COLLABORATIVE BUSINESS PROCESS ENGINEERING (CBPE) ACROSS MULTIPLE ORGANISATIONS

BY

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Submitted for the Degree of Doctor of Philosophy

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STATEMENT OF AUTHENTICATION

The work presented in this thesis is, to the best of my knowledge and belief, original, except where acknowledged in the text. I hereby declare that I have not submitted this material, either in whole or in part, for a degree at this or any other institution.

Abbass Ghanbary


**Preface**

This thesis reflects my research study and its results in the area of collaborative business environments in the Information and Communication Technology (ICT) domain. This thesis presents a model that aims to bring together the business processes of multiple organisations, transcending various time, location and technological boundaries.

Sa’adi Shirazi, the great philosopher and poet from the historic land of poetry and philosophy in Shiraz, Persia, has been a source of inspiration for me during these studies. He was born in circa 1213 and died on December 9, 1293. His thoughts are best illustrated in the following poem:

\[
\begin{align*}
\text{All human beings are in truth akin;} & \quad \text{All in creation share one origin.} \\
\text{When fate allots a member pangs and pains} & \quad \text{No ease for other members then remains.} \\
\text{If, unperturbed, another’s grief canst scan,} & \quad \text{Thou are not worthy of the name of man.} \\
\end{align*}
\]

Sa'adi Shirazi

The underlying philosophy of the above poem also translates to the fact that the children of Adam are members of the same family – having been created from one essence. When the calamity of time afflicts one member, the other members cannot remain at rest. This philosophy also means that we are all connected by a common thread; a problem faced by one member of the human race can have repercussions on other members and, in fact, the entire human race. A person who has no sympathy for the troubles of others is unworthy to be called by the name of a man. This poem has also been adapted by the United Nations.
AHORA MAZDA, the God of Zoroastrians, in the holy book of AVESSTA teaches us to have decent thoughts, decent behaviour and decent conversation. As I emerged from this background of a sensitive culture and entered the area of science and technology, I sought to understand how I could serve society by facilitating cooperation and collaboration rather than competition and conflict.

In 1991, destiny brought me from Persia to Australia. Eventually I progressed in my education and commenced intense PhD-level research. At around the same time, in the year 2005, my wife and I were blessed with a lovely son, “Avessta”.

Following the early discussions with my supervisor, I immediately realised that my PhD studies were also my means of expressing my long-held desire to help the society in which I live, and in which my son and family is growing. This led me to conduct my research in such a way as to capitalise on the technological advances and use them to aid collaborations amongst people, organisations and society. I could see the shades of the great poet and philosopher, Sa’adi, in my work – albeit very humbly and in traces.

Throughout my research, the philosophical, methodological and the theoretical backgrounds of my approaches helped me to observe the impact of my investigation on a collaborative society. Research philosophies such as interpretivist and constructivist approaches, a combination of qualitative and quantitative methods, evolutionary and socio-technical theories were considered as the bridge to cross the gap and maintain objectivity while allowing me the freedom and interplay of subjectivity that would help me remain creative.
Acknowledgments

I would like to take this opportunity to express my gratitude to the following individuals, without whose assistance this work could not be accomplished.

Firstly, I thank my wife, Naghmeh Khandan, for her support and encouragement and, at the same time her unending endurance and tolerance of all the idiosyncrasies that are all hallmarks of any doctoral research. Without her support and understanding during the past few years, I could never have reached where I am today.

Secondly, I thank my baby boy, Avessta Ghanbary, for all the time he gave me to proceed with my research. Avessta was two months old when I started my PhD. He grew up as my research was developing. He always wanted me to play with him instead of merely observing me sitting in front of my computer and working on my research. For the sake of the record – as, one day, I am sure he will read this thesis – I did always play with him first.

Thirdly, I appreciate all the help and support provided to me by my supervisor Dr Bhuvan Unhelkar. Bhuvan always pointed out to me the best direction to take in my research and also helped me balance my social life with the academic life. His words are many times more than written documents for me. I take this opportunity to thank him and also, to set the record straight, sincerely apologise to him for calling him day and night, weekdays and weekend, in order to help and guide me with my studies. THANK YOU.
Fourthly, I thank my first co-supervisor, Dr M. Ranjbar, for his continual support, both in my under-graduate as well as my post-graduate studies. Dr Ranjbar always believed in me and supported me with his kind words. I appreciate his advice that has helped me in all aspects of my life. I am also thankful to my second co-supervisor, Dr Robyn Lawson, for her continuous support. Dr Lawson managed different meetings with all the PhD students in our schools that advanced our research in a manner that would not have been possible otherwise.

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I also thank the University of Western Sydney, especially the School of Computing and Mathematics for providing this opportunity to advance my education. The scholarship awarded by the university and the school has gone a long way in ensuring that this study is completed. I am also thankful to organisations that responded to the questionnaire.

Finally, my special regards to the Thesis Writing workshop team who helped me to overcome my difficulties in expressing my thoughts in writing.
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LIST OF ACRONYMS

Architecture Development Method (ADM)

Australian Bureau of Statistics (ABS)

Australian Computer Society (ACS)

Business Integration (BI)

Business Process Engineering (BPR)

Business Process Management (BPM)

Business Process Management Initiative (BPMI)

Business Process Management Notation (BPMN)

Business to Business (B2B)

Central Processing Units (CPU)

Chief Executive Officer (CEO)

Chief Information Officer (CIO)

Chief Medical Officer (CMO)

Chief Technical Officer (CTO)

Chief Technology Evangelist at Sonic Software (CTESS)

Collaborative Business Process Engineering (CBPE)

Collaborative Web Based System (CWBS)

Common Object Request Broker Architecture (CORBA)

Customer Relationship Management (CRM)

Diffusion of Innovation (DoI)
Distributed Component Object Model (DCOM)

Emerging Technologies (ET)

Enterprise Application Integration (EAI)

Enterprise Architecture (EA)

Enterprise Java Bean (EJB)

Enterprise Resource Planning (ERP)

Enterprise Service Bus (ESB)

eXtensible Markup Language (XML)

Global Positioning System (GPS)

Hypertext Transfer Protocol (HTTP)

Information and Communication Technology (ICT)

Innovation Diffusion Theory (IDT)

Knowledge Management (KM)

Massachusetts Institute of Technology (MIT)

Message-oriented Middleware (MOM)

Mobile Technology (MT)

Mobile Web Services (MWS)

Model of PC Utilisation (MPCU)

Motivation Model (MM)

New South Wales (NSW)

Object Management Group (OMG)
Object Request Brokers (ORB)

Really Simple Syndication (RSS)

Remote Procedure Calls (RPC)

Return on Investment (ROI)

Service-oriented Architecture (SOA)

Simple Object Access Protocol (SOAP)

Social Cognitive Theory (SCT)

Standard Generalised Markup Language (SGML)

Supply Chain Management (SCM)

Technology Acceptance Model (TAM)

The Open Group Architecture Framework (TOGAF)

Theory of Planned Behaviour (TPB)

Theory of Reasoned Action (TRA)

Unified Theory of Acceptance and Use of Technology (UTAUT)

Universal Description Discovery and Integration (UDDI)

Web Services (WS)

Web Services Definition Language (WSDL)

Wireless Application Protocol (WAP)

World Wide Web Consortium (W3C)
ABSTRACT

Keywords:

Collaborative Business Process Engineering (CBPE), Collaborative Web-based System (CWBS), Web Services (WS), Universal Description, Discovery and Integration (UDDI), Business Process Reengineering (BPR), Business Process Management (BPM), Mobile Technology (MT), Service-oriented Architecture (SOA), Business Integration (BI), Enterprise Architecture Integration (EAI).

This research is an investigation into how organisations can engineer new collaborative business processes. This engineering of processes is based on technical advances, which enables organisations to enhance their communication and collaboration with their customer and each other. This research identifies how advanced technologies can be properly applied to create collaborative business processes of within and across organisations. This research has enabled this collaboration and extended its boundaries to facilitate dynamic collaborations amongst multiple organisations that may not necessarily be known to each other.

The new model of collaboration achieves the recommended collaborative environment by restructuring the business processes for Web-based applications. This thesis also validates the proposed model for the collaboration in a global environment. This creation and validation of the model satisfies the requirements of a PhD-level research.

The concept of Collaborative Business Process Engineering (CBPE) is unique in that it describes how cluster-based processes of multiple organisations can
be engineered. Furthermore, this research also integrates the existing concepts of Business Process Re-engineering (BPR) and Business Process Management (BPM) in the model. CPBE is able to evaluate the impact of the interoperability of the organisations on their engineered business processes as well as their business structures. This research further demonstrates the implementation of CBPE in a proposed Collaborative Web-Based System (CWBS).

This thesis discusses how the Web Services (WS) and mobile technologies, specifically Universal Description, Discovery and Integration (UDDI), influence the interoperation amongst multiple organisations. The impact of the WS on engineered business processes and the extension of this impact on multiple organisations and their clusters are included in this research.

This thesis also describes the existing model of collaboration and provides a literature review to support the need for the proposed model of collaboration. Existing technologies for the engineering of the new collaborative business processes are explained. Detailed descriptions of the research methodologies (quantitative and qualitative), philosophies (interpretivist and constructivist) and theories (evolutionary and socio-technical) used are identified and described here.

The dynamic aspects of collaboration in the proposed new model of collaboration, wherein organisations can enter and exit the collaboration at will are discussed. The thesis also discusses the factors influencing the collaboration, such as trust, security, confidence level and the availability of the channels for collaboration. The dynamic aspects of the proposed model are tested against the static aspects of the
current model wherein the collaborating organisations need to set up prior contract before collaboration. A part of this study deals with evaluation of the significance of the CBPE for the organisations that adapt technologies such as Web Service and mobility.

Finally, this thesis demonstrates an investigation in the impact of interoperability emanating from emerging technologies, specifically the Web Services technology, on organisations by providing a model as well as conceptual implementations. The proposed model of CBPE and the conceptual implementations facilitate the use of the emerging technologies for effective collaborations. These emerging technologies are presented and described in Chapter 2 while their impacts on the proposed model of CBPE are explained in Chapter 4. The proposed model in this thesis enables numerous businesses to collaborate electronically thereby producing dynamically collaborating groups/clusters. This thesis presents the modelling, understanding of collaborative business process that transcend the organisational boundaries, factors that influence collaborative business processes and the entry and exit criteria for these collaborative organisations.
CHAPTER 1 – INTRODUCTION

1.1 OVERVIEW
A business process is a set of coordinated tasks and activities that provides significant guidance in achieving a specific organisational objective. According to Virdell (2003), a business process can be defined as a set of interrelated tasks linked to an activity that spans functional boundaries. Besides activities and tasks, business processes also have starting points, ending points and deliverables, and these business processes are repeatable. Furthermore, business processes are closely supported by software applications. The rapid advent of the Internet allows these software applications, and the many organisational processes that are built around these software applications, to communicate easily with each other. The resultant transactions cross geographical and time boundaries with relative ease. Subsequently, the current business processes can span multiple organisation boundaries transcending across many different countries and operating under varying socio-political and legal climates.

The sheer potential of these Internet-based business processes is such that there is a pressing need to study them carefully and in detail. These business processes that transcend geo-political boundaries, particularly when these business processes employ Internet-based connectivity, are changing the business landscape to include hitherto unknown possibilities. The potential of Internet-based business processes, their effect on organisations and customers, and the challenges faced by the business
world resulting from these processes comprise a vast field requiring formal research and studies.

The research described in this thesis is an attempt to precisely study those business processes capable of transcending internal boundaries of organisations. The study in this thesis describes how business processes of multiple organisations can electronically collaborate with each other. Furthermore, this study also delves deeper into the possibilities offered beyond simple connectivity between two business applications, and reaches into the realms of dynamic collaborative businesses. Finally, this study also encompasses all the dimensions of technology, methodology and sociology (as discussed by Unhelkar, 2007), and the corresponding points-of-view of these dimensions in the context of understanding and modelling these business processes. Such modelling, it is envisaged, will eventually result in a truly collaborative and dynamic global market. The ability of organisations to electronically get together, perform a certain goal, and then disperse, is a new reality of collaborative business. This new reality rests heavily on Internet-based software applications that support the business processes of these collaborating organisations. This research lays down the path for such dynamic Internet-based collaborations between myriad businesses.

In order to understand what can be achieved through the collaborative model proposed here, understanding the current electronic collaboration between businesses is crucial. The current collaborations, that take place daily, occur between two or more organisations that are known to each other. Such electronic collaborations imply that the business applications belonging to the organisations are in prior electronic contract with each other and that such collaborations have been “set up”
prior to the occurrence of business transactions. Figure 1.1 shows such an existing collaborative environment.

**Figure 1.1: Current Collaborative Environment (Travel Industry Example)**

Figure 1.1 depicts a current Business-to-Business (B2B) collaborative environment, using a travel industry example. Herein, a customer has multiple needs in order to undertake travel: the need to book and purchase an airline ticket, to book a hotel room, to hire a car and to purchase travel insurance. These needs of the customer are submitted through an “application” that contains his or her specific requirements. The customer enters the desired destinations, desired date and time of the departure, desired date and time of return and required services (the airline ticket, car, hotel room and hired car). This application, made up of these various parameters, is then submitted to one of the businesses. Once the application is received by the specific website of a business, it can register the details, make the bookings and provide the customer with a schedule. Furthermore, this website also provides the customer with an invoice and, possibly, an easy electronic way of making the payments.
The business collaboration and cooperation described in Figure 1.1 takes place in a traditional Business-to-Business (B2B) collaborative environment. The B2B integration architecture on the receiving website is responsible for the complete processing of the B2B events. The underlying software system not only has to provide the connectivity, but also the back-end system storage, process and security management. An active sub-component of this architecture, the B2B engine, is responsible for the communication aspects of the B2B events with the various trading partners (Bussler, 2002). This B2B engine implements the various aforementioned functionalities required by the customer and makes it available to the overall B2B integration architecture.

The current collaborative environment has been researched, discussed and implemented across myriad businesses, globally. This current environment for business collaboration is able to satisfy customer needs once the website and the business that is represented by the website are “known” to the customer. Furthermore, the response is able to satisfy the customer demand only to its capacity and ability. For example, this same collaborative environment is unable to assist the customer if the customer has much greater demand than the ability of a particular business can satisfy. The travel scenario described above is not able to provide a solution that requires a complex request, such as two airlines, three hotels and four car companies, to get together to satisfy the travel needs of a large client (such as, say, a touring party or a school excursion). The customer has to physically search and book with different businesses (service providers) in order to satisfy the his or her travel needs. There is no provision, within the current business models, to easily enable the customer to create a major tour package without the customer searching, booking and submitting MULTIPLE applications. Therefore, this current approach to
business collaboration can be classified as static collaboration. Such static collaboration is mundane, routinely occurring between millions of businesses, not warranting much research.

Figure 1.2 demonstrates how the collaborative environment could be improved to receive the full potential of collaborations where multiple organisations are involved in partnerships. These organisations are not necessarily known to each other.

![Figure 1.2: The Proposed Model of Collaboration (Travel Agency Example)](image)

**Figure 1.2: The Proposed Model of Collaboration (Travel Agency Example)**

Figure 1.2 shows how this particular research aims to redress the shortcoming of the B2B scenario depicted in Figure 1.1. In Figure 1.2, the proposal is for a new collaborative environment that is based on the model created in this research as: **Collaborative Business Process Engineering (CBPE)** model. Figure 1.2 demonstrates, simply, that by interoperation amongst multiple organisations, the customer is able to present requirements for multiple airlines, hotels and other required services or products through one simple application. Thus, for example, if a customer needs to purchase tickets, insurances and book a hotel and cars for 150
people, the customer submits only one single application to the proposed collaborative system. This collaborative system is capable of accessing multiple airlines, insurance companies, hotels and hire car agencies. The underlying CBPE system model would automatically access various other organisations and collaborate with them in order to satisfy the needs of the customer. For example, if one organisation is unable to provide for the needs of 150 people in a touring party, the underlying CBPE system model will access more than one hotel and car company to satisfy these needs of the customer. These multiple organisations from specific industries need not necessarily be known to the customer, or to each other. And yet the customer is able to book multiple numbers of tickets, travel insurances, hotel rooms and hired cars from multiple different organisations by submitting just one single application. The scenario presented in Figure 1.2 is classified as *dynamic collaboration*.

The scenario depicted in Figure 1.2, and described above is different from the known B2B scenario. The differences in the B2B scenario of Figure 1.1 and the proposed collaborative scenario of Figure 1.2, can be listed as follows (please note that these may be obvious or apparent differences that are subjected to further rigorous research as this study progresses):

(a) The B2B businesses set up a relationship beforehand, whereas in a true collaborative (CBPE) -based scenario, the collaborations between the businesses may not be set beforehand.

(b) The B2B businesses “know” each other, and are therefore more secured in their transactions; the CBPE-based businesses may not be known to each other, leading to higher security risks.
(c) The CBPE-based collaborative businesses are dynamic – in the sense that they get together on a portal to achieve a particular business objective, but then can disperse after the business objective has been satisfied; the B2B businesses remain in continuous contact with each other.

(d) The collaborations between multiple businesses create business challenges; the issues of trust and legal enforcement become very important in terms of these collaborations in CBPE, compared with B2B collaborations.

(e) There appears to be a dearth of in-depth modelling of these collaborative business processes, compared with the B2B processes.

This research addresses these various differences and produces answers to the challenges emanating from these differences. As is noted later, during the literature review, the collaborative business process scenario encompassing multiple organisations does not appear to have been addressed previously in the formal literature. However, there are a few studies that try to evaluate the different interoperation environments for businesses. One such study, by Hogg, Chilcott, Nolan and Srinivasan (2004), highlights the various research issues in B2B integration frameworks. These research issues, which need to be addressed, include process-based integration of services, dependable integration of services, support of standardised interactions, security, and privacy. The current research, reported in this thesis, addresses these issues in the context of collaborative business processes through the CBPE framework.

The underlying technical capabilities that result in the collaboration envisaged here are based on the Internet’s capability to facilitate communications. This communication between software applications has been made possible through the technologies for electronic communications. Earlier, before the open Internet-
based communications, these technologies include Microsoft’s DCOM (Distributed Component Object Model) and the Object Management Group’s (OMG’s) CORBA (Common Object Request Broker Architecture).

However, Internet-based collaborations that are now being made possible between multiple businesses are dependent on the technologies of Web Services (WS) and Mobile Technologies (MT). Therefore, this research studies these technologies and investigates their impact on transitioning to successful CBPE. Some earlier studies in these emerging technologies of WS and MT have already been reported by Ghanbary and Unhelkar (2007a), Ghanbary and Unhelkar (2007b) and Ghanbary (2006b). These publications, based on the progress of this current research, have identified and described the concept of Collaborative Business Process Engineering (CBPE) as distinct from the traditional Business Process Re-engineering (BPR). This thesis presents the full analysis of these aforementioned publications, together with the testing and evaluation of the CBPE model. Furthermore, this study also demonstrates the validation as well as the practical usability of the proposed model through action research in medium and large organisations. The major parts of the research can be summarised as follows:

1) What are the limitations of the existing environment of collaboration?
2) How are the business processes of different organisations able to communicate with each other?
3) How can the technology solve the identified and described (please see Figures 1.1 and 1.2) limitations of the current collaborative environment?
4) What are the methodological and social consequences of the proposed environment of the collaboration?
1.2 DEFINITIONS OF TECHNICAL TERMS
This section defines the technical terms appearing in this study. The need to describe these terms formally is felt to be important, due to the rapid advances in Information and Communications Technologies (ICT). Due to these advances in ICT, it has become important to understand the terms clearly and unambiguously. The definitions in this section will clarify the meanings of these terms to this researcher and for the reader of this work.

Emerging Technologies: Emerging Technologies (ET) have the prospect of reshaping existing industries and even creating new ones (Korson and Vaishnav, 1992). The application of emerging technology helps potential investors in developing their companies (Rombach, 1999). Web Services and Mobile Technologies are the current ET that is reshaping industries, globally. Emerging technologies include (but may not be restricted to) Web Services (WS), Web 2.0 (as the upcoming and continuously improving versions of the Internet), grid computing, mobile technologies, microelectromechanical systems, nanotechnologies, genomics, robotics, artificial intelligence and sensors.

Business Process Re-engineering: A process is a continuous stream of business activities. It is also stated that every process has some linkage to other processes. Unless each process has some relevance in delivering a product or a service to a customer it has little value (http://www.acs.openlab.net.au/). Hammer and Champy (1993) describe the term “re-engineering” as a fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in significant, contemporary measure of performance such as cost, quality, services and speed. Re-engineering a company’s business processes ultimately changes practically all
aspects of the company such as people, jobs, managers and values that are linked together. The business processes involved in collaboration integrate and are linked with the business processes of the other organisations. While in the past, business processes have been studied and re-engineered by Hammer and Champ, (1993 and 2001), almost all of the re-engineering studies dealt with the business processes of a single organisation. However, with the increasing impact of WS and ET, business processes are – more often than not – spanning across several organisations.

This research is concentrating on this linkage of the processes across multiple organisations that may not be known to each other and the software applications that may not have had prior electronic contract.

The existing concepts of Business Process Re-engineering (BPR) and B2B collaboration are unable to describe satisfactorily what is presented in the proposed model of collaboration demonstrated and described in Figure 1.2. Thus, the concept of Collaborative Business Process Engineering (CBPE) is new, and the word “engineering” rather than “re-engineering” is used, hence the proposed business process is not currently in operation.

**Web Services:** Web Services (WS) are a unit of business, software application or a system that can be accessed over a network by eXtensible Markup Language (XML)/Simple Object Access Protocol (SOAP) messaging. According to the World Wide Web Consortium Working Group (http://www.w3.org), a Web Service (WS) is a software system designed to support interoperable machine-to-machine interactions, over a network. WS has an interface described in a machine-processable format (specifically Web Services Definition Language (WSDL)). Other systems interact with the Web Service in a manner prescribed by its description, using SOAP
messages, typically conveyed using Hypertext Transfer Protocol (HTTP) with an XML serialisation in conjunction with other Web-related standards. A WS can simultaneously serve many different consumers on different technical platforms. WS capabilities include the ability to access various applications by using the industry standard network, interfaces and protocols. This capability of Web Services results in documents and applications being able to interact with each other. Although WS centre around documents, it does not necessarily follow that such documents should be readable by people (Taylor, 2005). WS takes many of the ideas and principles of the Web and applies them to computer-to-computer interactions (Cabrera, 2005). The HTTP does not encrypt before sending the data. HTTP also does not provide any support for storing information across HTTP transactions (Alonso, 2004). However, Web Services have the potential to solve many of the interoperability problems that have plagued application integration efforts, as they standardise the interfaces of any platforms.

This research is about the impacts of WS in general ET on the business processes of a cluster or group of organisations. As such, this research investigates the impact of Mobile, Internet and Web Service technologies (which may together be called Emerging Technologies) in bringing various organisations together in a cluster and the subsequent effect of this collaboration of the organisations on their business processes. This subsequent effect of ET is likely to be in the manner in which organisations get together electronically, in a cluster, and conduct business.

Web 2.0: The Web has provided an opportunity for a professional software developer to create Web pages for a large number of people. Web 1.0 has enabled people to use the Internet as an informative tool, however, over time people have
used the Internet for more complex tasks such as transactions (e-commerce), operation (e-business) and their collaboration (c-business). The need for a new set of tools and technology capable of handling the new dimensions was born.

According to MacManus and Porter (2005), Web 2.0 is a vision of the Web in which information is broken up into “micro content” units that can be distributed over dozens of domains. The Web of documents has morphed into a Web of data. The Internet users no longer just look to the same old sources for information. Now they are looking to a new set of tools to aggregate and remix micro-content in new and useful ways.

Web 2.0 technology is a production of Web-based communities and services facilitating collaboration and sharing between users. According to O’Reilly (2006), Web 2.0 is the business revolution in the computer industry caused by the move to the Internet as a platform and an attempt to understand the rules for success on that new platform.

**Service-oriented Architecture (SOA):** Based on Hao (2003), SOA achieves loose coupling among interacting software agents. There are two architectural constraints employed:

1. A small set of simple and ubiquitous interfaces to all participating software agents. Only generic semantics are encoded at the interfaces. The interfaces should be universally available for all providers and consumers.

2. Descriptive messages constrained by an extensible schema delivered through the interfaces. No, or only minimal, system behaviour is prescribed by messages. A schema limits the vocabulary and structure of messages. An
extensible schema allows new versions of services to be introduced without breaking existing services.

WS and SOA create the potential for businesses to offer as well as locate and consume services irrespective of the physical location. The emergence of Web 2.0 and SOA is rapidly improving as the best practice for building services, by providing open access to data and functionality. Web 2.0 drives the consumption of services by making use of the loose-coupling encapsulation of SOA.

**Mobile Technology:** The usage of mobile devices in the modern era could be classified as a crucial factor for a business survival and prosperity. The simple and basic mobile phone access enables rapid access by customers to current business applications and databases of the business, irrespective of time and place (Mennecke et al., 2003). Thus, the impact of mobility is assuming tremendous importance in today’s world and, as per Ghanbary (2006a), is felt on both business and personal levels. The most radical impact of mobility on an organisation is generated when mobile data is used as an enabler and a participant inside reconfigured business processes; as compared with mobility simply providing an additional access point for those business processes.

Based on Schneiderman (2002), the innovations in mobile gadgetry have increased the prospects for the organisations to adapt the mobile technology. The quicker access to the corporate database and new applications that embody wireless and Internet connectivity has benefited the organisations by improving their operations.
Mobile Web Services (MWS): A mobile application that is using WS to transmit its data is classified as MWS. According to Pashtan (2005) mobile terminals and mobile services are an integral part of the extended Web that includes the wireless domains and, as such, requires descriptions that facilitate automated interoperation between terminal and network services. WS can replace less flexible methods for information exchange of specific transaction data. WS enable the building of software applications that execute on the Internet and that use the same software paradigms that were successfully applied in the development of enterprise applications. Mobile Web Services apply Web Services technology to the mobile environment, enabling exciting new services to be offered to consumers on their mobile telephones, wireless-LAN-enabled PDAs and laptop computers (Farley and Capp, 2005).

According to the Australian Computer Society (ACS) report on MWS, with Web Services, phones now have the potential to actually consume useful services. The developer of the mobile applications must consider using different routes before taking the SOAP/HTTP route. First of all, turning a phone into a SOAP client might have some performance costs related to slow data speeds and processing both HTTP commands and XML. Secondly, most phones do not come with Web Services support built in. Finally, WS can hide the complexity and leverage existing technologies to make use of their widespread availability (http://www.acs.openlab.net.au/).

Microsoft defines MWS as an initiative to create Web Services standards that will enable new business opportunities in the PC and mobile space and deliver integrated services across fixed (wired) and wireless networks. Mobile Web Services use existing industry standard Extensible Markup Language (XML)-based Web
Services architecture to expose mobile network services to the broadest audience of developers (http://www.microsoft.com/serviceproviders/).

1.3 BACKGROUND TO THIS RESEARCH
The primary issue considered in this research is the manner in which WS and MT influence collaboration in the business world. However, since the business world itself is a part of the overall socio-cultural fabric, it is also worth considering the impact of these emerging WS technologies on society in general.

The influences of emerging technologies cause the restructure of the organisation and its existing business processes. Furthermore, emerging technologies are a creative cause for introduction of a new suite of business processes. These changes to the organisation and the introduction of new processes enable the business to not only remain in the market, but grow as well. This growth is achieved by dealing with greater number of customers (see Ginige, et al., (2002) for a detailed discussion). The overall impact of the mobility has been summarised by Unhelkar (2005a), who states that mobility has had a significant impact on the quality of life for individuals and the society in which they live. This impact of emerging technologies on society revolves around the way communication, through mobile devices, has changed the way people relate to each other, their corresponding ethics (in their private and working lives) and how security and privacy concerns have changed due to these technologies.

However, while the location-aware mobile connectivity has dramatically increased the ability of individuals to communicate, it has also produced challenges in terms of privacy and new social protocols. The effect of globalisation now needs to be further considered in the context of a global-mobile society.
There have been many studies in understanding Business-to-Business collaboration, such as those conducted by Grewal, Comer and Mehta (2001) and Barnes-Vieyra and Claycomb, (2001). These studies indicate that B2B e-commerce use has proved more difficult than expected. The business as well as Information Technology (IT) communities are looking for answers on how to proceed with B2B collaboration. The significance of B2B e-commerce makes it imperative to research it for three reasons (Grewal, Comer, and Mehta, 2001):

1. B2B collaboration is becoming a viable alternative to traditional markets;
2. The commercial potential of B2B collaboration is enormous; and
3. Not enough is known about the factors that influence the nature of organisational participation in B2B collaboration.

B2B integration (or Business Integration) is a secured coordination amongst two or more known businesses and their information systems. This B2B integration has dramatically transformed the way business is conducted between specific business partners, suppliers, customers and buyers. The Internet has made B2B e-commerce more accessible at a lower cost than older communication methods (Sharma, 2002).

B2B e-commerce helps firms avoid value migration (that is, capture of growth in revenue, profits, and market value by competing firms) attributable to declining market prices (disinflation), rising competitive intensity, advanced technology (enabling increased communication flows), and reverse marketing strategies, hence ecommerce is more customer-focused rather than product-focused.

B2B e-commerce is defined by Barnes-Vieyra and Claycomb (2001), as a supply chain innovation that generates cross-firm process integration. The use of the World Wide Web has secured the trading of goods, information, and services before,
during, and after the sale. The ideas presented in this thesis extend the aforementioned concept of the Business-to-Business (B2B) collaborations and apply them to multiple organisations in a dynamic manner. Furthermore, the organisations may not even be known to each other and yet get together electronically to satisfy a particular business demand.

Thus, this research attempts to model collaborative services that can be offered and consumed by organisations that may be unknown to each other electronically. This ability to offer services by publishing them on the Internet, and then locating and consuming them, results from the ability of WS to “transcend” technological boundaries and environments, as discussed later in this thesis.

Web Services technology enables applications from different organisations to communicate with each other regardless of the specific platform requirements. This research is an attempt to extract the full potential of this opportunity offered by Web Services technology. A service is a component that can be invoked by a requester dynamically; furthermore, the technical platform of Service-oriented Architecture (SOA) describes how the service could be invoked and how the services attributes are implemented.

Most research until now only has concentrated on the business processes “internal” to the organisation. This research investigates the cross-organisational processes within multiple organisations when these organisations are not necessarily known to each other, in order to provide the required services/products by customer.

As a part of the development of the model for successful Collaborative Business Process Engineering (CBPE), many important issues and challenges have been identified and studied. Based on the three-dimensional process framework developed by Unhelkar (2005a), these issues and challenges in CBPE could be
broadly categorised into technical, methodological and social challenges. These three types of challenges are now explained in the context of CBPE.

Technically, the challenge is to research the simplicity of implementation of Web Services and their corresponding security and performance issues. These technical issues, revolving around SOA, further expand into identifying the availability and management of the various channels of transaction capabilities between the collaborating organisations. Methodologically, the challenge is to identify, model, evaluate and investigate the impact of collaborative business processes on the structure and dynamics of the collaborating organisations. Socially, collaborations lead to challenges in terms of privacy, trust, and legal as well as cross-cultural issues, between organisations that may be lying across vast geographical boundaries.

This research has also addressed the impact of the collaboration on social system (people “trust”, reward “why collaborate?” and authority structure “who is in charge of the collaboration?”) as well as technical system (processes “before and after engineering”, tasks “security, convenience and availability of the channels” and technology “Web Services” and “Mobile Technology”).

This research is thus a unique attempt to examine model processes for a cluster or group of organisations and how these processes can be engineered to incorporate emerging technologies in them. Logically, this research delves into the advantages and limitations of the aforementioned emerging technologies, and uses those advantages and limitations in creating a base for engineering business processes of multiple organisations (further in-depth discussion is presented in Chapter 5).
1.4 RESEARCH AIM AND RESEARCH OBJECTIVES

The primary aim of the research is to identify *how Web Services could facilitate interoperability amongst multiple organisations that result in collaboration of business processes to provide a unified service to the customer?* The answer to this research question provides an opportunity for the customer to reach multiple organisations to receive a service that is in need of more than one organisation when these organisations are not necessarily known to each other.

Arising from the research aim there are several research questions that need to be studied, as follows:

- What is the nature of interoperation in the existing practice (model) of collaboration?
- What is the impact of interoperability emanating from Web Services on organisations that collaborate electronically? (Here we address the dynamic aspect of collaborations wherein organisations can enter and exit the collaboration at will.)
- What are the characteristics and the mechanisms to model collaborative business processes that transcend organisational boundaries (also technical boundaries) as against business processes within a single organisation?
- What are the factors influencing collaborative business processes (such as trust, security, confidence level and availability of channels)?
- What are the benefits of the constructed model of collaboration (*CBPE* Model) in terms of its efficiency as well as its practicality?
- What are the impacts of mobile technology on the *CBPE* model?
- How do organisations adapt the new technologies (such as mobile and Web Services technologies)?
The above questions are not exclusive to each other but are inter-related, leading from one question to the next. The dependencies of these questions and their answers are an important factor in the creation of the **CBPE** model.

### 1.5 RESEARCH FRAMEWORK

This research is thus an investigation into how Web Services (WS) influence the business processes of a cluster or group of organisations. This research also creates the **Collaborative Business Process Engineering (CBPE)** model. As such, this research investigates the technologies of WS and how they facilitate interoperability amongst a cluster or a group of organisations, which results in their electronic collaboration. There is a need for the study of such processes, that appear unified to the customer (end-user) but which are in the background, comprising numerous organisations and their individual business processes.

This research is a unique attempt to look at cluster-based processes of multiple organisations and identify how these processes can be engineered to dynamically integrate multiple unknown organisations. This research naturally delves into the advantages and limitations of the aforementioned emerging technologies, and uses those advantages and limitations in creating a platform for engineering collaborative business processes. Figure 1.3 presents the research process that has been undertaken in order to satisfy the requirements of this research.

![Research Process Diagram](image)

**Figure 1.3: The Research Process Undertaken**
The overall research framework for this thesis, described in detail in Chapter 3, follows constructivist and interpretivist philosophies with a realistic approach. This research uses constructive, action research studies and a survey as methods to reach the research aim. The employed theories in this research are evolutionary and socio-technical (for detailed information, please see Chapter 3).

1.6 SIGNIFICANCE OF THE RESEARCH
Organisations are employing communication technologies to reach their business partners and customers. Currently, this trading is based on the emerging mobile communication technologies. The phenomenal growth of WS and Mobile Technology (MT) has created a new culture in the business world. The new technology of Mobile Web Services (MWS) has capabilities of text, voice and videoconferencing using wireless devices, as well as the ability to connect to the World Wide Web. Therefore, understanding Mobile Technologies, and the process of transitioning an organisation to a mobile organisation, is crucial to the success of business.

Pashtan (2005) indicates that Web Services can replace less flexible methods for information exchange. Pashtan (2005) also states that with Web Services multiple WSDL interface can be defined for accessing a service and multiple clients can make use of the provided access methods.

The application of WS has provided the opportunity to implement business processes that cross inter-organisational boundaries and that go beyond the simple exchange of information. Web Services deliver additional value to application integration, including a standard application for publishing and subscribing to software services, both local and remote. XML provides a common data-exchange format, encapsulating both data and metadata (Linthicum, 2004).
The application and the use of mobile and Internet technologies require that people are organised into various common-interest groups. These groups are mentioned by Conners and Conners (2004) as varying from harmless fun groups (such as school sports groups) to serious military or political operations.

The expansion of MT also provides a robust basis for the organisation’s desire to reach wide customer and corporate bases. With the aid of mobile and Web Services technologies (MWS), the proposed application, demonstrated in Figure 1.4, will give the opportunity for multiple organisations to communicate with each other in single transactions or multiple transactions. As shown in Figure 1.4, the hospital, pathology, pharmacy or other related enterprises can collaborate and communicate with each other across organisational boundaries, to satisfy patient needs. The collaborating m-enabled WS have made it possible for service-providers to benefit all people involved in the process.

Figure 1.4: Key Research Investigation – Business Processes across a Cluster of Organisations (This example, Hospital, Pathology and Pharmacy)
Figure 1.4 demonstrates how the business processes of multiple organisations could collaborate in a health-domain example. The full development of the collaborative model is presented in Chapter 4.

Technically, with the aid of WS technology (especially XML) applications talk to each other irrespective of the differences in their operating platforms. The WSDL is an XML-based description of the services that are being offered. The WSDL defines services as collections of network endpoints, or ports. The Universal Description Discovery and Integration (UDDI) is a platform-independent, XML-based registry for businesses worldwide to list the services on the Internet. The ensuing use of the WS technologies in the model described in Figure 1.4 is as follows:

Firstly, the use of the mobile devices enables physicians to monitor their patient’s heart beat on their mobile gadget, conduct a conference call, prescribe medications and have faster access to the patient’s records. Secondly, nurses will also have immediate access to the patient’s records and the nurse is able to transmit it to the relevant area, enable a conference call with physicians on the move and check the patient’s schedule on the move. Thirdly, patients will benefit by having remote check-up devices enabling physicians to check on them faster, diagnose the sickness and prescribe medicine through their mobile gadget to the patient and relevant pharmacy. Fourthly, faster receiving or ordering processes will be possible between hospital and suppliers, along with faster access to the recorded databases (hospital and pharmacy’s inventory) and more efficient access to the medicine available in the nearest pharmacy. These are the advantages of the constructed model that connects the hospital, pharmacy, pathology and other related organisations together.
These organisations that are brought together by this model could use entirely
different platforms and frameworks. MT has its own characteristics and limitations
that should be clearly identifiable to business enterprises when it comes to
collaboration. Access to the wireless mobile Internet is not just an extension of the
Internet into the mobile environment that would give the user access to the Internet
while on the move. This access is about integrating the Internet and
telecommunications technologies into a single system that covers the communication
needs of all people. The current network architectures used in either the wired
Internet or cellular networks would not be appropriate and efficient for the future
wireless mobile Internet, even if we assume that the cellular network will provide the
major infrastructure of the mobile Internet (Jamalipour, 2003).

The described advantages of Web Services have opened up opportunities for
organisations to revolutionise their business processes. WS make software
functionality available over the Internet so that programs can request a service
running on another server (a Web Service) and use that program’s response in a
website, Wireless Application Protocol (WAP) services, or other applications. The
possibilities are endless (Unhelkar et al., 2005b). However, the organisational
success depends upon their channels of communications.

The development of an organisation is based on the choice of a suitable
development model such as site and applications, its document orientation, content
and graphic design, budget and time constraints and the changing technology
(Deshpande and Ginige, 2001).

1.7 SCOPE OF THIS RESEARCH
The scope of this research is to discover the full potential and functionality of WS
and mobile technologies for the dynamic collaborations amongst multiple
organisations. These organisations are not necessarily known to each other. They may also be in any geographical location and may have diverse technical environments.

The proposed CBPE model of collaboration incorporates an understanding of how the business processes of multiple organisations could collaborate with each other, even when they are not aware of each other’s existence. Note, however, that the proposed model of collaboration enables them to collaborate and find each other through products and services that they offer across the Internet using Web Services.

1.8 JUSTIFICATION FOR THE RESEARCH
The proposed CBPE model in this research enables the creation of a new collaborative environment. This collaboration is based on the business processes of multiple organisations. Such collaborative business processes serve all the parties involved in the collaboration by providing opportunities to get together on a unique portal. The research aim is achieved by focusing on interpretivist and constructivist philosophies with three action research studies and a survey.

The main justification for this research is the provided benefit to the organisations by:

- Preparing the organisations for the new collaborative environment in the business world.

- Preparing the organisations to use ICT in collaborative as against a competitive environment.

- Preparing them to change their organisational infrastructure.

- Preparing the organisations to have a futuristic vision.

- Preparing the organisations to effectively prepare their people, processes, infrastructure and technology for collaboration.
• Preparing the organisations to realise the important concepts and risks when adapting new technologies.

There is no doubt that the future success of the organisations is based upon the way they adapt the new technologies. The organisations are expected to incorporate new hardware, software and telecommunication technologies in order to remain competitive in the market. The success of the organisations also depends upon the way they use their resources, work within the constraints and collaborate with each other. The business collaboration provides organisations with better opportunities to provide Customer Relationship Management (CRM), Supply Chain Management (SCM) and Enterprise Resource Planning (ERP) systems.

The technology cannot solve problems unless the problem is discovered and described. This research identifies a problem in a collaborative environment, defines it and recommends solutions based on the problem.

1.9 OUTLINE OF THE THESIS

The opening chapter of this thesis, Chapter 1, provides an overview of the problem statement of this research describes the used terminology and presents the aim, questions, significance and the scope of the research.

Chapter 2 incorporates a literature review in the rapidly evolving ICT technologies and e-collaboration. The literature review in this chapter will prove how emerging technologies can solve the problem identified in the research.

Chapter 3 discusses the methodologies, philosophies and theories used in the course of completion of this research. This chapter introduces the numerous methodologies, philosophies and theories and justifies their selections in a way that serves this research.
Chapter 4 explains the core philosophies of Web Services, Enterprise Architecture and Service-oriented Architecture. In this chapter the constructed model for the new environment of the collaboration is presented. The validation of the constructed model is also presented.

Chapter 5 presents the methodological issues involved in the validation of the CBPE model in three organisations based on the action research studies.

Chapter 6 presents the businesses’ integration concepts and also presents the results of the survey distributed to the participating organisations. This chapter identifies the application, limitations and important concerns of the organisations while adapting the new technology for collaboration.

Chapter 7 concludes the research and evaluates and demonstrates that the aim of the research is completed. This chapter also discusses the future recommendations and directions for this research. The final chapter describes the challenges faced by this research from technical, methodological and social perspectives.

