Toward Successful ISD in Developing Countries:

First Results from a Nigerian Risk Study Using the Delphi Method

Anja Mursu [a] & HA Soriyan[b] & KC Olufokunbi [c] & Mikko Korpela [d]
anjamu@jytko.jyu.fi[a] & hsoriyan@oauife.edu.ng[b] & kcfoks@hotmail.com[c] & mikko.korpela@uku.fi[d]
University of Jyväskylä, Finland
Department of computer science and information systems [a]
Obafemi Awolowo University, Nigeria
Department of Computer Science and Engineering [b c]
University of Kuopio, Finland
Computing Centre[d]

Abstract

The literature of software risk management indicates that the risk of failure in information system development (ISD) can be mitigated by identifying and analysing the threats of success. Moreover, the goals when implementing new technology in Africa, concerning socio-economic development, are more manifold. We have developed a holistic approach for studying successful ISD in Africa, which includes risk research in software projects as well as information system implementation and use contexts.
In this paper we present the process of a Delphi-study in Nigeria, which aims to produce a rank-order list of most common risk factors in software projects. The first results of risk factors in software projects in Nigeria are introduced.

Keywords: IS risk management , Risk assessment , Risk, Delphi technique

BRT Keywords: EL08, EE0504, EI0221, AF0801

Introduction

The number of failures in information system development (ISD) projects is high in spite of development in information technology (IT) and the increase in the knowledge and the experience of the users. A recent survey by the Standish Group (according to Conrow et al. 1997) of 365 respondents and 8380 commercial software-intensive projects indicated that 53 % of the projects were 'challenged': they were over budget, behind schedule, or had fewer features and functions than originally specified, and 31 % of the projects were canceled. On average, these projects had cost increases of 189 % and schedule slippage of 222 % versus the original estimates at the time they were completed or canceled. In addition, the completed projects had an average of only 61 % of the originally specified features and functions

Risk management has been found to be an important part of the success of system development processes. Most analyses of the software disaster projects have indicated that if the high-risk elements have been identified and resolved in time, the problems would have been avoided or considerably reduced (Boehm 1989, Charette 1989, Ropponen et al. 1997).

In the development literature it is agreed that IT has become a major precondition for socio-economic development in Africa. However, the question of how ISD is practiced in Africa is very little studied. We establish a project to study ISD practices and risks in Africa, using Nigeria as the case. As a part of the project, we are in the progress of a Delphi study to examine what are the most common risk factors in Nigeria, and to determine which of those risk factors are most important. This paper presents the Delphi method used in risk study and the first results.

The rest of the paper is structured as follows. Firstly, we review the literature of software risks as well as IT in Africa, and present some factors behind our research context, Nigeria. Secondly, we briefly present the research approach and objectives. Consequently we present the methodology of the Delphi study. Then the first findings are reported and discussed. Finally, in the conclusion we summarise the first results and the contribution of this study.

ISD Risks

In the western literature the failures in system development usually refer to cost overruns, project delays, and unmet user needs (Barki et al. 1993). The concept of risk has several definitions in information systems. Webster's dictionary defines it as 'the possibility of loss or injury'. We define software project risk here, in terms of Barki et al. (1993), as a product of uncertainty associated with project risk factors and the magnitude of potential loss due to a project. A risk factor can be defined as a contingency capable of creating a serious threat to the successful completion of an information systems development project (Keil et al. 1998).

Since the 1970s, several articles have been published concerning risks associated with software projects in western countries (McFarlan 1981, Barki 1993). Boehm's (1989, 1991) 'top ten' list has been among the best known and used lists of common risk factors. Anyway, many of these risk studies are based on anecdotal evidence or they are limited to a narrow portion of the development process. There has been a lack of systematic attempts to identify software project risks by inquiring the opinions of those who actually have experience in managing such projects. (Keil et al. 1998) An international Delphi study was conducted in three different socio-economic contexts (Hong Kong, USA, Finland), where experienced software project managers identified and ranked the most important risks. The study was conducted to obtain some insights into the cultural variation in risk item perception and ranking (Keil et al. 1998). There is still no comprehensive study of the common risks in ISD in any developing country. There have been some studies in the 90s about the key issues in IS/IT management (Pervan et al. 1998) and about the software industry (Hassan 1998). The list of up-to-date risk factors and the consciousness of possible environmental biases are valuable results for project management anywhere.

Information Technology in Africa

The creation of a local software industry in developing countries, indeed in Africa also, is essential, because it is seen as a potential catalyst for socio-economic development (Hassan 1998, Heek 1996). The goals when implementing new technology are still manifold. The implementation must go with minimal disruption, it must ensure acceptance from end-users, and deliver the tangible benefits on time and within planned costs (Lopez et al. 1996). According to Waema (1996), the real test of economic development is whether it reaches people and whether it is sustainable.

Waema (1996, p. 17) defines failure in his article on information technology and economic development in Africa as: 'Failure here implies that implementation of information technology fails to meet the espoused requirements, and, by implication, does not result in economic development.' About time overruns, Waema writes in the African context: 'When projects take a long time to implement, we are often quick at condemning them as failures. Nevertheless, … if we have the skills to manage this change process and the requisite patience, it is indeed such situations that may have a chance of higher IT implementation sustainability.' *Sustainability* usually implies maintaining something that already exists. In the case of IT sustainability is the ability to identify and manage the risks of failure so as to maintain the long-term viability of the information system, or of the ISD activity (Korpela et al. 1998).

However, the social and cultural environment have usually had difficulties in following the speed of technological changes. Thus many countries find it problematic to integrate new technologies into existing institutional structures (Roche et al. 1996, Waema 1996). Many times, for example in Africa, if the computerisation project has not failed, the delivered technical system does not have a significant positive impact on the performance of the organisation or the equipment is under-utilised (Odedra 1992). There is an extensive literature on the problems within information technology. These problems can be grouped to operational problems, contextual problems, and strategic problems (Lind 1991):

1. Maybe the most observable are *operational problems*. Operational problems in organisations are mostly due to technical, economic and personal problems. For example, new technology and shortened product life cycles (Lobez 1996), inadequate infrastructure (Roche et al. 1996, Bhatnagar 1992), the shortage of skilled personnel (Odedra 1992), poor maintenance (Mundy 1996), lack of planning, and inability to manage change (Waema 1996). Thus the system developers in Africa work under severe practical constraints but are less adequately trained to cope with them than their colleagues in industrialised countries. Above all, research generally is under-funded and IT research is not an exception (Ojo 1992).

