Implementing small scale ICT projects in developing countries – how challenging is it?

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ABSTRACT

This paper summarises experiences of efforts made by twenty individuals when implementing small-scale ICT development projects in their organizations located in seven developing countries. The main focus of these projects was the use of ICT in educational settings. Challenges encountered and the contributing factors for implementation success of the projects are systematically investigated using interviews and follow up surveys. Results show that the typical limitations of technology and infrastructure were the key obstacles. The commitment of individual project managers in the role of "change agents" and organizational support in the were the strengths behind the success of the projects. Based on the outcome of this study, professional development of the change agents is a key factor for the success of projects. IT and infrastructure limitations contributed to the failure of the majority of the ICT related projects.

Keywords: *ICT, education, project implementation, change projects, success factors, developing countries*

INTRODUCTION

Use of Information and Communication Technology (ICT) to enhance the quality and quantity of education and related services have become an integral part of education projects (Khan, et al., 2012). However, use of ICT as a solution to enhance education and related services has not always been recognized as successful (Heeks, 2010) due to many reasons including lack of skills, funds, and motivation of the entities involved (Belassi & Tukel, 1996; Musiyandaka, et al., 2013). On the one hand, measuring the success of ICT based solutions about development goals is still a challenge (Kleine, 2010), and on the other hand, summing up and generalizing the lessons learned from different ICT initiatives have not been practically effective due to the extent and heterogeneity of the projects. The subjectivity of e- solutions concerning the domain of application as well as demographical and cultural differences of the countries limit the systematic evaluations of the impact of ICT approaches. The diversity of ICT approaches results in limited generalisability. Furthermore, the rapid development of the field contributes a lot to costly projects becoming obsolete quickly. However, the awareness of potential risks and obstacles, as well as the knowledge of strengths in relation to the country, context, the area of focus, etc. could be distinctly advantageous when planning future ICT and development projects. In this paper, an effort is made to explore how challenging is the implementation of a project that aims at enhancing education and related services using ICTs in developing regions. The success factors and key challenges encountered during the implementation of several small-scale projects focusing on education in some selected developing countries are thereby investigated. The focus of this study when analyzing the critical factors for project succession is on the perceptions of the manager of the project instead of externally evaluating the project itself.

In the following sections, the background and the domain in focus, the methodology and specific methods used in collection and analysis of data, results and the discussion as well as the concluding remarks are described.

BACKGROUND AND THE DOMAIN IN FOCUS

ICT tools, models, methods and systems used in education are ubiquitous and are being introduced into the field daily, as stated in the preceding section. Although the ubiquity allows the field to grow rapidly, not all attempts made to enhance education by ICTs are successful due to many reasons (Nicholson, 2015; Kumaraswamy & Ugwu, 2007). What factors affect the success of ICTs has been a focus of many studies in the literature.   Hossain Khan, et al (2012) for example lists the following six factors to consider when implementing ICTs in Education, based on a case from Bangladesh. The focus was on the educators' perspective. Commitment from the state and the stakeholders is the crucial factor identified. Other critical factors include relevant resources, backup policies/strategies/guidelines, collaboration with local and international ICT organizations (industries), professional development of the educators and the technical savvy. Hew & Brush (2007) present a comprehensive study of the barriers that affect using technology in K-12 curriculum based on existing studies. It identifies 123 factors grouped under six general barriers that impede the successful introduction of ICT into K-12 curriculum, namely, resource limitations, institutional practices, subject culture, attitudes and beliefs of the stakeholders involved, knowledge and skills of both students and teachers, and assessment. The same study also proposes some strategies to overcome the identified barriers such as clear vision and plan for technology integration, addressing resource limitations, changing the attitudes and believes that hinder ICT integrations, supporting the involved stakeholders and restructuring the assessment criteria. Furthermore, it discusses some knowledge gaps that need to fulfill to for successful technology integration. By ordering the identified barriers in two levels, this study tries to map the barriers with the recommendations provided more deeply and strategically. Andersson & Grönlund (2009) have compiled thirty challenges in implementing e-learning projects based on a corpus of previous research in the field, in four main categories such as course challenges, challenges pertinent to individuals' characteristics, technological challenges, and contextual challenges. Lawson & Comber (1999) focuses on personal factors affecting the success of ICT in education. The attitudes and perceptions of the stakeholders, namely, teachers, the IT administrators and senior management, as well as the availability of required support for IT are pointed out in this work. Quite a similar set of success factors are described in (Wannasiri, et al., 2012). Twenty-two critical factors are categorized into learner's characteristics, instructors' characteristics, institution and service quality, infrastructure and system quality, course and information quality and extrinsic motivation, in this study. Quite similar critical factors have been discussed with respect to governance (Altameen, et al., 2006; Panopoulou, et al., 2014; Basu, 2004; Gichoya, 2005), society (Heeks, 2008; Kolko, et al., 2014), public and business (Hassan , et al., 2011) and so forth. Most, if not all the literature addresses the lack of the technical expertise in project managers and other involved stakeholders as a significant factor (Hew & Brush, 2007).

