A Literature Review of Benefit Analysis Approaches for IT Projects in the Public Sector

Oscar Avila[1], Sebastian Sastoque[1] and Orlando Cuevas[2]
[1]*Department of Systems and Computing Engineering, School of Engineering, Universidad de los Andes, Bogota, Colombia*
[2]*CIFI - Informatica, Universidad de los Andes, Bogota, Colombia*

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Abstract: The financial investments of public institutions in Information Technology (IT) projects have considerably increased in recent years. This has resulted in an enormous pressure on IT managers of these institutions to find ways to analyse the benefits of these investments. However, this task is very difficult because, in the public sector, IT projects do not only generate financial benefits but also create public value through the generation of other types of benefits, such as social and political. In addition, in this sector there is a variety of beneficiaries and manners of measure the benefits. In this context, this work presents a survey aimed at analysing the research literature to analyse what are the main types of benefits and beneficiaries as well as analysing methods. From the literature review, the paper presents a conceptual model that aims at establishing the basis for a complete approach for benefit analysis in the public sector.

1 INTRODUCTION

Information Technology (IT) has become an integral part of modern organisations as it has the potential to enhance the performance at different levels such as the operational or the strategic. Thus, in the last decades, IT has represented a substantial financial investment for many organisations (Standing and Lin, 2007). In fact, it has been estimated that investments in IT projects now amount at least the half of most large organisations annual capital investments (Kohli et al., 2012). Thus, IT executives and managers are under pressure to find a way to forecast the contribution of their investments to organisations, as well as to find reliable ways to ensure that business benefits from the investments are actually realised (Hinton and Kaye, 2006). However, some survey studies show that very few organisations have a complete or comprehensive method or process to analyse and ensure potential benefits from investments in IT projects (Ward et al., 1996). As a consequence, IT Managers have found difficult to justify the IT investments. This problem has become complex as the nature of IT investments and the benefits delivered have evolved over the time.

In the private sector companies, the benefits associated with IT projects are measured in terms of financial value (Kohli et al., 2012; Davern and Kauffman, 2000) or organisational performance (Sabherwal and Jeyaraj, 2015; Tambe and Hitt, 2012). More rarely, intangible benefits are considered such as increasing of innovation capacity (Kleis et al., 2012) and impact on downsizing risk (Otim et al., 2012). Furthermore, in the public sector, IT projects do not only generate the aforementioned types of benefit but also create public value through the generation of other types of benefits, such as social and political benefits. The diversity of benefit types in the public sector makes very hard to quantify benefit targets during the planning phase of IT projects and very complex and expensive to assess the benefit level reached after project implementation. In addition, other circumstances of the public institutions that make difficult to quantify and assess benefits are: (i) the wide variety of beneficiaries that need to be considered as the benefits will directly depend on their expectations and needs; (ii) most of the existing benefit methods consider the financial value as the greatest benefit, giving little attention to intangible benefits which are relevant to the public sector; and (ii) IT managers in the public sector tend to focus primarily on the delivery of a technical solution, on time, tailored to the specifications and with the minimum budget expenditure (Ashurst et al., 2008; Devaraj and Kohli, 2000; Lin and Pervan, 2003; Love and Irani, 2004).

As in the private sector, in the public sector, insti-

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tutions lack of complete methods to analyse benefits from investments in IT projects. Regarding the research literature, some approaches have already been proposed to this end, such as (Ward et al., 1997) and (Remenyi et al., 1997). However, the reported use of such approaches is fairly low and they do not cover all the dimensions of benefit analysis in the public sector such as the whole types of benefits and beneficiaries as well as the manner of analyse and measure the benefits.

Thus, our main objective is to carry out a systematic review of the literature in order to identify and analyse the main methods that could help project managers in the public institutions to respond the research question formulated above. In addition, this paper presents a conceptual model for benefit analysis based on the systematic review in order to establish the basis for the designing and development of a complete approach for benefit analysis that includes the main elements gathered in the reviewed approaches. The remaining of this work is organised as follows: Section 2 synthesises an analysis of the state of the art related to the benefit management and realisation. Section 3 introduce the model for benefit realisation in the public sector. Finally, Section 4 concludes the paper and introduce future work.

