



Research Proposal

Design and implementation of a management information system for a university degree portfolio.

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Introduction / Background to the proposed research

Introduction

In this first section of the proposal, we are going to consider the type of project that is going to be undertaken and the setting that the project will take place in. We will consider in brief the current literature and research pertaining to the project as well as the aims and objectives that we hope to achieve and the outcomes that will be delivered at the completion of the project.

- Give your research a working title.

The title for the research project is *Design and implementation of a management information system for a university degree portfolio*.

- Describe clearly the background to the subject area of study.

Management Information Systems have been implemented in academic institutions to allow Users in different departments but within the same institution to store, manage and manipulate related information all on one system. But what is a Management Information System and what does it do? A Management Information System or MIS is a 'computer-based system comprising of a "collection of hardware, software, people, data and information' [1]. This system gives users the facility to organize, evaluate and work efficiently and is made up of components that are interdependent but together make a whole. The aim of the system is to achieve a common goal and is achieved by each component working on its own task whilst working together with the other components [2].

When designing a MIS there appears to be two approaches possible. The first approach is where the system is designed and built without considering the process and functions that will be undertaken and the structure of the system is the driver. The second approach is to where the tasks the users will carry out are used to decide the systems design. Terry Lucey in his book 'Management Information Systems' writes that one commonly held definition of a Management Information System is

'The combination of human and computer-based resources that results in the collection, storage, retrieval, communication and use of data for the purpose of efficient management of operations and for business planning'[3].

He argues that a production-orientated definition is not the best way to view a MIS and that the key role of a MIS should be to provide the correct information in a usable

format, when and where requested. He continues that a more appropriate definition should be

‘A system to convert data from internal and external sources into information and to communicate that information in an appropriate, in all functions to enable managers to make timely and effective decisions for planning, directing and controlling the activities for which they are responsible’[3].

Chen in his 2009 paper states that MIS users in universities are not satisfied with the current systems that are used. He believes that whilst the user requirements are initially requested, by the time that the system is built their needs have changed and the system is no longer appropriate. As the MIS is built, flexibility needs to be included so that any changes that may become necessary can be accommodated. This can be achieved by analysing all the components that are coming together under the umbrella of the MIS. Chen even believes that the analysis of the users work area should be considered [4]. Surely, taking into account the user’s workplace is unnecessary, after all with many users comes many differing workplaces to consider.

Haifeng believes that there are four principles that need to be adhered to when designing a MIS, they are:

1. System integrity
2. System manageability
3. Strong scalability and ease of maintenance
4. System security and reliability [5]

He states that the system should be built from an object-orientated system analysis. By doing this the developer is able to have an understanding of the ‘system responsibilities’ and makes it possible to recognise the classes and outline their attributes. Only once this ‘model’ has been completed are the user requirements considered.

Haifeng considers two types of modelling ‘System Static Model’ and ‘System Dynamic Model’. The system static model uses UML diagrams, where a class contains ‘objects’ that have the same properties, methods and relationships. In the system dynamic model the system is ‘active’ and a dynamic model is needed to show the exchanges in the system. Sequence and State diagrams are used as a part of the analysis based on UML. The state diagram shows the different states for an object as well as the beginning and end points and any transition in between. A paper analysis is then carried out for both models before a final system structure is established [5].

A further viewpoint which is made by Wang and Zhao, is that the basis or core of the MIS remains relatively stable but that it is the changing needs of the institution that affect the usefulness of the MIS. For a MIS to be service-orientated in operation, the core of the MIS can be thought of as fundamental, business and statistical data. The fundamental data structure is least likely to need to be changed, as this is student related information, e.g. name, date of birth, gender etc. Business data relates to teaching data e.g. course and module codes, examination details. As programmes

evolve and are re-validated this information will change with the programme structure. Statistical data contains information relating to pass and failure rates, teacher to student ratios and other course and university related statistical information that would need to be changed as different statistical data is required. [6].

The major of the research read on this subject has stemmed from China and Japan as it appears that there has been a mass introduction of computerised systems in educational institutions that will store and process educationally related data. This has led to differing views on which design and build model is the best approach to take. Both models are successful and result in a working MIS, however this doesn't allow mean that the user of the system are 'satisfied' with the end result.

- Provide the reader with an understanding of the field in which your study lies and an idea of where and how your study fits into this field.

The aim of this project will be to design and build a Management Information System that focuses on the business needs and requirements which have been identified by users both general and technical. By achieving this users when questioned on completion of the project should be 'more satisfied'. User experience and satisfaction is an ever increasing issue and with many software solutions of a similar nature and standard available, it will be the user experience that may be the final decider for a business purchasing a new application.

- If relevant, introduce the industry/organisation/context that is being investigated.

The setting for the research is University of Wales, Trinity Saint David, Swansea Metropolitan. The institution provides vocational based higher education course to Swansea and the surrounding areas. The University currently uses Agresso's Unit 4 QLe software to run its MIS.

