Study of Enterprise Information Systems

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Abstract

The concept of an Enterprise Information System (EIS) has arisen because of the need to deal with the increasingly volatile requirements of modern organisations. These requirements include technical requirements for software systems, reducing costs of processes, dealing with distributed systems, sharing business processes, and making best of resources. An EIS is a platform capable of supporting and integrating a wide range of activities across an organisation. In principle, the concept is useful and applicable to international or national organisations of different sizes. However, the range of applications for EIS is growing and they are now being used to support e-government, health care, and non-profit / non-governmental organisations. This is a report of progress toward an approach for supporting the early stages of EIS development aiming at clarifying goals of a system for decision-makers and developers before any implementation phase.

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Chapter 1

Introduction

1.1 Background[1]

Since the 1950s, organisations have been developing computer-based information systems to support their business processes. Through improvements to IT and changes in the ways that businesses use IT, computer-based systems have become more complex and yet more reliable; as well as increasing functional requirements have been placed upon these systems (Edwards, Ward, & Bytheway, 1993). However, building this kind of system has many difficulties, including fundamental challenges regarding the construction of such systems, and the challenges of evolving systems to accommodate new requirements. Understanding the challenges of building such IT systems is essential for planning, designing, and development in order to provide early risk understanding and potential means for mitigation of risk.

The assumption in this research is that complexity of IT systems is due to the following factors:

- Increasing size of IT systems and organisations itself;
- The interactions between different IT systems using direct interfaces or via human users;
- The involvement of many different organisations, which can be clients, developers, and partners in the construction and use of IT systems;
- The increasing rate of organisational and social changes.
- The changeable requirements of organisations for IT systems.

[1]The material of this section is based on a book chapter in (Tabatabaie et al., 2010)

The challenges of understanding and building complex software systems can be observed in both the public and private sectors. In the public sector, understanding the challenges, and reflecting based on these challenges during the development process, is important. For example, failure (whether financial or otherwise) in the governmental systems can result in significant damage to the reputation of the government.

The National Audit Office/Office of [UK]Government Commerce lists the common causes of the project failure as follow (Academy, 2004):

1. Lack of clear connections between the project and the organisation's key priorities, including agreed measures of success
2. Lack of understanding of and contact with the supply industry at senior levels in the organisation
3. Lack of effective engagement with stakeholders
4. Too little attention to breaking development and implementation into manageable steps
5. Inadequate resources and skills to deliver the total portfolio
6. Lack of clear senior management and Ministerial ownership
7. Lack of skills and proven approach to project management
8. Evaluation of proposals driven by initial price rather than long term value for money (especially securing delivery of business benefits)

The first three points imply that there are important and hidden challenges due to a *lack of visibility* of the software systems. For example, in the case of constructing a building, stakeholders can visualise the building by looking at its mock-up; in the case of software systems there is no such a clear and easy to understand mock-up. Software systems are not visible and tangible for the stakeholders; therefore, stakeholders cannot picture the functionality of them before they are actually built, which can cause unrealistic expectations and other undefined problems. They also cannot see how their decisions will result in changes to the software.

Flexibility and supporting change are other challenges that software systems embedded in organisations have to deal with. Building flexible systems and supporting changes to systems is extremely challenging when the IT system itself is used to support a poorly defined (or undefined) business processes or model.

1.2 Motivation

The high-level motivation for this research is to improve the development of software systems that handle different requirements of organisations. Software systems that have the ability to provide smooth and secure collaborations between business partners. The ones which can satisfy the requirements of organisations that handle different business processes. In general, the software systems that can improve and simplify functionalities of organisations rather than adding to the complexity of business processes and functionalities of organisations in addition to unnecessary costs for them.

In order to achieve the high-level motivation of this research, the focus will be narrow down to the use of *goal-oriented approaches (GOA)*. The objective of this approach is to answer the following question: "How we can plan and design an *Enterprise Information systems* (EIS) that can satisfy the true, hidden and rational requirements of organisations." The possibility of adding extra cost and complexity to the development processes however should be considered in the evaluation of the goal-oriented approach.

The examples from companies such as IBM which were described in detail in qualifying dissertation (Tabatabaie, 2008) illustrates the requirements for information systems (IS) that can handle various business processes and the changes in them. The result of my research so far indicates that this type of IS can be called EIS (Tabatabaie, Paige, & Kimble, 2008). Therefore improving the development of this type of systems motivates this research to study the current approaches which are looking at business side of organisations too.

As it was discussed in the background section there is a niche in visualising and engaging decision-makers through out development. There are approaches for these challenges such as prototyping techniques which are mainly discussed in requirement engineering (Robertson & Robertson, 2006). However, the challenges of this type of techniques such as inability of presenting complex and large scale systems and its cost opens the space for more research on other possible approaches.

Goal oriented concepts have a history in different computer science fields. For example, requirement engineering (T, J, J, & S, 1998; Lamsweerde.A.V, 2004; van Lamsweerde, 2001),software assessment (Weiss, Bennett, Payseur, Tendick, & Zhang, 2002), argumentation over the software system (Kelly & Weaver, 2004). Based on the results of my literature review, this research will continue studying GOA as an approach for tackling the challenges of lack of effective engagement with stakeholders. Thinking of goals for planning the future is a human habit (Kim, Park, & Sugumaran, 2006). Thus we consider this natural habit of successful people in the case of developing EIS which

is faced with complexities of its own. Another motivation for thinking of a goal-oriented approach is the current views on software system for example sequence diagram, component diagram. All these views aim to clarify some aspects of the system for the designer and programmer team however, the goal-oriented model can help to clarify the goal aspect of system not only for designer and programmer teams but also for the main decision-makers and requirement engineer team. This type of views can help to involve the decision-makers which have less IT specialists with the goals of EIS. This also may help them to minimize the unrealistic requirements from developer team. Last but not least, it helps the goals of EIS be compatible with the goals of organisation.

The results of my general review on the literature (Tabatabaie, 2008; Tabatabaie et al., 2008) suggest that GOA could be an approach to tackle part of the challenges of developing EIS. Even though there is current research on goal-oriented techniques, the result of literature review shows that developing a model that can cover planning until architecture design and can possibly support the testing and maintaining phases is novel.

Chapter 2

Progress

2.1 Research Work: Enterprise Information Systems

By focusing on the concept of EIS, it become more clear that there is a niche in the definition of EIS; therefore, after a review of the history of enterprises and software systems a working definition for EIS has been constructed. This is one of the early achievements of this research, which resulted in publishing a paper and a book chapter. The working definition is as follow:

An Enterprise Information System is a software system that integrates the business processes of organisation(s) to improve their functioning. (Tabatabaie et al., 2008)

This working definition is the basis for presenting an argument about what is and what is not an EIS from this research point of view, and for refining our understanding of the objectives for this type of systems.
Using this definition a line can be drawn between systems that can be called EIS and other type of information systems (IS). This can help us to define EIS more precisely. The two next sections provide examples of both EIS and non-EIS.

2.1.1 Extracting Common Features of EIS from examples

Having arrived at a definition of EIS, examples of EIS were considered, with a view to identify ranges and typical forms of characteristics and business processes, and the ways in which IT is used in these organisations. This section identifies examples that can be considered as EIS and the one which are not considered as EIS.

