

# The PhD in light of Project Management

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## Abstract

A PhD is the highest academic qualification for which students produce the longest text of their lives. Such an enormous project undoubtedly needs to be managed. In this paper we examine the application of project management theories and techniques to a PhD research project. Both literature surveys and case studies were used to collect data related to the characteristics of PhD research as a project. This data has been analysed using a project management classification model as well as Theory of Constraints thinking processes. It was found that most success criteria of PhD projects are related to scope. Furthermore, many PhD project failures are caused by ill-defined scope. Therefore, in order to get the real benefit of project management in a PhD research project, attention should be diverted to tools and techniques that facilitate scope clarification. The applicability of various project management techniques such as the Gantt chart and scope analysis methods such as Goal tree and Current reality tree has been explored. This paper contributes to a better understanding of PhD research as a project and the possibilities of increasing its success using more appropriate project management techniques.

**Key words:** Project Management; PhD research project; Theory of Constraint thinking processes

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## Introduction

A PhD is the highest academic qualification. Despite the fact that PhD students are usually enthusiastic and capable (Grover & Conger, 2007), some authors report that only 50% of PhD students complete their PhD (Kearns, 2006), while Ministry of Education (2011) reports 65% successful completion, half of whom completed their PhD in more than 5 years. A PhD is a time consuming and costly endeavour with relatively high opportunity cost. It is in fact considered a high-risk strategy (Powell & Green, 2007). Undertaking PhD research is an important decision, which demands a high level of commitment. Unlike undergraduate studies with many subjects and exams, a PhD is a process of producing a tangible output, written in one book that might be the longest text produced in the student's life (Dunleavy, 2003). Such an enormous project undoubtedly needs to be managed. This paper investigates the appropriateness of various project management practices applied to PhDs and proposes a rethink of what management science can offer to a PhD research project.

PhD research is a project and like any other project it is a unique undertaking and has a start and finish date. PhD research also produces both tangible and intangible products. The contribution to the science and the learning aspect of a PhD are some of the

intangible outcomes of a PhD (Churchill & Sanders, 2007), while the thesis is the tangible product of the PhD (Dunleavy, 2003). Although the process of accomplishing each of these outcomes can be different in different universities and across different disciplines, it could be argued that the general expectations which are common for all PhDs are not very different. This has been reflected in most prescriptive guide books for managing or authoring a PhD. Most of such guides include a section addressing the management aspect of PhD research. However, such discussions are not necessarily based on project management techniques.

However, the notation of life cycle and project phases is apparent in most PhD guidebooks. In particular Howard and Sharp (1983) divide a PhD project into three main phases and claim problems encountered in the first and last phases are more common. Interestingly, most students withdraw from their PhD either in the first or last phase (Brailsford, 2010). Therefore, it could be argued that although each individual PhD research project is different, what is most common is also more important to be addressed and managed. In fact there is a recognizable pattern that exists in all PhD research projects and it has been discussed in most prescriptive guide books for pursuing and managing a PhD. This further supports the idea that a PhD research project could and should be managed as any other project using appropriate management techniques. The following is a brief discussion on such application.

### **Application of project management to research projects**

The application of project management to PhD research is not new. PhD students submit a proposal, describing their research as a project with a start and a proposed finish date, budget, a schedule, and a deliverable. Some of the project management tools are applied to PhD research as mandatory requirements. For example, a research proposal exhibits some characteristics of a project initiation document. Furthermore, most PhD students are required to provide a Gantt chart demonstrating the schedule in their research projects. However, the extent to which such techniques do or can contribute to the success of PhD project worth exploring.

Perhaps it could be said that 'managing research' is a paradox in itself. While research by nature entails uncertainty and ambiguity of outcome, management involves planning and foreseeing. Erno-jolhede (2000) argues that while project management thrives on realistic planning. Research projects are derived from ambitious goals that are challenging and optimistic. Furthermore, while executing has been interpreted as mere controlling, a research project entails constant discovery of new opportunities. Finally, while traditionally projects end with evaluation of the results based on what was first set, research projects are to be evaluated based on the future implications of the project outcome. Erno-jolhede (2000) claims that project managers in the research field are required to find a balance among many paradoxical factors, for example the balance between risk taking and allowing for innovation. Perhaps one of the sources of such a paradox is the fact that there is little literature that addresses specific issues related to research project management. Project managers in the research field look for information on how to manage their projects from available literature in project management, most of which have their roots in industrial and military projects.

