Comparative analysis of the phases and processes of the theoretically defined SDLC versus the practical solutions applied by Creative Solutions Ltd.

A dissertation submitted in partial fulfilment of the requirements for the degree of Bachelor of Science (Honours) in Business Information Systems

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Declaration

I hereby declare that this dissertation entitled *Comparative analysis of the phases and processes of the theoretically defined SDLC versus the practical solutions applied by Creative Solutions Ltd.* is entirely my own work, and it has never been submitted nor is it currently being submitted for any other degree.

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Abstract: The purpose of this dissertation is to critically compare the theoretically modelled SDLC to the practical solutions applied by the non-specialists at Creative Solutions Ltd. in the field of systems development. The study uses primary and secondary research as sources for analytical comparison. The methodology utilises the comparative analysis technique to create data matrices which illustrate the results of the research. The analysis concludes that the theoretical and the practical models of the SDLC are largely similar. The findings may be useful to system developers as it would provide them with an understanding of where the similarities and differences between the theoretical and practical models are.

Key Words: Systems Development Lifecycle (SDLC); Information Systems Development (ISD); Systems Development Approach; Agile Approach; Structured Approach; Non-specialists
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1 Introduction
1.1 Background
For years, systems developers have been struggling to find a “better” methodology which would allow them to develop systems faster, cheaper and more efficiently (Dahiya & Jain, 2010).

The initial approaches to systems development were mostly structural and did not allow for many changes (Yeates & Wakefield, 2004). As the Information Technology (IT) demand grew all over the world, more and more new systems had to be developed. Soon, specialists realised that the structured approaches which they had been utilising until then were not as efficient and proved to be highly expensive throughout their execution. To a large extent, that was a result of the rapidly changing IT environment (Brancheau & Wetherbe, 1987; Durney & Donnelly, 2015). As technologies evolved and developed, companies needed to adapt and consequently change their initial requirements (Gen, et al., 2015). The structured approaches, however did not allow room for such changes and eventually when the system was delivered, it was no longer fit-for-purpose.

Following this realisation, theorists concluded that a ‘non-traditional’ approach should be adopted. Thus in 1970 in his paper “Managing the Development of Large Software Systems” (Royce, 1970), Dr Winston Royce argued that systems or software should not be developed in sequential phases as this approach not only does not allow for any changes to be implemented or even considered, but also secures that there is little to no communication amongst the specialists and the stakeholders (in this work ‘stakeholders’ refers to everyone who will be using the system).

From this point onwards, a variety of ‘non-traditional’ approaches collectively called ‘agile’ began to emerge. However, regardless of the chosen approach, a constant which is the System Development Lifecycle (SDLC) can be identified. Ever since its introduction in 1956 (Canning, 1956), it has been a part of the practice of systems development. Its purpose is to split development into distinct phases which, depending on the chosen approach, would be executed in a consecutive or a type of iterative order (Wynekoop & Russo, 1993).

In a later chapter, this dissertation will elaborate further on a number of the different traditional and non-traditional approaches, however it would mostly engage the SDLC.

Nonetheless, despite the variety of approaches to systems development (such as Structured and Agile), nowadays companies follow their own structures for development and implementation of their new systems (Managing Design and Development, 2015). For some large organisations, the decision not to utilise the theoretical models is derived through the belief that the approach created within the company suits the particular organisation best, therefore an approach which is considered highly individual is undertaken every time the company introduces a new system. Other usually smaller organisations find hiring a system analyst costly and attempt to execute
the system development and implementation internally basing their knowledge on online research. (Russo, et al., 1995; Carugati & Rossignoli, 2011)

Yet other company managers are unaware of ‘system development approaches’ or ‘SDLC’. This dissertation will be looking into how such a company manages the development and implementation of a new, working, fit-for-purpose system without using any theoretical knowledge. The paper will identify whether, despite not having been introduced to the theoretical methodologies surrounding the SDLC, the team still goes through the phases which this theoretical model introduces.

1.2 Problem Statement
In the modern world, some managers of smaller businesses attempt to develop and implement systems without any prior knowledge of the theoretical models depicting system implementation. Often they will decide that a new information system needs to be put in place and will start working towards creating such a system without following any particular order of actions. Such ‘chaotic’ approach may prove disastrous and inevitably result in system implementation failure. Accordingly, the outcome will be loss of money, time, other resources and lack of a feasible system.

But, sometimes, managers are able to create a working, fit-for-purpose system without consulting either experts or Information Systems Development (ISD) theory. Consequently the question can be asked – how are these systems built successfully?

Section 1.4 of this paper will define the research derived from this question.

1.3 Dissertation Goal
The goal of this dissertation is to critically compare and analyse the similarities and differences between the SDLC which originates from theory and the one which originates from purely practical solutions.

This main goal contains the following sub-goals:

To identify the steps which non-specialists go through when developing and implementing a new system in their company. The research is aimed at identifying the steps which the selected company Creative Solutions Ltd. have followed;

To critically compare them to those suggested by theory in the field of systems development.

This paper will help understand and identify whether the practical resolutions applied by non-specialists correspond to the methodologies proposed by the theoretical models and, if there are any actions which theory suggests but real-world practice overlooks.

The research will also identify if the theoretical models which are being researched entirely reflect the methods of practice through the specific perspective of the SDLC and, accordingly,
whether the steps followed by practice and the non-specialists correspond to the SDLC theory examined in this research.

The dissertation will also ascertain whether there is always a necessity for applying theoretical models and/or hiring a specialist, or if there are cases where such are not required.

1.4 Research Questions

The research question is structured as a combined question describing the issues addressing the three main sections of the investigation – Theory, Practice and Theory vs. Practice. All sections are looking to uncover and compare the SDLC – its phases and the processes within these phases. The three sections are explored further below. This examination is deemed necessary by the author as it is believed that a method of categorisation will allow for a better presentation of the final implications of this dissertation.

The main research question is formulated as such:

*Do the processes and phases of the theoretically modelled SDLC and those of the naturally progressing SDLC, followed by the non-specialists in the real world, correspond to each other?*

The questions related to the three categories are formulated as such:

1.4.1 Theory

The research question related to theory is concerned with its application by the non-specialists in practice.

Do the phases of the theoretically designed SDLC and the processes within them correspond to those, occurring in the SDLC ‘designed’ by the non-specialists in the real-world?

1.4.2 Practice

The research question related to practice is concerned with its correspondence to the suggested theoretical models.

Do the practical resolutions applied by the non-specialists reflect the phases which occur within the lifecycle?

Are there any cases when theoretical knowledge and specialists are not required in order to develop and implement a working, fit-for-purpose system?

1.4.3 Theory vs. Practice

The ‘theory vs. practice’ research questions, examine how theory and practice could supplement, contribute and extend upon each other in the field of ISD.

Are there any practical resolutions undertaken by the non-specialists in the process of ISD which theory has not yet depicted?

Would the final product have been overall better, if the theoretical models had been followed?
1.5 Relevance and Significance
Understanding the practical resolutions adopted by non-specialists and the extent to which theoretical methodologies correspond to the real-world cases is important and valuable knowledge. It will allow specialists to recognise whether theory truly reflects practice. It is crucial to note that the theoretical methodologies developed in the field of system development, and especially the SDLC, are considered unavoidable as arguably all systems have to undergo the phases of the SDLC in one form or another (Kendall & Kendall, 2002).

Through undertaking this research, it will be revealed whether theory reflects the practically driven processes adopted by the non-specialists. It will also detect if there are any differences in the methodologies suggested by the examined theory and those suggested by practice.

This paper will reveal if there are any cases in system development, which do not demand the involvement of either a specialist’s or of theoretical knowledge in the field, in order to produce a working and fit-for-purpose system.

1.6 Barriers, Limitations and Issues
A number of potential barriers, limitations and issues could be identified in relation to this paper. Some of them are related to the investigation – the primary and secondary research; and others are related to the technicalities surrounding the creation of the paper.

The barriers and limitations to the primary research are largely related to the data gathering technique chosen by the researcher which is face-to-face interviews. This type of data collection is primarily dependent on the skills of the interviewer; e.g. he/she must not demonstrate any conscious or unconscious signals which might guide the interviewee in a particular direction (Anon., n.d.). Other issues might arise from time constraints; difficulty analysing the gathered data and validity of the interviewee responses (Blandford, 2013). Also, the data which will be gathered by the researcher will be related primarily to the specific company, consequently, it cannot be concluded that all related cases will have the same outcome, if similar research is carried out. This issue can be considered as a limitation to the research as, in this paper, the investigation of the applied processes considers only one company.

Barriers to the secondary research include finding relevant academic material to assist the researcher and allow for comparison and critical evaluation of the work of different authors.

Technical barriers include the time constraints within which the paper should be written; the facilities provided to the researcher; and the access to relevant and timely feedback by the supervisor.

1.7 Assumptions and Scope
1.7.1 Assumptions
Parts of the research which the researcher takes for granted are referred to as ‘assumptions’ (Ellis & Levy, 2009). The author identifies two assumptions related to the primary research. Firstly, that the participants would answer the interview questions truly and fully. Secondly, that
the interviews were constructed in a valid and reliable matter. This assumption is derived from theoretical suggestions of how to construct semi-structured interviews (Saunders, et al., 2009; Phellas, et al., 2011; Schultze & Avital, 2010).

1.7.2 Scope
This research is investigating specific resolutions for system development and implementation applied by Creative Solutions Ltd. The extent of this research will not surpass the boundaries of the scope due to insufficient resources such as time, funding and amount of experts working on the research.

It is also important to note that the secondary research will identify the basic theoretical methodologies in order to allow the reader to create an overall understanding of the subject of system development. However, more specific and in-depth theoretical explanations will be added only to sections which require them in order for the researcher to be able to use them as a reference point in the analyses sections of the dissertation. Such use of theoretical explanations will be adopted, as the theory surrounding the subject of systems development is considerably large and stating it in its integrity is beyond the scope and the needs of this paper.

1.8 Summary
Information Systems are constantly being developed and implemented within modern organisations (Carugati & Rossignoli, 2011). However, it can be argued that a large proportion of companies attempt to implement their systems without the assistance of a specialist or even without having studied the theoretical methodologies within the field (Russo, et al., 1995; Carugati & Rossignoli, 2011). Therefore, the focus of this paper is to identify whether the practical resolution applied by non-specialists in fact reflect unavoidable practices suggested by theory in systems development. The author will identify the key aspects within theory and practice which will be compared, thus allowing for a critical evaluation and consequently reaching valid answers for the proposed questions in section 1.4 of this dissertation. Additionally, the paper will identify if there are any cases within the field of systems development that do not necessarily need to employ either theory-driven practices or professionals in the field. Upon completion, this dissertation will be useful for the understanding of the theoretical models surrounding the SDLCs.

The author has made a small number of assumptions regarding the data collection methodologies related to the validity and the fullness of the gathered data. The scope of the investigation covers the work of the team of Creative Solutions Ltd; consequently the limitations are related to the generic ethos of the research.
2 Literature Review

2.1 Overview of Theory

This literature review will summarise the theory explaining and related to the key theoretical concepts of this dissertation.

2.1.1 System, System Development Processes, SDLC

A SDLC refers to ‘System Development Lifecycle’ as defined earlier. In order to set a baseline understanding of what that is, the author will examine the components of the abbreviation.

System

In the different fields of study the word ‘system’ has a variety of meanings. For example, people who work in the IT field have developed a different understanding of what a system is, compared to the people working in the field of behavioural psychology. Through this literature review, the author aims to provide the readers with a working definition of what a system refers to in this paper.

In computing the word ‘system’ encapsulates two main notions – the hardware and the software components (Cambridge University Press, n.d.).

The hardware component is in fact a collection of tangible physical elements. For example, in a computer hardware system such elements may be the monitor, the hard disk drive, the graphic and sound cards, etc. (Microsoft, 2016)

However, this dissertation is mainly focusing on the software components within the system and, more to the point – how they are developed. Therefore, the next paragraph of this paper will identify what a software system is.

Sommerville (2007) denotes a software system as a set of individual programmes which utilise configuration files; and system and user documentation which describe the system structure and how it should be used (Sommerville, 2007). Similar descriptions are given by a number of different authors (Skidmore, 2007; Kendall and Kendall, 2002; Hawrysikiewycz, 1997) in the field of ISD.

System Development Process

The process of developing a system could refer to either the development of a hardware system, software system or both simultaneously. It is described as set of stages which a system follows in the process of its development – from the very first stage (the initial idea) to the final stages (implementation and maintenance) (Farm Credit Administration, 2007).

From this short description, it could be inferred that the process of developing a system has a validated set of stages. Those will be examined further in the next section.

System Development Lifecycle
The SDLC is the overall procedure of developing, employing, maintaining and retiring a system. It follows a multistep process which implements a variety of stages and phases, each of which contain of a number of specific tasks (Radack, 2012). The stages generally consist of a number of phases which require the performance of several tasks. Depending on the system development approach which has been chosen for the development of a particular system, the phases can be executed in a sequential or iterative order (Li, 1990).

The SDLC can also be referred to as a framework which is set in order to provide an easy description of the activities through which a system must pass during its creation and later on in the duration of its ‘life’ (Isaias & Issa, 2014). Even though such a description sounds strongly linear, not all system development methodologies follow a structured approach (Fong, et al., 2011).