2 STATE OF THE ART

A modification to the methodology proposed by (Mayring, 2014), consisting of the following steps, was used to conduct this review process:

- **Planning:** This stage focuses on planning the search to identify the most relevant contributions. Thus we define research questions to conduct the search as well as validate and select the most pertinent works.
- **Realisation:** It consists in making an exhaustive search for works using the criteria defined in the previous step and assessing the found approaches in order to select those that answer the research questions.
- **Synthesis and Analysis:** This stage is related to the extraction of the relevant information of each selected approach to answer each research question.
- **Towards a Conceptual Model:** It consists in establishing the conceptual elements that allow the construction of a conceptual model for benefit analysis.

2.1 Planning

The following questions are proposed to analyse the state of the art:

1. *Who is benefited?*, i.e., to identify the people, communities, associations, organisations, public and private institutions that are benefited from benefits delivering.
2. *What are the types of benefits?*, i.e., to establish what are the benefit types or categories.
3. *How benefits are measured?*, i.e., to determine the means to measure the benefit level such as indicators, metrics, targets, among others.
4. *How benefits are analysed?*, i.e., to identify methods, steps or procedures to analyse benefits.
5. *How benefit are modelled?*, i.e., to distinguish notations, languages, models or symbols used to model benefits.
6. *In which phase of the project the benefit analysis is performed?*, i.e., before the project start, during project execution or after project implementation.

2.2 Realisation

To find relevant works addressing the review objective and answering the review questions previously defined, we use the Scopus and Google databases by introducing the following criteria:

- **Search Terms:** IT Projects, Information Technology Projects, IT Implementation, Information Technology, Public Sector, Government, Benefits Measure, Cost Benefits Analysis, Business Case.
- **Document Type:** Scientific papers in conferences and journals, guidelines published by governments and state documents.
- **Application Area:** Information Technology and Computer Science.

An initial search in Scopus was performed by introducing the following query: *TITLE-ABS ("IT projects" OR "Information Technology Projects" OR "IT Implementation" OR "Information Technology") AND TITLE-ABS ("Public Sector" OR "government") AND TITLE-ABS ("Benefits Measure" OR "Cost Benefits Analysis" OR "Business case").* However, as we did not find a sufficient number of relevant works from the scientific database (we only found 15 results), we completed the search by introducing the query into Google to identify documents that were not published in scientific journals and events. As a consequence, we found that governments and public institutions from several countries have proposed

frameworks to analyse benefits from their investments in IT projects. In this way, we decided to add to the results the works that followed a well defined methodology for their construction and were validated by applying them to, at least, a documented real case.

Therefore, we were able to collect 35 candidate works. A selection of works was carried out by reading the title and abstract of each candidate paper. From this analysis the work was set to 20. Then a reading of each work was performed, as a result the number of works was reduced to 15.

2.3 Synthesis and Analysis

A synthesis of the selected works, with reference to the research questions is presented below. Table 1 presents an overview of this analysis.

2.3.1 Who Is Benefited?

Beneficiaries described in the reviewed works (see second column in table 1) can be classified as follows:

- *Final beneficiaries*: they can be characterised as the last beneficiaries of the IT resources and capabilities resulting from IT projects. These can be classified into 2 broad categories:
  - Internal beneficiaries: all stakeholders belonging to the entity investing in the IT project, e.g. public servants.
  - External beneficiaries: all stakeholders that do not belong to the entity that invests in the project, e.g. citizens, private institutions, etc.
- *Intermediate beneficiaries*: they are public institutions or entities that consume the IT resources and capabilities resulting from IT projects to improve their operation and / or the public services that they offer to the final beneficiaries.

2.3.2 What are the Types of Benefits?

The following typology of benefits has been identified for final beneficiaries. Table 2 shows the most common benefit types examples.

- *Financial*: in this case, resulting IT resources and capabilities enable the beneficiary to generate or increase his income or reduce his costs.
- *Political*: consisting in enhancing participation and equity or conferring political capital as well as increasing transparency, among others.
- *Social:* related to social mobility, creating new opportunities, improving quality of life, increasing safety or improving working conditions.
- *Strategic:* helping the beneficiary to reach its high level objectives. In this case, the main beneficiaries are public and private institutions, as well as the state as a whole.