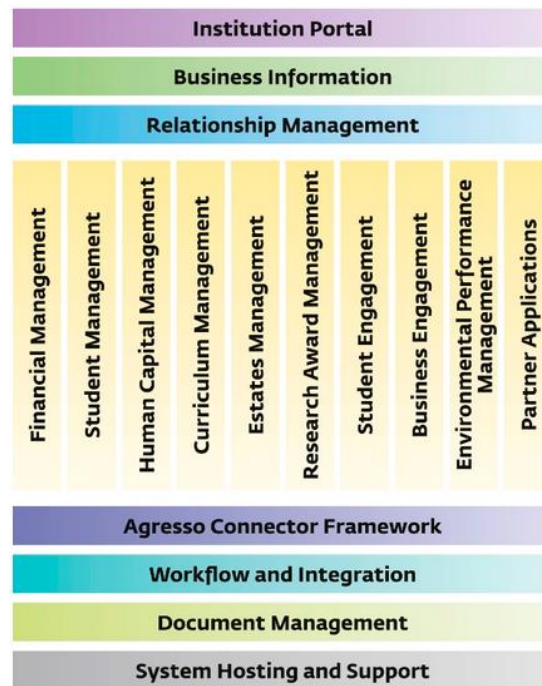


Figure 1: Agresso Unit 4 QLe [7]

This research is being complete in the context of providing a custom designed MIS specifically for a University degree programme within a one of the four faculties at Swansea Metropolitan.

- Define one overarching aim of the study (the research purpose). Construct a series of objectives that specify what you will do to achieve the aim (typically 3 or 4 objectives).

The aim of the study is to provide a Management Information Systems that can be used by a Programme Portfolio within any School or Faculty in the University setting. In order to achieve this aim, the following objectives will need to be achieved:

1. Investigate what a Management Information System is and its functions.
2. To analyse and evaluate the University's current Management Information System.
3. To write a Requirements and System specification for the proposed Management Information System.
4. To design and build a Management Information System
5. To analyse and evaluate the new system and produce a list of recommendations for further improvement

- Expected outcomes and/or deliverables

At the end of the project, it is expected that a Management Information System will have been designed and built to meet the users' needs and that it can be implemented by a degree programme portfolio in a University setting.

To accompany the MIS will be a combined Requirements and Systems Specification which will include the User interviews and observations of the University's current system and the supporting analysis of the feedback and an evaluation document.

For the new system, a report will be completed and submitted that will include a User Manual with screenshots, feedback from User Testing and recommendations on how the new MIS system can be improved.

Conclusion

In this section, we have outlined the research that is to be undertaken and the setting, considered previous research and specifically the different approaches to designing and building a Management Information System which is being implemented in educational institutions. In relation to this research, set the aim of building a Management Information System to meet the requirements identified and sub-divided the aim down four specific objectives that will see the project through from inception to completion.

In the next section, we will look at research and development methods.

Research and Development Methods

Introduction

In the previous section, we set the scene for the research that is being undertaken, in this section, we consider firstly the research methodology that will be followed and secondly the development method that is being implemented. We will contemplate any ethical and legal issues connected with the project as well as risks or limitations that might arise and the steps that can be taken to prevent them. Finally, in this section we will consider how at the end of the project we will evaluate if the aim and objectives have been achieved.

- **Philosophies**

Before the research can be begin, an appropriate research philosophy needs to be decided on. In figure 2, we can see the breakdown of the 'Research Onion' which identifies how the different philosophies, approaches, strategies, time horizons and techniques/procedures are all linked. Different types of research are best suited to alternative philosophies and their corresponding or complementary strategies.

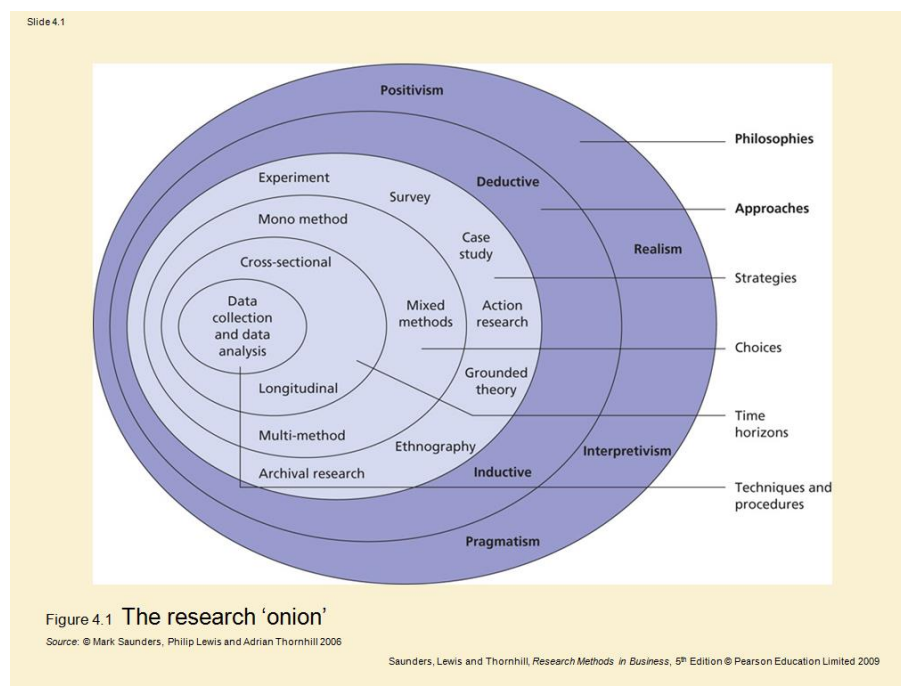


Figure 2: The Research Onion [8]