1.10 SUMMARY

This chapter has introduced the research problem by defining the shortcomings of the current collaborative environment. This chapter has also presented the existing brief literature to describe the current B2B collaborative environment and described how the available technologies could improve the collaboration.

Based on the introduction of the overall background of the research, the scope of the research has also been defined. The chapter also lists the research aim and research objectives, followed by explicit research questions. The fundamental technical terms which are used in this thesis have also been defined in this chapter.
Chapter 2 provides more detailed analyses of these fundamental technical terms and defines how these technologies support the proposed model of the collaboration.

This study prepares the organisations to view the world from cooperative and inter-operative angles, to understand how the technology can revolutionise the way in which they operate their daily activities in a collaborative manner. Finally, the chapter has outlined the overall structure of this thesis.

1.11 REFERENCES


CHAPTER 2 – LITERATURE REVIEW

2.1 INTRODUCTION
This chapter documents the output from the literature review carried out to identify and study the important issues existing in the collaborative business environment. The focus of this literature review is on studying and understanding service-based businesses applications. The Information and Communications Technology (ICT) utilised by these business applications primarily comprises the emerging technologies of Web Services (WS) and mobile technology (MT). These aforementioned technologies are meant to be applied by businesses in order to construct and participate in the new collaborative environment. This new collaborative environment transcends multiple organisational boundaries and dynamically enables the organisations to deal with each other in order to satisfy cross-organisational business processes. Therefore, the literature review undertaken in this chapter concentrates on the Web Services technologies, Business-to-Business (B2B) interactions and collaborations, and the influence of mobility on business collaboration. These technological and business issues are studied here in order to understand their current state as well as their future collaborative environment. Such a study is conducted firstly in order to identify the gap in the existing literature. Secondly, this literature review is aimed at helping the research to create a model of collaborative businesses that would fill the existing gap in the literature. Thus, the purpose of this chapter is to study the literature in a scholarly manner in order to specifically achieve the following:

- Define the technologies of WS and how they facilitate service-based applications.
- Define the concept of collaboration in a B2B environment.
- Define the existing gap in the current collaborative environment.
- Define the challenges and risks in proposing the new collaborative environment.
- Define the fundamental technologies that facilitate the proposed model of **Collaborative Business Process Engineering (CBPE)**.
- Define the implication of mobile technologies in business collaboration.

Emerging technologies include (but may not be restricted to) Web Services (WS), Web 2.0 (as the upcoming and continuously improving versions of the Internet), grid computing, mobile technologies, microelectromechanical systems, nanotechnologies, genomics, robotics, artificial intelligence and sensors. This chapter focuses on these emerging technologies that are relevant to this research. These emerging technologies not only provide enormous opportunities for enhancing the quality of life (Eng, 2005) but they also have phenomenal impacts on businesses.

For example, the enhanced ability of businesses to communicate with each other has led to global business opportunities and global customer relationships that are not possible without the help of these technologies. Similarly, mobile technologies, including mobile applications, devices, networks and content management systems have become catalysts for changes to customer relations, creation of customer groups, inventory management processes and also deep organisational structured changes within the business.

The businesses accomplish their goals by moving beyond automating their existing business processes and reaching a wider customer base, business partners
and regulatory bodies such as governments by engaging most efficiently with them through the Internet and mobile technologies (Alag, 2006).

Furthermore, emerging technologies, such as mobile technologies, have resulted in a high degree of personalisation for the users. This personalisation capability of MT has dramatically shifted the customer expectation towards the new era of management called Customer Relationship Management (CRM). As stated by Hsu, Burner and Kulviwat (2005), personalisation provides significant advantages to the business in terms of enhanced customer services directed towards the needs of an individual. In the modern age mobile technologies facilitate this personalisation much better than any other technology. With the use of mobile technologies, clients and users of organisations can access their applications from anywhere and at any time. This location- and time-independent accessibility brings a new dimension to the usage of mobility by businesses, as this phenomenon did not exist in the traditional land-based Internet (Arunatileka, 2007). Therefore, this literature review has also studied mobile technologies for a collaborative environment, leading to what is called Mobile Web Services (MWS). These emerging technologies and their specific issues are considered, in this literature review, in the context of business collaborations.

2.2 BUSINESS TO ELECTRONIC COLLABORATIVE BUSINESS

Understanding the evolution of the Internet helps in defining how the Internet has progressed from a mechanism to provide simple information to enhancing the electronic commerce, electronic business and ultimately business collaboration (please see Appendix C for the relevant evolution of the Internet).
2.2.1 Business Utilising the Web

The history of the Internet detailed in Appendix C becomes relevant when it is understood in the context of its utilization by business. This increasingly complex yet fruitful utilisation of the Internet’s communication capabilities is shown in Figure 2.1. This figure maps the technological evolution of the Internet and its usage by business (based on S’duk and Unhelkar, 2004).

![Diagram of Internet Evolution and Business Utilisation](image)

**Figure 2.1: Model of the Internet’s Evolution and Its Use by Business (based on S’duk and Unhelkar, 2004)**

As seen in Figure 2.1, the Internet technology has evolved through the four layers of the triangle – namely, informative, transactive, operative and collaborative layers. Each layer of the triangle builds upon the lower layers. The ability of a business to thoroughly implement the preceding layers has a positive effect on the success of the subsequent layers.
These layers correspond roughly to the four distinct eras of businesses utilising the Web. As each layer moves closer to the top of the triangle, it becomes smaller to depict the reduced usage of the Web by business, more complex to depict the technical requirements to facilitate this usage, and last, but not least, the more risky and expensive to implement than the previous layers. Once a business has successfully traversed each layer and positioned itself at the top of the triangle then it had maximised its usage of the Web by achieving the strategic business goals (S’duk and Unhelkar, 2004).

The tip of the triangle depicted in Figure 2.1 represents the c-business or collaborative business era. That collaborative era is a natural evolution that starts from the e-information (informative) era. This evolution is discussed here with the aim of understanding the impact of the Internet on collaboration.

2.2.2 TheInformative Stage of Internet Usage

The informative aspect of the Internet is the most primitive use of the Internet. This was the first utilisation of the Internet and its usage was initiated after the Massachusetts Institute of Technology (MIT) published the first newspaper (The Tech) online. Initially, this usage of the Internet meant scanning of the company’s brochures and putting them up on the Web. Therefore, this informative use of the Internet was also called “brochurware”. Even today, this informative aspect of the Internet usage is the most used aspect of the Internet and it includes providing online newspapers and business advertisements.
2.2.3 The Transactive and Operative Stage of Internet Usage

The informative layer of the Internet usage is followed by e-commerce (transactive era). This transactive layer encompasses two-way interactions between business and the users, for example, free services such as free web-pages and chat rooms, which were offered for community building. Online sales have grown rapidly for such products as books, music and computers. These sales transactions form the transactive aspect of the Web. Ordinary business is not capable of satisfying the sales of the goods and services online. As a result, a new mechanism is required. This mechanism is called “e-business”.

The term e-business is used when the Internet technology is used not only to collaborate with customer, supplier and business partners but also more to internal business processes or the Web. In other words, e-business is the utilisation of the Internet’s communication capabilities to handle all aspects of business, including information, transaction and operations, both externally and internally.

E-business in an enterprise with the capability to exchange values (goods, services, money, and knowledge) digitally via computer networks (Hackbarth and Kettinger, 2000), uses distributed information technology, knowledge management, and trust mechanisms to transform key business processes and relationships with customers, suppliers, employees, business partners, regulatory parties, and communities (Craig and Jutla, 2001). E-business is not only rapidly changing the way that companies buy, sell, and deal with customers, but also changing the relationships with its employees (Abu-Musa, 2004).

E-business is the carrying out of business activities that lead to an exchange of value, where the parties interact electronically, using network or telecommunications technologies (Jones, Wilikens, Morris and Masera, 2000).
The competitive environments of electronic business (e-business), with frequent and rapid changes to their digitally enabled supply, production, and logistics and distribution networks, are increasingly dependent on electronic interconnections that are innovative in their functionality (Lai, 2006).

E-businesses result in the organisations sharing their data and information both inside and outside the business boundary. This sharing is achieved by unlocking data in the back-end computer systems and opening them up in a secured manner to conduct electronic transactions.

While e-business means conducting business online using paperless methods, it needs a multi-disciplinary approach to a business process (Lawson and Alcock, 2003). Thus, one of the most important issues, as far as the e-business is concerned, is the ability to bring together information technology, business processes and secured communications across organisational boundaries, resulting in an efficient business. Such a business increases its chances to globalise easily (Lan and Unhelkar, 2005).

As seen in Figure 2.1, the e-business evolution has taken more time than the earlier adoption of e-information and e-commerce. This is so because the diffusion of new technology can take decades, and involves more than simply reproducing and distributing the technology. Indeed, making full use of the new technologies relies on the IT skills of staff within organisations (Roseberg, 1976 cited in Forester, 1985). Therefore, as the IT skill set within organisations improves, so does the ability of people to use the Internet for internal business processes as well as external ones.

These external and internal business processes are in many ways based on the Online Transaction Processing (OLTP) of the earlier era of software applications. In OLTP applications, a class of program facilitates and manages transaction-oriented
applications, typically for data entry and retrieval transactions in a number of industries. The online transaction-processing increasingly requires support for transactions that run on different computer platforms in a network.

The OLTP enables business applications to receive immense enhancement when transacting across the Internet. Therefore, the organisation benefits from wider marketing, better communication, improved business practices and increases its business activities. (Lawson et al., 2001).

Increasing business dynamics, changing customer preferences, and disruptive technological shifts create the need for two kinds of flexibility that inter-enterprise information systems must address: the ability of inter-enterprise linkages to support changes in offering characteristics while offering flexibility, and the ability to alter linkages to partner with different players such as partnering flexibility (Sanjay, Malhotra and ElSawy, 2005).

Flexibility is also an effective means by which an e-business can hedge against uncertainty in a swiftly changing environment. Systems, applications, and business processes – in short, the entire environment supporting e-business – must seamlessly adapt to changes without costly and time-consuming infrastructure overhauls. Decision-makers therefore have a growing need for knowledge about e-business flexibility. However, flexibility remains largely an abstraction in the e-business domain (Shi and Daniels, 2003).

The environment in which e-business systems operate is also changing. Businesses are no longer likely to have total control over the systems and networks upon which their e-business applications depend.
2.2.4 The Collaborative Stage of Internet Usage

The c-business (that is, a collaborative business in the collaborative era) is initiated when a significant number of electronically collaborating applications start transacting in the market. Collaborations are widely acknowledged as a means to share and leverage knowledge within a context forged by the organisation’s history, culture, and its external environment (Fahey et al., 2001). Collaborations, by their very nature, are democratic. The business does not always control what its customers do. As per Siegel (1999), good collaborative businesses take the bold steps of facilitating collaborations between their customers. This collaboration between customers can lead to interesting discussions and subsequent results, such as the specifications for a car. Another example is the discussion about the quality of a book (the latter having been tried out by amazon.com).

Electronic collaboration or e-collaboration is defined as collaboration among individuals engaged in a common task using electronic technologies (Kock et al., 2001). The rapid development of Internet-based communication has caused e-collaboration to evolve from its original role as a substitution for traditional face-to-face collaboration into a genuine creator of novel associations between businesses and customers (Unhelkar, 2003).

The integration of e-collaboration and virtual technologies increases the effectiveness and speed of interactions between organisations, thereby enhancing strategic decision-making and genuine operational agility (Barekat, 2001). These collaborations are well supported by technologies that are built on top of the Internet. For example, there are web-based chat tools, web-based asynchronous conferencing tools, e-mail, Internet-based list servers, collaborative writing tools, and group
decision-making tools, as discussed by Kock et al. (2001) that operate on the Internet.

2.2.5 The Desired Evolution in the Collaborative Layer

This section is focused on the topmost layer of Figure 2.1, namely the collaborative business layer. This research is furthering the investigation into collaborative business environment based on Internet technology in order to justify the next stage of the Web evolution: “Collaborative-Business”. Based on Curtis, Kellner, and Over (1992), a process model is an abstract definition of an actual or proposed process. The collaborative process model here is also, to a certain extent, an abstraction of the actual process that a collaborative group of organisations can undertake. Consequently, in Figure 2.1, the tip of the triangle represents this current, abstract, final stage of the Internet usage by business. This research is pushing this abstract stage further and is evaluating how the business processes of multiple organisations can collaborate with each other in practice. The term Collaborative Business Process Engineering (CBPE) has been selected to explain the proposed dynamic collaboration of the multiple organisations.

The proposed collaborative process model in this research facilitates creates a new collaborative environment and provides opportunities for people and organisations to interact with each other in a “free market” environment. The collaborative business process discussed especially here deals with situations in which the organisations may not be known to each other beforehand. The dynamic and “free market” nature of what is being proposed is new, and it requires the rigours of process engineering. The engineered process could become a part or an extension of an existing business process or it can be a fully re-engineered process.
These newly engineered processes, resulting from CBPE, enable an organisation to become part of a global collaborative environment. The modelling of these collaborative business processes, however, needs a detailed understanding of the architecture and design of a process itself: therefore, the study can benefit immensely by understanding the corresponding software-modelling processes. For example, Graham, Henderson-Sellers and Younessi, (1997) discuss various software development methods through their OPEN (Object-Oriented Process, Environment and Notation) – wherein they discuss and provide strong support for process-modelling. Unhelkar (2003) has also discussed elements of process architecture.

The discussions of the aforementioned authors, especially the use of lifecycles and patterns, processes to capture requirements, configuration and enactment of processes – all of this has relevance to the CBPE model discussed in this thesis. This relevance of process-modelling, discussed in the software literature to the CBPE model can be seen in Figure 2.2. The activities, deliverables and roles, as presented in Figure 2.2, have their origins in software processes such as OPEN.

![Figure 2.2: Collaborative Business Process Environment](image-url)
Figure 2.2 demonstrates that the collaborative business process has brought together the organisations in a collaborative environment using relevant technologies. As has been noted by Vij and Patel, (2006), current information retrieval systems provide only a list of ranked documents with a very brief summary against user-supplied keywords. However, the proposed CBPE improves the search engine’s information retrieval results by increasing the compactness of clusters based on the processes discussed here. In order to achieve this efficiency, CBPE restructures the infrastructure, refines the activities, deliverables and roles, and links these elements to the existing environment. The CBPE presented in Figure 2.2 is also made up of these elements of activities, deliverables, and roles. These elements therefore comprise:

- **Activities:** Potential organisations, creating the CBPE model, validation of the model, testing of the model, training of users, deploying the system and educating the end-users.

- **Deliverables:** Policies and standards involved in the management of the proposed collaborative system.

- **Roles:** Business management, Enterprise Architecture (EA) and the facilitator.

The evolution of the technology is clearly demonstrated in this section by stating how the Internet technology has evolved from not only being informative to also becoming effective in providing a fully collaborative environment.
2.3 BUSINESS-2-BUSINESS COLLABORATION

The collaboration, as discussed by Yildiz, Marjanovic and Godart (2006) is an activity of a group of people that results in a virtual team that exchanges information amongst its members. This definition of collaboration can also be extended to online collaboration. For example, as discussed by Unhelkar (2003), collaborations provide the backbone of business growth on the Internet when collaborative parties as a group of individuals and/or organisations come together for a specific purpose such as a project or a task. Linking individuals and systems towards achieving better information sharing, real-time interactive communication and seamless collaboration is the goal of any business that wants to capitalise on the Internet revolution.

Currently, this collaboration between multiple organisations does not take place in a formal manner. This lack of formality implies that the existing technical and business environment has not been “engineered” in a manner that would encompass new processes that are conducted across multiple business organisations. This literature review indicates that all the business-process modelling and Business Process Re-engineering (BPR) that has been undertaken so far has been within a single business entity. This is true even in the case of a global business wherein the global processes are still within the organisational boundary. The BPR discussions, right from the original discussions by Hammer and Champy (1993) through until now have concentrated on the business processes belonging to a single organisation. When these business processes are indeed extended beyond the boundaries of an organisation, they are invariably extended to another “known” and dedicated business partner. These business processes have resulted in what is described as Business-to-Business (B2B) processes. However, throughout the usage of the
Internet, the question of modelling integrated but dynamic business processes that transcend multiple organisational boundaries is still an open question.

### 2.3.1 Alternative Collaboration Models

An alternative collaboration with regard to multiple organisations is possible when a gateway is positioned to facilitate the interactions amongst the organisations, as illustrated in Figure 2.3. This demonstrated gateway in Figure 2.3 is the only existing channel of collaboration between the two organisations (ordinary B2B model). The model presented in Figure 2.3 clearly demonstrates the shortcomings of collaboration, since the organisations are not in direct contact with each other.

The Gateway (an individual organisation) can collaborate with many other organisations. For example, your bank (Gateway) can pay different bills to different service providers (electricity, water, phone service) through their BPay addresses. Figure 2.3 is an illustration of the existing environment of collaboration, as observed by this research.

![Example of Existing Model of Collaboration](image)

**Figure 2.3: Existing Environment of Collaboration**
This research is focused on cross-organisational processes. The new engineered processes must be able to facilitate collaborations and negotiations with organisations that are getting together electronically, but that are not necessarily known to each other and they may have different technical environments. Business processes cutting across multiple organisations are the main concentration of this research. Goethals and Vandenbulcke (2006) explain that Web Services may be used for integrating systems for unknown parties. In creating the type of integrations, the infrastructure used should be built in such a way that it can easily be adapted to new requirements.

Furthermore, Fong (2005) argues that the limited empirical evidence of successful e-collaboration is attributed not only to the short history of e-collaboration and software, but also to the challenges associated in business with this revolutionary way of operating and sharing information.

The challenges of e-collaboration are mainly classified where individual organisations use varying technologies and data standards that give rise to islands of networks that now need to be integrated and coordinated. Web Services can overcome this problem of interoperation. This is so because WS enable applications to talk with each other through Extensible Markup Language (XML). This XML-based interaction is relatively new and different from the B2B interactions between two dedicated applications. WS are understood as independent application components that take the Web to a new stage of business interactions in which software applications can transmit and receive the required data, irrespective of their existing platform under operation.

The customers are better informed with the availability of information at their fingertips over the Internet. The Internet also has offered a window of opportunity
for users to purchase products and receive services on a global scale. The WS provides an opportunity for Web applications to be discovered by other software components to conduct their business transaction.

There is no doubt that through the technologies and communication abilities of WS and the Internet, the customer is able to dictate to the business as to what s/he wants or doesn’t want. This direction given by the customer to the business gives the opportunity to the customer not only to buy products but also to decide on the way they are produced. Customer awareness and maturity create a heavy impact on the use of Information and Communication Technologies (ICT) in order to direct the business to globalise its product and services. The globalisation matures the company, since the organisation has overseas trade and is aware of the foreign market potentials.

The success of the global collaborative businesses depends heavily on the socio-cultural nuances of participating organisations. Organisations are encouraged to embrace diversity and turn the multicultural characteristics into strategic advantages. The multicultural characteristic will provide organisations with a certain level of competitive edge in the global business environment. Countries, and societies within countries, need to be understood to provide collaborative products/services to them.

Traditional e-collaboration plays a strategic role in business direction, and the proposed new business process ($CBPE$) has emerged from the traditional e-collaboration, by examining beyond the boundaries of the internal processes of the organisation. E-collaboration, facilitated by Internet technology, is more than mere substitution of traditional collaboration. The $CBPE$ also changes the organisational infrastructure, resulting in the flat reporting hierarchy, while people at similar levels
in collaborating organisations continue to interact with each other. Thus, human interaction is the significant factor in collaborative business. The technical infrastructure facilitates rapid creation of e-collaboration. However, technical issues such as storage and system architecture also need to be addressed for the success of a collaborative business.

### 2.4 EVOLVING ISSUES IN COLLABORATIVE BUSINESS

This section presents the main factors of the investigation by this research and shows the difference between the existing model of collaboration and the proposed model of collaboration. Table 2.1 distinguishes between existing collaboration and the recommended way of collaborating by this research.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Existing Model of Collaboration</th>
<th>Evolving Model of Collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static versus dynamic collaboration</td>
<td>Organisation must know each other to collaborate (B2B)</td>
<td>Organisations may collaborate without prior knowledge of each other</td>
</tr>
<tr>
<td>Interoperation amongst multiple organisations</td>
<td>Not addressed</td>
<td>Identify the issues involved in <em>interoperation</em></td>
</tr>
<tr>
<td>Interoperation amongst multiple organisations</td>
<td>Not addressed</td>
<td>Business processes are “engineered” in a way to facilitate numerous businesses</td>
</tr>
</tbody>
</table>
Pre-qualification (e.g., prior contract) | Pre-qualification is necessary for collaboration | No Pre-qualification is required
--- | --- | ---
Trust | Appear in current collaborative environment | Additional research required when multiple organisations collaborate
Security | Only between known entities and applications | Additional research required to ensure when multiple organisations collaborate
Channels | Pre-fabricated | Additional research required when multiple organisations collaborate to create the channels and investigate their availabilities

**Table 2.1: Research Investigation**

The “dedicated WS” (the term “dedicated WS” is selected to define the current state of the Web Services) discusses the existing use of the Web technology. Based on the review of literature, this research shows that the full potential of the WS is not extracted. This research will develop a model in order to exploit the full potential of WS for CBPE.

The existing model of collaboration needs pre-qualification as a necessary item for the collaboration. This pre-qualification implies the existence of a contract prior to the collaboration that clearly instructs the applications of their policies and
responsibilities. However, in CBPE, there is no prior contract, since the organisations might not know each other.

The proposed model of collaboration should be evaluated in the collaborative environment to test the performance of the channels of the collaborations, the security and how these organisations trust each other to collaborate when there is no prior contract.

2.5 POTENTIAL IN CBPE

The incorporation of the proposed collaborative model by business has many issues and challenges. These issues and challenges are as follows:

- Limitation and shortcomings of the Web Services standards identified by Goethals and Vandenbulcke (2006), such as the slow speed of the XML applications. The following challenges are identified by this research.

- Technical issues of interoperation.

- Methodological issues of interoperation.

- Social issues of interoperation.

- The requirements of the “manager” of the Directory Service

- The basis for the Trust amongst participant businesses and their managers.

- The basis for a successful “business model” for the management of the collaborative environment

- The benefits for the participated organisations.

- The concerns of the participated organisations.
The best “technical model” for the success of the CBPE while considering the enforcement of standards.

The convenience and the availability of the channels.

To convince the organisations to adapt Web Services technology considering the limitation of the WS. (for example, slow speed of XML applications)

Identify the dynamic aspects of collaboration wherein organisation can enter and exit the collaborative environment at will.

The limitation of business or technological issues to create the best environment of collaboration.

Security issues involved in the collaboration.

Privacy issues of collaboration.

2.6 WEB SERVICES AND CBPE

Web Services (WS) is a unit of business, software application or a system that can be accessed over a network by Extensible Markup Language/Simple Object Application Protocol (XML/SOAP) messaging. A Web service is defined by Preist (2004) as a computational entity that is accessible over the Internet (using Web service standards and protocols). The term ‘Web service’ means to request a service over the Internet, with the agreed standards (http://www.Ambysoft.com).

The W3C (World Wide Web Consortium) has defined that Web Services provide a standard means of interoperating between different software applications, running on a variety of platforms and/or frameworks. Web Services provide a conceptual model and a context for understanding Web Services and the
relationships between the components of this model. Web Services architecture is interoperability architecture: it identifies those global elements of the global Web Services network that are required in order to ensure interoperability between Web Services (Booth et al., 2004).

A Web Service (WS) is a delivery mechanism that can serve many different consumers on many different platforms at the same time. Web Services technology act as an enabler to connect incompatible stand-alone systems to integrate a complex distributed system in a way that was not possible with previous technologies (Stacey and Unhelkar, 2004).

Web Services enable Web applications to “talk” with each other independent of their technical environments which could be defined as open standard (XML, and SOAP) -based Web applications that interact with other Web applications for the purpose of exchanging data. Initially used for the exchange of data on large private enterprise networks, Web Services are evolving to include transactions over the public Internet by providing generic coordination mechanisms that can be extended for specific protocols (Curbera, 2003). The collaborative coordination includes the execution of short-running transactions within an organisation (similar to traditional distributed transactions) and long-running transactions across organisations.

IOPSIS Software Company (http://www.iopsis.com/) is one of the organisations that help enterprises deliver greater value over their supply and sales chains using Web-Services-based solutions. IOPSIS has developed an application called LiveWeaver(TM) which is a completely free, user-driven application home page, on which the users can create, share, find and use Web-based applications, without the need to write or understand any code (http://www.techieindex.com/).
IOPSIS enables businesses to effectively collaborate with external entities while leveraging existing infrastructure rapidly without additional infrastructure. The benefits of LiveWeaver are compelling – new value from existing infrastructure for faster Return on Investment (ROI). IOPSIS enables businesses to successfully, rapidly, securely and non-disruptively transact in a collaborative environment by leveraging Service-oriented Architecture while remaining platform-agnostic and conformant to open standards.

Web Services as an attractive service model are able to incorporate standards on open protocols for calling services and transmitting data. The availability of these services over the Internet allows the programs to request a service running on another server (a Web Service) and use that program’s response in a website, WAP service, or other application (S’duk and Unhelkar, 2004). Web-Services-based technologies enable applications to “talk” with one another even across organisational firewalls, resulting in an opportunity for a cluster or group of organisations to simultaneously transition to web-based entities (Unhelkar and Deshpande, 2004).

Web Services as a network accessible interface to application functionality are built using standard Internet technologies (Snell and Tidwell, 2002), while as a novel approach to engineer and deploy software solutions such as cooperative information systems (Tilley et al., 2002). Another definition states that they are any services that are available over the Internet, use a standardised XML messaging system, and are not tied to any one operating system (Cerami, 2002).

XML Web Services are the fundamental building blocks that provide exchange of information over different computing standards on the Internet. XML uses open standards to communicate and collaborate amongst applications. Thus we see that WS tend to offer opportunities that are way beyond the business integration
that is commonly discussed and that merely talks about document exchanges. Web Services hold the promise of considerable gains for many organisations by giving them the opportunity to develop techniques to effectively integrate disparate applications by leveraging computer technology (Kirda et al., 2001). The above statement emphasises that not only can integrated systems provide better business value by sharing data, communicating results and improving overall functionality, the ability to integrate systems opens up doors to synergise between systems of disparate organisations.

The advent of the Internet and computer-mediated communication has intensified the nature of collaboration between businesses. The Internet enables business applications to interact with each other quickly. The resultant electronic collaborations (e-collaborations) are also broadly defined as collaboration among individuals engaged in a common task using electronic technologies (Kock and Nosek, 2005).

The existing literature does not explain in sufficient detail how to extend the aforementioned electronic collaboration across multiple organisations that would enable them to share their products and services in an open and free market. The research has identified that such an extension is possible through the application of Web Services technologies. This statement also appears to be supported by Goethals and Vandenbulcke (2006), who mention that Web Services could be used for integrating system for collaboration even amongst unknown parties.

One of the challenges of the collaboration occurs when the involved organisations have to make the investment necessary for replacing redundant or older systems as well as building a dynamic platform that incorporates multiple standards (Fong, 2006). The challenge is further increased when, in unstructured e-
collaboration (without prior contract), creating or exchanging of non-standard documents takes place.

The ability to promote as well as locate services, however, is provided through Universal Data Dictionary Integration (UDDI). UDDI is a platform-independent, XML-based registry, allowing businesses worldwide to list themselves on the Internet. Enterprise UDDI Services is a key element of Web Services infrastructure that provides a standards-based solution for discovery, sharing, and reuse of Web Services, helping to maximise the productivity of developers and IT professionals. The purpose of UDDI is to allow users to discover available Web Services and interact with them dynamically. The process can be divided into three phases: searching (discovery), binding, and executing.

The UDDI specifications provide a mechanism to register and locate WS. It defines an electronic business registry in which businesses can describe their business and register their WS as well as discover and integrate with other businesses that offer Web Services (Roy and Ramanujan, 2001).

The UDDI is not the best means for realising Web Services discovery, since the current UDDI directories are accessible to anyone (Goethals and Vandenbulcke, 2006). It is very important to note that the current registries are storing the information without proper indexing.

Hence, UDDI will allow companies to publish information about the Web Services they offer in a Universal Business Registry (UBR) that will be accessible by anyone. The solution would be to use the private UDDI or WSIL (Web Services Inspection Language).

The B2B collaborative environment fully supports static collaboration. Static collaboration is collaboration that always follows the same pattern, such as the same
invoices, same forms, and same organisation. The correct application of the UDDI enables organisations to benefit from the dynamic environment of the collaboration in which people and organisations interact through various environments and people.

Considering Pollock’s (2002) opinion that most problems contributing to the high failure rates of integration projects are not technical in nature, but logical, the following will recommend a technical and logical model to resolve already identified problems. Based on the literature provided on the Web Services, the following can be concluded:

- the Internet access will soon be built into nearly every program anyone ever writes.
- the generic browsers will not be required.
- the solution providers need to write code that talk with other code, over the Internet.
- the XML is the lowest Common Denominator.
- WS Provide integration within and amongst Enterprise Applications.
  - Thereby facilitating Global business.
- WS provide environment (technical) independence.
  - Beyond DCOM and CORBA.
- WS enables existing legacy assets on the Web.
- WS enables application-to-application businesses.
- technology enables Globalisation, called Enabling Technologies.
- WS-based on the Internet, provide maximum globalisation opportunity.
- interaction and implications of the Web Services in Web 2.0 technology.
- Extensible Markup Language (XML) provides the support for the development of the Web 2.0 applications. Web 2.0 builds on the existing
Web server architecture, but relies much more heavily on the back-end software of Web Services technology.

This research will investigate the full potential of the Web Services technology and examine it to establish a clear understanding of how this technology evolves in enabling collaborative business.

2.7 THE ROLE OF WEB SERVICES IN INTEGRATION

2.7.1 Understanding Service-oriented Architecture (SOA) and Web 2.0

Web Services (WS) technologies, built around the ubiquitous Extensible Markup Language (XML), provide many opportunities for integrating enterprise applications. However, XML/Simple Object Access Protocol (SOAP), together with Web Services Definition Language (WSDL) and Universal Description Discovery and Integration (UDDI) form a comprehensive suite of WS technologies that have the potential of transcending beyond mere application integration within an organisation, and providing capabilities for integrating processes across multiple organisations.

The WS technology adapted by Web 2.0 opens up the doors to collaborative Enterprise Architecture Integration (EAI) and Service-oriented Architecture (SOA), resulting in Business Integration (BI). WS can be used in order to align and integrate business processes of organisations (internal and external processes) to satisfy the needs of Enterprise Architecture (EA).

Thus far, the concept of Business Integration (BI) has mainly focused on integrating the business processes internal to an organisation. However, this research is an investigation to identify how the organisations can extend this integration with these business processes belonging to “other” enterprises.
The concept of “Web 2.0” began with a conference brainstorming session between O’Reilly and MediaLive International. According to O’Reilly (2005), Web 2.0 is a business revolution in the computer industry caused by the move to the Internet as platform, and an attempt to understand the rules for success on that new platform.

Web 2.0 allows the network itself to become a platform for delivering services and allowing users to access applications entirely through a browser (O’Reilly, 2003). Web 2.0 technology is WS-enabled (second generation of Web), contributing to easy collaboration and integration of applications on a network-based system.

According to Murugesan (2007), Web 2.0 is a collection of technologies, business strategies and social trends, more dynamic and interactive than its predecessor Web 1.0 technology. Web 2.0 facilitates flexible Web design, creative reuse and updates. Web 2.0 facilitates collaborative content creation and modification, as well as enabling the creation of the new applications by reusing and combining different applications on the Web or by combining data and information from different sources.

The flexibility of the Web 2.0 technology supports the collaboration of the social trends and businesses facilitating the reuse of the services. Reuse of the services is the main objective of the SOA through Enterprise Architecture (EA). Therefore, Web 2.0 technology is an instrument for the organisation to develop EA and SOA.

Enterprise Architecture (EA) builds on business knowledge and allows business specialists to apply their respective knowledge to determine the most effective technology and process solutions for the business (Finkelsteing, 2006).
Enterprise Application Integration (EAI) is also a relevant approach to integrating core business processes and data-processing in the organisation. The EAI automates the integration process with less effort. EAI is a business computing term for plans, methods, and tools aimed at modernising, consolidating, and coordinating the overall computer functionality in an enterprise (Lee, Siau and Hong, 2003).

EA helps integrate different enterprise systems, such as Supply Chain Management (SCM), Selling Chain Management, CRM, Enterprise Resource Planning (ERP), procurement, human resource, payroll and Knowledge Management (KM). The EAI plays an important role in integrating them and increases enterprise more effectively and efficiency. Using mobile devices in enterprise modelling can help real-time information access amongst systems on production planning and control, inbound and outbound logistics, material flows, monitoring functions, and performance measurements (Rolstadas and Andersen, 2000). Information and Communication Technology (ICT) architectures have not paid enough attention to integration of the services in the past.

Service Oriented Architecture (SOA) is an architecture that makes the services of a system to interact and perform a task supporting a request. SOA is classified as part of Enterprise Architecture. Therefore, SOA is part of an EA and can be viewed as “sub-architecture” of an Enterprise Architecture. SOA existed before the advent of Web Services. Technologies such as Common Object Request Broker (CORBA) and Distributed Component Object Model (DCOM) afforded the opportunity to create SOA. However, Web Services is an ideal technology for developing sophisticated architecture (Barry, 2003).

SOA is a collection of services capable of interacting in three ways, commonly referred to as “publish, find and bind” (Harrison and Taylor, 2005). A
service must be able to make its interface available to other services (publish), other services must be capable of discovering the interface (find), and finally, services must be able to connect to one another to exchange messages (bind). The loose coupling of an SOA is achieved firstly through the separation of data exchange from the software agents involved in the exchange, and secondly through the discrete nature of the service.

SOA also describes how the service could be invoked and how the service attributes are implemented. The concepts of SOA and The Open Group Architecture Framework, TOGAF (website) relate to each other when Technology Architecture is invoked by different requesters. TOGAF contains two reference models that can be used in this way: a platform-centric Technical Reference Model that focuses on the services and structure of the underlying platform necessary to support the use and reuse of applications, and an Integrated Information Infrastructure Reference Model that focuses on the applications space, and addresses the need for interoperability and for enabling secure flow of information where and when it is needed (Harding, 2005).

According to Rivett et al. (2005), TOGAF is a critical architecture for the effective and safe construction of business and information systems. TOGAF provides the Architecture Development Method (ADM). This TOGAF ADM is a comprehensive, detailed, industry standard method for developing EAI, and related information, application, and technology architectures that address the needs of business, technology, and data systems (http://www.integrationconsortium.org).

2.7.2 Understanding TOGAF for CBPE

Based on Chase (2006), originally designed as a way to develop the technology architecture for an organisation. TOGAF has evolved into a methodology for
analysing the overall business architecture. The first part of TOGAF is a methodology for developing the architecture design which, as mentioned earlier, is called the Architecture Development Method (ADM). This ADM has the following nine basic phases that are mentioned here along with their relevance to CBPE:

- **Preliminary phase: Framework and principles.** Get everyone on board with the plan. This phase has a significant influence in the CBPE. This phase in the CBPE enables everyone to participate in the collaborative environment.

- **Phase A: Architecture vision.** Define your scope and vision to map your overall strategy. In CBPE, the scope and vision of the participating organisations must be clearly stated upfront. The CBPE maps the overall strategy.

- **Phase B: Business architecture.** Describe your current and target business architectures and determine the gap between them. This phase enables the organisations to realise the need for CBPE. After the business architecture phase, the organisations start to realise the initial benefit of the CBPE for the collaborative environment.

- **Phase C: Information system architectures.** Develop target architectures for your data and applications. The CBPE keeps records of all transactions and data throughout a well-defined Information Systems (IS) architecture. The actual creation of the IS architectures is left up to the architects.

- **Phase D: Technology architecture.** Create the overall target architecture that you will implement in future phases. In CBPE, all the recorded data will be implemented for the future phases and transactions. Web Services technology provides the base for technology architecture, also networks.
• **Phase E: Opportunities and solutions.** Develop the overall strategy, determining what you will buy, build or reuse, and how you will implement the architecture described in Phase D. The recorded data in *CBPE* supports the reuse of the services implementing better architecture for the collaboration.

• **Phase F: Migration planning.** Prioritise projects and develop the migration plan. *CBPE* prioritises the organisations and the customer’s request. *CBPE* has the capability of cooperating with Phase F of the TOGAF by marking the organisation that received the previous request. The next request will go to the next organisation capable of handling it.

• **Phase G: Implementation governance.** Determine how you will provide oversight to the implementation. One of the functions of the *CBPE* manager is to provide an oversight to the portal implementation.

• **Phase H: Architecture change management.** Monitor the running system for necessary changes and determine whether to start a new cycle, looping back to the preliminary phase. The communication within the different levels of the *CBPE* determines the new cycle if a customer desires to receive products and service from different industries.

These phases provide a standardised way of analysing the enterprise and planning and managing the actual implementation. The SOA is considered in **Phase D: Technology architecture** where the TOGAF defines the services and their relationship with each other and defines how the services could be invoked by different requesters.

The term “enterprise integration” (or “system integration”) reflects the capability to integrate a variety of different system functionalities. The increase in
demand for managing information has contributed to the focus on integrating business processes and data.

Traditionally, information systems are implemented to support specific functional areas. However, the advancement of information technology enables new forms of organisations and facilitates their business processes to collaborate even when these organisations are not necessarily known to each other. As organisations become more complex and diverse in the collaborative context, it becomes nearly impossible for organisations to implement their collaborative business concepts without enterprise integration.

The demand for flexible, efficient and user-friendly collaborative services is becoming more and more urgent as the competition in the current market-oriented arena is becoming more intense and fierce (Jostad et al., 2005). Enterprises have to be more dynamic in terms of collaboration with partners and even competitors. The SOA is a promising computing paradigm offering solutions that are extendible, flexible and compatible with legacy systems.

The SOA’s biggest challenge may exist as the result of the user’s behaviour to adapt to the developed system, considering that the consumer of a service is not required to have a detailed knowledge of implementation, implementation language, or execution platform of the service (Chen et al., 2006). The only concern of the consumer is how a service can be invoked according to the service interface.

The successful architecture confirms that business requirements and information technology design are captured in models. The modelling technique of abstraction to separate business concerns from technology concerns (what the
business system needs to do, versus its underlying computing platform) is also an important aspect of the success of the architecture.

Based on Miller and Mukerji (2003), the following issues could also be classified as the critical factor for the success of the Service Oriented and Enterprise Architecture:

- The capture of business requirements.
- The Platform-independent Model (PIM), by promoting the design of a business solution prior to selecting how it will be deployed.
- The Platform-specific Model (PSM) adds to the PIM the details of a specific computing platform on which the business solution will be deployed.
- The transformations (mappings) are performed on these models to progress from a higher level of abstraction to a lower level of abstraction.
- The activities are based on internationally accepted standards.

Most organisations have already realised that their information technology infrastructure is effectively a distributed computing system. The integration of information assets, and effective use of information, must be accessible across the department, across the company, across the world and, more importantly, across the service- or supply-chain from the supplier, to one’s own organisation, to one’s customers. This means that Central Processing Units (CPU) must be intimately linked to the networks of the world and be capable of freely passing and receiving information, not hidden behind glass and cooling ducts or the complexities of the software that drives them (Miller and Mukerji, 2003).
The SOA is architecture constructed based on internal and external processes of an organisation. The Web Services technology is the most appropriate technology to develop SOA. Web Services represent the applications that organisations “Publish and Locate” on unknown and disparate platforms (Ghanbary, 2006). Web-Services-based technologies enable applications to “talk” with one another even across organisational firewalls, resulting in an opportunity for a cluster or group of organisations to simultaneously transition to web-based entities (Unhelkar and Deshpande, 2004). Chapter 4 of the thesis demonstrate how these technologies facilitate and support the implementation of the CBPE model in the organisations.

2.7.3 External and Internal Impacts of Web Services

The use of Web Services appears to be the missing piece of the puzzle in creating a complete picture of making a service-oriented architecture work (Barry, 2003). The statement given identifies the importance of the universal adoption of Web Services by software vendors.

Figure 2.4: Internal and External Impacts of WS

Figure 2.4 illustrates the importance of the adoption of the Web Service by internal as well as the external architecture. Following is an explanation of the
functionality of the Web Services that could create a successful service-oriented architecture.

![Figure 2.5: Web Services Functionality](image)

Extensible Markup Language (XML) is a simple, very flexible text format derived from Standard Generalised Markup Language (SGML) (ISO 8879). Originally designed to meet the challenges of large-scale electronic publishing, XML is also playing an increasingly important role in the exchange of a wide variety of data on the Web and elsewhere (http://www.w3.org/XML/).

XML schemas associated with SOAP message payloads often need to be designed with some of the more advanced features of the XML Schema Definition Language. Specifically, the use of extensible or redefined schemas may be required when building documents that represent multiple data contexts. The application of the WS provides the opportunity to implement the cross-internal organisational boundaries, beyond the simple exchange of information, considering that Web Services’ main purposes are basic request and response functionalities. XML provides a common data-exchange format, encapsulating both data and metadata. This allows the various applications and databases to exchange information without having to understand anything about one another.
According to the World Wide Web Consortium, WSDL is an XML format for describing network services as a set of endpoints operating on messages containing either document-oriented or procedure-oriented information. The operations and messages are described abstractly, and then bound to a concrete network protocol and message format to define an endpoint. Related concrete endpoints are combined into abstract endpoint services (Christensen et al., 2001).

