International Standards in the IT Marketplace: How to bridge the gap and face the threats

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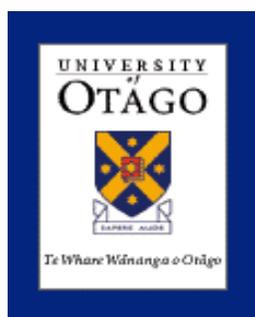
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Standards development and adoption play a crucial role in shaping competition in the IT industry. In addition to the traditional, formal standards development organisations (SDOs), many private consortia bodies are formed and are seen to produce standards that are more competitive. International SDOs are well-respected because of the legitimacy of the standards that they develop. However, given the rapid nature of IT and the demands for standards to be set and released in pace with the industry rapidity, the traditional approach of standard development have been criticised over the years for being slow and bureaucratic and organisational reforms have been called for. Some believe that international standards are at the crossroads.

This study examines the position of international standards against consortia standards. It aims to bring a perspective in which informal standards are seen as a complement to formal international standards, not a competitor. This paper contributes to the literature by combining the perspectives of different authors on both international and consortia standards. It is an exploratory research study that looks at the standardisation phenomena and the confrontation between 'traditional' and consortia standard-setting approaches from two perspectives: on one hand it analyses the nature of each standardisation approach, and on the other hand it examines the adoption of standards in the market and its trends. This paper is based largely on a comparative, critical survey of papers written about both international and consortia standardisation. Initial findings were validated and supplemented with insight gathered through personal interviews with people who encountered standards in their work experience. The findings from the literature illustrate an unbalanced portrayal in the way the tension between international standards and consortia standards is perceived. Findings lead to the conclusion that international standards will always have a role to play and should co-exist with consortia standards without losing their significance.

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PREFACE

In the course of writing this dissertation paper, I have received great support from Professor Martin Purvis who helped me shape my research problem. I also thank my supervisor Associate Professor Hank Wolfe who was always willing to provide me with insights and motivated me to organise my work. Others to whom I would like to express my gratitude are: Associate Professor Stephen Cranefield and Mr Tony Bastin Roy Savarimuthu for the advice they gave me along the way. I am grateful to those who participated in the interviews. In particular, I would like to thank Mr Mariusz Nowostawski, the research fellow in the University of Otago, for his unconditional willingness to participate in the interview and for his valuable insights. My thanks also go to Heather Harris, the secretary in the Information Science Department, for helping me send interview requests to the department staff.

I am also thankful to all the writers and others who approached this subject before I did, and whose research supplied me with information and ideas. Last, but not least, I am grateful to my family and friends for their love and support.

Dunedin, 13 October 2006

1.0   INTRODUCTION

Standards have become very important in every industry because they influence and shape the competition scene amongst standards. Standards in the field of information technology (IT) – the focus of this paper – in general and software engineering in particular are even more important because of the crucial role they play in managing technology, producing software effectively and efficiently, and ensuring interoperability. However, the rapidly-changing nature of the IT industry imposes challenges on the area of standardisation in respect to both standards development and adoption. For IT, standards are expected to endure for a long time and be able to preserve their position in the market. To be able to keep up with the rapid change, standards are supposed to be developed quickly, however this might deteriorate the quality of the standards developed and released to the marketplace.

Standards are developed by various regional, national and international organisations, of which Standard Developing Organisations, also known as SDOs, are main entities. International SDOs perform activities to produce standards that are recognised in the industry internationally. These bodies are well-respected and apply a formal, traditional approach to standard setting. However, given the rapid nature of IT and the demands for standards to be set and released in pace with the industry rapidity, the traditional approach of standard development has been criticised over the years for being slow and bureaucratic so organisational reforms have been called for.

On the other hand, relatively new approaches have emerged in the standardisation arena, namely the consortia. The consortia standard setting entities and approaches have been considered as competitors for formal SDOs, putting them under

threat. The consortia movement is even considered as a major source of competitive fragmentation (van Wegberg, 2004).

Within the literature of standardisation in the IT and software engineering domain, there are studies that are apposed to the consortia movement, while others consider consortia as the way to go and predict that international standards will lose their significance. This is a very debatable topic, with a variety of perspectives.

This paper contributes to the literature on the development of IT industry standards with an exploratory research study that looks at the standardisation phenomena and the confrontation between 'traditional' and consortia standard-setting approaches from two perspectives: on one hand it analyses the nature of each standardisation approach, and on the other hand it examines the adoption of standards in the market and its trends. This paper contributes to filling the gap among studies that analyse international standardisation processes from different perspectives, whether for or against.

This paper is based largely on a comparative, critical survey of papers written about both international and consortia standardisation. Initial findings were validated and supplemented with insight gathered through personal interviews with people who have encountered standards in their work experience.

1.1   STRUCTURE OF THE REPORT

The structure of the report is as follows. In Part 1, research related details are presented to give an overview of the research questions, objectives, and the research limitations. In Part 2 the research methodology is described in detail. For the reader who is less familiar with the issue in hand, Part 3 provides general information about standards and standardisation. Part 4 describes the research conceptual framework on which the literature review was based. Part 5 presents a critical literature review. A

discussion and a summary of the literature review are in Part 6. The initial conclusions are outlined in Part 7. Part 8 includes the findings from the interviews that were conducted. Finally, in Part 9 general conclusions are drawn and recommendations are made. Interview-related materials are listed in Appendix A.

1.2   STATEMENT OF THE PROBLEM

The formal international standards system is facing a rapidly-changing, competitive marketplace. Because of the fast-moving nature of the IT industry, and the tendency toward adopting open, less rigid standards, international standards might not be able to keep pace with the market, some say. The problem to be addressed here is to find out whether the international approach to standardisation can meet the IT market demand for standards adequately and preserve its significance. A perspective is to be established on how the 'tension' between international and consortia standards should be portrayed. In other words, the questions are: Will international standards lose their ground in the IT industry? Can they preserve a long-term competitive advantage in the market without sacrificing their current strengths?

1.3   PURPOSE OF THE STUDY

The study aims to look at the process of developing formal standards and enforcing them by looking at what other standardisation approaches, particularly consortium standardisation, offer. By doing so, this study will present a perspective concerned with the current position of international standards and what it is ought to be like in the future to preserve the interests of the majority in the IT industry.

This study will also combine the knowledge on various facets of standardisation. A reviewer of the papers written about standardisation will notice how discrete the

available literature is. This paper is aimed at presenting a resource that comprehensively covers the issue of international standardisation versus consortium standardisation as an example of an informal approach. It establishes a view on the subject of the ongoing, dynamic push and pull tension between these approaches.

1.4   RESEARCH QUESTIONS AND HYPOTHESES

The following questions will be addressed: What is the state of international standards? What is the potential of consortium standardisation? How do different standardisation approaches compete? What are the threats facing formal international standards? Why do some organisations adopt informal standards instead of formal standards? Are informal standards likely to take over formal standards?

The main standardisation organisations in the IT industry are the International Organisation for Standardisation (ISO), the International Electrotechnical Commission (IEC), and the International Telecommunications Union (ITU). The process by which standards are developed by these organisations have been criticised for being slow, inefficient and costly. Relatively better standardisation practices exist in the market and are being successfully implemented by some other organisations. This research will address the threats imposed on international SDOs by other standards such as consortia standards. From a commercial point of view, standards that offer the potential to meet the industry needs are not only those that are approved by a standardisation organisation. The potential of a standard lies in how it interacts and reacts to the dynamics of the market.

There is no doubt that information technology (IT) standards that are developed by international standardisation organisations have improved the process of exchanging information and combining technologies. They have also helped to maintain quality and spread technology. However, in every market, opportunities are the gateway for gaining

competitive advantage. In a market that is moving toward agile development methods, SDOs are expected to do a good job when it comes to producing timely standards.

