RISK IDENTIFICATION TOOL FOR ICT IN INTERNATIONAL DEVELOPMENT CO-OPERATION PROJECTS

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ABSTRACT

Various stakeholders in international development co-operation projects have presented frameworks for managing those projects. Each framework has different strengths and weaknesses, and they vary from highly abstract to relatively practical. However, none of those frameworks pays attention to situations where professionals are unable to identify possible risk sources due to insufficient information about the project milieu. Yet, such situations are common in international development co-operation projects where information technology (IT) is involved, and where IT professionals have to operate in an unfamiliar project milieu. This article presents a risk identification tool that is aimed at assisting IT professionals and organizations to identify sources of challenges in international development co-operation projects, and to design appropriate countermeasures for overcoming risks before the project enters the implementation phase. Our tool does not replace project management frameworks or software, but when utilized appropriately, it guides preparation of IT professionals to face possible threats that originate from an unfamiliar project context, especially in international development co-operation.

KEYWORDS

Risk identification; ICT for development; ICT4D; ICT projects; International development co-operation.

1. INTRODUCTION

Failures in information system projects can be categorized into quality problems and productivity problems (Flynn, 1998). Furthermore, eight perspectives can describe causes for failures in those categories (Bennet et al., 2002). The four perspectives for quality problems are addressing the wrong problem, neglecting the project context, having incorrect requirement analysis, and carrying out the whole project for the wrong reasons. The four perspectives for productivity problems are that changes in user's requirements cause project requirements to drift, that external events change the project environment making already designed solutions invalid, that the management is poorly organized and resources are wasted, and that designed implementation is not feasible in the specific context of use. That categorization of failures applies to ICT in international development co-operation projects, too.

Hoffer et al. (2002) argued that all projects have risks, and showed that understanding of their sources and types creates a foundation for project assessment. Similarly, Bennet et al. (2002, p. 25) argued "An understanding of potential problems is an essential precursor to information systems analysis and design". In addition, Bennet et al. (2002) showed that the explanations for failures in information system projects depend on the perspectives of end-users, managers, and developers. This variety of explanations indicates that risk identification process depends on people's understanding of a certain project milieu (Taylor et al., 2012). Even more, because information and communication technology (ICT) projects may fail due to a number of reasons, various risks can be considered characteristic of project work. Therefore, risk identification is always an essential part of project planning.

It was shown that information technology (IT) professionals in all countries face challenges that are unique to their specific socio-cultural, economic, geographic, environmental, political, and technical context (Tedre et al., 2009). Therefore, the characteristics of IT work that specialists face in one country differs from the characteristics that they face in another country (Tedre et al., 2011). As a result, consideration of the characteristics of unfamiliar context of use becomes a crucial element in IT professionals' work (Kamppuri, 2011). When IT professionals from the Global North undertake projects in the Global South, it is, hence, especially important to recognize the dissimilarities in characteristics of IT work between countries. Unfortunately, our observation in the field of international development co-operation is that IT professionals often discover risks emerging from the unique characteristics of their new surroundings through mistakes and through cycles of trial and error, instead of systematic analysis and considerations of necessary preparations, e.g. (Brewer et al., 2006; Kemppainen, 2007).

The following subsections discuss the need for a risk identification tool for ICT in international development co-operation projects. The first subsection presents challenges related to current situation of technology oriented development projects, as well as their design and management methods. The second subsection summarizes a number of recognized challenges when risk management practices of commonly known project management frameworks are applied to ICT projects in international development co-operation.

1.1 ICT in International Development Co-operation Projects

Smillie (2000) argued that technology offers a solution to the poverty problem, but the history of development initiatives shows that it is inappropriately utilized in international development work. In addition, Smillie argued that technology is a product of a certain social and historical context, and therefore its transfer from one context to another always requires modifications (Smillie, 2000). Yet, that problem is not specific to developing countries: local modifications of ICT are rarely possible in industrialized countries either due to lack of necessary technical capacity (Hoffer et al., 2002). ICT design, manufacturing, and re-design require skills, resources, and specialization that are not available in most locations. In addition, localizations of ICT are not always economically profitable and they are often limited to certain features. For example, mobile phones are technically similar in Africa and Europe apart from minor user-selectable features, such as language settings.

The unique issues of IT research and development in developing countries have been discussed in several publications, e.g. (Brewer et al., 2006; Avgerou, 2008; Surana et al., 2008; Tedre et al., 2010), and several models have been presented for assisting IT professionals in appropriate utilization of ICT in unfamiliar contexts of use (Heeks et al., 2001; Vesisenaho,

2007; Bass & Heeks, 2011; Tiihonen, 2011; Andersson & Grönlund, 2009). In that literature, the word *model* is used when a tool has to be applied to a situation, and the word *framework* is used when a tool defines specific practices, procedures, or output for a situation. For example, the COCPIT (Coordination/control systems, Objectives and values, Capabilities, Processes, Information, and Technology) model aims to identify locally relevant tacit knowledge necessary for successful implementation of project (Heeks et al., 2001). The CATI (Contextualize, Apply, Transfer, Import) model is a four-level model for designing, implementing, and analyzing the necessary expertise for transferring technology between countries (Vesisenaho, 2007). The LACASA (Levels of Analysis, Categories of Analysis, and Scopes of Analysis) framework aims to address context-specific topics in information systems development (Tiihonen, 2011). The *design-reality gap model* aims to reduce the possible gap between design and reality by identifying key dimensions of the context of implementation (Bass & Heeks, 2011).

The use of above models for utilization of ICT in unfamiliar contexts of use is impractical due to the models' generality, to their assumption that the models' users have deep understanding about the particular context of implementation, and to ICT projects' inflexible timeframes. In the optimal circumstances, where designers have already gained experience in multicultural projects, utilization of the models above help to guide the design and implementation process to a sustainable direction. The contribution of those models to international development work strongly depends on IT professionals' earlier experience on similar kinds of situations. In practice, this means that the models' contribution to IT professionals' work is negligible compared to commonly applied project planning and management frameworks, such as Logical Framework Approach (LFA), Objective Oriented Project Planning (OOPP), Results Based Management (RBM), and Results Oriented Assistance (ROA). In addition, IT professionals' expertise in commonly used generic project management frameworks, such as PRINCE2 (PRojects IN Controlled Environments), seems to be a more important factor for project success in international development co-operation than utilization of the former, specialized models is. In spite of their practical limitations, the former models show that IT professionals who construct ICT services in unfamiliar context of use require technical expertise that is accompanied with contextual awareness.

In addition to project management frameworks, a number of models have been developed for software process management, e.g. (Hoffer et al., 2002; Bennet et al., 2002; Chemuturi & Cagley, 2010). Those models are chiefly aimed at project life cycle management, where a product development process is subdivided to smaller tasks that are easier to manage (Bennet et al., 2002). The principles and procedures of software process management models are applicable to development projects, but not without deep contextual understanding. For example, agile software development methodologies aim to create software through iterative and incremental development (Hoffer et al., 2002; Bennet et al., 2002). This means that a failure in a software development path does not lead to the failure of the whole project, but the development process continues on another path. Such testing cycles are not always possible in development projects, where hardware investments and ICT infrastructure development often play a major role. In practice, this leads ICT projects in international development co-operation to follow the waterfall model. Still, agile methodologies can be considered as an option when the project focus is on software development.

