

## Re-imagining the Iron Triangle: Embedding Sustainability into Project Constraints.

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### **Abstract**

Since the emergence of the formal discipline of project management, academics and practitioners have sought to define criteria against which project success can be measured. Perhaps the most well known criteria are encapsulated in the 'Iron Triangle' that places Cost Time and Quality at the center of project success. However it has been suggested that whilst this triple constraint is important, it can also narrow the focus away from other crucial project success factors. One area that is gaining prominence within the field of project management is the consideration of sustainability principles and there is an increasing understanding of the need to develop methods, tools and techniques to integrate sustainability criteria into the management of projects. This paper presents the results of an empirical study in which project managers were asked to re-draw the traditional Iron Triangle with the inclusion of sustainability. The results of the study indicate that whilst sustainability is seen by practitioners as a key factor to be included in project planning and implementation, there is disagreement as to where the issue sits in relation to traditional time, cost, quality constraints and how sustainability principles should be integrated into projects.

**Keywords:** Project constraints, Sustainability, Iron Triangle, Project Management, Success factors, Sustainable Project Management

### **Introduction**

Since its introduction in the early 1950's the discipline of project management has sought to define criteria against which projects can be measured. Perhaps the most well known measure of success criteria is the 'Iron Triangle' that places Cost Time and Quality at the center of project success (Atkinson, 1999). It has been suggested that while this triple constraint model is important, it can also narrow the focus away from other crucial factors that lead to project success as project managers see their role as restricted to achieving the predefined time, cost and quality objectives (Crawford and Earl, n.d.). Furthermore, projects that are delivered on time, within budget and meet scope specifications may not necessarily be perceived to be successful by key stakeholders (Shenhar and Dvir, 2007; Turner and Bredillet, 2009). One area that is gaining prominence within the field of project management is the consideration of sustainability principles (Gareis et al., 2011; Silvius and Schipper, 2011). Accordingly

there is increasing understanding of the need to develop methods, tools and techniques to integrate sustainability criteria into the management of projects. As one of the foundations of projects and project management, the Iron Triangle, or Triple Constraint is perhaps an ideal starting point for leveraging sustainability into the management of projects.

This paper presents the results of a questionnaire in which project managers were questioned on their knowledge of the Iron Triangle, their understanding of the concept of sustainability, and whether they considered sustainability principles in the management of their projects. Participants were also asked to re-present the traditional Iron Triangle with the inclusion of sustainability as one of the criteria. It begins by introducing the concept of the triple constraint and its place at the heart of project management theory and practice. This is followed by an outline of sustainable development and the importance of incorporating sustainability principles into business and project management to create 'sustainable project management'. The paper then briefly reviews previous attempts to re-define the model of project constraints before introducing the study in which project managers were asked to re-consider the Iron Triangle with sustainability in mind.

### **The Iron Triangle**

The Iron Triangle was originally conceived as a framework to enable project managers to evaluate and balance the competing demands of Cost, Time and Quality within their projects (Atkinson, 1999). Subsequently it has become the de-facto method to define and measure project success, with the general perception amongst project managers that a successful project is based upon these three criteria alone (Shenhar and Dvir, 2007; Duggal, 2011). Any attempt to deviate from, or supplement the three criteria that make up the Iron Triangle is often considered a problem that must be either corrected or prevented in the first place (Shenhar and Dvir, 2007; Turner and Bredillet, 2009).

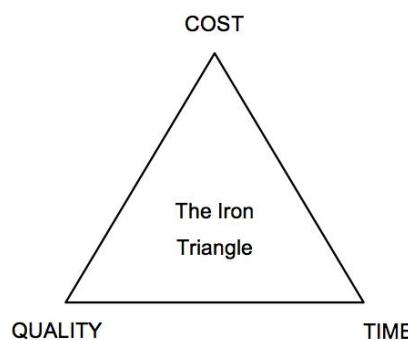


Fig. 1. The Iron Triangle

Centre to the concept of the Iron Triangle is the mutual dependency between the three constraints: increasing quality will increase the amount of time needed, which also will lead to an increase in cost. A tight time schedule could lead to a decrease in quality and

