**Abstract**

**Purpose**: This paper studies how the concepts of efficiency, effectiveness and efficacy are used in project management literature. The concepts relate to the degree of success or failure of projects and the degree to which the results are achieved. The purpose of this paper is to review the use of the concepts of efficiency, efficacy and effectiveness in project management literature and among practitioners.

**Design/methodology/approach**: The study is based on an extensive literature review, initially from the *International Journal of Managing Projects in Business*. The first phase involved searching the words ‘efficiency’, ‘effectiveness’ and ‘efficacy’ in all articles of the journal, then quantifying the results. This was followed by a qualitative search of the same articles with the aim of understanding how the terms ‘project efficiency’, ‘project efficacy’ and ‘project effectiveness’ are used. A further intensive literature review was then conducted in other literatures in the field of project management, including, but not limited to, *International Journal of Project Management* and *Project Management Journal*. Finally, we complemented the review by including theories from deep searches of Google Scholar and Google Books using the parameters ‘project efficiency’, ‘project effectiveness’ and ‘project efficacy’ and checked how the three concepts are used in other fields.

**Findings**: This research reveals there is wide diversity in interpretations of the three concepts among research scholars and practitioners, which makes it challenging to apply these three concepts appropriately and clearly. As a consequence, we propose a model for describing these concepts.

**Research limitations/implications**: This research is based on an academic and non-academic literature review. It identifies a number of inconsistencies in existing literature regarding the three concepts.

**Practical implications**: This review enriches understanding of project management. Clarifying the understanding of project efficiency, project effectiveness and project efficacy will help and support organisational improvement. A clear and aligned view of these concepts can also be a basis for measurements based on possible developed indicators.

**Originality/value**: This paper highlights the gap in the literature concerning the practical use and interpretation of the concepts ‘project efficiency’, ‘project effectiveness’ and ‘project efficacy’.

**Keywords**: project efficiency, project effectiveness, project efficacy

**Paper type**: Literature review.

1. **Introduction**

According to Merriam-Webster, (1984, p. 280), “Effective, effectual, efficient and efficacious all mean producing or capable of producing a result or results, but they are not freely interchangeable in idiomatic use”. When discussing with project management practitioners and reviewing literature on project management, these concepts are used with a variety of meanings. Some authors and many practitioners consider efficiency and effectiveness synonymous. This confusion is often present in project management literature, but is also reported in organisational theory (Belout, 1998; Ika, 2009). ‘Project efficacy’ is a rarely used term in project management literature, but there are some examples, including as a synonym for project effectiveness (e.g. Brewer and Runeson, 2009; Sankaran *et al*., 2009), or to project efficiency (e.g. Wong and Wong, 2014).

This paper aims to highlight use of the concepts of efficiency, effectiveness and efficacy, and their different interpretations by academicians and practitioners related to project management. The research focuses only on literature written in English.

The research questions of the paper are:

* To what extent are the concepts of efficiency, effectiveness and efficacy used in *International Journal of Managing Projects in Business*?
* How are the terms ‘efficiency’, ‘effectiveness’ and ‘efficacy’ used in project management among academicians based on academic literature, among professionals based on non-academic literature, and in other fields (e.g. pharmacology)?
* What is our overall impression of the use of the three concepts in the field of project management?
1. **Methodology**

This paper is based on a systematic literature study. According to Petticrew (2001), systematic reviews are not just big literature reviews, but address specific issues. Being systematic reduces bias in the selection and inclusion of studies. a Cook *et al*., 1997; We have focused on the use of the concepts of project efficiency, effectiveness and efficacy within the project management area. In addition, we consider interpretations of those three concepts suggested in the academic and non-academic literature.

David Gough (2007), Director of the EPPI-Centre, describes a nine-phase process for systematic reviews:

(1) Establishing the review question.

(2) Defining inclusion and exclusion criteria.

(3) Articulating the search strategy, including information sources.

(4) Screening the articles to see if they meet the inclusion and exclusion criteria.

(5) Reporting the results of the search strategy, usually through a flowchart.

(6) Extracting relevant data from included studies.

(7) Assessing the methodological quality or rigour of the included studies.

(8) Synthesising, either quantitatively or qualitatively, the collective evidence of the included studies.

(9) Drawing conclusions and communicating these findings in a manner which is relevant to the readership.

The study is conducted in four phases. The first phase involved searching the words ‘efficiency’, ‘effectiveness’ and ‘efficacy’ in all articles in selected journals; the second was a qualitative search of the same articles, aiming to understand how the terms ‘project efficiency’, ‘project efficacy’ and ‘project effectiveness’ are used. Thirdly, another intensive literature review was carried put in other literatures in the field of project management. Lastly, we complemented the review by including theories from deep searches with Google Scholar to check how the three concepts are used in other fields.

Firstly, we conducted a quantitative search of *International Journal of Managing Projects in Business*, downloading all the articles and counting use of the words ‘efficiency’, ‘efficacy’ and ‘effectiveness’. We created a count table including all the 351 articles and the number of appearances of each of the three terms in each article. We found that 96 articles contained none of the three terms, so they were excluded (exclusion included articles using project management success for efficiency and project success for effectiveness). We then disregarded the articles where the three terms appeared only in the reference list.

Secondly, for the remaining articles, we performed qualitative selection, where we checked use of the three terms and their context; we selected 27 articles where the terms were used more than ten times, reflecting the context in which they had been used. Following this, a second qualitative review was conducted where we checked use of the terms ‘project efficiency’, ‘project effectiveness’ and ‘project efficacy’ and created a summary table of how the three concepts were defined in each article.