Capacity building in developing regions- The ITP program

Recognising the need for capacity building and improving the technical expertise of those involved in ICT and development projects, The Swedish International Development Agency (SIDA, n.d.) implemented a human capacity building program called Information Technology and Pedagogical development program (ITP). This program includes training potential candidates from developing regions who could make a change in their organization and/or social processes with the help of ICT. Stockholm University, Sweden, and a non-governmental organization called Life Academy (Life Academy, n.d.) have partnered in delivering the program. Twelve countries were prioritized in this capacity building programme, namely, Afghanistan, Bangladesh, Bolivia, Cambodia, Ethiopia, Kosovo, Liberia, Rwanda, Sierra Leone, Tanzania, Uganda, and Zimbabwe. The program was initiated in 2012. As of 2015, nine groups of about 30 participants each, called change agents from the countries above in Asia, Africa, and South America have been trained. Figure 1 shows the number of applications received by the program from 2012 to 2015. The number of selected participants during the same period plotted with regards to the country is given in Figure 2.
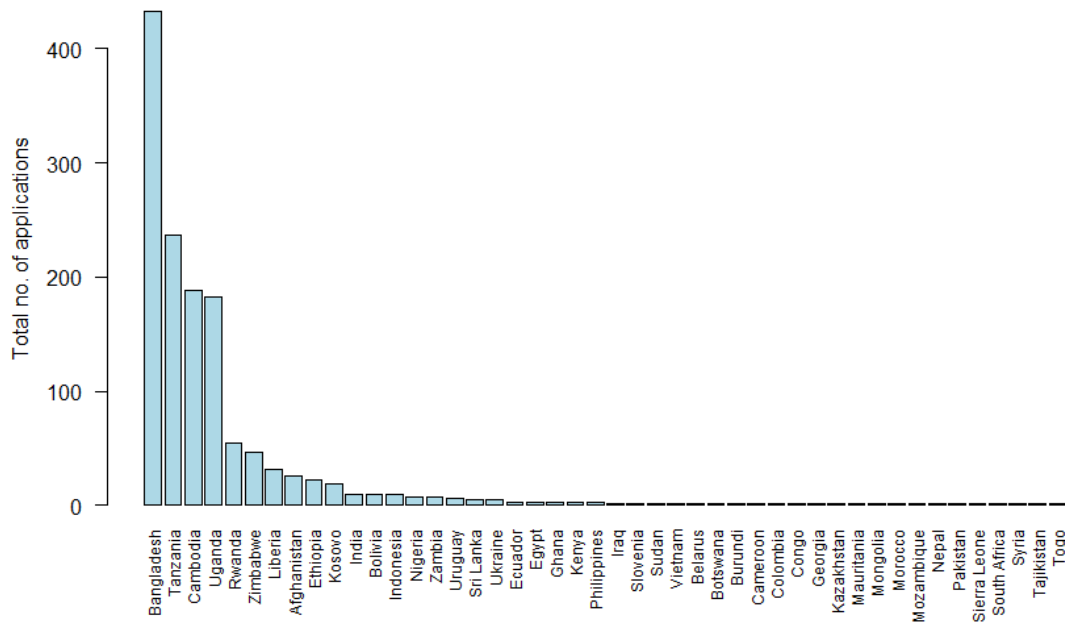
Figure 1: *Total number of applications during 2012-2015 by country.*
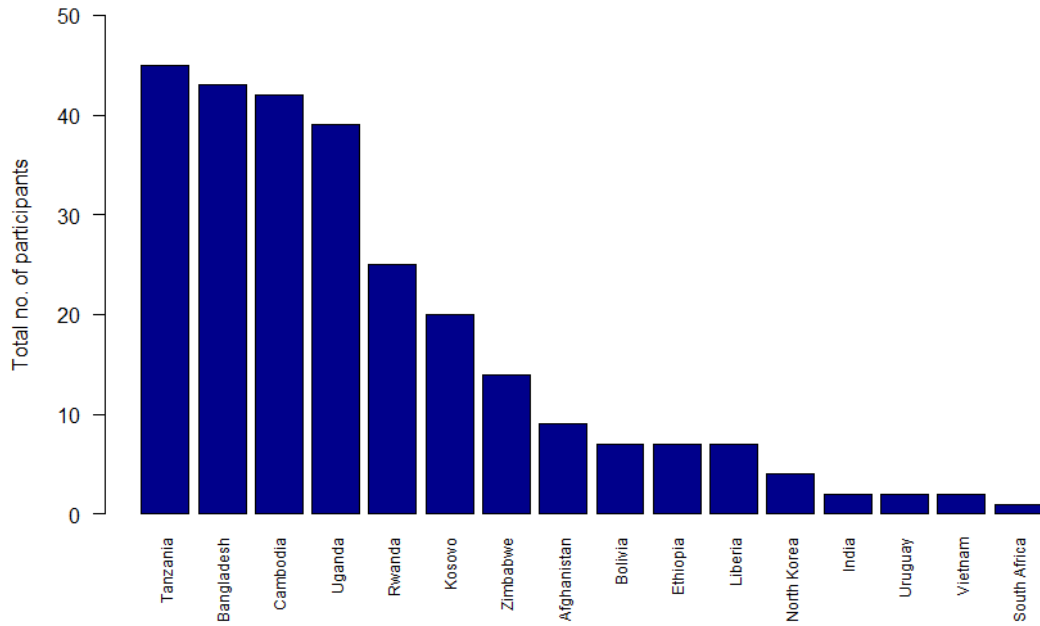
Figure 2: *Total number of participants during 2012-2015 by country*