For this research project which is about developing software, the philosophy that best meets the project's aims is positivism. It is asserted that positivism asserts the 'natural scientist' and research is based on observations which in return produce data that is credible and quantifiable. It also encompasses the paradigms of objectivist and experimentalist and research of this nature is based on facts rather than impressions.

An alternative philosophy is phenomenography which is based on people's perceptions and is involved in trying to understand the behaviours of humans and people's perceptions of interpretation of their experiences rather than the generation of facts and does not match a software development of this nature.

Having chosen an appropriate philosophy a research approach needs to be chosen that complements the chosen philosophy. The two research approaches to choose from are inductive and deductive. The inductive approach focuses on building a theory and of having an insight of how humans append values to experiences. In this approach the researcher is very much part of how the research is conducted. The structure to the research is fluid and changes as the research is carried out and develops. Induction is linked to phenomenography and the two work hand in hand.

The alternative approach is deduction and as it is based on an analytical approach that links to positivism. Deduction uses variables to prove or disprove causal relationships by having fixed variables and a change variable. This approach is highly structured and allows for the process to be replicated because of this the data produced is valid and facts identified are quantitatively measured. This will be the approach taken for the project [9].

- **Strategies**

The type of research being undertaken can be classed as an explanatory study rather than an exploratory or descriptive study as it is trying to produce a causal relationship between specific variables and will produce quantitative data. There are numerous research strategies that could be used either solely or in a combined approach.

Case Study has been chosen as the appropriate research strategy for this research although it could also have been an experiment. Although case studies are more a kin to the phenomenographical methodology, it will work well for this software development project as there will be only one unit of analysis and multiple data collection methods. The different data collection methods that will be used are structured interviews, observations and surveys. By obtaining data from more than one means, should produce data with high validity. Case Studies function ably with an explanatory research study.

The time horizon employed will be cross-sectional rather than longitudinal. Cross sectional has been chosen as it will be best suited to a short term project of this nature. Data is gathered quickly and is more cost efficient as they are less resource exhaustive [9].

- **The study population and sample**

The study population and sample for the project will be the staff at the University who use the current University-wide MIS system. This sample will include staff from within the Faculty of Applied Design and Engineering, Data Services and ITS. The staff within the faculty are general users of the current system and only search information already

contained within the system. The staff within Data Services upload data to MIS, this may be student details as well as programme and module details. ITS maintain the server that the MIS runs on and resolves any technical issues. Therefore all three groups of staff whilst using the system have different functionality.

A further option for sampling is to join an MIS research forum of which there are several with websites in the internet. But at this stage this idea is just a thought in the early stage of planning.

- **Data collection methods**

Mixed method research will be used as the method of collecting data for all of the objectives. Quantitative and qualitative methods will be used to collect the data with the data being analysed using the appropriate quantitative or qualitative technique.

In order to identify the requirements needed for the MIS, a structured interview will be carried out with all staff/participants. This will be followed by an observation session, where the user will complete tasks on the current MIS system. The knowledge gained from these two tasks will provide information that will allow Context-Level and Level 1 Data Flow diagrams to be drawn. These diagrams along with an entity-relationship diagram will be included in the Requirements and Systems specification.

Once the new MIS has been built, the staff/participants will be invited to complete tasks using the new system. Once the tasks have been undertaken, the staff will be invited to complete an anonymous questionnaire that will be posted on an online survey site, for example, a site such as Survey Monkey. The information obtained but this means will be used to produce a list of recommendations on how the system can be improved and the general satisfaction level.

- **Reliability and validity**

Consistent results are as a result of reliability whilst the data collection, for example, was being carried out. However, it is possible that the reliability of the results can be undermined. According to Saunders et al, they are

1. Subject or participant error
2. Subject or participant bias
3. Observer error
4. Observer bias [9]

Validity is concerned with whether the resulting data is accurately portraying what is actually happening. As with reliability, they are reasons why the validity can be threatened. Saunders et al, believe they are

1. History
2. Testing
3. Instrumentation
4. Mortality
5. Maturation

6. Ambiguity about causal direction[9]

All of these reasons can affect the results that are returned and a loss of validity would threaten the worthwhileness of the whole project [9].

With the use of mixed methods and having both quantitative and qualitative data, hopefully this will ensure that there is both reliability and validity in the results.