Thirdly, our literature review continued. We made a further search of the three terms in different forms (‘project efficiency’, ‘efficiency of project’, ‘efficient project’”, etc.) in other journals. The searches included, but were not limited to, *International Journal of Project Management*, *Project Management Journal*, *Project Appraisal Journal*, *Administration in Social Work Journal*, and many other academic journals related to the three terms.

Finally, our research was extended to other journals related to social sciences, behavioural sciences, psychology, pharmacology, medicines, public heath practice and healthcare, since these were using the concepts intensively and with very clear definitions. Other databases and search engines were utilised to uncover books published since the 1960s, technical reports and public documents, as well as business-focused and NGO sites (e.g. OECD, JICA, etc.). We used a Google . Tfor We used a wide range of search terms, including ‘project success’, ‘project performance’, ‘efficient’, ‘efficacious’, ‘effective’, ‘efficiency’, ‘effectiveness’ and ‘efficacy’. We examined other definitions of the three concepts from different fields and disciplines, from academic and non-academic views.

1. **Literature review**

Under the umbrella of project management, the concepts of efficiency, effectiveness and efficacy are commonly used but rarely defined. Some researchers use the terms when describing how to improve project management methodology itself, as is the case with some authors in *International Journal of Managing Projects in Business* (Niebecker *et al.*, 2008; Alam *et al.*, 2010; Joslin and Müller, 2016). Others (among many, Randeree and Ninan, 2011; Müller and Jugdev, 2012; Muganda and Pillay, 2013; Analia Sánchez *et al.*, 2013; Haji-Kazemi and Andersen, 2014; Mullaly, 2014; Badi and Pryke, 2015; Messner, 2015; Coetzer, 2016; Lahdenperä, 2016; Ssegawa and Muzinda, 2016) apply them in how to improve some parts of project management practice (e.g. leadership, communication, project teams, organisation, project member as an individual, cost, time, quality, support tools, etc.).

Many authors deployed Drucker’s (2000) famous expression: “management is doing things right; leadership is doing the right things”, where they reflected on management as project management success (in this paper, efficiency) and leadership as project success (in this paper, effectiveness).

Olsson (2008) claimed that efficiency is related to producing direct outputs, and effectiveness is related to added value for owners and users. Eikland (2000) related efficiency in a construction process to cost and time used. High efficiency, then, mean that the construction process uses a minimum of resources, time and cost to produce the specified result. Furthermore, Eikland (2000) sees efficiency as a measurement of friction in the value chain, related to the level of cooperation between the involved actors. In this interpretation, efficiency is related to doing things in the right way and is an internally focused measurement. According to Olsson (2008), effectiveness can be related to doing the right things. It is an external type of measurement. The effectiveness of a construction process can be seen as the ability of the process to satisfy the requirements, objectives and priorities related to customers in the construction industry, primarily the project owners. Effectiveness is focused on how the construction process contributes to increased value for the owners and users. The needs of the owners and users vary; the context of the project may change. Consequently, effectiveness is a loosely defined and moving target. According to Samset (1998), effectiveness measures the realisation of the project’s purpose, or the project’s long-term consequences. This is the perspective of the project owner and the users. However, there are a number of different definitions, approaches and uses of the terms ‘efficiency’ and ‘effectiveness’, as well as the related term ‘efficacy’.

Brewer and Runeson (2009) and Sankaran *et al.* (2009) used the three terms ‘effectiveness’, ‘efficacy’ and ‘efficiency’, but without defining any of them. Nevertheless, it can be understood that efficacy is used as a synonym for effectiveness. Ika *et al.* (2010) addressed project efficiency and effectiveness and related it to project success, but there was no explicit interpretation of the terms ‘efficiency’ and ‘effectiveness’. Alam *et al.* (2010) discussed the effectiveness of a British project management professional development programme and its impact on work efficiency on the individual level. Emil Berg and Terje Karlsen (2014) did the same regarding the operational effectiveness of project managers. Randeree and Ninan (2011) mentioned that efficiency is a measure of the quality and quantity of the team performance outcomes. On the other hand, the term ‘team effectiveness’ was used and was defined as being achieved “when the members of the team work together towards the achievement of common goals” (Jiang *et al.*, 1997, cited in Randeree and Ninan, 2011, p. 32). This latter strongly overlaps the term ‘efficiency’ used previously; the same can be said about the term ‘efficacy’ within the same article. Cavaleri *et al.* (2012) linked project effectiveness and organisation effectiveness with problem-solving effectiveness. Moreover, effectively managing a project problem-solving pattern enables project teams to balance the two critical functions needed to achieve optimal levels of project effectiveness (Cavaleri *et al.*, 2012). Emil Berg and Terje Karlsen (2014) used the three terms on the individual level to reflect self-efficacy, work efficiency and personal effectiveness. Lloyd-Walker *et al.* (2016) referred to self-efficacy, where they considered it in terms of a person’s confidence in their ability to successfully undertake work tasks and respond to challenges. Joslin and Müller (2016), based on the description by Bryde (2005), discuss the relationship between the effectiveness of a project methodology and the characteristics of project success where they refer to project success as project efficiency evolved from simple, quantifiable time, scope and cost measures. In addition, project effectiveness is the measure with the longer-term perspective (Shenhar *et al.*, 1997; Belout, 1998; Jugdev *et al.*, 2001). Cicmil and O’Laocha (2016) and Hodgson and Cicmil (2016) demonstrate that the success of the project is more than its effectiveness and efficiency and relates more to giving voice to issues of morality, equality and ethics in project-based work; however, they did not define the two terms. Kujala *et al.* (2015) mentioned project efficiency in an example where they related it to a delay in decision-making until later phases of the project, which decreases project efficiency, but again project efficiency was not defined. Ferrada and Serpell (2013) related project efficiency to performance in terms of time, cost and quality and the satisfaction level of clients. Ssegawa and Muzinda (2016) define project success in terms of effectiveness and project management success in terms of efficiency, both being very important in project delivery. Klakegg (2010), cited in Hjelmbrekke *et al.* (2014), mentioned that project effectiveness was the link between the company and the owners. In addition, the concept is increasingly being linked to projects in order to align their outcomes with the general strategy of the parent organisation. Shenhar and Dvir (2007), cited in Eduardo Yamasaki Sato and de Freitas Chagas Jr (2014) and in Jugdev *et al*. (2013), propose five dimensions of success criteria: efficiency, impact on customer, impact on team, business and direct success, and preparation for the future. Project efficiency refers to the usual triple constraint, but there is no reference to project effectiveness. Yamin and Sim (2016) defined project efficiency as the extent to which the project incurred the lowest possible expenditure to meet the objectives of the project, while project effectiveness was defined as the extent to which the project was able to meet its objectives, but the two concepts seem to overlap in their context. Martinsuo *et al.* (2013) consider that the success of a project is a constant concern for project managers and owners, and forecasting and evaluating project success has also remained among the main topics in project research. We find that a general trend in project management research is that the attention in evaluating project success has moved from the efficiency of project management towards effectiveness—i.e. doing the right things—and efficiency (doing things right).