Deriving from this explanation, the existence of two main types of models can be defined: Structured and Agile (Crnkovic, et al., 2005). Those types of approaches will be examined in further detail in section 2.1.2 of this dissertation.

Due to the fact that the SDLC was initially created in the late 1960s when mostly structured approaches to system development were used, it is commonly referred to in relation to linear approaches to systems development. However, the SDLC could be considered as a part of any approach to developing a system – both structured and agile.

The structure of the SDLC can be presented in a variety of ways as the different authors use different terminology to express the same meaning. Therefore, there are many figures representing the SDLC, which convey the same information, but depict it in a different way. Figure 1 illustrates the author’s representation of the SDLC stages.
2.2 System Development Approaches

As previously mentioned, there are two distinct types of approaches to developing a system – structured and agile. Very different in their essence, they were developed to fit in with the requirements of the different types of systems. Firstly, the structured approaches were developed. After utilising those for years, analysts realised that the methodologies which they employ hardly manage to fit the requirements for the development of current systems, as those were now being produced in a rapidly changing environment (Abbas, et al., n.d.). Consequently, the steps followed by the structured approaches started lagging behind the environment in which the system was being created. An example would be the change in the stakeholders’ requirements – what was initially thought of as important for the system, might no longer be eligible after a few months, due to the advance in IT. Thus the agile approaches to systems development were designed. They allow for rapidly changing requirements and utilise a non-rigid structure (Cohen, et al., 2004).

Both types of approaches will be discussed further in the following sections of this paper.

Structured Approaches

Even though the SDLC is not an approach itself, its stages were taken as a basis for the introduction to the majority of the structured approaches, with the most explicit example being the ‘Waterfall Model’.
In 1976 Bell and Thayer (1976) discuss the Waterfall Model as an approach to system development (Bell & Thayer, 1976). It (and the rest of the structured approaches) was composed with the aim to rationalise, systematise and clarify the process of developing a system (Parnas & Clements, 1986). It assumes that each phase, as stated in the SDLC, has to be completed before the start of the subsequent phase. Because of its rigid structure, it can be argued that this approach never worked very well in the rapidly developing field of IT (Hardy, et al., 1995; Satzinger, et al., 2012).

Other structured approaches include Structured System Analysis and Design Methodology (SSADM); Yourdon; Jackson; Merise, etc. (Yeates & Wakefield, 2004). For the purpose of this work, it will not be necessary to provide in-depth descriptions of the structured models at this stage. If the author finds it necessary to elaborate on the models in any later chapter of this dissertation, the needed descriptions and clarifications will be provided to the reader. Those descriptions will be gathered from books and papers written by academics and theorists in the field of system development.

Such academics and theorists include:

- Donald Yeates and Tony Wakefield (2004) *System Analysis and Design*
- Kenneth E. Kendall and Julie E. Kendall (2011) *System Analysis and Design*
- Alan Dennis, Barbara Haley Wixom and Roberta M. Roth (2012) *System Analysis and Design*
- Agile Approaches

It could be argued that the agile approaches originated from the iterative and incremental methodologies which, even though thought of a ‘modern’ practice, have been utilised since the 1950s (Larman & Basili, 2003). However, Agile consists of much more than what the iterative and the incremental practices can offer. It focuses on the stakeholders of the system (all people involved one way or another with the system), instead of the roles which people play when utilising the said system (Lin, 2011). One of the main characteristics of the methodology is that it is looking to be adaptive in its planning, to have an evolutionary development, to aim at early delivery, to respond quickly and to improve the system continuously and in accordance with the ever-changing user requirements (Agile Alliance, 2013).

About 10 years after the official introduction of agile approaches to system development (around 1990), the Manifesto for Agile Software Development (Beck, et al., 2001) was officially stated. It can be argued that the roots of the Manifesto originated from the works of James Martin (1991) and Kerr & Hunter (1993) where they utilise, a new (at the time) development methodology called Rapid Application Development (RAD) (Martin, 1991; Kerr & Hunter, 1993).
The Manifesto is based on 12 core principles which explain in simple sentences how agile approaches function. Those principles can be found in “Principles behind the Agile Manifesto” (Beck, et al., 2001).

Agile methodologies usually break tasks into small and achievable increments; but instead of doing this in a linear manner (one entire task has to be entirely finished before the other is started), those increments are composed of pieces of all tasks (not just small increments of the same task). The iterations for completion of the various increments are framed within time; this frame is called a timebox. A timebox usually lasts between 1 and 4 weeks. The iterations generally consist of the following phases: planning, requirements gathering, design, coding and testing (those are the phases of the DSLC). At the end of each iteration, the ready-product is presented to the stakeholders who provide feedback which is immediately taken into account by the development team.

There are a number of different agile approaches to system development. Some of them are focused on a particular phase or a set of phases in the SDLC, but others fully cover all of its stages (Abrahamsson, et al., 2002). The choice of approach is dependent on the type of system which is being developed.

As the scope of this dissertation does not cover an extensive research on the topic of agile methodologies, the paper will provide a list of some of the most used approaches followed by a figure (Figure 2) which depicts the correlation between the approaches and the SDLC phases.

Some of the most utilised approaches are:

- **Adaptive Software Development (ASD)** – intended for projects which need to be executed very quickly and are likely to experience a large amount of changes throughout the development. This approach aims at improving performance and to moderate burnout for larger projects with distributed teams. (Highsmith, 2013)

- **Agile Modelling** – aims at effectively modelling and documenting software based systems as a practice-based methodology (Agile Modelling, 2014).
- Crystal Clear Methods – focuses on people, their collaboration, co-operation and good citizenship (Highsmith, 2002).
- Dynamic Systems Development Method (DSDM) – emphasises the use of facilitated workshops and exploratory development approach (Highsmith, 2002).
- Extreme Programming (XP) – values “community, simplicity, feedback, and courage. [...] provides a system of dynamic practices” (Highsmith, 2002).
- Feature-Driven Development (FDD) – “consists of a minimalist’s, five-step process that focuses on developing an overall “shape” object model, building a features list and then planning-by-feature followed by iterative design-by-feature steps.” (Highsmith, 2002).
- Open Source Software
- Rational Unified Process – iterative and adaptive software development process framework, developed intentionally to allow system analysts and developers to use only the elements and processes whichever suit a particular project best (Kruchten, 2004).
- Scrum – iterative and incremental framework for managing software development, which recognises that clients may change their mind a number of times during the development process (Scrum Alliance, 2016).
- Kanban – emphasis on just-in-time delivery, manages knowledge work, presents the team members with a full overview of all tasks to be executed in order not to overload the teams with work (Anderson, 2010).

Figure 2 – Correlation between agile approaches and the SDLC (Abrahamsson, et al., 2002)
As mentioned before, this dissertation does not require the extensive overview of agile methodologies. However, if such is needed at any time in the duration of this text, it will be provided through the means of academic research of the available literature.

2.3 Overview of similar research
2.3.1 Other Authors and their research
Through examining the available literature, the researcher has identified that there is little research specialising in identifying the similarities and the differences between the theoretically modelled SDLC and the lifecycles which emerge naturally from the development processes undertaken by non-specialists.

The overview of the literature presented a large number of papers written on the topic of ‘closing the gap between theory and practice in ISD’ and case studies related to the ‘use of DSLCs and development approaches in ISD’. Despite this, only small sections of the research undertaken in those articles can supplement this dissertation.

However, the researcher was able to identify a number of relevant papers which complement the understanding of the theoretical concepts described in the first section of the literature review.

2.3.2 Findings
As it has been already identified in the previous section, the SLDC is a theoretical method which depicts the processes which a system must go through in its development; it is “tried-and-true” and has not changed with time (McMurtrey, 2013). However, arguably, it is still recognised as a set of processes which are best handled by specialists in the field (Blery & Michalakopoulos, 2006). This is due to the theoretically driven nature of the ISD methodologies which are built especially for the purpose of constructing reliable, fit-for-purpose systems with as little resource loss as possible.

Following on from that point, it becomes clear that the implementation of a fit-for-purpose system may prove to be a difficult task for non-specialists who have no theoretical knowledge.

Researchers have identified that some of the primary reasons for failure of system implementation are the lack of clearly defined goals; not clarifying the expected benefits and the strategy which will be used to achieve them (Frisk, et al., 2015); and failure of understanding the user requirements (Saeed, 2004). Theory has suggested a vast number of ways which can be used to prevent such problems from occurring – mostly though utilising documentation and planning (those solutions will be investigated further in sections 4, 5 and 6).

However, in relation to the specific case of Creative Solutions Ltd., there is research providing insight into the reason why the company and its team (ref. to point 3.3.2.1. – small team) may have been able to create a fit-for-purpose system despite being non-specialists. Research suggests that the leaders of small teams are likely to come up with an innovative and working
idea even if they do not have any particular knowledge in system development (Gorla & Lam, 2004).

2.3.3 Summary
ISD is a subject which contains a large amount of variables related to all phases which any system has to go through in the duration of its development. Those variables hold risks which are difficult to mitigate, if the procedures and practices suggested by theory are not utilised.

3 Methodology
3.1 Introduction
The researcher has received an ethics approval with reference number 2015D0402 by Cardiff Metropolitan University to carry out the research (see Appendix 1- Ethics Form).

The research approach which is undertaken follows the philosophy of interpretivism. The approach chosen to analyse the gathered data combines elements of both the inductive and the deductive approach.

The approach to investigating the practical resolutions applied by the non-specialists of Creative Solutions Ltd. for developing and implementing an IT system include semi-structured interviews with the team which executed the implementation. This investigation reveals whether the practical solutions coincide with the theoretical implications in the field of systems development and whether there are occasions when a fit-for-purpose system can be implemented without any theoretical knowledge or expert help. Research by a number of different authors in the field shows that in order to create a feasible system, the utilisation of a system development approach is necessary. Also, the literature review proves that regardless of the chosen approach, it is compulsory for the system to go through the stages of the SDLC. The author investigated whether the implementation of a system is possible in a case where the implementation team have no prior knowledge of either the SDLC or of system development approaches. The qualitative data which is gathered from semi-structured interviews is then analysed through the means of comparative analysis between the theoretical methodologies and the practical solutions. In addition, the analysis of the data will show whether there are any phases which the non-specialists have undertaken that are not mentioned in theory but are proved as necessary for successful implementation.

3.2 Research Methodology
3.2.1 Interviewee Population
The researcher has identified a total of 5 current employees of Creative Solutions Ltd. and the outsourced developers’ company – ThinkWeb, who were involved in the development and implementation of the system under investigation. Two out of the three employees of Creative Solutions Ltd. were asked to participate in the research and have answered the interview questions. One out of the two developers involved has been asked to participate and has
answered the interview questions. A total of 60% of the entire population have been interviewed.

3.2.2 Interview Design

After examining the data collection options, the researcher chose to utilise semi-structured interviews (Saunders, et al., 2009) for the purpose of this research. This type of interviews allows the interviewer to explore the researched field, as well as the interviewee to explain their answers and elaborate on the topics in more depth (Tashakkori & Teddlie, 1998). For this particular case, those interviews theoretically prove to be the best option, as they not only allow for the interviews to flow with ease (which is important considering the interviewees’ behavioural traits), but also for collection of the appropriate data. This research requires the gathering of exclusively qualitative data and does not need a quantitative investigation of any sort. Therefore, the semi-structured interviews were found most appropriate for this particular research.

Following the proposed design by Saunders, et al. (2009), the author developed interview questions which would provide the necessary information. The Interview questions can be seen in Appendix 2 – Managers’ Interview Questions and Appendix 3 – Developer Interview Questions. The approved Letter to Organisation (see Appendix 4), Participant Consent Form (see Appendix 5) and Participant Information Sheet (see Appendix 6), can be seen in the appendices.

The ‘Interview Questions – Theory Subordination Matrices’ below will provide the rationale for the asked questions. The Theory sections within the matrices reflect the theoretical methodologies already discussed in the literature review. Through the use of the matrix, the thread of questioning and its relation and focus which it has upon the research path can be seen.