- If relevant, identify and *justify* any development methods and techniques that you will use as part of systems development. Consider an evaluative framework (such as Avison and Fitzgerald) to compare methods or to justify your selection.

There is a plethora of choice when considering which software development method and technique to use for the systems development. Some of those that have been considered are more traditional such as waterfall model and V-model to iterative methods such as incremental model, unified software development process and timeboxing to agile methods such as eXtreme programming and feature-driven development.

The development method that has been chosen for this project is Structure Systems And Design Method or SSAMD. Before making my decision I considered Avison and Taylor's 5 classes. Each class has a descriptor they are:

Class 1: well-structured, defined problems, clear requirements

Class 2: as above but unclear requirements

Class 3: unstructured, unclear objectives

Class 4: high user-interaction systems

Class 5: very unclear situations [10]

The project fits very neatly into class one as it will need to be well structure, have clear requirements to meet and any problems hopefully will be defined. The corresponding software development method that meets Class 1 is SSAMD. SSAMD's structure has 7 defined stages to the development lifecycle. Whilst a feasibility study won't be produced at stage 0 with this project, the remaining stages such as the requirement and system specification as well as the logical and physical build will be completed.

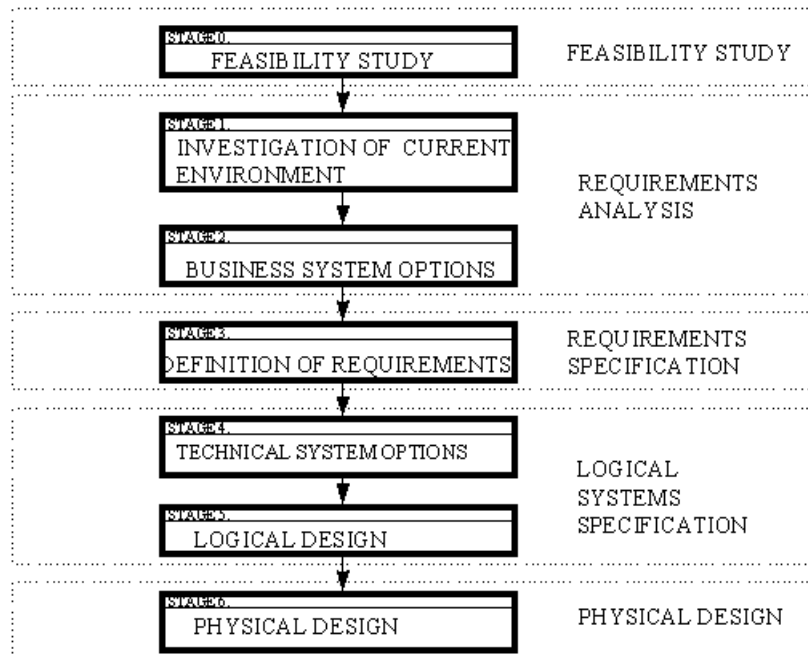


Figure 3: SSADM system development lifecycle [11]

The techniques that will be used with SSADM are Data Flow modelling, Logical Data Modelling and Entity Event modelling which are suitable for a software development that involves a database management system.

- Identify risks/limitations/ethical/legal issues and ways that you might deal with those risks.

There are several issues that have been identified and will need to be resolved before and during the project. There are several risks that are connected to the actual planning of the planning of the project and more specifically the build of the MIS. There risks are

1. Not allowing enough time to build the system
2. Poor time management and /or workload constraints
3. Choosing unsuitable software to build the MIS in
4. Not meeting all the requirements due to unrealistic goals/plans
5. Nobody completes the initial or final survey

The use of project planning tools, such as a Gantt chart with PERT analysis should help alleviate the risks surrounding time management and the setting of unrealistic goals. By using a Gantt chart it should be possible to identify the critical path through the project and the use of the PERT analysis with the calculation weighted more heavily towards the pessimistic should allow for a more realistic timeline to be proposed. Unfortunately, there isn't much that can be done about workload constraints other than being mindful of what is due in the coming months. As for the completion of both surveys, sending out polite reminders that there is a survey to be completed and hope for goodwill from those taking part.

The only legal or ethical issues that have been identified currently would be the use of actual student data to populate the tables in the MIS. This would probably not be acceptable and therefore it will be necessary to use dummy information when testing the system.

Finally, when considering the limitations for the project, the most significant would be not having the skills to be able to build the MIS due to lack of ability/knowledge. It may over time be possible to gain the skills or lack of knowledge through self learning. However, this would impact on the timescale. Therefore, the best option to this problem is to start off with a more simple system and as the build progresses make the system more complex.

- **How will you analyse the data/evaluate your results?**

The evaluation of the completed MIS system will be carried out by several different methods, in order to gain the fullest amount of data. The first type of analysis to be completed will be a comparison of the User requirements. A comparison will be carried out of the finished system with the user requirements that were obtained during the early stage of the project and the original aims and objectives of the project to see if they have been achieved. Software testing will be undertaken to ensure that the system is capable of performing the tasks required of it and to identify any issues that need to be resolved. Finally, the staff that completed the survey or interview at the beginning of the project will be asked to take part in User testing followed by completion of another survey.