As shown in Figure 1, the program received applications from countries outside the prioritized list. Out of the 1399 applications (877 male applicants and 439 female), 269 participants took part in the training program during a period of four years from 2012 to 2015. There were nine application periods and approximately 25-30 persons in each round. A high number of applications were

received from countries such as Bangladesh (433 applications) and Tanzania (237), followed by Cambodia and Uganda with 188 and 182 applications respectively.

The selected participants were supposed to implement a change project within ICT for Development related to education in their home countries within one year. The training program offered the skills required in implementing the projects. There were several stages of the program, each of which is designed as learning processes. In the first month of enrolment in the program, the change agents visited Sweden for a crash course in the use of ICTs in education, where the required knowledge for designing and implementing the change projects was provided. Change agents also received individualized coaching during the planning, designing and implementing their change projects. The progress of their projects was evaluated halfway through the program, that is, after approximately six months, at a workshop held in one of the selected developing countries. During the review meeting, the projects were thoroughly analyzed and further coaching was provided. A peer review process was also included throughout the project evaluation, which allowed the change agents to learn from each other collaboratively. The change agents submitted a complete project report at the end of the year, where, again, an evaluation is carried out. The projects were implemented in the participant's home country.

A successful change project is a project that met the objectives of the project. By the end of 2015, the program produced many such successful projects, especially from Bangladesh and Cambodia. Some successful projects were produced by participants from Bolivia, Ethiopia, Kosovo, Rwanda, Uganda, and Tanzania as well. There were a few completed change projects from Zimbabwe. Liberia and Afghanistan completed one project each. Sierra Leone had no change agents at all in the program, although it is a prioritized country in the program. Besides the target countries, India, Uruguay, Vietnam, South Africa and North Korea have been represented in the program based on the feasibility of their proposals. Many participants organized themselves as a community when it came to be executing their projects, cooperating closely from the beginning of the program. They also had a more strategic choice in the selection of participants from organizations, having many key persons participating in the program. For example, a large community involving top-level government policymakers made a huge difference regarding the transition speed and impact of the change projects in Bangladesh.

Overview of the change projects

This section gives a short overall summary and description of selected change projects on a country by country basis.

Bangladesh: The ITP program was very popular in Bangladesh. Forty-six projects at different education levels have had been completed by the end of the program. Bangladesh participants maintained a strong network of change agents. The change projects in Bangladesh were the most successful in the whole ITP program for several reasons. They had a well-coordinated network of change agents who cooperated before, during and after the change project period. Therefore, the change projects were not isolated individual projects, but highly connected projects across the country and education levels from primary school to university level. Also, there was a strong commitment among change agents from the grass root level to the ones at top management level. Government officials were involved in the projects. The phase of scaling up was quick. For example, the portal for teachers is a project aimed at sharing the teaching content and other information. Many change projects were linked with this portal. The "Teacher Portal" was created from scratch with the purpose of sharing digital learning material online, and within one year over 100,000 teachers were sharing their digital learning material (Chowdhury & Mohammed, 2016, p. 3). The number of teachers in the teacher portal is increasing continuously. As a motivation for the teachers to be engaged, a prize is offered for the most active online teacher in the country on a

weekly basis. A "Student Portal" is also launched now in parallel to the teacher portal, and it is expected to be even bigger in scale.

Cambodia: There were 41 change projects implemented in Cambodia. One of the change project's objectives was to develop an ICT textbook for the grade 12 students with the focus of vocational orientation. This project attempted to improve the preparation of students for vocational training or higher education while giving them a clear idea of possible career paths in the field that they have chosen, help them to integrate themselves in a workplace, and improve communication and computer skills. The project was started with the involvement of the Ministry of Education, Youth, and Sport and therefore, it directly impacts on the national level. A team leader of Young Women's Leadership Network of Cambodia introduced another change project for raising awareness on the ICT fundamentals, ethics of writing including Khmer Unicode, open source, e-advocacy and social media. The project was aimed to empower young women on the challenge of an undeveloped infrastructure. The issues from their community were written in a blog. This project also intended to create an opportunity for young women in embracing technology for advocacy and sharing their information resources through the organization's Facebook page. The project followed a crowdsourcing approach to content development, information sharing, and community building and has a good potential to expand as resources for informal learning.

Bolivia: Many large-scale ICT projects for education were started some years ago in Bolivia. E.g., in 2011 Government gave 5,700 laptops to teachers, and, in 2014 Government gave 140,000 laptops to students of the last year at secondary school. In 2015, 126,723 laptops were distributed among teachers in rural and urban areas. In parallel, 80,000 teachers have been trained in ICT. There is a satellite (Tupac Katari) that serve about 1,000 out of 1,600 telecentres. What is missing in this context is the informatics platforms and content. According to the country reports, Bolivia has invested in ICT, particularly in infrastructure but not on ICT skills training for teachers. With the support from SIDA, Bolivia now has laid fiber optic for all the University systems in La Paz City. In La Paz, the University Mayor de San Andrés (UMSA), the largest university in the country, has distributed tablets to all professors (about 3,000) in 2016. But, there had no training being given for using the laptops in the classroom or for research. One of a recent change project started to implement an ICT master plan for UMSA. Several other change projects focused on using ICT in informal learning.