For intermediate beneficiaries the following typology of benefits has been identified:

- *Effectiveness:* it is to help the public institution to produce a desired result or reach a defined goal.
- *Efficiency:* it consists in helping the public institution to execute an activity, produce a desired result with the minimum possible resources.
- *Enabling:* it is to allow the public institution to execute an activity that was not possible to be performed before.

Additionally, we identify two types of benefit nature: (i) Quantifiable nature meaning that the benefit level can be quantified; (ii) Qualitative nature, that is, the benefit has a certain grade of subjectivity and is related to the perception of the beneficiaries.

2.3.3 How Benefits are Measured?

Means to measure the benefit level depend on the nature of the benefit (quantitative or qualitative).
Measurement of quantitative benefits: The measurement of this type of benefit is made through methods, metrics and unit of measurement. With respect to the methods, for instance, (Australian Government Information Service, 2004) uses a financial analysis method that calculates the benefit level of the project through a ratio between cost and revenue. These two elements are determined by using metrics such as depreciation schedule, tax discount rate and cash flow. Regarding established metrics, for example, (Al-Raisi and Al-Khouri, 2010) propose to measure the ROI of a project by joining the social, political and financial ROI. However their approach do not show how to quantify each ROI. Concerning units of measure, most of them propose money (euros or dollars) to measure financial benefits, number of people benefited for social benefits , time (hours, days, weeks, etc.) to measure efficiency and effectiveness and percentages or specific ratio scales to measure political, strategic and ethical benefits.
Measurement of Qualitative Benefits: The qualitative measurement of benefits is commonly related to characterise the perceptions of the beneficiaries about how IT resources and capabilities resulting from IT projects are impacting them in a positive way. For example, to measure social benefits as qualitative benefits, (Vaughan et al., 2012; MacCarthaigh, 2008; Di Maio, 2003) evaluate the positive impact on citizens when they use a new public IT service by using satisfaction level categories.

Table 1: Synthesis of the articles included in the review by using the research questions.

Ref.	Benefit Types	Beneficiaries	Benefit Measures	Method of Benefit Analysis	Benefit Models	Project Phase
(Al-Raisi and Al-Khouri, 2010)	- Financial - Political - Social	- Government - People - Communities	- *Measures:* Social ROI, Political ROI, Financial ROI - *Units:* Money, number of people benefited, number of new policies	- ROI Analysis	- N/A	- After implementation
(Bhagwat et al., 1992)	- Social - Financial	- Communities	- *Measures:* Benefit Cost Ratio - *Units:* Money	- N/A	- N/A	- After Implementation
(Cresswell et al., 2006)	- Financial - Political - Social - Strategic - Ideological - Stewardship	- People (Direct Mechanism) - Public Institutions (Indirect Mechanism)	- *Measures:* Cost Savings, Quality, Enhanced trust - *Units:* Seconds, number of benefited people	- Benefit analysis framework	- Link Diagram that relates the beneficiary to the benefit impact.	- N/A
(North Ireland Financial Department, 2016)	- Financial - Efficiency - Strategic - Social - No benefit	- People (Direct Mechanism) - Public Institutions (Indirect Mechanism)	- *Measures:* N/A - *Units:* Money, Time, Satisfaction levels	- Framework of four stages	- Benefits dependency network diagram	- N/A
(Pollock et al., 2014)	- Strategic - Financial - Social	- N/A	- *Measures:* Net Present Public Value, Benefit Cost Ratio - *Units:* Money, number of benefited people, payback period	- N/A	- N/A	- During all the project phases
(Vaughan et al., 2012)	- Efficiency - Effectiveness - Strategic	- People	- N/A	- N/A	- N/A	- After project implementation
(Ward et al., 2008)	- Financial - Efficiency - Enabling	- N/A	- *Measures:* Key Performance Indicators, Impact level of the benefit - *Units:* Money, number of benefited people	- Method of six stages	- Benefit table	- Before the start of the project
(French Agency for the Development of Electronic Administration, 2005)	- Financial - Social - Efficiency - Effectiveness	- External people or organisations - Internal people or organisations	- *Measures:* N/A - *Units:* Money, Percentages, Scale levels	- Mareva Methodology	- Value Analysis: modelling of benefits, risks and need of project through a polar graph	- After project implementation
(Booz et al., 2002)	- Social - Financial - Strategic - Political - Efficiency - Effectiveness	- Final users of IT services	- *Measures:* Performance metrics defined by the analyst - *Units:* N/A	- External people or organisations - Internal people or organisations	- The Value Measuring Methodology	- After project implementation
(Emerson et al., 2000)	- Financial - Social - Strategic	- Public institutions - Communities	- *Measures:* Social Return on Investment, Business Indicators, Social Indicators - *Units:* Money, number of people benefited	- Social Return on Investment methodology	- N/A	- N/A
(Australian Government Information Service, 2004)	- Financial - Strategic - Social	- Communities - Inner organisation	- *Method:* Financial Analysis - *Measures:* N/A - *Units:* Money, percentages, scales	- The Demand and Value Assessment Methodology	- Benefits tables and Strategic Value Worksheet	- After project Implementation
(MacCarthaigh, 2008)	- Ethical - Political - Efficiency - Effectiveness	- Government institutions - Community	- *Measures:* N/A - *Units:* Money, percentages	- Service value methodology	- N/A	- N/A
(US Executive Office for President, 2007)	- N/A	- Citizens - Communities	- *Method:* Measuring model - *Measures:* N/A - *Units:* Money, time, number of benefited people	- Performance Reference Model	- N/A	- N/A
(Rothig, 2011)	- Financial - Efficiency - Effectiveness - Enabling	- Public Institutions	- *Measures:* N/A - *Units:* Money, time	- WiBe Framework	- N/A	- Before the start of the project
(Di Maio, 2003)	- Political - Enabling	- Private Sector - Public Sector	- *Method:* Measure framework - *Measures:* Political Indexes, Key Performance indicators - *Units:* Money	- N/A	- N/A	- N/A