Conclusion

In this section, we have discussed and justified the use of specific research and development methods that will be used throughout the project, identified any risks, limitations, ethical and legal issues that could arise and considered how the data and results will be evaluated.

In the next section, we will look at the resources required for the project and the project plan.

Resources & Planning

Introduction

In the previous section, we looked at research philosophies and strategies and the development methodology, identified risks, limitations, ethical and legal issues as well as thought about how to evaluate whether the aim and objectives have been met. In this final section, we will consider the resources required as well as the project management planning skills needed to successfully complete the project.

- Identify any resources required

In order to successfully complete the project, the following resources will be required

- PC/Laptop – to be used for the building of the system
 - Microsoft Access – to initially build a prototype of the system
 - SQL server/MySQL – for the build of the actual system accessed via a web front end
 - IT and Information Management journals that refer to past and current research on MIS
 - Books on the subject area – to be borrowed from the University and local libraries or purchased.
 - Access to an online Survey builder e.g. Survey Monkey etc
 - Staff to complete the surveys – Staff within the University will be asked to complete a survey, be interviewed and/or observed.
 - Join a forum on research into MIS
 - Sign up for a quarterly journal on MIS
- Construct a Gantt chart that demonstrates evidence of project planning and management. Identify the timescales for each component of the study.

In order to plan and manage each step of the project a Gantt chart has been constructed (see figures 4-8). The plan has been divided into two distinct sections that of Requirements & Specification and Implementation. Each task has been listed in order under the appropriate section before assigning dependencies to appropriate tasks. Finally realistic completion dates have been assigned to each task.

Resources needed for the project (see figure 9) have been considered and entered into the Resource sheet and assigned to each individual tasks.

The use of the PERT analysis tool can be used to work out the pessimistic, optimistic and expected dates. The weighting on the PERT can be set to favour one more than another. Using this will alter the dates to hopefully give a more realistic task completion date.