Take for example the standard-making process in the IEEE, another major standardisation organisation. Drafts for proposed IEEE standards should be written by working groups and presented to the IEEE Standards Board which is supported by a technical committee or a standards subcommittee. For a standard to be recommended to the Standards Board for adoption, it must first pass a sponsors' consensus ballot. In addition to that, the formal process of standardising includes comments suggesting changes from participating voters. Responses and unresolved negative comments get circulated by mail to all voters. The working group then holds meetings, supplemented by extensive network discussions and subcommittee meetings.

This process can take a long time from months to years. This is clearly an evidence of the slowness and ineffectiveness of the standards development process. However, formal SDOs do provide few benefits, such as legitimacy and trustworthiness. This paper argues that the international standardisation process should not be considered as being threatened by informal standardisation approaches because they will always have a role to play in the IT industry.

1.5   LIMITATIONS OF THE STUDY

The present study has specific limitations that need to be taken into consideration when evaluating the study and its contributions. This research has focused on a field that is very complex and extensive, i.e. the standardisation process. Clearly, this represents a challenging task for an inexpert researcher with limited personal experience with standards and limited access to the expertise of standardisation specialists. The selection of literature review as the basis for drawing initial conclusions naturally limits the scope of research and the results obtained. The chosen research

papers can also be seen to include certain limitations in the sense that they were written at distant points in time.

Another limitation in this study is the way the theories are analysed and compared in this study. I have strongly argued that this research contributes to the literature. The academic basis of this study can be considered to be fragmented as it includes such a wide variety of different perspectives. However, the purpose of following this kind of strategy in this study has been to include the major perspectives to examine them together and try to integrate them when possible.

1.6   DEFINITIONS AND TERMS

In this article, all terms and concepts are meant within the context of IT. Terms will be defined within the main content of this paper.

In summary, this research aims to examine the state of international standards as it is facing a strong competition from informal standards. The following section describes the research methodology in detail.

2.0   METHOD

This section describes the course of each step in the methodology used to carry out this research study. An explorative, qualitative approach was applied.

The major phases in the research were:
- Phase 1: Extensive literature review
- Phase 2: Critical assessment of literature review
- Phase 3: Interviews
- Phase 4: Analysis of data and conclusions evaluation

Details on the course of these steps are described in the following subsections.

2.1   EXTENSIVE LITERATURE REVIEW

Due to the nature and extent of this study, the survey of literature was identified as a critical component of this research project. The extensive literature review was expected to result in the following:

1. Building a well-established understanding of standards and standardisation.
2. Identifying and evaluating the issues related to standardisation in general and international standardisation specifically.
3. Determining the search strategy (data sources and their search terms), then perform the search for relevant studies.
4. Performing an initial selection of studies from all search results, based on information in titles and abstracts.

5. Investigating how past researchers approached subjects related to standardisation.
6. Developing a conceptual research framework to be followed.
7. Designing possible interview questions.

It was very important at this stage that there was an emphasis on recent literature because standards exist in a fast-moving research area. However, old literature was not to be ignored.

2.2   CRITICAL ASSESSMENT OF LITERATURE REVIEW

After the key issues and concepts were identified in the first phase, the second phase proceeded to compare and contrast different theories and evaluate the strengths of different views. This formed a critical opinion about the vast array of perspectives introduced by different authors. The outcome of the critical literature review phase served to come up with initial conclusions in answer for the research questions. This phase also aimed at filling in the gap in the available literature. Findings also served to fine-tune the interview questions. The main objective was, in short, to develop a perspective that can be assessed in the interviews phase.

2.3   INTERVIEWS

Interviews were to be arranged with staff members working in the Information Science Department and the Computer Science Department in the University of Otago. The interviews were targeted at those who had previously worked for IT companies and encountered standards. The aim of the interviews was to confirm or correct the initial conclusions drawn after the critical literature review phase. That is, the outcomes of the interviews were used as the basis for strengthening or refuting the initial conclusions.

Appendix A.1 includes the interview questions.

Appendix A.2 shows how the interview questions correspond to the research questions.

2.4   ANALYSIS OF DATA AND CONCLUSIONS EVALUATION

After the interviews were completed, the results of the interviews were analysed and used to validate the initial conclusions. Final conclusions were made afterward.

3.0   GENERAL INFORMATION ON STANDARDS AND STANDARDISATION

For the reader who is less familiar with the issue in hand, this section introduces the field of standardisation and standards in the context of Information Technology (IT). Basic terms are also defined here.

3.1   DEFINITION OF STANDARDS

Standards are produced by different organisations and are applied in different contexts. A standard is defined as:

> a document approved by a recognised body, that provides, for common and repeated use, rules, guidelines, or characteristics for products or related processes and production methods, with which compliance is not mandatory. Such term may also include or deal exclusively with terminology, symbols, packaging, marking, or labelling requirements as they apply to a product, process, or production method (Trade Agreement Act of 1979, U.S. Code, Title 19, sec. 2571., Definitions).

A standard is something that is known to form a basis for assessment and comparison. This research paper is particularly concerned with standards for quality, products, and processes in the field of information technology and software engineering. The definition mentioned above is not quite right when defining software engineering standards. There are many IT standards that are published without the approval of

formal standards development bodies. Some IT and software engineering standards are home-developed, some are produced by profit-seeking companies that develop standards and market them to other companies; others are developed by the government and formal standards organisations. Therefore, the term standard in this paper refers to both formal and informal standards.

In a software engineering division of a company, standards are applied on processes, roles, documents, management structures and tools. Pfleeger, Fenton and Page (1994) compared software engineering standards with standards from other engineering disciplines and concluded that software engineering standards are heavy on process and light on product, whereas other engineering standards focus less on the process and concentrate on evaluating the final product. Pfleeger et al. pointed out another difference between software engineering standards and those of other engineering disciplines in the method used to assess compliance. Other engineering disciplines insist that the final product complies with the standard and that they include a description of the method of compliance assessment, while software engineering standards do not.

The process by which standards are developed is called standardisation. The term standardisation, as defined by Hanseth, Monteiro & Hatling (1996), refers to the social and technical process aimed at developing the standards which control the communicative patterns. In the context of this research, standardisation denotes the activities of developing IT standards whether by formal bodies or informal consortia organisations.

3.2   THE ROLE AND IMPORTANCE OF IT STANDARDS

Standards and standardisation absolutely have a crucial role to play in the IT industry. The character of the information infrastructure, being complex, geographically spread and highly inter-connected stimulates the need for standardisation (et al., 1996). There

is a common belief that standards are the only enabler to achieving interoperability which leads to a ubiquitous information infrastructure and empower economy (Aiken & Cavallini, 1994). Standards help to spread technology and facilitate communication among different participants in the IT industry. Standards are not only a key to increased growth in the IT industry, but also influence the growth of other industries (Hurd & Isaak, 2005). Moreover, given the current movement toward globalisation and free trade, standards are not considered a luxury but a necessity.

3.3   THE TYPES OF IT STANDARDS

It is worthwhile to present the definitions of different sorts of standards to set apart the different categories of standards in a way that will enhance the reader's comprehension of the structure and content of this paper.

Standards are the results of either official activities by authorised organisations (de jure standards) or the result of exercising power without being officially established (de facto standards). Standards can be categorised based on different aspects. A good, typical categorisation of standards that suits the content of this paper is based on the processes whereby they emerge. This section describes the classification of standards according to the organisations by which they are developed and how they are positioned in the market.

3.3.1 International standards

An international standard is a standard that is approved by an international body. For the purposes of this paper, international standards are those published by the following entities:

       a. The International Organisation for Standardisation (ISO),

       b. The International Electrotechnical Commission (IEC).

c. The Institute of Electrical and Electronics Engineers (IEEE)

d. Other international bodies that have similar standing to that of ISO/IEC; such as CIE, IWTO and ITU. rival

Official standards development organisations (SDOs) have the most centralised coalition structure and are called grand coalitions (van Wegberg, 2004).