Table 1 elicits the questions posed to the Creative Solutions Ltd.’s implementation team.
<table>
<thead>
<tr>
<th>No</th>
<th>Interview Question</th>
<th>Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Do you know what a “system development lifecycle” and “system development approaches” are?</td>
<td>The participation of non-specialists is essential for the research</td>
</tr>
<tr>
<td>2.</td>
<td>What processes did you go through in order to identify that the old system needed to be substituted for a new one?</td>
<td>SDLC Phase → Plan; Analyse (Skidmore &amp; Eva, 2007)</td>
</tr>
<tr>
<td>3.</td>
<td>Did you consider many alternative solutions to your problem?</td>
<td>SDLC Phase → Plan; Analyse (Skidmore &amp; Eva, 2007)</td>
</tr>
<tr>
<td>4.</td>
<td>Did you create documentation which presents the positive and the negative sides of the solutions?</td>
<td>Looking for utilisations of methodologies within structured approaches</td>
</tr>
<tr>
<td>5.</td>
<td>Did you create any documentation where you stated what you would like to keep and what you would like to change in the new system?</td>
<td>Looking for utilisations of methodologies within structured approaches</td>
</tr>
<tr>
<td>6.</td>
<td>When did you start considering how the new system should look like?</td>
<td>SDLC Phase → Design (Skidmore &amp; Eva, 2007)</td>
</tr>
<tr>
<td>7.</td>
<td>Who made decisions about the way the system should look like?</td>
<td>SDLC Phase → Design (Skidmore &amp; Eva, 2007)</td>
</tr>
<tr>
<td>8.</td>
<td>Was there an approach which you utilised in order to create the system the way you envisioned it?</td>
<td>Determining System Development Approach (Skidmore &amp; Eva, 2007)</td>
</tr>
<tr>
<td>9.</td>
<td>How did you communicate your requirements to the development team?</td>
<td>SDLC Phase → Design; Develop; Determining System Development Approach (Skidmore &amp; Eva, 2007)</td>
</tr>
<tr>
<td>10</td>
<td>When the new system was put in place, did you run it simultaneously with / parallel to the old one?</td>
<td>SDLC Phase → Implementation (Skidmore &amp; Eva, 2007)</td>
</tr>
<tr>
<td>11</td>
<td>Who maintains the new system?</td>
<td>SDLC Phase → Maintenance (Skidmore &amp; Eva, 2007)</td>
</tr>
</tbody>
</table>

Table 1 – Interview Questions – Theory Subordination Matrix; Questions to Implementation Team of Creative Solutions Ltd.

Table 2 presents the interview questions raised to the outsourced development team (for the coding stage).
<table>
<thead>
<tr>
<th>No</th>
<th>Interview Question</th>
<th>Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>How were the initial requirements for the system presented to you?</td>
<td>SDLC Phase → Plan; Analyse; Design (Skidmore &amp; Eva, 2007)</td>
</tr>
<tr>
<td>2</td>
<td>Did you play a role in creating any of the requirements for the system?</td>
<td>SDLC Phase → Plan; Analyse; Design (Skidmore &amp; Eva, 2007)</td>
</tr>
<tr>
<td>3</td>
<td>What platform did you use?</td>
<td>SDLC Phase → Develop; Determining the core characteristics of the system (Skidmore &amp; Eva, 2007)</td>
</tr>
<tr>
<td>4</td>
<td>What programming language did you use?</td>
<td>SDLC Phase → Develop; Determining the core characteristics of the system (Skidmore &amp; Eva, 2007)</td>
</tr>
<tr>
<td>5</td>
<td>Did you integrate systems testing for this particular system?</td>
<td>SDLC Phase → Testing (Skidmore &amp; Eva, 2007)</td>
</tr>
<tr>
<td>6</td>
<td>Did you integrate network testing for this particular system?</td>
<td>SDLC Phase → Testing (Skidmore &amp; Eva, 2007)</td>
</tr>
<tr>
<td>7</td>
<td>What system development approach did you use to create the system to the initial requirements?</td>
<td>Determining System Development Approach</td>
</tr>
<tr>
<td>8</td>
<td>At what stages did you give access to the parts of the system which were ready for use?</td>
<td>Determining System Development Approach</td>
</tr>
<tr>
<td>9</td>
<td>How was feedback provided to you?</td>
<td>Determining System Development Approach; Looking for the utilisation of agile methodologies</td>
</tr>
<tr>
<td>10</td>
<td>Did you find it difficult to create the system to the specifications based on the way they were communicated to you?</td>
<td>Determining feasibility of the chosen system development approach</td>
</tr>
<tr>
<td>11</td>
<td>Did you have to reconstruct pieces of the system to fit any requirements which in your opinion were presented to you differently initially?</td>
<td>SDLC Phase → Plan; Analyse; Design; Determining System Development Approach; Looking for the utilisation of agile methodologies (Skidmore &amp; Eva, 2007)</td>
</tr>
<tr>
<td>12</td>
<td>Did you have to often add new features to the system as new requirements were coming up?</td>
<td>Determining System Development Approach; Looking for the utilisation of agile methodologies</td>
</tr>
<tr>
<td>13</td>
<td>Do you maintain, update and upgrade the system?</td>
<td>SDLC Phase → Maintenance (Skidmore &amp; Eva, 2007)</td>
</tr>
<tr>
<td>14</td>
<td>Are there often new requirements given to you?</td>
<td>SDLC Phase → Maintenance (Skidmore &amp; Eva, 2007)</td>
</tr>
</tbody>
</table>

Table 2 – Interview Questions – Theory Subordination Matrix; Questions to Developer

3.2.3 Data Collection

Participants were contacted by the researcher initially via e-mail (see Appendix 7 – Initial e-mail to Company) in order to establish a connection with them. Following the specified arrangements, the researcher has visited the central office of Creative Solutions Ltd. where the semi-structured interviews were conducted.
Gathering any type of personal data is not required for the purpose of this research, therefore none was disclosed by the participants.

The researcher was taking notes throughout the entire length of the interviews; the interviews were also recorded with the permission of the participants. The transcriptions of the interviews can be seen in Appendix 8 – Interview with Manager 1, Appendix 9 – Interview with Manager 2 and Appendix 10 – Interview with Developer.

3.2.4 Data Analysis
Data analysis will be carried out through the methodology of Comparative Analysis which will be presented in more depth in section 3.3 of this dissertation.

The data will be presented in a form of a table which will allow for an easier comparison between the investigated theoretical methodologies and the researched practical resolutions.

3.3 Comparative Analysis
3.3.1 Theory and Theoretical Methodologies
3.3.1.1 Summary
Thorough the completion of the literature review, it is can be identified that ISD theory states the existence of two major concepts which comprise the process of systems development as it is now known – the SDLC and the system development approach.

According to academic theory in ISD, the SDLC depicts the phases which every new system has to undergo in the duration of its life: from the initial stages of forming an idea - to the maintenance after the system has been implemented. Evidently, a system cannot be created without going through a SDLC.

The second major concept: the approach, refers to the methods which systems developers and analysts utilise when creating a new system. In this paper, those theoretical methodologies are divided into two distinct types of approaches: structured and agile. Both of those types have a large variety of methodologies: some which differ slightly from the others and some which take up an entirely different approach. The developers and analysts choose the most appropriate type of methodology according to the nature of the system which will be developed and its environment. Once the approach is chosen, its strategy is followed by professionals (such as system and business analysts, programmers and test engineers) in the systems development team.

3.3.1.2 Conclusion
Theory suggests that the two abovementioned major concepts (SDLC and systems development approach) are a mandatory requirement in the process of systems development. However, the literature review presents those concepts as highly technical and consequently, as a process which necessitates the aid of specialists.
Research done in the field of systems development is not only very extensive but has also been worked on continuously over the past 60 years. Consequently, the theoretical models involved in the development and implementation processes for developing an IT system for an organisation, have been perfected over time and are likely to have embraced a very large proportion of the possible methodologies utilised for this purpose. In other words, even if a new agile or structured approach is developed, it would still be executing the same tasks but with an alternative point of view.

Therefore, it can be concluded that the theoretical implications in this particular field are the most reliable way forward for organisations utilising information systems. Moreover, as the concepts are highly technical and would require understanding of the material in the field in order to carry out the processes, the involvement of specialists presents itself as needed and very valuable, in order to secure the successful development and implementation of a new information system.

3.3.2 Practical Resolutions

3.3.2.1 Company Background

Creative Solutions Ltd. (see Appendix 11 – Creative Solutions Logo) is a small organisation, operating with a small team (10 people), specialising in a number of different fields with the main ones being: advertising, publishing and events management. The company publishes its own magazine (‘PREMIUM Lifestyle’ (see Appendix 12 – ‘PREMIUM Lifestyle’ Magazine)) which is directly distributed to a certain niche of people who usually occupy senior managerial positions or are owners of companies providing boutique products (watches, jewellery, fashion, wineries, cars, etc.). As a part of its events management field of work, the company organises its own event ‘CHIC & COZY International Party’ which also invites a selected niche of professionals.

The company focuses on establishing personal bonds with all of their customers and partners which is a part of their organisational culture.

3.3.2.2 System Background

In order for the company to maintain the personal relationships with their clients and partners, to distribute its magazine and send invitations for events, an information system is required. Their system is a database.

Initially, when the company started functioning in 2002, the management decided they would keep all of their contacts and contact details in Microsoft Excel Spreadsheets. However, as the database grew larger and larger by the day, maintaining the system became very time-consuming and inefficient.

After the main server in the company malfunctioned, a large portion of the database was lost. That is when the management decided that they needed a new system which they could access online from anywhere, not only through the intranet of the company.
The new database system works on an online based platform and contains all contact details and relevant information related to the company’s clients and partners.

The database managers can either add the details of a new company or a new individual. Individuals are linked to companies and companies are categorised according to their business.

The fields which hold the information within the new online database system are similar to the fields in the old system (e.g. Company Name, Industry, Company Telephone Number, Main Office Address, etc.). The fields are specified to fit with the managerial requirements related to the data which needs to be stored. The identification of those requirements will be elaborated in Section 5 of this dissertation.

3.3.3 Comparative Analysis

Comparative research has a long history in the field of science. It is used extensively in a large number of social and technological sciences as it is arguably a fundamental stand-alone research method just like statistical and experimental methodologies (Lijphart, 1971).

In other words, the aim of comparative analysis is to critically compare and contrast two specified cases. Those could be processes, theories, texts, etc. or any of these in combination (Pickvance, 2005).

The method of comparative analysis in this instance utilises the creation of a number of matrices which depict the current status of the two compared observations (an observation can also be referred to as a case; it is the object which is being compared). Each observation occupies a row in the matrix. Any phenomenon can be studied through applying different levels of analysis to the matrix (Lor, 2010). The different subject areas where this methodology is used require the creation of a set of levels of analysis which vary according to the studied subject.

Due to the diversity of methodologies within the comparative analysis research method and the flexibility of the method, which provide the researcher with the opportunity to tailor it in accordance with the needs of the current exploration, the author finds the comparative analysis to be the most-suited research methodology for this dissertation.

In the case of this paper, comparative analysis will be used as a series of well-defined phases which will present the points of comparison between theoretical methodologies in ISD and the practical resolutions of Creative Solutions Ltd. (the non-specialists).

In section 6 of this dissertation the author will set out and elaborate those steps, where facts gathered from the primary and the secondary research will be presented. Upon organising and displaying the facts, they will be evaluated and compared. The final stage of the analysis will be to present the findings of the research in a clear and concise manner.

Facts gathered from the primary and secondary research will be placed in the matrix as observations. Since the research is looking into several categories related to the research questions (ref. to 1.4 of this paper), those will be the levels of analysis.
The findings will be denoted as descriptive text, as well as in a matrix to enhance the understanding.

4 Theoretical Methodologies

This chapter will elicit the theoretical methodologies of systems development as proposed by theorists in the field. The chapter will be based on the literature review and will present the findings of the secondary research of this dissertation.

As explained in the methodology, comparison will be made between theory and practice. The theory which is referred to, is related to the SDLC and its stages. The SDLC is arguably a set of process which cannot be omitted, and is absolutely essential when a system is being created as evidenced by the literature review.

Table 3 below is created to depict the stages of the SDLC along with short descriptions of each stage. In section 6, the first column of this table will be utilised once again, this time for the purpose of comparison between the theoretically modelled SDLC and the practical resolutions of the non-specialists. Therefore, no further explanation of the stages of the lifecycle will be provided, as that will only make the tables more complicated and consequently difficult to comprehend.

<table>
<thead>
<tr>
<th>Process</th>
<th>Short Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan</td>
<td>This stage looks into the organisation of activities which will be executed in the duration of the development. Here reports regarding initial costing, timeframes, scope, objectives, benefits, drawbacks, etc. are presented. Other relevant reports may be: Business Analysis; Feasibility Check; Cost-benefit Analysis; Risk Analysis; Impact Analysis. An initial plan is compiled. Human resources (teams) are allocated to different tasks.</td>
</tr>
<tr>
<td>Analyse</td>
<td>In this stage, the current system (if there is such) undergoes examination. Facts are gathered, current problems are diagnosed, initial solutions are proposed. Current tasks and actions are investigated.</td>
</tr>
<tr>
<td>Design</td>
<td>This stage is where the features, operations and processes are described in great detail. Some of the most used processes here are: requirements gathering, requirements validation and requirements documentation. Other processes in this stage include choosing what the system will look like (colours, form of button, etc.), on what platform will it be built, what programming language will be used, who will have access to it, etc.</td>
</tr>
<tr>
<td>Develop</td>
<td>This is a purely coding stage.</td>
</tr>
<tr>
<td>Test</td>
<td>During this stage, the entire system is put together and different sets of tests are being run to assure the fully finished system is working correctly in the environment.</td>
</tr>
<tr>
<td>Implement</td>
<td>This is the final stage of the development itself. In this stage the system is produced and actually run in the organisation.</td>
</tr>
<tr>
<td>Maintain</td>
<td>This stage is ongoing until the system is disposed of. In this phase, the system is being ‘looked after’ by specialists who assure that it is working correctly.</td>
</tr>
</tbody>
</table>

Table 3 – SDLC processes Short Description

Each of the stages has a specific set of actions which have to be executed in order for a finished product to be implemented at the end of the development (the ISD approach is not taken into consideration).
In Section 6, the methodology of comparative analysis will be utilised to compare these stages to the stages formulated from the primary research.