1.2 Risk Management in Development Projects

International Organization for Standardization (ISO) defines, in its ISO 31000 standard, a risk as "the effect of uncertainty on objectives" (International Organization for Standardization, 2009). ISO 31000 presents arrangements and guidelines for practices required in risk management. According to ISO 31000, risk management means identification, assessment, and management (avoidance, reduction, sharing, and retention) of risks. The utilization of ISO 31000 in project management requires careful planning of risk management tasks, responsibilities, activities, and budget. Other standards, such as ISO 27005:2008 (International Organization for Standardization, 2008), BS 7799-3:2006 (British Standards Institution, 2006), SP 800-30 (Stoneburner et al., 2002) and Risk IT (ISACA, 2009), describe several processes for managing IT risks. For example, ISO 27005 defines processes called context establishment, risk assessment, risk treatment, risk acceptance, risk communication, and risk monitoring and review (International Organization for Standardization, 2008). Even though those processes are vital parts of IT risk management as a whole, our experiences indicate that their implementation unduly complicates development projects, diverting management resources from other project activities into bureaucracy. In addition, organizations that operate in the field of development co-operation rarely employ project workers permanently, but they are hired for designated periods of time during a project's lifecycle. Those organizations do have permanent workers too, but they are employed in project management tasks and they are not normally able to assess or estimate the relevance of the presented risks in ICT projects.

LFA defines a risk as "an external factor that may negatively influence the realization of objective(s)", and it utilizes an objective-based risk identification method as a project table, e.g. (Team Technologies, 2005). That table describes the connections between project's inputs, activities, and outputs, aiming at a certain purpose and goal. The table rows describe how progress and performance is monitored and the columns describe relationships between inputs, activities, and outputs. In addition, the columns specify the main risks that might prevent the project from meeting its purpose and goal. The risks are always related to the project's assumptions. For example, an ICT project's risk might be that procured ICT equipment are not delivered in time when the underlying project's assumption is that the delivery of the equipment materializes before a certain date. Our experience is that the successful utilization of LFA in ICT-related development co-operation projects depends on planners' and donors' earlier experience in the particular location of development, because LFA does not specifically address characteristics of IT work in developing countries.

Business originated project management frameworks are rarely used in development projects, but their contribution to risk management is noteworthy. For example, the PRINCE2 framework aims to isolate the project's management aspects from specialist aspects (The Office of Government Commerce, 2009). That isolation is aimed at presenting project management procedures that are independent from project scale, type, organization, geography, or culture. That separation means that project management staff organizes, supervises, and controls specialist work throughout the project's lifetime. The underlying assumption is that many of the necessary management skills are the same everywhere. PRINCE2 defines a continuous procedure for risk management, where possible negative effects (threats) and positive effects (opportunities) are identified and assessed, and where responses are planned and implemented. When applied appropriately, PRINCE2's risk management procedures are comprehensive. The challenge is that the separation between managerial and specialist jobs easily hinders

management professionals' capacity to appraise the work of other specialists, and therefore the assumed risks in a project plan might become irrelevant. That challenge materializes easily in those ICT projects where unprepared IT professionals from the Global North enter projects in the Global South. In addition, even though the management procedures are similar between projects and they are somehow independent from jobs of substance experts, a project management framework should not ignore local context. For instance, PRINCE2 is based on the Western, paper based reporting culture and it works poorly without staff that is well-educated in project management. In developing countries, such assumption means that it is impossible to win funding for a development project without expensive project organization.

Risk management does not necessarily contain risk analysis, but risk management is sometimes constructed on the information gathered during the risk analysis phase (Taylor et al., 2012). For example, in ITIL (formerly known as Information Technology Infrastructure Library), risk analysis collects information about possible threats and vulnerabilities, and appraises their significance compared to values of assets (Adams et al., 2009; Bon et al., 2007). Risk management monitors and re-evaluates possible risks, and decides countermeasures when appropriate. Even though ITIL is not a project management framework, but focuses on collecting and connecting the good practices of IT service management together, its contribution to our tool is vital. ITIL's main aim is in design of ICT services that fulfill organization's requirements: all ICT services that are constructed in an ICT project are aimed at fulfilling organizational goals and they should be self-sustainable later. In the history of ICT-oriented development co-operation there are numerous examples of ICT projects where ICT services are technically advanced, but locally unmanageable without continuing support from foreign experts and funding, e.g. (Avgerou, 2008; Torero & Braun, 2006; Dias & Brewer, 2009).

The project frameworks and models above leave risk analysis under the control of project staff. The frameworks present general procedures for risk management, and the models assist in considering typical differences between contexts of use. All of them expect that specialists are able to estimate and define risks in specific project contexts. However, that assumption is strongly related to the specialists' earlier experience and their understanding about project context, e.g. (Kemppainen, 2007). For example, one specialist might consider low education of maintenance staff to be a threat to the project's self-sustainability, and therefore recommends focus on staff education. Another specialist in the same situation might conclude that the complex technology is a threat, and therefore recommend technical design that recognizes the earlier expertise of local staff. Such differences of approach are common and they are a source of debates concerning technologies' appropriateness.

The project management staff of development projects are typically management experts but rarely experts in appraising the risks of ICT projects, e.g. (Ewusi-Mensah, 1997). There again, if IT specialists are not familiar with the characteristics of IT work in developing countries, their risk assumptions might not be relevant for project's continued self-sustainability. The specific challenges of development projects have led to the development of numerous risk analysis tools that are designed for risk analysis in various project areas in international development co-operation, e.g. (Mango, 2009; Ministry of Foreign Affairs of Denmark, 2009). Their methods vary, but they all are based on some common practices, such as objectives-based risk identification, scenario-based risk identification, taxonomy-based risk identification, common-risk checking, and risk charting. For example, Danida Environmental Screening Note is a list of questions for Danida's field staff when they assess environmental impacts of a

development project (Ministry of Foreign Affairs of Denmark, 2009). That list is based on the common-risk checking method, and it is a part of Danida's environment guide for international development co-operation.

1.3 Research Approach

This research focuses on international development co-operation projects that have an ICT component. Such projects might aim at wider development goals, such as improved quality of education, but their success depends on some ICT aspects. This research is founded on our own extensive work experience in a number of different positions in development co-operation organizations—those positions include, for instance, development coordinator (country coordinator), project manager, project coordinator, technical expert, chief technical advisor, and software designer.

We have amended our subjective experiences from decades of work in rural Tanzania, Mozambique, and South Africa with extensive literature review and participant observation from a few dozen other developing countries. Our own recorded data includes project reports, memos, field notes, email exchange, research diaries, and project documents since 1992, when our involvement with IT related development projects in Sub-Saharan Africa began, e.g. (Kemppainen, 2007; Tedre et al., 2010; Vesisenaho, 2007; Tumaini University/Iringa University College, 2000-2008; Tumaini University/Iringa University College, 2001-2004; Tumaini University/Iringa University College, 2009-; Tedre et al., 2011). That data set consists of roughly 9000 pages of records. In addition to our own documentation, the data include ICT coverage in Tanzanian media, evaluations of ICT project sites, and a great number of informal discussions with people who have been involved in IT work in developing countries as teachers, administrators, or project workers. From those sources, we have identified an array of characteristics of IT work that complicate technical work as well as collaboration between stakeholders. As our own work background is in East Africa, the home ground for this tool is in those countries, yet the literature suggests wider applicability.