3.3.2 Government standards/de jure

These are standards that are imposed by law.

3.3.3 De facto standards

De facto standards are used widely without being approved by formal standardisation organisations and have been taking over the market.

3.3.4 Consortia standards

These are standards that power successful areas of technology such as the Internet, the World Wide Web, e-Commerce, and the developing wireless revolution. Such standards are created outside formal international standardisation bodies, especially in consortia (Cargill, 2001). It can be widely observed that, in the field of information technology, there has been a tendency toward adopting less rigid approaches to standardisation such as consortium standardisation. Consortium standards are also referred to as market-driven standards because of their perceived relevance to the market (Egyedi, 2001).

It seems like there is no conventional definition available for the term "Consortia standards" yet. However, in the context of this research a consortium can be defined as:

an informal alliance of firms, organisations, and (sometimes) individuals that is financed by membership fees for purpose of co-ordinating technological and market development activities (Hawkins, 1999).

In IT, the Object Management Group (OMG), founded by eight companies in 1989 to develop software specifications, is considered as the biggest consortium (Werle, 2001).

In most recent literature on the subject of standardisation, there has been a talk about how consortium standards might take over the standards developed by accredited standardisation organisations. In consortiums, participants do not need to have lengthy discussions and go through a due process to decide on a standard because, in most cases, those who are involved in a consortium have similar interests. Another crucial difference is that while standards are considered as the final product of the SDO, the consortia objectives go beyond standards-setting. The consortia's further aim is to coordinate technology within the marketplace and create business communities (Hawkins, 1999).

3.4 STANDARDS DEVELOPERS

Standards are developed by many organisations and bodies, with different structural features, in different manners. This section provides a general categorisation of the organisations involved in standards development in a way that serves the content of this paper.

3.4.1 International standards organisations

International standards organisations produce standards that are used worldwide. They follow a democratic procedure in standard setting in way that aims at maintaining a standards process which is technically and politically neutral (Egyedi, 2003).

3.4.2 Private sector organisations

There are some non-government agencies that develop standards. Consortia and fora fall under this category.

4.0   CONCEPTUAL RESEARCH FRAMEWORK

A conceptual framework, as presented in Figure 1, was developed to establish a vision and organise the research efforts effectively so that they are focused on the major elements that shape the research problem in hand. The framework was derived from the extensive literature review phase. This section describes the conceptual framework and how the critical literature review is structured based on it.
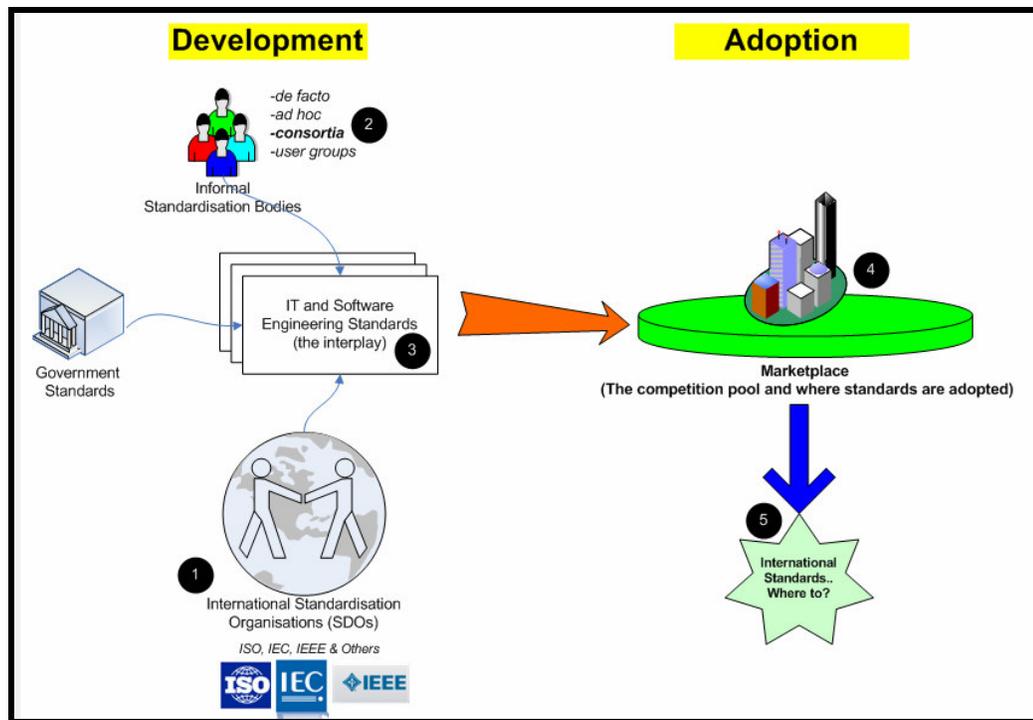

Figure 1: The research conceptual framework

The research focus is on formal international IT standards and how they are seen to be threatened by informal standards. The conceptual framework designed for this research asserts that one must consider the interplay between the two approaches to

standardisation. It also takes into account both the standards development phase and the market adoption phase. An examination of Figure 1 shows that there are five aspects that have been identified as particularly important in shaping the research problem: (1) the development of international standards, (2) the consortia movement, (3) the comparison between international standards and consortia standards when put side by side, (4) the adoption of standards in the marketplace, and (5) the future of international standards. The critical literature review is divided to five areas based on these five identified aspects.

5.0   LITERATURE REVIEW

Reading the literature on standards is like looking at a mosaic where there are so many diverse pieces that make the big picture. Nearly, each paper or research related to IT standardisation had its own perspective, justifications and approach to studying the phenomenon making it a tricky task to decide on the best categorisation for the available literature.

This literature review follows the research framework described earlier to identify the main sections. It will include five main areas: (a) the development of international standards, (b) the consortia movement, (c) the conflict between the two approaches, (d) the factors affecting the adoption of standards, and (e) some issues related to the possible future of international standards.

5.1   DEVELOPING INTERNATIONAL STANDARDS

International standards are those that get recognised and adopted for use internationally. Many research papers have been written to investigate how IT and software engineering standards are developed and implemented. This part of the literature review presents the perspectives of different authors on the process of standards development and asks if the slow process is costly rather than beneficial.

By presenting and discussing the way different authors have viewed the process of developing international standards and their functioning in the IT industry, one can form a general but comprehensive view of the benefits and deficits of the formal international standardisation system.

A basic literature review of the past papers written on international standards development will quickly reveal to the reader that during the 1990s, international standards development organisations (SDOs) were being heavily criticised for being slow and bureaucratic. From then onwards, ISO and other standards developers realised the need for speed and have carried out several reforms to improve the process of standard development.

The majority of articles criticising the slowness of the formal standards development process call for organisation reforms. However, advocates of the formalised procedure of international standardisation argue that the reason why it is slow is that it aims at producing complete, well-designed standards.

Lehr (1992) is one of the few authors who defended the time-consuming, bureaucratic process and focused on its benefits. His article, titled "Standardisation: Understanding the Process", delves into the reasons why the formal approach to

standard setting is slow and interprets them as an efficient response to the problems created by industry standardisation. It offers an analysis for the process based on political economy theories. The main arguments in the article are that:

1. The mechanism used to select standards has more importance if we realise the importance of reconciling conflicting preferences. This helps to ensure that the selected standards serve the interest of the industry as a whole instead of individual firms.
2. In the absence of standards development organisations, competition determines which technologies and practices are adopted as standards. Therefore, big firms with large installed bases are more expected to win in these de facto standards competitions.
3. The formal structure of standards development protects the interests of both incumbents and entrants.
4. The features that make the standard development process slow, reduces the likelihood of a strategic minority successfully capturing the standardisation process.
5. The slow process establishes a lower limit on the inefficiency of potential standard outcomes.
6. The slow process gives time for threatened firms to organise their opposition. This is especially true for large firms which are less able to respond flexibly to sudden changes.
7. The industry standardisation is ironic because the fast nature of technical change increases the social costs from both delay and adopting the wrong standards.