WSDL is extensible to allow descriptions of endpoints and their messages regardless of what message formats or network protocols are used to communicate. Web Service Definition Language SOA starts with the design of a service. Building software services commence with the definition of what the service is and what the service does. SOA provides a standardised means of building software services that can be accessed, shared, and reused across a network. While SOA is a well-established concept, it has become increasingly popular with the emergence of Web Services. The starting point in developing SOA services is the Web Services Description Language (WSDL).

Universal Description, Discovery and Integration (UDDI) specifications define a registry service for Web Services and for other electronic and non-electronic services. A UDDI registry service is a Web service that manages information about service-providers, service implementations, and service metadata. Service-providers can use UDDI to advertise the services they offer. Service consumers can use UDDI to discover services that suit their requirements and to obtain the service metadata needed to consume those services (http://www.uddi.org/faqs.html).

UDDI discovers the prospective requester from the directory that is also an integral part of an organisation. This specification allows for the creation of
standardised service description registries both within and outside organisational boundaries. UDDI provides the potential for Web Services to be registered in a central location, from where they can be discovered by service requestors. Hence SOA services should be accessed, shared, and reused across a network. The UDDI directory provides the channels of access across the network.

One of the key challenges in modern-day business is the pressing need to integrate organisations’ wide and varied software systems and applications. Furthermore, large organisations such as banks and insurance companies have vast amounts of data that are embedded in their legacy systems. They have a need to expose this data and the corresponding applications in a “unified” view to the customer on the Internet – resulting in what is known as “business integration”. However, as a result of this integration, and technical ability of applications to transact over the Internet, businesses are now readily able to offer and consume “services” across the Internet. Currently, there is limited literature on modelling and managing the challenges emanating from collaboration between varied businesses and applications.

Service interoperability is paramount. Although researchers have proposed various middleware technologies to achieve SOA, Web Services standards better satisfy the universal interoperability needs (Pasley, 2005). In order for multiple organisations to collaborate, many challenges are identified, such as: technological, methodological and social factors resulting rational interactions between businesses. The good architecture takes place when the services of different applications have the capability to communicate. The previous statement leads us to the concept of SOA departing beyond the boundary of standard communications framework.
SOA is a design model with a deeply rooted concept of encapsulating application logic within services that interact via a common communication protocol (Erl, 2004). Web Services are used to establish this communication framework. WS basically represent a web-based implementation of SOA. Business process integration is part of enterprise integration solutions, which is why coordination services for business activities are utilised exclusively for the management of long-running business activities.

2.7.4 The Role of SOA in CBPE

Web Services integration enables a dynamic e-business model that fosters collaboration with heterogeneous business services and opens the doors for new business opportunities (Chung, 2005). A SOA is an application framework that takes everyday business applications and breaks them down into individual business functions and processes, called services. Figure 2.6 explains how SOA impacts on the requirements of CBPE.

![Figure 2.6: The Role of SOA in CBPE](image-url)
Figure 2.6 shows the importance of SOA in developing the applications of CBPE. The technology and the architectural aspects of this integration based on collaboration have also been demonstrated. The requirements of CBPE, as far as the multiple organisations are concerned, are the required technology, required methodology, social threats, how to implement the integration, how to architect the integration and investigate the structural changes to the organisation after the integration.

Web Services technology enables applications in separate technical environment to talk with each other, leading to opportunities to collaborate electronically across the globe. On the other hand, SOA is a platform, a backbone, on which the actual services can rest. Therefore, SOA is a strategic development of technology within an organisation to enable it to deal with the rest of the world.

The Web Services technology gives the opportunity to applications to “talk” on disparate platforms. Web Services are self-contained, modular, Internet-based applications, offered by different providers that have standard interfaces to enable efficient integration and implementation of complex business applications (Marjanovic, 2006). Composite Web Services enable flexible, on-demand integration of individual services offered by different providers to meet a specific business objective. This integration is made possible by the fact that Web Services are platform-neutral, so as long as they comply with the common standard they can be integrated into a more complex structure.

SOA gives an opportunity to architect new processes enabling multi organisational collaboration. SOAs, especially Web Services, are emerging as middleware to implement cross-organisational processes (Yildiz, Marjanovic and
Godart, 2006). The very recent advances in this domain such as WS-Coordination, WS-Agreement and WS-Policy are the actual agreements among involved Web Services. These technologies aim to specify the protocols supported by collaborating services, such as the order in which individual services can be invoked or how the relevant message should be exchanged while they interact.

The highly competitive nature of the current business environment creates tremendous pressure for organisations to collaborate. It is essential for companies to understand rapidly changing business circumstances. The rapidly changing environment encourages the enterprises to integrate their business functions into a system that efficiently utilises ICT. The recommended implementation of the integration utilises the technologies of SOA, EAI and TOGAF to integration processes in the collaborative environment of the business processes of multiple organisations.

2.8 IMPLICATIONS OF MOBILE TECHNOLOGY IN COLLABORATION

Since Mobile Technologies (MT) form the basis for collaborations and have a great impact on business integration, the following section discusses the implications of mobile technology in collaborations.

As Toffler (1980) predicted, people’s dependence on technology has increased to a level at which technology affects every aspect of human life. Mobile technology, which is an integration of communication and computer technology, has created very high expectations in humans’ behaviour. These human expectations from mobility also influence businesses strategies, business development and, in the context of this discussion, business collaboration. Therefore, it is only appropriate that the literature on mobile technology and mobile business is reviewed here.
2.8.1 Mobile Technology

Unhelkar (2005) defines mobility as a significant factor impacting on the quality of life of individuals and the society in which they live. The correct application of mobile technologies into business processes provides an opportunity to the business enterprises likely to gain advantages, such as increased profits, satisfied customers and greater customer loyalty. These customer-related advantages will accrue only when the organisation investigates its customer behaviour in the context of the mobile environment.

The application of mobile technologies can be classified into two different categories: on-line and off-line services. The applications of on-line services are the executed applications when the mobile gadgets are connected to the mobile Internet.

The applications of online wireless mobile Internet depends on situation (walking, driving), place (remote area, city metropolitan area), goal (aim of the connection), immediacy (instant action and reaction to demand) and load (how occupied the Internet-provider is at the time of the connection). The congestion of the network clearly depends on the usage, which varies at different times of the day. As expected, during business hours the network load on the Internet service-provider is heavy.

The major on-line mobile applications provide information, check e-mails, enable payments, mobile banking, mobile shopping, mobile education, general government bulletins, provide messaging and enable leisure activities. Mobile applications also facilitate telemetric services such as Location-Based Services (LBS), Global Positioning Services (GPS) and Car Navigation System (CNS).

The off-line mobile applications are also an important consideration for business. The major off-line services offered by related network-providers include
personalised diaries, games, ordinary communications, built-in memory, expert
systems, remote supervision and connectivity to local devices through Bluetooth and
infrared. These can be extra features on particular mobile devices.

The aforementioned on-line and off-line application of mobile technology
helps us understand how this technology can be used by organisations in order to
enhance their collaborations. For example, Chapter 5 of this thesis identifies a simple
application using GPS that enables an organisation to locate the nearest tradesperson
to the site by the aid of GPS in mobile technology.

Thus, increasingly, it is noticed that the consumer’s demands and corporate
objectives to satisfy those demands can be different in the m-enabled world. These
usages in m-enabled society are classified in three categories of interaction (voice,
email chat, digital postcards, etc.), trading and business (banking, shopping,
auctions, advertising, ticketing, etc.) and mobile-provided services (news,
entertainment, driving directions and many more).

Mobile technology has provided the organisations with a platform from
which to access customers in special ways. For example, with mobile technologies,
customers can be reached independent of their specific locations. The Internet has
also provided opportunities for service-providers such as Paypal, an online payment-
processing company founded in 1999 (https://www.paypal.com/), to offer more cost-
effective payment related services that are similar to banking services to its
customers. Paypal, introduced in 2000 and in a mere seven years of operation, has
become the most used payment system for clearing auction transactions on eBay
(Schneider, 2004), competing directly with the traditional banks. Thus the experience
of the customer and business in dealing with each other is changing with the
advancement of technology. The marriage of Internet with mobile technology has
provided opportunities to generate more revenue in many areas, such as banking, shopping and work-related activities.

While the location-aware mobile connectivity has dramatically increased the ability of individuals to communicate, it has also produced challenges in terms of privacy and new social protocols. The effects of globalisation now need to be further considered in the context of a global-mobile society. Therefore, there is also a need to investigate WS and mobility together.

WS have promised to expand and enrich the existing distributed computing arena with their ability to connect disparate systems and allow communication between them from anywhere and on any platform (Stacey and Unhelkar, 2004).

This promise of Web Services to revolutionise the way in which companies interact with each other and also how they come together or discover each other to form business alliances also needs to be studied together with mobility.

A specific form of WS, using mobile technology, is described next. This new technology is that of Mobile Web Services (MWS). MWS has the capabilities of text, voice and videoconferencing using wireless devices, as well as the ability to connect to the World Wide Web.

2.8.2 Mobile Web Services

The expansion of Mobile Technologies will also provide a robust basis for the organisation’s desire to reach a wider customer and corporate base. This expansion of WS and MT is on the assessment of a business in the context of WS and MT discussing the approach of transitioning to new collaborative mobile organisations with the aid of emerging technologies.

The mobile and Web Services technologies together (Mobile Web Services) create opportunities for multiple organisations to interact in one application. The
Web Services initiative effectively adds computational objects to the static information of yesterday’s Web, and therefore offers distributed services capability over a network (Davies et al., 2004). Web Services have the potential to create new paradigms for both the delivery of software capabilities and the models by which networked enterprises will trade.

The collaborating organisations that have m-enabled WS technology make it possible for sale-/service-providers to benefit all people involved in the process. A mobile application that is using the WS to transmit its data is classified as MWS. Mobile users interact with the system by mobile terminal browsers (software components in mobile phones). The GPS-enabled terminals can provide location data and so allow the retrieval of information which is pertinent to their location (Puustjarvi, 2006).

According to the Australian Computer Society’s (ACS, Sept 08, 2005) report on MWS, with Web Services, phones now have the potential to actually consume useful services. But before developing a mobile client, one might want to think twice before taking the SOAP/HTTP (Simple Object Application Protocol/Hyper Text Transfer Protocol) route.

First of all, turning one’s phone into a SOAP client might have some performance costs related to slow data speeds and processing both HTTP commands and XML. Secondly, most phones do not come with Web Services support built in. Finally, the user can hide the Web Services complexity and leverage existing technologies to make use of their widespread availability. This would require a gateway to sit in between the phone and the Web Service to handle the passing and conversion of messages but there is no longer any worry about client-side performance issues or even deploying a client (http://www.acs.openlab.net.au/).
Microsoft service-providers define MWS as an initiative to create Web Services standards that will enable new business opportunities in the personal computer and mobile space and deliver integrated services across fixed (wired) and wireless networks. Mobile Web Services use existing industry standard Extensible Markup Language (XML)-based Web Services architecture to expose mobile network services to the broadest audience of developers (http://www.microsoft.com/).

The functionality of MWS is examined in the light of how MWS could enhance the current process, enhancing its functionality to talk to the People Soft system directly via the Web, eliminating the second data entry at Head Office which is happening in the current process.

The Next Generation Enterprises (NGEs) rely on automation, mobility, real-time business activity monitoring, agility, and self-service over widely distributed operations to conduct business. Mobility is one of the most invigorating features, having an enormous impact on how communication is evolving into the future (Umar, 2005).

Considering the new achievements in information technologies, companies are vulnerable if they do not respond to technologies such as mobile technology in a fast and proper way. Such systems as Mobile Supply chain Management (M-SCM) can further enhance the global SCM by reducing time and cost, increasing correct delivery and customer satisfaction, and providing for the global enterprise to do business at any time and anywhere. As an example, the international logistics management focus international ship delivery schedule management, time, place, and product quality management (Long, 2003).
The globalisation era has created possibilities for interactive organisations to conduct business across different geographical boundaries. Enterprises in some countries can provide low labour costs, and some in different countries may have low material cost, or others in different countries may provide professional skills or idea product designs. However, all enterprises want to sell their products globally. The resultant ability of businesses and customers to connect to each other ubiquitously – independent of time and location – is the core driver of this change (Unhelkar, 2005).

It leads traditional supply chain management to global supply chain management. Mobile technologies are thus a key influence in any effort towards the globalisation of business (Unhelkar, 2004). The process of such m-transformation of an existing business into the mobile business via the adoption of suitable processes and technologies that enable mobility and pervasiveness has also been discussed by Marmaridis and Unhelkar (2005).

2.9 OVERALL EVALUATION OF THE LITERATURE
Electronic collaborations have been investigated and experimented on in many studies. In electronic collaboration, there has not been an ample focus on the effect of the dynamic environment and the rapidly evolving technologies on organisations. Undoubtedly, these changes cause organisations to restructure and introduce a new suite of business processes to enable them to collaborate with the business process of other organisations. The collaborative environment also needs to address the following problems:

- Distribution Network Configuration: Number and location of suppliers, production facilities, distribution centres, warehouses and customers.
- Distribution Strategy: Centralised versus decentralised, direct shipment, cross-docking, pull or push strategies, third-party logistics.
• Information: Integrate systems and processes through the supply chain to share valuable information, including demand signals, forecasts, inventory and transportation.

• Inventory Management: Quantity and location of inventory, including raw materials, work-in-process and finished goods.

Although many community sector organisations compete with other organisations for access to government and private funds, collaboration between organisations can provide important benefits to organisations and their clients or constituents. Working with other organisations, either though informal networks or more formal partnerships can provide:

• Less duplicated effort.

• Access to additional resources or lower costs through sharing resources.

• Improved service coordination across agencies, with better pathways or referral systems for service users.

• A holistic approach to meeting client needs, with better and more efficient access to the range of services required, improved quality and consistency of service and greater responsiveness to needs.

• Organisational knowledge and improved service system capability:
  ▪ greater innovation and flexibility to respond to changing, emerging or more complex client needs and changing operations and operational environments
  ▪ access to up-to-date information, new ideas and strategic thinking
  ▪ improved capacity to demonstrate best practice.

• Political and lobbying strength.
• Increased capacity to successfully submit tenders or expressions of interest and to deliver projects.

• Additional expertise, support or legal protection for small, new, or struggling organisations (http://www.qld.gov.au/).

Collaboration should be taking place in order to make sure that all parties involved in the collaboration are satisfied. In the past, collaboration was inadequate, with retailers hesitant to share information with others, however, the technology is capable of providing more support for the collaboration. The collaboration requires individual participants to adopt simplified, standardised solutions based on common architectures and data models. Time to market is critical, and participants will have to forego the luxuries of customisation and modification that characterised the proprietary infrastructures of the past (Horvath, 2001).

Rising customer expectations have a direct connection to the advancement of technology. People’s demand of the technology has not always been so realistic. The word “technology” has constantly fascinated human beings. Information and communication as the defining technology of the modern era have increased the expectations to an irrationally higher level.

People rely on technology even when technology does not have the capability, or it is not robust enough, to support their task. There is no guarantee for me not to lose my work while writing this thesis on my computer and the very same technology is used when, in fact, human lives are involved. As an example computers are used to take off and land aeroplanes.

This research has identified the drawbacks and limitations of technologies to understand the adaptation of the organisations to mobile technologies. Chapter 6 of the thesis has investigated these issues further to provide detailed information on
how the organisations adapt the new technology as such mobile and WS technologies.

According to Murugeson and Deshpande (2001), the development of organisations can be classified as the choice of a suitable development model; according to practitioners and researchers, their site (and applications), their document orientation, content and graphic design, budget and time constraints and the changing technology.

The organisations must plan and manage change (cultural, technological, internal and external) and understand the key areas associated to dangers related to their working environment that others have discovered and faced. The Australian e-business guide describes that implementations for e-business initiatives must be rapid and each project should be delivered in a maximum of three months. Build quickly and move to the learning stage, then build the next stage and fix the previous ones based on what has been learned (Philipson, 2001).

Management must support the variations in business and market strategies, organisational restructure and management strategies. The corporations must prepare all the existing clusters ready for change. Managing the transformation by having a reliable and calculated plan is the crucial factor for success. The transition must remain persistent, alongside the detailed knowledge of the development of the individual clusters. Generally mobile transition takes place by distinguishing what kind of portable devices, networks, application gateways and enterprise applications are required (Brans, 2003).

Today, mobile devices have surpassed the number of personal computers in use. The number of WAP-enabled devices has also surpassed the numbers of PC-enabled Internet users. As outlined by Pashtan (2005), over 100 million wireless
Internet users were recorded as at September 2003. The majority of users are in Japan and Korea, while fast growth rates are being experienced in Europe. A similar study by Gohring (2005), found that 53 per cent of phones being used by 4,000 surveyed mobile users around the globe are data-enabled. Armed with such data-capable phones, those customers are increasingly using online services, such as Internet or mobile e-mail access.

Therefore, the Mobile Technologies, which are a convergence of communication, computer and Internet technologies with mobility, are a relatively new but rapidly growing area.

The access and connection to the Internet and the functionality of WS or MWS have also become very simple and ubiquitous. These facilities have opened up opportunities for organisations to revolutionise their business processes. Undoubtedly, improvement of the communications technology has impacted not only on the business domain but on also the socio-cultural domain. The reason that the service model is so attractive is its ability to incorporate standards and open protocols for calling services and transmitting data (Unhelkar and S’duk, 2004). WS make software functionality available over the Internet so that programs can request a service running on another server (a Web Service) and use that program’s response in a website, Wireless Application Protocol (WAP) services, or other applications. The possibilities are endless.

Normal day-to-day activities become more related to the way we communicate with each other. Faster transfer of data, transactions and communications, which are independent of location, time and with the identified functionality of mobile devices, has become the mainstay of all challenged business processes.
The impacts of ICT (such as Internet, mobile technology) on people’s lives have been an evolutionary transformation. For example, at the beginning of the Internet age, with the aid of its communications capabilities, businesses were transformed to e-businesses. There is no doubt that many technological products that were first considered by people as luxuries were later consumed as necessary items in daily life. IT products are no exception.

Thus Mobile Technologies along with WS would form a formidable front in tomorrow’s technology. As far as the emerging technologies are concerned the major areas of investigation would be technological issues such as modelling of the WS applications (extracting the full potential of Web Services), as well as the issues and challenges in incorporating Web Services in businesses with the aid of Mobile Technologies. These issues and challenges of CBPE are as follows:

- The software applications that would facilitate business processes to collaborate across multiple organisations.
- The methods to transit from already e-transformed businesses into collaborative may be m-enabled. Collaborative business process engineering is an important part of this research.

This research has investigated suitable organisations that have the capability of the smoothest transition in order to find the most suitable transformation method. The parties involved in the process need to know that some changes need to take place, since people must be prepared to adjust themselves. The training is the most suitable method for internal parties of the organisations, however, it is very important to provide sufficient information to external parties and advise them about the change (Ghanbary, 2006).
2.10 CONCLUSION

The chapter has summarised an investigative literature review in the area of collaborative business environment. Web Services and their importance in Web 2.0 technology have been investigated, taking into consideration the importance of the Mobile technologies as a vast area which can potentially branch off into several secondary or perhaps tertiary research areas. This chapter has described the existing literature in many different technological applications, including literature about what technologies could be applied with regard to the creation of the proposed collaborative environment amongst organisations that are not necessarily known to each other. The chapter also described how organisations have moved from paper-based to electronic business (e-business), mobile business (m-business) and how they could transform to collaborative business (c-business). The next chapter will describe the research methodologies used in this research.

2.11 REFERENCES


Australian Computer Society

IOPSIS Softwares

Queensland Government

UDDI.ORG

World Wide Web Consortium
Acquire new knowledge whilst thinking over the old, and you may become a teacher of others.  
Confucius (BC 551 – BC 479)

CHAPTER 3 – RESEARCH METHODOLOGY FOR CBPE

3.1 INTRODUCTION

This chapter describes the existing and well-known research philosophies and corresponding methodologies available for the kind of research undertaken in this study. The aim of this chapter is to study, understand, identify and justify the use of the most suitable approach or a combination of suitable approaches that would serve the purpose of this research. Thus, this chapter discusses the various philosophical and methodological backgrounds to research. This discussion is followed by a discussion of the suitable philosophies, methodologies and theories for this research, with the aim of finding the best combination of research approaches that will serve the aim and objectives of this research and help in arriving at answers to the research questions.

Understanding the research methodology provides the necessary background for guidance in carrying out any research. This importance of the research methodology has been particularly understood by this researcher during his earlier honours work. Hence, considerable significance has been attached by this researcher in identifying the research methodology. The correct selections of the research approach by understanding the many research philosophies, methodologies and theories, comparing them with each other have aided this research in formulating and answering the research questions.
3.1.1 Research Aim and Research Objectives

The primary aim of this research is to identify *how Web Services could facilitate interoperability amongst multiple organisations that result in collaboration of business processes.*

Arising from this research aim there are several research questions that need to be studied. They are as follows:

- What is the nature of interoperation in the existing practice (model) of collaboration?
- What is the impact of interoperability emanating from Web Services on organisations that collaborate electronically? (Here we address the dynamic aspect of collaborations wherein organisations can enter and exit the collaboration at will.)
- What are the characteristics and the mechanisms to model collaborative business processes that transcend organisational boundaries (also technical boundaries) as against business processes within a single organisation?
- What are the factors influencing collaborative business processes (such as trust, security, confidence level and availability of channels)?
- What are the benefits of the constructed model of collaboration (*CBPE* Model) in terms of its efficiency as well as its practicality?
- What are the impacts of mobile technology on the *CBPE* model?
- How do organisations adapt the new technologies (such as mobile and Web Services technologies)?
3.2 PHILOSOPHY OF RESEARCH

The definition of the traditional philosophy is presented here in order to relate it to the use of the philosophy in advanced technological environments. Sometimes, especially in the field of scientific research, there is a possibility of confusion about the use of the term “philosophy” – when the research is in an entirely scientific domain, and not in a philosophical one. This section of the chapter clarifies the use of the term “philosophy” in scientific research.

Philosophy is a combination of ethics (as such religious beliefs) that we have achieved throughout of our life, value systems based on family, society and culture, and the use of these ethics and value systems in practice – such as this scientific research. Thus, the term philosophy emanates from our ability to create, understand and apply our value and ethics in practice.

A philosophy, in a way, exists between religion and science. However, philosophy (similar to religion), is concerned with the human thoughts and subjects that science is unable to answer. Science is entirely related to human knowledge. The unresolved subjects created by the human thoughts are not solvable by science, however, philosophical views of scientists might help answer it.

Based on Chalmers (1976), the common belief is that the authority of science depends on the way that it “is derived from the facts”. The strength of a theory lies in its continued survival while being open to being falsified. If a theory is stated in a way that makes it impossible to falsify it by logic or experimentation, then it is of little use to the progress of knowledge and science.

There is a strong intuition that we are not disconnected from the world. We and what we see around us are part of a continuous whole, to which we have direct access through our senses such as vision, touch, smell, sound and taste.
Traditional philosophy tries to drive a wedge between us and the world by insisting that the information we get from perception is the result of inference from an indirect audience that is about how things look and feel to us (Pollock and Oved, 2005).

A philosophy that aims to comprehend the current age in thoughts cannot afford to neglect science and technology. Thinking is nourished by knowledge, and most of our knowledge nowadays originates from science. Thinking is nourished by practice as well, and most of human practice nowadays is affected by technology. Science and technology are not only worthy objects but, above all, indispensable sources of timely philosophy.

Specialised sciences seem to have neglected the context in developing their understanding. That neglect might be the reason why they are unable to synthesise heterogeneous knowledge with regard to practical problems. While there is a general hue and cry for inter-disciplinary views on scientific topics, there appears to be less awareness of the theoretical point of inter-disciplinary integration. The awareness of inter-disciplinary views is exactly the mission of a realistic philosophy of the world. The philosophy of technology deals with the nature of technology and its effect on human life and society. The influence of technology on human existence has initiated the interest in a philosophical analysis of technology (Günter, 1999).

The philosophy of technology involves the relationship between humans, nature and culture. The philosophy of technology also deals with the question of whether technology follows its own inevitable course of development, irrespective of its social, political and cultural context.
Science and philosophy are often distinguished by pointing out that science seeks explanation while philosophy seeks justification. Science is also concerned with critically evaluating beliefs and analysing concepts.

Based on Zhao (2004), computer science may appear to distinguish itself from philosophy. However, computer science is unique amongst the various sciences, especially in the way in which models are created within it. The computer scientist constructs models for explaining phenomena. Although technology is, to some extent, shaped by society, there are also non-social factors, such as technical aspects of technology itself, which involve technological development.

3.2.1 Social Philosophy and Technology

The social philosophy of technology focuses on the relations between technology and social, economic and political structures. It analyses technological development as a social process and addresses the problem of how to control its development. One of the problem is whether technological development is primarily determined by its context (social shaping of technology), or whether technology determines the social context, including its systems of norms and values. In other word, the idea of technocratic society emerges in which technological rationality imposes itself on all domains of social life. Philosophical approaches to the technology can be classified as the following:

3.2.1.1 Realistic Approach

Realistic idealism is dedicated to the concept that philosophical ideas and morality can be based on evidence. Through scientific discovery, finally, we can know where we come from, where we have been, where we are, where we are going, and what things are possible.
Realistic Idealism is not liberal, yet there is no doctrine. Some newcomers to what has been discovered through science will find parts to be preposterous or harsh. However, once one assimilates the initial concepts and ideas, in time, they will become meaningful and provide hope and peace of mind through the experiences of one’s own life (www.seanet.com).

3.2.1.2 Deterministic Approach
Technology is a major contributing factor of human civilisation and the primary force of social change. Technology shapes our way of life, our survival depends on it and it is necessary for socio-economic growth. From this point of view, we have created a monster and we are dependent on it. Technology determinism is a perspective that views technical innovation as driving society.

3.2.1.3 Optimistic Approach
Technology refers to the tools, devices, and machines that expand human skills. They carry out the difficult repetitive tasks in order to make human life easier. Technology is a consequence of the social changes that bring longer, healthier, fuller and richer lives. People are the final decision-makers on whether to use or refuse technology.

3.2.1.4 Pessimistic Approach
Technology is potentially a grave danger and a great destroyer. It alienates people from the real world and from each other and gives them no freedom in making and shaping their future. The pessimists claim that technology is de-skilling people (who rely on machines), converting them into machine operators. They blame technology for environmental pollution and the destruction brought by war.

There are numerous reasons why an understanding of philosophical issues is important, as far as scientific research is concerned. Exploring personal belief can assist in understanding wider philosophical issues.
Notably, there is an interrelationship between ontological (what is the nature of reality?), epistemological (what can be known?) and methodological (how can a researcher discover what is believed, can be known?) levels of enquiry (Proctor, 1998). The word “ontology” seems to generate a lot of controversy. Ontology has a long history in philosophy, in which it refers to the subject of existence. Ontology is also often confused with epistemology, which is about knowledge and knowing. The body of formally represented knowledge is based on a conceptualisation: the objects, concepts, and other entities that are assumed to exist in some area of interest and the relationships that hold among them (Genesereth and Nilsson, 1987).

Ontology is an explicit specification of a conceptualisation. The term is borrowed from philosophy, where ontology is a systematic account of existence. In ontology the knowledge of a domain is represented in a declarative formalism, the set of objects that can be represented is called the universe of discourse, while in epistemology the scientist can intervene in the world to improve the existing knowledge. According to Russell (1912), epistemology is concerned with knowledge and examines:

1) The nature or definition of knowledge – for example, is knowledge the same as true belief?
2) The nature and importance of the most fundamental sources of knowledge – for example, perception, memory, reason and testimony;
3) The scope or extent of knowledge – for example, knowledge of external objects;
4) The basic structure of knowledge and justified belief – for example, is there foundation knowledge?
5) The ultimate justification for certain kinds of basic inferences – for example, inferences from observed cases of some connection;

6) Certain fundamental concepts connected with knowledge, such as truth, belief and justification.

Over the past 30 years, much of the philosopher community has become persuaded that intentional contents of creation of a subject’s “thoughts” are to be individuated with essential reference to the environment (Majors and Swayer, 2005).

Easterby-Smith (1991) identifies three reasons why the exploration of philosophy may be significant in the scientific research:

- It can help the researcher to refine and specify the research methods to be used in a study, that is, to clarify the overall research strategy to be used in a study. This would include the type of evidence gathered and its origin, the way in which such evidence is interpreted, and how it helps to answer the research questions posed.

- Knowledge of research philosophy will enable and assist the researcher to evaluate different methodologies and methods to avoid inappropriate use and unnecessary work by identifying the limitations of particular approaches at an early stage.

- It may help the researcher to be creative and innovative in either selection or adaptation of methods that were previously outside his or her experience.

Based on Russell’s (1912), philosophy, like all other studies, aims primarily at knowledge. The knowledge it aims at is the kind of knowledge that gives unity and system to the body of science, and the kind that results from a critical examination of the grounds of our conventions, prejudices and beliefs.
3.3 METHODOLOGY OF GENERAL RESEARCH

Creating an assumption is the most difficult part of scientific research. Therefore, making an assumption based on creative imagination should be considered as a highly significant ability of the human being.

The people who impacted on the foundation of the new science had patience in their observation and great imagination based on their assumptions. There is no doubt that the results achieved from the science have changed the people’s imaginations.

We can believe there is a limited border to what we can achieve by proper use of existing science of research. Correct application of the existing science of research gives us the ability to experiment with our ideas to see the real picture of our imagination outside our soul.

According to Gerber, from the Centre for Teaching and Learning and Media in Nelson Mandela Metropolitan University, the research methodology selected for any individual study is directly connected to the problem statement, aim and objective of the research. Research is a purposeful, precise and systematic search for new knowledge, skills, attitudes and values, or for the re-interpretation of existing knowledge, skills, attitudes and values (http://www.petech.ac.za/).

Research methodology refers to the study of research methods. As a general rule, research methodologies can be broadly classified into two distinct approaches. They are: scientific empirical tradition, and the naturalistic phenomenological models (Burns, 1997).

These two broad approaches are also classified as qualitative and quantitative research methodologies. Research methodologies assist scientists to develop and/or
design a system or models. The qualitative and exploratory way of thinking can lead to quantitative confirmations.

Quantitative research is the systematic scientific investigation of quantitative properties and phenomena and their relationship. Quantitative methodologies manipulate variables and control nature phenomena. They construct hypotheses and “test” them against the hard facts and reality (Leedy, 1993). Quantitative research also involves analyses of numerical data.

Qualitative research is based on the use of a naturalistic approach that seeks to understand phenomena in context-specific settings. Qualitative research is any kind of the research that produces findings not arrived at by means of statistical procedures or other means of quantification, but involves analysis of actual data. Qualitative research generally aims to answer research questions which are rather different from those addressed as hypotheses in quantitative research. Qualitative research is essentially “exploratory”, setting out to describe, understand and explain a particular phenomenon (Barbour, 2000). Table 3.1 identifies the differences between qualitative and quantitative research.

<table>
<thead>
<tr>
<th>Quantitative</th>
<th>Qualitative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective</td>
<td>Subjective</td>
</tr>
<tr>
<td>Literature review must be done early in study</td>
<td>Literature review may be done as study progresses or afterward</td>
</tr>
<tr>
<td>Tests theory</td>
<td>Develop theory</td>
</tr>
<tr>
<td>One reality, focus is concise and narrow</td>
<td>Multiple realities: focus is complex and broad</td>
</tr>
<tr>
<td>Reduction, control, precision</td>
<td>Discovery, description, understanding, shared interpretation</td>
</tr>
<tr>
<td>Measurable</td>
<td>Interpretive</td>
</tr>
<tr>
<td>Report statistical analysis</td>
<td>Report rich narrative, individual interpretation</td>
</tr>
<tr>
<td>Basic element of analysis in numbers</td>
<td>Basic element of analysis is words/ideas</td>
</tr>
<tr>
<td>Researcher is separate</td>
<td>Researcher is part of the process</td>
</tr>
</tbody>
</table>
Table 3.1: Comparison of Quantitative and Qualitative Research  

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Context-free</td>
<td>Context-dependent</td>
</tr>
<tr>
<td>Hypotheses</td>
<td>Research questions</td>
</tr>
<tr>
<td>Reasoning in logistics and deductive</td>
<td>Reasoning is dialectic and inductive</td>
</tr>
<tr>
<td>Establishes relationship, causation</td>
<td>Describe meaning, discovery</td>
</tr>
<tr>
<td>User instruments</td>
<td>Uses communication and observation</td>
</tr>
<tr>
<td>Strives for generalisation</td>
<td>Strives for uniqueness</td>
</tr>
<tr>
<td>Designs: descriptive, correlation, quasi-experimental, experimental</td>
<td>Design: phenomenological, grounded theory, ethnographic, philosophical and case study</td>
</tr>
</tbody>
</table>

The *Macquarie Dictionary* defines research as “diligent and systematic enquiry or investigation into a subject in order to discover facts or principles”. This intellectual investigation produces a greater knowledge of events, behaviours, theories, and laws and makes practical applications possible. The goal of the research process is to produce new knowledge, which takes three main forms:

### 3.3.1 Exploratory Research

Structures and identifies new problems. As the term suggests, *exploratory research* is often conducted because a problem has not been clearly defined as yet, or its real scope is as yet unclear. It allows the researcher to familiarise him/herself with the problem or concept to be studied, and perhaps generate hypotheses to be tested.

The results of exploratory research are not usually useful for decision-making by themselves, but they can provide significant insight into a given situation.

According to Jopps, from the School of Hospitality and Tourism Management at Ryerson University, although the results of qualitative research can give some indication as to the “why”, “how” and “when” something occurs, it cannot tell us “how often” or “how many”. In other words, the results cannot be generalised,
nor are they representative of the whole population being studied (http://www.ryerson.ca).

Research perspectives should identify that:

- The natural sciences typically observe reality
- The social sciences interpret organisational and social phenomena
- The computer sciences assume natural sciences as the way of doing research
- The information systems take a more multi-paradigmatic view.

An exploratory study examines the influence of translation on the validity and reliability of qualitative data (Twinn, 1997).

3.3.2 Constructive Research

Constructive research develops solutions to a problem. This form of research is adapted by this research study. In the next section, a clear definition of constructive research will be provided.

3.3.3 Empirical Research

Empirical research tests the feasibility of a solution using empirical evidence. Empirical research can be defined as research based on the observation to discover an unknown or test a hypothesis (Knight and Brilliant, 1998). Based on Kallakuri and Elbaum, from the Association for Computing Machinery, empirical research is characterised by an investigator gathering data and performing analyses to determine the meaning of the data, and encompasses the following research strategies:
1. The experiment provides the researcher with control over some of the conditions in which the study takes place by manipulating independent factors to elicit responses from the dependent factors.

2. The observation of a single data point, through anecdotes and case studies, which investigate real-life phenomena in the context of a current theory.

3. A demonstration of technology on selected subjects (http://www.acm.org).

This research has used the empirical research method to collect and gather data based on action research, experiments, interviews and statistical surveys to be explained later in the Chapter. Figure 3.1 depicts the complexity of the scientific world by actually separating the different areas of the disciplines as far the information systems and research are concerned. The research and system development for different disciplines indeed becomes very complicated.

![Figure 3.1: The Complex World of Science and Information Systems](image-url)
3.4 SELECTED APPROACHES
The approaches to this research encompass the creation and validation of the model for CBPE. The methodologies used for this research are a combination of quantitative and qualitative research methodologies.

3.4.1 Selected Philosophies
Selected philosophies for this research are a combination of interpretivist and constructive, while adapting the realistic approach. The interpretivist approach will also focus on groups or a group of objects under investigation. The interpretivist approach confronts the difficulties presented by the nature of the research domain, and in particular the intangibility of many of the factors and relationships of the researcher within the research domain.

The constructivist approach is the fundamental tenet of constructivist philosophy, indicating that interpretivism is about contextualised meaning, and that reality is socially constructed. The constructivist paradigm, therefore, provides the assumptions, the rules, the direction, and the criteria by which research is conducted (Lincoln and Guba, 1985). The constructive research approach is used to contribute towards serving an identified problem in need of an innovative construction of a model or theory.

The solution recommended by this research will use constructivist methodology to construct the new model of collaboration by multiple organisations.

3.4.1.1 Rational Interpretivist Approach
The interpretivist approach is a combination of descriptive and interpretive research. In these techniques, empirical observation has control over the researcher’s intuition, including self-examination of the researcher’s own pre-suppositions and biases, cycles of additional data collection and analysis, and peer review.
The interpretivist approach confronts the difficulties presented by the nature of the research domain, and in particular:

- The intangibility of many of the factors and relationships;
- The inherent involvement of the researcher within the research domain;
- The dependence of outcomes on the researcher’s perspective of:
  - The selection and definition of the research domain
  - The selection and rendition of existing theory
  - The definition of the research question
  - The design of the research framework
  - The selection, definition and operationalisation of variables
  - The measurement of variables.

Action research is also classified as part of the interpretivist approach, and is considered the most suitable method for this research to test the constructed model. Table 3.2 illustrates the importance of the action research for the Interpretivist approach. The concept of the action will be described in the selection of the method in this chapter.

<table>
<thead>
<tr>
<th>INTERPRETIVIST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subjective/argumentative</td>
</tr>
<tr>
<td>Reviews</td>
</tr>
<tr>
<td>Grounded theory</td>
</tr>
<tr>
<td>Action research (used in this study)</td>
</tr>
<tr>
<td>Descriptive/interpretive studies. (case studies)</td>
</tr>
<tr>
<td>Future research</td>
</tr>
<tr>
<td>Roles/game-playing/simulation</td>
</tr>
</tbody>
</table>

Table 3.2: Research Categories and Approaches (Adapted from: Galliers, 1990)
3.4.1.2 Rational Constructivist Approach

The constructivist approach means problem-solving through the construction of models, diagram, plans and organisation. The term “construct” is often used to refer to the new contribution being developed. A construct could be a theory, algorithm, model, software or a framework.

The constructivist approach refers to a method of research that produces “construction”. This mode of research is widely used in technical science, mathematics, operational analysis and clinical medicine. The constructivist approach may be characterised by dividing the research process into phases.

Figure 3.3 shows the possible phases of the construction which could vary from case to case. These phases could be classified as identifying the problem, understanding the topic; constructing a solution; demonstrating that the solution works; showing the theoretical connections; showing the research contribution, and examining the scope of applicability of the solution (Kasanen, Lukka and Siitonen, 1993).

![Figure 3.3: Elements of Constructive Research](image)

Nevertheless, the conclusions have to be objectively argued and defined. As far as this research is concerned, the demonstration in Figure 3.4 presents the expected evaluation of constructivist methodology.
The "fuzzy information" refers to different information sources that originated the research. The "practical relevance" refers to the methods used for creating the knowledge. The "theoretical relevance" represents the theory body of the knowledge adapted by this research. The "solution" represents the outcomes of the research that offers the final benefit.

### 3.4.2 Selected Theories

The research methodologies are becoming increasingly sophisticated and now frequently combine both quantitative and qualitative approaches. Therefore a scientific opinion called theory is required to define the expected outcome of the research.
Theories are often evaluated in terms of their content based on the specific concepts used and the human values served. Level of analysis refers to the entities about which the theory poses concepts and relationships—individuals, groups, organisations, and society (Markus and Robey, 1998).

A scientific theory is a rigorously tested statement of general principles that explains observable and recorded aspects of the world. A scientific theory, therefore, describes a higher level of understanding that ties “facts” together. A scientific theory stands until proven wrong—it is never proven correct (Cragg and King, 1993).

3.4.2.1 Rational Evolutionary Theory

Evolutionary theory is used in several disciplines. Evolutionary theory has been applied to a broad range of situations involving change processes. Evolutionary theory is present in the field of economy, often tied to the development of technology, or to the evolution of institutions as in the work. Any theory of evolution is about processes of change. Evolutionary theories concern themselves with the mechanisms that produce change.

Richard Nolan’s (1997) stage model is the best known and most widely cited model of computing evolution in organisations. Nolan’s model presents the development over a decade in its own evolution from a simple theory, based on the factoring of change states indicated by changes in computing budgets, to an elaborate account of the characteristics of six stages of computing growth (King and Kraemer, 1984). The following figure demonstrates Nolan’s model of evolution.
The model shown in Figure 3.4 demonstrates an “evolutionistic” theory within the theories of evolution in the social sciences, focusing on assumed directions of growth and an implied end state toward which growth proceeds, and suffering from problems inherent in such theories. Further research based on an “evolutionary” view of computing growth is suggested as a means of improving theories of computing in organisations.

In general, evolutionary theories are about the dynamics of processes of adaptation, replication and information of systems in environments. The key to evolutionary theory is based on an explanation about the build-up of knowledge out of “nothing”, or out of an evolutionary process (Cragg and King, 1993).

Based on Richard Nolan’s model, the use of the evolution theory is mapped to this research as follow:

- **Initiation**: The primary stage of this research was initiated by literature review to identify the existing gap in the literature.
- **Contagion**: How do the organisations learn from each other to adapt the proposed model of collaboration (Collaborative Business Process Engineering (CBPE))?
• **Control:** Who should be in charge of the proposed model of **CBPE**?

• **Integration:** How do the available technologies aid the business processes of these organisations to integrate with each other?

• **Data Administration:** How can the technology of the Web Services, specifically the proposed UDDI directory, administer the collected data?

• **Maturity:** How does the proposed model change the organisational structure?

### 3.4.2.2 Rational Socio-Technical Theory

A socio-technical system is applied where there is a need to update, change or entirely re-engineer systems and working operations of organisational units or departments. Socio-technical system methodology can be undertaken when there is:

- Inaccurate and incomplete data in the database
- Inability to satisfy request for information
- Communication problem with staff/stakeholders/customers
- Low-quality work
- Low productivity.

Limitations of the socio-technical theory are classified as follows:

- researcher/designer driven
- a need to focus on all changes (structure – people; technology – task); not always achievable
- not easy to determine the information needs of a working system

The socio-technical theory involves three phases:

1. Strategic design process (users, goals, policies, participation)

2. Socio-technical system design process (change process, systems’ requirements)
3. Ongoing management process (usually known as action research, monitoring, changing observing new system).