2. Secondly, there are *strategy problems*. It is argued that Africa should develop its own software industry to meet its own needs (Heeks 1996). The lack of national IT policy makes it more difficult. A national IT policy would give guideline on how information technology would contribute the social, economic and political conditions in a country. An unsupportive public sector culture is also a common problem. (Waema 1996)

3. Thirdly, there are *contextual problems*. The transfer of technology to Africa has often being criticised for not taking into account contextual factors (Nulens 1998). There are argued to be some 'socio-cultural' and organisational issues influencing the development and outcome of IT applications, for example, in Nigeria. These issues

comprise an over-politicized decision-making process, bureaucratic complexity, and preference for informality. The colonially inherited administrative culture (Korpela 1996) is not conducive to ISD. In addition, many of the IT vendors are more concerned about what they will get out of a business, rather than their clients' productive utilisation of acquired computing systems. (Ojo 1992)

In addition, many African countries are experiencing grave ecomonic and political problems which cause insecurity of life and uncertainty of future. Naturally, this a formidable hindrance to long-term initiatives like ISD. On the other hand, the ethics and socio-economic justification of information systems are more conspicuous issue than in an affluent country (Korpela et al. 1998, 1992)

Because of the magnitude of these constraints in Africa, the risk of failure in ISD is very high. This makes also the sustainability of would-be information systems a major issue. Despite the numerous problems, there is no doubt that IT can offer positive benefits to African countries. The key message of the World Development Report (WDR) 1998/99 for Africa is that most countries on the continent need to do much more, much faster, to increase their knowledge base, to invest in educating their people, and take advantage of the new technologies for acquiring and disseminating knowledge. African countries must carefully analyse the potential economic, social and political costs of introducing IT and develop specific policies to adapt these technologies to their local context and needs. (Roche et al. 1996) Strategies for the successful implementation of IT include for example effective project leadership to manage the change process; empowering users meaning user participation; education and training; and experimentation, piloting and learning. We agree that it is particularly important for Africa to include broader organisational, social and political issues into systems development. (Waema 1996)

Nigerian context

Nigeria is the most populous country in Africa, representing about 20 per cent of the entire Sub-Saharan African (SSA) population. Nigeria achieved her independence in 1960 and received her national boundaries as a result of a colonial history. It is a country with a tropical climate, 250 to 400 or more recognised ethnic groups and 350 to 400 languages, English being an official language (Metz 1992). The country became a parliamentary democracy at independence but has been under military rule from 1966 to 1979 and from 1983 to 1999.

From an economical point of view, a major feature since the 1970s has been Nigeria's dependence on crude oil (over 90 % of total exports). According to the Special Programme of Assistance (1998), the overall economic growth has slowed in the 1990s because of the absence of a viable and stable macroeconomic framework, poor infrastructure, and because of an inadequate enabling environment for private sector expansion.

Table 1 provides some statistics concerning size of economy, communication, science and technology in Nigeria and a few other countries from SSA, East Asia, South Asia, and Latin America.

	Nigeria	South Af	Ghana	Thailand	India	Brazil
Population	118	38	18	61	961	164
Total GNP	30.7	130.2	6.6	169.6	373.9	773.4
GNP /capita	260	3400	370	2800	390	4720
Telephones	4	100	4	70	15	96
Personal com.	4.1	37.7	1.2	16.7	1.5	18.4
Internet hosts	0.00	30.67	0.15	2.11	0.05	4.20
R&D	15	..	..	173	151	165
High-tech.	..	..	..	36	10	18

Table 1. World Development Report (1998/99) Statistics

(Population is for 1997 in millions, GNP is for 1997 in billions of dollars, GNP per capita is for 1997 in US dollars, Telephone main lines per 1000 people in 1996, and personal computers per 1000 people in 1996, Internet hosts per 10000 people in 1997, Scientists and engineers in R&D per million people in 1981-95, High Technology exports % of mfg. Exports 1996)

The figures in Table 1 indicate differences between the countries. The technology development in Nigeria and Ghana seems to be somewhat slower compared to Thailand and Brazil. The first computer in Nigeria was introduced in 1962. The bulk of computer installations are in the Lagos metropolis. The pioneer computer users were banks, the oil industry, government ministries and parastatals, and educational institutions (see Korpela 1994 for a review of computers in Nigeria). According to World Development Report 1998/99, SSA has generally been marginalized from the telecommunication revolution. Telecommunication and information technology are a critical strategic entry-point for private sector development in SSA.

Africa offers a great variety of widely differing countries and regions. Nigeria is 'one step ahead' in SSA because of her sheer size, improved health care system and the amount of educated personnel. Still, many of the problems found in other parts of the Africa are known in Nigeria as well: the climate, the net outflow of capital due to foreign debts, and inadequacies in infrastructure. Since the Nigerian experience can be 'an antecedent' for the rest of the continent. (Daini et al. 1992), it is highly appropriate (and also feasible) to conduct the study in Nigeria.

Research approach and objectives

The overall objective of our research is to investigate if and how ISD in Sub-Saharan Africa in general and in Nigeria in particular is different from the industrialised countries. The results should contribute to the practice of IS development and use by making them more sustainable in the severely constrained context of Nigeria and Sub-Saharan Africa. The study is part of a larger joint research project by the University of Kuopio, Finland, and the Obafemi Awolowo University, Ile-Ife, Nigeria.

The original idea was repeat the international Delphi Study conducted in three different socio-economic contexts (Hong Kong, USA, Finland) by Keil et al. (1998). By repeating the Delphi study in Africa, we intend to obtain a richer understanding of the matter. The aim of the study is to develop a list of risk factors in Nigeria, and to determine which of those risk factors are most important.

However, the understanding of success or failure in ISD in Africa has a broader meaning compared to western countries. The magnitude of constraints in Africa makes the sustainability of information systems - that is IT in use - a major issue. Therefore we argue that the question of risk factors in software projects alone is insufficient to understand the whole phenomenon of ISD in Africa. The purpose is to make all the stakeholders of system development as winners. Thus the research framework focuses on four research questions: 1. What are the most serious risk factors in software projects in Nigeria? 2. What kinds of methods, techniques and practices are used in ISD? 3. What factors promote the sustainability of IT? 4. When IT has a positive impact on society? The idea of this framework is to form a holistic approach for ISD. Not only the productive software project, but also the sustainable use of IT and its positive impacts (intended or unintended) are keys for successful ISD in Africa. A more detailed report of our framework is published elsewhere (Mursu et al. 1999).