This tool is aimed at risk analysis in a situation, where an IT professional is involved in a project that is funded by official development assistance (ODA), and where practical work occurs in a context foreign to that expert. This tool is not specific to any model for multicultural IT work or any framework for project management, but it can be used in any project management framework for project risk identification. The tool assists IT professionals in international development co-operation projects to prepare for their future work environment, and it supports minimizing risks that might hinder the success of such project. The tool is also aimed at those administrators who develop policies for or oversee ICT-related projects in the development co-operation arena.

2. RISK IDENTIFICATION TOOL

It is important to repeat the statement above that our risk identification tool is not a project management tool; its users should be familiar with standard project planning procedures and should be able to analyze project resources, such as funds and personnel. In IT work in development projects, those skills are typically required from foreign IT professionals, and we have not recognized differences between countries according to their utilization, e.g. (Kemppainen, 2007). In addition, It is important to recognize that a number of questions that our tool presents derive from existing good practices of development project management, e.g. (The

Organisation for Economic Co-operation and Development, 2011). We take those practices in this research as they stand because they are based on international agreements, and they are widely used among the international development community. In addition, organizational capacity to meet those management practices is typically a pre-condition for donor support. For example, organizations that receive EU's development co-operation funds have to use accrual-based accounting in their financial management (European commission, 2008; Ministry of Foreign Affairs of Finland, 2011). Similarly, the rights-based approach is commonly required in development projects because of its justification by international human rights, e.g. (Office of the United Nations High Commissioner for Human Rights, 2006).

In addition to the fundamental technical and project management skills, IT professionals require specific understanding of the characteristics of IT work in developing countries, e.g. (Brewer et al., 2006; Kemppainen, 2007; Surana et al., 2008). Those characteristics can be classified into five groups: institutional, educational, socio-cultural, environmental, and technical, as presented in Figure 1 (Tedre et al., 2011). In addition, those groups are divided into twenty-four categories of characteristics of IT work that IT workers might face when undertaking projects in a new country. Our tool uses that classification scheme.

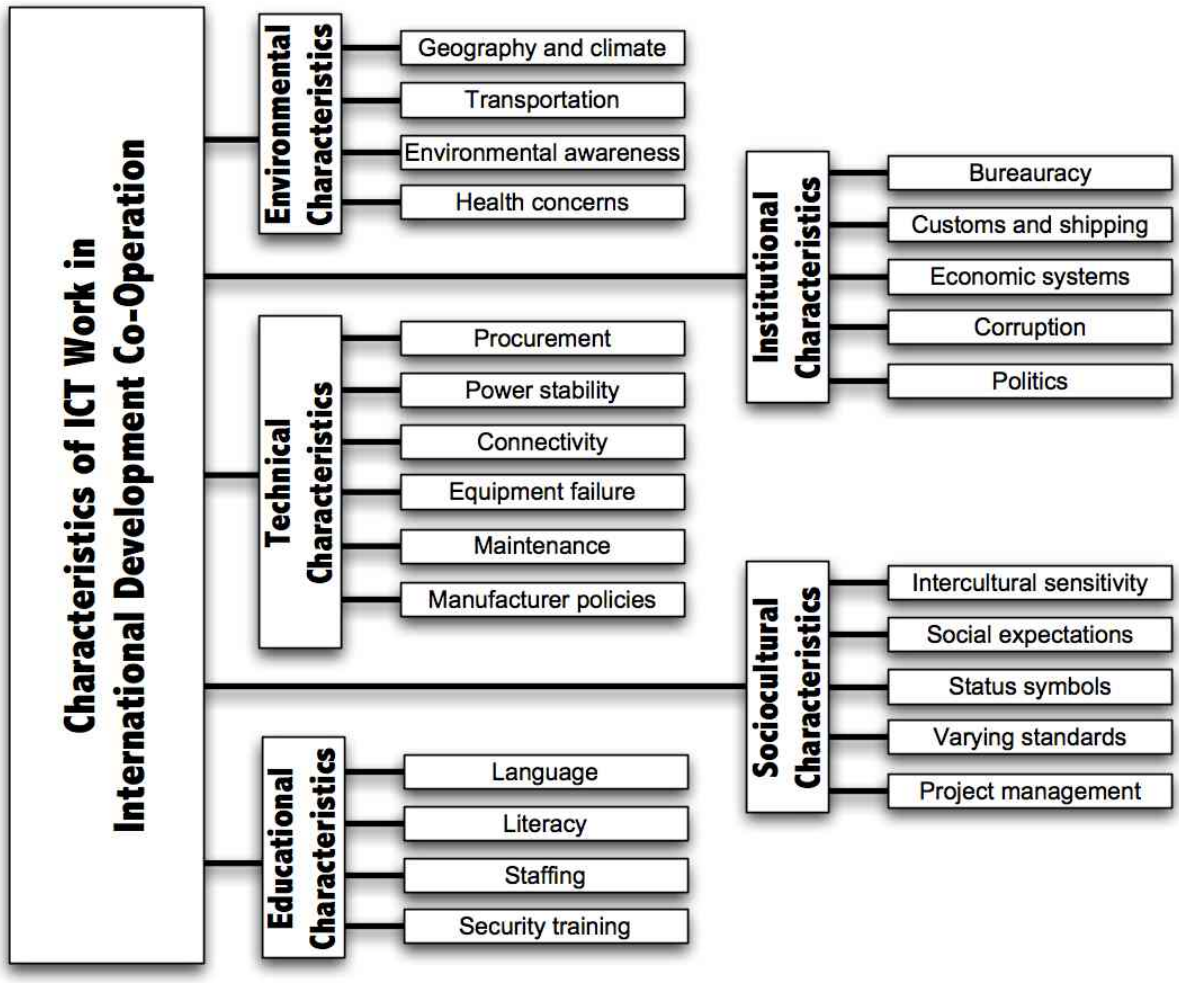

Figure 1: Characteristics of IT Work in Developing Countries, Adapted from (Tedre et al., 2011).

As an output, the risk identification tool provides a general indication of how well project management staff and other staff are prepared for the possible challenges of IT work in a foreign working environment. The tool appraises the project preparedness through a taxonomy-based risk identification process, using an electronic questionnaire.

The risk identification questions address factors that affect the realization of possible risks. The structure of those questions always requires a yes/no answer. That simplified format is preferred over more complex scale alternatives because evaluating one's project to high precision, such as using a 7-point Likert scale, is not meaningful for those IT professionals who are unfamiliar with their future project milieu. Each question is also scored, based on the significance of each issue to the project success. The system records answers to the risk identification questions (presented in Tables 1-5) and classifies the preparedness score according to rules presented in Table 6. The system identifies the project's risk status and gives recommendations for countermeasures.

The question-scoring scheme describes each factor over two dimensions: generality of that factor and how directly that factor influences the work of project staff (Figure 2). Consequently, the score measures both the significance of each factor to project success, as well as the capacity of project staff to overcome challenges that may emerge. For example, the existence of procurement policy is a general institutional factor that directly influences the project staff work. All projects of a well-organized institution must follow that institution's standard practices, which directly influences the practical work of project staff. Therefore, the existence of procurement policy adds three points to preparedness score, as presented in Figure 3, whereas non-existence of procurement policy gives zero points. Similarly, for example, having a local procurement expert available for project is a project-specific factor that directly influences the project staff work. The local expert assists and simplifies the work of project technical staff, and minimizes the risk of delays that may negatively affect the project. Therefore, the availability of a local procurement expert for project use results score four (see Table 1).