Successful organisations have a balance between the technical sub-system and the social subsystem. The technical subsystem comprises the devices, tools and techniques needed to transform inputs into outputs in a way that enhances the economic performance of the organisation.

The social system comprises the employees (at all levels) and the knowledge, skills, attitudes, values and needs they bring to the work environment, as well as the reward system and authority structures that exist in the organisation. Extensions to the theory also tend to include customers, suppliers, the rules and regulations, formal and informal, which govern the relations of the organisation to society at large, and the environmental subsystem. Hence any design or redesign must seek out the impact each subsystem has on the other and design must aim to achieve superior results by ensuring that all the subsystems are working in harmony (Bostrom and Heinen, 1977).

Figure 3.5 demonstrates the interrelations of people, structure, technology and task in the social and technical systems and presents the direct impact of the Management of Information System (MIS) on the mentioned systems.
People play a major role in this equation, as they are the fundamental dimension of the transformation evolution. Process and technology are in use when people are involved (Ghanbary and Arunatileka, 2006).

Figure 3.6 represent the importance of people by being presented on the top; however, the importance of the technology and process, including the crucial role of the organisation and its infrastructure, has also been illustrated.

![Figure 3.6: Relationship of Organisation, People, Processes and Technology](image)

Adapted from: Ghanbary and Arunatileka, (2006)

The Socio-technical theory was also recognised as a suitable theory for this research since this research is investigating the influence of the collaborative environment on organisations, people, process and technology.
3.4.3 Selected Methods

The research method refers to the manner in which a particular research project is undertaken. Research methods used for this research are as follow:

- Action research (interview, observation and experimenting on the constructed model)
- Statistical surveys.

3.4.3.1 Rational Action Research (Qualitative Research)

Action research is considered to be one of the suitable methods for this research. By observation and recording the daily activities of the organisations, the research can evaluate the existing business processes to identify what kind of business processes will be affected after the operation of engineered process. Furthermore, action research aids this research to evaluate how to get these organisations to collaborate with each other and how people, process, technology and the infrastructure of the organisations will be affected. It enables the researcher to investigate a specific problem that exists in practice.

Action research is characterised by the fact that problem-solving, seen as renewed corrective actions, cannot be generalised, because it should comply with the criteria set for scientific character. Problem-aimed research focuses on a special situation in practice. Action research is aimed at a specific problem recognisable in practice.

The director of the Southern Cross University’s Institute of Action Research, Associate Professor Stewart Hase, defines action research as a family of research methodologies which pursue action (or change) and research (or understanding) at the same time. Action research is participative and the change is easier when those affected by the change are involved (http://www.scu.edu.au).
Action research is a qualitative methodology that allows the study of complex situations in which context cannot be separated from the problem. It is problem-focused, context-specific and future-oriented. It involves a change intervention with an aim to improvement where researchers are participants in the change. There is interaction between researchers and practitioners and it is suited to professional areas such as workplaces (Avison et al., 1999).

However, the limitations of action research have been identified as being that it is not fully accepted, as it is not explicit in research literature, it cannot be generalised, it is criticised as being too close to consulting, without intervention it could be described as the case-study method, and control over the process and outcomes of the project can be difficult (Baskerville, 1999).

The purposes of action research for this research are listed below:

- How to evaluate the proposed constructed model of collaboration?
- How to get these organisations to collaborate?
- How do these organisations adapt Web Services?
- How to create trust?
- How to identify the possible channels?
- How to secure these channels?
- How to evaluate the impact of mobility?
- How to evaluate the existing business processes?
- How to measure the impact on affected business processes after the engineering?
- How people, process, technology and the infrastructure of the organisations will be affected?

The action research will find the answers for the following diagnoses:
• What factors directly influence the search and locate part of the business process?
• What factors directly influence the define and offer part of the business process?
• What are the technical, methodological and social impacts of interoperability?
• What are the requirements of the “manager” of the directory services?
• What is the basis for trust amongst participant businesses and between the businesses and the manager?
• What is the basis for a successful business model for the portal manager?
• What are the benefits for the participating organisations?
• What are the concerns of the participating organisations?
• What is the procedure for organising the portal? (Who owns it, runs it, legal obligations of the portal?) … How does one participate or pull out of this portal while a process is taking place?
• What happens to the engineered processes if the portal disappears?
• What are the limitations of the model?
• What are the consequences of implementing the proposed model?
• What are the consequences of implementing the trust, security of the channels, convenience and the availability of the channels?
• What factors will convince the organisations to adapt Web Services? The limitations of WS are considered, for example, the slow speed of XML.

Additional concepts to be investigated in action research are listed as follow:
• Consumers who are not a part of the portal can and should be able to come to the portal to do business. Consumers who are part of the portal
should be able to get their services (purchase) from the service-providers listed in the portal (directory)

- The system’s capability of redirecting the request any other service-providers whose systems are interoperable if consumers (listed or unlisted) decide on services that are not available within the listed participants
- The organisations have dedicated application in .net
- The applications have XML interface (can go beyond .net)
- The applications have XML and directory services (UDDI.org), and fully interoperable applications
- Any of these “PLAYERS” with interoperable systems can OFFER services and CONSUME services.

To do an action research one should take action to implement the required changes.

Action research is classified as follows:

- Collaborative
- A systematic learning process
- A process that requires “testing” our ideas about our work
- Keeping a personal journal about the work experience
- Critical analyses about the place change will happen
- Justification for the work practice.

Action research submits each new innovation to the test of practical use. The reflective insights of the researcher/practitioner form the basis of the developmental process (Schon, 1983). Participatory action research offers a way to redirect resources from those who wield power to those who bear its consequences by empowering participants; the production and use of knowledge is transformed into a
collective enterprise with value to all participants. Participatory action research thus serves the agenda of bringing theory and practice together (Ryder and Wilson, 1997). Figure 3.7 depicts the phases involved in an action research.

![Figure 3.7: Involved Phases in the Action Research (Ryder and Wilson, 1997)](image)

Considering the characteristic of the action research, it was recognised that it fits into the implementation of the Mobile Web Services technologies to re-engineer business processes across multiple organisations, which may operate through different platforms. Furthermore, it has been decided to continue with the action research during the completion of the data collection for the surveys. The following describes the four phases defined by Ryder and Wilson (1997).

**Plan**

The plan phase involves identifying the problem to be solved. The initial interviews and meetings in the organisations provide information in the plan phase to identify the issues and requirements of the organisations. A review of action research
frameworks reveals several common features. An action research study seeks to create knowledge, propose and implement change, and improve practice and performance (Stringer, 1996). Kemmis and McTaggart (1998) suggest that the fundamental components of action research include the following: (1) developing a plan for improvement, (2) implementing the plan, (3) observing and documenting the effects of the plan, and (4) reflecting on the effects of the plan for further planning and informed action. New knowledge gains results in changes in practice (see Fullan, 2000a and 2000b). Action research is often conducted to discover a plan for innovation or intervention and is collaboration. Based on Kemmis and McTaggart’s (1998) original formulation of action research and subsequent modifications, Mills (2003) developed the following framework for planning of the action research:

- Describe the problem and area of focus
- Define the factors involved in your area of focus
- Develop research questions
- Describe the intervention or innovation to be implemented
- Develop a timeline for implementation
- Describe the membership of the action research group
- Develop a list of resources to implement the plan
- Describe the data to be collected.
- Develop a data collection and analysis plan.

This research has considered this phase as a very significant part of the action research projects. During this phase, the research fully studied the individual organisations’ processes and documentation to gain knowledge about the functionality of the organisations under study.
Action
The researcher, in this phase, specifies how the diagnosed problems can be solved. The planned actions would be guided by a framework, which indicates a desired future state to be achieved by the organisation under investigation. The plan establishes the target for change and the approach to change. The researcher selects the appropriate tool for inquiry while the participant organisations are involved in the research.

In each cycle there is action and critical reflection. During reflection, people first examine what happened previously – they “review”. They then decide what to do next – they “plan”. Based on Dick (2002) the action is followed by critical reflection: What worked? What did not work? What have we learned? How might we do it differently next time?

![Figure 3.8: A Simple Action Research Spiral (Dick, 2002)](image)

The action phase has also been considered as the very crucial phase of this research, hence the study must diagnose the existing problem. The organisations involved in the action research projects have not been fully aware of the potential of the proposed collaborative model and it was very time-consuming to define it as a “problem” that needs to be solved.
This research aims to use this phase to address the “problem” in the current collaborative environment and then demonstrate the desired future of the collaborative environment as a “solution”.

**Observe**

The observation in an action research study places the researcher in position as a partner (working alongside those affected by the problem) rather than as an objective observer (who might impose changes from the outside). In contrast to “basic” research, the focus is on specific desired changes in a unique situation (Deshler and Ewert, 1995).

This research has used the observe phase of the action research to inspect and understand the internal/external business processes of each individual organisation under the study. The observation provided familiarity with the daily functions of the organisations and each individual study considered the existing collaborative environment on evaluating how the business process integrates when an external party is involved. Understanding the current collaborative environment aids the researcher to identify the needs of the proposed CBPE model for more comprehensive and futuristic collaboration.

**Reflect**

The solution achieved from the plan, act and observe phases of action research projects led the researcher and organisations to collaboratively evaluate the outcomes of the implemented solution. The main purpose of the action research is to improve the quality of an organisation and its performance by reflecting the result achieved from the previous phases in the reflect phase, ready for the next cycle of Figure 3.8.

Action research can be undertaken by individuals or by teams of colleagues. The team approach is called “collaborative inquiry”. The implemented solution was
evaluated and the effectiveness of the implemented solution was measured through the change that had been effected due to the implemented solution.

Action research has the potential to generate genuine and sustained improvements in organisations by giving them new opportunities to reflect on and assess their performance to explore and test new ideas, methods, and materials.

The reflect phase aids this research to propose and evaluate the improvement on the quality of the work that the CBPE model provides. The new engineered processes improve the functionality of the operation, hence the products/services produced/required are more accessible for the individual who provides/needs them.

3.4.3.2 Rational Questionnaire (Quantitative Research)
The designed questionnaire surveys the current status of business organisations with regard to the use of mobile technology and web services. Questionnaires are ideally suited for measuring people’s attitudes and opinions.

The set of questions is aimed to get an idea of the organisation for classification purposes in the final analysis. These questions are investigating the size of the organisation and the industry to which the organisation belongs and also the position and the area of work of the person who answers the questionnaire. The remainder of the questions evaluate the process of adaptation of the organisations to the new technology, specifically the technology of the Web Services and Mobile Web Services.

The questionnaire will also establish whether there are issues when mobile applications and web services are used as a tool in the business activities of the organisations. Thus the questionnaire will provide us with good insight into the corporate management in terms of mobile technology (Nardi, 2003).
A detailed description of the 500 such questionnaires sent to large and medium-sized business organisations, and the subsequent data collection and analysis are presented in Chapter 5. A sample of the questionnaire is provided in Appendix A. The questionnaire was designed and sent to a random sample of organisations to ensure that the data gathered would be reliable and valid for research purposes. Ginige et al. (2000) grouped their industries for the study on the use of Information Technology in the Western Sydney area, based on the organisations’ population size and the industry category. Organisations that are already using mobile devices are preferred for this research, since their experience can be used to develop an idea based on their previous encountering.

Freund et al. (1993) explain the term “population” and “sample” by defining that if a set of data consists of all conceivably possible observations of a certain phenomenon, this is called the population and if a set of data contains only a part of these observations, we call it a sample.

The result of the above discussion is illustrated in a comprehensive figure that illustrates the overall robust research design created for this research study. This research design is shown in Figure 3.9.
Figure 3.9: The Comprehensive Research Design for This Study

Figure 3.9 depicts the final research design customised for this research. The figure demonstrates the research was initiated by understanding the basis of philosophy in research. The literature review identified the most suitable philosophical approaches adaptable by this research. The identified gap in the existing collaborative environment was modelled in order to understand the depth of the problem. The qualitative methodology constructed the proposed collaborative environment, and is described in Chapter 4 in detail. The selected theories are the most appropriate theories, since they have the capabilities to define change in our society and organisations. The Darwinian theory of evolution has survived the test of time and thousands of scientific experiments; nothing has disproved it since Darwin first proposed it more than 150 years ago. Lenski (2000) states that scientific understanding requires both facts and theories that can explain those facts in a coherent manner. Evolution, in this context, is both a fact and a theory.

The use of action research and organisational survey were also clearly defined. Three business organisations in the product and service-provider industries are
selected for action research, which is described in Chapter 6. The selection of the organisations is conducted on a needs basis and their willingness to participate in such a research project. The needs basis ensures that the organisation is identified as having a requirement to participate in the proposed collaborative environment.

The research problem also focuses on identifying the drawbacks of adaptation to the new environment. The combination of action research and organisational survey assists the researcher to identify the negative aspects of the proposed model.

Although some evaluations arising from implementation are yet to take effect due to organisational decision-making constraints, the full solution, with regard to the proposed model, is designed based on the organisational need of the collaborative environment, and blueprints are handed over to the organisations. There is correspondence between the researcher and the organisations in order to answer and provide any explanation for any queries during the process of implementing the proposed collaborative environment.

3.4.4 Time Plan and Milestones for the Research:

<table>
<thead>
<tr>
<th>Main Activity</th>
<th>Milestone</th>
<th>Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Literature Review</td>
<td>Create survey</td>
<td>Throughout the research</td>
</tr>
<tr>
<td>Publications</td>
<td>Book Chapter</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conference papers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Journals</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Throughout the research</td>
</tr>
<tr>
<td>Action Research 1</td>
<td>Provide Full Report</td>
<td>March 2006</td>
</tr>
<tr>
<td></td>
<td>1st Review of Survey</td>
<td>March 2006</td>
</tr>
<tr>
<td></td>
<td>Completed</td>
<td>June 2006</td>
</tr>
<tr>
<td>Publications –</td>
<td>Book Chapter</td>
<td></td>
</tr>
<tr>
<td>Based on Action</td>
<td>Conference papers</td>
<td></td>
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<tr>
<td>Research</td>
<td>Journals</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Throughout the Study</td>
</tr>
<tr>
<td>Sending the surveys to</td>
<td>1st Review of Collected</td>
<td>March 2006</td>
</tr>
<tr>
<td>participants</td>
<td>Data</td>
<td></td>
</tr>
<tr>
<td>Data Collection</td>
<td>2nd Review of Collected</td>
<td>Simultaneous</td>
</tr>
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</table>
Table 3.3: Time Plan and Milestones for the Research

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</thead>
<tbody>
<tr>
<td>Data</td>
<td></td>
</tr>
<tr>
<td>Develop Collected Data</td>
<td>Evaluations</td>
</tr>
<tr>
<td>Statistical Analyses of the Data</td>
<td>Evaluations</td>
</tr>
<tr>
<td>Review Publications</td>
<td>Provide Comments</td>
</tr>
<tr>
<td>Action Research 2</td>
<td>Acceptance-Rejection</td>
</tr>
<tr>
<td>Action Research 3</td>
<td>Provide Full Report</td>
</tr>
<tr>
<td>Publications – Based on Action Researches</td>
<td>Book Chapter</td>
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<td>Conference papers</td>
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<td></td>
<td>Journals</td>
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<tr>
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<td>Review and Evaluation</td>
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<tr>
<td>Final Draft of Thesis</td>
<td>Submission</td>
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</table>

3.5 CONCLUSION

This chapter has summarised an investigative literature survey in the areas of philosophies, methodologies and theories. The discussion was initiated by providing a clear background on the philosophies and methodologies involved in the research. The clear definitions of existing philosophies and methodologies were immediately followed by introducing the selected approaches for this research. The reasons for adapting the selected approaches have been clearly stated. In most cases, when identified, the limitations and advantage of the employed philosophies, methodologies, theories and methods have been defined.

Firstly, the selected research philosophies are a combination of the interpretivist and constructive approaches. Secondly, the selected methodologies are a combination of quantitative and qualitative methodologies. Thirdly, the selected theories are a combination of evolutionary and socio-technical theories. Finally, the selected methods are a combination of action research and statistical survey to identify the use of mobile and Web Services technologies.
Chapter 4 explains the core philosophies of Web Services, Enterprise Architecture and Service-oriented Architecture. Chapter 4 presents the constructed model for the new environment of the collaboration.

### 3.6 REFERENCES


Jopps, M. Exploratory Research. Ryerson University.  


Our problems are man-made; therefore they may be solved by man. No problem of human destiny is beyond human beings.

John F. Kennedy (1917–1963)

CHAPTER 4 – THE COLLABORATIVE BUSINESS PROCESS ENGINEERING (CBPE) MODEL

4.1 INTRODUCTION

This chapter describes the Collaborative Business Process Engineering (CBPE) model which is the core contribution of this research. The descriptions of the technologies that facilitate CBPE are also presented in this chapter. Chapter 1, section 1.1, highlighted the need for a new collaborative environment. That discussion on the collaborative environment is expanded here, together with its limitations and expectations.

This chapter also creates an understanding of a business cluster. This understanding of a cluster provides further clues to the challenges and limitations of the current as well as proposed collaborative environment. The identification and discussion of concepts and technologies such as Web Services (WS), Enterprise Application Integration (EAI), Service-oriented Architecture (SOA), Enterprise Service Bus (ESB), Mobile and Web 2.0 technologies also takes place in this chapter.

These technologies and their functionality are described in Chapter 2 while the purpose of this exploration of the aforementioned technologies in this chapter is to understand the role undertaken by these technologies in the creation of the CBPE model. This chapter also introduces the Collaborative Web-based System (CWBS) which demonstrates the application of the CBPE in practice.
4.2 DEVELOPMENT OF THE CBPE MODEL

Collaborations enable businesses to communicate with each other in order to provide better services and products and improve management of the business itself. This is so because, through collaborations, businesses are able to share resources efficiently and effectively. However, Unhelkar (2003) has argued that when such collaborations are numerous and are not guided by underlying business principles, they tend to waste resources. This wastage of resources occurs as the collaboration between numerous potential customers, business partners and service-providers remains only at superficial level and may not get converted into real business. There is a need to forge collaborations that result in real business. There is also an equally important need to study these collaborations and clusters, and understand how technologies foster their formation.

4.2.1 Business Clusters and Collaborations

Organisations trying to collaborate with each other tend to perform frequent transactions with each other. A logical classification or grouping of businesses that need to deal with each other on a more frequent basis than others leads to formation of groups of clusters of businesses. A “cluster” can be understood as an electronic segment of a group of organisations with some identifiable commonality. A “cluster” is usually a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities, complementariness and perhaps ease of communication. The transactions between clusters of businesses are frequently conducted electronically. These electronic transactions are based on connections that use the information and communications technologies. Following are some well-known descriptions of the term “cluster”: 
• An industrial cluster is a set of industry sectors related through buyer–supplier relationships, or by common technologies, common buyers or distribution channels, or common labour pools (Porter, 1990).

• A regional cluster is an industrial cluster in which member firms are in close geographical proximity to each other. A more inclusive definition would be: regional clusters are geographic agglomerations of firms in the same or closely related industries (Enright, 1992, 1993).

• A concentration of firms involved in interdependent production process, often in the same industry or industry segment (Sforiz, 1992).

• A business segment consisting of several firms that have ongoing communication and interaction (Staber, 1996).

• Clusters are a group of businesses that are collaborating electronically, but which are grouped with an underlying logic or business purpose. (Unhelkar, 2003).

Understanding these electronic clusters and collaborations is an important factor for building a model of electronic collaboration.

4.2.2 Limitation of Current Collaborative Environment

The above descriptions and definitions of clusters indicate that, in an existing environment of collaboration, a cluster as an electronic segment can only collaborate:

• With parties that are using common technology: This means that prior to the collaboration, organisations need to decide on the technologies that will be used in the collaboration. These technologies need to be common between the organisations.

• With a common customer: This means that the customer is already known to the organisation. The fact that the customer is known, and so are the
technologies, indicate that these clusters need to be set up “beforehand”. The setting-up of electronic collaborations amongst businesses beforehand tends to indicate that these collaborations are static.

- **With using the common channels:** Channels are lines of communication that are used to connect the organisations. These channels could be in a mobile (or wireless) environment or the landline. In the current collaborative environment these channels are set in the same frequency (if mobile or wireless) and same path as that of a landline. These channels are preset for the known static collaboration.

- **With the known geographical proximity:** The current collaborative environment supports enterprises as long as their collaborative chain has already been created. This chain depends on the “homogeneity” of the business environment, usually provided by a similar geographical region.

- **With related industries:** This means that the current collaborative environment is able to support transactions within industries that are related to each other. Collaborations between vastly different industries may not be supported by the current collaborative environment.

- **With organisations that have ongoing communication and interaction:** This means that the current collaborative environment is supporting the collaboration amongst the organisations that already have existing electronic transactions happening amongst them.

- **With similar legal framework:** Current collaboration requires legal commonality that enables conducting collaborative transactions with legal support especially if multiple geographical locations are involved.
4.2.3 Expectations of the Modern-day Collaborative Environment

The expectations of the collaborative environment by the business world, and the technologies capable of delivering them, are discussed in the previous section in order to determine the need for the advent of the dynamic modern-day collaborative environment. These expectations of a dynamic modern-day collaborative environment can be summed up as follows:

- Collaborations are expected to happen between parties that may be using different technology. This implies that the organisations are using different platforms, operating systems, databases and related technologies.

- Collaborations are expected to happen when dealing with any customer, even when the customer is not known to the organisation. The collaboration with unknown customer and organisations can be understood as a dynamic collaborative environment, since there is no need for prior set-up of transactions.

- Collaborations are expected to happen on various channels. There is no opportunity for prior setup of the channels in collaborating dynamically. The collaboration can occur at any time, even when organisations manage to locate and consume each other’s services.

- Collaborations are expected to happen when the organisations are in far-spread and dispersed geographical regions. This means that the organisations are able to locate each other irrespective of the geographical boundaries or proximities.

- Collaborations are expected to happen amongst the organisations from any industries. This means a collaboration supporting multiple
transactions, across multiple organisations in various industries, can occur by submission of a single application.

- Collaborations are expected to happen amongst the organisations that do not have an ongoing, pre-determined communication and interaction. This means that there is no prior contract and agreement. These organisations are not necessarily known to each other. They can get through on a collaborative platform to satisfy a need, or application, and disperse on the completion of that need.

- Collaborations are expected to happen amongst the organisations in different geo-political environments with varying legal frameworks.

The above section provides the expectations of the collaborations in an environment when the organisations are not necessarily known to each other. This research has identified these expectations as remaining unsatisfied through the formation of current clusters. This dissatisfaction was demonstrated in Figures 1.1 and 1.2, wherein it was shown how the current environment does not support dynamic collaboration amongst multiple organisations. This is so because, while the existing collaboration model enables the customers to submit multiple applications to the various clusters, these are individual submissions by customers and business partners as they reach various organisations and their clusters for their specific products or services. Such individual pre-determined electronic submission does not capitalise on the full potential of the collaborative environment possible on the Internet. As against that submission of multiple applications, in the expected collaborative environment, the customer/client receives the desired services/products from multiple organisations by submitting only a single application that reaches these different organisations and the desired clusters.
This discussion thus far has highlighted various characteristics of a collaborative environment. The existing model of collaboration and the expected model of collaboration are now discussed with an example from the hospital domain.

4.2.4 Example of Current Collaborative Environment

As discussed in Chapter 2, Business-to-Business (B2B) can be understood as a existing collaborative environment. The limitations of this existing collaborative environment are demonstrated in Figure 4.1, which reviews an existing model of collaboration in more detail with an example from the real world. Figure 4.1 provides the pictorial illustration of the existing collaborative environment with a hospital application.

![Diagram of the Current Collaborative Environment](image)

**Figure 4.1: The Current Collaborative Environment**

(The operation on the current collaborative environment)

Figure 4.1 depicts an example considering a major disaster scenario wherein a Chief Medical Officer (CMO) of a Government hospital is in urgent need of 50 doctors and 300 nurses in the next 12 hours. Currently, this CMO must either make phone calls or send faxes to all the available hospitals to see whether they can satisfy
this requirement. Alternatively, as shown in Figure 4.1, this request can also be submitted electronically, wherein the CMO will require multiple applications forwarded by him/her through the existing B2B connections to the various service-providers. Submission of such multiple applications can become very time-consuming. The connections between the businesses must be “pre-fabricated”. Furthermore, these requests may not reach the hospitals capable of providing the personnel at the right time if the connectivity is not correctly established. Thus, the CMO may have to contact each individual hospital manually, again and again, in order to find the availability of suitable required personnel.

The CMO of the Government hospital may have set up alliances or agreements amongst the various hospitals (for example, Hospital 1, Hospital 2 and Hospital n) beforehand. Such a B2B relationship can ease some of the pressure of contacting the hospitals manually. As mentioned before, this is, indeed, collaboration at a base “pre-determined” level. It should also be noted that all these hospitals need to be known to the CMO “beforehand” to help each other in major disasters.

The CMO might have already decided on the existing facilities and technologies, such as phone, e-mail and fax as contact mechanisms. They may even have a dedicated phone that can only be used in emergency situations such as major disasters. The CMO might have already calculated the time of transporting the personnel to the hospital in need of help. Thus, while there is collaboration amongst various hospitals in this scenario, it is all pre-determined, and worked out beforehand. These characteristics of static collaboration have been discussed in section 4.2.2 of this chapter.
4.2.5 Example of Expected Collaborative Environment

Figure 4.2 demonstrates what is expected from a new collaborative environment. This example, based on the proposed model of CBPE, simplifies the whole process of calling for help by assigning a single message to a collaboration that is set up on an electronic portal. This set-up simplifies the channels of collaborations.

Figure 4.2: The Simplified CBPE-based Business Process

Figure 4.2 shows that in the proposed environment the Chief Medical Officer submits only one request to the portal. The portal contacts all the hospitals, submits the application, creates the list of all the required doctors and nurses, their hospital resources and all the required information, and then forwards it to the Chief Medical Officer. Creation and use of a portal itself is not new, and has happened in the past. However, what is genuinely expected of this collaboration is that any number of hospitals from any region can get together to satisfy the need. Thus, there is an element of dynamicity that is happening in this collaboration. The important issue to
note here is that Hospitals 1 and 4 might not be known to each other. However, the collaboration still takes place because they are known to the portal. This “knowledge” of the portal is not “pre-determined”.

In the expected collaborative environment the hospitals should be able to interconnect through the CBPE-based portal, even though they may be using different technologies and may not have had prior contract for the collaboration. The CMO who is demanding the help is no longer restricted to “known” hospitals. Any number of hospitals that are capable of providing services and that can offer their services on the portal are in this collaboration. Collaboration takes place through the CBPE-based portal in a dynamic manner for a particular application or need.

The CBPE-based portal is responsible for identifying the most suitable channel for the collaboration. This collaboration may be via land-line or mobile channel. Mobility can enable this collaboration to take place anywhere and at any time.

This collaboration amongst the organisations that do not have ongoing, pre-determined communication and interaction can be understood as dynamic collaboration. This dynamic collaboration requires a formal model that would encompass wide-ranging issues from the core technologies that facilitate such collaboration through to social issues of trust and legal compliance.

4.2.5 Influence of Web Services on Dynamic Collaborations

As discussed, the core technology that facilitates dynamic collaboration is that described in Chapter 2, Web Services (WS). WS, through the underlying XML, have changed the Enterprise Architecture (EA) and the business landscape. Web Services have been continually refined and, now, they play an integral part in bringing
together various aspects of an enterprise’s information systems. Formal incorporation of WS is accomplished through what is known as Service-oriented Architecture (SOA). Whenever we use SOA to amalgamate and integrate information systems in an enterprise, it leads to what we understand as Enterprise Architecture.

The Web Services operations are based on exchanging messages using the Internet communication protocols such as Hyper Text Transfer Protocol (HTTP). Extensible Markup Language (XML) is used for representing data that are exchanged among services in each operation. Web Services are often described as a component-based distributed architecture in which one application calls upon the services of another to perform a particular function. According to Gurguis and Zeid (2005), IBM considers the following standards as the base technologies for developing Web Services:

- **Simple Object Access Protocol (SOAP)**: Implements the bind and use operation by containing an Extensible Markup Language (XML) message in a standardised envelope.

- **Web Services Definition Language (WSDL)**: Implements the publish operation by defining abstracts interfaces and bindings.

- **Universal Description Discovery and Integration (UDDI)**: Implements the find operation by providing a public registry that is accessed or queried for either searching or publishing.

Web Services become a simple SOA where applications are offered as services both within and across the enterprises (Cubera, 2003) with lower development costs (Huang and Chung, 2003; Chen et al., 2003; Maruyama, 2002). Web Services standards allow interfacing, publishing and binding of loosely coupled services available on the Web.
Web Services can easily live with distributed object computing middleware such as Common Object Request Broker Architecture (CORBA), Distributed Component Object Model (DCOM) and Enterprise Java Bean (EJB) technologies. Web Services technology is becoming the most attractive technology for interoperation. However, WS is still not mature enough, due to methodological factors, and its full potential is yet to be realised.

The literature review in Chapter 2 and action research in Chapter 5 undertaken in this research identify the limitations of the existing technologies and collaborative environment. The research subsequently proposes a new dynamically collaborative environment. This proposed collaborative environment enables multiple organisations to collaborate with each other in order to serve a customer’s electronic application. Figure 4.3 shows the functionality of the WS technology and the significance of this technology in the proposed collaborative environment.

![Figure 4.3: The Web Services Technology](source: Unhelkar (2003))

Figure 4.3 depicts how the business application A1 submits an XML application. WSDL, on the left-hand side, defines the application and the UDDI publishes the application. On the left-hand side, the UDDI of the organisation is capable of handling the submission of the application or service. The business application B1 has to locate the application. After location, the WSDL (on the right-
hand side) consumes the application. This publishing and consumption of the required service happens in a global environment.

The portal presented in Figure 4.4 is equipped with all the explained technologies such as Web Services, Enterprise Application Integration, Service Oriented Architecture, Enterprise Service Bus (ESB) and also has the capability of connecting to mobile devices using Mobile Web Services.

In Figure 4.4, the proposed portal is equipped with the Web Services technology enabling the organisations A1...A5 to interact with each other through the proposed portal. In this portal multiple, organisations within the same industry are registered. When an organisation is unable to fulfil the requirements of the specific application, the portal will forward the remaining part of the request to other organisations capable of handling the request until it is fulfilled. The Web Services technology (XML, WSDL and the UDDI) facilitates this new collaborative
environment. However, the problem could be more complicated when an application requires multiple services from different industries.

Figure 4.5: The Complex Model of Collaboration
(Different Industries Involved)

The proposed portal should have the capabilities of contacting multiple industries and connecting to multiple organisations. Figure 4.5 presents this increasing complex model, which is based on separate industries. The letter A could be a representation of the airline industry, while the letter B could be representative of the hotel industry.

Figure 4.5 demonstrates how the organisations within the same industry are interconnected, while different industries are not in collaboration with each other. Therefore, a mechanism is required to create the interconnection of these organisations in various industries. The next section presents the comprehensive model wherein the organisations from various industries are collaborating with each other.
4.3 THE COMPREHENSIVE CBPE MODEL

Having discussed, with specific examples, the limitations of and expectations from collaborations, now, the comprehensive model of Collaborative Business Process Engineering (CBPE) is described. Figure 4.6 presents this Collaborative Business Process Engineering model. Initially, the two industries shown in Figure 4.5 are used to demonstrate how these different industries interconnect to each other in the proposed CBPE model. This description is followed by the practical model of multiple unknown industries in the CBPE model.

4.3.1 Initial CBPE Model (Two Industries)

The CBPE model, shown in Figure 4.6 is made up of two levels of portals. Both portal-levels are made up of corresponding “Directory Level 1” and “Directory Level 2”.

The portal in level 1 is responsible for the collaboration between the industries, and the portal in level 2 is responsible for the collaboration of the organisations. The ovals named A1, A2 and so on present organisations while the ovals named IA and IB present the industries. There are two different levels of portals. The first-level one acts as an “engine” identifying the desired industries, while the second portal is the database of the registered organisations in a specific industry. The dark ovals on the right-hand side of the figure present the organisations that are not using interoperable systems (Web Services). Therefore, these organisations are unable to participate and use the proposed collaborative environment.

Figure 4.6 depicts how the proposed CBPE model creates the channels for the collaborations amongst multiple industries and organisations. The dashed line in the picture presents a request entering the model. The request goes to the directory of
level 1 within the portal. All industries can be registered in the level 1 UDDI directory through a parameter. The directory at level 1 processes the request by identifying the industries involved. The system then sends the request to directory level 2 portal in order to find the organisation capable of handling the request, and submits the application.

The aforementioned proposed model has the capability of sending the application (request) to multiple organisations either in the same or different industries, until the overall process of fulfilling the request is completed. The response is then submitted back to the level 1 portal which informs the client of the final result. This model is also capable of performing another transaction by submitting the application back to level 1 to find the related industry for further processing at level 2. Alternatively, the process of submitting requests for various “sub-requirements” can continue through multiple industries until “cross-industry” applications have been fulfilled.
Figure 4.6: The CBPE Model with Two Industries
This arrangement in CBPE two-level portals helps in classifying the organisations as well as their relative industries. Such classification simplifies the publication and location of the submitted application.

Figure 4.6 also illustrates how the organisations that do not adapt Web Services remain outside the model, unable to use or register in the system (dark-shaded organisations) that is based on the model. However, an organisation or a client wanting to use the proposed system, but not registered, will still be able to use the system as long as it is using the Web Services (light-shaded organisations). Thus, the requirement of the CBPE model is not the need to “pre-register” but the need to be able to publish and consume services by using the WS technologies.

The application returns back to the client after the completion of the request, informing the finalisation of the request by supplying all the related booking and transactions numbers. The dashed line in Figure 4.6 shows these dynamically created channels of collaborations across the organisation and shows how the participants can collaborate without “pre-fabrication”.

4.3.2 Comprehensive CBPE Model (Multiple Industries)

The model of collaboration, discussed for two industries in the previous section, can be expanded to include multiple industries and an unknown number of organisations. Figure 4.7 presents this full model of the proposed collaboration when multiple industries and organisations are involved in the Collaborative Business Process Engineering (CBPE) environment.

The organisations that are using WS technology have the capability of sending their request to the system. A sample of these organisations is presented in the bottom-left-hand side of Figure 4.7. Please note that these organisations need not
be registered in order to submit a request. However, the organisations that are not using the interoperable system are not able to submit a request, receive a request or generally participate in the proposed model. These organisations are presented by the shaded circle in the bottom-right-hand side of Figure 4.7.

The UDDI directory in level 1 locates the required industry and processes the request through an engine. This CBPE engine then forwards the request to the relevant UDDI level 2 directories. The UDDI directory in level 2 then forwards the request to the relevant organisations. Various organisations are approached, one after the other, until the overall request by the customer has been fulfilled.

The level 1 and level 2 UDDI directories have the capability of registering numerous industries and organisation. The implementation of the presented model is presented later in section 4.6 of this chapter.

Figure 4.7 (similar to Figure 4.6) is capable of handling the request when multiple industries and organisations are involved in the process of collaboration. The literature review in the Chapter 2 of this thesis discussed how, currently, there is no comprehensive model of collaboration in place. This research study builds and describes a Collaborative Business Process Engineering (CBPE) model that is able to handle the complete collaborative model.

The CBPE model has the potential for practical application. This chapter also shows the practical or realistic aspects of the theoretical CBPE model. However, the technology has been a major cause in creating a dynamically collaborating electronic environment. Without the understanding of these technologies, it is not possible to create the CBPE model. Therefore, it is important to discuss the technologies separately, in the context of the CBPE. The next section discusses these various technologies and their influence on CBPE.
Figure 4.7: The Complex Model (Multiple Industries and Organisations)
4.4 TECHNOLOGIES FACILITATING CBPE

The following sections provide detailed discussion of the aforementioned technologies that facilitates the CBPE model. The concepts of SOA (Zimmerman et al., 2005), Business Process Choreography (Leymann et al., 2002) ESB (Keen et al., 2004) and Web Services technologies (Booth et al., 2004) form part of the technologies supporting the proposed model of CBPE. Figure 4.8 depicts the various technologies that are influential in supporting the creation of the CBPE environment.

Figure 4.8: The Technologies Facilitating and Supporting CBPE
Figure 4.8 highlights the technologies that facilitate and support the **CBPE** model. These technologies enable the proposed **CBPE** model to extract the full potential of business collaborations.

These technologies are Web Services (described in section 4.2.5), Enterprise Application Integration (EAI), Service-oriented Architecture, Enterprise Service Bus, Mobile and Web 2.0.

The left-hand-side box on the bottom presents the advantages of the technological facilitation while the right-hand-side box presents the challenges, such as channels of collaboration, trust and control. The following sections describe the aforementioned technologies and their influence on the proposed collaborative model.

### 4.4.1 Enterprise Application Integration (EAI)

When the existing applications are linked together electronically, in order to provide a single integrated response to a user request, it results in Enterprise Application Integration. Enterprise Application Integration (EAI) automates and extends the data integration process. Data integration involves storing the data of an application that can be manipulated in ways that other applications can easily access. This integration is as simple as using a standard relational database for data storage, or perhaps implementing mechanisms to extract the data into a known format such as Extensible Markup Language (XML) or a comma-separated text file that other applications can consume (Gorton and Liu 2004).

Such an electronic exchange enables firms to have information systems (IS) that encourage the unhindered flow of information. The paradigm that addresses this need of firms is popularly known as Enterprise Application Integration (Erasal,. et
al., 2003). EAI involves developing and devising ways to efficiently reuse what already exists, while adding the new application and data (Jinyoul, Siau and Hong, 2003).

EAI provides the means to integrate strategic business solutions within and across the parts of organisational information system infrastructures. The increased deployment of enterprise application alongside legacy systems means that companies are being compelled to adopt Information System (IS) infrastructures that connect applications, data and information together (Sharif et al., 2004).

EAI is a pertinent approach to integrating core business processes and data-processing in an organisation (Reiersgaard et al., 2005). EAI maps the business processes, rather than technology-driven processes, by providing the linkage to applications at the business level.

The mapping of the business processes enables CBPE to employ these internal integrated business processes to provide enhanced collaboration with the business processes of the other organisations. Furthermore, the emerging technologies extend the ability of the organisations to create dynamic interconnections between various parts of the information networks in CBPE model. This ability to dynamically interconnect various parts of the data and information through emerging technologies results in “correlations” that provide new insights to the organisations to be part of the modern-day collaborative environment. This modern-day collaborative environment includes dynamic correlations that result in greater business advantage while the customer receives sufficient service or product.

EAI allows integration and coordination across whole enterprise, including internal and external enterprise. The mapping of the business processes enables CBPE to
place the organisation within the right industry categorisation, so that the services that are provided are easily recognisable.

4.4.2 Service-oriented Architecture (SOA)

Web Services technology implements SOA by means of standard XML-based initiatives. Web Services use XML to enable connection between various applications. The SOA is a system architecture that integrates different systems distributed over a network with a standard procedure. Thus, the SOA considers the system as made up of autonomous distributed components. These components are loosely coupled with each other by strictly-typed interfaces and standardised communication protocols (Nakamura et al., 2004).

SOA is essentially a collection of Web Services (WS) that communicate with each other. This communication can involve either simple data passing from a browser to a Web server or it could involve two or more services coordinating some activity (Dorenhoefer, 2005). The SOA is business-process-centric rather than technology-centric. This means that a service represents a business task. The SOA supports the exchange of messages and documents in a standardised, platform-agnostic format. According to Knorr and Gurman, (2007) the hardest part of constructing SOA is not technology; it is actually redrawing the business processes that provide the basis for the architecture.

SOA is a contractual architecture to offer and consume software as services. According to Gustavo et al., (2004) there are three entities that make up a SOA:

1. Service-providers: The owner of the services. They define descriptions of their services and publish them in the service registry.
2. Service Requesters: They use a “find” operation to locate services of interest. They are also known as service consumers.

3. Service Registry: Returns the description of each relevant service.

According to Jammes et al. (2005), the basic interaction patterns of a device-level SOA can be described according to five levels of functionality. These functionalities are described here briefly from the point of view of utilising them in CBPE.

- **Addressing**: This is the foundation for device networking. The Internet Protocol (IP) based networking is supported by the IP protocols and IPv6. According to Philip Argy (2007), the National President of the Australian Computer Society (ACS), IPv6 will create a network that is vastly larger than the current Internet, extending the current IP addresses. The created network will also be more secure, easier to implement, and enable a ubiquitous nanotechnology-connected world with vastly increased potential for innovation. In CBPE, each organisation registered is allocated to a specific portal through an IP address. The individual IP address enables the services to be reused while searching for an individual product and service. IPv6 provides support for the CBPE model by creating a larger network and the IPv6 potential for innovation.

- **Discovery**: Once the addressing of networking is established, the devices need to discover each other. A discovery protocol enables a device to advertise its services on the network. A search request is sent out for all devices and then the devices that match the request send a corresponding reply. In CBPE, the UDDI stores the services and products offered. The
The **CBPE** system has the capability of discovering the products and services irrespective of the used platforms.

- **Description**: The device metadata may include information like manufacturer name, version and serial number. Each service exposed by a device defines the command message or actions, as well as the associated message formats. In **CBPE**, the system has the capability of registering such a description through recommended suites of attributes that specify the products or services being discovered.

- **Control**: To invoke an action on a device service, a controlling service sends a control message to the network endpoint for that service. In **CBPE**, the system has a portal manager controlling the transaction. The manager could be an electronic artificial intelligence device or a person.