Kosovo: The New Kosovo Curriculum Framework and its implementation are interlinked with teacher development, including how to effectively use ICTs in teaching and learning. One of the change projects "Teachers Development in using ICT for Education", which has been designed in cooperation with Ministry of Education, Science and Technology (MEST) and EU "ICT and e-learning in Education Project" is to support the Kosovo government in improving the quality and efficiency of education and training services through the integration of ICTs into the teaching and learning process, thereby improving lifelong learning and employability skills for teachers in Kosovo. It is nationally the most important project in this field. The specific objectives or purposes of this project are: enhance the implementation of the recommendations and policy proposals developed by the Ministry of Education, Science and Technology (MEST) and IT. Another change project was scaling up the "ICT and e-learning in Education Project." The project addressed the most important components of the ICT usage in the education such as, knowledge raising and increased usage of ICT in all aspects of education, which may influence the planning for educational system and lifelong learning, development and sharing of education resources, and integration of ICT within selected schools as a MEST priority defined in strategic development documents. Although the change agents from Kosovo were aware and knowledgeable about ICT and its use in education, the organizations they were involved were not open and ready to change sometimes. Another change project investigated the mobile innovation hubs and creation of new companies together with schools and universities. There was also a project about using ICT for

kindergarten to facilitate communication with parents focussing on children's activities, needs, and joint planning in a very creative way.

Rwanda: According to the National ICT Strategy and Plan (NICI, 2015), Rwanda has a higher level of ICT infrastructure, but there is no information of how ICTs are integrated at the primary level of education. In general, the national pupil computer ratio is about 16:1 (NICI, 2015). The government's project of one laptop per child (OLPC) enhanced the use of ICTs because it allows students in primary schools to have early access to computers. Still, one of the major challenges is the lack of infrastructure and the high costs to acquire power, equipment, and connectivity (Ministry of Finance , 2000). In Rwanda focus should be on using ICT effectively in education since the infrastructure is already there (Ministry of Finance , 2000). There are more results to be expected from the Rwandan change projects including speeding up the progress. A limiting factor is the hierarchies in decision-making (NICI, 2015). The change agents from Rwanda were diverse in their academic qualifications. Some projects were very dynamic and innovative. For example, one project was about developing mobile phone learning content in video format. Another project transformed a whole school into an ICT enabled school in teaching and learning. Some change projects from Rwanda dealt with content development and peer to peer learning on use of learning management systems among teachers at higher education.

Uganda: The majority of change projects focused on integrating ICT into learning environments. Two change agents implemented a Blended Learning environment using Moodle and interactive tools in a teacher training college. Tutors have started presenting their lessons both offline and online, they have started engaging learners with online activities such as Kahoot, Poll Everywhere, online quizzes and so on. They have started using videos and audios in classrooms. Tutors have started using Open education resources such as in the Teacher Education in Sab Saharan Africa -TESSA- repository. They have enriched them with content from the internet and through collaboration with teachers from other institutions of learning.

Ethiopia: Ethiopian change projects have been implemented at different levels. One change project was to create a portal, which students can access and use multimedia solutions and upload their multimedia solutions into a well-organized portal that is similar to their textbooks. The specialty of this project is that students engage in the project as collaborators. In addition to using resources, students actively participate in the project as content developers. As an extension to this project, another change agent started a project to develop a mobile application to assist students. The teaching tablet project, called YaNetu, which has an artificial intelligent avatar with a complete dialogue system which can act as a virtual teacher. This teaching application will play the role of a teacher according to each student's academic level. The application will be contextual through time. It will follow the student's result and make more emphasis on areas where he/she shows weaknesses.

Tanzania: ICT has not been well integrated into education in Tanzania due to poor internet connectivity, lack of facilities, high costs of bandwidth etc. and therefore, most educators seem to be unfamiliar with how to use it for teaching and learning (Esselaar & Adam, 2013). As some regions have started to be connected with the National ICT Broadband Backbone, there is a possibility for many educational institutions to use ICT as a pedagogical tool enhanced by connectivity (Esselaar & Adam, 2013). The change projects from Tanzania vary from primary education to higher education and include rural and urban areas. It is important to note that several Tanzanian projects targeted students who need special assistance. One example is the project titled "Assistive Technology Program for Visual Impaired Students at all Education Levels in Tanzania." Also, there have been several projects focused on how to use mobile technologies for education. The use of mobile technologies expands the use of ICT in education in rural areas. Other major topics are teacher training, content development, policy implementation etc. Tanzania shows slow progress and there is no active alumni network as in Bangladesh. The ideas for change

projects are often broad and need a lot of re-designing to make it feasible within existing resources and time frame. Change agent's own knowledge was often very limited, which of course also limits the potential for the project to have a real impact.