subsequent increase in cost (Morris and Sember, 2008). However, the validity of the iron triangle and the traditional triple constraints of time, cost and quality, have been debated throughout the academic and industry literature on project management. Shenhari & Dvir (2007) questions the validity of the Iron Triangle. Furthermore, Garrett (2008) quoting Shenhari at a PMI meeting, suggests that the three traditional time, cost, quality factors are strictly efficiency based, whereas the focus should be shifted to more business oriented results and customer satisfaction (Garrett, 2008). This opens for the question whether sustainability can be seen as a new concept to consider in connection with the Iron Triangle as a planning tool since with project management comes changes. Research suggests that current standards for project management fail to seriously address the sustainability issues, or equip project managers with the tools necessary for them to integrate sustainability principles into the project planning, and operation (Eid, 2011; Silvius and Schipper, 2011).

### **The use of the Iron Triangle in Project Management**

When implementing the Iron Triangle into practice it is crucial to ask the project team to rank the three constraints (Morris and Sember, 2008). This is one of the fundamental ideas that cannot be neglected. When changes occur it is important for the project manager to assess the impact of the given event or decision and create a range of options. In addition, it is the project manager's role to show the impact on the three constraints and thereafter create the necessary balance between them (Morris and Sember, 2008). Besides, the Iron Triangle is an excellent tool for a project manager to discover the priorities and motivation for the various stakeholders and how well the project is understood. This gives the foundation for good dialogues but also view on whether stakeholders are aligned or not (Morris and Sember, 2008). What is important is for the team to prioritise the constraints so the project manager knows where to be aware and where to put the focus. Yet, as many other theoretical concepts, environments are changing rapidly, which therefore require some concepts e.g. the Iron Triangle to be re-shaped or adjusted thereto. Organizations are finding that they can meet all three constraints of the Iron Triangle, yet they still fail overall.

What is essential for the use of the Iron Triangle in project management independent of the constraints used is that it helps showing the effect that the various parts of a project have on each other (Morris and Sember, 2008). Furthermore, a user contributing to the article by Garrett (2008) argues that the job of a project manager is to ensure that a concept is implemented to meet the expectations of the stakeholders. Another commenter argues that the fundamental problem is that the Iron Triangle is not used effectively (Garrett, 2008). The reason being, that the experience has shown that only other project managers have understood the value of the concept. Does it then help to develop or modify the Iron Triangle? Not if this argument is proven to be correct.  
Sustainable Development

The concepts of sustainability still maintain openness to reinterpretation and adaptation to different social and ecological contexts (Kates et al., 2005). The first formal definition

of the concept and most commonly quoted appears in the 1987 World Commission on Environment and Development (WECD) report (later published as a book “Our Common Future”). Here sustainability is defined as: “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987). This definition contains two key concepts - the concept of needs, in particular the essential needs of the world’s poor to which priority should be given, and the idea of limitations, imposed by the state of technology and social organization on the environments ability to meet present and future needs (WCED, 1987). This definition, whilst useful, does not seek to present solutions to the problem of how to reconcile the fundamental aim of business, to create profit, with the principles of sustainable development.

## Sustainability in Business

When placing sustainable development in an organizational or business context, the concept of the “triple bottom line” becomes relevant. The term, coined by Elkington (1999), suggests that sustainability is about integrating economic, environmental, and social aspects in a ‘triple bottom line’ or three-P concept as shown in Figure 2. Increasingly Organizations are increasing seeking to align their business and project activities with the principles of sustainable development (Keeble et al., 2003). Perhaps the main driver for such an initiative is one of economic value creation for the business in terms of both product performance and production costs. In addition value may be created by improvements to the company’s reputation and image not only externally important but also internally as the motivation of personnel is influenced. Similarly, value can be created by increasing the coherence of various parts of the company and increasing their effectiveness and flexibility (Mulder, 2006). Another driver may be willingness to address global environmental issues such as climate change and resource depletion. Here it has been suggested that the discipline of project management is ideally placed to deal with these challenges (Lock, 2007). Despite Lock’s assertion, research suggests that current standards for project management fail to seriously address the sustainability issues, or equip project managers with the tools necessary for them to integrate sustainability principles into the project planning, and operation (Eid, 2011; Silvius and Schipper, 2011).