The review of the industrial cases of what might be considered as an EIS moves our discussion toward the example of Mitsubishi. As was mentioned in qualifying dissertation, Mitsubishi with more than 400 companies all around the word is an example of enterprises (Mitsubishi, 2007). Thirty top-level managers manage all the individual Mitsubishi's companies. This does not mean that each company does not have enough freedom to make their own decisions; it means that this group of thirty managers will make some of the top-level decisions and they provide the high-level standards that all these companies should consider. In this case, if there is a computer based system that links various parts of the Mitsubishi organisation (including high-level managers) together and makes information flow seamlessly between them, then we view this system as an EIS. Developing such a system is a large and complicated problem; hence, there is a need for powerful, reusable solutions to develop this type of system in a manner that can benefit all of the enterprise.

Another example in this area is the infrastructure being developed to support the National Health Service (NHS) in the United Kingdom where the information systems being developed to support management of patient records and prescriptions can be considered as an EIS, because such IT infrastructure aims to connect independent departments within and outside of the NHS. While we are looking at the NHS, which is a public sector organisation, we can raise e-Government as another example of public sector organisation that may be supported by and hence benefit from EIS infrastructure because it connects various governmental organisations or departments together to let information flow seamlessly between them.

In addition to examples of EIS, examples of organisations that are not considered to be EIS also provide insight. These organisations are also supported by information technology, but do not have multiple interacting and evolving business processes.

eBay is one of the well known international Information Systems that focuses in the auction industry. This online market which involves around 147 million people (Gopalkrishnan & Gupta, 2007) provides a platform for individuals or companies to sell or buy their products or services; but it does not connect the business processes of organisations together. Therefore, according to our definition, an EIS connects different business processes of organisations or departments of organisation together to make the information flow seamlessly and thus it seems that based on this characteristic of EIS, eBay is not an EIS. The information system is the element that processes data and put them online, there is no evidence of connection between business processes because it is not a requirement in this Information System. The same argument can be followed in the case of Amazon, therefore even though it is large-scale and international online shop but it is not an

EIS.

After exploring the domain and objectives of EIS for this research it become clear that EIS is one type of IS. It has its own requirements and it can benefit from similar development techniques as other IS. Thus, the next step for this research presents the idea behind an approach that can help us to improve the development of this type of IS. This approach is based on goal-oriented techniques.

2.2 Goal-Oriented modelling

AS it was discussed in section 1.2, GOA has been identified to bridge the gap in development of EIS. We started studying this approach in more detail by investigating different type of GOA in different area of computer science. More than seven GOA have been identified (Darimont, Delor, Massonet, & van Lamsweerde, 1997; T et al., 1998; Regev & Wegmann, 2005; Greenspan, Mylopoulos, & Borgida, 1994; Kim et al., 2006) which emphasizes the importance of investigating this concept. Evidence illustrates that GOA have successes in requirement engineering (RE) field. This makes GOA more promising for this research because we can use the current results and evaluate them for planning, which is one step before RE, and software system architecture, which is one step after RE. There is also work done on goal structure notation (GSN) for argumentation. This work had successes in the area of argumentation over safety of systems. The notation of this approach is available for this research therefore more work on GSN will be done to evaluate how it can benefit this research.

Goal-oriented approaches have been identified as a suitable choice to the initial study of EIS information technology requirements. The goal-based and goal-oriented thinking is used to plan for the future or to solve problems (Kim et al., 2006). The use of goal-oriented techniques has been proposed as a way to manage some of the difficulties associated with developing large-scale complex systems (Kavakli, Loucopoulos, & Filippidou, 1996), particularly the challenge of clearly identifying and specifying requirements. The literature review provided evidence that goal-oriented techniques can help developers develop a better complex system by making the system more clear for stakeholders. So far seven type of different goal-oriented approaches are identified for example KAOS (Darimont et al., 1997), GSN (Kelly & Weaver, 2004) etc. The result of studying these approaches will help me to collect ideas for the working goal-oriented model.

2.3 System Architecture

The characteristics of EIS point to a number of interacting and evolving business processes in organisations. This suggests that research in to support for EIS should focus on designing a flexible EIS systems architecture. Where the EIS is introducing integrated IT systems, it should seek to establish a flexible architecture that allows for expansion, changing use of software components etc. Where an EIS is seeking to integrate and extend existing IT systems, the architecture will have to respect the coverage and limitations of existing IT systems.

In short, the term design in this research limits to high-level architectural design of EIS, rather than the design of individual systems (such as databases, accounting systems, communication systems etc). There are various commercial components and studies regarding to individual pieces of a software system which studying them is out of domain of this research; however, the final aim is to integrate these components in a way that can support the business model and goals of an organisation.

2.4 Results

The summary progress of the research work so far is as follow:

- Defining EIS

  Defining EIS is one of the essential results for this research. After the qualifying dissertation, I focused on defining this type of system for the progress of this research. The aim was to clear the domain of the challenge by describing the main element which was EIS.

- Exploring the boundaries and objectives of EIS

  Through out defining EIS, other aspects of this research such as enterprise, different types of EIS, boundaries and objectives of EIS were studied. The results of this part of study is accepted for one book chapter and published as a paper.

- Investigating and developing Goal oriented idea

  Through out investigating enterprises, EIS, and other similar information systems I came up with the idea of using a goal- oriented approach

(GOA) that can make the goals of the system clear for different stakeholders. As it was discussed in section1.1 lack of understanding the system can cause lack of effective engagement with stakeholders and Lack of clear connections between the project and the organisation's key priorities, including agreed measures of success. Therefore we are investigating how defining the goals of the system can affect the lack of effective engagement between stakeholders, in addition to clarify what decision makers expect from the system. This can result to plan, design and implement a system with clear and documented goals that can satisfy the long term goals of organisations. However, it is clear that even a goal-oriented model should be updated when goals of an organisation is changing, but it does not necessarily means that the software system should change. In addition, in the cases of having current software components for organisation and organising them in a manner that can work together to improve the functionality of an organisation, we still can argue that, having a goal -oriented model before integrating the system parts together can help to make the goals of integration more clear. For example, consider a case that in one system integration [2], some components should communicate with each other, but some components should not. Therefore, having a goal-oriented model of the system, can trace this kind of relations and make them clear for the developer team.

2.5 Publications

To date, I have published a paper through the York Doctoral symposium 2008 (YDS08). A book chapter is in publication. Both are attached to this document.

2.5.1 YDS08

YDS08 was a suitable option for publishing a paper when I finished my qualifying dissertation. My aim was to practise writing a paper for a conference, workshop, or symposium; hence, I took the chance of YDS08. This paper also was the short review of my qualifying dissertations in 8 pages. This helped me to summarise the ideas that were collected through out the first phase of the literature review. Moreover, this article helped me to focus on the essential parts of my qualifying dissertation which led me to thinking of

[2]System Integration in this case means collaboration between sub-systems

goal-oriented ideas later. The presentation for YDS08 was a success for me, because the positive feedbacks from various students in different groups and some of the lecturers such as Prof. Jim Woodcock and Dr. Fiona Polack illustrates that defining the area was clear and successful. Thus I become more confident about this research.

2.5.2 Book Chapter

The proposal for a book chapter in the area of EIS was discussed after submitting for YDS08. The editor, Maria Manuela Cruz-Cunha, is publishing a book with the title of 'Organizational and Social Dimensions Social, Managerial and Organizational Dimensions of Enterprise Information Systems'. After submitting a successful abstract, the research on goal-oriented model started in parallel with writing the chapter. Therefore, the final results of this research is submitted for this chapter. This book will be published in 2010.