Zimbabwe: The government ICT policy of Zimbabwe aims to provide connectivity in all schools further bridging the urban-rural digital divide and enhancing teaching and learning through the use of technology tools and promoting universal computer literacy in Zimbabwe's schools (Consumer Council, 2015). Therefore, it was necessary for Zimbabwe to adopt strategies that ensure resources are maximized in order to realize their ICT policy. There are few change projects focused on policy and capacity building. One of change agent started a project to develop a project named "Toward a perfect eLearning Policy for Africa University." Although, the project aims at only one university the output and experience of the development process can be shared between other universities. Change projects from Zimbabwe were very diverse. Some projects were initiated and implemented at universities, while others are more informal learning projects for females or about human rights and political change.

Liberia: There have been eight Liberian change projects. One has fulfilled the project objectives successfully, and further scaling up as a globally supported project with a base in Nigeria. This project is about girls STEM (Science, Technology, Engineering, and Mathematics) education. The change agent was very active and her network and dedication was the key to the progress. However, in general, there was less teamwork between change agents in Liberia. The skills among the change agents were comparatively limited, which resulted in low impact of the change projects.

South Africa: There was only one change agent from South Africa. The project focused on an IT-learning tool which was commercially available. Not many generalizations can be made about South Africa in this program. The change agent did not participate in the Regional phase meeting. However, ICT is needed in South Africa in order to scale up and reach the disadvantaged groups. The adoption of ICT is slow at universities and schools even when it comes to the largest provider of distance education in Africa, the University of South Africa (UNISA) (UNISA, 2017). The university started as a letter based correspondence university and had a large printing section which is now completely outdated when moving into the digital era. Both the quality of education and the number of students who can access could be much higher in a country like South Africa, if ICT was effectively implemented.

Vietnam: There was only one change project from Vietnam as well. The project objective was to build an ICT application in administration and interactive learning in Ngo Quyen Junior High School. The change agent has identified two main challenges; motivating teachers to start new things and to get approval from the management as the system is quite bureaucratic. According to the change agent, ICT is now applied in Vietnam schools. But the primary level education has not yet taken advantage of the resources available. The project proposed to build a model for sharing knowledge on ICT in education and Interactive Learning among educational network, harnessing social media and online resources for distance learning, and building a network. The change agent reported mindset change, poor access to online resources, and system acceptance as main challenges of the project.

India: Two change projects from India were completed; "Formulate a strategy regarding the opening of information and advice centers on gender issues" and "Developing Techno-Pedagogy skills among Secondary School Teachers to Integrate ICT in Teaching and Learning." India was not a SIDA target country either. But it is both a regional leader in ICT development as well as lagging behind when it comes to implementation of ICT in education for all. There are vast differences between rural and urban schools, between private and public schools and between states (Banerjee, 2014). Therefore, it is a challenge to implement projects that have a general impact.

METHODOLOGY

The purpose of this study is to explore the perceptions of the change agents about implementing their change projects. An attempt is made to systematically formulate change agents' experiences into a set of guidelines that could be useful during the implementation of small-scale ICT and development projects in developing countries. Each project is considered as a unit of analysis. The guidelines are grounded in the aggregation of change agents' perceptions and experience about the challenges throughout the project lifetime. Considering the objective of the study, we selected the exploratory case study methodology. Exploratory case study method provides the researcher with a high degree of flexibility and independence with regard to the research design as well as the data collection (Streb, 2010). An exploratory case study is therefore not limited in terms of its qualitative or quantitative specificity and we use questionnaires and interviews as data collection methods. It should be recalled that the focus of this study is not to evaluate how successful are the projects the change agents implement, but to investigate the project manager's (change agent's) perceptions about critical factors that affect the implementation of the projects.