1. **Quantitative review of the three terms in the IJMPB**

As discussed in the methodology chapter, quantitative work has been carried out on all 351 articles downloaded from the journal (*IJMPB*) by counting the times the words appeared in each article (Table 1). The results show that the term ‘effectiveness’ is the most frequently used at 51 per cent, followed by ‘efficiency’ at 42 per cent and ‘efficacy’ at just seven per cent.

**Table 1.** Count of use of the terms ‘efficiency’, ‘effectiveness’ and ‘efficacy’ in *IJMPB*

|  |  |  |  |
| --- | --- | --- | --- |
| Sets | Number of words and articles | Total | Percentage  |
| 1 | Total number of journal articles downloaded | 351 | 100 |
| Articles with at least one of the three words | 255 | 73 |
| Articles with none of the three words | 96 | 27 |
| 2 | Total number of uses of the three terms in the journal | 1,537 | 100 |
| Frequency of word ‘efficiency’ in the journal | 652 | 42 |
| Frequency of word ‘effectiveness’ in the journal | 782 | 48 |
| Frequency of word ‘efficacy’ in the journal | 103 | 7 |
| 3 | Total number of articles using just one of the terms | 140 | 100 |
| Articles using only the word ‘efficiency’ | 65 | 46 |
| Articles using only the word ‘effectiveness’ | 68 | 49 |
| Articles using only the word ‘efficacy’ | 7 | 7 |
| 4 | Total number of articles mentioning each term | 379 | 100 |
| Articles referring to ‘efficiency’  | 171 | 45 |
| Articles referring to ‘effectiveness’ | 180 | 48 |
| Articles referring to ‘efficacy’ | 28 | 7 |

As seen in Table 1, the word ‘effectiveness’ was used in 180 articles, ‘efficiency’ in 171 articles, and ‘efficacy’ in 28 articles.

We made a selection of articles where the three terms were used in total more than ten times. The context of the use of each of the terms is summarised in Table 2. The order in the table is from least to most frequent appearance. The highest frequency of the use of the three terms is 97 times in the article by Mullaly (2014). We studied in what context the words were used, and found that the three terms were used in different contexts (e.g. organisational, leadership, work, personal, system, operation, travel, business, cost, process, customer, etc.).