This paper focus on the first research question - risk factors. As we repeat the international risk study (Keil et al 1998), the methodology must follow the same conditions for comparison reasons. Thus the questions focus on software development projects instead of ISD, which deals increasingly with adjusting and integrating prefabricated pieces to fit the needs of a specific work activity (Korpela et al. forthcoming). The obvious source for inquiring risk factors is an expert in the field, that is a project manager. However, the organisation of projects in Nigeria might be different from the usual Western understanding. In Nigeria a project manager may be a chief executive, software manager, officer-in-charge, assistant general manager, or head of department. Respondents selected for the study will be professionals with several years' experience in system development.

The questions of ISD methods and practices, sustainability and the impact of IT need a broader viewpoint. In order to complete the study, we will conduct few case studies including discussions with ISD people, sponsors, users and maintainers.

Research methodology for risk factors

In the studies of key issues in IS/IT management in developing countries, the most common research approach used has been the postal survey, either single-round or three- or four-round Delphi studies (Pervan 1998). In the case of studying risk factors, the survey is an obvious choice for the research methodology. The negative point of the survey is that it is likely to obtain little insight into the causes and processes behind the phenomena being studied (Galliers 1991). Also there is a possibility of bias in the respondents, at least in posted questionnaires. This will be avoided by using personal interviews. It will cost more, but it is not feasible to use posted questionnaires in Nigeria. By using interviews we ensure the commitment of the respondents and further, the postal service in Nigeria is not reliable. Besides, according to Marsh (1982), when collecting information about beliefs or attitudes, interviews are the best way.

In the case of risk factors, to get a little more insight into the matter and to elicit the opinions of respondents and to get feedback, the Delphi survey has been chosen as the research method. In the following the Delphi-method is explained briefly. The Delphi survey process is divided into three phases (Keil et al. 1998):

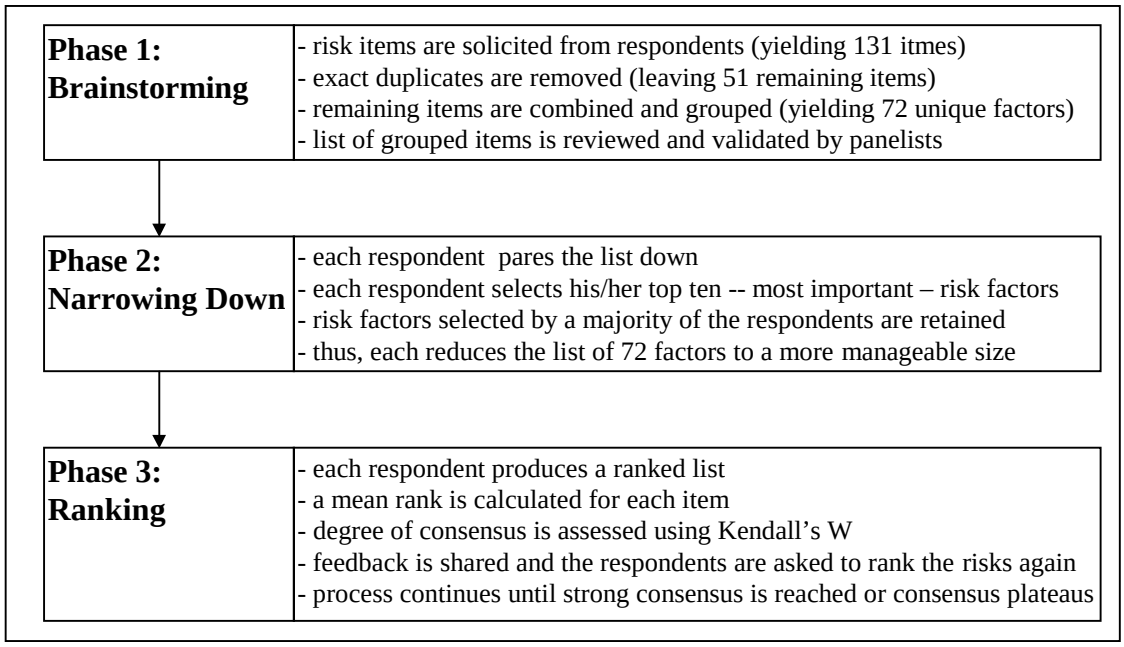

Figure 1. Description of Delphi Survey Process Used in this Study

In phase one, a brainstorming round is conducted to elicit as many items as possible from the respondents. Each respondent is asked to name at least six factors, and a short description of the factor. After that the results are combined with the results of the Keil et al. and grouped in a similar way. The combined list will be reviewed and validated by each respondent. We will take the earlier risk list (Keil et al. 1998) as a part of the results to make them more comparable.

In the second phase, the list of risk factors is narrowed down to a more manageable size. The respondents are asked to choose from the randomised list of items at least ten factors he/she considers most important, but not to rank these items. The criterion for narrowing the list is that the item selected to be important by over half of the panellists will be retained for the ranking phase.

In the third phase, the respondents are asked to rank the risk factors in order of importance. A multiple ranking course might be necessary to reach an acceptable level of consensus. The consensus will be measured by a statistical test called Kendall's coefficient of concordance. The ranking rounds will be sufficient when the respondents reach strong consensus or consensus does not change from one round to the next.

First Results of Risk Factors

We received 39 responses from eleven information technology companies in Lagos during phase one in the Delphi-study. The interviews collected 131 separate risk factors before modification. The expectation was that there will be some differences and new factors in Nigeria due to the socio-economic and infrastructural context.

The interviews were done by researchers from Finland and Nigeria and some students from the Obafemi Awolowo University, Ile-Ife, Nigeria. The companies mostly represent Nigerian owned private companies, two of which are foreign owned. All companies, expect one, produce systems for outside companies, like banks or the

oil industry, and they mostly produce business and management systems. One company produces its own packages. All the companies have e-mail addresses. The average number of employees in the company is 117; the education of most interviewees is a Bachelor's degree; the average experience in the IT-field is six and the half years; the average number of project headed by a respondent is six; and duration of the projects varies from eleven weeks (the smallest project) to 67 weeks (the biggest project) on average. Eight of the interviewees are women. Two interviewees has no project management experience, so their responses were discounted.