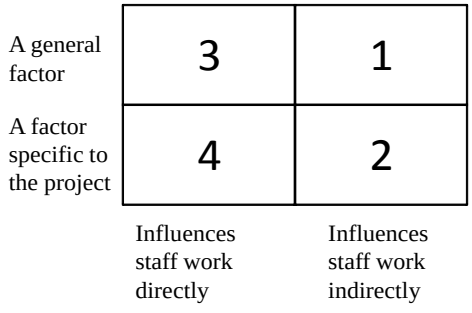

Figure 2: The scoring scheme for the questions.

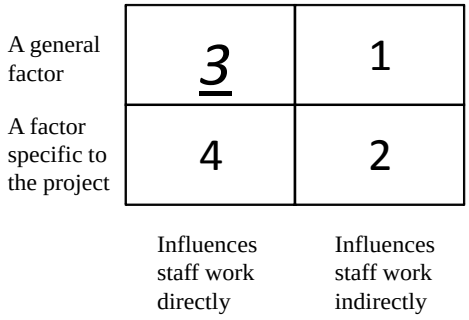

Figure 3: The existence of procurement policy is a general factor that directly influences staff work.

Successful utilization of our risk identification tool requires that various members of project staff in the participating-institution(s) contribute to the identification process. As a staff member might not have holistic understanding of the whole project milieu, the system also allows saving of partial responses and sharing the filling-up work between staff members. This

way the process is comprehensive, including the expertise of all the project staff members, not just some individuals. If staff is unsure about the response, "no" should be chosen. In addition, it is crucial that the participating institutions are committed to improving their projects' long-term impacts and self-sustainability. Without the commitment of leadership, and without a positive organizational attitude to improvements, staff members will not able to prepare the project and themselves for the challenges identified by this tool.

2.1 Institutional Characteristics

The first part of the electronic questionnaire analyzes five characteristics of IT work in developing countries that are mostly of the institutional kind: *bureaucracy, customs and shipping, economics, corruption, and politics* (Tedre et al., 2011). It is widely agreed that a well functioning and incorruptible institutional, regulatory, and legal system is one of the most important success factors for projects anywhere in the world (Dixit, 2005; Hyden et al., 2003; Sachs, 2010; Sachs, 2005). The literature shows that a number of challenges with project work in Africa come from governmental or non-governmental institutions that function slowly or inefficiently (Hyden et al., 2003; Collier, 2007). There are numerous bureaucratic and complex procedures (Smillie, 2000; Radelet & Sachs, 1998), that are politically motivated (Cornago, 2008), or that may be corrupt to some degree (Khan, 2006; Dowen, 2008; Transparency International, 2011). Even though such systemic issues are difficult for everyone, they are especially hard for short-term foreign project workers who do not stay in one place for long enough to learn the mechanisms, procedures, and pitfalls of each particular system. Table 1 presents the questions that address those institutional characteristics of IT work in a development co-operation project.

Firstly, the tool measures organizational awareness of general aspects of project work. Typically, when an organization is aware about the possible institutional challenges, it defines policies and project practices that guide its staff in practical situations. Hence, our tool addresses questions concerning organization's policies: its preparedness to manage development projects and its capacity to use appropriate expertise within the project organization. For example, without detailed enough anti-corruption policy, it is difficult for project staff to define and justify the boundaries between corrupt and uncorrupt practices due to cultural differences.

Secondly, the tool measures project's ownership issues. It is very likely that a project fails if the end users feel no ownership and acceptance over the project, e.g. (Collier, 2007; Dowen, 2008; Ewusi-Mensah, 1997; Sachs, 2005; Swantz, 1989). Therefore, all development projects should have their foundation on the national level, they should be designed to meet some local development objectives, and they must focus on development goals that are defined in a local community.

Thirdly, the tool addresses some contextual issues. Having local expertise in management of development projects indicates fewer challenges with the necessary bureaucracy. Similarly, an opportunity to manage financial transactions in a local bank is beneficial, as is a support mechanism that assists with the donor's management practices.

Fourthly, the tool addresses project management issues. One project cannot change global or local bureaucracies or politics, but minor organizational arrangements in foreign experts' job descriptions can make a vast difference in their workload in the practical project milieu. Therefore, a lot of frustration can be avoided if the project's management procedures and

staff positions are based on a thorough analysis of the project milieu. For example, if a local expert is available for procurement work, it is not necessary to involve a foreign expert. In addition, the project design should clearly define staff responsibilities and the decision-making structure.

Table 1: Questions that address the institutional characteristics of IT work in development co-operation projects.

Organizational Preparedness for Development Project:		**Yes**	**No**
1.1	Is a project manual available?	3	0
1.2	Is a financial management policy available?	3	0
1.3	Is a procurement policy available?	3	0
1.4	Is an anti-corruption policy available?	3	0
1.5	Is a staff policy available?	3	0
1.6	Is a fixed asset policy available?	3	0
1.7	Are there mechanisms for monitoring and/or evaluation? (For example, planning, monitoring, and evaluation mechanisms are defined and utilized according to organization's long-term goals/plans/programs, and the project has precise objectives with success indicators.)	3	0
Ownership and Environment:			
1.8	Is the project supported on the national level? (For example, the project is in line with national strategies for development, or the project has a high-level patron on the national level such as a minister or a member of parliament.)	1	0
1.9	Is the project supported on the local level? (For example, the project is in line with local priority areas for development, or the project has a high-level patron on the local level, such as a high-ranking regional officer.)	3	0
1.10	Is the project goal(s) supported in the local community? (For example, the project started on the local initiative, or the planning is based on a participatory approach.)	4	0
1.11	Has the local partner organization managed development funding before?	3	0
1.12	Are commercial banks operating normally in the project area? (For example, it is possible to open a separate bank account for the project, and it is possible to use credit cards for purchases.)	3	0
1.13	Is there a support mechanism for helping with investors'/donors' bureaucracy?	3	0
Staffing:			
1.14	Does the project have a responsible project manager? (Full-time or part-time, but there are a formalized position and an allocated budget)	4	0

	time, but there are a formalized position and an allocated budget)		
1.15	Does the project have sufficient financial staff? (For example, an accountant is appointed to the project organization.)	4	0
1.16	Are there expert(s) appointed for consultation on immigration and labor laws?	4	0
1.17	Are there expert(s) appointed for procurement?	4	0
	Maximum score for institutional preparedness is 54 points		

2.2 Educational Characteristics

The second part of the electronic questionnaire analyzes four characteristics of IT work in developing countries that are mostly of the educational kind: *language issues, illiteracy, staffing, and security training* (Tedre et al., 2011). The language situation is the same in non-English speaking industrialized countries and non-English speaking developing countries: one should not expect to cope well with English only. Varying literacy, numeracy, and functional literacy levels affect recruiting by reducing the recruitment base. Comparison between degrees, references, and work experience may not give an accurate picture of the applicants' actual capabilities. It is important to know whether an applicant's studies were theory- or practice- oriented and how the applicants see the role of practical (not management) work in their job. In addition, those African countries where we work have plenty of people who are equally or more competent than their counterparts in the industrialized countries, but well-educated and experienced professionals are often expensive or unavailable, as they have already a heavy workload, and the pool of experts is limited. Security training concerning equipment is important to be arranged well, as tampering and theft of equipment are not unfamiliar (Brewer et al., 2006). Table 2 presents the questions that address those educational characteristics of IT work in a development co-operation project.

Firstly, the questions measure general educational preparedness of project staff in terms of language, literacy, staffing, and security issues. For example, foreign staff members' inability to communicate in a local de-facto language is a weakness that delays their enculturation process, affecting finally their capacity to respond appropriately to challenges.