**Table 2.** Context of use of the terms ‘efficiency’, ‘effectiveness’ and ‘efficacy’ in *IJMPB*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Author(s) | Efficiency | Effectiveness | Efficacy | Sum | Context of word use |
| Lefley (2008) | 9 | 3 | 0 | 12 | Organisational efficiency, model effectiveness |
| Emil Berg and Terje Karlsen (2014) | 1 | 4 | 8 | 13 | Self-efficacy, work efficiency, personal effectiveness, project efficiency |
| Olsson and Bull-Berg (2015) | 11 | 2 | 0 | 13 | System effectiveness, system efficiency, operation efficiency, business efficiency, travel efficiency  |
| McEvoy *et al.* (2016) | 0 | 14 | 0 | 14 | Aid effectiveness, human capital and institutional effectiveness, organisational effectiveness, programme effectiveness |
| Henriksen and Røstad (2010) | 14 | 1 | 0 | 15 | Cost effectiveness, customer efficiency, process efficiency |
| Aranda-Mena *et al.* (2009) | 16 | 0 | 0 | 16 | Design efficiency, managing building efficiency |
| Badi and Pryke (2016) | 16 | 0 | 0 | 16 | Energy efficiency |
| Christensen (2011) | 15 | 1 | 0 | 16 | Public sector effectiveness, efficiency building |
| Niebecker *et al.* (2008) | 8 | 8 | 0 | 16 | Project management efficiency, project management effectiveness |
| Yamin and Sim (2016) | 8 | 11 | 0 | 19 | Aid effectiveness, project effectiveness, project efficiency |
| Andersen *et al.* (2009) | 20 | 0 | 0 | 20 | Organisational rationality efficiency |
| Alam *et al.* (2010) | 14 | 6 | 1 | 21 | Communication efficacy, organisational effectiveness, projectmanagement effectiveness, work efficiency |
| Ika *et al.* (2010) | 6 | 14 | 1 | 21 | Project efficiency, project effectiveness, cost effectiveness, organisational effectiveness, operational efficacy |
| Joslin and Müller (2016) | 2 | 20 | 0 | 22 | Project efficiency, project effectiveness, effectiveness of project management methodology  |
| Müller and Jugdev (2012) | 10 | 12 | 0 | 22 | Organisationaleffectiveness, team performance effectiveness, project effectiveness, effectiveness measures, team performance efficiency, project efficiency, efficiency metrics |
| Analia Sánchez *et al.* (2013) | 20 | 2 | 0 | 22 | Organisation effectiveness, portfolio effectiveness, efficiency of decision making, efficiency model, efficiency scores, efficiency formulation, efficiency frontier |
| Haji-Kazemi and Andersen (2014) | 21 | 2 | 0 | 23 | Software application and tool effectiveness, software application and tool efficiency |
| Lahdenperä (2016) | 24 | 0 | 0 | 24 | Cost efficiency |
| Badi and Pryke (2015) | 14 | 14 | 0 | 28 | Communication effectiveness, energy efficiency |
| Muganda and Pillay (2013) | 1 | 29 | 0 | 30 | Leadership effectiveness, project management effectiveness, personal effectiveness, virtual team effectiveness, leadership efficiency |
| Randeree and Ninan (2011) | 2 | 28 | 2 | 32 | Collective efficacy, team effectiveness, project efficiency |
| Bayiley and Teklu (2016) | 17 | 20 | 0 | 37 | Project efficiency, project effectiveness |
| Ssegawa and Muzinda (2016) | 24 | 18 | 0 | 42 | Cost effectiveness, project effectiveness, organisational efficiency, project efficiency |
| Lloyd-Walker *et al.* (2016) | 0 | 0 | 46 | 46 | Self-efficacy |
| Coetzer (2016) | 2 | 45 | 4 | 51 | Self-efficacy, project manager effectiveness |
| Messner (2015) | 0 | 73 | 0 | 73 | Intercultural effectiveness, performanceeffectiveness, contextual effectiveness |
| Mullaly (2014) | 0 | 97 | 0 | 97 | Decision-making effectiveness, project effectiveness, process effectiveness, rule effectiveness, effectiveness of project initiation decision |

1. **Qualitative examination of the three terms related to project success within the *IJMPB*, *IJPM* and *PMJ***

Since our concern is more with the use of the terms ‘efficiency’, ‘effectiveness’ and ‘efficacy’ with respect to project management, project success and project evaluation, then the three terms are linked in terms of project efficiency, project effectiveness and project efficacy. Our qualitative literature analysis targeted only articles discussing referring to project efficiency, project effectiveness and project efficacy, initially in *International Journal of Managing Projects in Business* before the search was extended to *Project Management Journal* and *International Journal of Project Management*. We extracted the definitions from each article and summarise them in Table 3. Our first impression is that the three terms corresponding to project and project management are less used in *Project Management Journal*. This may be because the journal focuses more on the project delivery itself and the mechanisms leading to project efficiency, and appears to be less concerned with the context of the project. In *International Journal of Project Management*, there are some cases where the terms are used as synonyms—for example, where efficiency and efficacy have the same interpretation (Wong and Wong, 2014).

**Table 3.** ‘Project efficiency’, ‘project effectiveness’ and ‘project efficacy’ in *IJMPB*, *PMJ* and *IJPM* respectively