It is true that the process of standard development is slow and that is due to the need to achieve consensus amongst all the participants. On the whole, Lehr's (1992) attempt to justify the slow pace of standards development in the perception of economics is rational and well-presented by cost-benefit analysis. However, it is not enough to justify the slowness of the standardisation process and overlook market needs and the drawbacks of the slow process or how the process can be improved. It is indeed true that the formal standard setting process has it strengths that should not be

sacrificed in the name of reforms. Yet, it should be speeded up and improved continuously so that it can serve the interest of the industry and the society which need standards that are high-quality and can keep up with the pace of the information technology.

It can also be argued that the slow, rigid process adopted by formal standard setting bodies does not necessarily always guarantee that the standards produced will be the best, most suitable standards to be released to the information technology market. One of the main benefits sought from IT standards is compatibility and interoperability. Both compatibility and interoperability allow different service and products to work well together. Although the slowness in the formal standardisation process is to ensure efficiency and compatibility as argued by Lehr (1992), politics might get involved in the process when some members are committed to certain de facto standards and try to influence the decision made by the standard setting body so that the agreed-upon standard comply with their current practices. Participants who have a strong position in the market will attempt to impose the standard that serves their interest even if it is not the best to ensure interoperability. For example, a technology sponsor that supports a particular specification for a standard may attempt to strongly influence the decision of a SDO by participating in its activities vigorously (van Wegberg, 2004). Heywood, Jander, Roberts and Saunders (1997, as cited in van Wegberg, 2004) showed in a study that big IT companies intentionally employ people who have a great experience with standard-setting and are recognised for having influence on the decision making process in official SDOs. They then send them to the meetings of official organisations to actively influence the decision making. According to Heywood et al. (1997, as cited in van Wegberg, 2004), they even try to have some bearing on who leads the standardisation workgroup.

Another perspective that implies that formal standards are not always the best standards released to the market comes from Zaninotto (1998) who surveyed some of the problems in standard setting and adoption in a society characterised by flexible economics. He contends that, in many cases, the design of the standard does not matter as much as just having a rough set of common items that can be tested, improved, or

adopted to growing needs. He supports his belief by considering the case of the standards for Open system Interconnection (OSI) which were designed over the years by the International Standardisation Organisation (ISO) to provide a set of standards to deal with all important aspects of open interconnection. Despite all the efforts, OSI standards were outdated by the de facto standards that were designed for Internet by less formal bodies using less rigid procedures and rapid implementations.

However, given the fact that traditional SDOs have a worthwhile function in the standardisation area and strengths that should not be sacrificed, the position of international SDOs should be preserved and utilised. The openness of formal SDOs is an attribute that should be made the most of. Hawkins (1999) suggested that re-orienting the SDO business model towards public information services would have positive results on technical co-ordination activities between formal and informal standardisation bodies. The integrity of formal bodies will give credibility to the knowledge available on coordination activities. He believes that this will shift costs from being spent on intra-organisational procedures to intra-organisational coordination efforts which is of a greater value to many organisations.

The previous section has showed that there has been a historical need to make the international standardisation process faster and more flexible in order to accommodate the rapid change in the IT industry. However, the formal procedures adopted by international SDOs have their strengths and social and economical benefits. Yet, in some situations, they may not be able to provide standards on time nor as needed although they are deemed to satisfy the needs of users in general and better serve their interests.

5.2   THE CONSORTIA MOVEMENT

IT and software engineering standards are being developed by organisations other than those that are internationally and formally recognised and many of them have dominated the market. For example, Adobe's Portable Document Format (PDF), the Internet standards developed by the Internet Engineering Task Force (IETF), and the Extensible Markup Language (XML) standards developed by the World Wide Web Consortium (W3C) are all consortium standards that have been widely adopted.

The performance of international standards cannot be fully and thoroughly understood and analysed without also looking at the other standards available in the marketplace. Consortia standardisation is regarded by many as an adjunct or alternative to formal international standardisation (Hawkins, 1999). This section deals with consortia standards which represent the opposite sort of standards to international standards. It precisely tries to focus on how different authors answered the following questions:

> What do consortia standards offer that international standards do not?
> How are consortia standards finding their way to the market?
> Are there any shortfalls for consortia standards? If so, what are they?

In the field of information technology, there has been a tendency toward adopting less rigid approaches to standardisation and that is what consortium standardisation provides. The number and types of consortia have been growing tremendously in the United States (Calderini & Giannaccari, 2006).

Hawkins (1999) attempted to examine some of the policy issues caused by the consortia movement. While doing so, he examines the origins and structures of consortia and critically looks at the advantages of consortia. He states that there is no proof to support the claim that the reduced "time-to-market" credited to consortia minimises cost. Moreover, according to Hawkins (1999), releasing standards to the market quickly is not necessarily a good thing in all instances. Rather, it depends on the potential users and

the readiness of the marketplace (Hawkins, 1999). He raises an interesting point when it comes to the common assumption that consortia achieve consensus more quickly than formal SDOs. He states that there are only a few clear reasons to believe that and when consensus agreement comes quickly, it may be a sign of only a partial consensus among the key players rather than a sign of all interests being taken into account.

However, Hawkins (1999) demonstrated that consortia satisfy the complex needs of the market when "efficiency" is not the ultimate goal of creating standards. He also implied that consortia standards target a niche in the market which can be better served by them than SDOs. That is the market of new products and services because consortia are more positioned to take commercial as well as technological directions.

Consortia standards do have a future. As pointed out by Hawkins (1999), consortia have the potential for creating internationally major bodies that are led by user interests such as aerospace, the financial sector, the media or the defence.

On the other hand, some see consortia as a problem. It has been criticised over years for its lack of democratic procedures. Egyedi (2003) examined this claim closely and attempted to redefine the standards consortium problem by analysing in-depth case studies of consortium standardisation, namely, Java in ECMA and the Extensible Markup Language (XML) in the World Wide Web Consortium (W3C). His conclusion is that the openness offered by industry consortia is undervalued and the formality and democracy in international standardisation procedures are overestimated. He supports his conclusions by presenting the findings from the case studies which show that consortia have settings that are similar to formal standardisation approaches. Both try hard to achieve consensus and take into consideration the needs of the minority. Difficulties arising in coming to consensus decisions tend to grow as the range of involved interests increases (Hawkins, 1999). Egyedi (2003) also claims that the role of consortia is marginalised because of how 'democracy' is defined in the context of standardisation and how democratic processes are imposed as a criterion for accepting standards.

In an older extensive study conducted by Egyedi (2001), he aimed at illustrating why consortium standardisation is sometimes more preferred than international standards. He found out that companies found consortia appealing because they provide well-timed standards that practically tackle the needs of the users. In addition to that, he states that the homogeneity and exclusiveness of consortium standardisation are things that are beneficial to some IT companies.

This section has shown that there is a general feeling that consortia standards are more effective than formal traditional standards. Yet, they are considered by many to be undemocratic because they only reflect the needs of certain groups within the IT industry.

5.3   IN BETWEEN INTERNATIONAL STANDARDS AND CONSORTIA STANDARDS

From the previous two sections, it was clear that the traditional approach in international standardisation is centralised and slow, while the consortia movement provides flexibility and is fast. This section inspects how different authors perceived the relationship between international standards and consortia standards. It simply attempts to answer the following question:

What is it like between formal international standards and informal consortia standards? Is it a case of competition or collaboration?