## **Characteristics of PhD research as a project**

Many project management techniques start with defining discrete tasks and their dependencies and estimating their durations using statistical information. It may be possible to define an identifiable process for a PhD research project with fewer than 10 major milestones (Churchill & Sanders, 2007; Phillips & Pugh, 2010), but such milestones are neither tasks nor discrete activities. Tasks are micro-level undertakings and a group of them can only produce the lowest level deliverable in a work breakdown structure. Therefore, it could be argued that those milestones can only provide a very broad guideline. Furthermore, statistical information may not be valid. This is because research projects vary in methodology, topic and nature of data.

In fact, figuring out the scope is the prime challenge of completing a PhD. While success criteria traditionally are defined in terms of scope, time, and cost, both the case studies and literature surveys indicate that the definition of success in PhD considered achieving the scope. Actually the ultimate success or failure of a PhD is decided during the submission process of the thesis, including the oral examination. Several scholars investigate PhD success or failure at this stage; clearly all criteria to declare a PhD as success are related to accomplishment and quality of the output. This is to say that unlike other projects a PhD project is not more successful if it costs less. Furthermore, with regard to duration it was identified by interviewees that the concern was more with where the PhD leading them to, than when it is going to be finished.

In terms of human resources, a PhD project is an extreme case where the whole project lies on the shoulders of one single student. PhD students start their research journey from very different backgrounds. Some may have already done a research degree such as an MPhil, while others are new to research. Some may be excellent writers and others are learning a whole new language in which they are expected to produce their longest and most sophisticated piece of writing. Some choose to use theories and concepts that are new to them and some stay within the most familiar domain. Nevertheless, none of the above will influence the standard expectations. As such, there is variation with regard to having or not having the required skills, and therefore the time it may take to acquire such skills. Furthermore, there is also variation in the amount of time that PhD students may devote to their research work. However, unlike many other projects, no part of a PhD project can be delegated to another person. If a PhD student does not have the required skills to complete the whole project there is no option to employ one with such skills. Rather the focus is on 'how to learn it' and how long it may take.

The required competencies for completing the PhD impose a layer of uncertainty. However, some measures are not necessary reliable and valid. An example of an unreliable measure of competency is using GPA to measure students from very different universities or countries. It is similar to comparing apples and oranges. In terms of validity one could argue whether general entrance exams which use multiple choices are good examples. Although they are consistent, they measure competencies that are not important to the completion of PhD. As such it is argued that both the university and students are not clearly aware of which competencies are to be learned and how long

this might take in the beginning of a PhD project. Such uncertainty influences both the scope and duration of a PhD project.

Defining and planning for required PhD competency is not only a challenge of having to do additional tasks and activities but also not knowing what those additional activities might be. The urge to learn additional competencies is not limited to the mere completion of the PhD but also an ambition for an academic career. These ambiguities coupled with curiosity and enthusiasm can lead students to many days and weeks working on something that has little or no contribution to their PhD progress while thinking they are working toward their PhD. For example, one interviewee spent many months studying all theories of another discipline assuming that it would be important to her final research. However, she found among many of those theories only one partly contributed to her research. Although it is interesting or useful to learn another discipline, in project management terms most of these activities are beyond the scope of a PhD and are manifestations of overestimation of what needs to be done.

The above discussion demonstrates a high level of ambiguity in the scope of research projects in general. In the PhD research project such ambiguity is not limited to the process but also extends to the final product. The PhD examination process with a comparatively low level of transparency (Tinkler & Jackson, 2000) projects a vague definition of the final expectations. While tolerance for the first layer of ambiguity is a prerequisite for any research work including a PhD (Phillips & Pugh, 2010) the second layer of ambiguity is likely to be reduced as more and more scholars are investigating and describing the PhD viva (Tinkler & Jackson, 2002). As a result of such investigations, some of the root causes of PhD project failure have been identified, which are discussed in the following section.

### **PhD project failure and lessons learned**

Phillips and Pugh (2010) identify both overestimation and underestimation of PhD scope as reasons for failing in the PhD. All above ambiguities can contribute such misestimation. Phillips and Pugh (2010) argue that underestimation is the result of misinterpretation of the original contribution to knowledge while the overestimation is due to an inability to formulate appropriate research questions. They claim that experienced practitioners are more likely to underestimate the PhD as they perceive that they know all the answers while some science students may fall into the trap of partial research as they join large research groups which may prevent them from developing all components of PhD research.