|  |  |  |  |
| --- | --- | --- | --- |
| Author(s) | Project efficiency | Project effectiveness | Project efficacy |
| *International Journal of Managing Projects in Business* |
| Ika *et al.* (2010) | Time, cost,and quality | Project objectives accomplished, long-term impacts | Operational efficacy |
| Andersen *et al.* (2011) | Benefit-to-cost ratio | Value of the project seen from a user or project owner perspective |  |
| Dalcher (2012) | On time, on budget and to scope | The extent to which the objective has been achieved |  |
| Ika and Saint-Macary (2012) | Project cost | Value, impact |  |
| Ferrada and Serpell (2013) | Performance on time, to cost and quality, client satisfaction  |  |  |
| Martinsuo *et al.* (2013) | Short-term interests | Long-term interest—‘doing the right things’ |  |
| Eduardo Yamasaki Sato and de Freitas Chagas Jr (2014) | Triple constraint | Customer satisfaction/acceptance |  |
| Bayiley and Teklu (2016) | Transform the availableresources into the intended results, measured in terms of quantity, cost and timeliness  | Achievement of theproject purpose |  |
| Ssegawa and Muzinda (2016) | Project management success | Project success, project impact on client |  |
| Yamin and Sim (2016) | Time, cost  | Objectives |  |
| *Project Management Journal* |
| Ika (2009)  | ‘Do things right’, or maximise output for a given quantity of inputs or resources | ‘Do the right thing’, or to attain the project's goals and objectives |  |
| Williams and Samset (2010)  | Delivering the planned output within cost and schedule—the value that a project can give | The value generated by the project |  |
| *International Journal of Project Management* |
| Belout (1998) | Maximisation of output for a given level of input or resources | The achievement of goals or objectives |  |
| Atkinson (1999) | Implemented on time, within cost and to some quality parameters requested | Getting something right, meeting goals |  |
| Crawford and Bryce (2003) | ‘Doing things right’: cost and process management (i.e. the efficient conversion of inputs to outputs within budget and on schedule) and wise use of human, financial and natural capital | ‘Doing the right thing’: the philosophical/developmental worthiness or appropriateness of the chosen project goal |  |
| Olsson (2006) | ‘Doing things right’ and producing project outputs in terms of the agreed scope, quality, cost and time | The extent to which the project’s tactical objective, or goal, can be achieved |  |
| Bernroider and Ivanov (2011) | Time and budget | Stakeholder targets and expectations |  |
| Geraldi *et al.* (2011) | Time, cost, scope |  Impact on stakeholders (benefit delivery); perceived value of the project (business and direct success) |  |
| Ghapanchi and Aurum (2012) | The extent to which output is created out of a particular amount of input—in other words, efficiency means doing things in the most economical way | The capability of producing an effect |  |
| Frinsdorf *et al.* (2014) | Maximises its return from its resources within the schedule and budget constraints of a project | The long-term and strategic issues |  |
| Wong and Wong (2014) | Same as efficacy | Accomplishing the goals | Pre-determined goals, time, cost and quality |
| Zwikael *et al.* (2014) | Meeting both time and budget expectations | Degree to which project specifications and customer needs are either met or solved |  |
| Joslin and Müller (2015) | Short-term project management measured by cost, time, and quality | Longer-term achievement of desired results from the project |  |
| Blomquist *et al.* (2016) | Operational performance, whether the resources were well utilised to attain the project results, meeting budget allowance as proxy of cost, meeting deadlines as proxy of time and delivering specification as a proxy of quality | Whether results of the project assisted in attaining business objectives; contribution to the strategy, meeting stakeholder expectations and delivering business benefits |  |

1. **Use of the three terms in other sources**

We extended our search of use of the three concepts to other sources like organisational management and quality management, and other journals related to project management, management and business. We also searched in non-academic literature to see how professionals are using those terms, and finally checked how the terms are used in other fields like pharmacology, medicines and others.

* 1. *Use of the three terms in other academic literature related to project management, management, economics and business*

It seems that it is not only project management literature that lacks consistency in defining efficiency, effectiveness and efficacy. Henderson and Lee (1992, cited in Jones and Harrison 1996), Wang *et al.* (2008), Huang and Li (2012) and Li and Huang (2013) define project performance according to a measure of the outcome or perceived success of the project team in meeting project goals, budget, schedule and operational efficiency considerations. They added that project performance is a combination of project effectiveness and efficiency; however, there was no clear definition of the terms ‘efficiency’ and ‘effectiveness’ separately. It may be seen that in the theory related to new product development, there is a strong overlap between the efficiency and the effectiveness of a project. However, this is not always the case: Olson *et al.* (2001), for example, are more explicit, defining efficiency by the measures concerned with the amount of resources required to complete the project. Cost and time are certainly among the most constrained—and therefore most important—resources necessary for developing new products. The authors add that measures of project effectiveness are concerned with the quality of the resulting product and its ultimate success in the marketplace. Verworn (2009) measures the efficiency of new product development projects by the degree of agreement between financial and personnel resources planned during the fuzzy front end (based on the developed model) and those actually required, and the accordance with milestone plans; the accessed projects are considered effective, but we can never know quite what project effectiveness is. Anthony et al. (2014) wanted to check coordination between lateral teams and its effect on project efficiency. In their study, they asked team leaders to rate each project’s effectiveness. The whole article talked only about project efficiency, however, where project efficiency is defined as the extent to which the project manages resources efficiently by adhering to budget (i.e. being less costly than expected and keeping its actual costs within estimated costs) and the ability to adhere to the projected schedule. Wynstra and Ten Pierick (2000) and Wynstra *et al.* (2001, cited in Su *et al*., 2008) proposed supplier involvement in product development projects to improve project effectiveness (product costs and quality) and project efficiency (development costs and time). Again, there is an overlap between project efficiency and effectiveness based on other definitions. In some very rare cases, project efficacy is seen as a combination of project effectiveness and project efficiency, where effectiveness is ‘doing the right things’ and efficiency is ‘doing things right’ (e.g. Riaz *et al*., 2013). Project efficacy in this case is ‘doing the right things right’, but this definition does not exist in any of the literature, at least to our knowledge. We found a definition of project efficacy (Pinto and Slevin, 1994, p. 339) wherein “the sole determinant of a project's efficacy has to do with whether or not its intended client will, in fact, make use of it”. In addition, the authors defined project efficiency in terms of internal efficiency (doing it right) and project effectiveness in terms of external effectiveness (doing the right thing). Other authors have been more explicit: Samset (2003) defines effectiveness as the extent to which the objective has been achieved—that is, the first-order effect of the project for the users in the market in terms of production, etc. Efficiency is a measure of the ratio between the input and the output (Bennett, 1975; Samset, 2003; Worsley, 2014).

* 1. *Use of the three terms in non-academic project management literature*

In a report titled ‘Feral swine damage management: a national approach’(U.S. Department of Agriculture, 2015), the three terms ‘efficiency’, ‘effectiveness’ and ‘efficacy’ were used without defining them, but by reading through the report one can understand that they are used as synonyms in some cases and are used interchangeably. Most commercial- and marketing-oriented organisations and NGOs more or less agree on the same definition of project efficiency, mostly converging to a measure of the ratio between the input and the output (e.g. UNIDO, 1972; USAID (PCI), 1979; UWA, 1996; NORAD, 1999; OECD, 2002; JICA, 2004). Nevertheless, more or less when it comes to project effectiveness; most of their definitions are divergent to some extent. On the other hand, they have a tendency not to use the concept ‘project efficacy’. Their definitions are summarised in Table 4.