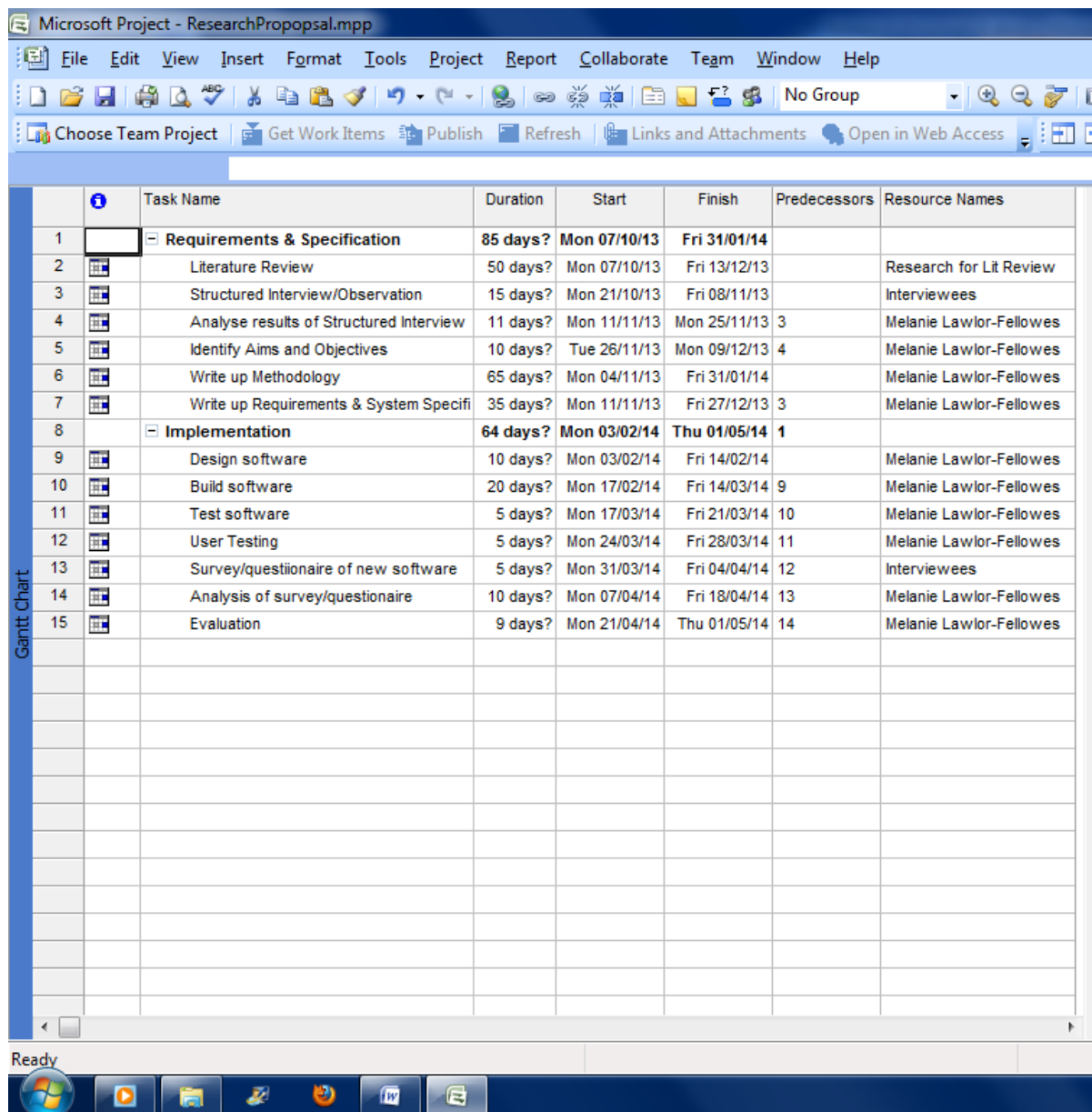


Figure 4: Gantt chart for the proposed project

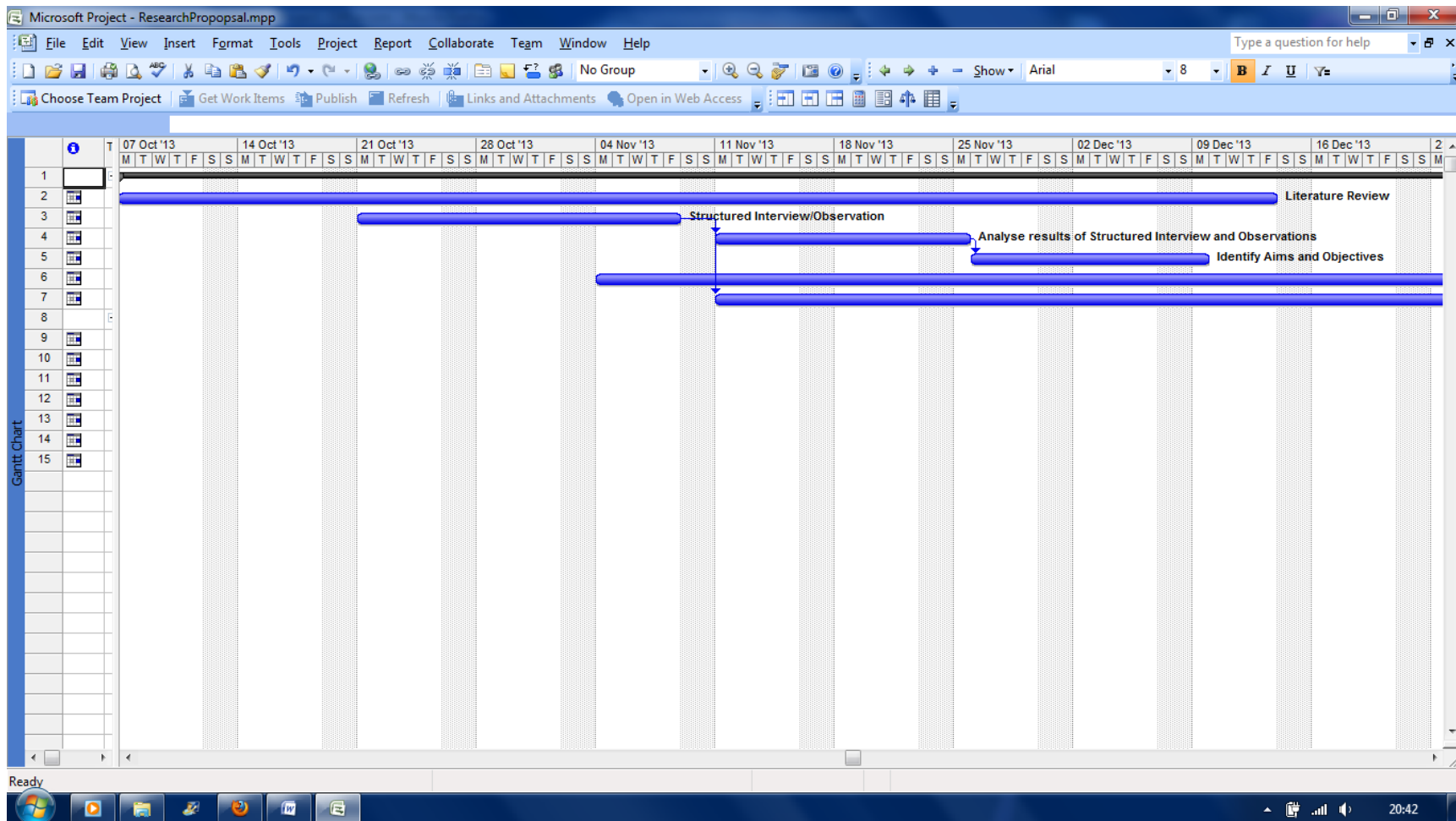


Figure 5: Calendar view of Gantt (1)