Any decision making process is heavily influenced by the number of participants involved. The more participants there are, the more the preferences are going to be wide-ranging which leads to disagreement. In a collective decision making process like standardisation, different levels of co-ordination are needed based on technological balance and connectivity between participants (asymmetrical or symmetrical interests) (NO-REST, 2004). The many participants involved in grand coalitions slow down the

process and results in politicking (van Wegberg, 2004). On the other hand, according to van Wegberg (2004), participants in consortia and fora are moved by competition which compels them to speed up the process of decision making. Consortiums do not allow for open membership which makes the process more controllable than it is in international SDOs (van Wegberg, 2004).

However, van Wegberg (2004) suggests caution with respect to regarding the correlation between formal international SDOs and consortia as a trade-off when claiming that "while formal international standardisation takes a long time to ensure compatibility, informal consortium standardisation is faster but with a lower level of compatibility achieved". van Wegberg (2004) points out that compatibility is not always guaranteed in a grand coalition because of political compromises. The need for political deals between the members involved in the process may result in producing standards that fail to be the de facto standard of the market (van Wegberg, 2004). He also stated that in formal SDOs, there is sometimes a tendency toward applying "hybrid standardisation[1]" which reduces the incompatibility of the produced standards.

The driving forces of each standardisation mechanism are different. There is a common belief that consortia standards are more 'market-driven' than international standards. Hawkins (1999) pointed out that user participation is obvious in a few major consortia more than in SDOs. However, the consortia movement is still greatly driven by suppliers (Hawkins, 1999).

Many claim that consortia are taking over international SDOs. Yet, Hawkins (1999) points out that there is no indication that firms switch standardisation resources from SDO committees to consortia. More accurately, the increase in net expenditure on SDO, consortia and other activities occur across the board (Hawkins, 1999). This indicates that formal international SDOs are still performing a task in the IT industry. Hawkins (1999) explicitly distinguished between the different circumstances in which

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[1] Hybrid standardisation is a standardisation process that integrates private market-driven standardisation and ex-ante standardisation (Glimstedt, 2000).

standards are needed. He noted that officially recognised standards are needed by implementers when the standards are associated with high risk markets where there are concerns about being "locked-in" to proprietary standards at an early stage. Some proprietary standards lock in the users and limit their usage of applications. Adopting such standards by international SDOs can be of great benefit to the end-users. In May 2006, the International Standards Organisation accepted the OpenDocument format (ODF) as an international standard for saving and exchanging digital office documents (Weiss, 2006). This allows individuals and businesses to better share documents with others with more interoperability without having to be fastened to proprietary business applications. While IBM announced to add support for ODF in its next version of Lotus Notes, allowing users to create, edit and save word processing, presentations and spreadsheet documents without having to switch between applications, Microsoft has decided not to support the new standard.

In their efforts to improve the formal standardisation processes, some international SDOs have made agreements with some consortia bodies to cooperate. For example, ISO placed ECMA recommendations on a 'fast-track' so that they can be processed further if they were presented for consideration as international standards (Hawkins, 1999).

In Werle's (2001) attempt to examine the institutional structure and characteristics of different SDOs, the author argues that jurisdictional conflict between them has continued because of two reasons. Firstly, the resources are scarce and thus it is necessary to avoid duplicated standardisation efforts. The other reason is that, according to Werle's study, there are that many of the standardisation bodies, whether formal or informal, share similar institutional features: negotiation, voluntary participation, consensus-based decision making and inclusiveness of committees.

This section of the literature review has shown that there are similarities and differences between international standards and consortia standards. Each type of standard has their advantages and disadvantages which may determine the circumstances each is better suited to.

5.4 THE FUTURE OF INTERNATIONAL STANDARDS

Many authors attempted to provide a grasp of the challenges facing the international standardisation process. This section of the literature review focuses on the studies that were conducted to examine how formal international standards are positioned in the marketplace among its competing standards now and where international standards might be heading to. In particular, it covers the findings related to the following questions:

What threats are facing formal international standards?

What causes these threats?

Is there a resistance growing to international standards?

How are international standards facing other standardisation approaches?

To what extent do informal standards produced by consortia compete with international standards by offering better advantages?

Many authors specifically attempted to study where international standards stand in the market and analyse the threats confronting the formal international standards system. Many of these studies have a common view on the disadvantages of formal international SDOs and ended up with the same conclusion. That is, fundamental operation reforms are required to improve the process by which formal international standards are developed. The shortfalls pointed out included the slowness of the development process, the costs and the deficiencies in the standards produced.

Weak points in international standards, as outlined in an article by Willingmyre (1997) are seen as the reasons for the competitive threats facing international standards. He claims that there are many standards other than international standards that can thoroughly meet the industry needs without having to be approved by an international body. Willingmyre (1997) stated five issues that he considered as fundamental institutional shortcomings that need to be addressed. He mentioned the slowness of the standard setting procedure in comparison to the pace of the marketplace, the

duplicative investments of time and resources, the separation between the standards produced and real industry needs, inappropriate driving forces and the involvement of politics. After all of that, he brings up the strengths of international standards that distinguish them from global, consortia, and proprietary standards. He explains that international standards are globally accepted because of the presumption of world wide agreement which is a result of the confidence in the integrity of the process of setting international standards. He also praises the fair, unrestricted, non-discriminatory access to the right to use and implement international standards.

For international standards to preserve their place in the IT standardisation arena, they have to be developed with the benefits that consortia provide in mind. Willingmyre (1997) describe a few approaches to bridge the gap between international standards processes and alternative approaches that can be seen as possible solutions, along with their strengths and weaknesses. His very first recommendation is to utilise the tools of today's technology to enhance productivity and speed up the process. Most of the solutions he proposed were actually being implemented at the time the article was written but it was and it still is too early to draw conclusions about their effectiveness. The approaches included inviting and accepting contributions from outside the traditional process, introducing improvements to the development process to produce timely recommendations and authorising fast-track submissions without prior approval for proposals within the scope of an existing committee.

The advantages of the international standardisation system should be acknowledged. While it is true that the traditional international standard setting process had and continues to have the shortfalls mentioned by Willingmyre, every shortfall can be justified in the context of the structural features of the SDOs and the process undertaken. Organisational procedures establish ideas on how standardisation should proceed, beliefs on which elements are important in the process of creating standards and why it is important, assumptions about the standards environment, etc. (Egyedi, 2003). The membership of SDOs allows for a broad representation of stakeholders with different backgrounds and opposite objectives which might slow down the communication and decision making processes and delay the release of standards (van

Wegberg, 2004). However, the speed of the standardisation process in formal SDOs ensures better chances of achieving compatibility between technologies by producing better standards in many cases (van Wegberg, 2004).

Mattli (2001) criticised the low level of consumer participation in the process of standards development within the international SDOs. He points out that the international SDOs such as ISO and IEC should reform their institutional and procedural structures in a way that support openness and transparency in order to make sure that the standards represent not only the needs of the industry but also the interests of the key players in the community.

This section has presented some of the suggestions to recuperate the strengths of international standards. The challenge exists in the IT industry and will continue to grow. There will always be a need to speed up processes and develop new mechanisms for producing standards.

5.5   FACTORS AFFECTING THE ADOPTION OF STANDARDS

In general, an organisation has options regarding the standards it can choose to take on. For example, It may choose to adopt a de facto standard that is been widely adopted in the market because of its potential or because it has been adopted by the top companies. A company might also choose to participate in the standard development processes of an international standardisation body and follow its standards. Another option is for the company to form a consortium with other companies to come up with their own standards.

For a standard to gain a competitive advantage and be adopted widely, it must meet the requirements of the organisation and direct it into achieving its organisational goals. Many authors and researchers tried looking into the factors that affect the adoption of standards and identify and define the characteristics that make a successful and desirable standard in the market. This section is concerned with some standard-adoption related articles and attempts to answer the following question:

> What are the main variables affecting a company's decision of which standards to adopt?

Resolving this question will give an approximate illustration of which standards are more embraced within the IT industry.