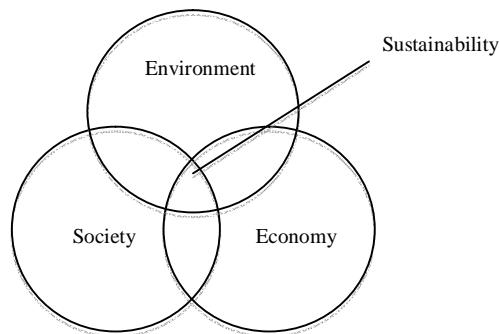


Fig. 2. Triple Bottom Line

## Sustainable Project Management

The concept of 'Sustainable project management' is a response to the realisation that many of the current project management frameworks do not effectively address the three goals of sustainable development, i.e., social equity, economic efficiency and environmental performance. Sustainable project management seeks to ensure that projects incorporate sustainability principles throughout the project lifecycle and beyond. Such a definition should not be confused with some literature which refers to sustainability in projects in a different context, i.e. sustaining the project over time, or sustaining management processes or changes (Melton, 2007). The responsibility for sustainability within projects rests amongst all stakeholders, but is of particular importance to the project manager, and project team as it is they who are charged with planning and implementing project activities (Silvius and Schipper, 2011). In theory, project managers are already equipped to manage sustainability principles, as the discipline of project management has long extolled the virtues of predictability and controllability in managing project constraints. In many ways embracing sustainability into projects necessitates a leap of faith alongside the acknowledgement that a more flexible approach may be required. Project managers need to learn how to manage social, environmental and economic sustainability issues in addition to the more classical constraints of time, cost and quality (Silvius and Schipper, 2011).

## Re Imagining the Iron Triangle

The validity of the iron triangle and the traditional triple constraints of time, cost and quality, have been debated throughout the academic and industry literature on project management. Some authors (see for example: Schwalbe, 2009; Norman et al., 2011) and researchers such as Bourne and Walker (2004) use the constraint "scope" instead of "quality" and argue that quality is one of the major components of the scope constraint. Other researchers use "schedule" instead of "time" such as (Chan et al., 2002; Jha and Iyer, 2007) and authors such as (Morris and Sember, 2008). However it should be recognised that within these criteria there is some discussion as to their exact definitions. For example, Turner and Bredillet (2009) discuss the definition of "quality" - Does it mean meet specifications, performance or functionality? They suggest that only the various stakeholders can define what quality actually means in the context of a specific project (Turner and Bredillet, 2009). Stevens (1996) argues that there is a hard and soft side to project success with time and cost being 'hard' and satisfaction being 'soft'. Similarly Jha & Iyer (2007) argue that success criteria can be categorized as either objective or subjective. The objective evaluation criteria are considered to be time, cost and quality since they are tangible and measureable. On the other hand, many newly proposed success criteria such as customer satisfaction or sustainability could be considered subjective and intangible. However issues such as sustainability can in fact be measured; however the measurement criteria itself can be subjective. In addition the assumption that 'quality' is objective is contested.

Chan et al., (2002) categorize project success within three trends. The first being that project success is achieved by meeting client's objectives. The traditional measure of this was the Iron Triangle (time, cost & quality), however, it is increasing understood that project success is in fact far more complex. The second trend is described by Chan et al., (2002) as the global approach, and the third project success beyond the project. These are factors that go beyond the Iron Triangle and contain issues such as customer satisfaction, business success, health & safety, technical performance and sustainability. Attempts have previously been made to introduce additional constraints to the traditional model of the 'Iron Triangle'. The Project Management Institute (PMI) (PMI, 2009) introduced Figure 3 (a) based on the original triple constraint. Here the traditional constraints of time, cost (budget) and quality have been supplemented with risk, schedule and resources in an attempt to distinguish between project inputs and project processes. The issue of project constraints and the Iron Triangle has also been discussed amongst project management practitioners. This is evident through the use of blog comments such as the responses to an article written by Garrett (2008).

Comments suggest that the Iron Triangle does indeed need to be updated to consider a broader range of critical constraints. One commenter argues that the Iron triangle should be broken up and a 360-degree understanding of what project success should be created instead. Another example is put forward by (Haughey, 2008) who describes the 'Project Management Diamond' (see Figure 3 (b)). Here quality is seen as a critical constraint that cannot be neglected and should be given equal importance alongside time, cost and scope.