The ambiguity of scope can also manifest itself in lack of positioning. Phillips and Pugh (2010) argue that not having a clear overall argument is an important reason for PhD failure. They call this the project 'thesis' which is the story and the new idea. They argue that spreading too widely and too thinly can result in failure. One interviewee also talked about it in terms of the theories she used. She regrets her desire to include many theories which she found interesting and considers this a source of stress throughout her research. Another interviewee suggests being able to look at the big picture throughout the process is a success criterion in completion of the PhD.

Another reason for PhD failure is not having a supervisor who knows what a PhD is or losing contact with the supervisor. The latter was one of the challenges that delayed the work of one interviewee. Both of these are manifestations of lack of skilled resources in project management terms, because supervisors are skilled resources. This is in fact very hard to be compensated for by other means. Phillips and Pugh (2010) claim that even qualified academics can over or underestimate the PhD scope or the capability of PhD students. As a result they may over or under supervise their students. Students can also underestimate the importance of good supervision. One interviewee discussed how she preferred educating herself to simply asking direct questions from her supervisor, which resulted in a year-long delay uncovering how to start analysing her data.

Two other factors contributing to the PhD failure as defined by Phillips & Pugh (2010) are employment prior to PhD completion and 'Not wanting a PhD'. As such it could be said that the PhD project is vulnerable to personal perceptions and circumstances as it is the job of one person. However, change of priorities is not unique to the PhD project in fact, Just as any other project, the PhD happens in the context of a portfolio. In fact both of the above circumstances are manifestations of influence of portfolio. Nevertheless, a PhD is a project and can benefit from project management.

### **The PhD Project in light of Project Classification model**

PhD research is expected to deliver original contributions to a specific field of knowledge within an academic framework; such originality requires innovation. Like any other research project, PhD research involves a complex process. Some activities require constant changes, new tasks may be added or it may require unforeseen interactions with many other participants such as interviewees, or some information may be found inaccessible. However, such complexity is not unique to PhD research; project management scholars already noted such requirements and many advanced project management techniques are proposed to address uncertainty and complexity. For example agile methods are particularly designed to deal with uncertainty of scope.

Along with new project management techniques there is also an emerging literature that discusses the fit between the project management style and the characteristics of the project (Shenhar, 2001). The finding of such extensive research recommends selecting a project management style based on characteristics of a project in terms of level of Novelty, Uncertainty, Complexity, and Pace, referred to as the NUCP model. In the following paragraphs the PhD project is examined against the NUCP model to gain a further understanding of the PhD project in light of this model.

#### **Novelty (N)**

The first dimension in the above model is the project novelty which is defined as how new the product is to its potential users. According to this definition the focus may seem to be on merely on the marketing the product. Such a concept may seem irrelevant in the PhD project. However, it is important to some students. For example, one interviewee explained how she examined whether her research topic was "a thriving topic or a dying one". Interestingly she explicitly mentioned she wanted to be able to "sell" a research finding and she clarified that she wanted to be able to present it among practitioners and academics. According to interviewees a PhD is not a breakthrough in

terms of novelty; rather they all agreed that it has a moderate level of novelty. Despite the fact the every PhD has to contribute to the body of knowledge by a new finding, there is a measureable standard which is expected to be used for every PhD this is in alignment with Mullins & Killey (2002) statement that 'It's a PhD, not a Nobel Prize'. Based on NUCP the appropriate recommendation for moderate level of novelty is to carefully analyse competitors. Using the NUCP model for a moderate level of novelty recommends a careful analysis of competitors. For a PhD research projects this means using published theses as an important guideline to clarify expectations. Two successful cases in my study suggested that published theses provided an idea of the expected style of writing, and even the size and/or depth of investigation.

### **Uncertainty (U)**

The second dimension is related to uncertainty caused by technology. Shenbar and Dvir, (2007) defined four levels starting from low-tech to super high-tech. While the lowest level of such uncertainty describes projects relying on well-established technologies, the highest level uncertainty describes projects based on technologies that do not exist at the time of initiating the project. The respondents considered there was a medium level of technological uncertainty in their research projects. The reason was that although the 'product' (contribution to knowledge) is new, the process is not. All required technics existed prior to initiating their projects, and few techniques were new to the researchers. Therefore, PhD research project can be classified as Medium-tech.

For a Medium-tech project design freeze as early as the first quarter and some testing are proposed. This is similar to what is generally done in the proposal stage. Proposal presentations are both evaluation and a point of design freeze. Readiness to accept change is yet another suggestion for this group of projects. However, high flexibility or prototyping is not used in PhD context. Both prescriptive and descriptive literature on PhDs suggest a set of processes that is best to be followed one after another (Churchill & Sanders, 2007; Dunleavy, 2003; Phillips & Pugh, 2010) as in waterfall project management model.