Table 2: Benefit type examples classified by beneficiary type.

Beneficiary type	Financial	Political	Social	Strategic
External	- Revenue increase - Cost and expenses reduction - Treasury earnings - Optimisation in expenses and costs	- Empowerment and design of public policies - Information and oversight - Election of representatives and life democratic	- Quality of life - Citizen security - Social mobility - New opportunities - Facilitate interaction with the institution	- Strategic plan - Risk mitigation - Competitive advantage - Resource Optimisation - New opportunities - Decision
Internal	- Reach of economic objectives - Reducing costs and expenses - Treasury earnings - Optimisation in expenses and costs	- Conferring political legitimacy and visibility - Improve reputation and image - Decision making - Articulation and implementation of public policies and laws	- Improving working conditions - New opportunities	- Development plans and government - Risk mitigation - Competitive advantage - Resource Optimisation

2.3.4 How Benefits are Analysed?

As it is shown in the column Method of benefit analysis of Table 1, the reviewed works use frameworks and methods made mainly of steps. For instance, (Ward et al., 2008) propose to define benefits within 6 steps: (i) define business motivators and investment objectives; (ii) identify benefits, owners and measures; (iii) structure the benefits; (iv) identify organisational changes; (v) determine the explicit value of each benefit; and (vi) identify costs and risks. In turn, (North Ireland Financial Department, 2016) presents a method for managing benefits based on 4 steps: (i) identification and structuring of benefits, (ii) planning the benefits realisation, (iii) benefits implementation and monitoring and (iv) benefits assessment. The method emphasises in the first step which includes three processes, namely, detailed benefit identification, benefit modelling and benefit profiling. These processes have allowed public institutions in North Ireland to identify and classify benefits and respective beneficiaries in the earliest phases of the IT project.

2.3.5 How Benefits are Modelled?

The reviewed works model benefits using several notations such as polar graphs, link graphs, dependency networks. For example, (North Ireland Financial Department, 2016) models benefits through a benefits dependency network diagram which relates three elements: the enablers, intermediate beneficiaries and final beneficiaries. (French Agency for the Development of Electronic Administration, 2005) models the benefits by using a polar graph that consider five factors: (i) need for the project, (ii) internalities, (iii) individual externalities, (iv) risk matrix and (v) profitability in the public sphere.