Secondly, the questions measure project's feasibility in terms of local staff and local security arrangements. Especially the questions address potential impacts of a low level of local IT expertise. For example, hiring local IT experts requires knowledge of and compliance with the local salary levels. There again, if the project's local staff salaries are exceptionally high compared to local standards, the project deforms healthy competition for workforce. In the worst case, this may cause local IT companies to collapse, and therefore hinder the project's self-sustainability later. It is ethically problematic for development co-operation projects to undermine healthy local businesses, but such unintended consequences can be found in the literature (Smillie, 2000).

Thirdly, the questions address the project's practical security arrangements. Even though our experiences indicate that education and communalism-based awareness building might be the best methods to address many security issues, the significance of practical security arrangements should not be underestimated. For example, foreign employees should not need to worry about security concerns at their new home, where even small issues can be intensified by

insufficient language skills and dissimilar cultural norms of the surrounding community. In addition, the high-value ICT equipment at project site requires adequate security arrangements.

Table 2: Questions that address the educational characteristics of IT work in international development co-operation projects.

Foreign Staff Educational Preparedness:		**Yes**	**No**
2.1	Have foreign employees been educated in development studies (or related)?	1	0
2.2	Do foreign employees have a basic understanding about the local culture? (For example, they have participated in orientation training.)	3	0
2.3	Are foreign employees able to communicate in the local de facto language? (Sometimes the official language might not be the common working language.)	4	0
Local Staff Expertise:			
2.4	Have sufficient resources been allocated for preparing local staff for the investors'/donors' project practices?	3	0
2.5	Will the project pay locally appropriate salaries to local staff? (The local salary structure is recognized in the project.)	4	0
2.6	Are there any incentives set for minimizing the risk of brain drain during the project?	3	0
Security Measures:			
2.7	Do foreign employees have a basic understanding about the necessary security measures in their new environment?	4	0
2.8	Is (are) the local partner organization(s) prepared to provide necessary security measures for the project? (For example, project site's physical security is properly organized and issues such as site's security fence, and 24/7 guarding are exist.)	3	0
		Maximum score for the educational preparedness is 25 points	

2.3 Socio-cultural Characteristics

The third part of the electronic questionnaire concerns five characteristics of IT work in developing countries that are mostly of the socio-cultural kind: *intercultural sensitivity, social expectations, status symbols, varying standards, and project management* (Tedre et al., 2011). The literature describes the possible challenges that working in a foreign culture generates (Pedersen, 1995; Searlea & Ward, 1990; Swantz, 1989) and coping with the stages of cultural shock is a common theme in preparatory workshops for people going to work abroad (Pedersen, 1995). In addition, the project staff preparedness for those characteristics is often crucial for a project's success, or a failure, depending on how well the project staff is prepared, e.g. (Kamppuri, 2011). Table 3 presents questions that address those socio-cultural characteristics of IT work in a development co-operation project.

Firstly, the questions measure the preparedness of project staff to face possible cultural clashes, social expectations, status symbols, and varying standards in multicultural work environment. The effects of those challenges can be estimated when staff work experience in multicultural teams, and staff members' understanding of the project milieu are known.

Secondly, the tool evaluates adequacy of management procedures in the project milieu. The questions measure the applicability of the organization's policies and practices to the project management in practical situations. For example, if a project manual does not define explicitly and exactly the required reports, its value as a tool in fieldwork is questionable. About each policy one should know *how* that policy is visible in people's everyday work, *what* does that policy cover, *who* is responsible, *which* situations does it apply in, *how often* does one need to undergo the procedures.

Thirdly, the tool addresses the project's organizational issues. For instance, the positions of foreigners and locals in the project organization should be carefully considered. It is often wiser to appoint inexperienced foreign experts to supportive roles instead of leading ones in the development co-operation project's organization. This way the local management skills are fully utilized and those skills can further be developed in work, which plays a key role for the project's self-sustainability.

Table 3: Questions that address the socio-cultural characteristics of IT work in international development co-operation projects.

Staff Members' Practical Preparedness to Multicultural Work:		**Yes**	**No**
3.1	Do the foreign staff members have experience working in multicultural teams?	3	0
3.2	Do the local staff members have experience working in multicultural teams?	3	0
3.3	Are the foreign staff members educated on development work? (For example, training course for development workers is a part of the project staff` orientation period.)	2	0
Adequacy of Project Management Procedures to the Project Milieu:			
3.4	Is the project manual practical? (For example, the manual has clear advice and templates for work plans, narrative reports, financial reports, etc.)	4	0
3.5	Are the instructions for financial management practical? (For example, there is a written policy for staff concerning authorization of expenditure.)	4	0
3.6	Is the procurement policy practical? (For example, the policy defines procedures for inquiring quotations and selecting suppliers.)	4	0
3.7	Is the staff policy clear and unambiguous? (For example, every job description includes clear statements of the job's responsibilities.)	4	0
3.8	Is the fixed-asset policy practical? (For example, the policy defines the use of vehicle's logbook, a format for the fixed-asset register, and people responsible for keeping such things up to date.)	4	0

3.9	Is the project plan flexible? (For example, if an unexpected internal or external event changes the project environment, the project plan can be adjusted accordingly.)	4	0
3.10	Is the foreign experts' role in the project organization a support role instead of a leading role? (Note! The answer should be "yes" if a foreign leader has lived in the context a number of years.)	4	0
		Maximum score for the socio-cultural preparedness is 36 points	

2.4 Environmental Characteristics

The fourth part of the electronic questionnaire concerns four characteristics of IT work in developing countries that are mostly of the environmental kind: *geography and climate, transportation, environmental awareness, and health concerns* (Tedre et al., 2011). Quite often, foreign project workers arrive in a country whose climatic, geographical, and environmental conditions are unfamiliar to them. Those conditions always affect the design, implementation, and maintenance of IT installations (Grier, 2009; Yu et al., 2006). The condition of roads, condition of transport vehicles, safety and reliability of traffic, and extent of railway networks, and availability and frequency of flights differ greatly between regions. Recycling, energy-efficiency, re-use, and various other environmental issues must also be considered in development co-operation (Grier, 2009; Yu et al., 2006). Even though tropical diseases and HIV/AIDS are usually the first worry of expatriates or short-term project workers in developing countries, the likelihood of serious health problems is, however, small if staff learns preventive health-care practices such as up-to-date vaccinations, and if they understand appropriate procedures for things like drinking water treatment. Table 4 presents the questions that address those environmental characteristics of IT work in a development co-operation project.

Firstly, the questions measure project staff preparedness to face the climatic, geographical, and environmental conditions of the project site. For example, without reliable statistics about site's climatic conditions, it is impossible to design ICT infrastructure to meet the site's temperature range. Similarly, climatic conditions might directly affect the project timetable if, for example, rainy season interrupts transportation to the project site or hinders transportation between the project site and long-term or temporary staff residences.

Secondly, the questions measure the general environmental awareness concerning waste management and other environmental impacts in the target country. Thirdly, the questions measure the preparedness of foreign staff to possible health concerns. Such concerns include, for instance, vaccinations, prophylactic medication, and basic preventive health care practices.

Table 4: Questions that address the environmental characteristics of IT work in international development co-operation projects.

