(Z)$$

The figure below indicates predicted variation and residual values for each variance (difference between actual and predicted)

Table 11 Actual vs predicted values for variation

Project	X	Y	Z	Actual(PS)	Predicted (PS)	Residual
1	-1	-1	-1	3.99	3.56	0.43
2	1	-1	-1	2	2.18	-0.18
3	-1	1	-1	1.58	1.89	-0.31
4	1	1	-1	0.58	0.95	-0.37
5	-1	-1	1	0.94	1.37	-0.43
6	1	-1	1	0.18	0.43	-0.25
7	-1	1	1	0.02	0.2	-0.18
8	1	1	1	0.01	0.36	-0.35

At this stage, we have eight data points. Calculating half normal will be done exactly like we did it earlier. 100 %/8 = 12.5 % for a full normal plot. For a half normal 12.5/2 = 6.25%. The figure below indicates normal a plot of residuals for performance.

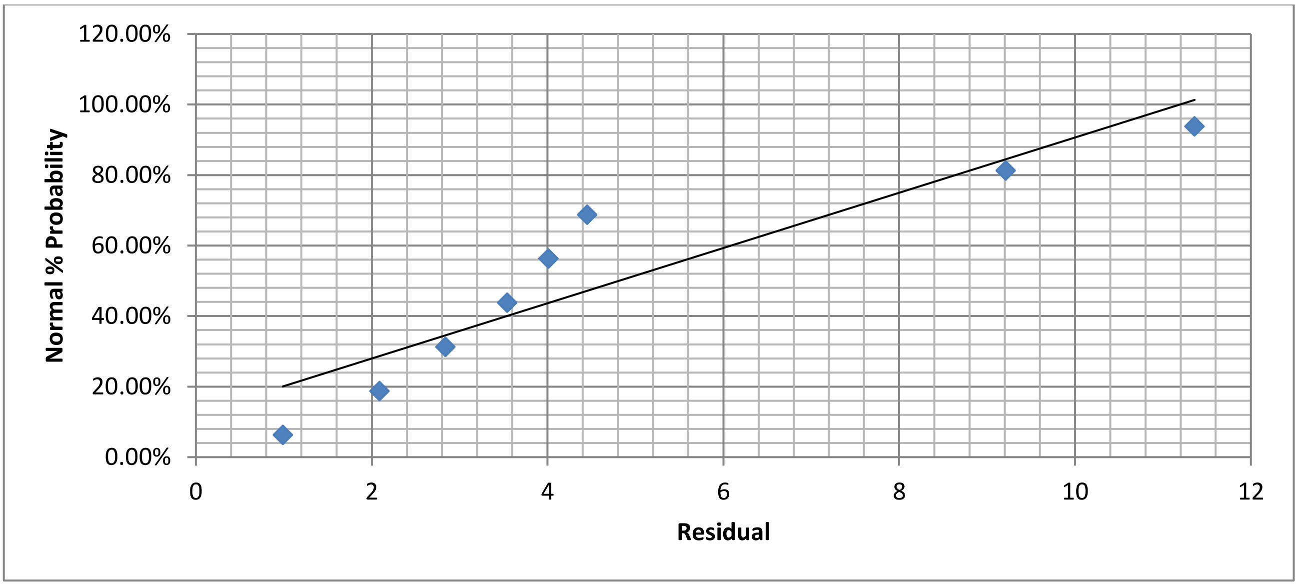

Figure 7 Normal plot for residual for performance

The figure below indicates a normal plot of residuals for variations.