Cromer and Horch (1999) presented a paper describing the path that was taken by COLSA Corporation to standardisation in which it attempted to establish a single, common process based on appropriate, available software engineering standards. The goal of COLSA, a company operating in the software engineering industry in the U.S.,

was to pursue ISO 9001 registration and Capability Maturity Model (CMM) Level 3 assessment.

The company used to have different practices and standards (government, industry, international, and in-house). Despite the great amount of time and money that was expended on standardising their process, Cromer and Horch (1999) stated that it was a good decision that brought more progress. They assert that the standardised processes and procedures are helping the company to produce products and services of better quality and had improved their reputation as a leading provider of software. COLSA has benefited from the improved profitability and increased developer and customer satisfaction.

During their adaptation process, their in-house developed standards were being carefully created and selected to fill specific needs or fill gaps between the external standards. They were also faced by a vast number of standards from which to choose. They considered that aspect as an obstacle that had to be dealt with by figuring which standards might be valuable for them to apply. A combination of international standards and in-house standards were used.

Aiken and Cavallini (1994) are some of the authors that praise the competitive diversity in standards rather than focusing on "fixing" or "reengineering" the current standards process. By providing examples of success and failure cases in adopting and using standards they attempted to show that an organisation can address its requirements and satisfy them in a timely and efficient manner, as well as provide interoperability with other organisations, only by applying a combination of various standards (formal, de facto, or de jure) at different levels of maturity and from various standards development organisations. The two authors claim that there is much convincing evidence to support the hypothesis that formal international standards are not the only means to attain interoperability.

Aiken and Cavallini (1994) contend that the new paradigm should support the multi-standard based environment because any selected standard will have been chosen

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from among its competitive standards, and thus will more likely meet with the needs of the organisation. They believe that the natural selection process in the variety of standards will create a wealthy intellectual and technological future characterised by healthy competition in which the best solution(s) survive.

Aiken and Cavallini's approach (1994) portrays an open, natural approach to selecting and adopting standards, yet they neglect the fact that being open can be an unmanageable process and gradually drift the organisation away from its goals. The natural selection of standards can result in fine standards being overlooked because they are unheard of. Likewise, they avoid mentioning the level of expertise and knowledge needed for an organisation to be able to set its standards naturally, and fail to establish their perception of how standards can be combined without jeopardising interoperability. While the abstract idea Aiken and Cavallini (1994) describes might bring benefits, there is a need for more extensive study of how to apply it and what organisations and projects are capable of operating in a multi, naturally-selected standards environment.

Generally speaking, the literature review revealed that both international standards and consortia standards are adopted by companies. However, the choice mainly depends on what the organisation is aiming to achieve based on a cost-benefit evaluation.

6.0   ANALYSIS AND DISCUSSION

Within the literature, there is no unanimous opinion when it comes to answering the question of whether international standards are going to conquer the standardisation scene or be taken over by voluntary consortia standards. However, there is, at least, one commonly shared view in the papers that attempted to compare the process of formally developing standards by international bodies with consortia standards. The shared view is that consortium standardisation produces standards quicker than formal organisations because the process does not depend on industry-wide consensus and only focuses on the needs on the few stakeholders involved. Traditional formal standardisation, unlike the consortium approach, is more democratic and follows an open process that aims to meet the interest of the majority, if not everyone.

Different perspectives were presented in the previous sections. Some perceived the competition between international IT standards and consortia standards as the beginning of the end of international standards because they will gradually fail to keep pace with the rapid pace in technology. The argument is that international standards is based on consensus, openness and due process which makes it take a long time to arrive at a decision that satisfies the needs of different stakeholders. Also, some criticise the formal international standardisation process for involving participants with antagonistic objectives which may lead to firms behaving adamantly which slows down the decision making process even more (van Wegberg, 2004). Hawkins (1999) also refers to the "free riders" problem in consortia because it cannot be assured that all participating members are prepared to technically add to the standard development process equally. Additionally, in some cases, formal standardisation bodies develop standards with different options to represent the different interests of the groups involved in the SDO.

This leads to political compromises between the members which reduces the ability of the process to ensure compatibility and clarity in the standards produced (van Wegberg, 2004). These are some of the shortfalls of international SDOs.

There have been some moves aiming at speeding up the decision making process of international standardisation. However, speeding up the process may jeopardise the level of compatibility and interoperability that can be achieved by the standards produced (van Wegberg, 2004).

Consortia on the other hand succeed in producing standards faster than SDOs. But consortia standards only seem to serve particular interests. This indicates that each sort of standard has its own tasks. There are occasions in which suppliers want quick-fix standards that can be developed quickly to meet the specific needs of a product or a business, while on other occasions implementers need standards that are deliberatively developed.

Whether the belief is that international standardisation will lose their ground in the market to consortia standards or vice versa, the debate can carry on. The supporters of each side have rationales and bring up examples that would prove their point of view. Instead of looking at the two approaches as total opposites that compete to dominate the IT industry, we should absorb the benefits that we can receive from each approach. The tension between international standards and consortia standards should be redefined by coordinating activities.

Hawkins (1999) pointed out that existing SDO activities can be complemented by consortia input when it is beneficial to combine the legitimacy of an SDO standard with a new technology to achieve more public confidence. It is indeed very important to work on developing the right marketplace where technology and standards are well-coordinated so that they can achieve their purposes. As much as the consortia standardisation approach may result in advantages to the IT industry, the legality of the standards produced by formal international SDOs is still socially and economically rewarding and thus should be preserved. Encouraging consortia while also holding on to

the benefits of formal standardisation is of special importance in cases where legal processes must meet voluntary standardisation processes (Hawkins, 1999).

7.0   INITIAL CONCLUSIONS

When it comes to what a standardisation technique should provide we should acknowledge that the process of developing standards is highly driven by the needs of the market, the users and the implementers. Their needs can be summarised in two words; speed and efficiency.

The speed to the market:

The need for speed in the IT standardisation industry is expected because of the trend toward the rapid development of technology. Nowadays and in the future, standards are less likely to drive technologies. It is more expected that standardisation efforts will be driven by new technologies. This indicates that the faster the technology moves, the faster standards need to be developed and released to keep up with the rate of change.

Efficiency:

The need for efficiency reflects the need of software and hardware companies which cannot afford standards that do not support their business objectives. Companies in the IT industry apply standards to facilitate their operations by speeding processes and reducing costs. Inefficient standards will cause duplication and delays.

IT standardisation is a complicated phenomenon. The new rules for standardisation are competing with the traditional ones. Which paradigm is more likely to take over and dominate the standardisation field depends on several issues related to technology, the market dynamics and other influential factors.

The needs driving of the adoption of standards should give us an indication of the sort of approach that is more beneficial in a given context. The sort of standards wanted depends on the actual need for standards. Each sort serves different needs. The link between formal and informal standardisation activities should take a new direction in which they deliberately aim to work together by coordinating efforts and avoid overlapping.

8.0   INTERVIEWS

To gain some insights into the sort of standards adopted by IT companies, a query was sent out to all staff in both the Computer Science and the Information Science Departments in the University of Otago, as well as a number of acquaintances in case of people who could speak with me about their previous or current work experience with IT standards.

Five interviews were conducted in-person. A sample of the questions that were asked is provided in Appendix A.1. However, in some situations, some questions were slightly altered and more questions were asked depending on the experience of the interviewee. A record of the interviews is in Appendix A.3.

Interviews recounted different experiences related to working with IT standards including encountering standards in small and big companies, plus encountering standards while doing research.

The aim of these interviews was to collect some end users' opinions regarding IT standards and find out what they thought about the use of both formal international standards and informal consortia standards and which they preferred, and the ways in which standards helped or hindered their work. The outcomes from the interviews were used to validate the initial conclusions. Appendix A.2 shows how interview questions relate to the research questions.

8.1   SUMMARY OF THE FINDINGS

The findings from the interviews can be used to support the following statements.