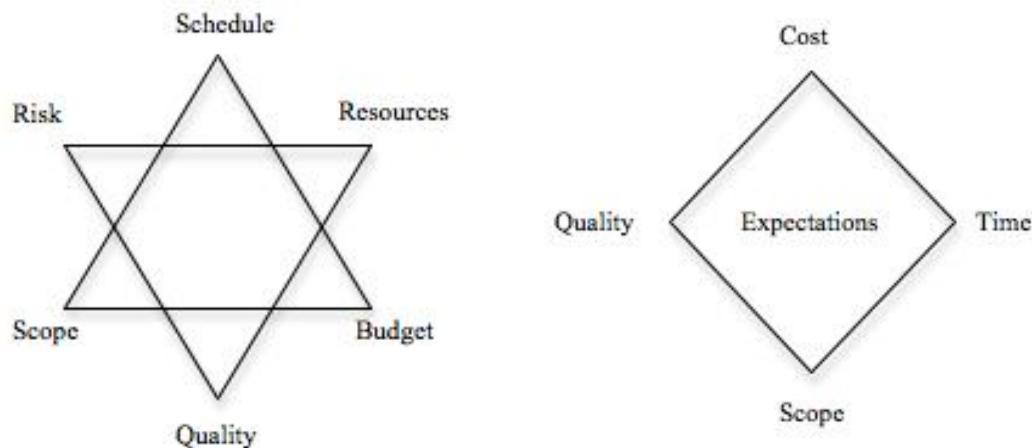


Fig. 3. (a) 'Triple Constraint' in Project Management (PMI, 2009);  
(b) The Project Management Diamond

Another discussion of success criteria in relation to the Iron Triangle took place on a blog hosted Duggal (Duggal, 2011). Many commentators agree that project managers need to adapt to the project environment in which they are operating and broaden their

perspectives to include other criteria than those presented by the Iron Triangle in combination with business outcomes such as customer satisfaction.

Finally some attempts have been made to align sustainability and project management by combining the three pillars and the Iron Triangle with sustainability principles Grevelman & Kluijwstra (2010). The idea behind the model shown in Figure 4 is that in order to integrate sustainability successfully into the project management process there has to be a balance between all 5 aspects, if not the project is considered to be at risk (Grevelman and Kluijwstra, 2010). It is interesting to notice the factor 'cost' from the Iron Triangle has been consumed by the 'economical' factor from the three pillars as the authors consider that these are synonymous.

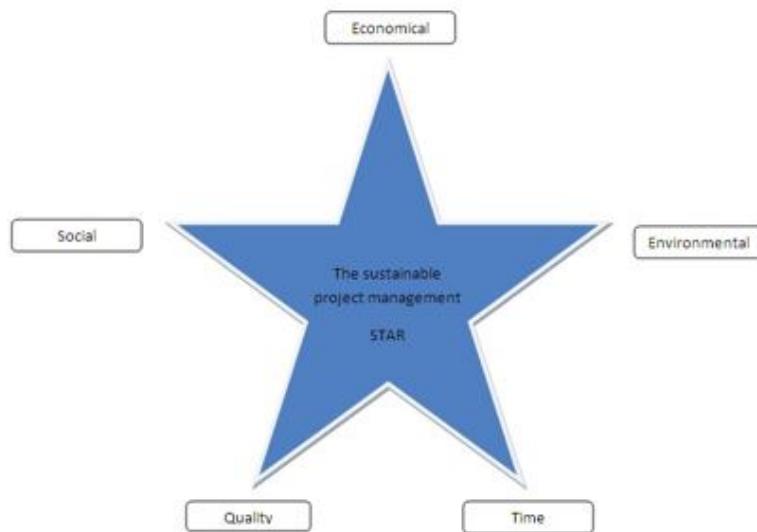


Fig. 4. The Sustainable Project Management Star Methodology (Grevelman and Kluijwstra, 2010).