Project's Preparedness to Face Environmental Issues		**Yes**	**No**
4.1	Are statistics about climate conditions in the site available? (For example, rainfall, snowfall, humidity, and maximum and minimum temperatures)	3	0
4.2	Is there regular and reliable transportation into and within the target area? (For example, regular flights, trains, buses, or taxes operate in target area or between the site and a major city in the area.)	2	0
4.3	Is the target area reachable around the year? (For example, roads are passable during rainy season too.)	3	0
4.4	Are relevant environmental issues acknowledged in the country and by the project? (For example, waste management is organized, and used batteries are recycled. Project documentation includes environmental impact assessment if necessary.)	1	0
Staff Preparedness for Health Concerns			
4.5	Are the staff members informed about the necessary insurances concerning medical treatments? (For example, employer's responsibilities concerning health issues are defined precisely.)	3	0
4.6	Are the staff members informed about the necessary vaccinations, health risks, and prophylactic medication? (For example, what kind of antimalarial medication is recommended.)	3	0
4.7	Are the staff members informed about preventive health care practices in the project area? (For example, how to process safe drinking water.)	3	0
4.8	Are the staff members informed about the available reliable acute care units, and about the local procedures concerning health services?	3	0
	Maximum score for the environmental preparedness is 21 points		

2.5 Technical Characteristics

The fifth part of the electronic questionnaire concerns six characteristics of IT work in developing countries that are mostly of the technical kind: *procurement, power stability, connectivity, equipment failures, maintenance, and manufacturer policies* (Tedre et al., 2011). Those characteristics vary between countries, and may surprise an unprepared technical expert. Decisions concerning, for example, local manufacturing, local purchasing, foreign goods importing, and equipment quality criteria are an important part of procurement process. Voltage stability is an essential factor affecting the uptime of ICT systems, the lifespan of ICT equipment, and generally the usefulness of any ICT system (Kemppainen, 2007). Internet access may not always be widely and cheaply available in developing countries, and the project team must be aware of the variety of available choices and their pros and cons. Equipment failures occur and procurement of new equipment and spare parts is sometimes harder in developing

countries than it is in industrialized countries. Varying availability of basic tools, inadequate supporting infrastructure, and spare components often complicate maintenance work. Projects should plan for preventive maintenance, appropriate location planning, cooling and ventilation arrangements, prevention of dust and dirt, and protection from constant exposure to ultraviolet (UV) radiation (Zeus Industrial Products, Inc., 2005). Special attention must be paid to issues such as debugging, identification of faults, and defects, remote management, robustness, malware protection, and system and virus protection updates (Surana et al., 2008). In addition, manufacturer policies differ between countries: prices may double between regions, warranty terms may be weaker, and equipment ranges may differ (Tedre & Bangu, 2009). Table 5 presents the questions that address those technical characteristics of IT work in a development co-operation project.

Firstly, the questions measure project's preparedness to technical challenges that may arise from instability of the site's electric power. Power stability depends mainly on the quality of national power grid or local power source, but it is also affected by the quality of the site's electrical wiring. Information about the quality of national power grid directly affects the requirements for spare power sources. In addition, power protection is an essential part of sustainability of ICT installations. Therefore, statistics about the power quality, site's electrical diagrams, and drawings of the site's buildings play a vital role in ICT project design.

Secondly, the questions measure issues concerning equipment failure and maintenance. Those risks can be minimized with sufficient information about locally obtainable expertise and materials. That happens through four project aspects. First, the involvement of local experts in the project design strengthens the local appropriateness of the technical solutions and develops the necessary human capacity for maintaining installations. Second, independent local experts simplify project administration due to decreased need to employ and educate permanent IT staff for the project organization. Third, locally obtainable spare parts and accessories simplify maintenance practices due to decreased need to store spare parts on the site. Fourth, the existence of more than one local Internet service provider typically benefits the project through increased competition, and subsequent improvement of quality of access and lower prices.

Thirdly, the questions indirectly address the issue of manufacturer policies. Projects usually cannot change such policies, but various unexpected delays can be avoided when those policies are clarified during the procurement process. For example, if a manufacturer's technical support is located in the country, the response time after equipment failure is shorter than when support is abroad. In a design phase, a local procurement expert can make a great difference to working when maintenance practices.

Table 5: Questions that address the technical characteristics of IT work in international development co-operation projects.

Preventive Measures:		**Yes**	**No**
5.1	Are up-to-date drawings of site buildings available?	4	0
5.2	Are up-to-date electrical diagrams of site buildings available?	4	0
5.3	Are statistics about the quality of electricity in the site area available or is the project prepared for significant power problems?	4	0
5.4	Does the site have a power source? (For example, the site is connected to the national power grid or it has a well-maintained power source such as local diesel generator or solar power system.)	3	0
Local Maintenance Preparedness:			
5.5	Has a local IT expert been involved in the project design?	4	0
5.6	Are there more than one local IT companies present in the project area?	3	0
5.7	Are there more than one local Internet service providers available?	1	0
5.8	Can ICT equipment be bought locally? (For example, there should be many enough IT companies for making project's bidding invitations adhere to the procurement policy.)	2	0
5.9	Are the necessary tools and accessories available locally? (For example, cabinets, cable chutes etc.)	2	0
5.10	Does the local partner organization have permanent IT staff for IT service management? (For example, IT support and maintenance is organized in the project site, and IT staff is permanently located there.)	3	0
5.11	Are procurement staff members experienced with bidding invitations for ICT equipment?	4	0
5.12	Are the crucial parts of ICT infrastructure maintainable locally? (For example, a Linux expert and an electrician are working for the organization, or their services can be contracted locally)	4	0
	Maximum score for the technical preparedness is 38 points		

2.6 Project Risk Status

Table 6 presents the taxonomy scales for the project's risk status. The table consists of rows for all five groups of the characteristics of IT work in international development co-operation projects, one row for the project's total preparedness score, and six columns. The first three columns present the names of question groups, a box for project's actual preparedness scores (from Tables 1, 2, 3, 4, and 5), and the maximum preparedness scores for each group. The last three columns define high-risk, medium-risk, and low-risk categories for each question group. Each group's risk is high if its preparedness score is less than 50% of the group's maximum

preparedness score. Each group's risk is medium if its preparedness score is between 50% and 80% of the group's maximum preparedness score. Each group's risk is low if its preparedness score is more than 80% of the group's maximum preparedness score.

Table 6: Project's risk status

Question group	Project Score	Maximum Score	High-risk	Medium-risk	Low-risk
Institutional preparedness		54	< 27	27 – 43	> 43
Educational preparedness		25	< 13	13 - 20	> 20
Socio-cultural preparedness		36	< 18	18 – 28	> 28
Environmental preparedness		21	< 11	11 – 16	> 16
Technical preparedness		38	< 19	19 – 30	> 30
Project's Total Score		174	< 87	87 - 139	> 139

The project is considered a low-risk one if its risk status is low in all groups. A low-risk status indicates that the preparedness of organization(s) and staff are already on an adequate level and countermeasures are not necessary. If that is not the case, the tool helps to create a starting point for designing appropriate countermeasures.

If any of the five groups is in the medium-risk category but none are in the high-risk category, contextual challenges may negatively influence the project implementation. The limitations or weaknesses in that group may affect the project implementation process or hinder the project's achievements in the long term. Even though the risks would materialize the probability of the whole project to fail is low, yet a medium risk status still indicates that a systematic plan for improvements should be designed.