**Table 4.** The concepts as used by NGOs

|  |  |  |
| --- | --- | --- |
| Organisation | Project efficiency | Project effectiveness |
| UNIDO (1972) | The relationship between the outputs produced and the inputs used in terms of quality, quantity and timeliness. It is a measure of the extent to which inputs are supplied and managed and activities organised in the most appropriate manner and at the least cost to produce the planned outputs. | The extent to which the outputs are used to achieve the immediate objectives that lead to outcomes. Indicators of outcomes are the main instruments to monitor the effectiveness of a programme. Outcomes are positive changes in development behaviour, the situation or the conditions of the counterparts and of their capabilities to benefit the performance of target beneficiaries, and the extent to which the provision of integrated services enhances the achievement of outputs and outcomes. |
| USAID (1979, p. 39) |  It measures the expected results per unit of input. | Objective measures of results are needed at each level of the hierarchy. In an actual project, specific targets will be included at all levels. |
| UWA (1996, p.5) | A programme needs to track its inputs and outputs. To assess compliance with service delivery standards, a programme needs to monitor activities and outputs.. | Helping participants. To assure potential participants and funders that its programmes produce results, and to show the general public that it produces benefits that merit support, an agency needs to measure its outcomes. |
| NORAD (1999, p. 97) | A measure of the ‘productivity’ of the implementation process—how economically inputs are converted into outputs (p. 97). | A measure of the extent to which a project or programme is successful in achieving its objectives. |
| OECD (2002, p. 20-1)  | A measure of how economically resources/inputs (funds, expertise, time, etc.) are converted to results. | The extent to which the development intervention’s objectives were achieved, or are expected to be achieved, taking into account their relative importance. Synonym for efficacy. |
| JICA (2004, p.21)  | A criterion for considering how economic resources/inputs are converted to results. The main focus is on the relationship between project cost and effects. | A criterion for considering whether the implementation of a project has benefited (or will benefit) the intended beneficiaries or the target society. |

We went through several professional reports (e.g. project evaluation and post project reports, project monitoring and controlling reports, progress reports, ex-ante project plans, etc.). We noticed that the practitioners who based their understanding of the three concepts on that used by international organisations, and foreign aid organisations in particular, such as UNIDO, OECD, USAID, UWA, NORAD and JICA, are more explicit and clear in using the concepts. In general, most of them refer to their sources within the reports.

* 1. *Use of the three concepts in other disciplines like pharmacology and medicine*

We moved a little out of our area, broadening the interpretations of the three concepts before narrowing them in the following discussion chapter. We wanted to check the significance of the three concepts in other disciplines.

The terms ‘efficacy’ and ‘effectiveness’ are intensively used in pharmacology and medicine to refer both to the maximum response achievable from a pharmaceutical drug in research settings and to the capacity for sufficient therapeutic effect or beneficial change in clinical settings. Efficacy is to some extent a synonym for effectiveness (depending on the circumstance in case of using it in pharmacology), both of which stem from the Latin verb *efficere* (in English, ‘to accomplish’. The effectiveness, or efficacy, of something is how well it works or brings the results you hoped for (Collins, 2004). As an example, a scientist does research to determine the efficacy of a vaccine or medicine under development. If it is efficacious, it will cure or prevent a disease. Price *et al.* (2013) define efficacy as the use of randomised controlled trials to test whether interventions have a benefit for selective patient populations under ideal conditions. Effectiveness is understanding real-life efficacy: it is the goal of pragmatic trials and observational studies. Hickey and Brosnan (2012, cited in Nardi *et al*., 2013) defined efficacy as the extent to which a specific intervention, procedure or service produces the desired effect under ideal conditions (i.e. controlled environment, laboratory/experimental circumstances—for example, the efficacy of a vaccine was achieved under ideal lab circumstances but its effectiveness needs still to be shown). The authors defined effectiveness as the extent to which planned outcomes, goals or objectives are achieved as a result of an activity, strategy, intervention or initiative, under ordinary circumstances (not controlled circumstances such as in the laboratory). Lastly, they defined efficiency as the ratio of the output to the inputs of any system. An efficient system or person is one who achieves higher levels of performance (outcome, output) relative to the inputs (resources, time, cost) consumed. According to Hickey and Brosnan (2012), efficiency can be seen as the sum of four efficiencies: (1) technical efficiency (outputs cannot be produced with less of some input); (2) efficient allocation (resources are optimally employed with respect to every available alternative); (3) efficient production (outputs cannot be produced at lower cost); and (4) social efficiency (no person can be made better off without making someone else worse off). The World Health Organisation (2004) defines efficacy as the extent to which a specific intervention, procedure or service produces a beneficial result under ideal conditions. It adds that effectiveness is the degree to which a treatment plan, programme or project has achieved its purpose within the limits set for reaching its objective—for example, an expression of the desired effect of a programme, service or institution in reducing a health problem or improving an unsatisfactory health situation. Lastly, the World Health Organisation (2004) defines efficiency as the extent to which the specific resources used to provide a specific intervention, procedure, regimen or service of known efficacy and effectiveness are minimised.