The research project upon which this paper is based conducted a qualitative questionnaire supplemented with interviews with practicing project managers. The questionnaire was administered electronically and distributed to project managers via the Association for Project Management (APM) website (the research section), and the APM and Project Management Institute (PMI) groups on LinkedIn. The questionnaire gathered contextual information about participants' knowledge of the iron triangle and sustainable development before asking them to re-draw the iron triangle whilst considering where they would place the issue of sustainability.

## Results

The study surveyed 17 project managers in total 64.7% with 1-5 years experience, 5.9 with 6-10 years experience and 17.6% reporting 15 or more years experience in the industry. Just over half of respondents were from an engineering background, whilst

17.6% reported a business/management accounting focus. 11.8%. Other participants' backgrounds included constructing architect and value chain management account.

### *Understanding the Iron Triangle*

All of the questionnaire participants indicated that they had heard of the Iron Triangle, and understood the concept of the triple constraint. The majority also referred to the three constraints in the common way – time, cost and scope. However three of the participants referred instead to scope, time and resources instead. The majority of the participants suggested that the three common factors are interrelated and critical in managing any project. However, one participant pointed out that "They are inextricably linked, but meeting the time, cost, quality criteria of a project doesn't guarantee its success". Furthermore, one participant argues that the Iron Triangle is an outdated concept, which echoing the assertion of Shenhar & Dvir's (2007) that other factors need to be considered when defining project success. For example, Participant D who is working for a leading renewable energy company sees functionality as a fourth factor that needs to be considered when delivering a successful project. This view corresponds to that of Duggal (2011) who suggests that over-reliance on the traditional three factors of the Iron Triangle can narrow the focus away from other crucial factors.

### *Understanding of sustainability*

In contrast to the understanding of the Iron Triangle among the questionnaire participants, there was little common understanding of the issue of sustainability. Whilst some participants did appear to be aware of the most widely accepted Brundtland definition, and referred to the issue in relation to economic, environmental and social responsibility, others offered more diverse and fuzzy interpretations, for example: "It is when you are creating – producing something and the materials you use, somehow are giving back to nature." and "Organic, re-cycling of garbage." Or "I would define sustainability as being careful with the environment and not harming it. I think that in your case sustainability should be defined as the power to endure and overcome the frustration/loss of a project management." In some ways such responses indicate that, for project managers at least, sustainability is poorly defined. Such a lack of common understanding may in turn make it more difficult to integrate the principles of sustainability into project management and to re-imagine project management models such as the Iron Triangle.

### *Sustainability in Project Management?*

Despite the apparent lack of understanding as to what sustainability actually is, or means, the majority of participants indicated that they were actively considering sustainability in project management. However, one participant who indicated this to be the case suggested that they "do not think this is true for the vast majority of PM." It would appear that whilst many project managers state that they are considering sustainability in their projects, in reality they might consider the term 'sustainability' to

refer to some other activity they are undertaking. Alternatively, project managers consider sustainability from a single dimension, such as the environmental aspect, rather than taking a more holistic triple bottom line approach. This is demonstrated by one participant's suggestion that they consider sustainability within projects "to fulfil the requirements from different standards such as ISO14001 (environment)". Another response suggested that to them, sustainability was considered so that they must be able to reproduce their product 20 years from now regardless of environmental constraints. However some participants did report that social and/or economic issues were a consideration with one suggesting that the social aspects of project are becoming more important. It would appear that there is some understanding amongst project managers as to the benefits of incorporating sustainability principles into projects. One participant reported that consideration of Corporate Social Responsibility (CSR) is an essential consideration of project managers that can help define a project and thereby achieve better results. Another participant stated "today it is almost impossible to make a project without making a business case, which shows the direct impact of the investment on the bottom line. I therefore argue that you achieve economical sustainability for the company)."

### *Re-imagining the Iron Triangle*

Participants were asked to re-draw the Iron Triangle whilst considering sustainability as a constraint. Whilst not all participants chose to do this, those who did presented a wide range of interpretations. Participant A, a project manager from a leading international industrial company created the diagram presented in Figure 5 (a). Here they stated that they viewed sustainability as an issue that surrounds the project rather than being an additional dimension. They also suggested they considered it possible to undertake a project that is on time, within budget and of the desired quality, that can be considered sustainable. Participant B produced Figure 5 (b) labeled 'Iron Box'. No further information or explanation was offered in respect of this.