- **Eventing**: In addition, devices may communicate through asynchronous eventing, usually implemented by “publish–subscribe” mechanism. Through eventing, a service exposes events corresponding to internal state changes, to which controlling devices can subscribe in order to receive event notifications whenever the corresponding internal state change occurs. In **CBPE**, the proposed UDDI has the capability of registering the event for future transactions. Furthermore, changes to the state of a service have the capability of broadcasting that state-change to all other subscribing services.

The current SOA is widely used to offer Web Services on wired networks. However, no significant research has been carried out in the field of mobile services that would provide availability and dynamic discovery service for mobile users. According to Brantner, Helmer, Kanne and Moerkotte (2006), while the software
industry has moved towards service-oriented architectures (SOA) in the last few years, this has mostly been undertaken for non-mobile enterprise systems. Nowadays, mobile devices are ubiquitous and they need to be considered in the context of SOA.

However, they are characterised by limited resources such as processing power, memory, display screen and connection bandwidth (Sanchez-Nielsen et al., 2006). SOA is a flexible and extensible architecture for designing and realising industry solutions and applications. Therefore, SOA needs to consider both mobile and non-mobile services and applications. SOA also needs to align IT strategy with business strategy. The application of SOA in CBPE is discussed in section 4.5.1 of this chapter.

4.4.3 Enterprise Service Bus (ESB)

An Enterprise Service Bus (ESB) is a software infrastructure that enables SOA by acting as an intermediary layer of middleware through which a set of reusable business services are made widely available. An ESB helps enterprises obtain the value of SOA by increasing connectivity, adding flexibility and speed, and providing greater control over use of the important service resources it binds.

A critical step for organisations is to align information technology (IT) systems using SOA with their business strategies. Such alignment provides an end-to-end enterprise integration and virtualised IT services. However, the SOA paradigm also needs to be extended to transmute organisational structures and behavioural practices (Bieberstein et al., 2005). ESB is a hub for integrating different kinds of services through messaging, event-handling, and business performance management (Luo, Goldshlager and Zhang, 2005). ESB does not implement an SOA.
However, ESB incorporates the SOA. The wide range of mediation services provided by an ESB is a broader architecture pattern, which may be partly or wholly implemented, depending on the breadth of actual requirements.

According to Gilpin et al. (2004), any enterprise looking to implement SOA should evaluate what form of ESB would be required, and begin to take the initial steps to exploit this key emerging technology (http://www.forrester.com).

An ESB is a bus which delivers messages from service requesters to service providers. Since it sits between the service requesters and providers, it is not appropriate to use any existing capacity planning methodology for servers, such as modelling, to estimate an ESB’s capacity. There are programs which run on an ESB called mediation modules. Their functionalities vary and they depend on how people use the ESB. This usage creates difficulties for capacity planning and performance evaluation.

According to Vaughan (2003), ESB is an open standards-based messaging means designed to provide interoperability between larger-grained applications and other components via simple standard adapters and interfaces (http://www.adtmag.com/). The infrastructure that underpins a fully integrated and flexible end-to-end SOA is called ESB (Schmidt et al., 2005).

The ESB provides a new way to build and deploy SOA architectures. ESB is a concept that is increasingly gaining the attention of architects and developers, as it provides an effective approach to solving common problems such as service orchestration, application data synchronisation, and business activity monitoring. In its most basic form, an ESB offers the following key features that are of interest to this discussion on CBPE:
Chapter 4 – The Collaborative Business Process Engineering (CBPE) Model

- **Web Services**: support for SOAP, WSDL and UDDI, as well as emerging standards such as WS-Reliable Messaging and WS-Security
- **Messaging**: asynchronous store-and-forward delivery with multiple qualities of service
- **Data transformation**: XML to XML
- **Content-based routing**: publish and subscribe routing across multiple types of sources and destinations
- **Platform-neutral**: connect to any technology in the enterprise, for example, Java, .Net, mainframes, and databases.

ESBs are the evolution of middleware infrastructure technology. In the past, developers used a variety of technologies to support program-to-program communication, such as Object Request Brokers (ORBs), Message-oriented Middleware (MOM), Remote Procedure Calls (RPC), and, most recently, point-to-point Web Services. These technologies are frequently grouped under the “middleware” category. ESBs are attractive to organisations today because they combine features from previous technologies with new services, such as message validation, transformation, content-based routing, security and load balancing. ESBs also use industry standards for most of the services they provide, thus facilitating cross-platform interoperability and becoming the logical choice for companies looking to implement SOA (http://dev2dev.bea.com/).

Many integration problems today are relatively simple in nature, requiring data synchronisation across two or more applications. For these types of problems, an ESB is a lightweight, cost-effective technology. ESB can be the backbone that transports and routes messages across an enterprise, as it is a standards-based integration platform that combines messaging, Web Services, data transformation
and intelligent routing in an event-driven SOA. According to Chappell, vice-president and Chief Technology Evangelist at Sonic Software (CTESS), ESBs are being rapidly adopted within IT organisations across a wide variety of industries, solving real-world integration challenges in unique ways. According to Roy Schulte, The ESB is primarily concerned with the program-to-program communications necessary to support services-oriented interactions and combines messaging, transformation, and content-based routing into a single off-the-shelf product. ESBs have emerged because of the growing need for general-purpose enterprise communication backbones. This is the whole concept of the enterprise nervous system gradually coming to life, step-by-step and without fanfare (http://www.sonicsoftware.com/).

The ESB model, in which there is a set of intermediary services that support the functions mentioned previously, is fundamentally more flexible and inherently more scaleable because it provides access to a core set of common functions without having to rewrite all of the applications that require those functions. Instead of one application simply consuming the services of another on an ad-hoc basis, proponents of the ESB model envision a network made up of collaborating services. Such network has repercussions for the CBPE model.

Based on Sherman, regular contributor to Enterprise Architect, ESBs support SOAs by implementing SOAP and leveraging Web Services Description Language (WSDL) and Universal Description, Discovery, and Integration (UDDI). In addition, ESBs make extensive use of XML-based content routing and transformation (http://www.ftponline.com).

The ESB influences CBPE because, based on an ESB, the choice of a platform can be made. This platform builds services from scratch based on
provisioned via configuration rather than the coding. The ESB enables the **CBPE** to connect services, while just focusing on design for the maximum reuse. ESB provides a messaging bus and service platforms, making it relatively easy to hook up legacy systems and to manage the orchestration of the **CBPE**. The ESB also transforms and routes the messages in the proposed collaborative model of the **CBPE**.

### 4.4.4 Mobile Technology

The evolution of mobile technology is considered in the context of the current discussion, in order to understand its origins and also to realise where it is heading. Mobile technologies form the basis of the “next wave” of software applications, resulting in “Global Businesses” that are unique in nature (Unhelkar, 2005a).

The uniqueness of mobile technology is that it has given organisations the freedom to conduct commercial transactions independent of both time and location. Established as an additional layer of technology on top of the traditional Internet, mobile networks ensure that information that is available through a physical computing device at a fixed location is now available at any time and anywhere in a true “wireless” manner (Tarasewich, 2003).

Furthermore, due to the personalised nature of individuality of the mobile devices, it is possible for businesses to create various personalised business applications.

According to Freeland, Mat-Amin, Teangtrong, Wannalertsri and Wattanakasemsakul (2001) and Godbole (2006), mobile computing is described as a vision of the creation of environments with information and computation, in which digital content, applications and services are made available in an integrated and
personalised way to users, through a diverse range of devices and access networks. The ability of mobile applications to make their users location-independent is the major characteristic of the mobile technology. Accessing the applications from anywhere, and at any time, brings a new feature to the usage of mobility by businesses extending the potential usage of the traditional land-line Internet.

The growth of the Internet and the World Wide Web has had a significant impact on business, commerce and industry (Murugesan, Deshpande, Hansen and Ginige, 2001). The electronic commerce resulting from the popularity of the Internet offers a global market, potential cost savings, and provides unprecedented new business opportunities for organisations (Chung, Lin and Shim, 2005; Dutta, Kwan and Segev, 1998; Manecke and Schoensleben, 2004). The integration of mobile technology in business and commerce results in what is known as mobile business (m-business), which integrates the Internet, wireless devices and e-business together (Kalakota and Robinson, 2002).

The development of mobile business is referenced here in order to identify the potential of the mobile technology in the context of the CBPE model. The potential of the mobility in the context of the CBPE is to create a streamline of the engineered collaborative business process for multiple organisations. The influence of mobile technology on CBPE is described in section 4.5.2 of this chapter. This influence on CBPE is also described in practical context in section 5.4 of the next chapter.

4.4.5 Web 2.0

Tim O’Reilly, an activist for Internet standards and open-source software, is also the founder of the Web 2.0 summit. He came up with the concept of the Web 2.0 in 2005
in order to define an emerging second generation of the Web technology. According to Omar et al. (2007), the Web 2.0 technology provides an enhanced platform for enterprise application integration as well as consumer content generation, sharing and collaboration. This collaborative ability of Web 2.0 is vital for the future of CBPE.

O’Reilly (2005a) predicts an improved and seamless user interaction and management of the Web environment and resources, guaranteeing required services and a flexible generation of user applications. Table 4.1 presents the difference between Web 1.0 and Web 2.0.

<table>
<thead>
<tr>
<th>Web 1.0 Features</th>
<th>Web 2.0 Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double Click</td>
<td>Google AdSense</td>
</tr>
<tr>
<td>Ofoto</td>
<td>Flickr</td>
</tr>
<tr>
<td>Akamai</td>
<td>BitTorrent</td>
</tr>
<tr>
<td>mp3.com</td>
<td>Napster</td>
</tr>
<tr>
<td>Britannica Online</td>
<td>Wikipedia</td>
</tr>
<tr>
<td>Personal websites</td>
<td>Blogging</td>
</tr>
<tr>
<td>Evite</td>
<td>upcoming.org and EVDB</td>
</tr>
<tr>
<td>Domain name speculation</td>
<td>Search engine optimisation</td>
</tr>
<tr>
<td>Page views</td>
<td>Cost per click</td>
</tr>
<tr>
<td>Screen scraping</td>
<td>Web Services</td>
</tr>
<tr>
<td>Publishing</td>
<td>Participation</td>
</tr>
<tr>
<td>Content management systems</td>
<td>wikis</td>
</tr>
<tr>
<td>Directories (taxonomy)</td>
<td>tagging (“folksonomy”)</td>
</tr>
<tr>
<td>Stickiness</td>
<td>Syndication</td>
</tr>
</tbody>
</table>

Table 4.1: The Differences between Web 1.0 and Web 2.0

Source: O’Reilly (2005a)

Web 2.0 applications make the most of the intrinsic advantages of that platform: delivering software as a continually updated service that gets better with usage. Thus there is consuming and remixing data from multiple sources, including individual users, as well as providing their own data and services in a form that allows remixing by others, creating network effects through an “architecture of
participation”, and going beyond the page metaphor of Web 1.0 to deliver rich user experiences (O’Reilly, 2005b).

The use of the Web Services technology in Web 2.0 provides the greatest benefit to the CBPE model. The interaction capabilities of the Web 2.0 create new collaborative opportunities on the Internet. Based on Murugesan (2007), Web 2.0 is an umbrella term encompassing several new Web technologies providing benefits for the proposed CBPE model, such as:

- **Blogs**: A Blog is a website on which people can enter their thoughts, ideas, suggestions and comments. The Blog technologies enable the users of the system to add their thoughts, in order to make the system provide them with better service. The use of the Blog technology enables any kind of customer to collaboratively publish his/her opinion in CBPE. The communication of the system and the user provides higher level of Customer Relationship Management (CRM).

- **Really Simple Syndication (RSS)**: RSS is an XML file that summarises information items and links to the information sources. RSS enables the CBPE model to identify the source of the specific product and services through checking the popular source for the desired request. RSS, through CBPE, can keep accessing various industries and organisations to satisfy a request.

- **Wikis**: A Wiki is a simple yet powerful Web-based collaborative-authoring system for creating and editing content. Wiki supports linkage of external documents, simple navigation, simple templating, access for multiple users, simple workflow and built-in search features. Wiki technology can assist the CBPE model to create a collaborative authored
discussion that encompasses collaborative channels across multiple organisations. Easy linkage of the application, easy conversion of the Wiki application to Hypertext Markup Language (HTML), easy linkages of the pages’ title, easy control of the privileged applications and search by the associated keys are the necessary components of the CBPE model provided by Wiki technology.

- **Mashups:** A Web Mashup is a website that combines information and services from multiple sources on the Web. Mashup can be grouped into seven categories of mapping, search, mobile, messaging, sports, shopping, and movies. The CBPE is a collaborative system searching the portals for various organisational services and products that are offered. The grouping-up of Mashup technology of Web 2.0 supports CBPE to have better access to the services required in the pointed-out seven Mashup categories.

The collected information is used by the proposed CBPE model to provide the right support to the users. The broad influence of Web 2.0 on CBPE is described in sections 4.5.1 and 4.5.2 of this chapter.

### 4.5 EVOLVING CBPE –BASED ARCHITECTURE

Section 2.7 in Chapter 2 (Literature Review) provided definitions of the Web 2.0 and SOA technologies. The previous section also discusses in detail some important information and communication technologies. In this section, the evolution of the CBPE-based architecture based on the technologies is discussed.
4.5.1 Influence of Web 2.0 and SOA in CBPE Model

SOA breaks down the software systems into sets and sub-sets of services. These services from building blocks can use new applications that have a very high level of integration and reuse. Web 2.0 is characterised by action-at-a-distance interactions and ad-hoc integration. Web 2.0 treats data as the most important component of the organisation, specifically while developing the new software systems. The SOA concept evolves from earlier component-based software frameworks, while Web 2.0 promotes Web experiences that encourage users to participate in sharing information and enriching services (Lin, 2006).

According to Hazra (2007), SOA governance provides transparency in the usage of services enabling consumers to search for, discover and locate desired services and obtain consistent services (response) from any specific service-provider.

The idea of writing the code once and then using it everywhere in SOA results in less code, lower cost and increased standardisation. SOA bonds independent services and resources, whilst Web 2.0 applications follow a platform that helps users create and share content with a broad audience, resulting in online collaborative platforms.

Web 2.0 and SOA enable creation of multiple applications that benefit many organisations. SOA and Web 2.0 define the network as a platform across all connected devices. Based on Philipson (2007), the SOA and Web 2.0 create ecosystems for communicating, connecting, collaborating and creatively expressing ideas and information in revolutionary new ways.

Web 2.0 technology is considered as a platform for building systems that are tied together by a set of protocols, open standards and agreements for cooperation. SOA is considered the philosophy of encapsulating application logic in services with
a uniformly defined interface and making these publicly available via a discovery mechanism. The SOA and Web 2.0 technologies are developed on the notion of reusing and composing existing resources supporting the collaboration and coupling of remote resources. Both Web 2.0 and SOA applications enable the loose coupling of distant resources and structural change (Schorth and Janner, 2007).

Web 2.0 and SOA also have divergent elements. First of all, many Web 2.0 applications incorporate a social aspect, such as facilitating human interaction. Web 2.0 applications deal with human-readable content (such as text and pictures). In contrast, conventional SOA merely aims at interconnecting dispersed business functionality and facilitating seamless machine–machine collaboration. Secondly, Web 2.0 is clearly about presentation and user interface integration, whereas SOA deployments are more abstract and less visible to its users (Schorth and Janner, 2007).

This research has identified that the SOA, as a software design principle, is able to streamline and harmonise the CBPE model and is able to set up a cross-organisational collaboration. Web 2.0 incorporates the technical concept of SOA to provide the techniques and design principles facilitating the CBPE to locate and consume the desired and available services and products online. Integration of the Web users into application design via all relevant channels (such as mobile channels) on the basis of various platforms (by the aid of Web Services) allows the discovering, mashing and tagging of diverse resources. Consider, for example Figure 4.9, which depicts the internal departments of an organisation before the application of SOA.
SOA enables organisations to restructure the applications to reuse their services. The organisations must change the organisational structure to be able to reuse their provided services. Figure 4.9 depicts how the individual internal departments of an organisation perform independently of each other while there is no SOA in place. Figure 4.10 demonstrates two possible options for the internal departments of the organisations to adapt SOA.
Figure 4.10: Two Possible Options for Adaptation of SOA

In option 1 (SOA-1) the interrelated cluster of individual departments communicate with each other while they are still independent of each other. Option 2 (SOA-2) proposes those interrelated clusters (that need constant communication) to partly integrate. There are numerous advantages and disadvantages. The advantages are sharing services, better quality, faster service and creating an opportunity for the CBPE model. The disadvantages are that the departments are not independent and their tasks are shared across the organisation, causing the complex issues of controlling the security, trust, management duties and control over the information and staff. Figure 4.11 provides a similar concept, presenting the impact of SOA when multiple organisations collaborate with each other in a B2B environment.
Figure 4.11 shows how multiple organisations are collaborating in a B2B environment. The research has identified that the same advantages and disadvantages (as presented in Figure 4.10) apply when these organisations are collaborating in B2B environment. Figure 4.11 demonstrates that internal departments of the organisations are also SOA-enabled. The full potential of the SOA is not extracted as far as the CBPE is concerned. The current SOA is not providing the full support for the expected model of collaboration, since the communications and the integration in the current organisations are limited and these organisations are not fully SOA-enabled. Figure 4.12 depicts how the SOA can support the proposed CBPE model by SOA-enabling the organisations.
Figure 4.12: The Final Impact of SOA in a CBPE

Figure 4.12 shows the application of SOA in CBPE environment while the clusters of multiple organisations communicate in different situations. Figure 4.12 demonstrates how, in CBPE, the impact of the collaborations affect the whole structure’s (internal as well as external) business processes when the internal as well as the external organisations are integrating in order to satisfy the requirements of the SOA.

The complexity evolves as individual departments are using numerous different applications on numerous different platforms. Figures 4.9, 4.10, 4.11 and 4.12 demonstrate the evolutionary influence of the SOA in the Collaborative Business Process Engineering (CBPE) model.

4.5.2. Influence of Mobile Technology and Web 2.0 in CBPE Model

The mobile devices have the capability to connect to the global network while they are connected to individual people, regardless of their location and time. Web 2.0 technology is capable of creating global connectivity using the experience of the prior technologies.
Web 2.0 energises IT-related entrepreneurs with a new approach. Web 2.0 serves different purposes based on the users’ request. Based on O’Reilly (2005), the differences between Web 2.0 and Mobile Web 2.0 are outlined in the following Table 4.2.

<table>
<thead>
<tr>
<th>Web 1.0 Features</th>
<th>Mobile Web 2.0 Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Google AdSense</td>
<td>Mobile Google</td>
</tr>
<tr>
<td>Flickr</td>
<td>Mobilised version</td>
</tr>
<tr>
<td>BitTorrent</td>
<td>Not yet</td>
</tr>
<tr>
<td>Napster</td>
<td>Not yet</td>
</tr>
<tr>
<td>Wikipedia</td>
<td>Mobile Wikis</td>
</tr>
<tr>
<td>Blogging</td>
<td>Mobile blogging</td>
</tr>
<tr>
<td>Upcoming.org, EVDB</td>
<td>Mobilised version</td>
</tr>
<tr>
<td>Search engine</td>
<td>Mobile search engine</td>
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<td>-optimisation</td>
<td>Speculation</td>
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<tr>
<td>Cost per click</td>
<td>Page per click</td>
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<tr>
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<td>Mobile Web Services</td>
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<tr>
<td>Participation</td>
<td>M-Participation</td>
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<td>Wikis</td>
<td>Mobile Wikis</td>
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<tr>
<td>Tag (“folksonomy”)</td>
<td>M.tag</td>
</tr>
<tr>
<td>syndication</td>
<td>M-syndication</td>
</tr>
</tbody>
</table>

Table 4.2: The Differences between Web 2.0 and Mobile Web 2.0

Source: O’Reilly (2005a)

According to Yamakami (2007), there are several critical issues for Mobile Web 2.0 in order to make it a new framework for the platform in the mobile Internet.

- Platform over multiple devices and execution environment
- Platform for any-time and any-place business.
- Context-aware platform
- Super distribution of knowledge
- Leverage social networks.

Web 2.0 gives a new perspective to the service engineering in the Internet. Mobile Web 2.0 provides the techniques and design principles facilitating the **CBPE**
to locate and consume the desired available services, regardless of the location and time boundaries. Table 4.2 demonstrate the additional features of the Mobile Web 2.0 technology. Integration of the mobile Web users into mobile applications allows the users to have access to the additional features offered in Mobile Web 2.0.

4.5.3 Impact of Emerging Technologies on CBPE

Web Services (WS) are based on the fact that applications from differing organisations and governmental bodies can communicate, and hence collaborate globally, provided they use the same core data types, message formats and communication protocols – regardless of the specific platform or vendor specifications. This collaboration can lead to potentially unlimited global growth for organisations – as collaborative entities through application service-providers. Furthermore, the technical platform of SOA provides a transparent way for systems to be accessed over networks or the Internet, thus opening entirely new revenue generation streams for global industries.

The offering and consuming of services is technically achieved through what is known as SOA. While SOA enables most software applications to easily offer and publish, as well as locate and consume services, this opportunity for businesses to collaborate has created challenges that are beyond the traditional ordinary challenges.

EAI comprises the computer applications enabling the computer applications of an enterprise to coordinate and consolidate each other. A successful CBPE model needs successful SOA when the internal applications of the organisations are capable of communicating. Figure 4.13 presents how the technologies support CBPE model and how the CBPE model enables them to have a successful SOA and EAI.
In summary, the mentioned technologies are the core tools that have made it possible for the research to proceed in order to propose the CBPE model.

Thus, EA provides the “organisational policy” in terms of how SOA (made up of WS) is to be used by the various information systems of the organisation. Thus, the implementation of EA leads to what is called Enterprise Architecture Integration (EAI).

An EAI sets the platform and plays an important role in enabling business processes to transcend various technological boundaries. The enhanced ability of information systems to connect and communicate with each other logically leads to the thinking “why restrict it to within an organisation?”

However, CBPE goes beyond the dedicated B2B interactions and, instead, aims to create a collaborative environment where “any number of businesses, known or unknown to each other” can come on and transact electronically.
In fact, CBPE facilitates businesses to first come and “search” for the kind of services they want to consume. Furthermore, CBPE also encompasses the ability of businesses to promote themselves by “publishing” their services. Eventually, when a cluster of businesses get together and “dynamically” start publishing and consuming, and in fact create a business process “on the fly”, based on what various types and sizes of businesses are offering, we have CBPE – as shown in Figure 4.7.

4.6 COLLABORATIVE WEB-BASED SYSTEM (CWBS)

This section of the thesis introduces the concept of the Collaborative Web-based System (CWBS). CWBS is the technical implementation of the proposed CBPE model. The Business Process Management Notation (BPMN) is used as a tool for modelling the technical implementation of the proposed CBPE model.

Business Process Management (BPM) is a study of the management responsibilities in the Information and Communication Technology (ICT) era. BPM encompasses methods, techniques and tools to design, enact, control, and analyse operational business processes involving humans, organisations, applications, documents and other sources of information (Aalst et al., 2003).

Business is a collection of processes that are increasingly complex, full of deeper interactions across systems and dependent on more collaborative activities. BPM conducts the appropriate process analysis by modelling new processes, demonstrates the operation of those engineered processes and provides facilities for reuse of those business processes.

From the technical point of view, the main objective of BPM is to provide a computer-based solution for management of processes that involve entities such as persons, activities and systems that all operate in tandem to fulfil particular business goals. (Yildiz et al. 2006).
According to the National Working Group Membership, (2001) Business Process Modelling Notation (BPMN) provides businesses with the capability of understanding their internal business procedures in a standardised graphical notation and gives organisations the ability to communicate these procedures in a standard manner. Furthermore, the graphical notation facilitates the understanding of the performance collaborations and business transactions between the organisations (http://www.bpmn.org).

BPMN is the new standard for modelling business processes and Web Service processes, as put forth by the Business Process Management Initiative (BPMI – bpmi.org). BPMN is a core enabler of BPM, a new initiative in enterprise architecture, which is concerned with managing change to improve business processes.

The BPMN demonstrates the interaction amongst all parties involved with a step-by-step process. These BPMN diagrams graphically present the chain of activities within a business process. According to White (2005), the characteristics of BPMN can be classified as follows:

- Be constrained to support only the concepts of modelling that are applicable to business processes.
- Be useful in illuminating a complex executable process.
- Be unambiguous. There should be a mapping from one or more BPMN notation instances to an execution-level instance (www.omg.org).

BPMN also offers technical business process diagrams, which represent the activities of the business process and the flow controls exactly the way they are performed. The advantages make the BPMN a tool for the test and validation of the proposed model.
A standard BPMN provides businesses with the capability of understanding their internal business procedures in a graphical notation and gives organisations the ability to communicate these procedures in a standard manner. Furthermore, the graphical notation facilitates the understanding of the performance collaborations and business transactions between the organisations. The study also presents the use case to demonstrate the involved interactions before showing the BPMN diagrams. Use cases were first described by Jacobson et al. (1992) in their objectory processes. According to Unhelkar (2005b), use case diagrams provide a visual overview of the requirements of the system. The use case diagram provides a comprehensive high-level view of the requirements modelling workshops as they are able to visualise where they fit the system. Figure 4.14 depicts the CBPE implementation of CWBS.

![Figure 4.14: The Creation of a CWBS](image)

The following section presents the proposed model of the CWBS as far as the business processes of those organisations (entering the expected collaborative environment) are concerned. Specific business processes considered are:

- Registration of the prospective member
- Registration in the directory
- Process product or service request.
Chapter 4 – The Collaborative Business Process Engineering (CBPE) Model

4.6.1 Registration of the Prospective Member

This section of the thesis presents the use case and BPMN diagram for the business process of a prospective member, ready to register in the system. The prospective members, such as user, person (for example, doctor or patient) and organisations could connect to the CWBS to register. The CWBS does not classify them as members until the registration is completed.

A prospective member connects to the CWBS and requests to register in the system. The CWBS prompts the appropriate member registration form to the prospective member to enter the relevant details. If the information is insufficient or incorrect, the prospective member is asked to input correct details.

Then, the CWBS prompts for the registration form to be submitted and the prospective member submits the registration form. At the end, the CWBS registers the prospective member by sending a unique registration number. The system recognises the prospective member as a member and allows the client to log out of the CWBS.

<table>
<thead>
<tr>
<th>Use Case:</th>
<th>Register prospective member</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actors:</td>
<td>Member, Collaborative Web Based System (CWBS), prospective member</td>
</tr>
</tbody>
</table>
| Description:         | Prospective member is registered in the CWBS  
                        | Please note that this is a generic use case. Different prospective members could come in to register. |
| Pre-condition:       | Prospective member is using Web Services.  
                        | Prospective member is willing to work through the CWBS. |
| Post-condition:      | Prospective member is upgraded to a member. |
| Type:                | Complex                                    |
| Normal Course of     | 1. Prospective member connects to the CWBS and |
Events:

1. Requests to register in the directory level 1.
2. CWBS prompts the appropriate member registration form to the member.
3. Prospective member enters his/her details in the registration form (A1)(A2).
4. CWBS prompts that the registration form is to be submitted.
5. Prospective member submits the registration form.
6. CWBS registers prospective member sending a unique registration number.
7. Member logs out of the CWBS.

Alternate Course of Events:

A1: Information entered is insufficient or incorrect. Prospective member is asked to input correct member ID.
A2: It is crucial for the prospective member to fill in all details specifically identifying the relevant industry.

References

- A prospective member could be any one of the following persons: doctor, patient, police, insurance company, pharmacist, hospital, health-care system who/that is not yet registered with CWBS.
- When any of the following categories of industry/person registers with CWBS, it/s/he is classified as a member.

Table 4.3: Use Case: Register Prospective Member

Table 4.3 present the detailed technical issues involved in the registration of the members. The system recognises them as prospective members until the last process, when they are officially registered in the system. The system might issue them with a Member Identification Number (MIN) and recognise them as a member.
The following BPMN depicts the pictorial illustration of the use case adopted from Unified Modelling Language (UML).

![BPMN Diagram](image)

**Figure 4.15: Business Process: Register Prospective Members**

As depicted in Figure 4.15, the developed system is ready to accept registration of all prospective members. A prospective member could be any one of the following persons: user of the system, doctor, patient; or an organisation such as police, insurance company, pharmacist, hospital, health-care system or any other organisations. Hence, this is the practical implementation of the CBPE model. The registration of the prospective members is not shown in Figure 4.7.
4.6.2 Placing the Registration in the Correct Directory

The following section demonstrates when the CWBS places the registration in the allocated directory in order to avoid the pollution of the directories. The CWBS identifies the relevant member industry from the registration form. The CWBS identifies the industry’s registration by informing the administrator for further direction if the industry does not exist. The directory level 1 receives an identification number from that specific member and the CWBS registers the member details of the member in directory level 2. Finally, the system stores the member details in the database. This is an automated process, and the only instance of human–actor involvement occurs when the specified industry is not available in CWBS.

<table>
<thead>
<tr>
<th>Use Case:</th>
<th>Registration in the directory.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actors:</td>
<td>Directory level 1, directory level 2, administrator.</td>
</tr>
<tr>
<td>Description:</td>
<td>When the CWBS place the registered members in the right place in order to locate and consume them.</td>
</tr>
<tr>
<td>Pre-condition:</td>
<td>Registration has taken place.</td>
</tr>
<tr>
<td>Post-condition:</td>
<td>Directories communicates with each other.</td>
</tr>
<tr>
<td>Type:</td>
<td>Very complex.</td>
</tr>
<tr>
<td>Normal Course of Events:</td>
<td></td>
</tr>
<tr>
<td>1. CWBS identifies the relevant member area from the registration form (A1).</td>
<td></td>
</tr>
<tr>
<td>2. Directory level 1 receives an identification number from that specific member.</td>
<td></td>
</tr>
<tr>
<td>3. CWBS registers the member details of the member in Directory level 2.</td>
<td></td>
</tr>
<tr>
<td>4. Member’s details are stored in the database.</td>
<td></td>
</tr>
<tr>
<td>Alternate Course of A1: If the industry does not exist in the directory level 2, the</td>
<td></td>
</tr>
</tbody>
</table>
Table 4.4: Use Case: Registration in the Directory

Table 4.4 presents the use case of the technical issues involved in placing the member registration in the right directory before the pictorial illustration of the BPMN in Figure 4.16.

Figure 4.16: Business Process: Place the Registration in the Directory
Figure 4.16 illustrates how an automated process places the member details in the right place for the uncomplicated publish/locate process. The difference between the process shown in Figure 4.16, and a non-collaborative business process would be that the non-collaborative business process would not have the directories.

4.6.3 Process Service or Product Request

This section is a further illustration of the nature of the CWBS. The channels of identifying a desired organisation are based on directories in which the products and services they offer are stored. The process is triggered when a client submits a request (an inquiry) to the CWBS. It is very important that the user is using the Web Services. The CWBS accepts the request and identifies the member’s relative industry/industries based on the submitted request.

The CWBS prompts an optional form requesting details of registration if the Client is not a member. The CWBS prompts a message denying the request when there is no prior registry of the organisation capable of handling the request. The CWBS finalises the appropriate checks and submits the application to the directory level 1. The directory level 1 identifies the industry and submits the application to suitable level 2 directory to identify the organisation capable of handling the requests. Then, the CWBS eliminates the organisations that do not meet the environmental boundaries (geographical, budget, member optional preferences). The CWBS follows eliminations of the capable parties that have received the most recent requests. In the next stage, the CWBS processes the client request and collaborates with selected members regarding the request.

Right at this stage, the system flags the members involved in the process who are not to receive the next query. The application returns back to level 1 and if other industries should be involved in the request, the CWBS goes through the process of
locating them in order to complete the request. Finally, the *CWBS* prompts a message to the client, informing him/her about the outcome of the requested application, and allows the user to log out.

<table>
<thead>
<tr>
<th>Use Case:</th>
<th>Process request.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actors:</td>
<td>Client, <em>CWBS</em>, directory level 1 and directory level 2.</td>
</tr>
<tr>
<td>Description:</td>
<td>Client requests a service or product (an inquiry) from the <em>CWBS</em>.</td>
</tr>
<tr>
<td>Pre-condition:</td>
<td>Client has to be using Web Services.</td>
</tr>
</tbody>
</table>
| Post-condition:    | 1. The system looks for Next Industry/Organisation if the request is uncompleted.  
                     2. Client receives a report on the request. |
| Type:              | Very complex.             |
| Normal Course of Events: | 1. *CWBS* accepts the request and identify the member area (A1)(A2)  
                                2. Directory level 1 checks directory level 2 to identify the party capable of handling the requests.  
                                3. *CWBS* eliminates the options that do not meet the environmental boundaries (geographical, budget, member optional preferences).  
                                4. *CWBS* follows eliminations of the capable parties that have received recent prior requests.  
                                5. *CWBS* processes the client request and collaborates with selected members regarding the request.  
                                6. *CWBS* flags the members involved in the process not to receive the next query.  
                                7. Processes request (A3).  
                                8. *CWBS* prompts a message to client informing him/her about the outcome of the requested application.  
                                9. Client logs out. |
### Alternate Course of Events:

| A1 | If the client is not a member, the CWBS prompts an optional form requesting details for registration. |
| A2 | If the industry is not available, the CWBS prompts a message denying the request. |
| A3 | If other industries should be involved in the request, the CWBS goes through the process of locating them. |

### References

**Table 4.5: Use Case: Process Request**

Table 4.5 presents the use case of the technical issues involved in processing an application submitted by a member (or non-member using the required technologies) before the pictorial illustration of the BPMN in Figure 4.17.

![Diagram of Business Process: Process Service or Product Request](image)

**Figure 4.17: Business Process: Process Service or Product Request**
Figure 4.17 above illustrates the finalisation of the processing of a request that could be a classified as a very complex type. Figure 4.17 presents the engineering of the business process enabling the collaboration across multiple organisations. Figure 4.17 also clearly demonstrates how they collaborate without even knowing each other. The Web Services technology creates an opportunity for their application to process and progress, regardless of the original platform used for their ordinary process.

In summary, this section of the chapter has explained how the proposed collaborative environment could be implemented on the Internet. The proposed system is called the Collaborative Web Based System (CWBS).

4.7 CONCLUSION

This chapter has introduced the CBPE model. The discussion commenced with an exploratory explanation of the Web Services, EAI, SOA and ESB, mobile and Web 2.0 technologies. The use of the aforementioned technologies has also been defined. Subsequent to the justification, the evolution of the model was discussed, followed by the introduction of the refined CBPE model. This discussion concluded with the presentation of the CBPE model in the Collaborative Web-based System (CWBS), using use cases and BPMNs. The ensuing chapter, Chapter 5, will describe three different action research projects, wherein the specific business processes of the organisations in line with the collaboration have gone through an evaluation to understand how the CBPE model can engineer new collaborative business processes in order to validate the proposed model.
4.8 REFERENCES


Dev2Dev. By Developers for Developers
CHAPTER 5 – VALIDATION OF THE CBPE MODEL THROUGH ACTION RESEARCH

5.1 INTRODUCTION
This chapter describes the three action research studies carried out in three separate organisations within Australia. These organisations have been selected for this action research study because of their different sizes, industries and technical sophistication. Their availability and readiness to participate in this research are also supporting factors in selecting them. The action research study has been carried out in these organisations with the aim to validate the CBPE model described in Chapter 4. Therefore, this chapter forms a significant part of the research. This action research studies described here are quite different from the discussion on the implementation of CBPE discussed in the previous chapter. However, the validation of the model can be seen through the way it can be implemented in Collaborative Web-based Systems (CWBS). The details of these organisations, in which the action research study is carried out, including their business sector, business processes, and related details, are discussed under the individual action research sections later in this chapter.

The empirical research was carried out as action research studies, including a study of the existing collaborative business processes of the organisations to understand the impact of a CBPE model on their collaborative environment. The subsequent observation of the impact of CBPE has led to the validation of the proposed model of the research.
5.1.1 Revising Action Research for CBPE

The term “action” implies a focus beyond mere data collection. The term “research” denotes a systematic effort identifying opportunities for improvement, constructing knowledge about the enfolding solutions and constantly generating new ideas. Figure 3.8 (Ryder and Wilson, 1997), in Chapter 3 described action research as an iterative process involving four phases. The four phases introduced therein are plan, action, observe, and reflect. Evaluation and specific learning, which are described in detail below, are used to map the actual research carried out in the organisations to validate the CBPE model as the new collaborative way for the organisations to offer their services and products. This chapter focuses on the empirical work which is carried out in these organisations that has led to the validation of the CBPE model. The four phases of the action research studies are described in detail with the mapping to the CBPE model, in order to understand the integration of these phases.

5.1.2 The Organisations in Action Research Studies

The first action research study has been carried out in a services company providing venue and security services, employing more than 230 people. The organisation is called MAS Venue Services. This organisation has been selected because MAS Venue Services is a medium-sized organisation. It participated in order to evaluate their collaborative business processes and understand how they could improve those business processes.

The second action research study has been carried out in an organisation providing technological services to other organisations in order to increase their performance and quality. This organisation was selected because it is a large-sized
organisation. The organisation participated in order to see how it can introduce its products and services to the international market.

The third action research study has been carried out in an energy-provider organisation in Australia. This organisation was selected because it is a large-sized organisation. It participated in order to see how it can change its collaborative business processes with numerous organisations (different sizes) in order to save time and money.

This research respects the privacy of the organisations in action research studies 2 and 3 by calling them Protect A and Protect B. The organisations are classified as medium to large organisations since they employ more than 200 people. Table 5.1 shows the organisations’ details.

![Table 5.1: Details of the Studied Organisations](image)

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Size</th>
<th>Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAS Venue Services</td>
<td>Medium</td>
<td>Security</td>
</tr>
<tr>
<td>Protect A</td>
<td>Large</td>
<td>Technology Provider</td>
</tr>
<tr>
<td>Protect B</td>
<td>Large</td>
<td>Energy Provider</td>
</tr>
</tbody>
</table>

The next section of the chapter provides details of the three action research studies.

### 5.2 ACTION RESEARCH STUDY 1 – MAS VENUE SERVICES

#### 5.2.1 MAS Venue Services – Introduction

MAS Venue Services specialises in the provision of fully licensed and professional security operatives to the hospitality industry. MAS focuses its business on hospitality, event, site, and asset protection. According to the organisation’s website
MAS Venue Services is an organisation that has been trading since 1989 in Sydney, New South Wales, Australia. MAS believes that its ability to adapt to the changing needs of the industry is its main reason for success. MAS holds a regular client base in the Sydney metropolitan area, with a number of licensed venues. Apart from being a service-provider for the industry, MAS is also a Registered Training Organisation (RTO) for the Vocational Education and Training Accreditation Board (VETAB) in New South Wales. MAS Venue Services is also fully licensed to carry out training activities in Victoria and Queensland.

New licensing requirements came into effect in February 2005, requiring a Certificate 1 in Security Operations (Pre-Licence) to be the entry point of work in the security industry. The current licensing arrangements create a more hands-on approach to the training and assessing of candidates. The training arm of MAS provides training to new and existing security personnel. MAS offers training in various levels of Security Operations.

MAS Venue Services has over 230 regular employees in its security and training operations. The security operation of MAS is two-fold:

1. Operations with regular on-going services.
2. Ad-hoc operations with sports/entertainment venues.

Operations with regular on-going services provide security services to organisations in various industries. The MAS Venue Service’s regular customers are in the hospitality, business and education industries. MAS provides security personnel to cover regular shifts in these locations. Ad-hoc operations are services provided to events such as sports events and concerts. These ad-hoc services differ
from one another and always have to be organised in the last few days, since the actual requirements are received only in that period.

MAS uses a workforce management tool named “Powerforce”, which provides functionality such as storing and billing clients, logging employee details, scheduling employees, paying employees, and interfacing with the accounting system. Powerforce also records employees’ biographical details, including their certifications with the expiry dates and on-the-job incidents. Subsequent to the requirements of the client being keyed in, Powerforce can choose a suitable list of people for a given job. Powerforce uses a modular approach and has the ability to analyse schedules using an award interpreter. The Operations Manager at MAS Venue Services sought the research to concentrate on the futuristic collaborative environment of their business processes.

5.2.2 MAS Venue Services – Plan Phase

The research problem has been formulated on the basis of how the business processes of MAS Venue Services could collaborate with the business processes of other organisations. The first task is to identify the business processes that could be classified as having potential for collaboration. Once the existing business processes are studied, the researcher is able to engineer business processes added into the main streamline of existing business processes. The functionality of the engineered processes has to be further observed in order to achieve a smooth flow of business. The action research was initiated by performing the following tasks:

- Meetings with the Operations Manager and Managing Director.
- Site visits to regular sites serviced by the organisation, and getting first-hand information from on-site supervisors.
• Reading the organisations manuals for their daily performances as well as their software system.

The specific research area was classified in three categories, as demonstrated in Table 5.2.

<table>
<thead>
<tr>
<th>Technical</th>
<th>Methodological</th>
<th>Social</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collaboration of MAS Venue Service’s system with other parties (incompatible technology).</td>
<td>How the existing business processes will change after placing the engineered process into the streamline.</td>
<td>Organisational structure.</td>
</tr>
<tr>
<td>The channels of collaboration</td>
<td></td>
<td>MAS’s and business partners’ attitudes toward the change.</td>
</tr>
<tr>
<td>Enterprise Application (EA) and Service-oriented Architecture (SOA) use in the existing system.</td>
<td></td>
<td>Legal.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trust.</td>
</tr>
</tbody>
</table>

**Table 5.2: The Area of Study at MAS Venue Services**

Three processes are identified as having the potential for validating the CBPE model through action research. This identification of the processes takes place in conjunction with the information gathered from the Operation Manager (OM). The three processes are carefully studied and modelled in order to analyse the potential for incorporation of CBPE in them. This study is ably assisted by inputs from the OM of the MAS Venue Services, who is able to assist in verification of the existing processes and work flows, as well as commenting on the strategic value of collaborative environment in the engineered processes. This results in a correct picture of the entire modelling exercises.
5.2.3 MAS Venue Services – Action Phase

Requesting Staff (From other venues)

MAS Venue Services needed to improve the staff list on a regular basis since these people are employed on a casual basis; therefore they only work at desired events.