- **Organisations adopt different standards**

One thing that was revealed in more than one of the interviews is that companies tend to adopt consortium standards when there is not an equivalent international standard. However, when seeking international recognition and establishing efficient procedures, companies adopt international standards. This was obvious because all interviewees have encountered both sorts of standards in their work experience. This partially supports the conclusion that there is a need for efficiency and speed in standard setting.

- **The size of the organisation is an influential factor**

A few interviewees pointed out that the sort of standards being adopted depends on the size of the organisation and the goals it is aiming at. A company may choose not to adopt any standard at all if it is a small firm. However, big companies adopt international standards and engage in consortium standardisation when they are seeking a competitive advantage in the marketplace.

- **Consortia standards have shortfalls**

One interviewee pointed out that some consortia produces standards that he described as "shocking". This gives a slight indication that consortia standards are developed to serve the interests of particular stakeholders and may not be suited for the developer's needs.

- **Users have different preferences**

Interviewees pointed out that they found different standards beneficial in different circumstances depending on the context of usage. This indicates that each sort of standard has a role to play.

9.0   CONCLUSIONS AND RECOMMENDATIONS

This research paper aimed to analyse the confrontation between 'traditional' and consortia standard-setting to find out where international standards might be heading to. This research has reviewed the existing studies concerned with the state of the IT standardisation arena in which formal and informal standards operate. The paper argues that there is a need to go beyond the current thinking on the tension between formal international standards and other informal approaches to standardisation, especially consortia standards. International standards do have a function for the end users and a role to play in the IT industry; thus formal international standards will continue to exist. However, consortia offers alternatives that can, in some cases, be better substitutions of international standards.

In the IT industry, where the need for standards exceeds that needed in other industries, the standardisation process is expected to be able to produce reliable standards quickly but thoughtfully. The international standardisation process follows a methodology that consciously regards the needs of all stakeholders in the market and produce standards to meet their needs as much as possible. On the other hand, consortia standards offer the speed needed to produce and release standards without delay. Rather than considering the two as competing approaches, they can be seen as two complements that work to serve the overall needs of the IT industry. They should also be seen as means to provide standards for varied needs.

However, with regard to the international standardisation approach, no matter how much this paper emphasises that international standardisation should survive and coexist with other standardisation approaches, it is important to continuously improve the process in a way that will minimise the conflicts of interest between the participants.

With the availability of technology, the process of standard development can be improved further to be more responsive to the market needs. Additionally, the better aspects of the consortia movement should be considered as a challenge for the formal standardisation approach to improve.

It is necessary to be modest and acknowledge that international standards cannot be the ultimate solution all the time. They have their shortfalls that will continue to exist. They create boundaries that sometimes are not suitable for the nature of IT and therefore other approaches will serve the industry needs better. Yet, almost certainly, there will always be a need for standards that are formally produced and internationally approved and recognised.

When there is a need for standards that can quickly meet the market needs, consortia might be better than formal SDOs. However, for the benefit of everyone, efforts should be coordinated and formal SDOs should consider adopting consortium standards that demonstrate efficiency to maximise the benefits. In order to do that, there is a need to make information about the activities of both formal SDOs and consortia widely available to the public so that efforts can be easily coordinated in the IT standardisation field (Hawkins, 1999).

The informal correlation analysis of existing standardisation literature highlighted two areas that are relatively under-represented in the standardisation literature. The first concerns the great possibilities for coordination between international SDOs and consortia which has not been widely examined in the literature because the focus has been on the conflict instead of the co-existence of those standards in the IT market. The second is the lack of literature surveying what sorts of standards are best for which context. However it may be that the perspective that consortia standards are taking over international standards has led researchers away from studying the idea of bringing together international and consortia standards.

The lack of literature on theoretical work related to the interactions between SDOs standards and consortia standards and how they can optimally serve the IT

market together leaves us with many questions that could be researched. Broadly speaking, the question of how formal and informal standards can locate a point in which they can meet rather than clash should be tackled and analysed from social and economic perspectives.

To sum up, the insight of this research is that international standards and consortia standards are peers that should aim at serving the public interest while preserving their own goals and grounds in the market. With coordination and openness, this could lead to establishing a well-standardised field in which technologies continue to emerge with barriers as few as possible.

A.1   INTERVIEW QUESTIONS

General Questions:

- What is/was the sort of IT company you work/worked for?
- Did you encounter IT or software engineering standards?

Specific Questions:

- Which standards do/did you come across?

  e.g.:

    o International standards (IEEE, ISO, IEC… etc).
    o Consortia standards (i.e. informal standards that are not approved by international standardisation organisations).

- What is/was the context in which standards were used?

  e.g.: Documentation, configuration management, etc…

- How are/were standards being used? What's your personal opinion in relation to the way they are used?

A.2 ALIGNMENT BETWEEN RESEARCH QUESTIONS AND INTERVIEW QUESTIONS

The interviews are aimed at:

- revealing insights related to the sort of standards being adopted by different companies. This can be taken as an indication of the different needs of organisations which drive their selected options.

- Finding about the co-existence of formal international standards and consortia standards within IT companies.

- Investigating users' opinion regarding why sometimes international standards are needed and why sometimes consortia standards offer other benefits.

- Investigating users' opinion regarding the performance of consortiums.

A.3   INTERVIEWS WITH PEOPLE WITH WORK EXPERIENCE IN IT

A.3.1 Interview (1)

User interviewed	**Tony Bastin Roy Savarimuthu** - B.E (Hons), M.E (Software Systems) Mr Tony Savarimuthu is associated with the Software Engineering group of the IS department in the University of Otago. He has a background of working as a Software Engineer and Assistant Lecturer in India. His research interests include agent based workflow systems, software engineering, object-oriented software development and distributed information systems. University of Otago Information Science Department Email: TonyR@infoscience.otago.ac.nz
Responses	**What is/was the sort of IT company you work/worked for?** I worked for CoralGrid in India (www.coralgrid.com). I was specifically involved in web-based developments and ERP (Enterprise Resource Planning) projects. **Did you encounter IT or software engineering standards?** Yes.
	Which standards do/did you come across? The standards related to Struts (a framework for developing Java EE

	web applications). The company was also trying to achieve SEI-CMM level 5 - the highest maturity level for any software process, so I encountered more standards. I didn't come across international standards within CoralGrid, but I encounter IEEE standards when I publish a research document.

What is/was the context in which standards were used?
We had to document every single of code. We had certain procedural standards such as a login record and other standards that we had to follow when doing reviews.

How are/were standards being used? What's your personal opinion in relation to the way they are used?
The use of standards and the sort of standards being adopted depends on the size of the organisation and its goals. I personally think that standards can become an overhead. Take for example standards related to the LOC (Lines of Code), they are useful to the organisation but they might be a disadvantage to the developer. |

A.3.2 Interview (2)

User interviewed	**Maryam Purvis -** BS(Texas), MA(Texas), PhD(Otago)

Dr Maryam Purvis has a background of working as a software engineer in the computer industry in the United States. Her experience includes all phases of software development such as requirement analysis, design, implementation, and testing. Her current teaching and research interests are in the areas of dynamic modelling of distributed processes, distributed and dynamic workflow systems, object-oriented software development, distributed information systems and software |

	engineering, especially requirements analysis and software testing. University of Otago Information Science Department Email: Tehrany@infoscience.otago.ac.nz
Responses	**What is/was the sort of IT company you work/worked for?** I worked as a software engineer in Texas Instruments, U.S.A. **Did you encounter IT or software engineering standards?** Yes.
	Which standards do/did you come across? I mainly encountered U.S. military documentation standards, networking-level standards and few standards related to requirements and writing test cases. **What is/was the context in which standards were used?** Documentation and testing. **How are/were standards being used? What's your personal opinion in relation to the way they are used?** I am not a total advocate of standards. I agree with how they set a certain baseline but if things and processes are over standardised, it's a waste of time. However, when working in the field of software engineering, you cannot do all the work in your own way because then it cannot be communicated with others.