2.6 Conclusion

In conclusion, the investigation on EIS declares the two main processes in developing this type of software systems. The first process refers to the development aspect of EIS. As it was discussed, EIS is one type of information systems, therefore, it requires IT specialists, processes and tools to satisfy the requirements of development. The second process refer to the decision-making aspect. The definition of EIS and its characteristics refers to the organisations and their businesses. Therefore, the processes, decisions, tools, and the stakeholders that belong to this aspect of EIS are like the sole of EIS, while IT is the skeleton. The skeleton without the sole have the shape of the system but it does not have the suitable functionalities. On the other hand, the sole can not accomplish its goals without being inside the suitable skeleton.

The suitable engagement between the two main processes can help developers deliver an EIS which can satisfies the requirements of businesses in an organisation. However, the engagement between the two main processes have its own challenges. In section1.1 we discussed one of the elements that causes failure in projects is the lack of understanding the system which can cause lack of effective engagement with stakeholders and Lack of clear connections between the project and the organisation's key priorities, including agreed measures of success.

To bridge the gap over the engagement challenge, this research investigates the goal-oriented ideas and approaches. Section 2.2 presented a review on the current state of goal-oriented approaches(GOA) in different parts of software engineering, for instance requirement engineering. The goals of an EIS is shared between decision-making and development processes. Both of these processes aim to satisfy the goals of EIS, one by looking at the business model, risks and making adequate decisions; the other one by looking at the IT side of EIS. Each of these two groups are the source of a set different goals which should be satisfied by an EIS.

However, currently there is no GOA which is used for this purpose. Therefore, the plan for this research is to investigate this option in more detail and evaluate how GOA can affect the development of EIS.

Chapter 3

Plan

The state of the art for building Enterprise Information Systems (EIS) is mostly ad-hoc; there are no systematic and precise methodologies. Similar to other software system engineering projects, developing an EIS requires a set of techniques, processes and tools. The techniques and processes that we are focusing on in this research are planning, risk analysis, requirements engineering and software system architecture.

My literature review and my analysis of common causes of project failure (section 1.1) imply that there is a gap between techniques, processes, and tools to support *decision-making* and *decision-makers*, and techniques, processes, and tools to support software development. This gap is important to bridge in order to improve coordination and engagement amongst developers and decision-makers (Academy, 2004).

The top level research question to be addressed by my thesis is:

Can we create an environment to engage decision-makers as well as developers within the processes of developing EIS?

The current hypothesis, which is derived from this research question, argues for the feasibility of defining such an environment.

3.1 Hypothesis

> It is possible to construct an environment that models the goals of EIS to facilitate planning software systems, that focuses on the goals for the enterprise and its EIS, and facilitates development of systems that interact and interoperate to support the enterprise business objectives.

The general approach that this project will take (based on the state of

the art) is to use goal-oriented techniques to help to bridge the gap between decision-making and development techniques and tools. More detail will be explained in the methodology.

Hypothesis Explanation: Given the hypothesis we will construct an environment, in particular a set of tools and processes. This environment will be constructed from the range of existing management techniques and tools (risk analysis, decision-making) and existing software engineering techniques and tools (requirements engineering, Model-Driven engineering). The principles we aim to establish are:

- Facilitate the joint consideration of enterprise management goals in relation to EIS, and supports elaboration of goals into development task and solutions used by IT developers.
- Provide access to the record of goals and justification to both enterprise management and enterprise IT developers.
- Provide suitable traceability to the source of goals.
- Provide suitable traceability from goals to the components of the software system architecture.

Testability: The hypothesis in this research is testable because by defining an environment based on current goal-oriented techniques and applying it to one or more *examples* of EIS development, we can test and analyse if this environment can be defined. Given the local expertise and available tools, Goal Structuring Notation (GSN) is the first candidate Goal-Oriented Approach (GOA) for this research.

Methodology: The research methodology which will be used in next step of this research is an *example driven approach*. Based on the preceding justification, the GSN will first be applied to a stroke care example (Team, 2008) which is an instance of EIS; the results will be evaluated. *The evaluation of stroke care results* will help to answer some of the following research questions.

- What are the specific characteristics and elements of this environment?
- What are the processes and tools for this environment?
- What is the role of decision-makers in this environment?

- Can the needs of decision-makers and developers be met from a single goal-oriented environment?
- Can the decision-makers and developers trace their goals through to software architecture components?
- Can the decision-makers and developers trace the source of their goals and modify them, when goals change over time?
- Can this environment support changes to the business model, for example by tracing and updating businesses objectives where required?

The answers to the preceding questions will allow us to evaluate the hypothesis.
An additional case study/example in the form of and enterprise crisis management system is also evaluated for use.

3.2 Plan Analysis

This section makes use of GSN in order to present the analysis of the plan for the next phase of the research in more concrete and systematic manner.

3.2.1 Top-level goals

The first and top-level goal is constructed based on the hypothesis of this research. The hypothesis refers to an enterprise-level environment, hence the focus of this research is on an environment with elements which makes it compatible for enterprises. Based on the hypothesis, this environment presents the goals of EIS; therefore, the definition of EIS is one of the elements of the environment that should be precisely defined. As it can be seen in Figure 3.1 and later in Figure 3.2, Goal 3 (G3) presents this phase of the research that we have completed.

Goal 4 (G4) in Figure 3.1 presents decision-making processes (DMP) as the next element of such an environment. This environment aims to present the goals of EIS to facilitate the planning of software systems, which can be partly achieved by providing suitable information and facilitating communication and understanding between decision-makers and developers. Information about the risks of a project, goals of a project, required resources, etc. should be provided systematically. This enables the decision-makers and developers to trace goals and develop a system which is aligned with the

business objectives of an enterprise. Thus Goal 4 (G4) in Figure 3.1 covers this point.

The aim of this research is to study the challenges of developing EIS. Therefore, the next element which should be explored in this environment is development of EIS. Goal 5 (G5) in Figure 3.1 covers this point as one of the top-level goals of this research.