5  Practical Solutions

This chapter will present the findings from the primary research in two main forms – descriptive and tabular (matrix), the latter being used in the comparative analysis in section 6.

A summary of the interviews with the managers will be provided first. The summary will be a combination of the answers given by both managers, as the researcher has noticed that the answers hold the same information. However, each manager provides more insights into their respective field. Everything mentioned by both managers will be described in the overall summary. For its purpose, the author will not specify which answer belongs to which manager, as this will not enhance the research in any way but only make the text more difficult to comprehend.

A similar summary of the interview with the developer will follow. The summaries will be merged together in a matrix (see Table 4 in section 5.3) describing the findings in the form of phases as they happen in a chronological order. Those phases will be formulated directly from the answers provided by the interviewees.

5.1  Managers’ interviews summary

The interviews were conducted in the main office of Creative Solutions Ltd. at a time specified by the interviewees. Both managers were interviewed in their respective offices.

The managers are not familiar with the SDLC nor with any of the systems development approaches suggested by theory. This is an important factor in the research as the researcher is investigating the successful development of a system without the applications of any theoretical knowledge in the specific subject of systems development.

The first action which was undertaken towards the development of a new system in the company, was to identify that the old system was not working as required for the needs of the employees and the company itself. The old system was based on storing all data on a large number of spreadsheets on a main server. As the input of data grew and needed to be constantly updated, the employees responsible for updating and maintaining the data were struggling to manage all static spreadsheets. Additionally, in 2011, the main server, where all the data was kept, malfunctioned which resulted in large data losses. This point in time can be taken as the turning point when the necessity of a new and better system was needed.

The company managers spoke to the database managers. Together they identified a number of improvements which were to take place in the new system. The identification process was conducted through oral means (formal and informal meetings between the managers and the employees working with the database) and practical use of the old systems by all parties (employees and managers). The managers also observed the processes the employees go
through when utilising the system, in order to obtain a better understanding of the current practices (employee-shadowing). No specific requirements were written down formally in relation to the features wanted in the new system.

The decision that the system should be online was quickly made after the malfunctioning of the server. This idea, as well as the desire to keep the data fields used within the old system were the two basic principles which derived the creation of the new system.

No formalisation or documentation was used during this period. Some ideas were written on a Microsoft Word Document, however, keeping a record of the required features was the responsibility of one of the managers.

In the team meetings, the managers and the rest of the involved staff were given tasks which they needed to look after. Those tasks were not specific and were better explained as a label for an overall matter which needs to be managed. Most of those were handled by one of the managers themselves.

Once the idea of having a new system became definite, the managers started searching online for different types of customer relationship management (CRM) systems and online databases. It was identified that, even though there are a large number of such systems, they are highly expensive; have features which the company does not need and do not have others which are required; and are generally designed for large scale businesses.

This resulted in all online researched alternative solutions deemed to be incompatible with the company’s requirements. Additionally, once again, no formal documentation was produced during the process.

After this research was conducted, the managers turned to one of their partner companies – Think Web – programming experts. For the purpose of this dissertation, they will be referred to as the ‘development team’ or ‘developers’.

In the duration of the initial meeting of the two teams, the management team communicated their requirements to the developers. Suggestions for improvements were made by the developers themselves, which were driven from a purely technological point of view. However, they were found very helpful by the managers and a number of the developer’s ideas were implemented into the new system.

If an idea for a new feature was generated by either of the teams, a Skype conversation (or more rarely an office meeting) allowed discussions to be made at any time since the two companies started working together and is still ongoing in the maintenance stage.

The author finds it important to mention that the teams of Creative Solutions Ltd. and ThinkWeb have built a strong, trustworthy working relationship which allows the teams to communicate on a less formal level and consequently allows for a more flexible working environment.
During the creation of the actual system, the development team often showed the progress to the managers of Creative Solutions Ltd. Feedback was instant and if any issues or ideas were to arise, they could be quickly talked over and either rejected or implemented in the system design.

Once the system was built, it was instantly run. As it is an online system, the developers were responsible to assign it to a network which could support the traffic and the data storage requirements.

From the moment of the initial release until now, the system is being maintained by ThinkWeb. If the employees of Creative Solutions Ltd. encounter an error or require any support, Skype conversations with the developers are arranged almost instantly. During those conversations, the problem is identified and (in most cases) fixed on the spot by the development team. If the error requires a longer time to be fixed, the developers inform the employees immediately after the problem has been resolved.

Once the new system was running, the data from the old system was transferred into the new system. However, due to the amount of data, the transfers took a large amount of time during which the two systems were run simultaneously.

5.2 Developer’s interview summary

The interview was conducted in the main office of ThinkWeb at a time which was appropriate for the developer.

In relation to the interview questions, they were asked and answered in a semi-structured format.

The initial requirements for the system were presented to the developers during their initial meeting with the management team. The format was verbal and no official documentation was provided. A list with specifications used by the managers was discussed in the meeting, in order for the teams to identify the feasibility of the desired requirements.

During the initial discussion, as well as throughout the entire duration of the development, the expertise of the development team was utilised. The team took part in depicting the functionalities and the design of the system by suggesting different options to the managers. Eventually the two teams would reach an agreement regarding the specifications.

The developers used a proprietary platform which they had previously coded – ThinkCMS by ThinkWeb. The programming language used to code the system (it is online – one of the requirements of the management team) is PHP.

System testing for this particular system was integrated during the coding of each specification. An overall system testing was initiated for the platform itself upon its initial build, however that does not directly relate to the system built for Creative Solutions Ltd.
Similarly, network testing was performed upon the build of the platform. As creators of the platform, the development team were aware of the capacity of the network which they are using. Therefore, upon completion of the initial version of Creative Solutions Ltd.’s system, network testing was not found necessary.

The communication amongst the two teams – management and development – was constant. The continuous feedback allowed the developers to code to the specifications with a very small amount of uncertainty about any of the features of the specifications. Many iterations were presented and executed from the beginning of the development process to the current point in time – maintenance. The feedback also used user testing as it was provided upon completion of each specification. This type of testing identifies whether users are satisfied with the new feature.

After the coding of the primary requirements (which started immediately after the first meeting), the system was shown to the management team. Likewise, after the development of every new specification, the developers tested it in the system and presented it to the management team. Those presentations were usually done through Skype calls and more rarely as meetings. If any issues were to arise with the newly developed requirement, the development team could immediately respond to those. All issues identified by the management team were always communicated to the developers as soon as possible, once again mainly through the means of Skype calls.

During the initial meeting, the development team took notes, informally documenting the initial requirements presented to them by the managers. Due to the open and easy-going communication between the two teams, the developers were able to concur with the managers on any ambiguities regarding the system requirements. Equally, if any requirements presented by the management initially were changed, those could easily be communicated to the developers, who in turn would modify the system to fit the new specifications.

As the database enlarged, there have often been and still are, new requirements emerging. As per the contract signed by the two companies, ThinkWeb maintain and update the system on demand.

5.3 System Lifecycle Phases: Non-specialists
The following matrix is based on the data gathered during the interviews which is summarised in points 5.1 and 5.2 above. It will elicit the stages of the development of the aforesaid system in chronological order.

For simplicity, the names of the phases will be aligned with the theoretical names, if their descriptions coincide (see SDLC’s phases description in section 4).
<table>
<thead>
<tr>
<th>Phase No</th>
<th>Phase Name</th>
<th>Phase Summary</th>
<th>Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Planning + Analysis</td>
<td>Trigger for decision; Analysis of the old system – good and bad features + Requirements statements for the new system – online, to have the same data fields; Online research of CRM systems and databases. ‘Overall’ managerial tasks allocation</td>
<td>Formal and informal employee – managers conversations; No formal documentation; Initial phone call (followed by meetings related to the next phase)</td>
</tr>
<tr>
<td>2</td>
<td>Finding a Development Team</td>
<td>Contacting a partner company.</td>
<td>Office meetings and Skype calls; No specific time allocated (ad hoc);</td>
</tr>
<tr>
<td>3</td>
<td>Design + Development</td>
<td>Iterative → specification – development (system testing) – feedback (user testing) – specification – development (system testing) – feedback (user testing)...; Development started instantly after the initial meeting.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Implementation</td>
<td>Upon completion; The old and the new system run simultaneously as information from the old system had to be translated to the new system.</td>
<td>Employees updating and preparing old spreadsheets to import them into the system; Skype calls (primarily); office meetings (rarely)</td>
</tr>
<tr>
<td>5</td>
<td>Maintenance</td>
<td>Ongoing – employees’ feedback to development team.</td>
<td></td>
</tr>
</tbody>
</table>

Table 4 – System Lifecycle Phases: Non-specialists’ matrix.

The matrix presented in Table 4 holds the information gathered by the primary research. The data collected from the interviews with the managers’ team and the development team who had been working on the creation of the system, is represented in the form of phases of a lifecycle of a system created by non-specialists.

The outcome of the analysis of the quantitative data reveals that the non-specialists have used a 5-stage system development lifecycle. The stages are (in chronological order):

- Planning and Analysis
- Finding a Development Team
- Design and Development (Testing implemented in the stages)
- Implementation
- Maintenance
Description of the stages is provided within the matrix. It specifies what processes have occurred in the duration of a particular stage (Phase Summary) and what means have been used to communicate information between the two teams (Means).

The research also uncovers that the approach to the development phase can be classified as ‘iterative’ (the entire process of system development falling under the ‘hat’ of agile approaches). Evidence of that finding can be seen in the description of phase 3 in the matrix. The graphical representation is provided to ease the understanding of the iterations within the non-specialists’ SDLC and, as later explained – approach.

![Non-specialists' SDLC and Approach](image)

The initial phase is Planning and Analysis. It is followed by the Finding a Development Team stage (or finding a platform which will be used to build the system on. In the case of Creative Solutions Ltd., the managers took the decision not to use any of the platforms they found on the Internet, but to outsource the code-writing process to programming specialists). The third phase is Design and Development. The processes within this stage are being repeated until the best possible outcome within the time frame and the budget is achieved. There is no particular time frame – work is done on demand; all implementations are to be ready ‘as soon as possible’. The iteration in this stage is: formulating a specification (done by Creative Solutions Ltd. team), developing/coding the specification on to the system and testing the new code (outsourced company – ThinkWeb), feedback provided along with user testing (delivered by Creative Solutions Ltd. team). If the feedback is positive, the change is accepted and remains live within the systems; if it is negative the iteration is repeated. This process occurs for all specifications. Once all main specifications are developed, the system is implemented and is used by
employees of Creative Solutions Ltd. A separate Testing phase does not occur as both system and user testing happen as the system and its specifications are being developed and presented for feedback. The final phase is Maintenance; this phase is ongoing. If a new specification has emerged, the two teams communicate and discuss it. For this particular specification, the process is repeated from the Design and Development stage onward, the difference being that the implementation phase no longer concerns the entire system but only the newly developed specification.

Following on from that point, it can be logically concluded that the system developed by the non-specialists has its own system development lifecycle from which an approach to systems development is built. Due to the iterative and unstructured (no specific time frames, documentation, etc.) nature of the processes taking place in the approach, it can be concluded that the newly developed approach of the non-specialists is in fact a type of Agile Approach. Further support for that statement can be seen in the literature review (section 2.1.2.2) where the fundamentals of agile approaches are discussed. It is presented that Agile originates from the iterative (and incremental) approaches and that it is strongly people-oriented. In the case of Creative Solutions Ltd.’s approach, the entire system development was driven primarily by the stakeholders of the system – their problem statements and ideas have been the origin of the concept of creating a new system in the first place. Also, this system is specifically made in order to ease the work of the database managers in the company. Another very important factor linking the non-specialists’ approach to Agile is the constantly provided feedback given by all stakeholders (both from the development and managerial teams).

To conclude, the system created by the non-specialists has its own SDLC. Its resemblance to the theoretical representation of a SDLC will be discussed in the following chapter. From the said lifecycle, an approach to systems development has also been created. It is based on the processes followed in the duration of the system’s creation. The researcher has also established that the newly developed approach is a part of the agile approaches. Evidence of that statement can be seen by exhibiting an understanding of the core principles of the agile approaches and comparing those to the principles applied by Creative Solutions Ltd., uncovered by the primary research conducted for this dissertation.

6 Comparative Analysis
This chapter will critically compare the findings from the primary and secondary research and will analyse the differences identified by the comparison of the characteristics. Those characteristics are the phases of the SDLC.

For the purpose of this dissertation, the phases proposed by theory will be the baseline characteristics. In this case, the baseline represents the scenario to which the alternatives will be compared (in this paper, those alternatives are the practical solutions applied by Creative Solutions Ltd.).
The establishment of such a baseline is vital for the research and specifically its outcome. If neither of the two sets of characteristics (SDLC phases) are not set as a baseline to which the other set is compared, the results will have no meaning, as all characteristics will have to be taken as variables by assumption. This is due to the fact that both sets have been created by the author of this dissertation as a part of the research. However, it is presumed that the secondary research, in this case the theory explaining the SDLC, is the more reliable methodology, as it has been studied by theorists and utilised in the field of ISD for a much longer period of time.