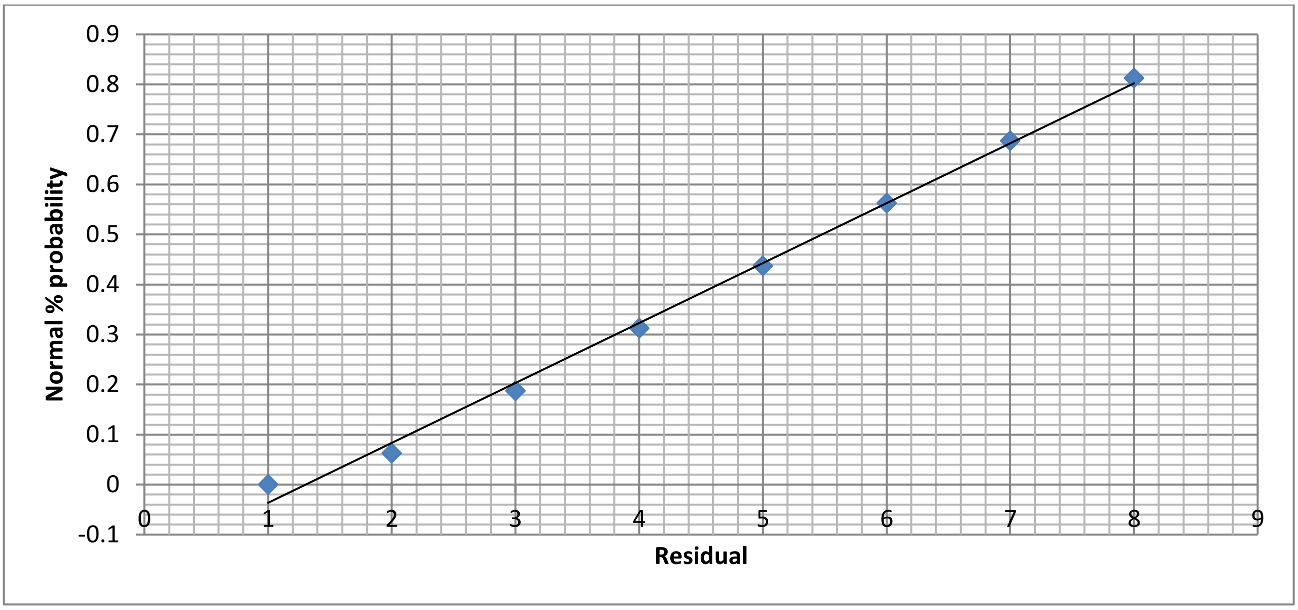

Figure 8 Normal plot for residual for variation

Results analysis

The integrated model was developed and DOE was used to prove the model effectiveness. The DEA method is used to calculate efficiencies and a final value, which describes the success of the project, product, or corporate performance (ROI) at a specific point in time into a single overall performance considering critical success factors. The model's inclusion of operational and maintenance criteria forces all stakeholders to look beyond their direct activities but to focus on the overall lifespan. The research findings for each research hypotheses were analyzed in the following paragraph:

Hypothesis 1

H_0 : Business model integration will not improve project management decision making which saves money and time for utilities.
H_1 : Business model integration will improve project management decision making which saves money and time for utilities

The strength of a linear association between two variables can be measured by the Pearson correlation coefficient where the value r = -1 means a perfect negative correlation and the value r = 1 means a perfect positive correlation. The strength and association:

- Project success and product success, the value of R is 0.8852 showing a strong positive correlation indicating that the high project success variable scores go with the high product success variable scores (and vice versa). The value of R^2, the coefficient of determination is 0.7836.

- Project success and organizational success, the value of R is 0.5555 indicating a moderate positive correlation, which means there is a tendency that high project success variable scores go with high organizational success variable scores (and vice versa).
- Product success and organizational success, the value of R is 0.3518 indicating a technically positive correlation, but with the weak relationship between variables (the nearer the value is to zero, the weaker the relationship). The value of R^2, the coefficient of determination is 0.1238.

These results show that enough data will be available and visible at all stages which will lead to timely and better decision marking while minimizing financial, governance, misdirected efforts, and resource utilization risks. This will leverage the processes and lessons learned from previous projects and capturing this information in the project repository enabling repeatable success while proving value to all stakeholders.

From the above results H_1: Is accepted - Business model integration will improve project management decision making which saves money and time for utilities

Hypothesis 2

H_0 : There are process no optimizations benefits for project organizations which will improve the performance of the project management, product management, and organizational management
H_1: There are process optimizations benefits for project organizations which will improve the performance of the project management, product management, and organizational management

The results from the design of the experiment (DOE) indicate that, due to process interdependency, optimizing one process has a very big impact on the overall results. The analyses of variance show that projects that are well planned, executed, and operated will bring more revenue to the business while the opposite is not possible. Therefore, the results from the DOE confirms that the more processes are performing optimally, the better the variability. This ensures that teams perform more work as planned while eliminating surprises.

By using the integrated model, projects will benefit from the application of systems thinking and improve the integrity and value of the product that is delivered by anticipating possible challenges at the interfaces and by anticipating additional enabling tasks in addition to systems beyond the obvious. This will improve the realism of cost and schedule estimates and the understanding of stakeholders' needs throughout the (extended) project lifecycle. A systems view in projects will encourage broader thinking about how a product or service meets the needs of various stakeholders, and what higher-level goals and constraints exist outside the boundary of the delivered system.

From the above results H_1: Is accepted - There are process optimizations benefits for project organizations which will improve the performance of the project management, product management, and organizational management.

Conclusions

Achieving strategic alignment of business models and project models will ensure that the organization always spends money in line with the current business objectives which is ever-changing depending on what organizations are exposed to overtime. This will improve project management office (PMO) relationships with business leaders which will realize the optimization required for business success in today's everchanging world. If utilities are to pursue their plans for stability and growth they need to cease seeing project management as a functional activity and place it at the core of their business processes.