2.3.6 In Which Phase of the Project the Benefit Analysis Is Performed?

The benefit analysis is performed in three phases of the project: (i) before the start of the IT project, (ii) during execution and (iii) after implementation. In the first case, the main objective is to identify and plan potential benefits in order to assess them after the project implementation (Rothig, 2011) or to evidence the potential impact to get funding or sponsorship (Ward et al., 2008). In the second case, the objective is to measure how the execution of the project can generate benefits for the identified beneficiaries (Pollock et al., 2014). Finally, in the third case, the objective of the benefit analysis is to measure the impact and success of the project by comparing the planned benefits vs the benefits being realised (Booz et al., 2002; French Agency for the Development of Electronic Administration, 2005; Bhagwat et al., 1992) or by showing benefits during the operation of IT services (Australian Government Information Service, 2004; Vaughan et al., 2012; Al-Raisi and Al-Khouri, 2010).

2.4 Towards a Conceptual Model

From the analysis of the state of art, we conclude that the reviewed works have in common, at least, the following: the success of **IT projects** depends on the benefit generated from them against the investment made for implementation. In addition, IT projects generate IT resources and capabilities that, in most of cases, are made available to a group of **people** or **organisations** in form of **IT services**. These services aim at generating **benefits** to final beneficiaries or supporting supporting the operation of public entities in order to provide **public services**. The reviewed research or practical works use **methodologies** to analyse the benefits and **models** to characterise them according to their **type** and **nature**. From the above, it can be concluded that benefit identification is related

to the analysis of the relationship between the following conceptual elements: *IT Project, Public Service, IT Service, Beneficiary, Benefit, Benefit Type, Benefit Measure, Benefit Nature, Methodology and Model*. Consequently, the following section presents a conceptual model for benefit analysis from the elements listed above.

3 CONCEPTUAL MODEL FOR BENEFIT ANALYSIS OF IT PROJECTS IN PUBLIC SECTOR

The proposed conceptual model, shown in Figure 1, is designed to help public organisations to perform benefit analysis that can be derived from IT projects. The model consists on the following elements:

- **Public Organisation:** a public sector organisation is one that is operated by the government (Al-Raisi and Al-Khouri, 2010).
- **IT Project:** an IT project is a project with at least one Information System or Information Technology component amongst its outputs (Project Management Institute, 2001).
- **Public Service:** a public service is a service which is provided by the government to people living within its jurisdiction (Cresswell et al., 2006; MacCarthaigh, 2008).
- **IT Service:** an IT service is a complex and abstract concept that involves IT, processes and people (Avila and Sastoque, 2016).
- **Beneficiary:** a beneficiary is any person who gains an advantage and/or profits from something (Ward et al., 2008; French Agency for the Development of Electronic Administration, 2005).
- **Benefit:** in this context, a benefit can be defined as the expected outcome of an IT project that was planned to meet the particular needs of different stakeholders (Ward et al., 2008; Booz et al., 2002).
- **Benefit Type:** the type of benefit is a benefit feature that allows to differentiate and classify the type of advantage that a service provision has on beneficiaries (Ward et al., 2008).
- **Benefit Measure:** the measure is a feature to calculate the benefit level by using metrics, indicators or targets (Ward et al., 2008).
- **Benefit Nature:** it is a benefit feature to determine how the benefit could be measured. This feature is related to quantitative and qualitative features of the benefit (Ward et al., 2008).
- **Model:** a model is a simplified version of something complex used, for example, to analyse and solve problems or make predictions (Bézivin, 2005).
- **Methodology:** it is a system of broad principles or rules from which specific methods or procedures may be derived to interpret or solve different problems within the scope of a particular discipline (Mayring, 2014).

Relations between the elements defined above are given as follows: IT and public services are provided by public organisations in order to enhance the quality life of citizens and deliver government programs. Public organisations fund IT projects to implement IT services that can support public services or be used directly by the citizens. Beneficiaries use these services and thus obtain benefits. These benefits may have different types (financial, social, political, etc.), measures (units, categories, etc.) and nature (qualitative and quantitative). Methodologies are used to identify and analysing beneficiaries and benefits. In addition, models are used to represent the benefits, beneficiaries and projects with their relationships.