Therefore, the SDLC phases established by theory and stated by the secondary research for this dissertation are assumed to be a constant and consequently are used as baseline results for this paper.

A comparison table (Table 6 below) gives a concise presentation of the descriptions of the characteristics which allows the reader to better understand the compared characteristics and identify the differences and similarities.

Upon identification of the differences, descriptive analytical conclusions will be presented after Table 6. They will be divided into three parts each: similarities, differences and conclusion. The first two will be established by the comparison to the baseline characteristics and their processes.

The similarities will show only the analogous processes of a certain characteristic. The differences will specify processes which vary and/or not utilised within the non-specialists’ SDLC. The conclusions section will state the outcome of the previous two sections (similarities and differences).

Table 6 - *Comparison between Theory Defined Phases of SDLC and Practice Defined Phases of SDLC* is colour coded in order to facilitate an even better understanding of the facts. The meaning of the colours is given is Table 5 below.

<table>
<thead>
<tr>
<th>Colour code map for Table 6</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dark Blue</td>
<td>Headers; Phases</td>
</tr>
<tr>
<td>Light Blue</td>
<td>The processes are different to a large extent</td>
</tr>
<tr>
<td>Light Green</td>
<td>The Processes are identical or largely similar</td>
</tr>
<tr>
<td>Light Red</td>
<td>The processes exist within the boundaries of a different phase in the same lifecycle</td>
</tr>
</tbody>
</table>

*Table 5 – Colour Codes for Table 6*
<table>
<thead>
<tr>
<th>Theory Defined Phase</th>
<th>Theoretical Description</th>
<th>Practical Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning</td>
<td>Activities regarding the process of developing the new system are created and documented. Relevant reports are produced. Alternative solutions are considered. Human resources are allocated to relevant tasks.</td>
<td>The good and bad features of the current system are examined but not officially documented. Simultaneously alternative solutions are examined but not officially documented. Through team meetings 'overall' tasks are allocated.</td>
</tr>
<tr>
<td>Analysing</td>
<td>Identification of issues, problems and solutions within every part of the existing system (system may be a computer/IT system, paper based, or other). Documented.</td>
<td>A development team is contacted and a business relationship is established.</td>
</tr>
<tr>
<td>Designing</td>
<td>Descriptions of every part of the new system are formulated and documented. Reports and tasks focusing on the requirements for the new system ensue. Meetings are organised to communicate requirements.</td>
<td>The main features are specified in the first meeting of the management and the development teams. Developing (coding) starts immediately after the initial meeting. New design ideas/new features are specified ad hoc, commented on by the managerial and the development teams and upon agreement instantly developed. Upon completion of a specification the developers test it in the system before presenting it to the managers who perform user testing. The phase is either repeated if the feature needs to be amended or a new feature is needed, or the next phase</td>
</tr>
<tr>
<td>Developing</td>
<td>Programming experts are writing code to the specifications (requirements) identified in the previous stages.</td>
<td></td>
</tr>
</tbody>
</table>
Testing

Tests are run on the every part of the system during this stage. It checks whether the entire systems works to the specifications.

A part of the Designing and Developing Stage.

Implementing

The system is run in the organisation. This is the final stage of the development process.

Implementing

Maintaining

This is an ongoing phase in which the system is getting updated and debugged on demand (depending on the contract between the developers and the owners of the system).

Maintaining

| Table 6 – Comparison between Theory Defined Phases of SDLC and Practice Defined Phases of SDLC |
| --- | --- |
| **Phase** | **Theory** | **Practice** |
| Testing | A part of the Designing and Developing Stage. | Testing | Occurs. |
| Implementing | The system is run in the organisation. This is the final stage of the development process. | Implementing | Occurs. |
| Maintaining | This is an ongoing phase in which the system is getting updated and debugged on demand (depending on the contract between the developers and the owners of the system). | Maintaining | Occurs. |

6.1 Phase: Planning

6.1.1 Similarities

The processes which are, in their core, the same are: the examination of alternative solutions for the creation of the new system (such are different platforms and bespoke contracts with a development team); and allocating ‘overall’ tasks to different team members who are involved in the creation of the system.

6.1.2 Differences

The management team of Creative Solutions Ltd. did not examine to a full extent the tasks which are fundamental for any development of a system. They arrived at logical conclusions about what sort of tasks have to be undertaken for the duration of the development, however, without consulting any theory, they could not know what sub-phases a system development goes through. Consequently, they could not identify all preliminary actions which should be undertaken (according to theory). An example of such actions for this particular stage would be the non-production of relevant reports (such as Business Analysis; Feasibility Check; Cost-benefit Analysis; Risk Analysis; Impact Analysis).

Another example derived from the same lack of theoretical knowledge is the fact that the task allocation which was done by the team does not address all issues which exist and need to be managed throughout the process of the development of the system. The allocated ‘tasks’ are related to major parts of the development such as ‘searching for alternative solutions’, ‘finding a development team’ and ‘communication with the development team’ where, in fact, the tasks
specified by theory are related to the production of the abovementioned reports and all of the research which is used as reference for their creation.

Other tasks which go beyond this stage also need to be allocated at this point, such as tasks related to the processes happening in the consecutive phases of the development. This will allow the team to better manage their time and resources and will lessen the chances of timetabling problems occurring. Such problems may lead to loss/wastage of resources (specifically time and monetary).

A further difference is the merge of the Planning and Analysis phases and the order of execution of the processes within them. The management team have initialised the development by deciding to change the system (after the trigger situation happened – the malfunctioning of the main server) - (Planning Phase), quickly followed by undertaking analysis of the current system (Analysis Phase) after which they have proceeded with searching for alternative solutions (Planning Phase), followed by a form of task allocation (Planning Phase) all the while identifying requirements for the new system (Analysis Phase).

It also has to be mentioned that no real documentation has been produced; instead live Word Documents with the manager’s comments were created. But mostly, it is relied on the memory of the manager to remember the specifications and outcomes of any research which was undertaken. This poses a threat to the systems as a whole and its success upon implementation. This threat is formed due to the unreliability of the human memory and possibly its non-availability at critical moments. The manager has a variety of tasks which need to be attended to on a daily basis and, as a result, important requirements or information may be lost and consequently not embedded in the system, thus making it unfit-for-purpose. Fixing such an outcome is usually costly and time-consuming.

6.1.3 Analysis of the Planning Phase

Firstly, the non-production of relevant reports will be discussed. This omission is a large risk to the company as the essence of these reports is aimed at assuring the management that the change is feasible. They would present how much financing would be required for this particular change and more in-depth research would show the costing for the different phases. Knowing those numbers will allow for a better resourcing of the human manpower, also it will allow the management to follow the flow of finances in and out of the company and identify if a particular process requires more financing than necessary. If that is so, a further analysis will present a problem. In correlation to that, a report on risk assessment should have covered most of the potential problems which could occur and where money could therefore be saved.

Secondly, by not understanding what processes occur during the development, the management are unable to foresee tasks which will need to be handled as the system is undergoing its SDLC. As mentioned above, not knowing those processes and consequently not allocating tasks to team members, risks of setbacks rise considerably. That is due to the ‘surprise factor’ which the team would experience upon the natural uncovering of a process specified by
theory. Setbacks could be very costly and disconcerting and which would impact the work behaviour of the team by raising tension within the work environment, which in turn could impact the work quality of the employees (Lumley, et al., 2011).

Thirdly, the lack of formal documentation as examined in the previous section, can lead to the conclusion that this action increases risk of failure due to unreliability of human memory and the inconstancies with may occur while communicating the requirements to the development team in a later phase. Therefore, theory suggests (depending on the system development approach) at least some form of formal documentation of requirements and research findings should be established.

Lastly, the merging of the first two stages of the SDLC and the disordered execution of tasks demonstrates that the management team was executing tasks as they appear without any initial planning of their order. The researcher concludes that this ad hoc approach is due to lack of planning (which is the first phase in the theoretical SDLC).

However, this ad hoc dynamic reveals the true logical order in which processes occurred during the creation of the new system as undertaken by Creative Solutions Ltd.

It can be logically concluded that the theoretically suggested approach does not correspond to the steps followed by practice in this particular case. The differences between the theoretical methodologies and the practical solutions come from the following of the logical order of events (or processes) as they occur in the environment of the non-specialists. This leads the researcher to believe that the inconsistency is due to perfecting the theoretical approach so as to allow for a more structured and subsequently less chaotic, less confusing and better prepared team and resource allocation which ultimately lead to a more concisely developed project with minimal risk, less setbacks and less resource losses.

6.2 Phase: Analysing
6.2.1 Similarities
The features of the current system are examined.

6.2.2 Differences
Due to the abovementioned merge of the Planning and Analysis phases in the non-specialists’ SDLC, a large amount of the differences and conclusions have already been critically evaluated and analysed in the previous section (point 6.1.2 and 6.1.3 of this dissertation).

The processes suggested by theory which relate to the examination of the current system differ from the processes which occurred in Creative Solutions Ltd. The differences are related to the type and style of analysis of the current system which usually happen (as suggested by theory). The researcher identifies those as: identifying problems (could happen through different means such as employee shadowing), diagnostics of the identified problems, investigation tasks and actions performed by the systems and staff members. It is advisable to formally document all of these processes and their outcomes as those identifications will be grounds for the creation of
requirements, which is done in the following phases. However, no formal documentation was produced; the problem identification happened in the form of non-structured reports during team meetings; the tasks investigation was performed by one of the managers in an on-demand basis. Put in other words, the manager asks the employee currently working with the system to perform the tasks they usually perform while being observed. This is followed by a discussion and the outcomes may or may not be noted in the live document of the manager.

6.2.3 Analysis of the Analysing Phase
Through examining the differences in the processes related to the Analysis Phase, the researcher identified a large amount of ambiguity regarding the collection of data in the form of issues or problems with the tasks performed by both employees and the system. The outcome of these unstructured processes is not formally documented thus corrupting the integrity of the collected data even further and consequently sets an uncertain ground for the formulation of requirements for the new system.

Also, as mentioned previously, due to the intertwining of the Planning and Analysis phases, many of the differences and conclusions discussed in the previous sections (6.1.2 and 6.1.3) are largely similar and will not be examined once again, as the outcomes will be the same. However, those will be once again mentioned.

The lack of formal (or any) documentation presents a large risk associated with the integrity of the collected data which, as described above, threatens the production of correct specifications to which the new system would be built.

6.3 Phase: Finding a Development Team
6.3.1 Similarities
None.

6.3.2 Differences
This phase does not occur in the theoretical model as a stand-alone.

Nonetheless, the process of finding a development team or a platform on which to run the software is a valid process which occurs in the Planning Stage.

The DSLC ‘created’ by the non-specialists, is presented as a separate phase, even though the actual duration of the phase is relatively short. It occurred as a natural progression of the lifecycle, as it would be impossible to continue the development without undergoing this phase.

Sections of the phase were already executed in the Planning and Analysis phase where the management team identified that it would not be feasible for the company to utilise any of the services they found online. However, the core of the process, as stated, is found in finding a development team and establishing a working relationship with them for this particular project. As this stage occurred on-demand at this particular point in the development process, it is stated as a separate phase.
6.3.3 Analysis of the ‘Finding a Development Team’ Phase

The researcher can conclude that the occurrence of this phase at that particular moment of the development is due to the fact that the management team are not familiar with the theory in the field. Had they been aware, this phase would not have appeared as a disruption of the theoretical model, as they would have finished it in the planning phase.

The researcher identified that this issue occurs as a result of the inaccurate undertaking of the planning phase. It is believed that the lack of appropriate planning allows room for the appearance of sub-phases or, as in this case, entire phases which may lead to a number of setbacks. Most commonly, resources such as money and time are lost. Consequently tension among the team members may increase which could lead to disturbances in the workflow and accordingly more losses (Ciriello, 2010).

In some cases it may be argued that since no timeframe is set, then no real development time is lost. However, in this case, the researcher was informed that the timeframe for the development of the system could be referred to as ‘ASAP’ (As Soon As Possible) which logically signifies that any setbacks are harmful for the company.

As a result of this critical discussion, it can be concluded that this phase occurs as a natural progression which follows a logical but unstructured/not-planned order of occurrences which need to happen in order for the development to continue. This occurrence may be costly as it stops the progression suggested by theory in order to complete a task which had already begun in a previous phase but was never finished. Such back-and-forth processes are costly in terms of time, human resources and monetary resources (Leido, 2014).

Logically, the researcher can identify that following the order of the processes identified by theory is more efficient as it minimises the loss of time and effort by structuring processes and adding them to their appropriate phases within the lifecycle.

6.4 Phase: Designing

6.4.1 Similarities

The main features of the new system are specified during the initial meeting of the management and the development teams.

The two teams discussed the specifications and reached conclusions on what can and cannot be done. The development team made educated suggestions regarding functionalities which can be incorporated (coded) into the system. Those suggestions were either approved or rejected.