The dilemma of flexibility and willingness to accept change versus early design freeze appears to be a common concern in doing a PhD. This impose a decision on the extent of exploration. While exploration is highly required in a research project it is also a cause of distraction and low focus. The findings show unfocused exploration not only takes away resources and time but also can cause distraction and confusion and thus lower the quality of research. One of the interviewees emphasised "if I go back to my research journey, I would definitely position myself in terms of theory at the very early stages, not later than the end of the first year". This is in line with Shenbar and Dvir's (2007) recommendation for design freeze for projects of medium-tech.

### **Complexity (C)**

The third dimension is complexity. Shenbar and Dvir's (2007) propose three levels of complexity in their model. The lowest level involves assembly of entities or units into a single performing product. The second level is when the product has multiple functions. The third level refers to to very large projects with many activities. Obviously, the output of a PhD is a single product but it may have multiple functions, such as

implications for future research or career prospects for the PhD students. The recommendation for the first group is a manual network of not more than 100 activities. In terms of management style an informal style is considered most appropriate. It is also recommended that the documentation for such project be simple and focused on technical aspects. Interestingly, that is what happens in most PhD manuals. The prime focus of most of those books is writing styles or research techniques rather than scheduling techniques. This supports the argument that managing and succeeding PhD is mostly about uncovering and achieving the scope, as such technical aspects are of most importance. Moreover, management techniques, which can contribute to better uncovering and achieving the scope, such as constraint analysis techniques and thinking aids are most appropriate.

### **Pace (P)**

The fourth dimension is related to pace with three levels of pace. The pace of a PhD project can be different for different students. Some students do their PhD either part time or full time side by side their current career. The maximum allowed duration, particularly if they are part time, is much longer than the average expected duration of a PhD project; as such for this category of students the PhD is a regular project as time is not critical to their success. For this situation Shenbar & Dvir (2007, p. 193) would recommend "Management by expectation". For many other students the PhD research can be categorized as fast competitive. This is because the PhD is a time consuming and costly endeavour with relatively high opportunity cost, particularly for those who leave jobs or family. The recommendation for this level of pace is structured procedures. Further research is required to see the pertinence of this recommendation to PhD research projects. Where there is an external constraint, a PhD can also have higher pace than fast competitive. For example certain scholarship schemes or job obligations may not allow extending the duration of a PhD, and thus result in withdrawal. The pace of a PhD can also change during the project; for example, for one of my cases her PhD moved from fast competitive to critical project after she accepted a job offer 6 months before completion. She clearly changed her strategy by reducing time spent in exploring alternative solutions and just focused on producing her research.

The above classification model provides some guidelines for managing PhD research projects. Along with an investigation into the PhD project characteristics and the literature on the PhD success and failure it is obvious that as a project, the PhD success lies on managing scope and therefore will benefit most from analytical tools that facilitate clarification of scope. As such Theory of constraints' (TOC) thinking processes (TP) are proposed to further investigate the PhD as a project.

### **Application of TOC to PhD project cases**

The following section demonstrates application of TOC thinking processes to a case of PhD research project. TOC thinking processes provides a set of logic tools that can be used in a recommended order to analyse a complex system, and identify and solve the system's problems. The first step in such a sequence is construction of the Goal tree. The Goal tree is a graphical, hierarchical representation of what a system is supposed to deliver, which is the systems goal. The next level is critical success factors, followed by

necessary conditions which are the factors that must be satisfied to achieve the critical success factors and/or the objectives. The value of a Goal tree its capability to keep the analysis focused on what is really important to system success (Dettmer, 2007). Figure 1 is a Goal tree constructed for one of the PhD graduates interviewed. The goal of a PhD research project is submission of the thesis that meets all the requirements identified by the university. Success criteria and necessary conditions were defined analysing the interviews. The constructed tree was then evaluated using the “categories of legitimate reservations”(Dettmer, 2007).