The list of risk factors identified in Phase 1 is shown in Table 2. We combined and organised the factors according to categorisation of Keil et al. (reported more detailed in Schmidt, Lyytinen, Keil, Cule, 1996) since the list is too long to be managed in a non-hierarchical form. Schmidt et al. (1996) used classification of 14 categories. We included one additional group of risks - socio-economic context - because we obtained risk factors differing considerably from the other factors resulted in earlier studies. Schmidt et al. (1996) define their first group of environment to contain also changes in political environment, but none of their risk factors focused on socio-economic context in the country. Since most of the environmental risks in our full list (the number of 17) focus on socio-economic situation rather than corporate environment, we decided to form a new group (see Appendix 1, Table 3).

We ended up to 51 different risk factors. In Table 2, after each factor there is a number of occurrences in total amount of 131 items. The shaded items represent factors that are not represented in risk lists of earlier studies.

Table 2. The full list of risk factors in Nigeria

0.	**Socio-economic context**	**No**
0.1	*Political climate in the country, including economic situation*: the poor economical state of the country does not allow for IT improvement and investment	5
0.2	*IT awareness in the country*: lack of proper IT exposure and policy	1
0.3	*Erratic and unreliable communication network*: poor communication (network, telecommunication etc.) can hinder some projects	4
0.4	*Energy supply*: When regular supply of power to computer systems cannot be guaranteed	5
0.5	*Tertiary institutions*: tertiary institutions in country today lack a lot of facilities required to prepare student for solid IT future	1
0.6	*Poor copyright / intellectual property right protection*	1
1.	**Corporate Environment**	
1.1.	*A climate of change in the business and organisational environment that creates instability in the project*	1
1.2	*Unstable Corporate Environment:* Competitive pressures radically alter user requirements, sometimes making the entire project obsolete.	1
2.	**Sponsorship/Ownership**	
2.1.	*Lack of Top Management Commitment to the Project.* This includes oversight by executives and visibility of their commitment, committing required resources, changing policies as needed	2
2.2	*Lack of client responsibility, ownership, and buy-in of the project and its delivered system(s).*	1
2.3	*Failure to gain user commitment*: Laying blame for "lack of client responsibility" on the project leader rather than on the users.	2
2.4	*Customer's staff turnover*	1
3.	**Relationship Management**	

3.1	*Failure to Manage End User Expectations*: Expectations determine the actual success or failure of a project. Expectations mismatched with deliverable - too high or too low - cause problems. Expectations must be correctly identified and constantly reinforced in order to avoid failure.	2
3.2	*Lack of Adequate User Involvement*: Functional users must actively participate in the project team and commit to their deliverables and responsibilities. User time must be dedicated to the goals of the project.	5
3.3	*Lack of Co-operation from Users*: Users refuse to provide requirements and/or refuse to do acceptance testing.	2
3.5	*Growing Sophistication of Users Leads to Higher Expectations*: Users are more knowledgeable, have seen sophisticated applications, apply previous observations to existing project.	1
3.7	*Lack of appropriate experience of the user representatives*: Users assigned who lack necessary knowledge of the application or the organisation	1
3.8	*Customer's ability to react to change*: Certain individuals do not want to conform the change because of general phobia of computers or they are worried their jobs are threatened	4
3.10	*Inadequate user training*: adequate training of customer is required to maintain systems.	1
3.11	*Negligence of agreements*: clients make illegal duplicates of packages	1
4.	**Project Management**	
4.1	*Not Managing Change Properly:* Each project needs a process to manage change so that scope and budget are controlled. Scope creep is a function of ineffective change management and of not clearly identifying what equals success.	2
4.2	*Lack of Effective Project Management Skills*: Project teams are formed and the project manager does not have the power or skills to succeed. Project administration must be properly addressed.	4
4.3	*Lack of Effective Project Management Methodology*: The team employs no change control, no project planning or other necessary skills or processes.	2
4.4	*Improper Definition of Roles and Responsibilities*: Members of the project team and the organisation are unclear as to their roles and responsibilities. This includes outsourcers and consultants.	1
4.6	*Poor Risk Management*: Countering the wrong risks.	1
5.	**Scope**	
5.1	*Unclear/Misunderstood Scope/Objectives*. It is impossible to pin down the real scope or objectives due to differences or fuzziness in the user community.	1
5.3	Scope Creep: Not thoroughly defining the scope of the new system and the requirements before starting, consequently not understanding the true work effort, skill sets and technology required to complete the project.	3
6.	**Requirements**	
6.1	*Lack of Frozen Requirements*. Because the needs of the users change, the requirements change. Consequently the system will never be moved into production because none of the requirements are ever completed. Alternatively, freezing a subset of the functionality and delivering allows for the completion of the system and update releases as required.	5
6.2	*Misunderstanding the Requirements.* Not thoroughly defining the requirements of the new system before starting, consequently not understanding the true work effort, skill sets and technology required to complete the project.	3
6.3.	*New and/or Unfamiliar Subject Matter for Both Users and Developers:* Lack of domain knowledge leads to poor requirements definition	2
6.4	*Inadequate documentation of user requirements*	4
7.	**Funding**	
7.1	*Under Funding of Development*: Setting the budget for a development effort before the scope and requirements are defined or without regard to them (i.e., picking a number out of the air).	11
7.3	*Bad Estimation*: Lack of effective tools or structured techniques to properly estimate scope of work. Unrealistic cost estimates cause illogical or sub-optimal planning, strategy, and decisions.	1
7.5	*No investments to IT*: Investors are cautious to put money on software development.	1