The majority of the staff (70%) on the active list and 10% of the staff on the inactive list accepts their allocated roster on a busy day. The remaining 20% are currently being filled by two other selected venues as sub-contractor. The most important concern for the organisation is how to fill the staff shortage on busy occasions, especially if the other venue requires more staff.

The investigation is initiated to identify how the technology could aid and rectify the mentioned problem. Figure 5.2 presents the recommended solution in a BPMN diagram.

![BPMN Diagram](image-url)

Figure 5.1: Borrowing Staff for Specific Roster
Figure 5.1 demonstrates that MAS submits a request on the proposed *Collaborative Web Based System (CWBS)*. The request will go the UDDI directory level 1 to identify the desired industry. The level 1 directory submits the request to the relevant level 2 directory. The system will search all the venues registered in the level 2 directory to detect which of them has additional staff to offer. The benefit remains for both parties, as the organisations will fill the staff shortage and the other part gains a sub-contract, which generates profit.

The *CBPE* model enables MAS Venue Services to hire staff from the other security-guard provider to finalise the required number of the staff for the specific venue when MAS is unable to supply staff. Currently, MAS has to prioritise the venues and provide a limited number of staff to the less important job. The reduction of the staff is due to causing them to generate less profit, while increasing the risk.

**Advertising the Performed Services**

Currently the organisation advertises in the Yellow Pages directory, on the organisation’s website and by word of mouth. The proposed *CWBS* would help the organisation to register its offered service on the system for people who need its services. The proposed system is an electronic Yellow Pages directory that directs the request to a relevant industry and party for further processing. In this action research study, the organisation under study already has its own website and the system could submit the request directly to its website. Figure 5.2 presents the process of registering the organisation’s services on the proposed system of *CWBS*.
Figure 5.2: Registering the MAS Performed Services on CWBS
Figure 5.3 illustrates that the organisation can submit a request by offering its services on the proposed system. When the request is submitted by parties in need of the services that are offered by the organisation, the request would go to it. Alternatively, if other venues need staff and the organisation has additional staff on the mentioned date, it could sub-contract its staff to the other venues if desired.

**Recruiting Staff**

The organisation has to advertise for recruitment on a monthly basis. The security guards are employed on a casual basis. The security guards have to work in a full financial year, otherwise the Operations Manager of the organisation will place the guards with fewer worked rosters on the inactive list at the end of the financial year, based on the operational work, such as disciplinary action, work availability and the guards’ general performance. The information on these people is registered in the Powerforce system; however the system will never allocate them for roster work.

The existing system requires the Operations Manager to place advertisements in newspapers and on the organisation’s website. Interested people must contact the organisation to submit their résumé by fax and post. The Operations Manager reads the resume and after approval will call them for an interview time for the final phase of recruitment. The Operations Manager needs to advertise on a monthly basis, however, due to the busy schedule, the Operation Managers fail to do so.

During this action research study, it has also been identified that the organisation could place its recruitment advertisement on the CWBS. Figure 5.3 shows how the recruitment advertisement could be posted on the proposed collaborative system.
In the proposed model, after submitting the request, people submit their résumés online and, based on the approval of the Operations Manager, the system would allocate an interview time to them. The busy schedule of the organisation will have no impact on recruitment, since by clicking on a button it can advertise for the recruitment.
5.2.4 MAS Venue Services – Observe Phase

MAS Venue Services only collaborates with two other selected security venues to roster their staff for the venues that require large numbers of staff. The organisation loses money and eventually the contracts if it cannot fill the positions due to the staff shortage.

The **Collaborative Business Process Engineering (CBPE)** is applied in order to engineer three additional processes for MAS to improve the outcome of its daily activities, generating more revenue and reducing the risk, hence there would be no limitation for the number of staff, purchase of cheaper operation supplies and advertisement of its products and services. Table 5.3 presents the proposed engineered collaborative processes and demonstrates how these activities occur in the existing daily activities to increase the organisation’s performance and compatibility in the new and modern market.

<table>
<thead>
<tr>
<th>Proposed CBPE-based Processes</th>
<th>Existing Processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requesting Staff (from other venues)</td>
<td>• Collaborating with two selected venues (not online)</td>
</tr>
<tr>
<td>Offering performed services</td>
<td>• Yellow Pages directory</td>
</tr>
<tr>
<td></td>
<td>• Advertised on MAS website</td>
</tr>
<tr>
<td></td>
<td>• Word of mouth</td>
</tr>
<tr>
<td>Job Advertising and Recruiting</td>
<td>• Newspapers</td>
</tr>
<tr>
<td></td>
<td>• Advertised on MAS webpage</td>
</tr>
<tr>
<td></td>
<td>• Word of mouth</td>
</tr>
<tr>
<td></td>
<td>• Send résumé (fax or post)</td>
</tr>
<tr>
<td></td>
<td>• Calling them back for appointment</td>
</tr>
</tbody>
</table>

Table 5.3: The Proposed and Existing Electronic Collaborative Processes at MAS Venue Services
The proposed engineered processes enable MAS Venue Services to provide faster and more accurate operations that provide more satisfied customer and staff. The research received excellent feedback from the management of the organisation.

5.2.5 MAS Venue Services – Reflect Phase
The discussion with the Chief Executive Officer (CEO) and also the Operations Manager revealed that the CBPE-based engineered processes improve the existing processes of the MAS Venue Services. The following improvements are required.

- **Incompatible technology**: When different organisations are using very old technology or no IT technology at all.

- **Competition**: When different organisations prefer not to share, in order to drive the competition out of the market. As an example, why would an organisation allow its competitor to use its staff when it prefers the competitor to lose the contract? This will provide an opportunity to submit a new tender.

- **Legal issues**: How to collaborate when legal issues are involved, such as licensing agreements? The roles and regulations imposed by the government.

- **Mistrust**: How can an organisation trust its competitor? Or its employee to provide the correct times?

Performing services and recruiting staff engineered processes are considered important for the future of the business. MAS Venue Services, being an established company, realises the importance of retaining existing customers as well as recruiting on a regular basis. The proposed engineered processes would be much more cost-effective than advertising in the Yellow Pages and in newspapers. Therefore the engineered processes are believed to be a very important area for marketing.
The following section concludes the MAS action research study and outlines some future directions where technology could be further used to enhance the organisational engineered processes.

5.2.6 Validation of the CBPE Model through MAS Venue Services

Figures 5.1, 5.2 and 5.3 map the CBPE model to the processes in MAS through the action research study performed in MAS Venue Services. The mapping of the CBPE model with the activities of MAS Venue Services resulted in improvement of the performance of the organisation. This was confirmed by interview with the CEO and OM of the organisation.

Research at MAS Venue Services investigated the collaboration of business processes of a company in the venue services industry. The collaboration occurs for employing staff, advertising the performed services and recruiting staff online. MAS Venue Services is interested in implementing the research outcomes.

However, MAS has become an early adopter in using the existing technologies in the venue services industry. The full implementation of the system is not yet complete at the time of writing this thesis; however, positive feedback has been gathered from the management of the MAS Venue Services.

The action research study at the MAS Venue Services identified that the CBPE is functional. This is so because the model enables the organisation to access other organisations that were not easily accessible prior to the introduction of the new collaborative environment.
5.3 ACTION RESEARCH STUDY 2 – PROTECT A

5.3.1 Protect A – Introduction
Protect A as a company provides professional expertise, world-class methodologies, consulting, and application services with adaptive platforms, intelligent solutions and advanced products to deliver the business results expected by its clients.

Protect A has over 10 million customers and 160,000 professional staff in 60 countries around the world. There are 3,000 employees in Australia and New Zealand. Protect A’s clients can be categorised in the following sectors of finance, government, health care, justice, manufacturing, retail, telecommunications, transport, distribution and utilities.

Protect A has an annual investment of more than US$2 billion researching and developing cutting-edge business technologies, resulting in over 32,000 patents with more regularly being added. Major initiatives include the Protect A Australia and New Zealand Software Technology Group, the System Engineering Research Centre, World Class Data centres and Protect A Microsoft Solution Centre.

Protect A’s consulting services provide the best practice, proven methodologies that deliver real results. Protect A’s highly qualified and skilled professional team draws on a rich pool of in-depth experience and intellectual property. By linking the organisation’s business strategies and change agendas to enabling technologies, it is already delivering value for a prestigious portfolio of clients spanning government departments, manufacturing, banking and finance, retail and service industries. Protect A’s capabilities encompass strategy, yield improvement, enterprise architecture, enterprise value management, change and business transformation, IT effectiveness, enterprise security and business intelligence.
Protect A also assists with the deployment of enterprise-wide applications that provide companies with the business agility they need to compete more effectively. It consults, designs, builds and manages enterprise solutions spanning all core businesses and IT management processes.

Protect A transforms business by delivering more than an extensive portfolio of IT services. Protect A ensures successful outcomes through a combination of professional expertise, successful track records and global capabilities, which lower risk and ensure a return on investment. In general, Protect A’s innovative products can be classified as servers, storage, notebooks, tablet PCs, mobility solutions, voice and data, retail and peripherals.

5.3.2 Protect A – Plan Phase

Protect A can benefit from the design and implementation of the CBPE model across various sectors, including: application-specific business solutions that offer measurable improvements for companies – streamlining the operations, integrating the existing technologies, improving customer service and providing business intelligence. Areas of investigation would include:

- Design
- Application development
- Packaged solutions
- Systems integration
- Deployment.

Protect A can also assist with the maintenance of the enterprise applications that are critical to its competitiveness. This expertise is complemented by proven
capabilities in strategic consulting, systems integration and infrastructure management, for:

- Business transformation
- Application portfolio management and support
- Optimisation.

5.3.3 Protect A – Action Phase

This action research study has identified that in the existing Non-Web-Service-enabled existing process, the external parties can find the products/services offered on Protect A’s Australian website. They have to submit a request for a product/service by e-mail or phone. The ticket will be logged, evaluated, allocated and the consultants will find the suitable package. After delivery of the package and testing, the task is completed.

Publishing the Consumable Products/Services Offered by Protect A

Publishing the consumable product/services on the proposed Collaborative Web-based System (CWBS) directory makes them available to the people who need this application, but do not necessarily know Protect A. Submitting a request to the directory enables them to consume the product/services already published by Protect A in the directory. This is a very important activity, since this process leads to the generation of more funds for Protect A.

The following figures, 5.5, 5.6, 5.7 and 5.8, present how Protect A could become part of the proposed collaborative environment by registering the offered services and products in the CWBS. Placing the services and products in the CWBS enables the unknown parties to reach Protect A in order to receive those services or purchase Protect A’s products.
Figure 5.4 demonstrates how the **CWBS** registers Protect A in the portal and provides the registration number for the organisation. The next Figure, 5.6, depicts how the system places the organisation in the correct directory, based on the industry’s classification.
In Figure 5.5, the system accepts the registration details of Protect A and checks for the availability of the industry in the system. The system will add the industry if the industry is not available in the proposed level 2 directory. The system performs the industry check and places Protect A’s details and name in the correct directory.
Figure 5.6: Protect A – Proposed BPMN for Publishing Product/Services
Figure 5.6 presents how the system would publish the product/services offered by Protect A.

![Diagram]

Figure 5.7: Consumption of the Published Product or Services
Figure 5.7 demonstrates how a party unknown to Protect A could access the product/services offered by Protect A on CWBS. The client/customer only submits an application stating the required service/product and the system provides Protect A’s details based on product, service and the other boundaries such as location and time. In summary, the plan phase of the action research identified the need for the new engineered collaborative process that improves Protect A’s work quality.

5.3.4 Protect A – Observe Phase

The investigation has been mainly conducted through interviews with Protect A’s staff in Australia and by studying some of their documents. Protect A’s sales and support offices in Australia are located in the capital cities of all states. Protect A’s clients come from almost all sectors. A study could be classified as the provision of Protect A’s expertise to a client organisation in terms of technical expertise, study management and other related services.

In the observe phase, this research has identified that currently Protect A is not collaborating with other organisations. The activities are concentrated on improving the internal processes of the organisation and aiding the other organisations to advance their internal business processes. In Chapter 2 (Literature Review) of this thesis, it was stated that most research until now has only concentrated on the internal business process. Protect A is an example of those concentrating on the internal processes. In the observe phase, this research has pointed out to the management of Protect A how collaboration could benefit the organisation.
5.3.5 Protect A – Reflect Phase

This action research has aimed at improving the existing business processes of Protect A in Australia and New Zealand, and is only a preliminary one. There could be other processes and other technological advances which could demand a change in the future.

The investigation has benefited the overall research findings in understanding how the organisational processes would change in order to accommodate organisations. Protect A would have a specific benefit in terms of implementing some outcomes from this research. Moreover, Protect A has the proposed engineered of the business process graphically modelled so that it could have a critical evaluation of that process in order to make any necessary changes further.

Currently, there is an ambiguity involved in the collaboration, since there are so many methodological and social drawbacks. However, by the aid of this research, when the true collaboration occurs, Protect A will be ready for the collaborative environment.

5.3.6 Validation of the CBPE Model through Protect A

Figures 5.4, 5.5, 5.6 and 5.7 map the CBPE model with the action research study performed in Protect A. The mapping of the CBPE model with the activities of Protect A confirms that the performance of the organisation has improved.

Since the empirical research is in the form of an action research study which follows the CBPE model, the action research study carried out in Protect A has identified the need for the CBPE model in the industry, specifically in an organisation as large as Protect A. The action research study has demonstrated how the CBPE model would benefit Protect A. The report submitted to the management
brought out the lack of the collaboration and improvement on the external business processes in Protect A, especially collaboration amongst multiple parties when these parties are not aware of the product and services offered by Protect A.

However, since the actual implementation of the new processes did not take place due to shortage of funds and time, the changes cannot be viewed in a practical sense. However, it can be predicted that the collaborative environment would create benefits, such as introduction of the services performed by Protect A to organisations that do not necessarily know that such a service or organisation exists. This should also lead to gaining more customers.

The customers would be more involved with the activities of Protect A, since they can access them, whereby they could interact with the Protect A through the services offered. The potential collaborative process is currently under investigation with a view to using the CBPE model.

5.4 ACTION RESEARCH STUDY 3 – PROTECT B

5.4.1 Protect B – Introduction
Based on the confidential documentation of the organisation, Protect B is a leading Australian energy-provider. Protect B provides gas and electricity to over two million Australian homes and businesses. Currently, the service design supports developing the requirements of the Fieldwork Service contract. The study of the Protect B proposes to either create a new service or cancel an existing service contract.

Providing a service to a new customer requires Protect B to identify the model of the counter that it uses in individual households. The identification of the counters enables Protect B to manage and provide the required service. Protect B needs to collaborate with other organisations such as gas, electricity, meter readers,
electricians, plumbers and the people who will check the meter to identify what kind of services could be delivered to specific customers. The common Government body already exists for the communications across Protect B and gas and electricity companies. Vancorp (for gas) and Nemco (for electricity) are the Government bodies that unite the energy-provider companies.

Protect B’s deployment of a re-engineering process for the Fieldwork Service provides an opportunity for the business agility it needs to compete more effectively to consult, design, build and manage enterprise solutions spanning all core businesses and IT management processes with regard to providing a better service to its customers.

Improving the process by delivering an extensive portfolio ensures successful outcomes through a combination of professional expertise, successful track records and capabilities, which lowers risk and ensures a return on investment.

5.4.2 Protect B – Plan Phase

The research problem addressed by this thesis has been formulated on the basis of how the business processes, Arrange Fieldwork and Establish Billing Account, of Protect B collaborate with the business processes of other organisations. The first effort is to investigate the processes under development to identify the potential of the applications of CBPE. Thereafter the processes have to be evaluated to assess their interfaces. The existing business processes are studied and the research is able to propose that an engineered section be added into the main stream line of existing business processes under development. The functionality of the engineered processes has to be further observed in order to achieve a smooth flow of business. The re-engineered process “Arrange Fieldwork” will support the following:
1: Single point of entry for information rather than re-keying
2: Support for handling multiple fuels and properties faster
3: New product model and tools to select the appropriate product
4: More information at sales point about the customer and its interactions with Protect B.

The re-engineered process Establish Billing Account will support the following:
1: Establish Billing Account
2: Terminate Billing Account
3: Reinstate Billing Account

The internal collaboration between the mentioned processes take place when setting up a billable account in the billing system for the purpose of recording financials such as billing charges and receipts as payments for the customer are required.

In order to provide better customer relationship management (CRM) the recent updated details are required for the specific period when any specific objective Billing Account is taking place. The Establish Billing Account process inter-collaborates with the Arrange Fieldwork process in order to locate a suitable external party to achieve the latest update to issue the bill.

5.4.3 Protect B – Action Phase

The investigation has been conducted through interviews with Protect B’s staff and also studying some of their current confidential documents. Protect B’s clients come from almost all sectors. A study could be classified as the provision of Protect B’s expertise to a client, organisation and other related mentioned entities.
Publishing the Service Required by Protect B

Publishing the consumable product/services on the proposed CWBS directory makes them available to the people who are capable of performing the requirement of the application (electricians, plumbers or meter readers and checkers) but do not necessarily know Protect B. Submitting a request to the directory allows the tradespeople to consume the request already published by Protect B in the directory. Hence, these people are not necessarily in their office; the mobile applications could be included to the portal to deliver the request to the nearest tradesperson to the location by the aid of a Global Positioning System (GPS). The application of mobile technologies is very important, since this technology leads to the generation of more funds for Protect B.

Protect B requires the services of tradespeople such as electricians, plumbers and meter readers. These are mobile people and they are only accessible via their mobile devices.

Various technologies must be combined in order to provide collaboration amongst these multiple parties. Mobile technology, Web Services (combined Mobile Web Services) and GPSs are part of the technologies required to engineer the required external business process for the Protect B. Understanding all these technologies and evaluating the application and limitation of them were classified as part of this research to distinguish how they can aid the proposed CBPE model specifically when these engineered processes are forming in the CWBS.
Figure 5.8: Registration of Protect B in CWBS

Figure 5.8 depicts how Protect B could register in the CWBS in order to be part of the proposed collaborative environment of the CBPE model.
Figure 5.9: Placing the Registration in the Directory

Figure 5.9 demonstrates how the CWBS would place Protect B in the correct directory. Placing the organisation’s details in the correct directory would avoid pollution in the directory by providing enhanced future access.
Figure 5.10 shows the publishing of Protect B’s application when a tradesperson is required. At this point the application would forward the information to the tradesperson closest to the premises location that is in need of the service. The system checks the tradesperson’s location on the GPS system and submit the application to that person. If the tradesperson does not accept the work, the system checks for the closest person.
Figure 5.11: Consumption of the Published Request

Figure 5.11 shows how the party that is unaware of Protect B’s services/products could access the services just by submitting an application.
5.4.4 Protect B – Observe Phase

Figure 5.12 presents the integration of Protect B’s internal and external business processes. In the previous section the services that are offered by Protect B were clearly identified. Figure 5.12 depicts those services that are available to internal as well as external parties. The core offering is also responsible for marketing, usability and the maintenance of the offered products and services.

![Diagram of Protect B's internal and external business processes]

Figure 5.12: The Integration of Internal and External Business Processes

The action research study demonstrates that by re-engineering existing processes and additional engineered section, the other external parties such as electrician, plumbers, meter checkers and readers can also find the required services offered by Protect B. Protect B submits a request for a specific service and the
proposed CWBS will use any technology such as the Internet or any mobile Internet devices to deliver the published application to the interested parties. The ticket will be logged, evaluated, allocated and the consultants will find the suitable package.

5.4.5 Protect B – Reflect Phase
The action research study aims at improving the business process called Arrange Fieldwork of Protect B, and is only a preliminary one. There could be other processes and other technological advances, such as the m-transformation and Mobile Web Services which could demand a change in the future.

In the reflect phase, the action research study has identified the need for the mobility in the proposed collaborative environment. In this phase, the research identified that more knowledge about the concepts of the mobile technology is required to propose the CBPE model for Protect B’s external business processes.

The research requires an understanding of the concepts of the mobile technology to propose new engineered processes for Protect B’s future collaborative environment. Chapter 2 of this thesis has already addressed the applications and limitations of the mobile technology.

5.4.6 Validation of the CBPE model through Protect B
Figures 5.8, 5.9, 5.10, 5.11 and Figure 5.12 have initially mapped the CBPE model depicting the actual action research study activities. The research has investigated the current systems in order to look at possible solutions to enhance the business processes of the company under study.

Selected business processes were studied in order to introduce the new collaborative environment to the organisations under investigation. The action research studies carried out resulted in introducing the engineered process to be added to those already under re-engineering. Currently, the organisation is
implementing this proposal systematically and carefully under the guidelines of the \textit{CBPE} model. There have been many presentations, meetings and publications on this action research study. Eventually, when all the proposed business processes are fully operational, the actual impact of the \textit{CBPE} model in \textit{CWBS} can be recognised.

\section*{5.5 DISCUSSION ON VALIDATION OF THE \textit{CBPE} MODEL}

The mapping of the discussed action research studies to the proposed \textit{CBPE} model has demonstrated how the model can be used as a generic model to connect the organisations together in new collaborative environment. Furthermore, this is also a demonstration of the dynamic nature of the collaboration. The research validated the introduced \textit{CBPE} model in three organisations by engineering new processes to increase their performance in the market. There are, of course, numerous other business processes in the organisations that can be engineered and subjected to the \textit{CBPE} model. The engineered processes are able to restructure the operation of the entire organisation. Additional issues such as socio-cultural issues also need to be addressed in order to successfully transform an entire organisation to a collaborative environment. This could be a base on the operation of the model in an area of future research.

Figure 1.3 illustrates that most research until now has been concentrated on business processes internal to an organisation. However, this research has been focused on the cross-organisational business processes. The action research studies involved in internal business processes can take place within one specific organisation. Conversely, this research has been concentrated on the cross-organisational business processes while investigating the internal business processes.
The validation of the CBPE model can only take place when the business process of the organisation (studied in action research studies) needs to collaborate with other entities. The introduced engineered process and the concept of the CBPE are very new, of course, and can be confusing to the organisations. The organisations have never operated and are not familiar with the proposed environment that enables them to collaborate with other entities.

The action research studies (using the CBPE model) enable the organisations to identify those other organisations through their product/services offered. The discussion of the above action research studies has shown how the CBPE Model is applicable separately to each organisation. Therefore, the researcher is able to assume that the proposed CBPE model provides a systematic methodology to enable organisations to collaborate with multiple unknown organisations. The CBPE model provides the necessary methodological consideration to mobile, WS, EAI, SOA and EBS technologies, enabling the collaboration amongst the multiple organisations. Therefore, the CBPE model aids the business processes of multiple organisations to collaborate in an entirely new collaborative environment. Tables 5.4, 5.5 and 5.6 provide a summary of the action research studies in the context of the four phases of plan, action, observe and reflect.

<table>
<thead>
<tr>
<th>ORGANISATION</th>
<th>PHASES</th>
<th>OUTCOME</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAS Venue Services</td>
<td>Plan</td>
<td>Identification of the business processes which could be classified as potential for collaboration.</td>
</tr>
<tr>
<td></td>
<td>Action</td>
<td>Recruiting staff from other venues</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Advertising the performed services</td>
</tr>
</tbody>
</table>
Chapter 5 – Validation of the CBPE Model Through Action Research

### Recruiting staff

<table>
<thead>
<tr>
<th>Observe</th>
<th>Collaborating with two selected venues (not online)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yellow Pages directory</td>
</tr>
<tr>
<td></td>
<td>Advertised on MAS website</td>
</tr>
<tr>
<td></td>
<td>Word of mouth</td>
</tr>
<tr>
<td></td>
<td>Newspapers</td>
</tr>
<tr>
<td></td>
<td>Advertised on MAS web page</td>
</tr>
<tr>
<td></td>
<td>Word of mouth</td>
</tr>
<tr>
<td></td>
<td>Send résumé (fax or post)</td>
</tr>
<tr>
<td></td>
<td>Calling back applicants for appointment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reflect</th>
<th>Incompatible technology</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Competition</td>
</tr>
<tr>
<td></td>
<td>Legal issues</td>
</tr>
<tr>
<td></td>
<td>Mistrust</td>
</tr>
</tbody>
</table>

Table 5.4: The Summary of the Action Research Study (MAS Venue Services)

The evaluation of MAS Venue Services’ collaborative business processes demonstrated that it has the capability of going beyond the ordinary B2B collaborative environment, validating the need for the proposed CBPE model.

Table 5.5 depicts the action research phases in the action research study in Protect A.
<table>
<thead>
<tr>
<th>ORGANISATION</th>
<th>PHASES</th>
<th>OUTCOME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protect A</td>
<td>Plan</td>
<td>Offering application-specific business solution that offers measurable improvements for companies</td>
</tr>
<tr>
<td></td>
<td>Action</td>
<td>Publishing the Consumable Products/Services Offered by Protect A</td>
</tr>
<tr>
<td></td>
<td>Observe</td>
<td>Protect A is not currently collaborating with other organisations</td>
</tr>
<tr>
<td></td>
<td>Reflect</td>
<td>Understanding how the organisational processes would change in order to accommodate collaboration amongst organisations</td>
</tr>
</tbody>
</table>

Table 5.5: The Summary of the Action Research Studies (Protect A)

The **CBPE** model enables the organisation to advertise its services and products to people who are in need of those products and services. These people might not even be aware that such an organisation exists.

Table 5.6 shows the four phases of the action research study in the Protect B organisation.

<table>
<thead>
<tr>
<th>ORGANISATION</th>
<th>PHASES</th>
<th>OUTCOME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protect B</td>
<td>Plan</td>
<td>Arrange Fieldwork.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Establish Billing Account.</td>
</tr>
</tbody>
</table>
Chapter 5 – Validation of the CBPE Model Through Action Research

<table>
<thead>
<tr>
<th>Action</th>
<th>Publishing the service required by Protect B.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observe</td>
<td>Engineering additional process and re-engineering existing processes, the other external parties such as electricians, plumbers, meter checkers and readers can also find the required services offered by Protect B.</td>
</tr>
<tr>
<td>Reflect</td>
<td>Identified the need of the mobility in the proposed collaborative environment.</td>
</tr>
</tbody>
</table>

Table 5.6: The Summary of the Action Research Studies (Protect B)

The CBPE model, with the aid of mobile technology, provides an opportunity for Protect B to collaborate with the tradespeople nearest to the location of the work. The model generates revenue, as well as saving time for Protect B.

The three action research studies have established the need of the CBPE model in the medium-sized and large organisation. The proposed engineered processes for the individual organisations have demonstrated, using the BPMN diagrams, how the CWBS could enable collaboration across multiple organisations when these organisations are not necessarily known to each other.

5.6 CONCLUSION

The chapter has described action research studies of the three organisations in which the investigations has been carried out in order to verify the proposed model. Analysis of the engineered business processes, through Business Process Modelling Notation (BPMN) has been undertaken in order to validate the recommended CBPE model. The use case diagrams of the organisations are included in the Appendix D.
The action research studies that arise from empirical research have been mapped to the CBPE model through a set of figures, in order to validate the CBPE model through the action research studies. This chapter has concluded with the identification of common areas in the three organisations with regard to the CBPE model which again validates the model as a generic model for medium-sized to large organisations. Chapter 6 presents the analysis of a survey carried out in large and medium-sized organisations, in order to assess whether the organisations in general are focusing on mobile and WS technologies, and in order to assess whether there is a widely felt need for the adaptation of the new technologies by the organisations in the context of collaboration.

5.7 REFERENCES


Protect A Website and Documentation.

Protect B Website and Confidential Documentation.
6.1 INTRODUCTION
This chapter describes a survey related to the research carried out in creating and validating the Collaborative Business Process Engineering (CBPE) model. This survey has been carried out in order to ascertain and validate the organisational motivation for collaborative business, keeping in mind the technical, methodological and social perspectives. Since Web Services (WS) and Mobile Technologies (MT) form the basis for collaborations between businesses, the survey discussed in this chapter also focuses on these two emerging technologies in particular. Hence, this survey identifies the organisations’ readiness to adapt WS and MT in collaborations.

Cabrera (2005) justifies that WS enables the interoperation of organisations by enabling the applications’ interaction through Extensible Markup Language (XML). Alag (2006) states that the mobile business process is one that consists of one or more activities being performed at an uncertain location and requiring the worker to be mobile. Such a business process is supported by mobile systems to increase process efficiency. Based on Gan (2006), besides improving the user’s experience, mobile applications also affect the work environment.

This survey has targeted the decision-makers in the industry (such as the Chief Information Officer (CIO), Chief Executive Officer (CEO) and senior managers) who have a comprehensive understanding of the way in which Information and Communication Technologies (ICT) are used in the business. This...
chapter also discusses the design, sample size, data-collection method, technology acceptance models, data-processing and analysis and other relevant demographics of the participating organisations. The quantitative methodology and the reason for designing a survey for the purpose of this research have already been described in Chapter 3.

6.2 DESIGN OF THE SURVEY

The survey is made up of 24 questions, grouped into five sections. The questionnaire with all of the questions is provided in Appendix A of this thesis. The questionnaire has received the approval of the University of Western Sydney’s Ethics Committee. The approval letter has also been attached in Appendix B. The questionnaire has been carefully designed to enable sound interpretation towards achieving the objectives of the research. The questionnaire consists of five sections:

<table>
<thead>
<tr>
<th>Section</th>
<th>Classification</th>
<th>Number of Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: The Organisation</td>
<td>Demographic</td>
<td>1–3</td>
</tr>
<tr>
<td>2: Mobile Technology Information</td>
<td>General Mobility</td>
<td>4–12</td>
</tr>
<tr>
<td>3: Mobile Technology Management</td>
<td>Management and Mobility</td>
<td>13–16</td>
</tr>
<tr>
<td>4: Mobile Technology and Process Issues</td>
<td>Processes and Mobility</td>
<td>16–20</td>
</tr>
<tr>
<td>5: Web Services</td>
<td>WS Adaptation</td>
<td>21–24</td>
</tr>
</tbody>
</table>

Table 6.1: The Structure of the Designed Survey

These five groups of questions enable the study to evaluate the incentive for organisations to adapt new technologies.
6.3 THE SAMPLE SIZE

The survey has been distributed amongst medium- and large-sized business organisations. The research has carefully investigated the required sample size for the purpose of this research. Statistical studies state that the sample size of this survey falls in the non-probability sampling procedures, since the survey has been targeting a specific group of people in specific organisations. The difference between probability and non-probability sampling is indeed a basic assumption about the nature of the population under study. In probability sampling, every sample has a chance of being selected. In non-probability sampling, there is an underlying assumption that there is an even distribution of characteristics within the population. In non-probability sampling, since elements are chosen arbitrarily, there is no way to estimate the probability of any one element being included in the sample (http://www.statcan.ca/). Following are examples of the non-probability sampling procedure.

- **Judgement samples:** The subjective judgement of the sampler determines which instances are to be included in the sample; the result is called a judgement sample. According to Mugo, from the Social Research Methods, a judgement sample is obtained according to the discretion of someone who is familiar with the relevant characteristics of the population (http://www.socialresearchmethods.net/).

- **Quota samples:** These samples are selected on the basis of more specific guidelines about which sampling units should be selected. In order to obtain a quota sample, the researcher must have information, for the population under study, about the proportion of sampling units with certain characteristics. A data-collection method is designed to select sample units in a block of a
predetermined size. Quota sampling is used to select sample units in order to capture the detailed behaviour of the process. A quota sample is especially useful for situations where the data is time- or sequence-dependent. This data-collection method is likely to capture the detailed behaviour of the process (http://mot.vuse.vanderbilt.edu).

- **Convenience samples**: These types of samples are used because of their convenience. A random sample is one where the researcher ensures (usually through the use of random numbers applied to a list of the entire population) that each member of that population has an equal probability of being selected.

According to the latest catalogue number, 1321.0, of the Australian Bureau of Statistics (ABS) by Trewin (2001), there are a total of 384,100 businesses in the state of New South Wales (NSW), of which 372,600 are termed small businesses. The ABS classifies small businesses as business organisations having less than 20 employees (ABS, 2001) and (ABS, 2004). The medium organisations are classified as organisations employing 20–200 people, and large businesses as those that employ more than 200 people.

Therefore, as per the above numeric figures (that is, 384,100 businesses, less 372,600 small businesses), NSW has 11,500 organisations classified as medium or large organisations. The targets for this survey are the medium and large organisations in the Sydney metropolitan area. The reason for surveying large and medium organisations, as opposed to small organisations, is discussed below.

The medium and large organisations with defined business processes are more likely to become early adopters and innovators (Rogers, 2003) in assimilating such new technology, rather than smaller organisations that have a more limited
budget and smaller workforce (Lawson, Alcock, Cooper and Burgess, 2003). Therefore, medium and large organisations are the focus in this research.

According to the geographical distribution report by ABS, 86% of NSW’s large and medium-sized organisations are located in the Sydney metropolitan area. The given percentage provides 9,890 medium and large organisations in Sydney metropolitan area.

Based on the judgment samples of the non-probability sampling procedure, by knowing the survey target (large and medium-sized organisations in the Sydney metropolitan area) and according to Nardi (2003), 5% of the total population of medium-sized to large organisations, amounting to 495 were targeted for the survey. The researcher decided to round the number to 500 surveys to be distributed.

Six hundred such questionnaires were sent out and approximately 12% responses, amounting to 60 responses were received. As stated by Falcnor and Hodgett (1999), response rates in the information systems management area are likely to be within the range of 10% to 36%.

Based on Kitchenham and Lawrence (2002), an appropriate sample of the population is required to lower the administrative costs when the population is large. The researcher has to make sure that the survey will not cost more than it needs to cost. The sample size must have sufficient responses to produce the answer to the questions.

The large number of the samples also decreases the ability to administer the follow-up procedure. Based on the above explanation, the study accepted the responses of 12% (60 surveys) and established them as valid responses. Table 6.2 present the distribution/collection figure and their percentages.
### 6.4 DATA-COLLECTION METHOD

Four different methods of data collection have been initially considered:

1. **Postal Survey**: This method requires the survey conductor to find the address of the participants and physically post them the survey. The Ethics Committee of UWS rejected this method, as the members wanted to know where the participants’ addresses would come from and whether the location of the found addresses would be ethical and legal.

2. **Telephone Interview**: This method requires the survey conductor to find the telephone number of the participants and contact them to complete the survey. The examining of this method also revealed that the same problems would apply as in a postal survey. The Ethics Committee would also reject this method, as the finding and calling the organisations would not be ethical.

3. **E-mail**: This method requires the survey conductor to send the survey by electronic mail to participants. This method was also rejected, based on the assumption that the Ethics committee needed to know how the research has obtained the organisation’s e-mail address.

4. **Questionnaire and Personal Interview**: This method requires the survey conductor to distribute the survey in person and help the participant to fill in the questionnaire. This method was considered the most suitable for the project and

<table>
<thead>
<tr>
<th>Organisations in NSW</th>
<th>Organisations in Sydney</th>
<th>Required Sample</th>
<th>Distributed Surveys</th>
<th>Received Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>11,500</td>
<td>9,890</td>
<td>495</td>
<td>500</td>
<td>60</td>
</tr>
<tr>
<td>100%</td>
<td>86%</td>
<td>5%</td>
<td>100%</td>
<td>12%</td>
</tr>
</tbody>
</table>

Table 6.2 General Information (Population and Sample Size)
was adopted. The questionnaire and personal interviews took place in seminars, such as Australian Computer Society (ACS) seminars.

The design, approval of the Ethics Committee, distribution of the survey, collection of the data, extraction and analyses of the data has been very time-consuming.

6.5 TECHNOLOGY ACCEPTANCE
According to Westland and Clark (2000), some estimates indicate that, since the 1980s, about 50 per cent of all new capital investment in organisations has been in information technology. However, for technologies to improve productivity, these technologies must be accepted and used by employees in organisations.

There have been many research studies in the area of technological acceptance by individuals and organisations, such as the Unified Theory of Acceptance and Use of Technology (UTAUT) model by Venkatesh et al. (2003).

The UTAUT is designed to predict user intentions to IT and subsequent usage behaviour. The UTAUT hypothesis is that four key determinants (performance expectancy, effort expectancy, social influence and facilitating conditions) predict usage intention and behaviour. Gender, age, experience and voluntariness of use are proposed to mediate the impact of the four key determinants.

Figure 6.1 presents the UTAUT model where there are links between gender, age, experience, voluntariness of use and performance expectancy, effort expectancy, social influences and facilitating conditions. All the mentioned issues will impact on each other to generate behavioural intention and use behaviour.
The UTAUT model is constructed based on eight models (see Venkatesh et al., 2003). These models are described in Table 6.3.

<table>
<thead>
<tr>
<th>Theory</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory of Reasoned Action (TRA)</td>
<td>“an individual’s positive or negative feeling (evaluate affect) about performing the target behaviour” (Fishbein and Ajzen 1975, p. 216).</td>
</tr>
<tr>
<td>Technology Acceptance Model (TAM)</td>
<td>“the degree to which a person believes that using a particular system would enhance his or her job performance” (Davis, 1989, p. 320).</td>
</tr>
<tr>
<td>Motivation Model (MM)</td>
<td>“the perception that users will want to perform an activity “because it is perceived to be instrumental in achieving valued outcomes that are distinct from the activity itself, such as improved job performance, pay or promotions” (Davis et al., 1992, p. 112).</td>
</tr>
<tr>
<td>Theory of Planned Behaviour (TPB)</td>
<td>“TPB has been successfully applied to the understanding of individual acceptance and usage of many different technologies” (Harrison et al., 1997).</td>
</tr>
<tr>
<td>Model of PC Utilisation (MPCU)</td>
<td>“the extent to which an individual believes that using a technology can enhance the performance of his or her job” (Thompson et al., 1991, p. 129).</td>
</tr>
<tr>
<td>Innovation Diffusion Theory (IDT)</td>
<td>“the degrees to which an innovation is</td>
</tr>
</tbody>
</table>
perceived as being better than its precursor” (Moore and Benbasat, 1991. p. 195).

| Social Cognitive Theory (SCT) | The performance-related consequences of the behaviour, specifically expectations deal with job-related outcomes (Compeau and Higgins, 1995). |
| Technology Acceptance Model (TAM2) | Experience was not explicitly included in the original TAM (Davis et al., 1998). |

Table 6.3: Role of Moderators in Existing Models

The Theory of Acceptance Model (TAM) is designed to predict IT acceptance and usage in the workplace. The TAM hypothesis is that the perceived usefulness of a system and its perceived ease of use determine an individual’s intention to use the system, which leads to the actual use of the system. Figure 6.2 depicts the theory of the acceptance model.

![Figure 6.2: Theory of Acceptance Model](Source: Davis et al. (1989), Venkatesh et al. (2003))

TAM is tailored to Information System contexts, and was designed to predict information technology acceptance and usage on the job. TAM measures the degree to which a person believes that using a particular system would be free of effort (Davis, 1989).
The theory of *Diffusion of Innovation (DoI)* has been designed to explain adoption of innovations (including IT) by dividing the population into categories (innovators, early adopters, early majority, late majority and laggards). There is a hypothesis that the diffusion process follows an S curve. The rate of adoption is affected by five factors described below:

1. Perceived attributes of the innovation (relative advantage, compatibility, trialability, observability and complexity)
2. Type of innovation decision (optional, collective, authority)
3. Communication Channels (mass media, interpersonal)
4. Nature of the social system (norms, degree of network interconnectedness)
5. Extent of change agents’ promotion efforts (Rogers, 1995).

Figure 6.3 depicts the S curve of early and late adopters of the diffusion process.

![Diffusion Process](image_url)
DoI theory is concerned with the manner in which a new technological idea, artefact or technique, or the new use of an old one, migrates from creation to use. According to DoI theory, technological innovation is communicated through particular channels, over time, among the members of a social system.

According to Clarke (1999), DoI theory is at its best as a descriptive tool, less strong in its explanatory power, less useful still in predicting outcomes and providing guidance as to how to accelerate the rate of adoption. Many of its elements may be specific to the culture in which it was derived.

The above theories demonstrate that literature has already concentrated on the theoretical issues in order to adapt to new technologies. The following sections, 6.6 and 6.7, of the chapter provide specific descriptions identifying the organisations’ identified drawbacks and concerns in adapting the mobile and Web Services technologies.

6.6 OVERALL RESULTS OF THE SURVEY

6.6.1 The Organisation

Question: The Organisations’ Size

This section of the chapter depicts the general demographic of those 12% organisations that have responded to the surveys. As mentioned earlier, the medium and large organisations are the early adaptors of the technology. Therefore the surveys have only been distributed to these large and medium organisations.

Forty-three per cent of the organisations, amounting to 26, are medium-sized and 57%, amounting to 34, have been classified as large-sized organisations. According to the ABS report, organisations with 10–200 employees are classified as
medium-sized and organisations with more than 200 employees are classified as large-sized organisations (Trevin, 2001). Figure 6.4 illustrates the demographics of the organisations, based on their organisational size.

![Composition of organizations](image)

**Figure 6.4: The Percentage and Size of the Participated Organisations**

The organisations span across different industries, as listed in Table 6.4 below.

**Question: The Organisations’ Category**

This question is related to the category of the participating organisation. The study identifies the importance of this section, as it is very important to reach different industries to be able to evaluate the general technological adaptation in different organisations. Table 6.4 demonstrate the organisational categories that responded to the distributed survey.