1. **Discussion**

Before discussing how the terms are used in project management literature and what we have presented in the previous chapters, let us look more closely at the origins of those words according to the dictionary. We extracted some definitions of the keywords related to our three terms from Merriam-Webster's *Dictionary of Synonyms* (1984, pp. 280–81). The word ‘efficient’ has synonyms including competent, qualified, able, capable, expert, skilful, skilled, proficient, adept and masterly. In addition, ‘efficient’ may apply to what is actively operative and producing a result. Efficiency implies acting in a manner to minimise the loss or waste of energy in production. ‘Effective’ emphasises the actual production of an effect or the power to produce a given effect. Synonyms of ‘efficacious’ include potent, powerful, puissant, cogent, telling, sound, convincing and compelling; ‘efficacious’ implies possessing a quality or virtue that gives a thing a potency or power that makes it effective. ‘Effectual’ has synonyms including accomplishing, achieving, fulfilling, operative, dynamic, active, decisive, determinative and conclusive. ‘Effectual’ suggests the accomplishment of a desired result or the fulfilment of a purpose or intention, so that the term frequently becomes synonymous with a decisive or final result and looks back after the event.

From the definitions of the terms ‘efficient’, ‘effective’ and ‘efficacious’, we can understand that to be effective we should pass the stage of being efficacious, since being efficacious implies the possession of the quality or virtue that gives a thing the potency or power that makes it effective. On the other hand, being efficient is about being less wasteful, and it is about doing things correctly or ‘right’, since its synonyms are competent, able, capable, etc.

To sum up:

1. To be efficient is to produce an output in a competent and qualified way.
2. To be efficacious involves possession of a quality that gives the produced results the potential to lead to an effective outcome.
3. To be effective is when results accomplish their purposes, thus giving an effective outcome.

Figure 1 reflects the three concepts and how they should link together in project management. Further discussion follows in the subsequent paragraphs.

**Figure 1.** Model reflecting efficiency, efficacy and effectiveness

There are several relevant terms related to the topic of this paper, such as ‘efficiency’, ‘effectiveness’, ‘efficacy’, ‘efficaciousness’, ‘effectualness’, ‘effectivity’ or ‘effectuality’, but our focus is on the three terms ‘efficiency’, ‘effectiveness’ and ‘efficacy’. Our discussion is more on the use of the concepts of project efficiency, project effectiveness and project efficacy and less on the three concepts in relation to describing an improvement of some parts of project management or another similar context. In *International Journal of Managing Projects in Business*, most authors discussing project efficiency who explicitly defined it typically mentioned time and cost as important factors in efficiency (see Table 3). However, the scope of the project is also an important element, but is mentioned only once in the given definitions (Dalcher, 2012). Some authors consider quality as one pillar of project efficiency, but what we need to consider about the concept of quality is whether it refers to the quality of the delivered product itself once the project is over or the quality of the project management. Zidane *et al.* (2016) define project efficiency as the question of doing things right and producing project outputs in terms of the agreed scope, cost, time and quality. They add that quality is not a constraint *per se*, but is often a by-product of the other three factors (scope, time and cost), and one that generally suffers when the others are not properly managed. Since the literature is about project management and not engineering management or technical management, academicians in the project management arena think more in terms of management. Thus, quality as a pillar of efficiency should be considered as a quality of management and not as a technical term (the quality of the product and the service, technical specifications, etc.). Martinsuo *et al.* (2013) define project efficiency in terms of short-term interests. Such a definition is very broad, since it does not reflect the different perceptions (e.g. of the owner, sponsor, users, contractors, etc.): each stakeholder may see the short-term interests in a different way from another. This brings us to a dynamic and flexible understanding of project efficiency, which makes it harder and more complex to measure. Some authors refer to project efficiency as project management success (e.g. Ssegawa and Muzinda, 2016). This means that project management as a mechanism and process exists only during the project implementation and ignores the phases happening before the decision to start the project and after the end of the project. Our concern with this definition is the part designated ‘project management success’. This is a narrow view of project management. Limiting project success to project efficiency will close all doors to academicians looking at projects and project management holistically. Project management success is beyond project efficiency. Literature on project management covering topics like post-project evaluation, ex-ante evaluation, value management and project front-end especially emphasises such a perspective.

From our side, project efficiency is the production of an output in a qualified and competent way in terms of the agreed scope, cost, time and quality, where quality is not a constraint *per se* but is often a by-product of the other three factors (scope, time and cost). Efficiency is more about comparing the outputs of the project to its inputs (Figure 1): we need to ask questions before the start of the project about how it will be done and, at its end, how it was done.