If any of the five groups ranks in the high-risk category, the project has serious weaknesses. There is a significant concern that the risks materialize and the whole project might fail. The organization or its staff members are inadequately prepared for the project, and appropriate countermeasures should be taken before the project starts. For example, the organization may not have the necessary policies to rely on, the project manual may be inadequate, or staff members' contextual understanding may be incomplete. Necessary countermeasures might be related to capacity building or to general improvements in organizational preparedness for international development co-operation projects. The general recommendation is that the project should not continue before the weaknesses are properly assessed and addressed. In the special case where the project's total preparedness score is on the high-risk risk level, the project should not continue without major re-consideration, capacity building, and further analysis.

3. WEB-BASED IMPLEMENTATION

A web-based implementation of the risk identification tool is in the testing phase. The implementation is designed on the client-server architecture and open-source software (Figure 4).

The server side runs on Linux operating system with Apache web-server and MySQL database. Hypertext Preprocessor (PHP) with SimpleXML extension is used as a scripting tool for questionnaire forms. The client side requires Adobe Flash player and a browser that allows cookies to perform crucial functions. After submission of answers, risk points are calculated and stored into a MySQL database for later retrieval. Finally, the results are shown on the screen with Open-Flash-Chart 2.

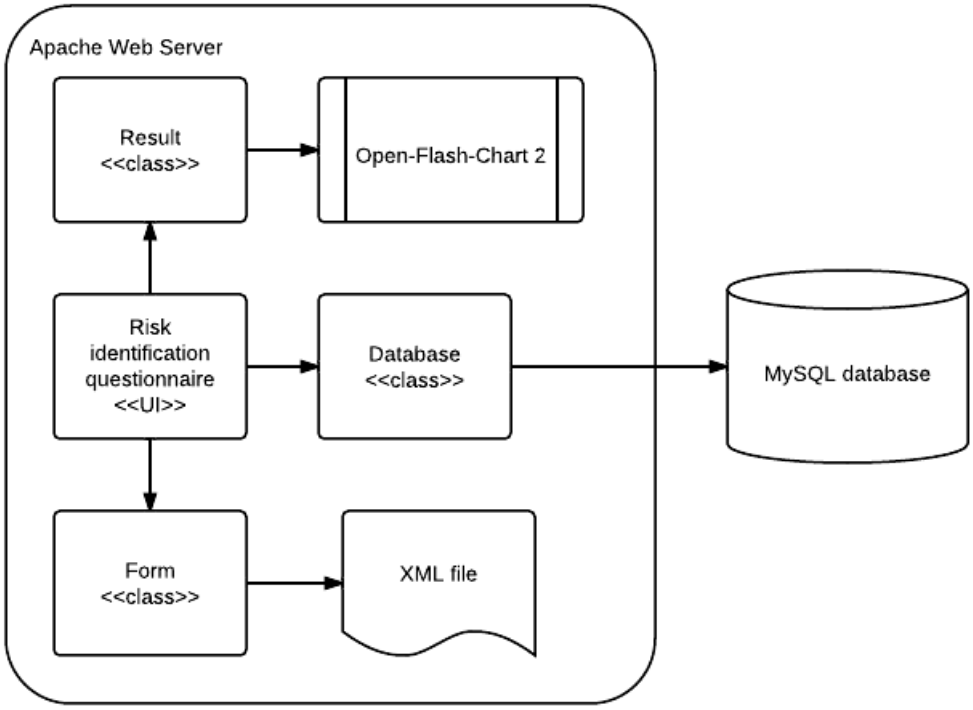

Figure 4: Architecture of the implementation.

The tool is available online in the web address http://cs.joensuu.fi/~pparvia/risktool/. At the first phase, the user has to answer the risk identification questions. That questionnaire is divided into five forms based on the question groups (Table 6): institutional, educational, socio-cultural, environmental, and technical characteristics. Figure 5 presents an example of the form layout for institutional characteristics. A user can save a link to an unfinished questionnaire and, hence, the job can be shared between a project's staff members. The tool does some preliminary checking and, for example, it reminds the user if questions are omitted. In addition, the use of CAPTCHA prevents automated answers. After the answers' submission, risk points are calculated, stored into a MySQL database, and with Open-Flash-Chart 2, the results are shown on the screen in two figures. The first figure (Figure 6) presents a project's risk status by groups, and the second figure (Figure 7) summarizes the project's total risk distribution by groups. Clicking on the figure bars allows a user to review the questionnaire answers. Finally, some recommendations for further actions are presented depending on the project's risk category.

1. Institutional characteristics

Organizational preparedness for development project:

1.1. Is a project manual available?
Yes ○ No ○

1.2. Is a financial management policy available?
Yes ○ No ○

1.3. Is a procurement policy available?
Yes ○ No ○

1.4. Is an anti-corruption policy available?
Yes ○ No ○

1.5. Is a staff policy available?
Yes ○ No ○

1.6. Is a fixed asset policy available?
Yes ○ No ○

1.7. Do monitoring and/or evaluation mechanisms exist? (for example, planning, monitoring, and evaluation mechanisms are defined and utilized according to organization's long term goals/plans/programs.)
Yes ○ No ○

Figure 5: A form for questions related to Institutional Characteristics

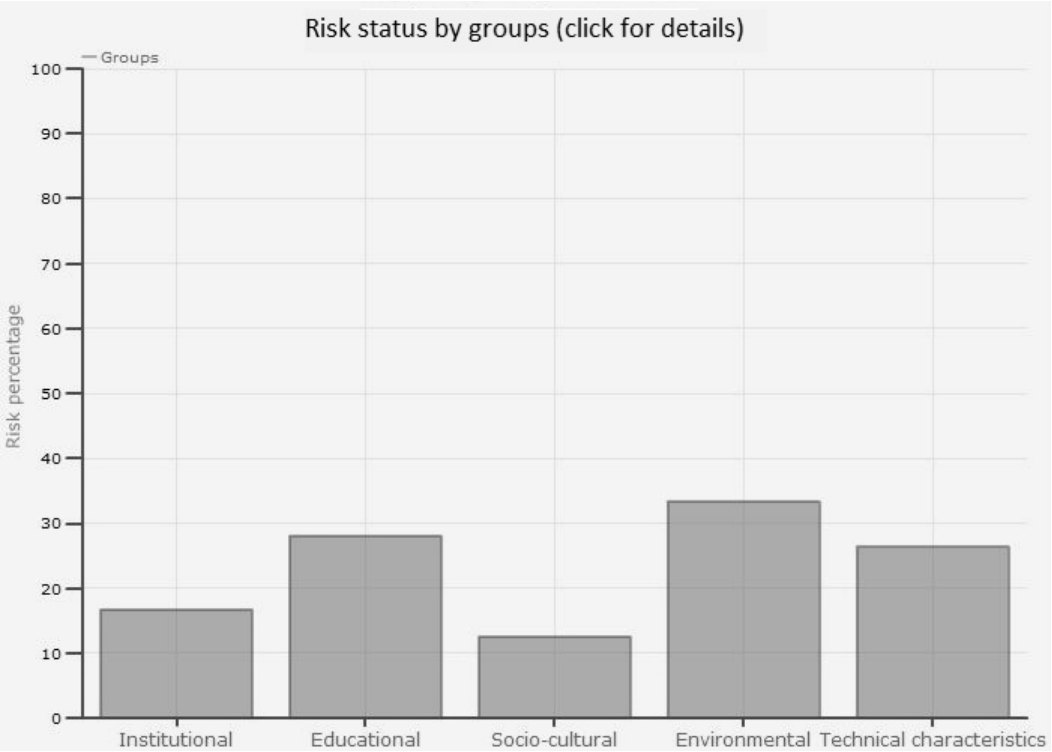

Figure 6: A project's risk status by groups.