<table>
<thead>
<tr>
<th>Organisations’ Categories</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information technology</td>
<td>20</td>
<td>33.3%</td>
</tr>
<tr>
<td>Government departments</td>
<td>14</td>
<td>23.3%</td>
</tr>
<tr>
<td>Education and training</td>
<td>7</td>
<td>11.7%</td>
</tr>
<tr>
<td>Banking, finance and insurance</td>
<td>7</td>
<td>11.7%</td>
</tr>
<tr>
<td>Professional services (legal and accounting)</td>
<td>5</td>
<td>8.3%</td>
</tr>
<tr>
<td>Retailing</td>
<td>3</td>
<td>5%</td>
</tr>
<tr>
<td>Health and community services</td>
<td>2</td>
<td>3.3%</td>
</tr>
<tr>
<td>Utility services and equipment</td>
<td>1</td>
<td>1.7%</td>
</tr>
<tr>
<td>Manufacturing and processing</td>
<td>1</td>
<td>1.7%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>60</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

**Table 6.4: The Organisations’ Categories**
The majority of the participants are from the information technology sector of the industry. The government departments, education and banking sectors follow in order. The study was able to proceed, as the distribution of the questionnaire had been correctly allocated and the study could evaluate the results achieved based on the different categories of the organisations.

**Question: The Position of the Participant in the Organisation**

This question is related to the position of the individuals in the organisations who actually responded to the questions. This question is also very important, since its answers can help the study to understand the role of the respondents in the organisation and also be aware of their control over the organisation. The positions held by the respondents are presented in Table 6.5.

<table>
<thead>
<tr>
<th>Position</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>General management</td>
<td>13</td>
<td>21.7%</td>
</tr>
<tr>
<td>Marketing manager</td>
<td>8</td>
<td>13.3%</td>
</tr>
<tr>
<td>Senior management</td>
<td>8</td>
<td>13.3%</td>
</tr>
<tr>
<td>Systems analyst/programmer</td>
<td>8</td>
<td>13.3%</td>
</tr>
<tr>
<td>IT/MIS manager</td>
<td>6</td>
<td>10%</td>
</tr>
<tr>
<td>Technical support</td>
<td>6</td>
<td>10%</td>
</tr>
<tr>
<td>Executive manager</td>
<td>5</td>
<td>8.3%</td>
</tr>
<tr>
<td>Sales officer</td>
<td>4</td>
<td>6.7%</td>
</tr>
<tr>
<td>Customer care</td>
<td>2</td>
<td>3.3%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>60</strong></td>
<td>100%</td>
</tr>
</tbody>
</table>

*Table 6.5: The Position of the Respondent in the Organisation*

The participants who held the general management positions in their organisations represent 21.7%, while marketing manager and senior management account for 13.3% of the respondents. The remaining 48.3% of the respondents hold key positions in their organisations. These people are the decision-makers in the organisations.
6.6.2 Mobile Technology Information

This section of the chapter demonstrates the result of the survey with regard to the respondents’ thoughts about mobility in business.

**Question: Importance of the Mobility in the Organisation**

The question relates to the use of mobile technology (use of mobile devices) in the daily activities of the business. The question further queried whether the organisations are already using mobile technology, or are planning to use it in the near future. The responses are detailed in Figure 6.5.

![Figure 6.5: The Use of Mobile Technology in the Organisations](image)

A substantial 87% (63% already using, and 23% that plan to use in the near future) of the organisations responded in the affirmative to this question. These answers indicate that the key personnel in the selected sample are very much aware of the value of mobility and mobile technology for their organisations. Thirteen percent of the respondents said that they do not have a plan to use mobile technology in the near future.
Question: Used Mobile Devices in the Organisation

The question is meant to identify the kind of the devices that are in use by the organisations. The answers provide an insight into the current use of mobile technology in the organisations. The responses for this question are listed in Figure 6.6.

![The Use of Mobile Devices](image)

**Figure 6.6: Type of Mobile Devices in Organisations**

The main issue to consider in this section is whether the organisations can use different devices in order to proceed with their daily business activities. The survey identified that 40% of the organisations are currently using mobile devices such as mobile phone, laptop, Personal Digital Assistants (PDA) or tablet Personal Computer (PC), while 30% of the respondent use mobile-enabled laptops. Figure 6.4 clearly demonstrates that organisations have realised that they need to take advantage of the location independence provided by the mentioned devices.

Question: The Scenario in Which Mobile Devices Are Used

The respondents were queried about the use of these devices in their business activities. In this section the research is trying to identify the reason for the use of
mobile devices in order to identify the use of this technology in the collaborative environment. Figure 6.7 depicts the typical reasons for the mobile devices in the daily business activities.

![Chart: The Reason for Using the Mobile Devices]

**Figure 6.7: Typical Reason for the Use of Mobile Devices**

Figure 6.6 presents the result by stating that the majority of participants believe that the use of mobility has increased the performance of their business activities, enabling them to have greater access to their employees, as well as being accessible by their customers. The use of mobile devices has created flexibility, availability and better access.

Questions 7, 8, 9, 12, 21, 22 and 23 are designed to rate the answers on different methods of evaluation. The legends are as follow:

- **VSA** – Very Strongly Agree
- **SA** – Strongly Agree
- **Ag** – Agree
- **DA** – Disagree
- **SD** – Strongly Disagree
- **VSD** – Very Strongly Disagree
Based on these ratings, the following results are extracted from the survey of organisations. In the following, the letter P stands for the Point as it was presented in the survey called Point number.

**Question: Current Application of Mobile Technology**

The question asked whether there are any new applications and areas in which mobile technology could be included in the daily business activities of the organisation, under four propositions, as listed in Table 6.6.

<table>
<thead>
<tr>
<th>New Applications</th>
<th>TOTAL</th>
<th>VS</th>
<th>SA</th>
<th>AG</th>
<th>DA</th>
<th>SD</th>
<th>VSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1 – Special Technology – Improve Efficiencies</td>
<td>47</td>
<td>6</td>
<td>15</td>
<td>16</td>
<td>8</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>PERCENTAGE</strong></td>
<td>100</td>
<td>13</td>
<td>32</td>
<td>34</td>
<td>17</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>P2 – Advertise in Captured Markets</td>
<td>44</td>
<td>2</td>
<td>9</td>
<td>20</td>
<td>8</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td><strong>PERCENTAGE</strong></td>
<td>100</td>
<td>5</td>
<td>20</td>
<td>45</td>
<td>18</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>P3 – Contacting Office (Any where/any time)</td>
<td>47</td>
<td>13</td>
<td>15</td>
<td>12</td>
<td>3</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td><strong>PERCENTAGE</strong></td>
<td>100</td>
<td>28</td>
<td>32</td>
<td>26</td>
<td>6</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>P4 – Track Goods in Transit</td>
<td>51</td>
<td>8</td>
<td>12</td>
<td>16</td>
<td>8</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td><strong>PERCENTAGE</strong></td>
<td>100</td>
<td>16</td>
<td>24</td>
<td>31</td>
<td>16</td>
<td>6</td>
<td>8</td>
</tr>
</tbody>
</table>

**Table 6.6: New Applications/Areas for Use of Mobile Technology**

**P1** – Mobile technology as a special technology improves efficiency in customer meetings. The survey shows that the majority, 78.7%, of the respondents either agreed or strongly agreed with this proposition. The response identifies the impact of technology on improving the efficiency of the business processes.

**P2** – Mobile technology has been used as a special tool to advertise in a captured market. The survey shows that 70.4% of the respondents agreed with this proposition. The response identifies that mobile technology enables organisations to capture the market by using the mobile devices.
P3 – Mobile technology as a tool has enabled people to contact the office for employees engaged in official travel. The survey shows that 63.8% agreed to this proposition. The response reveals that more than half of the organisations currently use mobility to connect for business purposes while the personnel are not physically in the office.

P4 – Mobile technology has enabled the business to track goods in transit. The survey shows that 70.5% of the responses agreed with this proposition. The response demonstrates that mobile devices are used to track goods globally.

The results indicate that mobile technology is a major technology that could improve their business activities. Therefore, this technology could also facilitate this research to enter the new proposed collaborative environment.

**Question: Advantages of Mobile Technology**

The question establishes the advantage of using mobile technology in organisations. Whilst the question queried the availability of applications of mobile technologies that can be included in the organisation, the objective of the next question is to re-emphasise this question in an alternate way, by probing the advantages of using mobile technology, rather than directly asking about new applications. The results of this question are listed in Table 6.7.

<table>
<thead>
<tr>
<th>Mobile Advantages</th>
<th>TOTAL</th>
<th>VS</th>
<th>SA</th>
<th>AG</th>
<th>DA</th>
<th>SD</th>
<th>VSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1 – Cost Savings</td>
<td>44</td>
<td>8</td>
<td>8</td>
<td>16</td>
<td>10</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>PERCENTAGE</strong></td>
<td>100</td>
<td>18</td>
<td>18</td>
<td>36</td>
<td>23</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>P2 – Connect Employees</td>
<td>48</td>
<td>21</td>
<td>15</td>
<td>9</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>PERCENTAGE</strong></td>
<td>100</td>
<td>44</td>
<td>31</td>
<td>19</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>P3 – Improve Productivity</td>
<td>55</td>
<td>13</td>
<td>26</td>
<td>10</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>PERCENTAGE</strong></td>
<td>100</td>
<td>24</td>
<td>47</td>
<td>18</td>
<td>11</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>P4 – Flexibility of Employees</td>
<td>47</td>
<td>7</td>
<td>10</td>
<td>17</td>
<td>12</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>PERCENTAGE</strong></td>
<td>100</td>
<td>15</td>
<td>21</td>
<td>36</td>
<td>26</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>P5 – Better Access for Customers</td>
<td>48</td>
<td>10</td>
<td>13</td>
<td>18</td>
<td>6</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>PERCENTAGE</strong></td>
<td>100</td>
<td>21</td>
<td>27</td>
<td>38</td>
<td>13</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

**Table 6.7: Main Advantages of Mobile Technology for Organisations**
P1 – Mobile technology as a special technology is very cost-efficient. The survey shows that 72.7% of the respondents either agreed or strongly agreed with this proposition. The response reveals that mobility enables the organisations to save money.

P2 – Mobile technology has been connecting people while out of the office. The survey shows that 93.8% of the respondents agreed with this proposition. The response identifies that connection with the personnel while out of the office is also crucial for increasing the efficiency of the business processes.

P3 – Mobile technology has been improving the business productivity. The survey shows that 71% of the respondents agreed with this proposition. The response reveals that the use of mobile technology has increased the productivity of the businesses.

P4 – Mobile technology has enabled employees to be more flexible, hence they can work regardless of their location and time. The survey shows that 72.3% agreed to this proposition. The response demonstrates that the location independency enables the personnel to be more flexible and increases productivity.

P5 – Mobile technology has created better access methods for the customers to contact the organisation. The survey shows that 85.4% of the responses agreed with this proposition. The response identifies that mobility cause the customers to have better access to the organisations.

Question: Advantage of Mobile Technology for the Business

The question has asked about other factors that would enhance the demand in introducing or using mobile technology in the organisation. Four propositions from which to choose were presented to the respondents. Table 6.8 lists the results for the question.
Table 6.8: Factors Influencing the Use of Mobile Technology in an Organisation

**P1** – Employees demand and show interest in using the mobile technology. The survey shows that 75% of the respondents either agreed or strongly agreed with this proposition. The response reveals that personnel of the organisations prefer to be flexible and perform their daily tasks while they are not necessarily in the office.

**P2** – Customers demand and show interest in using the mobile technology. The survey shows that 74% of the respondents either agreed or strongly agreed with this proposition. The response reveals that even customers show interest in using mobility to increase personal productivity.

**P3** – The supply chain sector is more interested and shows interest in using the mobile technology. The survey shows that 66.7% of the respondents either agreed or strongly agreed with this proposition. The response demonstrates the importance of the mobile technology in the supply chain sector.

**P4** – Social–psychological factors are influencing people to use mobile technology. The survey shows that 66% of the respondents either agreed or strongly agreed with this proposition. The response identifies that social–psychological factors are also important factors in using mobility, as people can perform their tasks anywhere and at any time.
Question: Improvements Caused by Mobile Technology

This question investigates the perceived value of mobile technology in the daily activities of the organisation. This section allows the respondents to select more than one choice. The survey results are listed in Figure 6.8.

![Figure 6.8: Mobile Technology Benefits to Business Activities](image)

The most important benefit of using the mobile devices, as predicted, has been classified as the availability to be contactable at any time, and anywhere. A fact revealed by this question is that cost savings are not the main driver for organisations to use mobile technology.
Question: Problem/Difficulties of Mobile Technology

The question has investigated the anticipated problems, difficulties and complaints the respondents may have when using the existing mobile gadgets. The results are listed in Figure 6.9.

![Figure 6.9: Problems Faced by Organisations Using the Mobile Gadgets](image)

The results state that the most important difficulty is the small screen while the limited applications, battery life span and complexity of mobile devices are classified as the remaining problems of mobile devices.

Question: Disadvantages of Mobile Technology

The question has investigated the disadvantages of using mobile technologies, as perceived by the respondents. The results are listed in Table 6.9.
Chapter 6 – Further Validation of CBPE Through Quantitative Research – Adapting Technologies

Table 6.9: The Recognised Disadvantages of Mobile Technology

<table>
<thead>
<tr>
<th>Disadvantages of Mobile Technology</th>
<th>TOTAL</th>
<th>VS</th>
<th>SA</th>
<th>AG</th>
<th>DA</th>
<th>SD</th>
<th>VSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1 – Establishment Cost of Applications</td>
<td>56</td>
<td>6</td>
<td>15</td>
<td>20</td>
<td>11</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>PERCENTAGE</td>
<td>100</td>
<td>11</td>
<td>27</td>
<td>36</td>
<td>20</td>
<td>4</td>
<td>4</td>
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<tr>
<td>P2 – Recruitment Cost of Mobility</td>
<td>54</td>
<td>5</td>
<td>16</td>
<td>24</td>
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<tr>
<td>PERCENTAGE</td>
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<tr>
<td>P3 – Technical Drawback</td>
<td>57</td>
<td>12</td>
<td>16</td>
<td>25</td>
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<tr>
<td>PERCENTAGE</td>
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<tr>
<td>P4 – Legal and Privacy Issues</td>
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<td>9</td>
<td>12</td>
<td>24</td>
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<td>PERCENTAGE</td>
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<tr>
<td>P5 – Training and Adaptation Issues</td>
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<td>24</td>
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P1 – Queried whether the cost of establishment of mobile applications is a concern for the organisation. The survey shows that 74% of the respondents either agreed or strongly agreed with this proposition. The response identifies that the establishing costs of the mobile applications are the major concern, rather than the utilisation of mobility.

P2 – Queried the recurring cost of using mobile technology as a major tool. The survey shows that 83% of the respondents agreed with this proposition. The response identifies that recurring costs are also a major concern for the organisations.

P3 – Queried whether technical drawbacks, which are inherent in current mobile technologies, are a factor considered as a disadvantage by organisations. The survey shows that 93% of the respondents agreed with this view. The response reveals that technical drawbacks are the major disadvantages of mobile technology’s utilisation by the organisations.

P4 – Queried legal and privacy concerns using mobile technology. Around 80% of the respondents showed concern about the legal and privacy issues with regard to mobile technology.

P5 – Queried with adoption and training issues in an organisation with regard to mobile technology. The survey shows that 78% of respondents in the selected sample
agreed that such issues are a concern for their organisations. The response identifies that the adoption and training issues are also a major concern in the utilisation of mobile technology by the organisations.

### 6.6.3 Web Services Technology

The following questions help the researcher to evaluate the participants’ opinion in terms of adapting Web Services (WS) technology in their business. The questions below deal with the three significant dimensions of adoption of WS technologies – namely, the technical, methodological and social dimensions.

**Question: Technical Drawbacks of Adaptation of Web Services**

The question has investigated the adaptation to WS technology from the technical perspective presented in Figure 6.10.

![Figure 6.10: The Technical Issues Involved in Adapting the Web Services](image-url)
**P1** – Queried whether the unfamiliar concept of the Web Services technology is a great concern for the organisations in order to adapt Web Services. The survey shows that 70% of the respondents either agreed or strongly agreed with this proposition. The response demonstrates that unfamiliarity with the concept of WS technology is a major concern in adapting the WS technology.

**P2** – Queried whether the limitation of the Web Services is important. The survey shows that 65% of the respondents agreed with this proposition. The response reveals that limitation of the WS technology is also a concern for the organisations in adapting the WS technology.

**P3** – Queried whether the ambiguity of the Web Services is a major concern (what it is and what it does). The survey shows that 70% of the respondents agreed with this view. The response indicates that the importance of the WS technology for interoperation is also not recognised by the organisations.

**P4** – Queried whether the participants understand how WS could facilitate collaboration. The survey shows that 80% of the participants agreed with this proposition. The response also reveals that the unfamiliarity with the concept of WS technology is a great importance for the adaptation rate of the technology by the organisations.

**Question: Methodological Drawbacks of Adaptation of Web Services**

The question has investigated the adaptation to WS technology from the methodological perspective. Results are presented in Figure 6.11.
Figure 6.11: The Methodological Issues in Adapting the Web Services

P1 – Queried whether the impact on WS on existing business process is a major concern while adapting the WS. The survey shows that 64.9% of the respondents either agreed or strongly agreed with this proposition. The response demonstrates that the organisations are concerned about the impact of the WS on existing business processes.

P2 – Queried whether the training of the employees is a major concern. The survey shows that 61.5% of the respondents agreed with this proposition. The response reveals that training costs and change management are also a concern for the organisations.

P3 – The concept of the competition while collaborating (how can you collaborate with your competitor?). The survey shows that 86.6% of the respondents agreed with this view. The response demonstrates that organisations are not willing to collaborate with their competitors.

P4 – The focus will shift to technology rather than process. The survey shows that almost 80% of the participants agreed with this proposition. The response reveals
that the adaptation of the WS technology shifts the concentration of the organisation to technology rather than the actual business process.

**P5** – How to manage the change when adapting the WS technology. The survey shows that almost 75% agreed with the proposition. The response reveals that organisations need to introduce a change management plan before the introduction of the WS technology.

**Question: Social Drawbacks of Adaptation Web Services**

The question has investigated the adaptation to WS technology from the social perspective. Results are presented in Figure 6.12.

![Figure 6.12: The Social Issues in Adapting the Web Services](image)

**P1** – Evaluate the adaptation rate by customer and the employees. The survey shows that about 60% of the respondents either agreed or strongly agreed with this proposition. The response demonstrates that the users (employees) and the end-users (customers) are also concerned when the organisation introduces the new technology.

**P2** – How the competitors react to change. The survey shows that 75% of the respondents agreed with this proposition. The response reveals that it is important to identify the competitors’ reaction to the introduction of new technology.
P3 – How the technology provides support in order to trust the competitor. The survey shows that almost 75% of the respondents agreed with this view. The response demonstrates that it is important to trust your competition before collaborating with it.

P4 – How the introduction of the WS technology impacts on the relationship with the organisations already in the line of collaboration. The survey shows that almost 65% of the participants agreed with this proposition. The response reveals that the introduction of the WS technology impacts on the relationship with the organisation that is already collaborating.

P5 – The legal issues involved in collaboration (government and internal policies). The survey shows that almost 65% of the participants agreed with the proposition. The response reveals that legal issues are also a major concern for collaboration, especially when collaborating with global organisations.

6.7 ANALYSIS OF THE DATA

This section describes the further analysis and the overall assessment of the quantitative survey in regards to the adaptation of Mobile and Web Services technology by businesses. The ensuing analysis correspond with understanding of the organisation’s concern in adaptation of the new technologies specifically the Mobile and Web Services technologies in order to be part of the introduced and validated CBPE model in Chapter 5 by the action research.

6.7.1 The Organisation (Evaluation)

The organisation category (refer to Table 6.4) indicates that the highest response was from IT, which represents 33% of the total responses. The second highest was the
government departments, including more than 23% of the participants. It has been mentioned previously that the survey was targeting large and medium-sized enterprises.

The positions of the individuals who filled in the survey have also been evaluated. The result has clearly identified that the surveys were filled in by participants who hold management (decision-maker) positions. In fact, 66% of the participants have held managerial (senior to executive) positions.

The organisations and the key role positions of the respondents have improved the quality of the sample selected from the actual population. This sample enable the research to understand and evaluate the unwillingness of a business to formally adapt new technologies and accept the risks associated with its adoption.

6.7.2 Mobile Technology Information (Evaluation)

Mobility appears to be an important technology for the businesses to use in proceeding with their daily activities. Figure 6.4 demonstrates that 63% of the organisations are already using their mobile devices to run their ordinary activities, while 23% stated that they are planning to adapt them in the near future. A total of 87% of the organisations recognises the importance of the mobile technology, while currently the majority of these people mainly use their mobile phones and mobile-enabled laptops.

The survey has also investigated the current and potential application of mobility, the advantages and disadvantages of mobility and the improvements caused by mobility to provide a better understanding of this technology.
Interestingly, the survey has identified that the cost of mobility is not classified as a big disadvantage in comparison to the benefits it provides. All these disadvantages and drawbacks seem to be due to the fact that the technology is new and still evolving. When there is more commercialisation of the technology, applications will become cheaper and recurring costs will be lower. The decreasing cost of technology while the capabilities are improving rapidly is highlighted by Roth (1998).

The respondents have defined that mobility is a great communication tool, making it easier to find and locate personnel, creating more flexibility and increasing the general productivity. The major advantage of mobile technology is providing availability to people, regardless of their location and time. The study revealed that accessibility is one of the greatest advantages of the CBPE model, therefore the advantage of mobility (anywhere – any time) could provide benefits to the proposed CBPE model. An example is the action research undertaken in Protect B, presented in Chapter 5. Without the aid of mobile devices, the proposed CBPE model would have been a failure, because the businesses that Protect 2 requires are always out of the office. The collaborative business process in the Protect 2 requires the mobile technology applications that are driven by a multitude of market forces to be distributed across different organisations in order to provide various benefits to the Protect 2 and its customers. Based on these various benefits that can be availed through the adaptation of mobile technology applications, organisations need a roadmap to implement these technologies in their various business functions and subsequently integrate these into a seamless mobile infrastructure. The advantages and disadvantages of the adaptation of mobile technologies by undertaken survey in this study provide an opportunity for the organisations to create the earlier mentioned
roadmap to implement the mobile technology in various business functions and finally their mobile infrastructure.

### 6.7.3 Web Services Technology (Evaluation)

The interoperation amongst multiple organisations needs a technology to support the collaboration across their business processes, especially when the participated organisation are not necessarily known to each other, and have never collaborated previously.

According to Barry (2003), the main driving forces for adopting Web Services are classified as interoperable network applications, emerging industry-wide standards, easier exchange of data, reduced developing time, reduced maintenance costs, availability of external services and availability of training and tools.

The main restraining forces are also classified as different semantics in data source, the semantic translation effect on operation systems for up-to-the-moment data request, evolving standards not being fixed, and mergers and acquisition.

Based on our survey, as demonstrated in Figure 6.10, all the issues identified by the research, such as unfamiliar concepts of Web Services, limitation of Web Services, how to adapt the new technology and how the processes collaborate, are classified as the major concerns of the organisations in relation to adopting Web Services. Only a minority, 10% of the participants, very strongly agreed to understanding how Web Services could help the collaboration, while close to 30% of the participants had the same concern, ticking the strongly agree box. The research has concluded that the organisation knowledge with regard to the technical issues of WS is very limited. This lack of knowledge could be classified as the major drawback to the adaptation of Web Services. More work is required to educate
enterprises with regard to the capability and functionality of Web Services from the technical point of view.

Based on the result of the survey, as presented in Figure 6.11, all the issues identified by the study, such as the impact of Web Services on existing processes, training of the employees, concept of competition in collaboration, shifting the focus of technology and the concept of change management, have been classified as important concepts. Almost 40% of the participants agree with these issues while close to 30% strongly agree. Close to 20% of the respondents classify the concepts of change management as their greatest concern in adopting WS technology for their organisations. However, about 20% and 30% of these organisations disagree that the effect of WS on existing business processes and training the employees are of great importance. There is no doubt that methodological issues play an important role in adopting Web Services technology.

Based on the survey, as presented in Figure 6.12, the customer/competitor reaction and the impact of the proposed CBPE model on the organisations that are already in collaboration have been classified by the participants as a strongly agree point. Almost a similar number attracted the very strongly agree comments, however, up to 35% of all participants classified all the issues identified by the study as the major drawback for adaptation of WS by organisations.

This research has concluded that technical, methodological and social factors identified by this study influence the adaptation and adoption of new technology by organisations. The business opportunities resulting from WS have seen these technologies being rapidly adopted across the world. For example, an IDC Report in 2003 revealed that 30% of Australian organisations are already using Web Services – although a large number of these organisations’ applications are behind the corporate
firewall. Another survey conducted by CSC found 105 of Australia’s largest organisations are already using Web Services or are planning to do so (Mackenzie, 2003).

In general, the issues of incompatible technology, competition, licensing agreement (legal issues) and mistrust have also been classified as additional major concerns when adopting the new technology, which will be discussed later in the thesis.

6.8 CONCLUSION
This chapter has described a survey carried out in the Sydney metropolitan area in large and medium-sized organisations, in order to assess the organisations’ concerns, readiness for and adaptability to collaborative business. The final result of the survey has revealed (in fact within the selected sample) that the key personnel of the organisations agree with the major concerns identified by the study and queried in the survey. The above 60% rate has been the result achieved for every individual question. The chapter has presented pictorial illustrations of the achieved results and the analyses provided of the collected data are also discussed. Chapter 7 concludes the thesis, provides recommendations for the future and discusses the challenges of this study.

6.9 REFERENCES


Australian Bureau of Statistics

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CHAPTER 7 – CONCLUSION AND FUTURE DIRECTIONS

7.1 INTRODUCTION

This chapter summarises this entire study. The summary of this research includes its aims, approach, survey, action research studies and the overall findings. This chapter also discusses the challenges faced by the researcher during these studies. The challenges in creating the Collaborative Business Process Engineering (CBPE) model are evaluated in the context of the aim and objective of the research. Finally, the future directions of this research and the relevant recommendations for potential future studies based on this research are also described.

7.2 REVISITING THE RESEARCH AIM

As specified in the introductory chapter, the research aim of this study is:

To investigate how Web Services could facilitate interoperability amongst multiple organisations that results in collaboration of business processes.

This aforementioned research aim has been achieved by following a research methodology. The comprehensive and detailed literature review that provides the basis and the outline of the subsequent model is discussed in Chapter 2. The research methodology itself has been discussed and modelled in Chapter 3. This methodology was based on a combination:

- **Constructive method**: The constructive method of research was used to create the Collaborative Business Process Engineering (CBPE) model.
The Business Process Management Notation (BPMN) was also explained and used in demonstrating the use of the CBPE model in practice; the practical implementation results in the Collaborative Web Based System (CWBS).

- **Action research:** Three action research studies in three different business organisations were explained in Chapter 5.
- **Quantitative research:** A survey to assess the opinions of key personnel in medium- and large-sized organisations with regard to the adaptation of the technology was clearly described and explained in Chapter 6.

The methodology selected for this research has been an appropriate choice, as it helped to create and validate the CBPE model. The action research studies, in particular, were quite appropriate research methods as they enabled the research without disturbing the day-to-day business activities of the selected organisations in the industry.

The new model of collaboration, constructed by this research (that is, the CBPE, as presented in Chapter 4) defines the proposed collaborative environment by identifying and facilitating the channels of collaboration. The proposed model of the CBPE has been validated by means of three action research studies. Furthermore, the potential use of the proposed collaborative environment in the daily activity of organisations has also been identified. In addition to the action research studies in this research, a survey was also carried out as part of the quantitative research methodology. This survey was conducted to assess the opinion of key personnel in organisations in terms of understanding their views when new technologies are introduced in the organisations. The dimensions of this understanding encompass the
technical, methodological and social perspectives. The result of the survey has been provided in Chapter 6 by providing detailed analyses and interpretations of the data.

Empirical research in the form of action research studies has been carried out in two large and one medium-sized organisations, as discussed in Chapter 5. The research validated and demonstrated the use of the CBPE model in Chapter 5, whereas Chapter 4 discussed the proposed CBPE Model and CWBS system.

7.3 REVIEW OF THE RESEARCH OBJECTIVES

The research objectives are re-emphasised here in order to demonstrate how this thesis handled the individual research questions of this research studies. The achievement of the objectives has resulted in fulfilling the research aim of this research.

7.3.1 Answers to Research Questions

Question 1: What is the nature of interoperation in the existing practice (model) of collaboration?

The existing model of the collaboration was presented in Chapter 1: Introduction and Chapter 2: Literature Review. The existing model of collaboration (static collaboration) does not support the business processes that need to be conducted across multiple organisations when these organisations may not necessarily be known to each other. Figure 1.1 in Chapter 1 of this thesis illustrates the existing model and Figure 1.2 in Chapter 1 also depicts the proposed model of the collaboration.
Question 2: What is the impact of interoperability emanating from Web Services on organisations that collaborate electronically? (Here the research examines the dynamic aspect of collaborations wherein organisations can enter and exit the collaboration at will.)

The proposed model of CBPE enables the organisations to be part of the new collaborative environment. The existing business processes of the organisations are not supporting the organisations to be part of the CBPE. Therefore, it has been identified by the research that (a) new engineered process/processes is/are required. Through the action research studies, the research has identified that the organisations were very concerned about the cost of the engineering process/processes. The management classifies them as costly and very time-consuming. Interestingly, the research identified that by understanding the existing gap in the collaborative environment and the benefits provided by the proposed model, the organisations were interested in engineering a new process enabling them to join the CBPE model and register their organisation in the CWBS.

These organisations can enter/exit the collaboration at will. The system must exhibit practical controls over the services from the organisations when these services decide to enter/exit the collaborative model. The CWBS places the registration/deletion task as the second-level process. The control must allow the completion of the transaction before allowing registration/deletion of the organisation.

Question 3: What are the characteristics and the mechanisms to model collaborative business processes that transcend organisational boundaries as against business processes within a single organisation?
The engineered process enables the organisations to be part of the global community. The current business processes are unable to support the single organisation. The organisation must register in the CWBS, adapted WS and, if required mobile and other mentioned technologies in order to be part of the CBPE model.

**Question 4: What are the factors influencing collaborative business processes (such as trust, legal, security, confidence level and availability of channels)?**

The concepts of trust, legal, security and availability of the channels play an important role in the success of the CBPE model. Please see Section 7.6 (the future recommendations) for detailed description of the mentioned concepts.

**Question 5: What are the benefits of the constructed model of collaboration (CBPE Model) in terms of its efficiency as well as its practicality?**

The three action research studies have shown that the organisations would greatly benefit by being part of the new collaborative environment. Chapter 5 of the thesis presented the proposed engineered processes for the three participating organisations in the action research studies.

The engineered processes generate revenue for the organisation. This revenue is either directly related to profit-making processes or aids the organisations to generate revenue by reaching the other organisations to satisfy their requirements in a shorter period of time.
Question 6: What are the impacts of mobility on engineered processes?

The action research study in Protect B presented the importance of the mobile technologies in the CBPE model. The model would not have been able to support the requirements of Protect B without mobile technology. Protect B needed to reach the tradespeople who were the closest to the work sites. The tradespeople are supposed to be registered in the CWBS, a mobile device carrier and the CWBS needs to be Global Positioning System (GPS) -enabled in order to identify the closest tradesperson to the work site. Then the proposed system contacts him/her by providing the desired task.

The CWBS enables Protect B to place better CRM in place while increasing its relationship with tradespeople who are working with it. The CWBS enables prioritisation of the work and placing the tradespeople in the received job list. This prioritisation assists the work to be distributed equally, based on the determined profile.

Question 7: How do organisations adapt the new technologies (Such as mobile and Web Services technologies)?

The quantitative methodology description in Chapter 3, the survey and the analysed data of the survey description in Chapter 6 provide the required answer to question 7 of this research. The thesis demonstrates the overall findings of the survey in the next section.

7.3.2 Overall Findings of the Quantitative Research

The survey identified that currently the majority of the organisations are using mobile technology. They use various mobile devices, as they strongly believe that
mobility enables them to communicate better, contact personnel on a regular basis even while they are out of the office, create flexibility, increase the personnel availability and increase the organisation’s productivity.

The majority of the organisations, in fact 80%, agreed that unfamiliarity with the concept of Web Services, limitations of Web Services, ambiguity when adapting the Web Services and how Web Services aid collaboration are the technical drawbacks to adapting the Web Services technologies. The survey also identified that the impact of Web Services on existing processes, training the employees, concept of the competition in collaboration, shifting the focus on technology and change management issues are the methodological drawbacks to adapting the Web Services technologies. The result of the survey shows that the organisations believe the partner organization already in collaboration might react to change. Trust issues and legal requirements are the social drawbacks to adapting the Web Services technologies.

The overall findings clearly demonstrate the important issues and concerns of the organisations in relation to adapting to the Mobile and Web Services technologies. The concentration of the research on the adaptation was purely based on the important fact that the success of the CBPE model depends on the adaptation of the organisations to the adaptation rate to these technologies, specifically Web Services technology.

### 7.4 CHALLENGES OF THIS RESEARCH

Technically, the challenges have been to investigate the implementation of Web Services through acceptable standards, their corresponding security and performance issues. These technical issues, revolving around Service-oriented Architecture
(SOA), have been expanded further into studying the availability of the collaborating organisations. Methodologically, the challenges have been to identify, model, evaluate and investigate the impact of collaborative business processes on the structure and dynamics of business processes that provide the services to the end-user. Socially, collaborations have led to challenges in terms of privacy, trust, legal as well as cross-cultural issues between the organisations. Based on this brief outline of the challenges, a more specific framework for these challenges has been identified by Ghanbary and Unhelkar (2007a and 2007b).

7.5.1 Technical Challenges

The technologies of Web Services have provided immense interactive capabilities and, at the same time, provide technical challenges arising precisely out of this need to interact. The need for collaborative software applications to have well-defined and accepted standards for interaction cannot be overstated. The W3C (World Wide Web Consortium) provides the necessary XML and related standards that can help implementation of Service-oriented Architecture in organisations. Such an SOA, however, is hampered by the lack of industry standards as each vendor attempts to push its own standard on the collaborative business applications. Without a common standard for interchange of data and applications that is also acceptable to the numerous tool vendors and subscribers, development of global businesses is thwarted. Thus, similar to the acceptance of HTTP, TCP/IP and HTML as standards for the original development of the Internet, the acceptance and definition of standards for the development of Web Services are critical to the ultimate success of globalisation through WS. The Chief Technical Officer (CTO) of the company BEA, Michael Smith, pointed to this fact in his statement “If things aren’t built on a solid foundation of standards that everyone agrees to, nothing will happen.” (Mills, 2003).
Yet, while the basic XML/XMI standards are increasingly being incorporated in software applications, according to Microsoft’s Greg Stone, conventional standards can simply take too long. “There needs to be some commercial reality brought to bear that makes it happen much more quickly. If you think of other open, collaborative standards, they can go on for years” (Mackenzie, 2003a, 2003b).

Lack of common acceptability of standards amongst application vendors can, in turn, also lead to tough competition (or friction and in-fighting) amongst the companies that produce the software development tools for services; and this can happen despite the platform independent nature of Web Services. For example, there appears to be a stand-off between Sun and Microsoft over their respective J2EE and .NET toolkits – eventually leading to Microsoft abandoning the Web Services “Choreography” working group in March, 2003. Similarly, IBM’s Websphere, Oracle’s 9i Application Server and BEA’s WebLogic, have long since competed for market share of their respective products that can help build Web-Services-based software applications for global businesses (Mackenzie, 2003c). Furthermore, the Universal Description Discovery Integration (UDDI) for publishing-locating-consuming services – a vital ingredient of WS – requires commonly acceptable standards, which also do not seem to be converging. An example of this disparity is the fact that Microsoft, SAP and Siebel, who used to maintain UDDI standards in the past, have discontinued their UDDI instances. Finally, the availability of robust content management systems and databases with relevant contents for global services directories and transactions is also a crucial technical challenge to the globalisation of businesses with WS.

Internally, to a business, collaborations enable dispersed teams and also participating businesses to communicate, coordinate and cooperate with each other in
order to consummate a task. These electronic collaborations increase the effectiveness and speed of interactions between organisations, thereby enhancing strategic decision-making and genuine operational agility (Barekat, 2001). However, there is a technical need to support the teams and decision makers through groupware technologies that use the Internet for communication. For example, there are web-based chat tools, web-based asynchronous conferencing tools, e-mail, Internet-based list servers, collaborative writing tools, group decision support systems, and teleconferencing tools as discussed by Kock et al. (2001). Furthermore, there are also non real-time and real-time discussion, whiteboard, screen-sharing, file- and document-sharing and document management groupware products such as Lotus Notes, and intranet that contains groupware functions such as e-mail, document management, electronic conferencing (Shani et al., 2000). These communication mechanisms need to be continuously kept up and running technically for the management aspect of the collaborations to develop, and are a technical challenge to the management itself.

The security of collaborative transactions is another major technical challenge that needs to be satisfactorily resolved before collaborative business can flourish. This is so because security in collaborations requires coordination amongst applications of numerous businesses and, as such, there are greater challenges than normal application security, as these service-oriented applications would be in separate technical environments, as well as different geographical regions. There is no doubt that the development of WS technologies has itself been much faster than the handling of corresponding security issues related to these technologies. According to Grance et al. (2003), organisations must frequently evaluate and select a variety of information technology (IT) security services in order to maintain and
improve their overall IT security program and enterprise architecture. IT security services, which range from security policy development to intrusion detection support, may be offered by an IT group internal to an organisation, or by a growing group of vendors.

In fact, security is considered crucial to Web Services’ future success. The adoption of the WS technologies and their communications framework as a dependable means of doing business relies heavily upon the ability of the business applications to ensure safe and secured transactions; and industry bodies such as the WS-I (Web Services Interoperability) are in the process of creating a way for protocols to handle this problem themselves.

Finally, the speed of WS-based transactions and the availability of corresponding bandwidths are also a crucial technical factor influencing collaborative businesses. SOAP, being based on XML, is not technically efficient, as it requires applications to send a lot of data to successfully communicate with each other. As reported in the past, XML-based transmissions are seven times or more inefficient than a standard CORBA (Common Object Request Broker Architecture) message (Foreshew, 2003). Subsequently, bandwidth may become a considerable technical challenge for the future of Web Services development.

7.5.2 Methodological Challenges
The major challenge from a methodological viewpoint, when it comes to collaborative business processes, has been the need to engineer these business processes. Collaborative processes transcend organisational boundaries; as a result multiple organisational policies, procedures, and applications need to be considered in detail, in order to create a single collaborative process that would provide a unified
view to the client. Modelling of such collaborative business processes does not seem to have been researched, or undertaken in practice formally (Ghanbary and Unhelkar, 2007a). These collaborative business processes bring about a radical re-thinking of the original business process re-engineering (BPR) discussions of Hammer and Champy (2001). This is so because the original concepts of BPR focused on a single organisation and the processes discussed therein were the responsibility of a single organisation. In the case of collaborative business processes, the re-engineering (or, more appropriately, engineering – as there are hardly any existing collaborative business processes) needs to account for multiple organisations and their particular nuances. Furthermore, undertaking engineering of collaborative business processes requires sufficient and acceptable standards to achieve that modelling. Although, in practice, the research has used Business Process Modelling Notation (BPMN), these standards need to be acceptable on a much wider scale to enable substantial modelling of collaborative processes. Finally, such CBPE model needs to go beyond modelling of interfaces between organisational boundaries and delve deeper into databases and applications. Once again, there is a need for (and dearth of) corresponding CASE (Computer Aided Software Engineering) tools that will enable modelling of collaborative services that go beyond a single organisation.

7.5.3 Social Challenges

Socio-cultural incompatibility results when two companies with different social environments, as well as disparate financial backing, collaborate in a cross-border alliance that is made possible by the technical ability of WS-based applications to interact with each other. While “going global” seems to be a strategic move for many businesses, the possible incompatible alliances resulting from the globalisation
attempts are of high risk to the business if partnering companies fail to give socio-cultural credence to the otherwise technical alliances. The failure to address differences and disparate value systems and operations between collaborating global organisations can quickly lead to the demise of an otherwise strong strategic alliance. This is more likely to happen in electronic collaborations, as the participating businesses may focus only on the electronic aspect of the collaborative transaction, and may not pay sufficient attention to the supporting physical communication required amongst businesses. Communication between participating companies within collaboration, or even a parent company and its foreign subsidiaries, can be hampered by diverse language, culture heritage and physical distance (Siegel, 1999). Overcoming the potential cultural hurdles, in terms of verbal or physical face-to-face communications, is an important challenge in collaborative business. Thus, collaborations between businesses that operate in separate domains, geographical regions and cultures, need to understand, accept and resolve the unique socio-cultural challenges. Management needs to come up with innovative ideas and approaches to create and “gel” such organisations and their corresponding virtual teams. While the collaborative “team management” tools mentioned in the technical challenges earlier can play an important role in achieving coordination amongst separate organisations and their people, there still need to be innovative approaches in order to manage geographically widespread collaborations. Traditional hierarchical management is unlikely to satisfy the needs of such teams and there is likely to be an impact on the organisational structures of these businesses. Organisational structure required to support human interactions is central to efficient e-collaboration (Rutkowski et al., 2002); however, electronic collaborations change the functionality and nature of the organisation, as well as those of the standard collaborating groups.
Successful collaborations require a supportive organisational structure that is based on trust-building and restructuring of group-based processes. The core need for employees and managers of participating organisations in collaboration to interact directly with their counterparts in other organisations further disturbs the well-known hierarchical organisational structure. The need to provide a unified view of a collaborative business process to the client also results in a “flattened” organisational structure – as the client is simply not interested in the internal hierarchy of the organisation and, as such, the internal hierarchy of the organisation loses significance. Such flattened hierarchies of organisations result in a loss of middle-management organisational structures that simply become redundant.