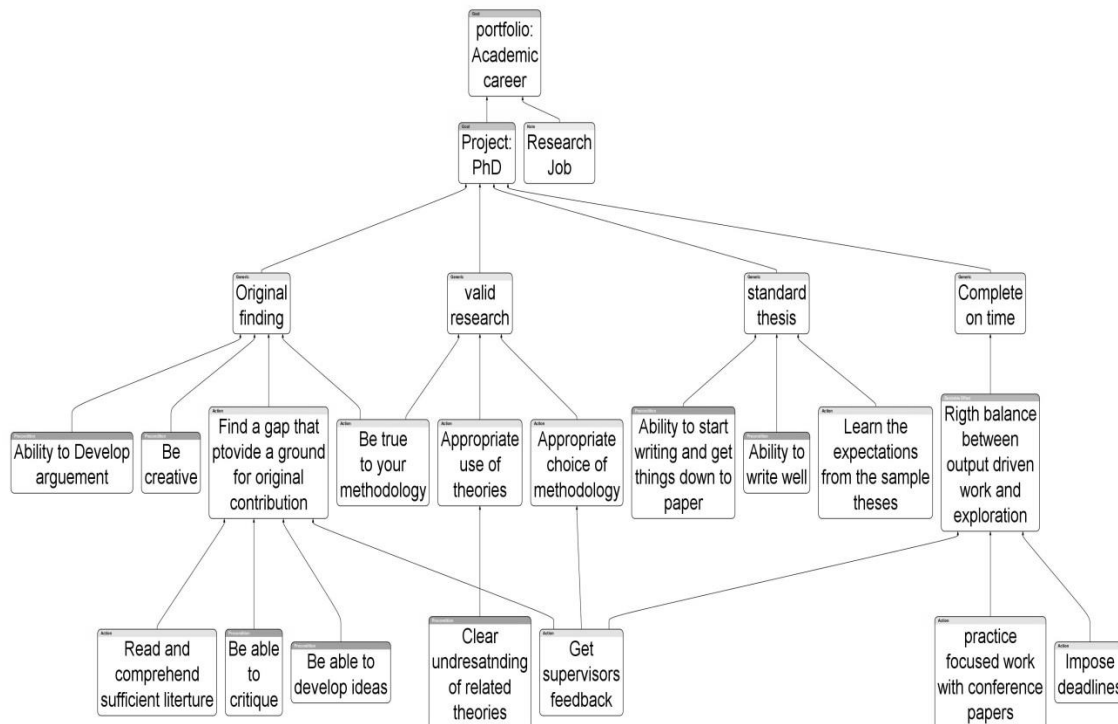


Figure 1: An example of a Goal Tree

As was discussed earlier, as with any other projects, a PhD research project should be depicted in the context of its portfolio. This has been demonstrated in figure 1. Only four criteria are agreed upon to be essential for realising the goal; this is because Dettmer (2007) suggests that a Goal tree should have only three to five success criteria. Comparing the case study findings with success criteria of a PhD viva (Mullins & Kiley, 2002; Tinkler & Jackson, 2002) and motivational reasons behind a PhD (Brailsford, 2010; Harman, 2002) reveals that there is an observable similarity with success criteria as defined in the viva. This implies further uniformity in defining the success of a PhD project. Furthermore, three of four success criteria address the scope, and only one is about completion on time. Interestingly, there was no concern with regard to cost. This does not mean that financial issues do not influence PhD projects. In fact one interviewee repeatedly emphasised the importance of her scholarship as a resource to her PhD. But obviously, cost has no place in declaring the success of a PhD. As was discussed earlier the challenge of managing the PhD research journey is not only because we do not know where exactly we are heading, but also due to the poor understanding of where we are starting from. For this reason current reality tree (CRT) is proposed to analyse the current situation and uncover the gaps needing to addressed in order to achieve the goal. The figure 2 is an example of a CRT.