4 CONCLUSION AND FUTURE WORK

This paper presents a literature review that identifies and analyses research works for analysing benefits from IT projects by using six research questions. Regarding the first research question, who is benefited?, we identified two beneficiary classes: final and intermediate beneficiaries. The rationale behind this classification is that IT resources and capabilities resulting from IT projects can be provided directly to final beneficiaries or to public entities (intermediate beneficiaries) that use them to improve their operation and provide better services to the final beneficiaries. Respecting the second research question, what are the types of benefits?, we identify that, unlike the private sector, in the public sector IT projects do not only generates financial benefits. Thus, we found four benefit types for final beneficiaries (financial, social, political and strategic) and three benefit types for intermediate beneficiaries (efficiency, effectiveness and enabling). This fact makes benefit analysis in the public sector a more complex task because of the difficulty to define targets those benefit types as well as to quantify the real impact or benefit level reached after project implementation. Another interesting founding is that any of the reviewed works suggests the 7 benefit types, which constitutes one of the main contribu-

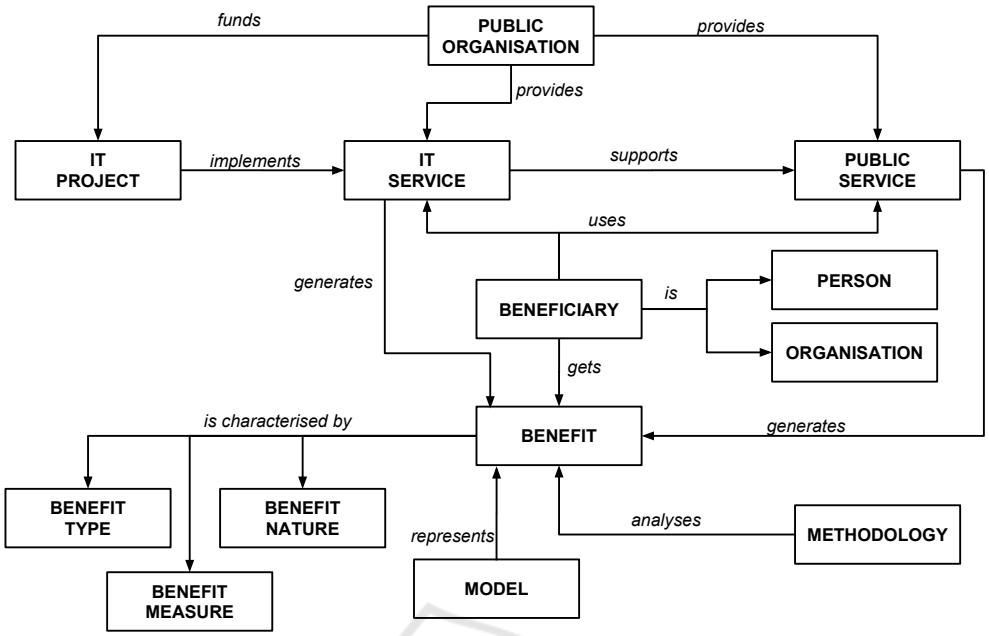

Figure 1: Conceptual model for benefit analysis.

tions of the present work. Regarding the third question, How benefits are measured?, the main measurement elements suggested in the reviewed works are: measurement methods, metrics and units of measure. Indeed, the use of these elements seems to be difficult considering that the authors do not show in detail their application. With respect to the fourth question, how the benefits are analysed?, the methods and procedures are applied to small case studies in a manual way, what highlights the lack of software applications to facilitate their use in larger cases. Regarding the fifth question, benefits can be modelled using several notations such as polar graphs and dependency networks. The former is the most reliable and easy to use notation technique because it is graphical and allows the project manager to illustrate benefits in one page. Concerning the sixth question, few approaches show strength to analyse benefits during the three phases of the IT project defined by us: before starting, during execution and after implementation. Respecting the conceptual model proposed in this paper, it summarises the most important findings as well as the experience obtained by practitioners and researchers that wrote the reviewed works. In addition, it provides important concepts and their relationship that public entities can consider when identifying benefits. One of the main conclusions that can be extracted from the model is that benefits are not directly generated by **IT Projects** but by the **IT Services** that are implemented from them. In this way, IT services emerges as an important element which motivates further research on how the articulation between IT projects and e-government generates public value to citizens and, in general, to the society.

As future work, the conceptual model can be used to propose a complete approach that includes the taxonomy of beneficiaries and benefits identified in this paper. In addition, the approach can addresses the three phases of the project and includes conceptual elements to facilitate its use. Such conceptual elements can be a graphical notation to model benefits and a well established method with steps to guide the project manager in the task.

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