A.3.3 Interview (3)

User interviewed	**Mariusz Nowostawski** - Master of Science in Advanced Computer Science Mr. Nowostawski is a Research Fellow in the Information Science Department in the University of Otago, New Zealand. University of Otago Information Science Department Email: mariusz@marni.otago.ac.nz
Responses	**What is/was the sort of IT company you work/worked for?** Few small and big IT companies in New Zealand. **Did you encounter IT or software engineering standards?** Yes.
	Which standards do/did you come across? Mostly IEEE standards and Internet protocols. **What is/was the context in which standards were used?** I came across many consortia standards. For example: - RDMA Protocol (Remote Direct Memory Access) which is developed by the RDMA Consortium and the DAT Collaborative. - Standards from iWARP Consortium. - The standards of the World Wide Web Consortium (3WC). - Standards related to query languages developed by OMG. These are not commercial and driven by community interests. I have also dealt with some **How are/were standards being used? What's your personal**

	opinion in relation to the way they are used?
	Many consortia standards are well-established and recognised world wide. Some standards are large, especially international ones. Those are relatively hard to implement and add extra work. However, on the other hand, when the right standards are put in the right context, standards speed up the process, minimise the margin of misunderstanding and facilitate communication. I prefer consortia standards because I know the benefits they can offer and I can freely use the parts that relate to my work only.

A.3.4 Interview (4)

User interviewed	**Adam Forbes -** BAppSc (Otago) Mr Forbes is currently doing his last year in software engineering in the University of Otago. He has work experience with few IT companies. University of Otago Software Engineering Student Email: forad587@student.otago.ac.nz
Responses	**What is/was the sort of IT company you work/worked for?** I worked for the State Services Commission and for a small IT company, Coeus Ltd. **Did you encounter IT or software engineering standards?** Yes.
	Which standards do/did you come across?

	Mostly in-house standards.
	What is/was the context in which standards were used?
	In the ICT department of the State Service Commission, I was mainly involved in gathering requirements and documentation. I was only asked to use what they called a "Planning Document" which was standardised in-house. There were other people developing web standards for government web site.
	How are/were standards being used? What's your personal opinion in relation to the way they are used?
	The use of standards depends on the size of the company and its objectives. For example, Coeus Ltd applied no standards at all because the company has no more than 3 people working in it. Everyone understands the process in the same way. The only standards they used were those related to CVS in the context of configuration management.

A.3.5 Interview (5)

User interviewed	**Mark George** - Professional Practice Fellow Mr Mark George's interests are in the areas of Software Engineering, Distributed Information Systems and Computer Graphics. University of Otago Information Science Department Email: MGeorge@infoscience.otago.ac.nz

Responses	**What is/was the sort of IT company you work/worked for?** I didn't work for any IT companies. I am mostly involved in IT technology research within the department. **Did you encounter IT or software engineering standards?** Yes.
	Which standards do/did you come across? Data-persistence related standards such as EJB 3.0 (Enterprise Java Beans) Persistence specification, standards created by particular groups such as OMG (Object Model Group). **What is/was the context in which standards were used?** Mostly data persistency and documentation such as Request for Comments (RFC) documents[2]. **How are/were standards being used? What's your personal opinion in relation to the way they are used?** I personally wouldn't have used a standard unless I thought it would give me something. Some consortia standards are really shocking because they are targeted at specific vendors rather than us, the developers. Some standards may not be applicable to what I am working on in every single aspect. For example, JCP (Java Community Process) define shocking standards! However, standards provide flexibility and sticking to a standard reduces risk if it's well-proven. Standards also provide you with several implementations.

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[2] The Requests for Comments (RFC) document series is a set of technical and organizational notes about the Internet (originally the ARPANET), beginning in 1969. Memos in the RFC series discuss many aspects of computer networking, including protocols, procedures, programs, and concepts, as well as meeting notes, opinions, and sometimes humour. Not every RFC is a standard. Only the IETF represented by the IESG can approve standards track RFCs, (RFC Editor, 2006).

REFERENCES

1. Aiken, R. J., & Cavallini, J. S. (1994). Standards: When Is It Too Much of a Good Thing? StandardView, 2(2), 110 – 119.

2. Calderini, M. & Giannaccari, A. (2006). Standardisation in the ICT sector: the complex interface between antitrust and intellectual property. Economics of Innovation and New Technology, Vol. 15, No. 6, September, pp. 543-567.

3. Cargill, Carl F. (2001). The Role of Consortia Standards in Federal Government Procurements in the Information Technology Sector: Towards a Re-Definition of a Voluntary Consensus Standards Organisation," testimony before the House Science Committee's Subcommittee on Technology, Environment, and Standards.

4. Cromer, T. & Horch, J. (1999). From the Many to the One - One Company's Path to Standardisation. Fourth IEEE International Symposium and Forum on Software Engineering Standards. p. 116.

5. Egyedi, T. (2001). Beyond Consortia, Beyond Standardisation? New Case Material and Policy Threads Final Report. Delft University of Technology.

6. Egyedi, T. (2003). Consortium Problem Redefined Negotiating 'Democracy' in the Actor Network on Standardisation, International Journal of IT Standards and Standardisation Research, Vol. 1 No, 2, July-Dec 2003.

7. Glimstedt, H. (2000). Politics of Open Standards, Modular Innovation, and the Geography of Strategic Patenting in GSM and UMTS Technologies. Division of Innovation, Lund Institute of Technology.

8. Hanseth, O., Monteiro, E. & Hatling, M. (1996), Developing information infrastructure standards: the tension between standardisation and flexibility. Science Technology and Human Values, Vol. 21 No.4, pp.407-26.

9. Hawkins, R. (1999). The Rise of Consortia in the Information and Communication Technology Industries: Emerging Implications for Policy. Telecommunications Policy 23: 159-173.

10. Hurd, J. & Isaak, J. (2005). IT Standardisation: The Billion Dollar Strategy. Journal of IT Standards and Standardisation Research, 3(1), 68-74.

11. Lehr, W. (1992). Standardisation: Understanding the process. Journal of the American Society for Information Science, 43 (8), September 1992.

12. Mattli, W (2001). The politics and economics of international institutional standards setting: an introduction. Journal of European Public Policy, 8, 3, pp. 328-344.

13. NO-REST (Networked Organisations – Research into Standards and Standardisation). (2004). ANNEXE. Retrieved October 1, 2006, from NO-REST Editor Web site: www.no-rest.org/Documents/Annex.pdf.

14. Pfleeger, S., Fenton, N. & Page, S. (1994). Evaluating software engineering standards. IEEE Computer, Sept, 1994, 71-79.

15. RFC Editor. (2006). The Request for Comments (RFCs). Retrieved October 13, 2006, from RFC Editor Web site: http://www.rfc-editor.org/

16. Trade Agreement Act of 1979, U.S. Code, Title 19, sec. 2571. Definitions. Retrieved September 3, 2006, from: http://www4.law.cornell.edu/uscode/uscode19/usc_sec_19_00002571----000-.html

17. van Wegberg, M. (2004) Standardisation and Competing Consortia: The Trade-off between Speed and Compatibility, International Journal of IT Standards & Standardisation Research, July-Dec., 2(2): 18 - 33.

18. Weiss, T. (2006, May 22). IBM Plans to Support OpenDocument in Notes. Computerworld. Framingham, Vol. 40, Iss. 21; pg. 20.

19. Werle, R. (2001). Institutional aspects of standardization - jurisdictional conflicts and the choice of standardization organizations. Journal of European Public Policy, 8(3), pp 392-410.

20. Willingmyre, G. (1997). International Standards at the Crossroads. *ACM StandardView,* Vol. 5 No. 4.

21. Zaninotto, E. (1998). Standards and standardisations on the eve of a new century. Standardview. ACM Perspectives on Standardisation, v. 6, n. 2, pp. 90-93.