7.6	*Huge capital requirements*: There is no efficient leasing program in the country (hardware is expensive)	1
7.7	*Poverty of software companies*: employing staff is very expensive, and the wages serve as catalyst for them to be committed	1
8.	**Scheduling**	
8.1	*Artificial Deadlines*. Presence of unrealistic deadlines or functionality expectations in given time period. - 'crash projects' in which test time or training time is reduced – using something other than work effort required to determine when the new system should move into production.	3
8.3	*Lack of experience of the user management*: timing demands are unrealistic	1
9.	**Development Process**	
9.1	*Lack of Effective Development Process/Methodology:* Leading to quality problems - Documentation, Software and Testing—poor estimating -- insufficient time for up-front work, e.g., design—little flexibility for change—insufficient testing.	2
9.3	*Lack of quality standards*	1
9.4	*Lack of computing literature*: no literature for development process or techniques	1
10.	**Personnel**	
10.1	*Lack of Required Knowledge/Skills in the Project Personnel*: e.g., technology, business knowledge and experience.	7
10.2	*Lack of "People Skills" in Project Leadership*: PM tries to "manage" schedules, technology, requirements, etc., ignoring that management is dealing with people on the team.	1
10.3	*Poor Team Relationships*: Strains existing in the team due to such things as burnout or conflicting egos and attitudes.	5
11	**Staffing**	
11.1	*Insufficient/Inappropriate Staffing*: Not enough people or people with wrong skills/insufficient skills assigned to project, regardless of availability.	1
11.2	*Staffing Volatility*: At some point in the project, losing the key project manager, analysts or technicians (especially in new technology).	5
11.4	*Lack of Available Skilled Personnel*: People with the right skills are not available when you need them.	4
12.	**Technology**	
12.1	*Introduction of New Technology:* Using new, or 'bleeding edge', technology that has not been used successfully at other companies, or major technological shift occurs during the project.	2
12.3	*Inappropriate technology*: Trying to achieve a particular task/project without the appropriate tools	7
13.	**External Dependencies**	
13.4	Importation of foreign packages: craze for foreign packages with cheep price do not allow the growth of indigenous developers	2
14.	**Planning**	
14.1	*No Planning or Inadequate Planning*: Attitude that planning is unimportant or impractical.	**4**
		131

Note: Items are grouped by category. Shaded items represent risk factors not observed in earlier lists of Schmidt et al. 1996.

The examination of the distribution of risk factors in our full list indicates that the most frequent risk items focus on socio-economic context, relationship and project management, requirements, funding, personnel and staffing. The average amount focuses on sponsorship / ownership and technology. The least attention is in corporate environment, scope, scheduling, development process, external dependencies, and planning.

The survey resulted 20 risk factors not mentioned in previous studies. To make the results more comparable, we combine our list with the list of Schmidt et al. They compared their list to a merger of older risk item lists by Barki et al. (1993) and

Boehm (1989). They suggest that their list is more encompassing and more reliable. We will use this combined list (see Table 4 in Appendix 2) in the next phases of the Delphi study to see if some important risks were not considered during Phase 1 of this study. The new risk factors obtained in this study increase the coverage of known risks. On the other hand, it must be noticed that the ranking has not yet been done, thus we cannot denote that the new risk contingencies have been emerged and what actually are the most important risk factors in Nigeria.

Discussion

The results so far represent the risk factors collected in phase one of the Delphi study. The following we present some discussion of the risk factors in Nigeria based on the categorisation and comparison to the previous study by Schmidt et al. (1996).

The risk factors concerning *socio-economic context* are very characterised for this peculiar research context. The infrastructural issues like unreliable communication network and energy supply are among the most frequently mentioned risk factors in Nigeria. Private businesses use quite much of money in order to guarantee power supply: 92 per cent of firms sampled in Nigeria had installed private generating capacity (World Development Report 1994). Poor communication network makes it difficult to keep contact between customers and suppliers. In addition, the political, social and economic environment in Nigeria has been quite uneasy for several years. The risks focus on political climate, including economic situation and IT awareness in the country. The lack of a national IT policy is current in Nigeria. Without a common IT policy it can be difficult to create technology suitable for the current use of technology and industrial base in the country, and for the educational level of the labour force. The mention of *tertiary institutions* is quite interesting detail, since it refers to inadequate facilities in schools and universities.

The other group of the most frequently named risk factors focuses on r*elationship management*. Even if the clients' role is seen important in ISD in Nigeria, the relationship with customers is one of the most important risks for successful implementation of software project. User involvement, client commitment, general phobia of computer by users and thus opposition from them, insufficient training of users among other things are common problems. *Customer's ability to react to change* is a factor not mentioned in previous list of Schmidt et al. This kind of risk has been recognised in the past ('unwilling users', Barki et al. 1993), but according to Schmidt et al. the level of detail in clarifying user related risks in their study is higher. However, for sustainable and beneficial use of IT in user organisation, the local technological capacity is important to be developed. It is not necessarily easy to recognise the fundamental defects in user organisation to improve the use of IT. In-house department or IT personnel in clients' side have been noticed to be important. Thus the user participation and involvement are essential for sustainable use of IT. Also in the previous Delphi-study, a large number of new risk factors relate to user relationships (Schmidt et al. 1996). Thus this is a problem in many industrialised countries as well, but the computer illiteracy by the users in Africa is more remarkable. The problems with user requirements in a project, which are also mentioned quite often in Nigerian study, are partly caused by the poor relationship management. Users are tend to change and make additional requests once they see what is possible, or the requirements are misunderstood or insufficiently documented.

The one major topic deals with *project management*. The risk factors in this group seem to be quite similar with the earlier Delphi-study. The important notice here is that the awareness and need for disciplined management practices and the lack of skills in this area have been recognised. (Schmidt et al. 1996)

Under funding of development is the most frequent individually mentioned risk factor in this study having 11 references. Usually the under funding causes lack of human and material resources. The new risk items, which have not been mentioned in earlier studies, deal with *low investments* by investors, *huge capital requirements* because of the quite expensive hardware and software in Nigeria, and also huge capital requirements for having proper staff. As one respondent expressed: *'Poverty*: *most development houses pay staff peanuts. That serves as catalyst for them to be committed*.' Paying 'peanuts' for staff could be a sign of increased inequality and economic and social polarisation of people that the introduction of IT is argued to bring (Roche et al. 1996).

The lack of *educated and trained personnel* as well as *staffing turnover* are problems in software projects in Nigeria. Especially the lack of technical know-how and design and management skills which are needed in today's projects. Human relationship problems rise due to this insecurity in project life cycle. In Nigeria the education is emphasised on computer science and engineering instead of information technology and information management. In addition, the equipment - at least in universities - is insufficient. For example in the Obafemi Awolowo University there is about 30 computers for 800 students and even the lecturers have no personal computers of their own.

The risks within technology focus on *inappropriate technology*, especially the lack of appropriate tools is frequently named. This risk was not mentioned in the previous risk study. Also the introduction of new technology is considered as a risk. According to one respondent, there are too many times a rush to a new technology. It is still interesting to notice, that the technology risks in the Top Ten List of Risk Items by Boehm (1989) - namely 'Real time performance shortfalls' and 'Developing wrong interface' - are not represented in our sample. Schmidt et al. (1996, p. 18) notice that 'the importance of these technological risk factors may have diminished over the last 10 years, perhaps due to better performance and scalability of hardware and software, and the wide-spread adoption of graphical user interface'. This seems to be true in Nigeria as well, even if the lack of tools is a problem (including technical literature).