6.4.2 Differences

The main differences occurring in this stage are related to the execution of the processes related to the identification of the requirements. The management team do not present any formally structured specifications to the development team. This is due to the fact that relevant processes such as Requirements Gathering, Requirements Validation and Requirements
Documentation are not executed. Once again, it can be determined that those are not utilised because the team is unaware of them.

Also, the requirements gathering stage is executed in an unstructured manner where the company manager and the database managers would have discussions regarding the issues of the system during various team meetings. Those issues would not be documented formally but could be noted by the manager in her live document to further be discussed with the development team at a later time.

The way the requirements are communicated to the development team also differs between the theoretical suggestions and the practical solutions applied by Creative Solutions Ltd. Where theory specifies that all requirements should be well described and documented, the approach followed by the non-specialists is much less structured, verbal and mostly ‘off the top of my head’. Some specifications which were kept in the live document were written down though not-fully described, however others were presented to the development team on the day of the initial meeting, followed by discussions about their feasibility. All specifications were written down by the outsourced development team who write the code to those requirements.

However, not all specifications were presented to the development team during this initial meeting. Some requirements appear as a follow-up. Those are communicated to the developers as they emerge, through the means of telephone calls, Skype calls or less often office meetings.

Another major difference is that the design phase is merged with the development phase and neither of them can be identified as stand-alone phases in this SDLC.

6.4.3 Analysis of the ‘Designing’ Phase

Once again, as a consequence to the unawareness of the theoretical methodologies, the non-specialists do not execute what is believed to be essential parts of the designing stage – the requirements gathering, validation and documentation processes. This may lead to inconsistencies when the requirements are presented to the development teams, thus carrying a risk of ending up with a system which is not fit-for-purpose due to ambiguity or simply wrongly presented requirements. This would lead to a major setback, which would be highly costly and time-consuming to fix. However, the severity of the setback will depend on the approach of the system’s development and more precisely how often the constructed parts of the system are presented to the management team. If they are shown often, the risk is smaller, as the team would be able to feedback what they find unfit-for-purpose and vice versa – if the development process goes on until the system is completed, then the re-designing and re-coding the ‘wrong’ parts of the system would take more time and more money.

The process of gathering the ‘correct’ requirements and accurately presenting them to the development team is highly dependent on a number of different factors. In this case, those are the processes on requirements gathering, validation and documentation. It can be concluded that by not executing those correctly or at all can be highly risky in relation to how fit-for-purpose the system is and how much time and money it has cost the company.
Similarly, not gathering and presenting all specifications to the development team during the initial design stage can slow down the work of the developers which results in delays in development and consequently monetary losses.

Once again, it can be concluded that following the theoretical methodologies allows for a more structured and hence a more efficient and less wasteful development.

6.5 Phase: Development

6.5.1 Similarities
Programming experts write code to the previously provided specifications.

6.5.2 Differences
The major difference in this phase is that it is merged with the design phase. This leads to change in the iterations of the process of coding for the ISD approach point of view.

The development team are also included in the designing on the systems. As specifications occur ad hoc after the initial requirements were given in the first design meeting, the coding iteration (coding-process) occurs as follows: the initial specifications are given, discussed, coded, system tested, presented to the management team, user tested and comments are fed back; new/changed specifications are given, discussed, coded, system tested, presented to the management team, user tested and comments are fed back, etc.

From this description, another major difference other than the process can be identified. Those are the incorporation of different types of testing into the design phase itself and the feedback. Testing, however, will be discussed in depth in the next section.

6.5.3 Analysis of the ‘Development’ Phase
The short iterations of the development of each, or a number of specifications, before testing them and presenting them to the management, correlate this phase of the SDLC directly to the system development approach origin of the lifecycle. Therefore, it has to be noted that in this case, the lifecycle and the approach are strongly connected, simply because the coding phase is broken up and bound to an iteration. This iteration is a coding process. As a result of this ‘process’, the coding phase is enlarged as more micro-processes are added to it. Consequently, the phase is not over until a large proportion of the iterations have produced an initial finalised ‘version’ of the product.

The word ‘version’ is used here to suggest that new specifications appear on demand in different periods of time. However, the counting of those periods of time starts after the initial development – after which the system is fit-for-purpose, or in other words – when the system is in a state of ‘finished’. After another specification is coded, a new state of ‘finished’ occurs. Therefore, it can be said that the system has a number of finalised ‘versions’ of itself, which happen after the coding process of every new specification. After the emerging of each new version, the previous one no longer exists.
The iterations created within the Design and Development phase of the non-specialists’ lifecycle demonstrate the connection between the lifecycle and the ISD approach which originates from it, as a natural progression of actions undertaken by the non-specialists.

6.6 Phase: Testing
6.6.1 Similarities
None.

6.6.2 Differences
This phase does not occur in the non-specialists’ model as a stand-alone.

Both types of testing (system testing and user testing) are a part of the development phase as described in the section 6.5.2 and 6.5.3 above.

Testing is a part of the lifecycle, however, the processes are not presented as a separate phase due to their incorporation in the above-mentioned coding process within the Design and Development phase.

Testing of the entire finalised primary version of the system was never initiated as the developers have used a platform previously developed by them, on which they eventually build the system to the initial specifications. The usage of their own platform provided them with a sense of security regarding the success of the system and all of its components, necessary for its ability to work (including the hardware, storage, network, etc.), as the platform itself was tested upon its creation. However, examining the work of ThinkWeb (the company of the development team) is beyond the scope of this dissertation.

6.6.3 Analysis of the ‘Testing’ Phase
The steps followed by the non-specialists regarding this phase cannot be examined ‘in a vacuum’ as the facts presented by the primary research – Developer’s interview summary (see section 5.2) demonstrate that testing of the system was not initialised as a separate phase (as described in Figure 3). However, testing of the platform of the system was undertaken outside of the boundaries of the system itself and consequently outside of the scope of this research.

Nonetheless, it can be concluded that executing system testing and user testing as a part of the development process, allows for quick feedback and reduces risks associated with coding errors and misunderstanding of the specified requirements. Such risks may be higher due to the already mentioned lack of formalisation of the requirements and the processes associated with their gathering and delivery to the development team.

Once again, the resemblance and connection between this SDLC phase and a phase which is a part of an agile or iterative approach must be mentioned. The author will further comment of the approach derived from the SDCL in section 8.1 below.
6.7  Phase: Implementation

6.7.1  Similarities
All processes in this stage are the same.

6.7.2  Differences
None.

6.7.3  Analysis of the ‘Implementation’ Phase
As has been identified in the sections above, the lack of theoretical knowledge in the field of systems development leads to the incorporation of changes in the processes and their order in the SDLC, if those processes allow room for such change. Consequently, it can be concluded that since all processes in the implementation phase are the same, this phase does not allow any room for change to be adopted. What this means is that the theoretical methodology has captured the essence of the phase and has described it exactly as it is in the real world. Through analysing this statement, it can be identified that the phase does not contain any processes which can vary in different scenarios.

6.8  Phase: Maintenance

6.8.1  Similarities
The system is maintained – debugged and updated, according to the contracts between the developers and the system owners (presumed that the owners of the system are its users).

6.8.2  Differences
As stated in Table 6 above, the processes within this stage can vary depending on the contract between the development team and the owners of the system (presuming that the system is owned by the company which is using it). This statement signifies that each and every system could be undergoing different set of processes. However, the core process defined in Table 6 and in section 6.8.1 above is the same for all cases.

6.8.3  Analysis of the ‘Maintenance’ Phase
After analysing section 6.8.2 above, it can be concluded that the processes occurring in this phase are contractually defined.

7  Conclusion

7.1  Scientific Contributions
A new approach to systems development can be derived through the investigation carried out in this dissertation. The approach can be classified as Agile due to the constant provision of feedback for the duration of the development and its iterative nature.

The approach itself is created from the SDLC which the development of the system of the non-specialists has followed. This represents the strong correlation between the non-specialists’ SDLC and their approach to system development.
The steps to the approach are summarised graphically in Figure 3 – Non-specialists’ SDLC and Approach, which is once again presented below for ease of understanding.

*Figure 4 – Non-specialists’ SDLC and Approach*

The main features of the approach can be summarised as follows:

The iterations in this approach are not time-boxed but ad hoc which allows for greater flexibility, although it introduces a variety of risks (explored in the sections above).

Constant feedback is provided. This allows for minimisation of errors related to misunderstandings but can be found time-consuming for both the development team and the management team.

No official documentation is provided. As agile methodologies depict, this decreases the time required for the initial stages of development and allows more focus on the actual development of the system. However, this lack of documentation can present risks associated with the integrity of the system and how fit-for-purpose it is actually built. This risk is minimised by establishing a trustworthy relationship between the management and the development teams. This relationship proves to be vital for the success of the approach, as presented by the behaviour of the two teams, which can be seen in the sections above, by their communication practices.

**7.2 Critical Précis**

As technology evolved, demand for the development of new information systems grew rapidly. The structured approaches to system development quickly became less feasible to a large number of organisations. This was due to the rapid change in the technological environment...
which demanded for a quicker and more flexible development. Therefore, in the 1970s, theorist Dr Royce argued that a new, ‘non-traditional’ approach to ISD (information system development) should be created. It would allow the required flexibility and consequently better systems would be developed in a more feasible timeframe.

As similar changes kept on emerging and evolving, there was always one constant in the field of ISD – the SDLC. It is not an approach to systems development but is arguably a model which cannot be omitted or significantly altered; it is the summation of phases and processes through which any information system has to undergo, in order to be created.

Through the secondary and primary research, this dissertation has established which phases and processes occur in the theoretical model of a SDLC; and has compared them to those established by a purely practically driven methodology of SDLC, followed by the non-specialists working in Creative Solutions Ltd., presented in sections 4 and 5.

Deriving from this background to the research, a problem statement was formulated. It concerns the creations of systems by non-specialists without consulting either theory or professionals in the field of ISD; and how such systems are built successfully.

The dissertation goal was achieved by identifying the steps suggested by theory and needed for the development of a system and those followed by practice; and providing a comparison between the two. By doing this it was identified that the practical resolutions applied by the non-specialists and the theoretically suggested models correspond to each other to a large extent with minimal differences. Lastly, it was determined that the specific case of Creative Solutions Ltd., examined in this research, proves that hiring a specialist, or even knowing the theory, is not always necessary in order to create a working, fit-for-purpose system.

The dissertation addresses the problem statement and the goals in sections 6 and 7.

The research question was formulated to reflect the problem and the goals of the dissertation and its implication was explored in section 7.1.

All three main sections of the research – Theory, Practice and Theory vs Practice and the questions relating to them have also been addressed in section 7. By exploring these questions, it has been identified that theory largely represents the ways of practice and its methodologies are proved to be more feasible and more risk-averse.

The discoveries made in this dissertation serve to enrich the understanding of the correlation between the theoretically derived models and those which are purely practical. It reveals that the theoretical methodologies well describe the existing possibilities in the real-world processes within a SDLC, followed by non-specialists.

The researcher has aimed to avoid the barriers stated at the beginning on the research. All barriers have been avoided by the utilisation of the methodologies described in their corresponding sections above.
The researcher has only explored issues within the identified scope of the dissertation.

Understanding of the limitation regarding the richness of the research compared to all possible research points (in this case, other companies who have developed a system without the use of specialists nor having any theoretical knowledge in ISD) is taken into account when representing the findings which are conclusive with certainty only for this particular study and Creative Solutions Ltd.

For the purpose of this dissertation, the literature review was split into two main sections – overview of the theory and overview of similar research. The theoretical overview describes in depth all items necessary for this research and identifies what a theoretically modelled SDLC is. It also uncovers the two main types of system development approaches – Structured and Agile and provides relevant information regarding both approaches.

The second section of the literature review reveals the similar research undertaken by other authors. However, the researcher found a relatively small amount of similar research, as this particular field proved not to be a largely-researched one.

In order for the research to be conducted, the gathering of qualitative data was necessary. This was addressed by the formation of face-to-face interviews. The research methodology required the creation of subordination matrices which depict the theory that correlates to the particular questions developed for the undertaken interviews. The interviewee population was optimised for the particular research by questioning 3 out of the 5 employees working on the development of the system.

The data collection and the data analysis were executed as specified in sections 3.2.3 and 3.2.4.

A background/introduction to the three sections – Theory, Practice and Theory vs Practice (Comparative Analysis) and their subsections was presented in order to allow the readers to better understand the analytical sections of the dissertation.

The creation of the theory driven and the practically driven models of SDLC was represented in sections 4 and 5. They were used to conduct the analytical comparison in section 6 which revealed the similarities and the differences between the two models of SDLC and how the two potentially shape the outcome of the development.

The phases and processes within those phases, described by the theoretically modelled SDLC and those executed in their natural order by the non-specialists and ultimately their SDLC, are largely similar, as the phases occurring in the theoretically proposed SDLC cannot be omitted in any way, due to their being fundamental for the development of any information system.

Implications were derived from the previously set research questions which reveal that the phases and processes described in the theoretical model of the SDLC cannot be omitted as they are fundamental for the development of any information system. Consequently, the purely practically driven SDLC phases correspond to those suggested by theory. Ultimately the only
differences are seen in the processes within the phases where some processes suggested by theory are not utilised by the non-specialists due to lack of theoretical knowledge in the field of ISD.