Ika *et al.* (2010) were the only researchers to include efficacy within project success or to describe it as part of a project. They mentioned that project success is about organisational effectiveness (quality of process, policies, deliverables, outputs or intermediate outcomes, and operational efficacy) and development effectiveness (development outcomes such as long-term impacts, which the project efforts aim for and should contribute to). However, we still ignore the real meaning of operational efficacy in the context they describe. Ika *et al.* (2010), Ika and Saint-Macary (2012) and Martinsuo *et al.* (2013) related effectiveness to long-term impacts and interests. Other authors reflected on project effectiveness in relation to stakeholders’ perceptions, mainly clients, sponsors, owners and users (Andersen *et al.*, 2011; Eduardo Yamasaki Sato and de Freitas Chagas Jr, 2014; Ssegawa and Muzinda, 2016). Dalcher (2012), Bayiley and Teklu (2016) and Yamin and Sim (2016) link project effectiveness to the accomplishment of project objectives. This divergence, having a common understanding and interpretation of project effectiveness, makes it harder to measure, knowing that the concept of project effectiveness is subjective. Adding complexity to the divergent interpretation of terms will not help the project management field to advance but will leave it stuck in an endless loop of misunderstandings between different schools. Extending our discussion to other project management literature, Wong and Wong (2014) argued that time, cost and quality merely represent project performance in terms of efficacy (where, here, efficacy means efficiency), without due regard to the importance of effectiveness. Project efficacy refers to the success in attaining pre-determined goals. In contrast, project effectiveness is concerned with the capability of accomplishing these goals (Wong and Wong, 2014). This is contradictory to most definitions of efficacy applied, but the confusion really starts with using the concept of efficacy instead of efficiency from the beginning. Going back to Wang *et al.* (2008), Wong and Cheung (2008), and Toor and Ogunlana (2010), where Wong and Wong (2014) define efficacy, we found no use of the word ‘efficacy’ in these three studies. Here, again, there is confusion in considering the concepts of efficiency and efficacy as synonyms, knowing that efficacy is getting things done and meeting target: it is the ability to produce a desired amount of the desired effect, or success in achieving a given goal (Hickey and Brosnan, 2012). Divergent from efficiency, the focus of efficacy is the achievement itself, not the resources spent on achieving the desired effect. Efficiency is doing things in the most economical way (minimum input to maximum output).), whereas effectiveness is ‘doing the right things’ (Drucker, 2000)—i.e. setting the right targets to achieve an overall goal. Samset (2003) defines effectiveness as a measure of the extent to which the management attains its objectives or the extent to which the objective has been achieved, which is the first order effect of the project for users in the market in terms of production, etc. Therefore, the measure of effectiveness is more related to project stakeholders. Many organisations and NGOs (e.g. UNIDO, OECD, USAID, UWA, NORAD and JICA) define project efficiency based on the ratio of the input to the project over its output. Moreover, they define project effectiveness based on the short- and medium-term effects of the outputs and outcomes of the project and the extent to which the development intervention’s objectives were achieved, or are expected to be achieved. There are few cases of the use of project efficacy: the OECD (2002) mentioned in their definition of project effectiveness that the concept of project efficacy is synonymous to the former. In the holistic view and system thinking approach, the measures of success are efficiency (whether the minimum resources are used in goal seeking), efficacy (whether the means employed enable realisation of goals) and effectiveness, which asks whether we are actually achieving what we want to achieve. Moreover, ‘elegance’ is reflected in the question of whether the stakeholders find what is proposed tasteful (Jackson, 2003). Drucker (2006) claims that effectiveness is a very important practice that can be learned. Effectiveness is not a destination, but it is a journey. What is effective is not necessarily efficacious, and what is efficacious is not necessarily efficient. The ‘tragedy’ of effectiveness is that it is very hard to measure.

We opt for this definition for efficacy (based on Figure 1. Once the project is completed, one of the results—the product produced—possesses a quality that has the potential to lead to an effective outcome. This means that when we ask the question ‘will it still work?’ before taking the decision to spend time, budget and resources on the project, we make sure to a high extent that the final product of the project will have the potential to lead to an effective outcome. In the moment where we decide to start running a project, the question that must be asked is ‘can it work?’

Last but not least, effectiveness is for us the hardest part to measure. It is about the purpose(s) and the objectives of the project. It happens that a project has a certain purpose(s), but at the end it serves other purpose(s). Project effectiveness occurs once the operation of the produced product generates positive impacts in the mid- and long-term.

1. **Conclusion**

This intensive literature review, which includes, but is not limited to, *International Journal of Managing Projects in Business*, has revealed the different forms and uses of the concepts of efficiency, effectiveness and efficacy. The review also covered other academic and non-academic literature in the arena of project management, including other disciplines. The findings from this literature study indicate that the use of the concepts of efficiency, effectiveness and efficacy in *International Journal of Managing Projects in Business* varies from one author to another. Few of the authors defined the concepts before using them: use of the three concepts was vague and imprecise, except in the few cases where they were explicitly defined. Moreover, their use among project management academics and practitioners is to some extent unclear. There were some exceptions among professionals, especially NGOs and public agencies (e.g. UNIDO, OECD, NORAD and JICA), and those practitioners using their methodology principally for post-project evaluation. In other fields, such as business management and economics, even in the field of pharmacology, medicine and healthcare, the concepts are used in a more defined way and are utilised to evaluate and improve processes and performances. Agreeing on the concepts in the field of project management could help both academics and practitioners to structure evolutionary work. The possibility of comparing the management of projects also allows new performance indicators to be developed. As emphasised in the discussion chapter, much of the focus when measuring project efficiency is on time and cost. When it comes to effectiveness, vague interpretations persist. This paper contributes to the academic discourse by taking a view on how the concepts are used. This paper’s contribution to the professional literature includes the various uses of the three concepts from different angles and perceptions. Furthermore, the paper highlights in the contemporary literature that not all uses of those concepts reflect their real meaning, or they are used in a vague context. This last point is especially important for the practitioner community to consider when using the concepts.

The literature review is limited by the inherent methodology of a literature review, being to collate and review existing knowledge rather than create new knowledge. Secondly, as this literature review broadly considers project management literature and is complemented by other literature, it does not intend to provide a deep analysis of the concepts, but rather focuses on the range of prior knowledge which closely uses the concepts. There is opportunity for further research on how possibly to align the understanding and the interpretations of these concepts and other concepts. This would provide new knowledge which is currently under-represented in the literature and would provide pragmatic outcomes for the practitioner community.

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