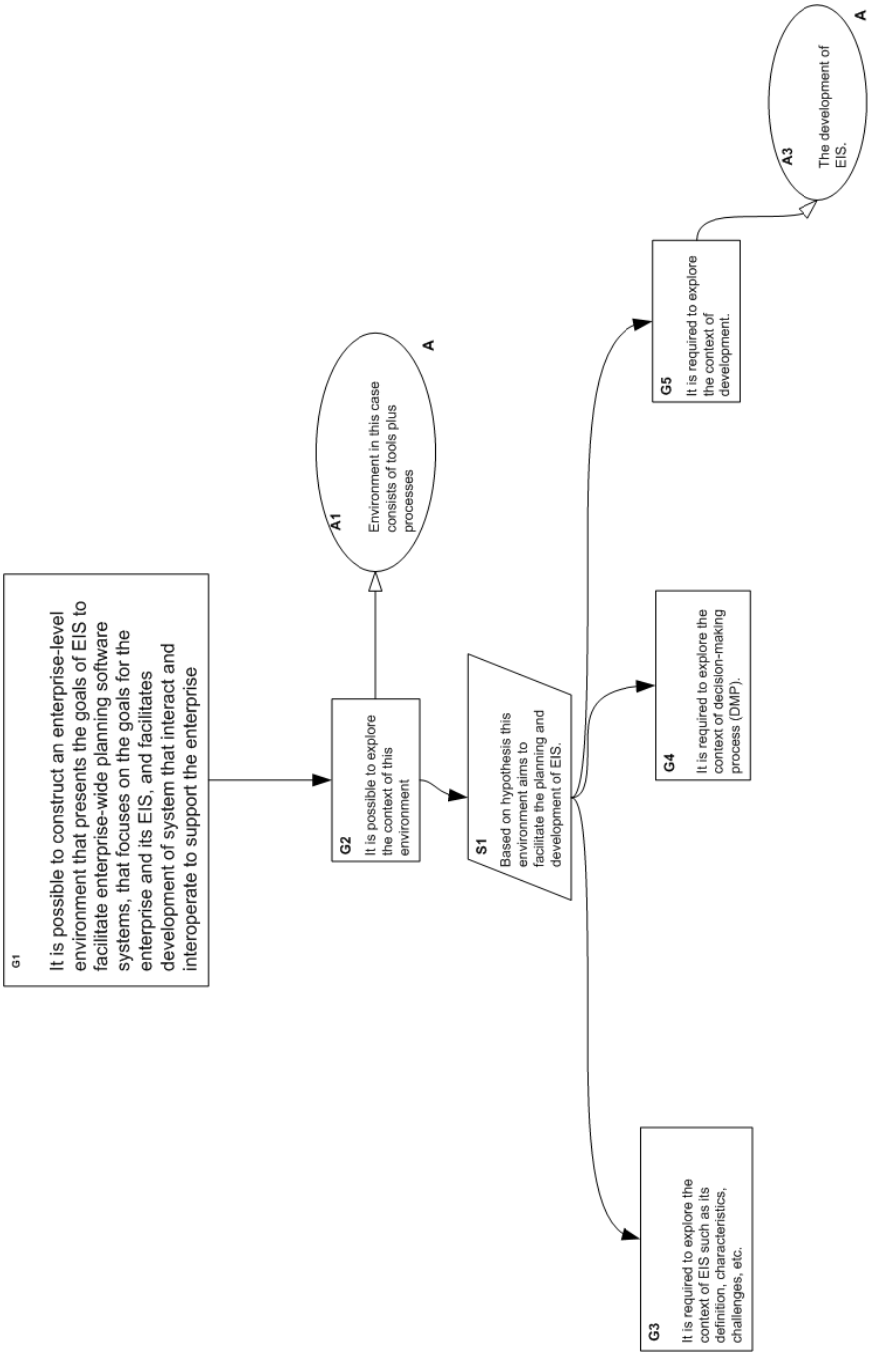


Figure 3.1: Presenting top-level Research goals using GSN

After analysing the top-level goals of this research, the next phase is to break them down to more detailed pieces. The aim is to break the goals down until they end with abstract tasks (which in GSN are presented as solutions).

3.2.2 Break-down of goals

The first element of this level is G3 which is shown in Figure 3.2. As it was presented in chapter 2, most of the research so far explores EIS from its definition to its challenges, domain and objectives. However, by investigating the environment in more detail extra information can be added to this section. The first solution, Sol1, refers to the results of this research so far.

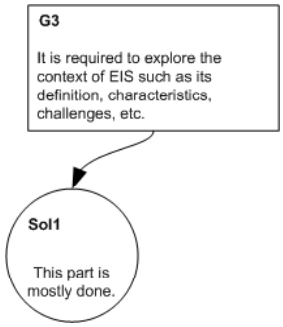


Figure 3.2: Goal 3 (G3)

Figure 3.3 presents G4, which is about exploring the context of DMP. This goal can be seen from different angles; the first angle (broken down in G6 and G7) describes the role of decision-makers in the processes of decision-making. If G6 is true, there is a need to clarify the domain of expertise in the decision-making group. This means that decision-makers can have different background in IT and business, hence the communication approach between the decision-makers and developers should be chosen in a suitable way. It is also required to consider decision-makers from different departments of an enterprise which have required knowledge about the business of the enterprise. This will help the IT and businesses of an organisation align with each other, that can result to achieve the EIS goals.

Solution 2 (Sol2) requires an argument to support the requirement for involving stakeholders. In addition, Sol3 request the list of stakeholders which are involved in the stroke care to evaluate G6 and G7 and test if in practice it is required to know the level of knowledge of stakeholders.

In Figure 3.4 the second part of an environment which can support DMP is justified. As it was mentioned earlier, the environment include processes and tools. Therefore, the required tools and processes for decision-making which is an element of this environment should be explored. The aim is to analyse how goal-oriented approaches (GOA) can effect the decision-making. However, there are other important elements for making a decision such as analysing the risks of a project. Based of a current study on the literature (Chapman, 1997), we can make an argument that it is possible that GOA can affect the generic risk management process. Thus Sol4 covers the task of justifying and investigating the effect of GOA on the risk analysis of EIS in more details.

Figure 3.5 illustrates the approach of this research towards goal-oriented techniques. The first step is to justify why GOA are appropriate. In order to answer this question, the characteristics of DMP in relation to GOA and the characteristics of GOA should be explored. This leads to more concrete step which is G12. In this phase the general characteristics of GOA is requested. In order to define the characteristics of GOA, this research will have a general review on the current GOA in different area of software engineering and partly artificial intelligent. This systematic review can benefit from the current reviews in this area and some comparison techniques such as (Matulevicius & Heymas, 2007; Regev & Wegmann, 2005).

In addition to having a general systematic review of the current research on GOA, this research will apply one of the GOA in an EIS example, stroke care, to add practical views on the analysis of GOA. This can help to understand how an example of GOA works and if this processes can help to analyse the hypothesis. G14 in Figure 3.6 illustrates the argument over using GSN as an instance GOA. As it was mentioned earlier given the local expertise and free tools, the GSN is the first candidate. Therefore GSN will be applied to Stroke care which is an example of EIS. The results should be evaluated using suitable techniques. Sol7 clarifies a task for investigating suitable evaluation technique (s). Expert review however, is one of the candidate approaches, more review on the GOA could suggest other techniques.