7.3 Conclusions

As a result of the research, the following conclusions can be drawn:

The phases and processes within those phases, described by the theoretically modelled SDLC and those executed in their natural order by the non-specialists and ultimately their SDLC, are largely similar, as the phases occurring in the theoretically proposed SDLC cannot be omitted in any way, due to their being fundamental for the development of any information system.

The phases of the theoretically modelled SDLC and the processes within them are found to largely correspond to the phases and processes which the non-specialists have reached through their entirely practical approach to ISD.

The practical resolutions applied by the non-specialists in the real world largely follow the phases presented in the theoretical model of the SDLC. However, as some of the processes within those phases are knowledge based, a proportion of them are not utilised by the non-specialists.

Due to the fact that the system built by the non-specialists is working and is fit-for-purpose, it can be confirmed that there are occasions when neither theoretical knowledge nor specialists in the ISD field are needed for the construction of a working, fit-for-purpose system.

No practical resolutions which theory had not already examined are utilised (discovered) by the non-specialists.

As presented in the conclusions sections in section 6 of this dissertation, the system created by the non-specialists would have needed to spend less resources on its development and would have minimised risks, had theoretical knowledge been utilised.

It is clear that the system developed by Creative Solutions Ltd. may have benefited from using specialist input and/or having prior theoretical knowledge in the ISD field. Their system would have been developed with less time, less manpower and less monetary resources.

While making a system, it is compulsory to go through certain phases and processes, without the execution of which, it would be impossible to create a new system. Even if the team working on the development has no theoretical knowledge in the field of ISD, the natural progression of events steers the phases in the direction stipulated by the theoretical model of SDLC.
8 Recommendation

Although the practical approach leads to what could be considered as a satisfactory result, the researcher would strongly recommend theory be consulted prior to the start of the system development.
References


Centers for Medicare & Medicaid Services, 2008. Selecting a Development Approach, s.l.: s.n.


Farm Credit Administration, 2007. *System Development*, s.l.: FCA.


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**Bibliography**


Definition of Terms

SDLC – System Development Lifecycle.

ISD – Information System Development.

System implementation – (i) The process of implementing a new system; (ii) The final stage of the development process in the SDLC.

Non-specialists – Professionals who have no theoretical knowledge of ISD.
**Appendixes**

**Appendix 1 – Ethics Form**

**PART ONE**

<table>
<thead>
<tr>
<th><strong>Name of applicant:</strong></th>
<th>Denitsa Encheva</th>
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<tbody>
<tr>
<td><strong>Supervisor (if student project):</strong></td>
<td>Stuart McNeil</td>
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<td><strong>School / Unit:</strong></td>
<td>CSM</td>
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<td><strong>Student number (if applicable):</strong></td>
<td>st20075557</td>
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<tr>
<td><strong>Programme enrolled on (if applicable):</strong></td>
<td>BSc (Hons) Business Information Systems</td>
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<tr>
<td><strong>Project Title:</strong></td>
<td>Comparative analysis of the theoretical methodologies for system implementation versus the practical solutions applied by Creative Solutions Ltd.</td>
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<tr>
<td><strong>Expected start date of data collection:</strong></td>
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<tr>
<td><strong>Approximate duration of data collection:</strong></td>
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<tr>
<td><strong>Funding Body (if applicable):</strong></td>
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<tr>
<td><strong>Other researcher(s) working on the project:</strong></td>
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<tr>
<td><strong>Will the study involve NHS patients or staff?</strong></td>
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<td><strong>Will the study involve taking samples of human origin from participants?</strong></td>
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**Does your project fall entirely within one of the following categories:**

| **Paper based, involving only documents in the public domain** | No |
| **Laboratory based, not involving human participants or human tissue samples** | No |
| **Practice based not involving human participants (eg curatorial, practice audit)** | No |
Compulsory projects in professional practice (eg Initial Teacher Education) | No
---|---
A project for which external approval has been obtained (e.g., NHS) | No

If you have answered YES to any of these questions, expand on your answer in the non-technical summary. No further information regarding your project is required.

If you have answered NO to all of these questions, you must complete Part 2 of this form

---

In no more than 150 words, give a non-technical summary of the project

The research looks into what steps non-specialists go through when implementing a new system in a company. The research aims to identify the steps followed by Creative Solutions Ltd and compare them to the ones suggested by theory in the field of systems development.

The research will help understand whether the practical resolutions of the non-specialists correspond with the methodologies proposed by theory. The research will identify any actions for development of a system which theory suggests or recommends and practice omits.

The outcome of this research is to identify whether the theory entirely reflects the methods of practice currently at play, and whether the steps which the practice follows (in the face of non-specialists) correspond with the theoretical methods.

---

DECLARATION:

I confirm that this project conforms with the Cardiff Met Research Governance Framework

I confirm that I will abide by the Cardiff Met requirements regarding confidentiality and anonymity when conducting this project.

STUDENTS: I confirm that I will not disseminate any material produced as a result of this project without the prior approval of my supervisor.

Signature of the applicant: | Date:
### FOR STUDENT PROJECTS ONLY

<table>
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### Research Ethics Committee use only

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Project reference number: **2015D0402**

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### PART TWO

#### A RESEARCH DESIGN

<table>
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<tr>
<th>A1 Will you be using an approved protocol in your project?</th>
<th>No</th>
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<td>A2 If yes, please state the name and code of the approved protocol to be used¹</td>
<td>Not Applicable</td>
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| A3 Describe the research design to be used in your project | The research approach with will be undertaken will follow the philosophy of interpretivism. The approach chosen to analyse the gathered data will combine elements of both the inductive and the deductive approach. The research strategy involves a series of semi-structured interviews (Saunders, 2009) of the management staff of Creative Solutions Ltd. Data will only be gathered through the method of interviewing. This data will then be analysed through comparative analysis (Baruch, 1999).

The data collection method will involve semi-structured interviews with employees of the company who were involved in the implementation of the new system.

Open questions, probing questions and closed questions will be utilised in the interviews.

Sample size: Three of the five employees in the company who were mostly involved in the implementation.

Sampling type: Purposive sampling.

Time and Date: The interviews will be conducted during business hours and in the main meeting room at Creative Solutions Ltd. office; the specific time will be stated at a later date as this will be provided by the Office Manager so that it does not affect business operations. Employees will be notified in a timely manner that the research will be conducted 15th May onwards.

Purposive Sampling method: Interviews will be conducted with most of the involved employees in the company.

Expected result: By interviewing the people involved in the process of the implementation of the new system, the researcher will be able to collect all relevant data which is needed.

Analysis methodology: Comparative Analysis (Baruch, 1999)

The research methodology will be comparative analysis and will be divided into three main sections:

Summary of the theory and theoretical rules;

Choosing a company (Creative Solutions Ltd.) which has implemented a new working system without using theoretical methodologies nor help from specialists

Comparative analysis: the theoretical methods vs. the practical resolutions adopted by non-specialists.

All collected data will remain confidential and will be stored securely in a password protected computer system.

All participants will remain anonymous; any data provided will not be traceable back to specific people. |
| A4 Will the project involve deceptive or covert research? | No |
| A5 If yes, give a rationale for the use of deceptive or covert research | |

¹ An Approved Protocol is one which has been approved by Cardiff Met to be used under supervision of designated members of staff; a list of approved protocols can be found on the Cardiff Met website here
Not Applicable

A6 Will the project have security sensitive implications? | No

A7 If yes, please explain what they are and the measures that are proposed to address them

Not Applicable

**B PREVIOUS EXPERIENCE**

B1 What previous experience of research involving human participants relevant to this project do you have?

No

B2 **Student project only**

What previous experience of research involving human participants relevant to this project does your supervisor have?

Stuart McNeil has over 16 years of student dissertation and research at both undergraduate and postgraduate level.

**C POTENTIAL RISKS**

C1 What potential risks do you foresee?

- **Interviewer bias** – Researcher has a long-term experience and connection with the company and the employees.
- **Interviewee bias** – The interviewees will need to address objectively their own methods and reason the use of those methods.
- **Arranging interviews** – causing inconvenience to interviewees during their working day.
- **Arranging interviews** – hazard with accessibility.
- **Safety and storage of gathered data.**
- **Risks of not meeting the research deadlines.**
- **Anonymity of the participants involved in the interviews.**

C2 How will you deal with the potential risks?

- **Interviewer bias** – The interviewer will research professional behaviour techniques and will exercise them while interviewing. All parties have worked together in a highly professional manner before.
- **Interviewee bias** – The interviewees will be asked to answer the questions truthfully and will be encouraged to speak of areas which they identify as areas for improvement. It will be explained to the interviewees that impartiality will allow the researcher to make better
suggestions in the end of the research which will help the company when pursuing future system implementations.

Arranging interviews – Interviews will be arranged for a date and time set by the interviewees.

Arranging interviews – If the office building is not accessible by the researcher, the interviewees will be contacted over the phone and the meeting date, time and place will be rearranged to suit both the researcher and the interviewees.

Data will be kept in a secure location by the researcher and will be destroyed in the end of the research.

Every effort will be made to complete the research phases in accordance with the anticipated research deadlines.

No personal data will be collected.
Appendix 2 – Managers’ Interview Questions

Cardiff Metropolitan University
Cardiff School of Management

INTERVIEW

The system development processes undertaken by Creative Solutions Ltd. for implanting their new online database.

Interview with the Creative Solutions Ltd. Manager.

Questions:

1. Do you know what “system development lifecycle” and “system development approaches” are?
2. What processes did you go through in order to identify that the old system needed to be substituted for a new one?
3. Did you consider many alternative solutions to your problem? (if ‘no’ go to 5)
4. Did you create documentation which presents the positive and the negative sides of the solutions?
5. If not, how did you keep track on all decisions you made and what they were based on?
6. Did you create any documentation where you stated what you would like to keep and what you would like to change in the new system?
7. If not, how did you make sure your requirements were met while the new system was being created?
8. When did you start considering how the new system should look?
9. Who made decisions about the way the system should look (e.g. features, main panel)?
10. Was there an approach which you utilised in order to create the system the way you envisioned it? [Describe to the interviewee what is mean by ‘approach’ and give as an example ‘Waterfall’.]
11. How did you communicate your requirements to the development team?
12. Did you provide them with documentation?
13. If not, how did you make sure that whatever they were doing was meeting your requirements?
14. When the new system was put in place, did you run it simultaneously with / parallel to the old one?
15. Who maintains the new system?
Appendix 3 – Developer Interview Questions

Cardiff Metropolitan University
Cardiff School of Management

INTERVIEW

The system development processes undertaken by Creative Solutions Ltd. for implanting their new online database.

Interview with the Developer.

Questions:

1. How were the initial requirements for the system presented to you?
2. Did you play a role in creating any of the requirements for the system?
3. What platform did you use?
4. What language did you use?
5. Did you integrate systems testing for this particular system?
6. Did you integrate network testing for this particular system?
7. What system development approach did you use to create the system to the initial requirements? [explain to the interviewee what the approaches are, e.g. throw-away prototyping]
8. At what stages did you give access to the parts of the system which were ready for use? (e.g. immediately)
9. How was feedback provided to you?
10. Did you find it difficult to create the system to the specifications based on the way they were communicated to you?
11. Did you have to reconstruct pieces of the system to fit any requirements which in your opinion were presented to you differently initially?
12. Do you think time could have been saved had the requirements been documented and presented to you in an improved and more structured manner?
13. Did you have to often add new features to the system as new requirements were coming up?
14. Do you maintain, update and upgrade the system? (if ‘no’, skip the following questions)
15. Are there often new requirements given to you?
LETTER TO AN ORGANIZATION

Dear Ms [Redacted],

I am a Computing and Information Systems student at Cardiff Metropolitan University. The title of my thesis is Comparative analysis of the theoretical methodologies for system implementation versus the practical solutions applied by Creative Solutions Ltd.

Its aim is to look into what steps non-specialists go through when implementing a new system in a company. The research aims to identify the steps followed by your company (Creative Solutions Ltd) and compare them to the ones suggested by theory in the field of systems development. As part of my research I would like to interview people who are employed your company at supervisory level and below. I am writing to you because speaking to the employees of Creative Solutions Ltd. will allow me to undertake the specified research and answer the research question. This research project has received approval from Cardiff Metropolitan University and all data collection will be in accordance with the university’s ethics code of practice.

My purpose in writing is to ask if you would permit me to interview your employees. Their participation would be entirely voluntary, neither they nor the company would be identified in the research and it would only take 10 to 15 minutes for each employee to answer the interview questions. I would hope to receive sufficient information by interviewing some specific employees who were involved in the implementation of your system.

The areas which would be covered by the interview include:

- The basic structure of the system and its functionalities
- What steps were following in the duration of the creation of the system
- How were system requirements gathered and communicated to different employees
- Is the system being maintained

I shall be very happy to make the results of my research available to yourself and the Creative Solutions Ltd. employees when it is complete. If you would like to participate in this project and or are interested in discussing it further please contact me on:

e-mail: st20075557@outlook.cardiffmet.ac.uk

Thank you in anticipation.