Overall, the main emphasis in risk factors in Nigeria seems to focus on environmental, contextual and organisational issues. These include economic situation, infrastructure, user and professional relationships and funding. The risk classification by Schmidt et al. (1996) seems to group the perceived risk factors properly, even if we had to form a new group for socio-economic context. Our addition was made only because we wanted to highlight this peculiar issue. The turbulence of the business environments, which is one of the major topic of new risk items in their study, did not get much attention in our study, since it lacks broader political perspective.

It is difficult to know the extent of generalisation of the findings all together. However, the combined list of risk factors identified in four very different countries (USA, Finland, Hong Kong and Nigeria) provides a useful tool for project managers to asses risks in software development projects. Secondly, the knowledge of the possible cultural or environmental factors that affect both the identification and perceived importance of various risks is valuable. On the other hand, this kind of list

can be too cumbersome for practitioners to deal with (Schmidt et al. 1996). Therefore the suitable framework or method for risk management is needed derived theoretically from these results and adjusted to be a part of ISD methodology.

Conclusions

The first phase in the Delphi study indicates that the risks in software development in Nigeria do not differ markedly compared to the risks in Hong Kong, USA and Finland. This was the brainstorming phase, so we cannot speculate with the importance of the risks. Only the frequency of different types of risks can be analysed. It seems that most frequently named risks are connected with the socio-economic context, relationship management with customers and other stakeholders, project management, requirement analysis, funding, and personnel and staffing management. Most of the 'new' risks identified in this study concerned socio-economic context including poor infrastructure and the difficult political and economic situation in the country. However, it is notable that the project managers have realised the importance of their work.

This paper reports the results of the first phase in the Delphi study and some discussion of the results. In future the study will continue with narrowing the list of risks to be a more manageable size and ranking the risk factors in order of priority. Thus we will have a list of most common risk factors in software development in Nigeria. However, the goals when implementing new technology in Africa, concerning socio-economic development, are more manifold. IT is anticipated to promote better, sustainable living conditions for people. Thus the result of this study is a part of the holistic framework for successful ISD in Nigeria, which includes risk factors, ISD methods, techniques and practices, sustainability of IT, and the impact of IT. This kind of list of risk items identified by our respondents provides a useful, up-to-date checklist for managers when they are managing software projects.

Acknowledgement

This research was funded by the Academy of Finland through the INDEHELA-Methods project.

References

Barki H., Rivard S., Talbot J. Toward an Assessment of Software Development Risk, Journal of Managment Information Systems, 10 (2), pp. 203-225, 1993.

Bhatnagar S.C. Information Technology Manpower: Key Issues for Developing Countries, New Delhi: Tata McGraw-Hill, 1992.

Boehm B.W. Software Risk Management Tutorial, Washington D.C: IEEE Computer Society Press, 1989.

Boehm B.W. Software Risk Management; Principles and Practises, IEEE Software (January), pp. 32-41, 1991.

Charette R.N. Software Engineering Risk Analysis and Management, New York: McGraw-Hill, 1989.

Conrow E. H. Shishido Patricia S. Implementing Risk Management on Software Intensive Projects, IEEE Software (May/June), pp. 83-89, 1997.

Daini O.A., Korpela M., Ojo J.O., Soriyan H.A. The Computer in a Nigerian Teaching Hospital: First-Year Experiences, In: Lun, Degoulet, Piemme, Rienhoff (eds.),

MEDINFO92, Proceedings, Amsterdam: Elsevier, pp. 230-235, 1992.
Galliers R.D. Choosing Appropriate Information Systems Research Approaches: A Revised Taxonomy, In: Nissen, Hirschheim, Klein (eds.), The Information Systems Research Arena of the 90s, Amsterdam: Elsevier, pp. 327-345, 1991.
Hassan S.Z. A Framework for IT Industry Development: A Case Study of Pakistan, Journal of Global Information Technology Management, 1 (4), pp. 38-55, 1998.
Heeks R. Building Software Industries in Africa, Information Technology in Developing Countries, 6 (4), pp. 5-7, 1996.
Keil M., Cule P.E., Lyytinen K., Schmidt R. A Framework for Indentifying Software Project Risks, Communication of the ACM, 41 (11), pp. 76-83, 1998.
Korpela M., Nigerian Practice in Computer Systems Development: A Multidisciplinary Theoretical Framework, Applied to Health Informatics, Dissertation, Helsinki University of Technology, 1994.
Korpela M., Soriyan H.A., Olufokunbi K.C., Mursu A. Blueprint for an African Systems Development Methodology: An Action Research Project in the Health Sector, In: Avgerou C. (ed.), Implementation and evaluation of information systems in developing countries, Vienna: International Federation for Information Processing, pp. 273-285, 1998.
Korpela M. Soriyan H.A., Olufokunbi K.C., Activity analysis as a method for information system development: General introduction and experiments from Nigeria and Finland, In: BodkØr S., Bertelsen O. (eds.), *Activity Theory Oriented Approaches in Information Technology Design*, Accepted for publication.
Lind P. (1991), Computerization in Developing Countries: Models and Reality, Routledge, London and New York.
Lopez E.J., Vilaseca M.G. IT as a global economic development tool, In: Roche, Blaine (eds.); Information Technology, Development and Policy: Theoretical Perspectives and Practical Challenges, Aldershot: Avebury, pp. 57-75, 1996.
Marsh C. The Survey Method, London: George Allen & Unwin, 1982.
McFarlan F.W. Portfolio Approach to Information Systems, Harvard Business Review (59:5), pp. 142-150, 1981.
Mundy D. IT in developing countries - a loss of independence?, In: Roche, Blaine (eds.); Information Technology, Development and Policy: Theoretical Perspectives and Practical Challenges, Aldershot: Avebury, pp. 45-56, 1996.
Metz H.C. (ed.) Nigeria, a country study. Washington: Congress Cataloging-in-Publication Data, 1992.
Mursu A., Soriyan HA., Olufokunbi KC., Korpela M., From Software Risks to Sustainable Information Systems: Setting the Stage for a Delphi Study in Nigeria, Accepted for publication of Journal of Global Information Technology Management, Special Issue for Information Technology in Developing Countries, coming in Summer 1999.
Nulens G. Information technology in Africa. The policy of the World Bank, In: Avgerou C. (ed.), Implementation and evaluation of information systems in developing countries, Vienna: International Federation for Information Processing, pp. 105-119, 1998.
Odedra M. Much more than human resource development for Africa, In: Bhatnagar (ed.), Information technology manpower, key issues of developing country, New Delhi: Tata McGraw-Hill, p. 189-199, 1992.
Ojo S.O. Socio-Cultural and Organisational Issues in IT Applications in Nigeria, In: Bhatnagar, Odedra (eds.), Social Implications of Computers in Developing Countries, New Delhi: Tata McGraw-Hill, pp. 99-109, 1992.
Oyomno G. Z. Sustainability of governmental use of microcomputer-based information technology in Kenya, In: Odedra-Straub (ed.), Global Information technology and Socio-economic Development, Nashua: Ivy League, pp. 19-34, 1996.
Pervan G.P., Akaphant S. A Survey of Key IS/IT Management Issues in the Thailand Public Sector, In: Avgerou C. (ed.), Implementation and evaluation of information systems in developing countries, Vienna: International Federation for Information Processing, pp.