Theoretical foundations

The underlying theoretic framework for this study was adapted from Information Technology (IT) and Information Systems (IS) research. Specifically, it's inspired by the model of critical factors as described in Belassi & Tukel (1996). Based on the related literature, (Belassi & Tukel, 1996) proposes a framework for critical success and failure factors of projects under four main areas, namely, factors related to the project, factors related to the organization, factors related to the external environment and factors related to the project manager and the team members. This study adapts the Belassi & Tukel (1996) categories with the following interpretation.

1. Process-related – factors associated with the implementation process of the change projects
2. Contextual – factors related to the organization the project is implemented
3. External – external supports received by the project and the change agent
4. Change agent related – factors about the change agent him/herself.

Sampling, data and data collection methods

Participants of this exploratory study are the change agents who completed their change projects within the given one year's period. Twenty of them were randomly selected for participating in the interview and follow-up questionnaire. There were 18 projects altogether. One project was created by a group of three persons from Bangladesh, and the rest were individual projects.

The duration of the interview was not controlled. Participants were allowed to give long and expressive answers. However, we have followed an interview guide with questions regarding 1) Motivated/involved staff/teamwork, 2) Support and training they received, 3) Organizational culture and support in implementing the projects, 4) Professional training provided to the actors, 5) Commitment of the leadership, and 6) ICT Skills of the change agents and target groups of the projects. The success factors and the obstacles the change agents faced during the process of implementing change projects are thereby extracted. The outcome of the interview data analysis was a set of critical success and failure factors. The same sample of change agents was used to rank the severity of the discovered critical factors. An open-ended questionnaire was distributed among participants. There was a time gap of about one to one and a half month between conducting the interview and distributing the questionnaire. The response rate was hundred percent, but the group who created one project has completed the questionnaire together. Therefore, the questionnaire data had only 18 instances.

Data analysis methods

The interviews of the 20 change agents were recorded and transcribed using the qualitative data analysis tool, Maxqda (MAXQDA, 1989-2016). We followed the suggestions from Denscombe (2010) for the data analysis that explained how to use the grounded theory for the qualitative data analysis. We used MaxQDA for organizing, transcription, and coding. First, we explored the collected data from interviews. Then, the collected data is coded by re-reading and writing memos to highlight the important concepts. The initial codes were numerous and they were merged in the second analysis phase in order to reduce the number of codes. The critical factors related codes emerged from the analysis. Then, codes were grouped into emerging categories. In the next step, we organized the codes and categorized by cross-checking the data and concepts of the underlying theory described above. Finally, we conceptualized the critical success factors and the challenges faced by the change agents while implementing their change projects. The outcome is discussed in relation to previous studies.

The questionnaire distributed among the participants of the study was created in google forms© and analyzed using R statistical computing environment (R Core Team, 2014) .

RESULTS AND DISCUSSION

The experiences and observations of 20 randomly selected change agents during the event of implementing small-scale change projects that uses ICT as the enabler for change in their organizations are systematically explored and summarized in the following sections.

Descriptions of the projects and change agents

The background of the change agents participated in this study and their change projects are summarised in this section. Table 1 summarises the descriptions of the participants and their projects.

There were ten males and ten female participants in the study. The participants were from Bangladesh, Cambodia, Ethiopia, Liberia, Rwanda, Tanzania and Uganda. Thirteen participants were from academia or teaching, and the rest were ICT specialists, managers, and other administrators. The highest number of selected change projects were within the area of higher education and secondary education and related to teacher and student training. Three projects were about ICT policy development. Figure 3 shows the target group (users) of their change projects.