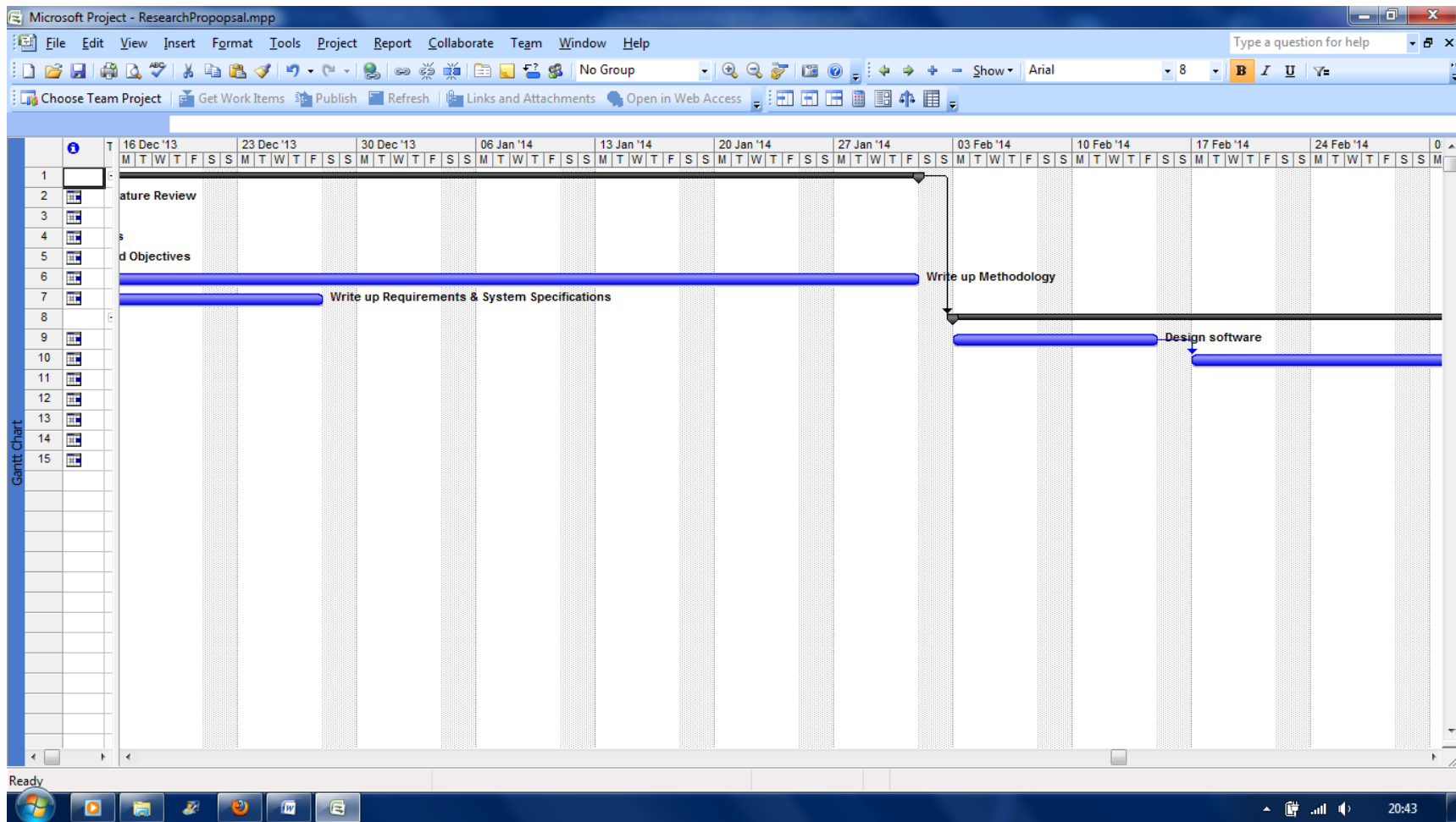


Figure 6: Calendar view of Gantt (2)