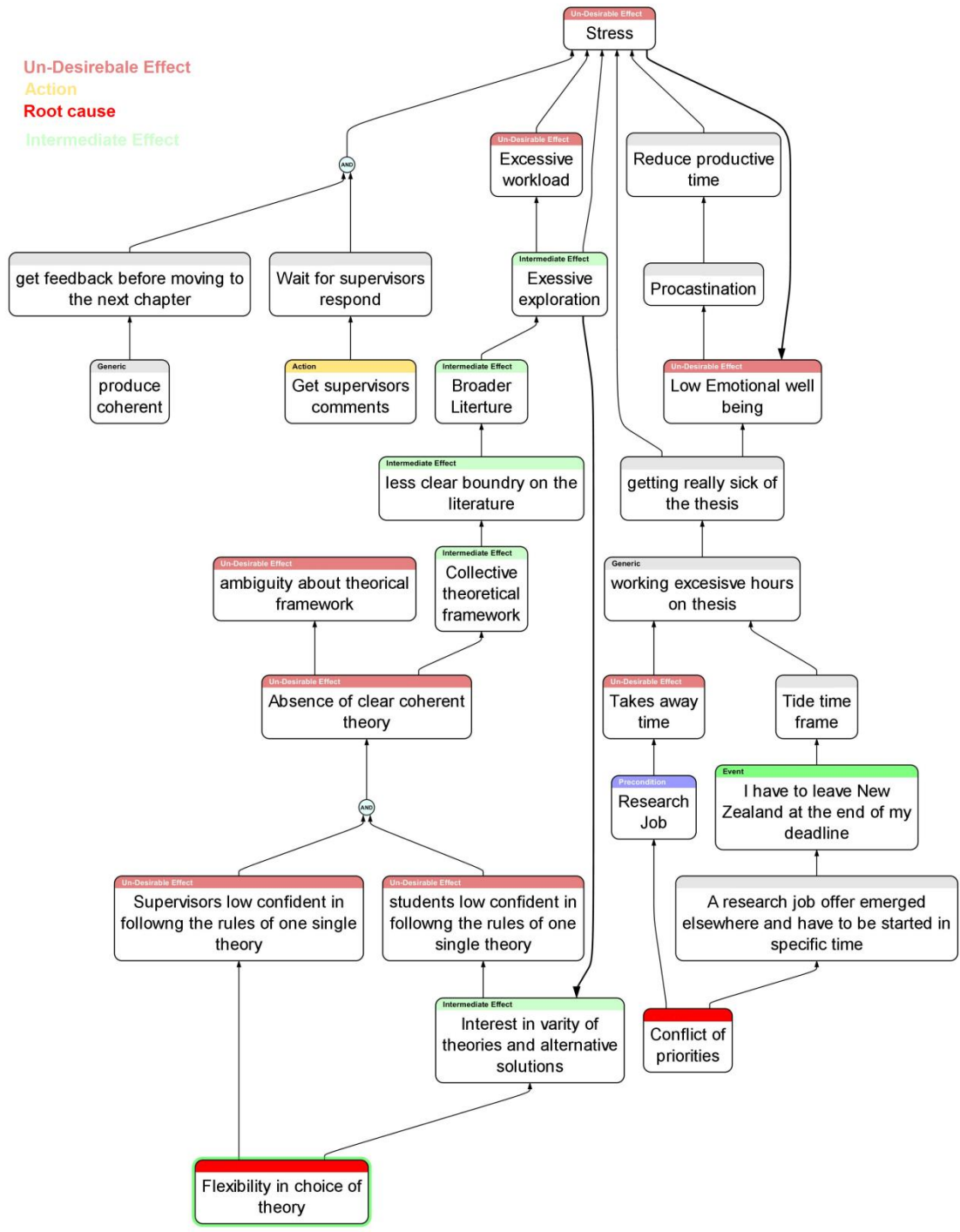


Figure 2: An example of a Current Reality Tree

Interestingly, it was found that the Gantt chart may have a totally different functionality from what it is known for. In response to the dilemma of exploring versus focusing, one interviewee found her way out of excessive exploration through setting deadlines. This shows that the Gantt chart can be used as a controlling technique against scope creep. After all the scope of PhD research is defined in terms of time! It also can contribute to the emotional feeling of being in charge. While a Gantt chart cannot provide a realistic view of a research project which entails high uncertainty, Whitty (2011) argues it signals a sense of being organized and in control even if you are not! This is interesting

as the emotional wellbeing and what a PhD students feel might have much more influence on success of PhD than does the sequencing of their work.

The Prerequisite Tree (PRT) and Transition Tree (TT) are some examples of tools that can contribute to a better understanding and managing PhD projects. PRT is a technique that facilitates analysing the constraints in a systematic way. Dettmer (2007) recommends application of the PRT when trying to achieve an ambitious target in complex or uncertain situations. While PRT is based on necessity logic, the TT uses sufficiency logic in its construction to provide a detailed action plan complete with the rationale for each step needed. Unlike the PRT, the TT is used to identify the necessary and sufficient actions and tasks required to implement proposed solutions (Davies et al., 2005).

## Conclusions

It can be concluded that as a project, the PhD is largely defined in terms of its scope. Therefore, analytical models that help to focus, attain the goal, and uncover obstacles can contribute the most. Looking at the characteristics of a PhD research as a project it is more likely that agile methods with their high focus on delivering the scope are most appropriate. Traditional scheduling tools such as the Gantt chart are unlikely to have much effect on delivering the PhD project on time unless they are used to limit scope creep.

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