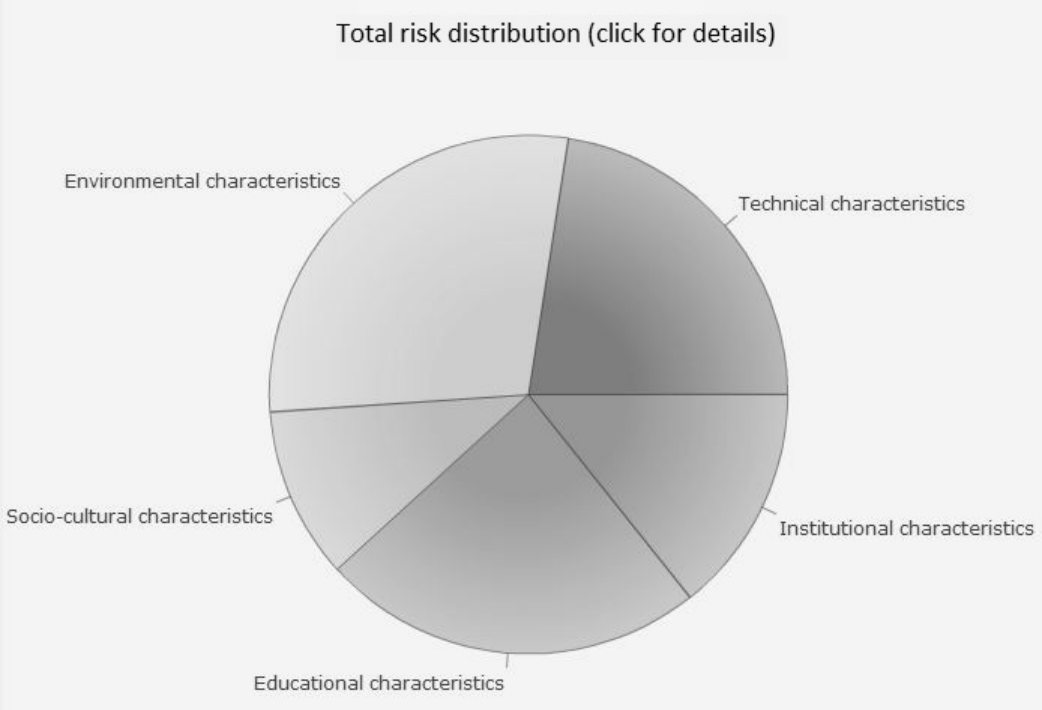

Figure 7: A project's total risk distribution.

4. DISCUSSION

Brewer et al. (2006) argued that the technical characteristics of IT work in developing countries are easier for foreign project workers to manage than cultural and environmental characteristics are. This is due to the reason that technical experts are not always educated in fields out of their specialty, such as development studies (Tedre et al., 2011). Unpreparedness may deteriorate experts' operational capacity in a foreign context and may seriously hinder their capability to predict project's risks. Our observation on a country-level comparison is that the probability of unexpected issues to materialize increases as Human Development Index (HDI) decreases (The United Nations Development Programme, 2011). This is also in line with poorer availability of local IT expertise in those countries.

An international co-operation development project is usually a temporary activity that has a timetable, budget, and implementing organization(s), and, most importantly, it is designed to meet specific development goals via a detailed work plan, e.g. (Team Technologies, 2005). Finally, the project should support a country in its progress to its national development goals. When those parameters are clearly defined—as they should be in a development project—that project's success or failure can be measured. The current trend in development project management is to define quantitatively measurable indicators that continuously describe projects' progress towards its development goals, and to define qualitative indicators that describe project's impacts on country's national development goals. Those indicators are based on information about the pre-project situation and a predicted post-project situation. As we showed, the design of such indicators is challenging if one's contextual understanding is inadequate. Inadequate contextual understanding may also lead to projects that address problems and build solutions that are prioritized in the international development co-operation community,

but that do not, for one reason or another, work locally. Therefore, the project results may not be sustainable in the long run, and the risk for a project failure is high in practice even if the indicators imply success.

In addition to special characteristics of IT work in developing countries (Figure 1) presented by Tedre et al. (2011), the risk identification tool addresses all eight perspectives of quality and productivity problems in information systems project presented by Flynn (1998) and Bennett et al. (2002). The quality problems (wrong problem is addressed, a project context is neglected, requirement analysis is incorrect, and whole project is carried out for the wrong reasons) are addressed when, firstly, the tool measures appropriateness of the project's goal to the end users. Secondly, the tool measures ICT system's suitability to its environment by measuring the implementers' knowledge about the project environment as a whole. Thirdly, the tool measures ICT system's appropriateness for the project's purpose. Strong local support and an adequate number of professionals increase the probability that the constructed ICT system fulfills its purpose. Fourthly, the tool measures project's sustainability by emphasizing commitment of local stakeholders. The productivity problems (user's requirements change, external events change the project environment, the management is poorly organized, and designed implementation is not feasible in the context) are addressed when, fifthly, the tool measures the adequacy of the project organization's management practices in a particular context and the project's practices vis-à-vis the practices of the international development co-operation community. Sixthly, the tool measures the project's flexibility in relation to external events. Seventhly, flexible project design also allows recognition of changes in user's requirements. Finally, the tool addresses issues related to the ICT system's technical and financial maintainability in the context.

5. CONCLUSIONS

This article analyzed risk management methods that are used in the most common project management frameworks in the context of international development co-operation. All of those methods have their strengths, but also obvious weaknesses. In spite of the different approaches to risk management, all the analyzed frameworks assume that technical professionals are able to identify and evaluate all dimensions of the project. Based on the literature, we showed that this assumption is invalid in situations where IT professionals operate in an unfamiliar context. That is because every project takes place in its own unique milieu that affects its design and implementation. It is common that in international development co-operation projects IT professionals must work in contexts unfamiliar to them.

This article also presented a risk identification tool for IT professionals who will work with an ICT-related project in the context of international development co-operation. Based on the literature, this article summarized a number of characteristics of IT work in developing countries that might pose risks to ICT projects. The risks included institutional, educational, socio-cultural, environmental, and technical characteristics. Then this article described a taxonomy-based risk identification tool that evaluates risks in a project. The tool consists of 55 quantified yes/no-questions, and of their impact analysis. Each question's quantification specifies the significance of each issue to project success. Based on the responses, the tool calculates that project's risk level and recommends appropriate countermeasures.

The aim of the risk identification tool is to assist IT professionals in preparation process for an unfamiliar project milieu in international development co-operation projects. Each of the

possible risks can be overcome with good preparation and competent assistance. Therefore, the risk identification tool can be used, for example, for tailoring IT professionals' preparation period for mitigating the probable future risks or for developing organization's capacity for managing international development co-operation projects. Above all, the tool can assist IT professionals and organizations to plan countermeasures for risks in specific ICT project milieus.

The risk identification tool focuses on risk identification only and it is not a project management tool. The risk identification tool helps IT professionals to consider possible weaknesses of their international development co-operation project and guide the preparation process. Still, it cannot predict or identify unexpected events that might appear anytime during the project implementation. Those events can significantly change the project milieu and affect project design, including ICT requirements. Therefore, in spite of good preparations, it is essential to use a flexible project design.

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