372-388, 1998.
Roche E.M., Blaine M.J. Introduction - information technology, development and policy, In: Roche, Blaine (eds.); Information Technology, Development and Policy: Theoretical Perspectives and Practical Challenges, Aldershot: Avebury, pp. 1-24, 1996.
Ropponen J., Lyytinen K. Can software risk management improve system development: an exploratory study, European Journal of Information Systems, 6, pp. 41-50, 1997.
Schmidt R., Lyytinen K., Keil M., Cule P., Identifying Software Project Risks: An International Delphi Study, An earlier version of this paper was presented as research-in-progress at the International Conference on Information Systems (ICIS), 1996.
Special Program of Assistance, Status Report for Nigeria, Prepared for the June 1998 SPA Meeting.
Waema T. M. Implementation of information technology projects and economic development: Issues, problems and strategies, In: Odedra-Straub (ed.) Global information technology and socio-economic development, New Hampshire: Ivy League, pp. 106-115, 1996.
World Bank. World Development Report, New York: Oxford University Press, 1994.
World Development Report 1998/1999.

Appendix 1
Table 3. Risk Categories (Modified by categories of Schmidt et al. (1996))

Risk Category	Source of Risk, Nature of Risk	No of risks
0. Socio-Economic context	**Context:** Condition of the political environment	17
1. Corporate Environment	**Environment:** Changes in the business or political environment or poor alignment of the system with the organizational culture.	2
2. Sponsorship/Ownership	**Mandate**: Lack of mandate for the PM to execute the project plan. Lack of trust or poor relationships with the owners of the system.	6
3. Relationship Management	**User Relationships**: Lack of trust and inadequate user involvement. Unclear roles and expectations among users or other stakeholders.	17
4. Project Management	**Management**: Poor or inefficient management strategy and execution.	10
5. Scope	**System Scope**: Unclear, changing or partial understanding of the system scope and mission.	4
6. Requirements	**Requirements**: Inadequate or poor management of system requirements; poor validation of system requirements.	14
7. Funding	**Resource management**: Too little or badly estimated resources for SD.	15
8. Scheduling	**Resource control**: Poor management of resource consumption and needs. Poor timing.	4
9. Development Process	**Process**: Inappropriate or lacking process approach.	4
10. Personnel	**Skills**: Inadequate personnel skills in development and process management.	13
11. Staffing	**Staffing:** Changes in personnel or staffing levels, unavailability of key personnel resources.	10
12. Technology	**Technology:** Inadequate understanding of the chosen technology.	9
13. External Dependencies	**Development environment**: Poor management or control over dependencies with external agents.	2
14. Planning	**Planning**: No interest or inadequate skills to plan the project.	4
		131

Appendix 2

Table 4: The combined list of risk factors (modified from Schmidt et al. 1996)

0.	**Socio-economic context**
0.1	*Political climate in the country, including economic situation*: the poor economical state of the country does not allow for IT improvement and investment
0.2	*IT awareness in the country*: lack of proper IT exposure and policy
0.3	*Erratic and unrealiable communication network*: poor communication (network, telecommunication etc.) can hinde some projects
0.4	*Energy supply*: When regular supply of power to computer systems cannot be guaranteed
0.5	*Tertiary institutions*: tertiary institutions in country today lack a lot of facilities required to prepare student for solid IT future
0.6	*Poor copyright / intellectual property right protection*
1.	**Corporate Environment**
1.1	*A climate of change in the business and organizational environment that creates instability in the project.*
1.2	*Mismatch between company culture and required business process changes needed for new system*. A mismatch between the corporate culture and the changes required by the new system.
1.3	*Projects That Are Intended to Fail*: Projects started for political reasons which carry no clear business value but serve to divert the organization's focus from actual needed change. Such projects are under-funded, not supported and are not intended to succeed. Projects have no business value and are used as diversionary tactics to avoid facing the real change needs.
1.4	*Unstable Corporate Environment:* Competitive pressures radically alter user requirements, sometimes making the entire project obsolete.
1.5	*Change in Ownership or Senior Management:* New owners and/or managers set new business direction that causes mismatch between corporate needs and project objectives.
2.	**Sponsorship/Ownership**
2.1	*Lack of Top Management Commitment to the Project*. This includes oversight by executives and visibility of their commitment, committing required resources, changing policies as needed.
2.2	*Lack of client responsibility, ownership, and buy-in of the project and its delivered system(s).*
2.3	*Failure to gain user commitment*: Laying blame for "lack of client responsibility" on the project leader rather than on the users.
2.4	*Conflict Between User Departments*: Serious differences in project goals, deliverables, design, etc., calls into question concept of shared ownership.
2.5	*Failure to get project plan approval from all parties*
2.6	*Customer's staff turnover*
3.	**Relationship Management**
3.1	*Failure to Manage End User Expectations*: Expectations determine the actual success or failure of a project. Expectations mismatched with deliverable - too high or too low - cause problems. Expectations must be correctly identified and constantly reinforced in order to avoid failure.
3.2	*Lack of Adequate User Involvement*: Functional users must actively participate in the project team and commit to their deliverables and responsibilities. User time must be dedicated to the goals of the project.
3.3	*Lack of Cooperation from Users*: Users refuse to provide requirements and/or refuse to do acceptance testing.
3.4	*Failure to Identify All Stakeholders*: Tunnel vision leads project management to ignore some key stakeholders in the project, affecting requirements definition, implementation, etc.
3.5	*Growing Sophistication of Users Leads to Higher Expectations*: Users are more knowledgeable, have seen sophisticated applications, apply previous observations to existing project.
3.6	*Managing Multiple Relationships with Stakeholders*: Some "clients" are also "partners" in producing deliverables in other projects. Leads to confusion of roles and responsibilities.
3.7	*Lack of appropriate experience of the user representatives*: Users assigned who lack necessary knowledge of the application or the organization
3.8	*Customer's ability to react to change*: Certain individuals do not want to conform the change because of general phobia of computers or they are worried their jobs are threatened
3.10	*Inadequate user training*: adequate training of customer is required to maintain systems.