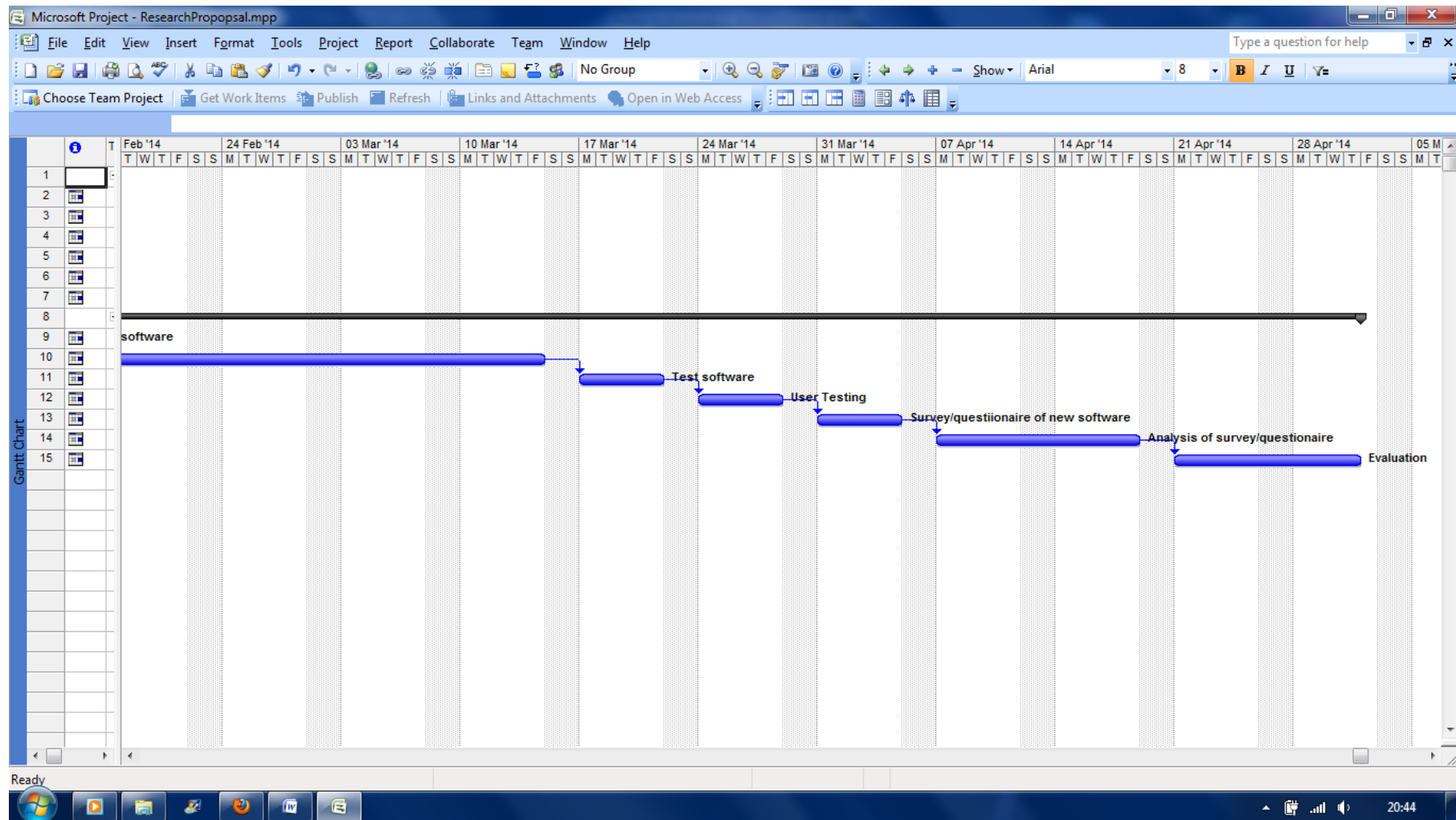


Figure 7: Calendar view of Gantt (3)

The screenshot displays the Microsoft Project application window titled "Microsoft Project - ResearchProposal.mpp". The interface includes a menu bar (File, Edit, View, Insert, Format, Tools, Project, Report, Collaborate, Team, Window, Help), a ribbon with various task management icons, and a search bar at the top right.

The main area shows a "Resource Sheet" table. The table has columns for Resource Name, Type, Material Label, Initials, Group, Max. Units, Std. Rate, Ovt. Rate, Cost/Use, Accrue At, Base Calendar, and Code. The first eight rows contain resource information:

	Resource Name	Type	Material Label	Initials	Group	Max. Units	Std. Rate	Ovt. Rate	Cost/Use	Accrue At	Base Calendar	Code
1	Melanie Lawlor-Fellowes	Work		M		100%	£0.00/hr	£0.00/hr	£0.00	Prorated	Standard	
2	Interviewees	Work		I		100%	£0.00/hr	£0.00/hr	£0.00	Prorated	Standard	
3	Access Software	Material		A			£0.00		£0.00	Prorated		
4	MySQL Server	Material		M			£0.00		£0.00	Prorated		
5	Laptop	Material		L			£0.00		£0.00	Prorated		
6	Printer	Material		P			£0.00		£0.00	Prorated		
7	Research for Lit Review	Cost		R						Prorated		
8	Journal Subscription	Cost		J						Prorated		

The status bar at the bottom indicates the system is "Ready". The Windows taskbar at the very bottom shows several open applications and the time as 20:29.

Figure 8: Resources Sheet

Conclusion

Having thought about the resources needed, it is always possible that during the course of the project a resource will be required that hasn't previously been considered. Hopefully this missing resource would not lead to the project failing. With the best will in the world, it is feasible to plan for the project using a Project Management tool however the timescales given are always going to be hypothetical. Only once the project is progressing will it be possible to see if the plan is not only workable but achievable.

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