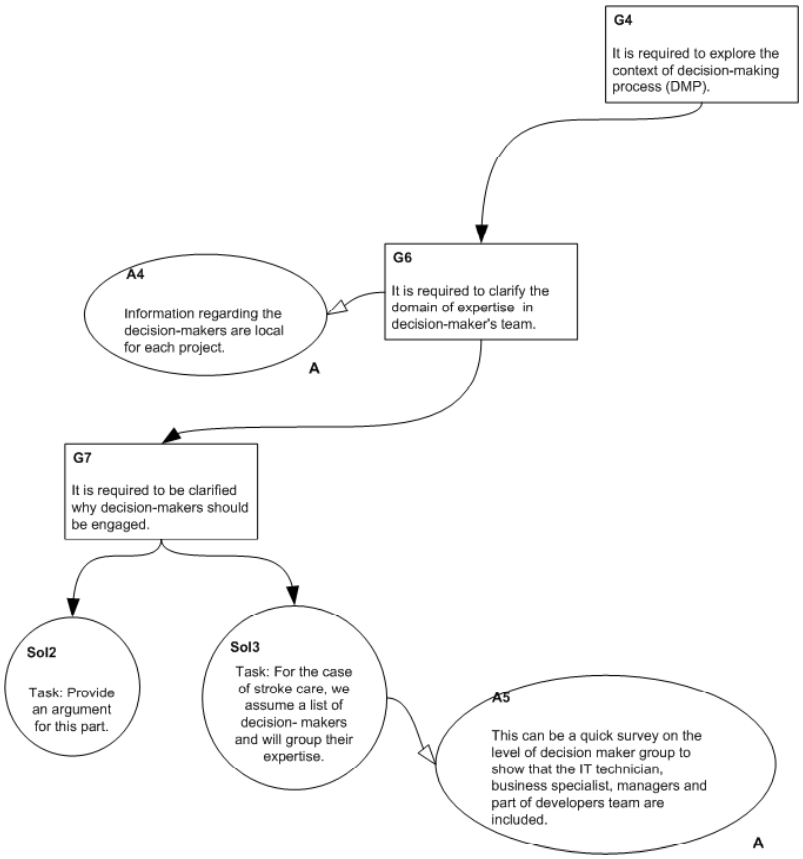


Figure 3.3: G4 breakdown to G7

The result of evaluation will illustrate if GSN (or revised version of it) is suitable for this case or not. If the results clarify that GSN is not suitable for stroke care system, the next step is to apply it to more cases to evaluate their results. On the other hand, if GSN or revised version of it is suitable therefore, it can proceed to Sol9, apply the GSN or revised version of GSN using other elements of the environment to the stroke care.

Sol9 is a common task between G18, It is possible the results illustrates GSN or adaptation of GSN be a suitable option, and G20, it is require to choose candidate tools for this environment. As it can be seen in Figure 3.7, G20 illustrates the requirement for investigating candidate tools for part of the development processes in this environment. Eclipse Process Framework (EPF) and Software Process Engineering Meta-Model (SPEM) are currently the two tools which are identified for this purpose. The reason for choosing these two tools are that, with the help of SPEM we can define a concrete process on how to use GOA to facilitate enterprise-wide planning software systems, that focuses on the goals for the enterprise and its EIS, and facilitates development of system that interact and interoperate to support the enterprise business objectives. subsequently, by using EPF we can provide tools and framework for this process.

By choosing the candidate tools part of the requirement for exploring the context of development, G5, will be covered. Another aspect of G5 is shown in Figure 3.8 which is clarifying the domain of development. The task for this step is to justify the current domain which is planning phase to the software architecture phase.