3.11	*Negligence of agreements*: clients make illegal duplicates of packages
4.	**Project Management**
4.1	*Not Managing Change Properly:* Each project needs a process to manage change so that scope and budget are controlled. Scope creep is a function of ineffective change management and of not clearly identifying what equals success.
4.2	*Lack of Effective Project Management Skills*: Project teams are formed and the project manager does not have the power or skills to succeed. Project administration must be properly addressed.
4.3	*Lack of Effective Project Management Methodology*: The team employs no change control, no project planning or other necessary skills or processes.
4.4	*Improper Definition of Roles and Responsibilities*: Members of the project team and the organization are unclear as to their roles and responsibilities. This includes outsourcers and consultants.
4.5	*Poor or Non-Existent Control*: No sign-offs, no project tracking methodology, unaware of overall project status, "lost in the woods".
4.6	*Poor Risk Management*: Countering the wrong risks.
4.7	*Choosing the Wrong Development Strategy*: e.g. waterfall, prototyping, etc.
5.	**Scope**
5.1	*Unclear/Misunderstood Scope/Objectives*. It is impossible to pin down the real scope or objectives due to differences or fuzziness in the user community.
5.2	*Changing Scope/Objectives*: Business changes or reorganizes part way through the project.
5.3	Scope Creep: Not thoroughly defining the scope of the new system and the requirements before starting, consequently not understanding the true work effort, skill sets and technology required to complete the project.
5.4	*Project Not Based on Sound Business Case*: Users and developers ignore business requirements, develop system for sake of technology.
5.5	*Number of organizational units involved*: increased number of lines of communication and conflict potential expands the scope of the system.
	6. Requirements
6.1	*Lack of Frozen Requirements*. Because the needs of the users change, the requirements change. Consequently the system will never be moved into production because none of the requirements are ever completed. Alternatively, freezing a subset of the functionality and delivering allows for the completion of the system and update releases as required.
6.2	*Misunderstanding the Requirements*. Not thoroughly defining the requirements of the new system before starting, consequently not understanding the true work effort, skill sets and technology required to complete the project.
6.3	*New and/or Unfamiliar Subject Matter for Both Users and Developers:* Lack of domain knowledge leads to poor requirements definition.
6.4	*Inadequate documentation of user requirements*
7.	**Funding**
7.1	*Under Funding of Development*: Setting the budget for a development effort before the scope and requirements are defined or without regard to them (i.e., picking a number out of the air).
7.2	*Under Funding of Maintenance*: Support for products in the maintenance phase. If the customer is unprepared or does not budget for this, the project can be judged a failure even if successful in all other aspects.
7.3	*Bad Estimation*: Lack of effective tools or structured techniques to properly estimate scope of work. Unrealistic cost estimates cause illogical or sub-optimal planning, strategy, and decisions.
7.4	*"All or Nothing":* Requires budgeting entire project at the outset, leading to under funding in later years of project.
7.5	*No investments to IT*: Investors are cautious to put money on software development.
7.6	*Huge capital requirements*: There is no efficient leasing program in the country (hardware is expensive)
7.7	*Poverty of software companies*: employing staff is very expensive, and the wages serve as catalyst for them to be committed
8.	**Scheduling**
8.1	*Artificial Deadlines*. Presence of unrealistic deadlines or functionality expectations in given time period. - 'crash projects' in which test time or training time is reduced – using something other than work effort required to determine when the new system should move into production.

8.2	*"Preemption" of Project by Higher Priority Project*: Management unable to resolve conflicting schedule demands.
8.3	*Lack of experience of the user management*: timing demands are unrealistic
9.	**Development Process**
9.1	*Lack of Effective Development Process/Methodology:* Leading to quality problems - Documentation, Software and Testing—poor estimating -- insufficient time for up-front work, e.g., design—little flexibility for change—insufficient testing.
9.2	*Trying New Development Method/Technology During Important Project*
9.3	*Lack of quality standards*
9.4	*Lack of computing literature*: no literature for development process or techniques
10.	**Personnel**
10.1	*Lack of Required Knowledge/Skills in the Project Personnel*: e.g., technology, business knowledge and experience.
10.2	*Lack of "People Skills" in Project Leadership*: PM tries to "manage" schedules, technology, requirements, etc., ignoring that management is dealing with people on the team.
10.3	*Poor Team Relationships*: Strains existing in the team due to such things as burnout or conflicting egos and attitudes.
11	**Staffing**
11.1	*Insufficient/Inappropriate Staffing*: Not enough people or people with wrong skills/insufficient skills assigned to project, regardless of availability.
11.2	*Staffing Volatility*: At some point in the project, losing the key project manager, analysts or technicians (especially in new technology).
11.3	*Excessive Use of Outside Consultants*: Can lead to a conflict of interest, e.g., billable hours vs. budget, or resulting in the internal staff not having significant involvement
11.4	*Lack of Available Skilled Personnel*: People with the right skills are not available when you need them.
12.	**Technology**
12.1	*Introduction of New Technology:* Using new, or 'bleeding edge', technology that has not been used successfully at other companies, or major technological shift occurs during the project.
12.2	*Stability of Technical Architecture* – Has to be done before comparable applications.
12.3	*Inappropriate technology*: Trying to achieve a particular task/project without the appropriate tools
13.	**External Dependencies**
13.1	*External Dependencies Not Met*: The project's consultants or vendors do not deliver, go out of business, or are unclear as to their roles and responsibilities.
13.2	*Multi-Vendor Projects Complicate Dependencies*: Integration of packages from multiple vendors hampered by incompatibilities and lack of cooperation between vendors.
13.3	*Lack of Control Over Consultants, Vendors, and Sub-contractors*: Schedule or quality problems beyond control of project manager. No legal recourse due to poor contract specification.
13.4	Importation of foreign packages: craze for foreign packages with cheep price do not allow the growth of indienous developers
14.	**Planning**
14.1	*No Planning or Inadequate Planning*: Attitude that planning is unimportant or impractical.

Note: Items are grouped by category. Shaded items represent risk factors named in our study.