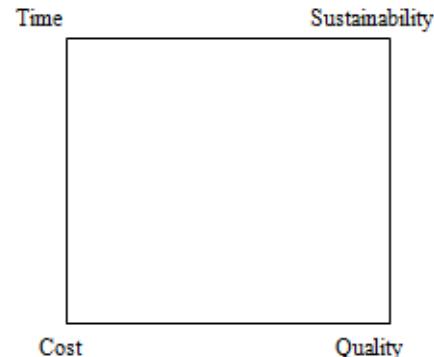
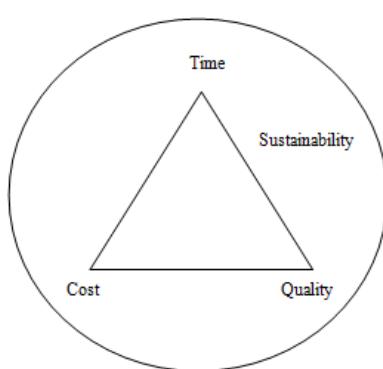


Fig. 5. (a) Participant A; (b) Participant B 'Iron Box'

Participant C, a project manager at a leading renewable energy company presented Figure 6. Here the respondent seeks to replace the constraint of 'quality' as an equal to time and cost, with functionality. Sustainability and quality are placed within the center of the triangle suggesting that both sustainability and quality are issues central to project management. The participant argues that the issues of time, cost and functionality are key determinants of quality and sustainability.

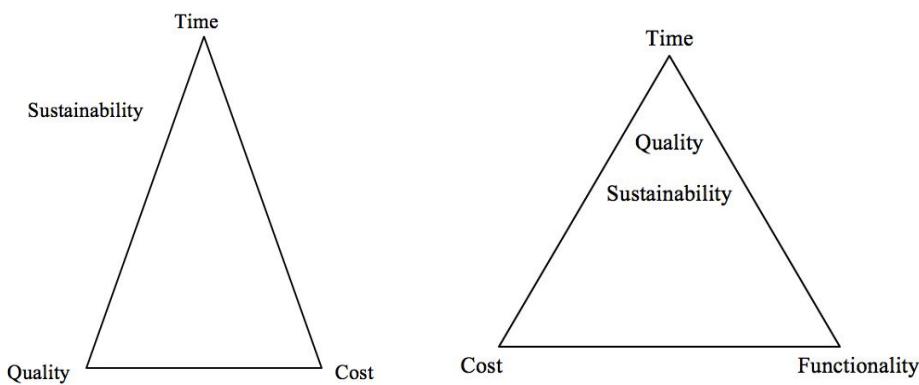


Fig. 6. (a) Participant C; (b) Participant D

Finally Participant D sought to depict the Iron Triangle as the same, but enlarged. They explain that when considering sustainability, resources used within a project must be 'returned to nature' which will increase the cost, time and quality components.

## Conclusion

The results of the study indicate that whilst sustainability is seen by practitioners as a key factor to be included in project planning and implementation, there is disagreement as to where the issue sits in relation to traditional time, cost, quality constraints and how sustainability principles should be integrated into projects. Participants agreed that there is a good understanding of the concept of the Iron Triangle amongst project managers, but many questioned its continued relevance. That being said the consensus appears to be that as a concept the triple constraint is valuable, but requires some modification to meet the challenges of managing modern day projects. When it comes to sustainability the understanding of the concept among the participants are not clear, however, the majority sees the concept as the future tool in order to stay in business. Yet, it is not quite clear if the participants are thinking in terms of sustainability when working on projects, which will need to be researched further. There are a number of recommendations that arise from the study presented here. First it is clear that the project management profession needs to adopt a definition of sustainability to enable project managers to fully understand sustainability issues. Secondly the reliance on the triple constraint model of the Iron Triangle need to be questioned and updated in light of 21st century project management challenges, of which sustainability is one.

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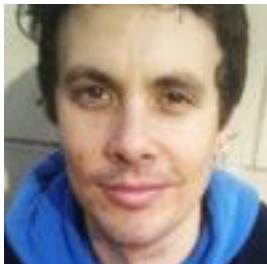
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