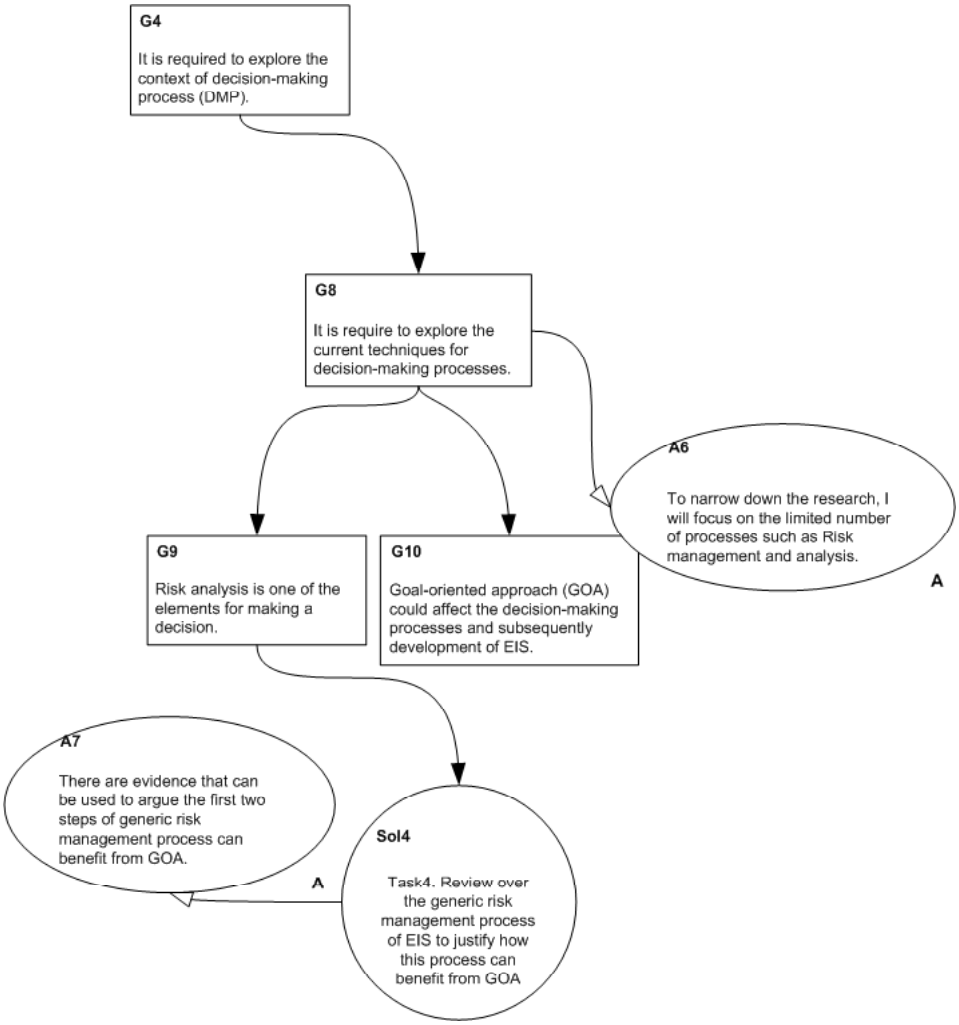


Figure 3.4: G4 breakdown to G10

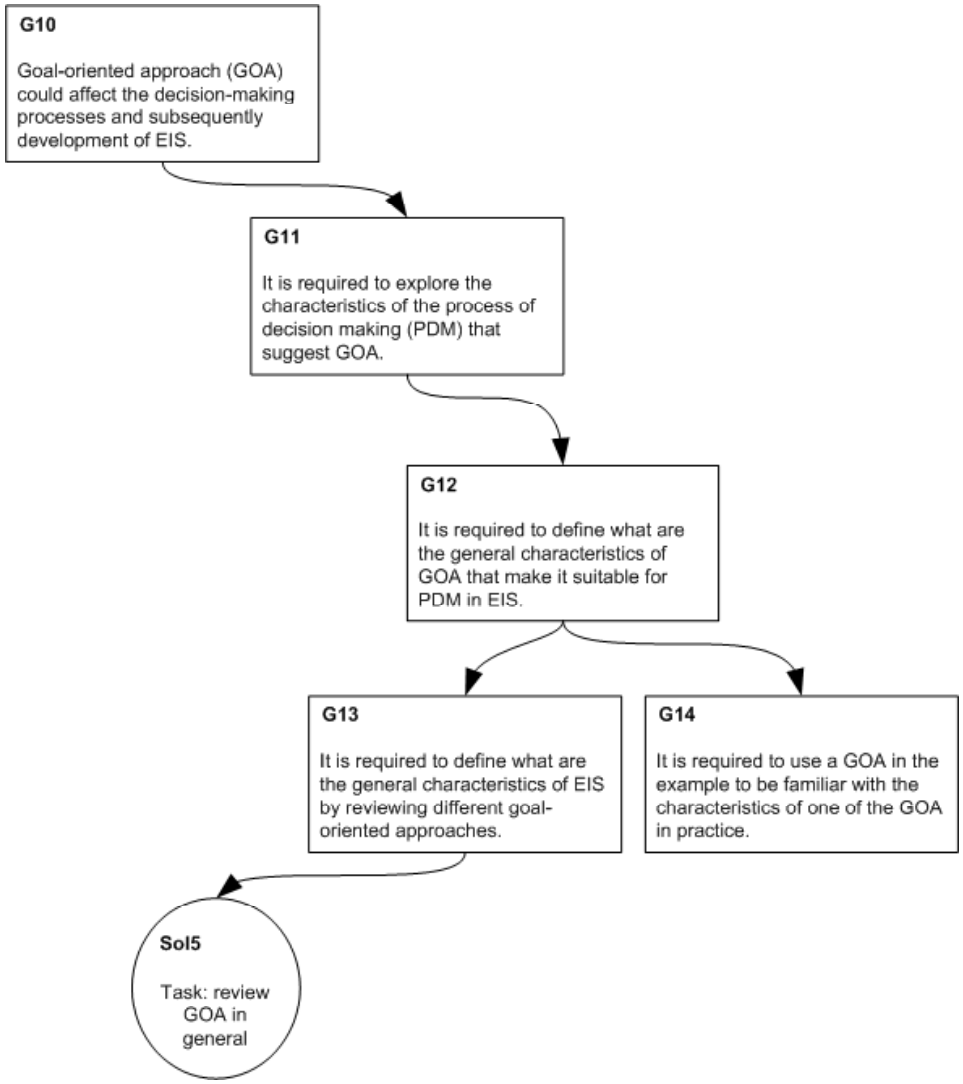


Figure 3.5: G10 breakdown to G13

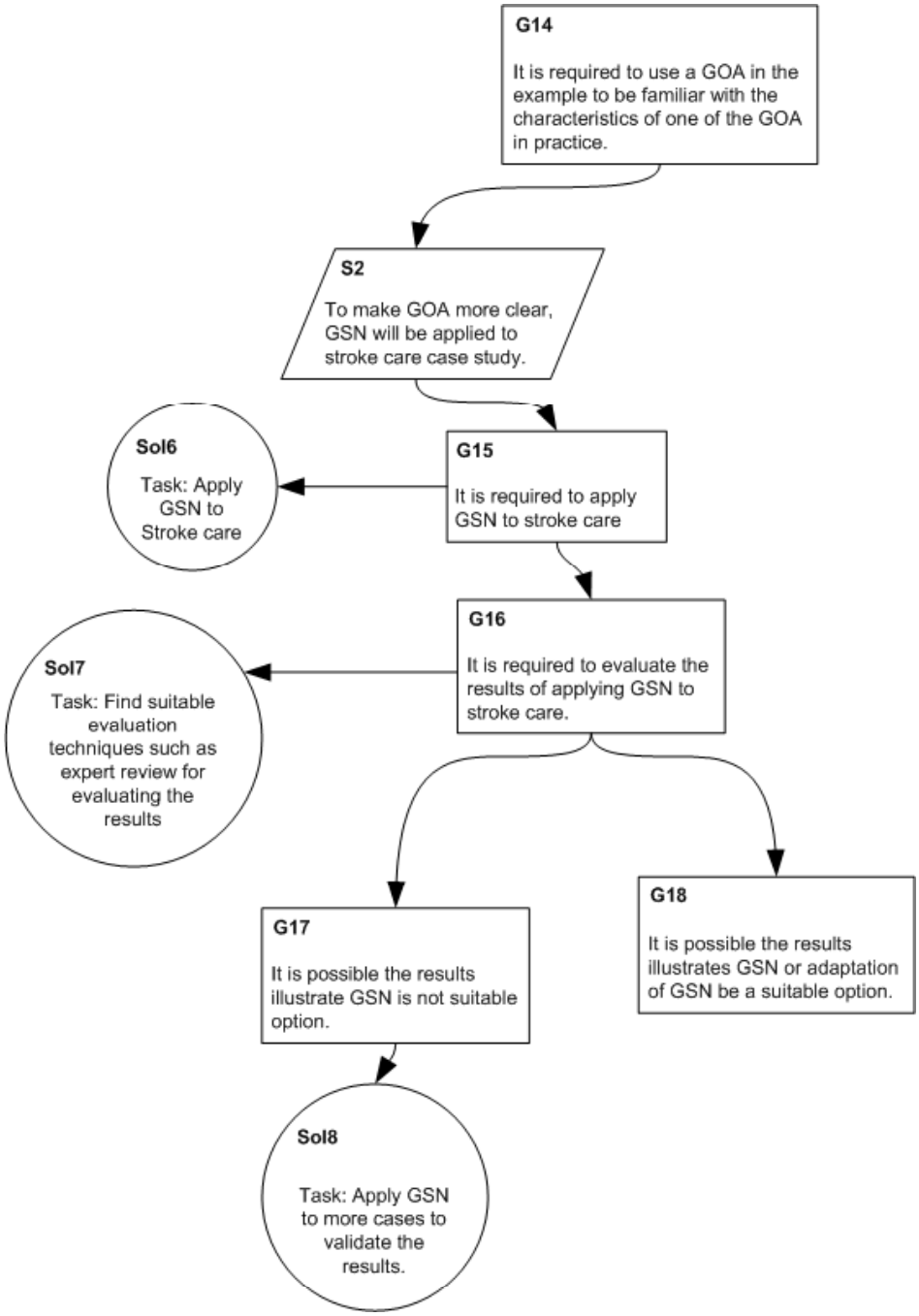


Figure 3.6: G14 breakdown to G18

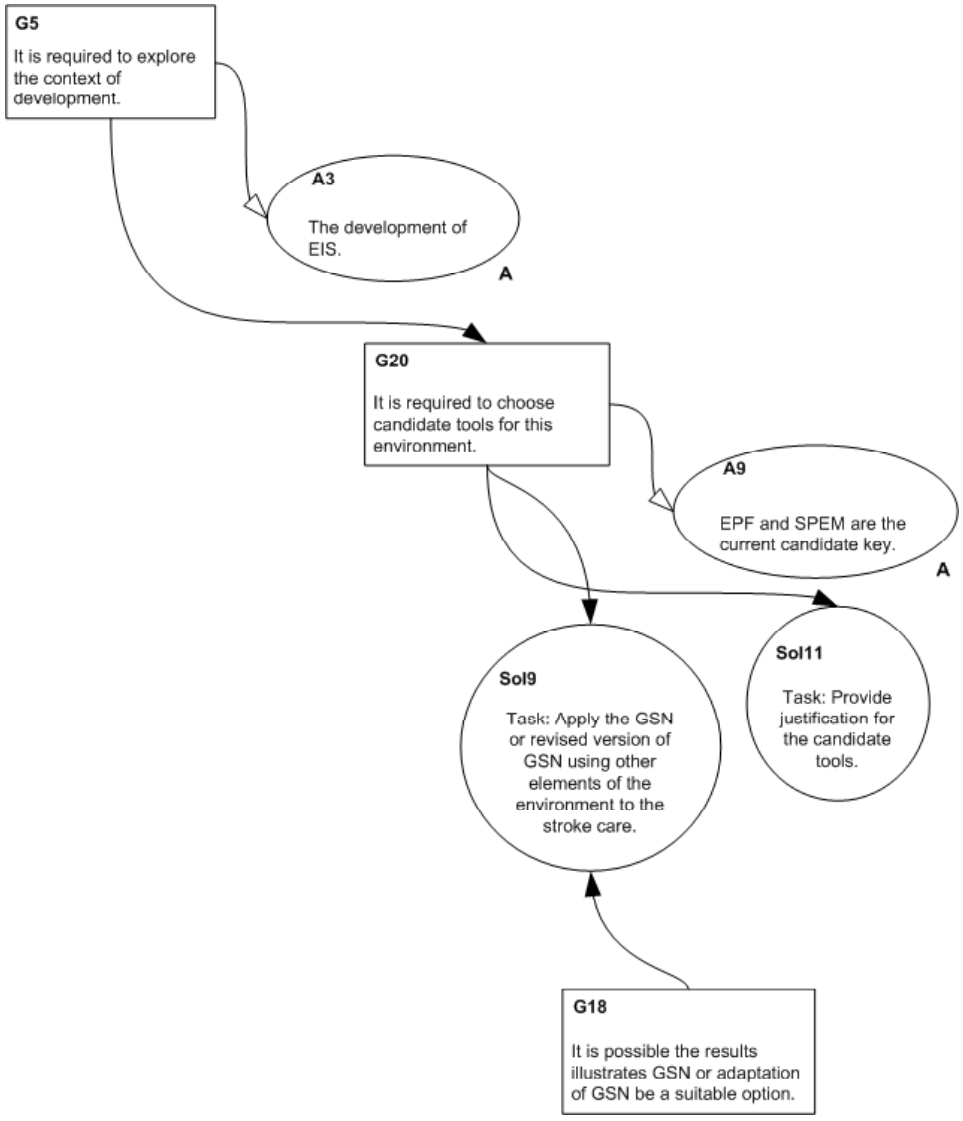


Figure 3.7: G5 breakdown to G18

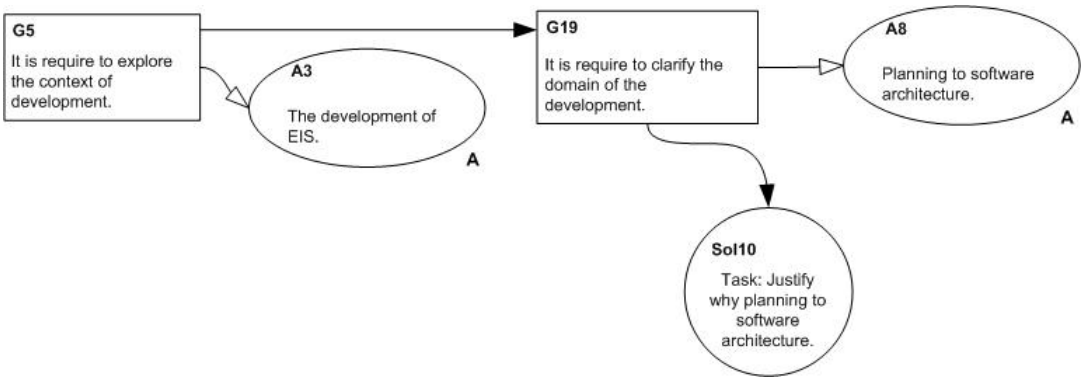


Figure 3.8: G5 breakdown to G19

3.3 Timetable

According to achieve a more concrete plan for the next phases of this research, Section 3.2 illustrates a set of goals and tasks. By putting the tasks in action and analysing the results, the list of tasks and the plan will be revised. This section will present the tasks of the plan in the timetable to evaluate the tasks are doable within the project period.

The tasks are categorised in two main groups. In Figure 3.9 the first group are tasks number 3, 4, and 5. This group's tasks focus the research on the effect of defining goals on decision-making process. The main tasks are as follow:

Sol6: Apply GSN to Stroke care example and evaluate the results. Sol5 and Sol7: Review GOA and suitable evaluation techniques.

Sol4 and G4: Explore DMP and Risk analysis as one of the element of DMP.

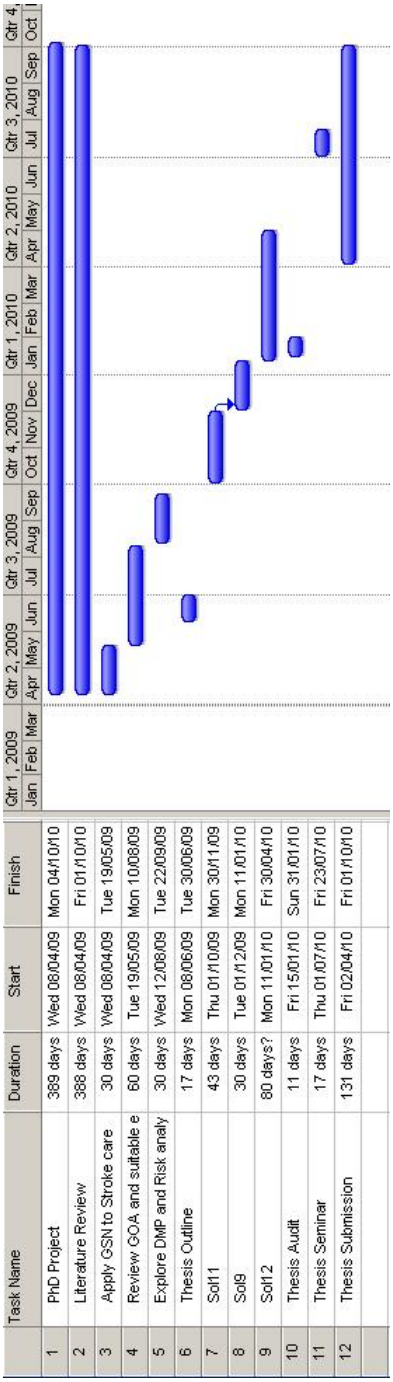
The second group tasks, 7,8, and 9 in Figure 3.9, focus on a process or a set of processes and tools that can be created from the results of the 1st group. This group includes applying the results to stroke care and one more example of EIS. The detailed steps of the second group rely on the results of the study in the 1st group.

In Figure 3.9, Sol9, SOl11, and Sol12 are defined as follow:

Sol9: If GSN required adaptation, the adapted version of it will be applied to stroke care case study.

Sol11: Choose a set of tools and provide justification for the candidate tools.

Sol12: Using the tools and processes to justify how GOA can affect the DMP and subsequently development of EIS.