Corporate mistrust is an important management challenge when it comes to globally collaborative businesses. While it is accepted that each collaborating party would attempt to protect its own interests, including assets, intellectual property, reputation and customer base, the very opportunity to collaboratively take up business opportunities requires the development of a win–win relationship. This development of a win–win relationship requires each collaborative party to enter in an electronic relationship with a certain amount of trust in its partner, and as discussed by Brooks and Alexis (1998), with an attitude that the partner’s success is just as important as its own. In fact, the very nature of collaborative businesses requires them to open themselves up to their customers and business partners and, without trust, collaborations are not likely to succeed. Mutual trust between collaborative businesses and their customers and business partners is an integral part of building the e-economy. Indeed, “building trust” is seen as a subtle but key issue during e-collaboration activities (Rutkowski et al., 2002).
Collaborations also occasionally need mediators and facilitator, despite the fact that electronic collaborations enable businesses to directly deal with each other and its clients. The reasons for such mediators and facilitators arise from the numerous social, legal, and business requirements that can be easily resolved only with the involvement of a third party. A common example is the popular auctioning site eBay; although the vendors and the buyers are transacting directly, they need the facilitation of eBay, as well as its protocols, rules and regulations to abide by, in order to conduct business successfully. This scenario becomes more complex when numerous large organisations are involved in collaborating electronically – eventually giving rise to the roles played by standards bodies like W3C, OASIS (www.oasis.org) and OMG (www.omg.org). Furthermore, these collaborative business processes across wide geographical regions require a corresponding legal framework that is also binding on the ensuing collaborative business transactions that are also on different software application domains (Neely and Unhelkar, 2005).

Finally, privacy (as against security, which has been earlier discussed in the technical challenges) is another significant social factor that needs to be considered in collaborative business processes. Privacy can be considered as the need and the capacity of individuals to negotiate social relationships by controlling access to personal information. As laws, policies, and technological design increasingly structure people’s relationships with social institutions, individual privacy faces new threats and new opportunities (Agre and Rotenberg, 1997). While a legal framework usually exists for privacy, the challenge to enforce that legal framework for collaborative transactions is enormous (as discussed, and also mentioned earlier in this thesis (Neely and Unhelkar, 2005). The response to this privacy challenge from management requires the creation of policies and procedures, both internal and
external to the organisation, that are acceptable to the stakeholders. Examples of such policies from an institution are provided by (Abood, 2006).

### 7.5 POTENTIAL FOR FUTURE RESEARCH

#### 7.5.1 Crucial Information for Potential Future Research

The challenges and limitations of this research are discussed here from the point of view of alerting potential future researchers to the challenges of conducting the research in this collaborative business management arena. While individual researchers are likely to face variations of these challenges, an understanding of these challenges is essential for future research. Some of the specific challenges are listed as follows:

- Demonstrating the problem (gap in the literature) to industries. This research focused on creating a dynamically collaborative environment and the practitioners from the industries are viewing it as the current standard “services-based” approach to collaboration. During this research, the researcher discovered that practitioners are not able to easily recognise the depth of the problem in terms of the dynamic collaboration being studied.

- Demonstrating the benefit of the proposed CBPE model to industries. This was a major challenge, as the advantages of the proposed model seemed very ambiguous. The full definition and the functions of the model should have been recognised in order to identify the benefits. As described, the research faced many challenges in addressing the depth of the limitations in the current collaborative environment.

- Demonstrating the need for the management of the proposed CWBS (system administrator). The research has identified the potential of the collaboration
in the global market. Control of the system in the global market faces the problematic catechistic in relation to the control of the Internet in the global market, that is, who is really in charge of the Internet?

- Demonstrating the need for understanding the trust and legal issues in collaboration when the other parties might be unknown to each other yet manage to collaborate. These issues can be interrelated in terms of how people can trust to collaborate. The other individual issue is the legal drawbacks. As mentioned in the action research in MAS Venue Services. MAS Venue Services is unable to hire staff from other organisations due to the approval needed for their staff credentials, such as licensing approval from the government.

- Demonstrating the limitations on testing the proposed model in action research studies. These addresses problems as follows:
  - Adaptation rate of the Web Services technology in the real world.
  - Organisations’ readiness to enter the new collaborative environment.
  - Organisations’ management issues with the cost of the engineered processes.
  - The impacts on current collaborative environment of the organisations.

- Demonstrating the limitation of the budget and time. This research has faced numerous issues, in that the allocated time and the budget have been unable to fully support the proper application of the proposed model in the industry. The researcher aims to proceed with the further evaluation of the model in a post-Doctoral study to investigate the full potential of the proposed model in the industry.
The above issues are crucial factors for potential future research to recognise the challenges and limitation of this research “beforehand”. Following sections list the future research area related to the collaborative business management arena.

### 7.6.2 Trust in Collaboration

Further research is required to evaluate the implications of trust in the collaborative environment. Trust is a very important issue in society and, in the case of CBPE, that challenge of trust translates into the challenge of implementing collaborative business.

Trust is also directly related to ethical issues in both society and business. Ethics are the principles used to determine the purpose of our decisions. Ethics are very important, especially in a society that is constantly influenced by the change of the technology. Research is required to identify the theoretical foundation of the ethical issues, specifically in the rapidly changing technological society.

The preferred relationship between the company and consumers takes place while the most influencing factor of trust is respected. According to Greenspan (2004), the factors are classified as positive customer service experience, length of the relationship with company, company or product reputation, brand familiarity and privacy policies. Therefore, the factors most likely to damage the trust could be classified as online security fears, telemarketing, the company’s reputation through past incident(s), general suspicions of the company and disapproval of the company’s business practice.

The new technological change requires new ethical issues that arise with the use and abuse of the technology. Future research is required to identify the need for trust and ethical issues in the CBPE model.
7.6.3 Legal Issues in Collaboration

Legal issues have been classified as the greatest concern of the organisations that have legal liabilities in order to operate. The action research study in MAS Venue Services identified that there are many legal issues involved in collaboration. The personnel (especially security guards) at MAS venue Services must have current approval. The CBPE enables MAS to hire staff from other organisations without any mechanism in place to check their licence validity.

Further research is required to identify how the CBPE model can solve the legal issues. The study by Neely and Unhelkar (2005) identified that the Web Services technology has revolutionised the concept of e-commerce, leading to “collaborative commerce,” wherein a large number of business applications can publish, locate, and consume services by transacting with each other in 24/7 mode and across geopolitical boundaries. We are thus entering an era where a large number of Web-Services-based applications could be dealing with each other, resulting in collaborative commerce transactions that need a legal framework surrounding them.

7.6.4 Security Issues Arising from the Collaborative Environment

Security is an area that has not been considered in this research, since it is outside the scope of the main focus of methodological considerations. The security, privacy and the integrity of the data are very important concepts for the success of the CBPE model. Further research is required in order to establish secure channels for the collaboration in place. Secure channels increase the availability of the channels and provide a robust and secure collaborative environment in which organisations can participate. The other potential areas of this research are in the areas of the risk involved in participation, the full support of the future technologies in CBPE and the relative consequences of those impacts.
7.6 CONCLUSION

This chapter has provided a summary of the overall thesis by reviewing the objectives of the research and providing answers for the research questions presented in Chapter 1. The challenges and limitations of the research were also identified.

This chapter has also presented a general overview of the result achieved from the conducted survey. It has described the additional challenges and limitations of this research for future research, before introducing them.

This thesis has demonstrated the existing gap in the current collaborative environment by discussing how the current collaborative environment is unable to serve a business processes across multiple organisations - especially when these organisations are not known to each other and there is no prior contract for the collaboration.

The thesis has presented current literature in the area of emerging technologies supporting the limitations of the current collaborative environment declaring the use of the existing technologies in order to develop the CWBS capable of handling the proposed collaborative environment.

The thesis then presented the development of the proposed CBPE and CWBS, including their use in real-world organisations, in three different action research studies. The adaptation of the organisations to the Mobile and Web Services technologies were also evaluated. The thesis explained the concerns of the organisations while adapting the new technologies. The research clarified that the introduced concept of CBPE is a complicated issue never addressed prior to this research.

The major point highlighted by this thesis is the identification of the collaboration of multiple organisations to provide services/products to other
organisations/people that/who need them by submitting only one application. Research in organisational collaboration provides insight into the contingency of how the collaboration replaces competition. Understanding this applicable body of the knowledge enables organisations to have better understanding in order to develop and grow, while having better relationships with their customers.

7.7 REFERENCES


APPENDICES
APPENDIX A: QUESTIONNAIRE

Dear Participant,

The aim of this questionnaire is to satisfy the requirements of a Doctoral-level research in the use of mobile technology being conducted at University of Western Sydney, School of Computing and IT. The questions in this survey relate to the mobile technology issues, mobile technology management issues, mobile business process issues and mobile web services.

The benefits of the project create awareness for the organisations in analysing the impact and importance of mobile technology. The organisations can also identify the challenges that this technology has created for them and suggest a new way to rectify those difficulties.

This is quantitative research. All the raw data are to be collected by this questionnaire and analysed and processed, using statistical methods, for deduction and testing of the hypothesis. The collected data are to be safely stored within UWS for five years.

In the design of the questions, the integrity of the organization is respected and but no confidential information is required. The questions are specific in the use of mobile technology and the organisation participation is voluntary. There is no risk involved in the collection of the data. The process of data collection takes approximately 20 minutes.

The results are going to be collectively discussed in our theses. Parts of the study may be presented in seminars and conferences. The final theses are going to be submitted to the School for assessment and, if successful, will be available to you and the public through the UWS Libraries

Queries regarding this questionnaire can be directed to the supervisor of this research: Dr. Bhuvan Unhelkar in University of Western Sydney. He can be reached at (02) 9685-9232, mobile 0413-821-454 and by email on bhuvan@cit.uws.edu.au.

NOTE: This study has been approved by the University of Western Sydney Human Research Ethics Committee. If you have any complaints or reservations about the ethical conduct of this research, you may contact the Ethics Committee through the Research Ethics Officers (tel: 02 47360883). Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.

Thank you for your cooperation,

Abbass Ghanbary
Study of the Issues of Mobility in Business – A Survey

This Survey aims to study the effect of mobile technologies on large and medium sized business organizations as a partial fulfillment for a doctoral study. The responses are collected in order to understand and research into the use of mobile technologies and related issues when it is used as a tool in the business processes of a business organization. Your response would be collected and analyzed and classified using statistical methods to draw conclusions. Your help in filling up this questionnaire is greatly appreciated.

The estimated time required to complete this survey is approximately 20 minutes; your kindness in completing this survey and returning it, in the envelope provided within a short duration is highly appreciated.

1.0 Your organisation

1. Which of the following best describe your organisation? (Please tick the most appropriate one)

[ ] Large - Approximately employing 200 or more workers
[ ] Medium - Medium size operations employing more than 20 but less than 200 workers

2. Which of the following is the most appropriate industry category of your organisation? Please tick more than one category if required.

[ ] Education & Training
[ ] Manufacturing and Processing
[ ] Building and Construction
[ ] Banking, Finance and Insurance
[ ] Professional services (legal, security, accounting)
[ ] Information Technology
[ ] Utility Services and equipment
[ ] Health and Community Services
[ ] Other (Specify) .................................................................

3. Your position in the Organization

[ ] Top Management
[ ] IT/MIS Manager, CIO
[ ] Marketing Manager
[ ] Customer care personnel
[ ] Sales and marketing
[ ] Executive Manager
[ ] Senior Manager/Officer
[ ] Systems Analyst/programmer
[ ] Technical support
[ ] Other (Specify) ............
2.0 Mobile Technology Information

4. Is mobility/mobile gadgets very important to run the daily activities of your organisation? (Please tick the appropriate box)

[ ] Yes - Please go to question 5
[ ] Plan to use in the near future? - Please go to question 5
[ ] Do not use and also no plans for the near future? – Please go to question 12

5. Please tick off the utilised mobile devices in your organisation.
(Please tick the appropriate box)

[ ] Mobile Phones
[ ] Personal Digital Assistants
[ ] Laptops with mobile connectivity
[ ] Tablet PCs
[ ] Other- Please specify …………………………………………………

6. What are the current/perceived scenarios where mobile gadgets are/will be used in the organisation. (Please tick the appropriate box(es))

[ ] As a communication tool for day to day business activities, specifically as a cheaper method compared to over and above other communication methods
[ ] As a technology used to contact employees any time any where in daily business activities
[ ] As a special communication tool to contact employees under special circumstances (eg In case of a fire etc.)
[ ] As a special tool to reduce duplication of work and improve productivity (eg – Use of tablet PCs for signature for delivery of goods or use of lap tops to get data entry on customer site for sales people)
[ ] As a tool providing flexibility to mobile employees (eg. top management, sales people, Managers)
[ ] As a tool for enabling customers to contact at all times.

7. Are there any new application/areas where mobile technologies could be included your daily business activities. Please tick the appropriate box for each point, out of six choices, in the table provided.

P1) As a special technology to improve efficiencies in customer meetings

P2) As a special tool to advertise in a captured market

P3) As a tool to enable contacts with office for employees while on official travel

P4) As a method to track goods in transit

Legend -
VSA – Very Strongly Agree SA – Strongly Agree
Ag - Agree DA – Disagree
SD - Strongly Disagree VSD – Very Strongly Disagree
8. What do you consider to be the main advantages of using mobile devices in your organisation? Please tick the appropriate box for each point, out of six choices, in the table provided.

P1) Significant cost savings

P2) Ability to connect employees anywhere and anytime

P3) Improved Productivity due to better communications

P4) Flexibility of employees thus improving morale of employees

P5) Availability for the customers to contact the organisation.

Legend -
VSA – Very Strongly Agree      SA – Strongly Agree
Ag - Agree                     DA – Disagree
SD - Strongly Disagree         VSD – Very Strongly Disagree

9. List the following factors which may be advantageous for the organisation? Please tick the appropriate box for each point, out of six choices, in the table provided.

P1) Demand for mobile technology is enhanced due to the interest by the employees in this technology

P2) Demand for mobile technology enhanced by the interest of customers to use this technology

P3) Demand for mobile technology is enhanced by the interest shown by the supply chain

P4) Demand for mobile technology is enhanced due to socio-psychological factors(eg. New look for the organization)
Legend -
VSA – Very Strongly Agree   SA – Strongly Agree
Ag - Agree    DA – Disagree
SD - Strongly Disagree   VSD – Very Strongly Disagree

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P5) Others (Specify)………………………………………………

10. How could mobile technologies improve your daily work/activities? (Please tick the appropriate Box(es))

[ ] Cost Savings
[ ] Time savings
[ ] Ability to contact any time, any where
[ ] More flexible approach towards work
[ ] Any other – Please specify

11. What (problems/difficulties/complaints) are/(perceived to be) experienced by you in utilising existing mobile gadgets? (Please tick the appropriate Box(es))

[ ] Not enough battery time available
[ ] Screen sizes are too small
[ ] The new mobile gadgets are too complicated to learn quickly
[ ] The lack of applications
[ ] Any other-Please specify

12. What do you consider to be the main disadvantages of using mobile devices/applications? Please tick the appropriate box for each point, out of six choices, in the table provided.

P1) Cost of establishment of mobile technology and applications

P2) Recurring cost to use mobile technology as a major tool

P3) Technical drawbacks of current mobile systems such as coverage, call drop, network issues and low rate of data transmission

P4) Legal and privacy concerns in using mobile technology

P5) Adoption and training related issues with regard to the use of mobile technology
Legend -
VSA – Very Strongly Agree  SA – Strongly Agree
Ag - Agree DA – Disagree
SD - Strongly Disagree VSD – Very Strongly Disagree

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P6) Any Other? Please Specify……………………………………………………………….
3.0 Mobile Technology Management

The Mobile Technology Management (MTM) Issues are further divided into two sub-classes. The following lists each sub-class and its corresponding MTM issues.

13. Mobile network and infrastructure. The drawbacks of these areas are a concern for your organisation. Please tick the appropriate box for each point, out of six choices, in the table provided.

P1) Lack of national mobile communication infrastructure
P2) Lack of mobile network systems for data transmission
P3) Lack of mobile network protocols
P4) Lack of planning and managing mobile communications and support by the providers
P5) Mobile transmission issues and coverage

Legend -
VSA – Very Strongly Agree  SA – Strongly Agree
Ag – Agree  DA – Disagree
SD – Strongly Disagree  VSD – Very Strongly Disagree

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P6) Any Other, Please specify ………………………………………………………………

14. Mobile - General issues. This deals with some general drawbacks. Please tick the appropriate box for each point, out of six choices, in the table provided.

P1) Improving data integrity, reliability and quality assurance for mobile transmissions
P2) Integration of data processing, office Automation with mobile communications
P3) Effective rules and regulations to manage mobile communications
P4) Moving to open systems/standards for mobile applications
P5) Ease of navigation on mobile devices
**Legend** -
- **VSA** – Very Strongly Agree
- **SA** – Strongly Agree
- **Ag** – Agree
- **DA** – Disagree
- **SD** – Strongly Disagree
- **VSD** – Very Strongly Disagree

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P6 ) Any Other, Please specify .................................................................

15. Please specify any other MTM issues that are important to your organisation but not included in the above questionnaire.

1. .................................................................

2. .................................................................

3. .................................................................

4. .................................................................

5. .................................................................
4.0 Mobile Technology and Process Issues

The Mobile Technology Process Issues are used to investigate any issues relating to how mobiles are used in the business processes by organisations when adopting mobile technology. Any process is a set of business activities happening in an organisation that leads to serving a customer.

16. Which points would you consider as Mobile Technology advantages when used in organisational business processes? Please tick the appropriate box for each point, out of six choices, in the table provided.
P1) Mobile technology’s flexibility to integrate with business processes
P2) Mobile technology’s any time any where contactability
P3) New mobile applications in the market providing a competitive advantage to business
P4) Mobile technology’s individual to individual relationship
P5) Mobile technology’s breakthroughs (eg. faster transmission, better screen sizes, etc.)

Legend -
VSA – Very Strongly Agree          SA – Strongly Agree
Ag - Agree                        DA – Disagree
SD - Strongly Disagree            VSD – Very Strongly Disagree

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P6) Any Other, Please specify

17. Mobile Technology Limitations. Please tick the appropriate box for each point, out of six choices, in the table provided.
P1) Limitations on the existing mobile network bandwidths
P2) Limitations on available time due to battery limitations
P3) Limitations of existing mobile applications
P4) Limitations with the mobile devices such as small screen sizes

Legend -
VSA – Very Strongly Agree          SA – Strongly Agree
Ag - Agree                        DA – Disagree
SD - Strongly Disagree            VSD – Very Strongly Disagree
18. Mobile Technology process considerations. Please indicate the areas that would be considered important to your organisation. Please tick the appropriate box for each point, out of six choices, in the table provided.

P1) A method for systematic transformation of business processes into mobile processes

P2) Identifying any new processes needed with the introduction of mobile technology?

P3) Re-visiting organisational objectives in the context of mobile technology and applications

P4) Re-visiting the customer relationship with regard to mobile technology

P5) Changing the existing processes to allow mobile gadgets

Legend -
VSA – Very Strongly Agree SA – Strongly Agree
Ag - Agree DA – Disagree
SD - Strongly Disagree VSD – Very Strongly Disagree
19. Mobile Technology Methodology drawbacks. Please indicate the areas that would be a concern to your organisation. Please tick the appropriate box for each point, out of six choices, in the table provided.

P1) Training of employees with the new processes and applications

P2) Shifting the focus of the organisation to adopt the new technology and work flow

P3) Eliminating any processes which are redundant when using mobile technology

Legend -
VSA – Very Strongly Agree   SA – Strongly Agree
Ag   - Agree                DA – Disagree
SD   - Strongly Disagree    VSD – Very Strongly Disagree

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<td>P3</td>
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</tbody>
</table>

P4) Any Other, Please specify?

……………………………………………………………………….

20. Sociology Issues with regard to people when mobile technology is introduced. Please indicate the areas that would be considered important to your organisation. Please tick the appropriate box for each point, out of six choices, in the table provided.

P1) The pressure from customers and employees to adopt new processes

P2) Adoption of new processes by the competitors

P3) Ethical considerations of some processes with regards to privacy issues (eg. Calling customers Outside their regular business hours)

P4) Legal issues in using mobile devices in certain situations such as when driving etc.

P5) Legal issues in handling mobile applications such as pushing advertisements in certain locations etc.

Legend -
VSA – Very Strongly Agree   SA – Strongly Agree
Ag   - Agree                DA – Disagree
SD   - Strongly Disagree    VSD – Very Strongly Disagree
<table>
<thead>
<tr>
<th>Point Number</th>
<th>VSA</th>
<th>SA</th>
<th>Ag</th>
<th>DA</th>
<th>SD</th>
<th>VSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
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<td>P5</td>
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</tbody>
</table>

P6 ) Any Other, Please specify?

……………………………………………………………………………
5.0 Web Services

The Web Services are used in collaboration with the business processes of different organisations while adapting to new technology. The questions in this section refer to Web Services adaptation.

21. What do you consider as the major technological drawbacks in using Web Services. Please tick the appropriate box for each point, out of six choices, in the table provided.

P1) Issues with unfamiliarity with the concepts of the Web Services

P2) Limitations on Web Services

P2) New technology. How do we adapt and adopt it.

P4) Limitations with handheld devices

P5) How the collaboration process will take place

Legend -
VSA – Very Strongly Agree  SA – Strongly Agree
Ag – Agree  DA – Disagree
SD – Strongly Disagree  VSD – Very Strongly Disagree

<table>
<thead>
<tr>
<th>Point Number</th>
<th>VSA</th>
<th>SA</th>
<th>Ag</th>
<th>DA</th>
<th>SD</th>
<th>VSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
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<tr>
<td>P5</td>
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</tr>
</tbody>
</table>

22. What do you consider as the major methodological drawbacks in using Web Services. Please tick the appropriate box for each point, out of six choices, in the table provided.

P1) How the existing processes will be affected when Web Services are introduced

P2) Training of employees with the new processes and applications

P3) If the concept of competition will change to collaboration

P4) Shifting the focus of the organisation to adopt the new technology and work flow

P5) Change Management issues with the introduction of Web Services.

Legend -
VSA – Very Strongly Agree  SA – Strongly Agree
Ag – Agree  DA – Disagree
SD – Strongly Disagree  VSD – Very Strongly Disagree
23. What would be the Social issues with respect to introduction of Web Services. Please tick the appropriate box for each point, out of six choices, in the table provided.

P1) The pressure from customers and employees to adopt new way of trade

P2) How the competitors might react in such a scenario

P3) How could competitors be trusted if Web Services are use to collaborate with them

P4) What happens with the organisations we are already collaborating with (If they do not adapt Web Services)

P5) Legality of sharing the customer information with other organisations

Legend -
VSA – Very Strongly Agree    SA – Strongly Agree
Ag – Agree                  DA – Disagree
SD – Strongly Disagree      VSD – Very Strongly Disagree

<table>
<thead>
<tr>
<th>Point Number</th>
<th>VSA</th>
<th>SA</th>
<th>Ag</th>
<th>DA</th>
<th>SD</th>
<th>VSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
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<td>P4</td>
<td></td>
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</tr>
</tbody>
</table>

P6) Any other. Please specify.

............................................................................................................
24. Please specify any other process issues that are important to your organisation in regards to the Web Services but not included in the above questionnaire.

1. 
2. 
3. 
4. 
5. 

END OF QUESTIONNAIRE

The following *Optional* information may help in clarifications of the responses, if required by the research team.

<table>
<thead>
<tr>
<th>Name of your organisation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact person</td>
</tr>
<tr>
<td>Phone no.:</td>
</tr>
<tr>
<td>Email address:</td>
</tr>
<tr>
<td>Web:</td>
</tr>
</tbody>
</table>

*Address:*
School of Computing and IT, Parramatta Campus, University of Western Sydney
Locked Bag 1797, Penrith South DC NSW 1797, Australia
Attention: Dr. Bhuvan Unhelkar  
*Fax: +61-2-9685-9557*

Thank you for your time.
APPENDIX B: ETHICS COMMITTEE APPROVAL

15 November 2006

Abbass Ghanbary
93 Manorhouse BVD
Quakers Hill NSW 2763

Dear Abbass

Re: HREC 05/177 The Impacts of Mobile Technology on Organisation

This letter is to confirm you were noted as one of the chief investigators together with Dinesh Arunataleka on the above mentioned project which was approved on 25 November 2005.

You are advised that the Committee should be notified of any further change/s to the research methodology should there be any in the future. You will be required to provide a report on the ethical aspects of your project at the completion of this project. The form is located on the Research Services Ethics Web Page.

The Protocol Number HREC 05/177 should be quoted in all future correspondence about this project. Your approval will expire 31 March 2008. Please contact the Human Ethics Officer, Kay Buckley on tel: 02 47 360 883 if you require any further information.

The Committee wishes you well with your research.

Yours sincerely

[Signature]

Associate Professor Christine Hulse
Chairperson
UWS Human Research Ethics Committee
Cc Cc Dr Bhuvan Unhelkar
APPENDIX C: EVOLUTION OF THE INTERNET

August 1991
Tim Berners Lee officially introduced the Internet. He said that the aim of this technology is to link the scientific column. However the linking was introduced in prior years he combined this linkage with the Internet.

12 December 1991
The first server outside the Europe was introduced. The American scientists visited the Cern labroatouary in Geneva. The Slac server was equipped with Mr. Berner’s software.

26 November 1992:
The number of the servers for public use was increasing all around the world.

22 April 1993:
The Mosaic first browser for windows was launched. This program was giving the opportunity to ordinary people to browse the Internet.

30 April 1993:
It was announced that the using the Internet is free. Ordinary people would get the opportunity to use the facilities for free.

May 1993:
MIT published the first newspaper (The Tech) online.

June 1993
HTML was introduced.

November 1993:
The first Internet camera transmitted the first image on the internet. This camera was invented in Cambridge University.

February 1994:
The American students launched Yahoo.

April 1994:
BBC launched the first .net site for showing their TV programs.
13 October 1994:
Bill Clinton placed the white house site on the Internet.

25 October 1994:
The first advertisements were placed on the internet. These advertisements belonged to ATT Company and Zima soft drinks.

February 1995:
HK radio was the first 24 hours radio online.

1 July 1995:
Amazon.com started their operation on the Internet. The first internet book shop cadabra.com was already in operation. To day, they sell music instruments, electronic devices and even furniture.

August 1995:
18957 sites exist on the Internet.

9 August 1995:
The .com boom in New York financial markets.

24 August 1995:
Internet explorer was introduced in Win 95.

September 1995:
E-Bay the first auction online started their operation on the Internet. The first item was a laser targeting device sold for $1383.00. To day eBay is the biggest auction online.

15 December 1995:
Alta Vista as a first multi language search engine was introduced.

4 July 1996:
Hotmail launched the free email on American Independence Day.

August 1996:
342081 sites exist on the Internet.

May 1997:
The BBC used the Internet for their news in regards to 1997 election.
June 1997:
The Business.com domain was sold for $150000.00

1 March 1998:
Kozmo.com promised to deliver their sold item within an hour.

September 1998:
Google opened the first office in a house garage in California.

19 October 1998:
Open diary the first virtual community was introduced.

May 1999:
Shawn Fenning, a student in Boston developed the Napster. Napster was the first program for file transfer (Data Communication). Right after, the music companies sued the Napster.

19 August 1999:
The first version of MySpace for file transferring was launched.

November 1999:
Boo.com started their operation for selling the clothing items online.

January 2000:
The price on .com shares were in fact increasing.

7 February 2000:
8 important sites such as yahoo, CNN and Amazon were attacked by viruses.

August 2000:
More than 20 million sites exist on the Internet.

11 January 2001:
Jimmy Wales introduced wikipedia.

4 September 2001:
Google received an award for their web page order design.

22 November 2001:
Pop John Paul the second sent his first email from his laptop.

11 December 2002:
For the first time FBI placed the list of American most wanted online.
27 January 2004:
Amazon made profit for the first time.

5 February 2004:
The naked part of Janet Jackson breasts was placed on the Internet. Her name was placed on all search engines more than any other world.

July 2004:
Tim Berners Lee received the Sir title from the Queen of England.

19 August 2004:
Google shares were available for public to purchase. Very soon the shares jumped from $85 to $400.

9 November 2004:
Mozilla Firefox was launched.

October 2005:
More than 17 millions sites were added to the list of existing websites.

12 April 2006:
Google is offering more services by introducing the GU and GE sites.

2006:
Currently more than 92615362 sites exist on the Internet. 49 millions are belonging to American sites.

Close to 80% are .com sites.

7 millions are .net.

3 millions are .info.

Germany, Canada, England and China in order are coming after USA.
APPENDIX D: ADDITIONAL USE CASES

MAS VENUE SERVICES: Use Cases

The Use case demonstrates that MAS Venue Services can hire staff from the other security guard provider to finalise the required number of the staff for the specific venue when MAS is unable to supply staff.

<table>
<thead>
<tr>
<th>Use Case 1:</th>
<th>Requesting Staff (from other venues)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actors:</td>
<td>MAS, Collaborative Web Based System CWBS, Directory level 1 and Directory level 2</td>
</tr>
<tr>
<td>Description:</td>
<td>MAS submit a request form asking for staff from other venues. These venues might not be known to MAS.</td>
</tr>
<tr>
<td>Pre-Condition:</td>
<td>MAS is Using Web Services</td>
</tr>
<tr>
<td>Post-Condition:</td>
<td>MAS will receive a report that request is published ready to be consumed.</td>
</tr>
<tr>
<td>Type:</td>
<td>Very complex</td>
</tr>
</tbody>
</table>
| Normal Course of Events: | 1. CWBS accept the request and identify the member area (A1)  
2. Directory level 1 checks Directory level 2 to identify the party capable in handling the requests  
3. CWBS eliminates the options that are not meeting the environmental boundaries (geographical, budget, financial issues, etc.)  
4. CWBS follows eliminations of the capable parties who have received recent prior requests.  
5. CWBS process the MAS request and collaborate with selected members regarding request.  
6. CWBS flags the members involved in the process not to receive the next query.  
7. Process request (A2)  
8. CWBS prompts a message to MAS informing the |
outcome of the requested application
9. MAS roster the staff on Power force
10. Submit the roster to those members.

Alternate Course of Events:
A1: If the industry does not exist the CWBS prompt a message denying the request.
A2: If other industries should be involved in the request, the system will go through the process of locating them.

References

Use Case: Requesting Stuff from other Venues

The following Use case demonstrates the advertisement of MAS Venue Services for the provided services. MAS Venue Services publishes the performed services and people in need of these services consume them and can contact MAS Venue Services on the Web-based system.

Use Case 2: Advertise Performed Services

Actors: MAS, Collaborative Web Based System CWBS, Directory level 1 and Directory level 2

Description: MAS submit form advertising for the services performed by MAS.

Pre-Condition: MAS is Using Web Services

Post-Condition: MAS will receive a report that request is published ready to be consumed.

Type: Very complex

Normal Course of Events:
1. CWBS accept the request and identify the members in need of such services (A1)
2. Directory level 1 checks Directory level 2 to identify the party capable in handling the requests
3. CWBS eliminates the options that are not meeting the environmental boundaries (geographical, budget, financial issues, etc.)
4. CWBS process the MAS request and collaborate with
selected members in need of such a request.
5. CWBS prompts a message to MAS informing the outcome of the requested application.

Alternate Course of Events:
A1: If the industry does not exist the CWBS prompt a message denying the request.
A2: If other industries should be involved in the request, the system will go through the process of locating them.

References

Use Case: Advertised Performed Services by MAS Venue Services

The following Use case demonstrates the advertisement of MAS Venue Services as for recruitment on a monthly basis. The Operation Manager of MAS Venue Services place the guards with less worked roster on the inactive list at the end of the financial year based on the operational work such as disciplinary action, work availability and the guard’s general performance.

Use Case 3:
Job Advertisement and Recruitment

Actors: MAS, Collaborative Web Based System CCWBS, Directory level1 and Directory level 2

Description: MAS submit form informing that MAS recruit staff.

Pre-Condition: MAS is Using Web Services

Post-Condition: MAS will receive a report that request is published ready to be consumed.

Type: Very complex

Normal Course of Events:
1. CWBS accept the request and identify the members in need of such services (A1)
2. Directory level 1 checks Directory level 2 to identify the party capable in handling the requests
3. CWBS eliminates the options that are not meeting the
environmental boundaries (geographical, budget, financial issues, etc.)

4. CWBS process the MAS request and collaborate with selected members in need of such a request.
5. CWBS accept the resume of the interested people.
6. CWBS submit the resume to MAS.
7. Operation Manager will read the resume.
8. Inform CWBS of the result. (A2)
9. CWBS prompts a message to MAS informing the outcome of the requested application.

Alternate Course of Events:
A1: If the industry does not exist the CWBS prompt a message denying the request.
A2: If the resume is accepted books an appointment.

References

Use Case: Job Advertisement and Recruitment Online

PROTECT A: Use Cases

The following Use case demonstrates registration of Protect A in the proposed portal.

This Use case shows that by registering in the portal, Protect A can publish their products and services online.

<table>
<thead>
<tr>
<th>Use Case:</th>
<th>Registration of Prospective Member (Protect A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actors:</td>
<td>Member, Collaborative Web Based System (CWBS), Prospective member</td>
</tr>
<tr>
<td>Description:</td>
<td>Prospective Member is getting registered in the CWBS Please note that this is a generic use case. Different prospective members could come in to register.</td>
</tr>
<tr>
<td>Pre-Condition:</td>
<td>Prospective Member is using Web Services. Prospective Member is willing to work through the CWBS</td>
</tr>
</tbody>
</table>
Post-Condition: | Prospective Member is upgraded to a Member
---|---
Type: | Complex

| Normal Course of Events: | 1. Prospective Member connects to the CWBS and requests to register in the Directory level 1  
2. CWBS prompts the appropriate member registration form to the member  
3. Prospective Member enters his details in the registration form (A1)(A2)  
4. CWBS prompts that the registration form is to be submitted.  
5. Prospective Member submits the registration form  
6. CWBS registers Prospective member sending a unique registration number  
7. Member logs out of the CWBS. |

| Alternate Course of Events: | A1: Information entered is insufficient or incorrect. Prospective Member is asked to input correct member ID.  
A2: It is crucial for the Prospective member to fill all details specifically identifying the relevant industry |

| References |  
- A prospective member is Protect A  
- After the registration process Protect A is a member. |

Use Case: Registration in Proposed Collaborative Web Based System
The following Use case demonstrates how the Collaborative Web Based System (CWBS) register the Protect A in the portal and place the organisation within the right industry.

<table>
<thead>
<tr>
<th>Use Case:</th>
<th>Place the registration in the directory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actors:</td>
<td>Collaborative Web Based System(CWBS), Directory level 1, Directory level 2, Administrator</td>
</tr>
<tr>
<td>Description:</td>
<td>When the CWBS place the registered members in the right place in order to locate and consume them.</td>
</tr>
<tr>
<td>Pre-Condition:</td>
<td>Registration has taken place</td>
</tr>
<tr>
<td>Post-Condition:</td>
<td>Directories communicates with each other</td>
</tr>
<tr>
<td>Type:</td>
<td>Very complex</td>
</tr>
</tbody>
</table>

**Normal Course of Events:**
1. CWBS identifies the relevant member area from the registration form (A1)
2. Directory level 1 will receive an identification number from that specific member
3. CWBS Register the member details of the member in Directory level 2.
4. Member details are stored in the database.

**Alternate Course of Events:**
A1: If the industry does not exist in the Directory level 2 the CWBS will inform the administrator for further direction.

**References**
This is an automated use case. Only instance of human actor involvement will occur when the specified industry is not available in CWBS.

Use Case: Place the Registration in the Directory
The following Use case demonstrates how the **CWBS** publishes the products and services offered by Protect A. This publication enables other organisations to consume and contact Protect A if they need these services and products.

<table>
<thead>
<tr>
<th>Use Case:</th>
<th>Publish Product/Services</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actors:</strong></td>
<td>Protect A, Collaborative Web Based System CWBS, Directory level 1 and Directory level 2</td>
</tr>
<tr>
<td><strong>Description:</strong></td>
<td>Protect A publishes the consumable applications</td>
</tr>
<tr>
<td><strong>Pre-Condition:</strong></td>
<td>Protect A is Using Web Services</td>
</tr>
<tr>
<td><strong>Post-Condition:</strong></td>
<td>Protect A will receive a report that request is published ready to be consumed.</td>
</tr>
<tr>
<td><strong>Type:</strong></td>
<td>Very complex</td>
</tr>
</tbody>
</table>
| **Normal Course of Events:** | 1. CWBS accept the request and identify the members in need of such services (A1)  
2. Directory level 1 checks Directory level 2 to identify the party capable in handling the requests  
3. CWBS eliminates the options that are not meeting the environmental boundaries (geographical, budget, financial issues, etc.)  
4. CWBS process the Protect A request and collaborate with selected members in need of such a request.  
5. CWBS prompts a message to Protect A informing the outcome of the requested application. |
| **Alternate Course of Events:** | A1: If the industry does not exist the CWBS prompt a message denying the request.  
A2: If other industries should be involved in the request, the system will go through the process of locating them. |

**References**

Use Case: Publish the Product/Services Offered By Protect A
PROTECT B: Use Cases

The following Use case demonstrates the registration of Protect B on the CWBS enabling the organisation to become part of the proposed collaborative environment.

<table>
<thead>
<tr>
<th>Use Case:</th>
<th>Registration of Prospective Member (Protect B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actors:</td>
<td>Member, Collaborative Web Based System (CWBS), Prospective member</td>
</tr>
<tr>
<td>Description:</td>
<td>Prospective Member is getting registered in the CWBS Please note that this is a generic use case. Different prospective members could come in to register.</td>
</tr>
<tr>
<td>Pre-Condition:</td>
<td>Prospective Member is using Web Services. Prospective Member is willing to work through the CWBS</td>
</tr>
<tr>
<td>Post-Condition:</td>
<td>Prospective Member is upgraded to a Member</td>
</tr>
<tr>
<td>Type:</td>
<td>Complex</td>
</tr>
</tbody>
</table>
| Normal Course of Events: | 1. Prospective Member connects to the CWBS and requests to register in the Directory level 1  
  2. CWBS prompts the appropriate member registration form to the member  
  3. Prospective Member enters his details in the registration form (A1)(A2)  
  4. CWBS prompts that the registration form is to be submitted.  
  5. Prospective Member submits the registration form  
  6. CWBS registers Prospective member sending a unique registration number  
  7. Member logs out of the CWBS. |
| Alternate Course of Events: | A1: Information entered is insufficient or incorrect. Prospective Member is asked to input correct member ID.  
  A2: It is crucial for the Prospective member to fill all details specifically identifying the relevant industry |
| References:          | • A prospective member is Protect B |
Use Case: Registration in Proposed Collaborative Web Based System

<table>
<thead>
<tr>
<th>Use Case:</th>
<th>Place the registration in the directory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actors:</td>
<td>Collaborative Web Based System(CWBS), Directory level 1, Directory level 2, Administrator</td>
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<tr>
<td>Description:</td>
<td>When the CWBS place the registered members in the right place in order to locate and consume them.</td>
</tr>
<tr>
<td>Pre-Condition:</td>
<td>Registration has taken place</td>
</tr>
<tr>
<td>Post-Condition:</td>
<td>Directories communicates with each other</td>
</tr>
<tr>
<td>Type:</td>
<td>Very complex</td>
</tr>
</tbody>
</table>

**Normal Course of Events:**
1. CWBS identifies the relevant member area from the registration form (A1)
2. Directory level 1 will receive an identification number from that specific member
3. CWBS Register the member details of the member in Directory level 2.
4. Member details are stored in the database.

**Alternate Course of Events:**
A1: If the industry does not exist in the Directory level 2 the CWBS will inform the administrator for further direction.

**References**
This is an automated use case. Only instance of human actor involvement will occur when the specified industry is not available in CWBS.
The following Use case demonstrates the publication of the request when the organisation (Protect B) is in need of specific trade’s people within specific geographical boundary.

<table>
<thead>
<tr>
<th>Use Case:</th>
<th>Publish Request</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actors:</td>
<td>Protect B, Collaborative Web Based System CWBS, Directory level 1 and Directory level 2</td>
</tr>
<tr>
<td>Description:</td>
<td>Protect B publishes the consumable application</td>
</tr>
<tr>
<td>Pre-Condition:</td>
<td>Protect B is Using Web Services</td>
</tr>
<tr>
<td>Post-Condition:</td>
<td>Protect B will receive a report that request is published ready to be consumed.</td>
</tr>
<tr>
<td>Type:</td>
<td>Very complex</td>
</tr>
</tbody>
</table>
| Normal Course of Events: | 1. CWBS accept the request and identify the members in need of such services (A1)  
2. Directory level 1 checks Directory level 2 to identify the party capable in handling the requests  
3. CWBS eliminates the options that are not meeting the environmental boundaries (geographical, budget, financial issues, etc.)  
4. CWBS process the Protect B request and collaborate with selected members in need of such a request.  
5. CWBS prompts a message to Protect B informing the outcome of the requested application. |
| Alternate Course of Events: | A1: If the industry does not exist the CWBS prompt a message denying the request.  
A2: If other industries should be involved in the request, the system will go through the process of locating them. |

References

Use Case: Publish the Service Required by Protect B
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<table>
<thead>
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</tr>
</thead>
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</tr>
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</tr>
<tr>
<td>Australian Bureau Of Statistics (ABS) · 269</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>B2B · 4</td>
</tr>
<tr>
<td>Business · 9, 23, 29, 30, 90, 91, 153, 154, 221, 323</td>
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