References

1. Adler, M., & Ziglio, E.1996. Gazing into the Oracle: The Delphi Method and its Application to Social Policy and Public Health. London: Jessica Kingsley Publishers.
2. Aibinu A.A. and Jagboro G.O.2002. The effects of construction delays on project delivery in Nigerian construction industry: International Journal of Project Management 20 (55):593-599.
3. Atkinson, R. 1999. Project management: Cost, time and quality, two best guesses and a phenomenon, it's time to accept o ther success criteria, International Journal of Project Management, 17(6), 337–342.
4. Alghbari , W.A.M.2005. Factors affecting construction speed of industrialized building system in Malaysia" Master's thesis , university of putra Malaysia , serdang.
5. Ahmed , S.M, Azhalar , S.,kappaggntula,P & Gollaphudil, D.2003.Delays in construction: A brief study of the florida construction industry. Proceeding of the 39th annual ASC conference, clenson university, cleson , pp257 – 266.
6. Ashley, D and Jaselskis, A.1987.Determinants of construction project success, project management journal, Vol 18(2), pp 69 – 79.
7. Attarzadeh , I and Hock Ow, s .(2008). Project management practices: criteria for success and failure. Communication of the IBIMA volume 1, 2008
8. Assaf, S.A., Alkhalil, M., Alhazmi, M.1995.Causes of delays in large building contraction project, Journal of management in engineering, ASCE (2), pp 60 – 79.
9. Ahlemann, F., F. El Arbi, M. G. Kaiser, and A. Heck.2013. A Process Framework for Theoretically Grounded Prescriptive Research in the Project Management Field. International Journal of Project Management 31: pp 43–56.
10. Bakker, K. De, A. Boonstra, and H. Wortmann.2012. Risk Managements' Communicative Effects Influencing IT Project Success. International Journal of Project Management 30: 444–457.
11. Baccarini, D. 1999. The Logical Framework Method for Defining: Project Success. Project Management Journal, 30(4): 25-32.
12. Bannerman, P. L. (2008). Defining project success: A multilevel framework. In Proceedings of the PMI research conference (pp. 1–14). Newtown Square, PA: Project Management Institute.
13. Baker, B.N., Murphy, D.C., and Fisher, D. 1983. Factors affecting project success. NY: Van Nostrand Reinhol.
14. Belassi, W., and Tukel, O.I.1996. A new framework for determining critical success/failure factors in Projects, International Journal of Project Management, vol.14 (3), pp.141-51
15. Bryde, D. J. 2003. Modelling project management performance. International Journal of Quality and Reliability Management,20(2), 229–254.
16. Bryde, D. J., & Robinson, L. 2005.Client versus contractor perspectives on project success criteria.International Journal of Project Management, 23(8), 622–629.

17. Bassi, L.J.,.2000.Measuring knowledge management effectiveness. In The Knowledge Management Yearbook 1999–2000, edited by J. Hermans, pp. 422–427, 1999.
18. BMG research (2014).Factors in project success: The association of project management. Birmingham: Bostock Marketing Group.
19. Cao, Q., & Hoffman, J. J.2011. A case study approach for developing a project performance evaluation system. International Journal of Project Management, 29(2), 155–164.
20. Cooke-Davies,T.2001. The real success factors on projects, in Proceedings of the International Project Management Congress . November, Tokyo, Japan.
21. Cooper, R.G. 1998.Benchmarking new product performance: results of the best practices study, European Management Journal, 16, 1, Feb. 1998, 1-17.
22. Cheng, M.Y. Li-Cuan, L., Tsai, H.C. And Pi-Hung, C. 2012.Artificial Intelligence Approaches to Dynamic Project Success Assessment Taxonomic, Life Sci. pp 44 -56.
23. Chan, D.W.M.,& kumaraswamy,M.M.2002.A comparative construction duration :lessons learned from hongkong building projects , Int j project manage 20 , P23-35.
24. Chan, H.D.C.,& Tan, C.M.1995.Impact of management styles on project performance, published in the proceedings of the first international conference on construction project management , pp 227 – 233.
25. Cicmil, S., & Hodgson, D.2006. New possibilities for project management theory: A critical engagement. Project Management Journal, 37(3), 111–122.
26. Dvir, D., Lipovetsky, S., Shenhar, A., & Tishler, A.1998. In search of project classification: A
27. Non-universal approach to project success factors. Res. Policy, 27(9), 915-935.
28. Humphrey, W. S. 2005. Why big software project fail: The 12 key questions. Crosstalk: J. Defense Software Eng., 3, 25-29.
29. Kerzner, H. 2001.Project Management: A Systems Approach to Planning, Scheduling and Controlling. 7th ed. New York: J. Wiley & Sons.
30. Saynisch, M.2010.Beyond frontiers of traditional project management: An approach to evolutionary, self-organizational principles and the complexity theory-results of the research program, Project Management. Journal, vol. 41, no. 2, pp.21–37
31. Prabhakar, G. P. 2008.What is project success: A literature review, International Journal of Business and Management, v.39, pp.3-10.
32. Kujala, S., Artto, K., Aaltonen, P. and Turkulainen, V., 2010. Business models in project-based firms–Towards a typology of solution-specific business models. International Journal of Project Management, 28(2), pp.96-106.
33. Artto, K., Wikström, K., Hellström, M. and Kujala, J., 2008. Impact of services on project business. International Journal of Project Management, 26(5), pp.497-508.

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