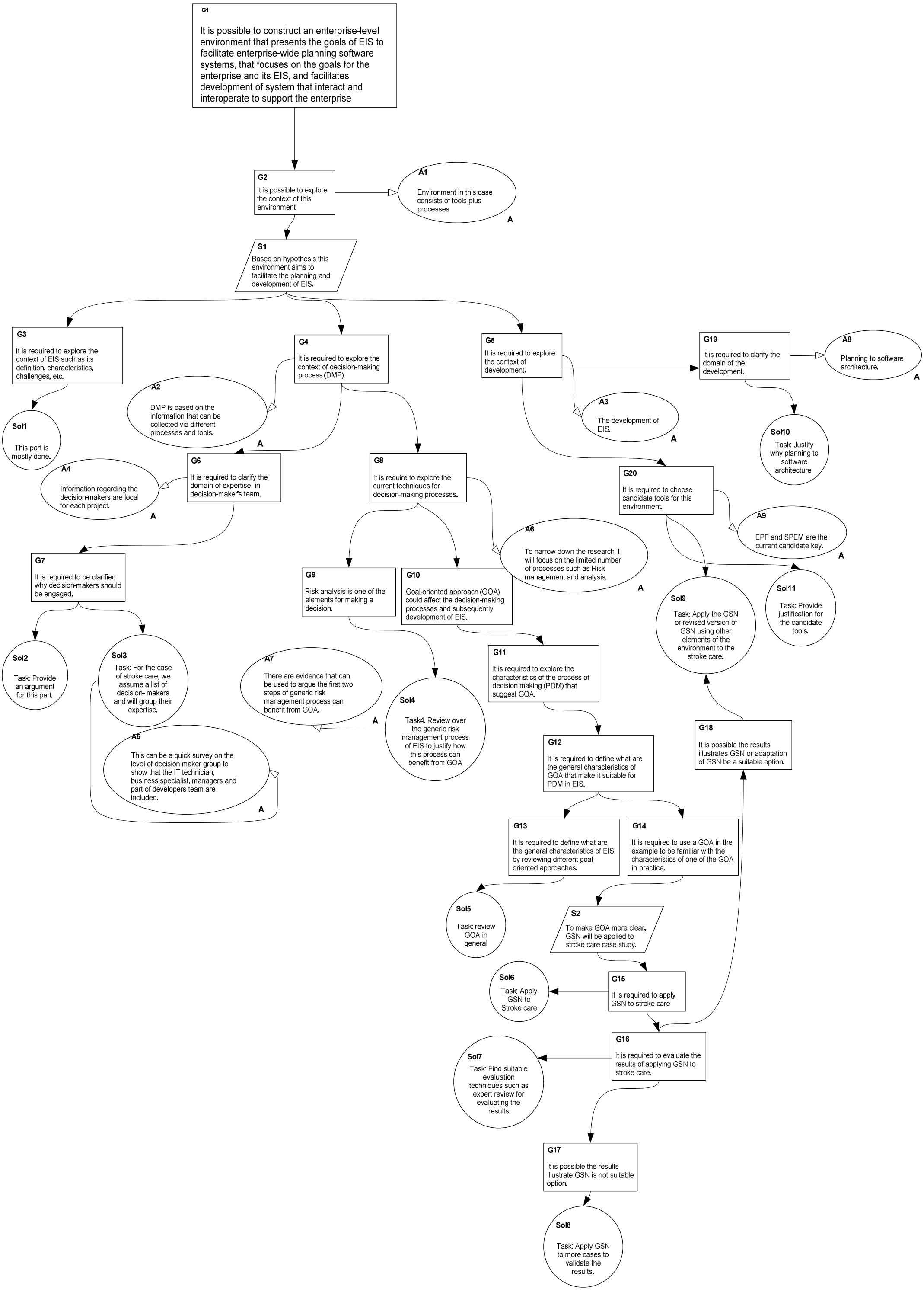


	Task Name	Duration	Start	Finish
1	PhD Project	389 days	Wed 08/04/09	Mon 04/10/10
2	Literature Review	388 days	Wed 08/04/09	Fri 01/10/10
3	Apply GSN to Stroke care	30 days	Wed 08/04/09	Tue 19/05/09
4	Review GOA and suitable e	60 days	Tue 19/05/09	Mon 10/08/09
5	Explore DMP and Risk analy	30 days	Wed 12/08/09	Tue 22/09/09
6	Thesis Outline	17 days	Mon 08/06/09	Tue 30/06/09
7	Sol11	43 days	Thu 01/10/09	Mon 30/11/09
8	Sol9	30 days	Tue 01/12/09	Mon 11/01/10
9	Sol12	80 days?	Mon 11/01/10	Fri 30/04/10
10	Thesis Audit	11 days	Fri 15/01/10	Sun 31/01/10
11	Thesis Seminar	17 days	Thu 01/07/10	Fri 23/07/10
12	Thesis Submission	131 days	Fri 02/04/10	Fri 01/10/10

Figure 3.9: Timetable

.1 Appendix: Plan Diagram

The diagrams in chapter 3 are the pieces of the main diagram which is presented in this appendix.


G1
It is possible to construct an enterprise-level environment that presents the goals of EIS to facilitate enterprise-wide planning software systems, that focuses on the goals for the enterprise and its EIS, and facilitates development of system that interact and interoperate to support the enterprise
G2
It is possible to explore the context of this environment
A1
Environment in this case consists of tools plus processes
A
S1
Based on hypothesis this environment aims to facilitate the planning and development of EIS.
G3
It is required to explore the context of EIS such as its definition, characteristics, challenges, etc.
G4
It is required to explore the context of decision-making process (DMP).
G5
It is required to explore the context of development.
G19
It is required to clarify the domain of the development.
A8
Planning to software architecture.
A
Sol1
This part is mostly done.
A2
DMP is based on the information that can be collected via different processes and tools.
A
A3
The development of EIS.
A
Sol10
Task: Justify why planning to software architecture.
A4
Information regarding the decision-makers are local for each project.
A
G6
It is required to clarify the domain of expertise in decision-maker's team.
G8
It is require to explore the current techniques for decision-making processes.
G20
It is required to choose candidate tools for this environment.
A9
EPF and SPEM are the current candidate key.
A
A6
To narrow down the research, I will focus on the limited number of processes such as Risk management and analysis.
A
G7
It is required to be clarified why decision-makers should be engaged.
G9
Risk analysis is one of the elements for making a decision.
G10
Goal-oriented approach (GOA) could affect the decision-making processes and subsequently development of EIS.
Sol9
Task: Apply the GSN or revised version of GSN using other elements of the environment to the stroke care.
Sol11
Task: Provide justification for the candidate tools.
Sol2
Task: Provide an argument for this part.
Sol3
Task: For the case of stroke care, we assume a list of decision- makers and will group their expertise.
A7
There are evidence that can be used to argue the first two steps of generic risk management process can benefit from GOA.
A
Sol4
Task4. Review over the generic risk management process of EIS to justify how this process can benefit from GOA
G11
It is required to explore the characteristics of the process of decision making (PDM) that suggest GOA.
A5
This can be a quick survey on the level of decision maker group to show that the IT technician, business specialist, managers and part of developers team are included.
A
G12
It is required to define what are the general characteristics of GOA that make it suitable for PDM in EIS.
G18
It is possible the results illustrates GSN or adaptation of GSN be a suitable option.
G13
It is required to define what are the general characteristics of EIS by reviewing different goal-oriented approaches.
G14
It is required to use a GOA in the example to be familiar with the characteristics of one of the GOA in practice.
Sol5
Task: review GOA in general
S2
To make GOA more clear, GSN will be applied to stroke care case study.
Sol6
Task: Apply GSN to Stroke care
G15
It is required to apply GSN to stroke care
G16
It is required to evaluate the results of applying GSN to stroke care.
Sol7
Task: Find suitable evaluation techniques such as expert review for evaluating the results
G17
It is possible the results illustrate GSN is not suitable option.
Sol8
Task: Apply GSN to more cases to validate the results.

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