Yours sincerely,

Denitsa Encheva
Appendix 5 – Participant Consent Form

PARTICIPANT CONSENT FORM

Reference Number:
Participant name:
Title of Project: The Methods Utilised by CS Ltd during the Implementation of Their New System: online database
Name of Researcher: Denitsa Encheva

Participant to complete this section: Please initial each box.

1. I confirm that I have read and understand the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason.

The following statements could also be included on the consent form if appropriate:

1. I agree to take part in the above study.

2. I agree to the interview / focus group / consultation being audio recorded

3. I agree to the use of anonymised quotes in publications

_______________________________________   ___________________
Signature of Participant                        Date

_______________________________________   ___________________
Name of person taking consent                  Date

_______________________________________
Signature of person taking consent

* When completed, 1 copy for participant & 1 copy for researcher site file
Appendix 6 – Participant Information Sheet

Reference Number:

The Methods Utilised by CS Ltd during the Implementation of Their New System: online database

**Background of the research:**
This research aims to understand whether the theory reflects the methods of practice and whether the steps which the practice (in the face of non-specialists) follows coincide with the theoretical methods. That will be achieved by looking into what steps non-specialists go through when implementing a new system in a company and comparing them to the ones suggested by theory in the field of systems development.

**Your participation in the project research:**

**Why have you been asked to participate?**
You have been asked to participate in the research because you have taken a part in the processes of development and implementation of a system which are being researched.

**What would happen if you agree to participate?**
You will participate in a semi-structured / structured interview where you will be asked about the methodologies which your company has used for the implementation of your new system.

**Are there any risks?**
No health and safety risks are recognised. The interviews will take place in a location of your choice. If you feel unwell at any moment during the interview, you are free to leave without providing an explanation.

**What happens to the collected data?**
The data will be compared to secondary data and analysed accordingly. The data will only be used for the purpose of this research and will not be published anywhere outside the research.

**Are there any benefits from taking part?**
The data provided will be used to support the research; the evaluation and analysis of the data will be represented in a way which will allow your company to better understand the implementation methodology for new information systems. This understanding will contribute to the improvement of any future information systems implementations the company undertakes.

**What happens next?**

The researcher will take the gathered data, conduct analysis, undertake critical evaluation of the used methodology and present results in the form of a dissertation; this document will then be forwarded to the company for reference.

**How is your privacy protected?**

You will not be asked any personal information other than your name and position in the company. If you find the usage of your name inappropriate, you can request that your real name is substituted.

**Further information:**

If you have any questions about the research or how we intend to conduct the study, please contact us.

E-mail: st20075557@outlook.cardiffmet.ac.uk
Appendix 7 – Initial e-mail to Company

Dear Miss [redacted],

My name is Denitsa Encheva. I am a final year student in Business Information Systems in Cardiff Metropolitan University.

This year I need to write my dissertation and the topic which I have chosen is in the field of Systems Development and Analysis. I would like to investigate how working systems are created in companies whose management has decided not to use any help from specialists in the field or have particularly studied systems development methodologies.

As I am aware, your company and you system - your online Database fit the profile I am describing and I would kindly like to ask you if it is possible to use the example of your company in my dissertation?

I am looking forward to hearing from you!

Kind Regards,

Denitsa Encheva
Appendix 8 – Interview with Manager 1

DE – Denitsa Encheva; The researcher

M1 – Creative Solutions Ltd. Manager 1

DE: Alright. Let’s start the interview with a question which will identify whether you can actually help with the research.

M1: Okay.

DE: Do you know what a “system development lifecycle” and “system development approaches” are?

M1: I have heard about this, probably from you anyway, but no – I don’t really know.

DE: Great. Then we can proceed. The second question is: What processes did you go through in order to identify that the old system needed to be substituted for a new one?

M1: Well, mainly listening to the employees’ feedback. If anyone feels like there is an issue, they report it to me. We have team meetings at least once a week where such issues can be more formally raised, though we communicate with each other a lot during the day, in the kitchen for example, so I am kept up-to-date with anything that’s going on around here. For this specific system, I myself have to use it on daily basis, so I know how it works and where the problems with the old system were and such. And if there is an issue which I haven’t encountered before, I go to the employee’s computer and I can see what the problem is for myself.

DE: OK. And did you consider many alternative solutions to your problem? Meaning, did you look at other options before you decided to employ the current system?

M1: Yes, we did. We knew that we wanted to keep more or less what we had before but some people from the team wanted to have a new off-line system, and others, including myself, wanted to have it online. This was the way forward, at the time, and now as we can see, everything is online anyway. So eventually we decided to look for online solutions, to which everyone agreed after considering the problem with the server.

DE: That’s good. And what were these other options.

M1: Mainly CRM systems which were already designed.

DE: Off the shelf.

M1: Exactly. But as we were doing the research those were just way too big and too expensive for our organisation. Also, we did want something more personalised.

DE: Alright, and during the research process did you create documentation which presents the positive and the negative sides of the solutions?

M1: Well, we didn’t have any like specific documentation produced. I kept a Word document with things I found important but nothing official per se.
DE: Mhm, I see, so, in that case how did you keep track on all decisions you made and what they were based on?

M1: Well, firstly, in order to … decide on features and other things, the team just told me what they liked and what they didn’t.

DE: So, about the features, colours even…?

M1: Yeah. And also we do send e-mails to each other which we don’t delete immediately. Actually, if something is very important, I won’t delete it at all. Another thing is – the team meetings. But mainly we made decisions “on the go”.

DE: Alright, and when did you start considering how the new system should look like?

M1: Well, the main features we knew before we even decided to work with ThinkWeb. Because the fields are the same pretty much as what they were in the old system. But about what it would look like and other functional features ThinkWeb helped quite a bit with ideas.

DE: And how did that actually work? – did you meet with them often…or-?

M1: We did meet sometimes but we use e-mail a lot to send specifications. Also Skype calls are very practical.

DE:… Was there an approach which you utilised in order to create the system the way you envisioned it? And by that I mean for example: prototyping which is where many prototypes are made and shown to you to comment on…

M1: Ah, yes, Ok. Well we, as I told you, were doing things mostly “on the go” as they are happening. We didn’t really see prototypes, they were just showing us whenever they had a new feature ready to work. And really, if there was anything at all that we wanted new, or was bothering us, we would just tell them.

DE: Via Skype?

M1: Yeah, Skype, phone, e-mail… it all depends on how pressing the matter is but usually both our responses were almost immediate.

DE: OK, and initially, how did you communicate your requirements to the development team?

M1: Same thing – we just collect ideas of what we want to have on the system and we send an e-mail to them. Also, at the very beginning we had a meeting where we spoke about the basic … requirements.

DE: Mhm, and in that meeting did you actually have any documentation to give them?

M1: I remember I had a list of the very basic requirements I took with me but the guys were taking notes on what we were discussing. They also suggested a few things back then.

DE: That’s good. And the one before the last one – when the new system was put in place, did you run it simultaneously with or, like, parallel to the old one?

M1: Um, yes, we did. We had to transfer all of our data from the old system to the new one…

DE: Alright, thanks, and finally – who maintains the new system?
M1: ThinkWeb. They are really good.

DE: Have you known them for a long time?

M1: Yes, we had worked with them before, so our business relationship is quite strong, also we are friends outside of the line of work, so we find it very easy to work together.

DE: Lovely. Thank you so very much for your time.

M1: No problem. Good luck.
Appendix 9 – Interview with Manager 2

DE – Denitsa Encheva; The researcher

M2 – Creative Solutions Ltd. Manager 2

DE: So, first I need to know do you know what “system development lifecycle” and “system development approaches” are?

M2: I have some ideas but officially – no.

DE: Perfect. Now could you please describe to me what processes did you go through in order to identify that the old system needed to be substituted for a new one?

M2: The young people in the team had thought about having a new system installed before, but when the server stopped working and we lost almost all data that we had, [identifying the name of Manager 1] M1 presented many arguments for installing a new online system. Some of us were more used to the ‘old’ ways, though.

DE: You mean the old system which was offline?

M2: Yes.

DE: So how did you identify exactly what you wanted?

M2: We had team meetings where, once [identifying the name of Manager 1] M1 described to the rest of the team why an online system will be more useful for the entire team, we decided that it would be a good call.

DE: So what happened next?

M2: To be honest, you will get more information from [identifying the name of Manager 1] M1 as this project was hers. But in a summary, they did some research, spoke to a few companies who created and maintained systems such as the one they were looking for and eventually ended up making a contract with ThinkWeb. We know this company from a previous project we had worked together on before and they seemed to have a good relationship.

DE – Okay, and when you were doing all that and going through the different options, as well, did you document things officially?

M2 - [Identifying the name of Manager 1] M1 likes to have a document where she keeps some more important thought but nothing was official.

DE – And did you create any documentation where you stated what you would like to keep and what you would like to change in the new system?

M2 – Officially?

DE – Yes.
M2 – Not really. We knew what we wanted from the offline system so we translated that to the online one. And if the younger people in the team decided there will be some good new options to have, they discussed it with ThinkWeb.

DE – Alright, and when did you start considering how the new system should look like?

M2 – As I told you, we already knew because we wanted to keep the characteristics of the offline system but for more details, you should see [identifying the name of Manager 1] M1.

DE - Who made decisions about the way the system should look like?

M2 – We all had ideas but mainly the younger people in the team and ThinkWeb took over the design. Again, ask them about details.

DE – Was there an approach which you utilised in order to create the system the way you envisioned it? For example: prototyping when the developers create a series pf prototypes and those are shown to the clients for feedback...

M2 – The way things usually go is simply telling ThinkWeb our ideas and then showing us what they have done. If it doesn’t work or it doesn’t work as we want it, they fix it.

DE – OK, sounds good. And could you please tell me how did you communicate your requirements to the development team?

M2 – Mainly by calling them on Skype or over the phone but we do occasionally have meetings in the office to discuss more important questions.

DE – Did you provide them with documentation?

M2 – As far as I know nothing official, [identifying the name of Manager 1] M1 send them e-mails so we can keep track of who said what.

DE – When the new system was put in place, did you run it simultaneously with / parallel to the old one?

M2 – Well, yes. We needed to move all the information from the offline to the online one.

DE – OK. And finally, who maintains the new system?

M2 – The database manager and if there are technical issues ThinkWeb.

DE – Lovely, thank you very much for your help.

M2 – Thank you. Good luck!
Appendix 10 – Interview with Developer
DE – Denitsa Encheva; The researcher

DE: My first question is how were the initial requirements for the system presented to you?
Developer: Well initially we had a meeting where [the managers of Creative solutions] told us about what they expect more or less.
DE: Did they have any specific requirements?
Developer: Yeah, they wanted the fields from their old system to be the same in the new one.
DE: Did they have any official documentation provided to you?
Developer: We mostly discussed things verbally but we took notes of everything we agreed upon that day. From then on, we used mainly e-mails and calls.
DE: So, you played a role in creating some of the requirements for the system?
Developer: We did have suggestions from a purely coding perspective about how things can actually look like in real life and such. But really any suggestions we discuss. I mean if they want something which we see not feasible, we tell them, but that’s not usually the case with them anyway.
DE: What platform did you use?
Developer: Proprietary – ThinkCMS by us [ThinkWeb].
DE: And what was the language?
Developer: PHP, as an online platform, that was the best one at the time.
DE: And did you integrate systems testing for this particular system?
Developer: Creative’s [Creative Solutions’] CRM?
DE: Yes.
Developer: We did all necessary testing on the platform but we haven’t tested the whole thing again for that particular system.
DE: OK. And network testing?
Developer: Same as before.
DE: Just initial testing when you developed it firstly?
Developer: Yep.
DE: And did you use any particular systems development approach to develop this system?
Developer: To be honest, it was a very ad hoc thing. I mean, once we had the initial system put together we showed them what we had and from then on we just kept adding and removing features on demand really.
DE: And how did that work? What was the process?

Developer: It was pretty good. They just called or sent an e-mail with issues and we coded them pretty much instantly, if they weren’t too difficult, then we showed them what we have done, they give feedback and if everything is alright, we move on, if not we fix it and that’s how it pretty much works.

DE: Alright... You answered my next three questions just now. [...] Next question – did you have to reconstruct pieces of the system to fit any requirements which in your opinion were presented to you differently initially?

Developer: Well, you know, requirements often change but if you’re asking whether we have had some real problems – not really. Maybe a couple times but that’s normal.

DE: How did you fix those?

Developer: Talking. [Laughs] Communication is key.

DE: That is true. But do you think time could have been saved had the requirements been documented and presented to you in an improved and more structured manner?

Developer: Yeah, certainly but I'm pretty happy with the way we work. We are accustomed to it and it works well.

DE: Ah, OK. Did you have to often add new features to the system as new requirements were coming up?

Developer: Initially more than now. Sometimes if they are making any major changes to the way they need the system to work to fit their new business idea we have to do many changes but that’s our job anyway.

DE: You answered my next questions again. [...] So, you are the company who maintain the system?

Developer: Yes.

DE: And finally, as you said already, you do get new requirements every once in a while which you need to implement into the system?

Developer: Yeah, as I said, initially more than now.

DE: Great! Thank you very much!

Developer: No problem!
Appendix 11 – Creative Solutions Logo

Appendix 12 – ‘PREMIUM Lifestyle’ Magazine