Table 1: *Summary of the change agents participated in this study*

| Country	Gender	Organization	Title of the change project:	Area of the project
Bangladesh	Male	Teacher Training College	Creating Online Platforms using Mathematics website for Secondary Students	Teacher education
Bangladesh	Female	Ministry	Pedagogical improvement by integrating ICT in Secondary Level	Teacher education, Student education, Digital content
Bangladesh	1 Male and 2 Females	Teacher Training College	Introducing In-house Training on ICT on Education at secondary level	Policy, Upper secondary education
Bangladesh	Male	Ministry	ICT in Education Initiatives through Field Level Administrative Supervision	Policy
Cambodia	Male	NGO	Changing Teaching Practice-From Tradition to ICT Integration	Teacher education, Student education
Cambodia	Male	High School	Integration ICT in high school	Upper secondary education
Cambodia	Male	Open Institute	Development of ICT textbook for grade 12 students	Upper secondary education, Student education, Education technology, and software, Digital content
Cambodia	Male	University	Integration of ICT in Teaching and Learning in Higher Education	Higher education
Cambodia	Male	NGO	Changing Teaching Practice-From Traditional to ICT Integration	Upper secondary education, Primary education, Teacher education, Student education, Preschool education
Ethiopia	Male	University	Integration of ICT for Teaching Learning Processes	Policy, Higher education, Education technology, and software, Digital content
Liberia	Female	High School	METS Afrika4D	Higher education, Upper secondary education, Primary education, Civil society
Rwanda	Female	Technical college	Enhance the integration of ICT Facilities in Teaching/Learning	Higher education
Rwanda	Female	High School	Institutional Strategy and Capacity Building of Teachers using ICT	Upper secondary education
Tanzania	Female	University	Development of e-Learning Content for Secondary Schools	Upper secondary education, Teacher education, Student education, Digital content
Tanzania	Female	Ministry	ICT use for Quality Improvement in Teaching and Learning	Teacher education
Tanzania	Female	University	Development of e-Learning Content for Secondary Schools	Upper secondary education, Teacher education, Student education, Education technology and software, Digital content,
Uganda	Male	University	Propelling an ICT Led Pedagogy	Policy, Higher education
Uganda	Female	University	ICT for Enhancing Teaching and Learning	Higher education, Education technology, and software, Digital content
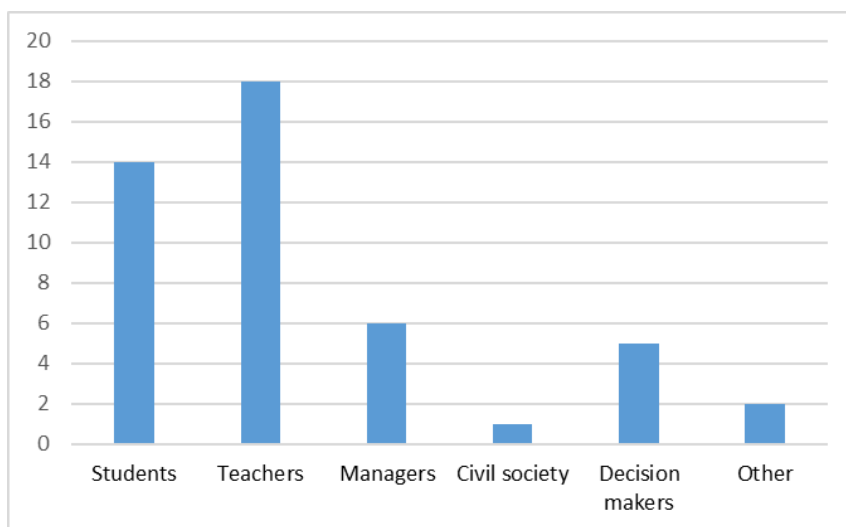
Figure 3*: The target group (users) of the change projects*

According to Figure 3, all the 18 projects have teachers and/or students as the target groups. Therefore, the critical factors this study brings out are mostly related to small-scale projects of using ICT in teaching and learning settings. How inclusive their projects are with respect to different focusses is presented in Table 2. The scale S1-S5 presents the agreement from strong to the least.

Table 2*: The change agent's perceptions of the inclusiveness of their projects*

Question	S1	S2	S3	S4	S5
The project is aligned with the national policy for ICT in Education	11	2	3	0	0
The project addresses equity of access for remote schools	4	7	4	0	1
The project addresses equity of access for minority groups	5	7	4	0	0
The project addresses equity of access for girls/women	13	0	3	0	0
The project addresses equity of access for children with special needs	3	6	5	2	0
The project addresses development of ICT skills of teachers/trainers	12	2	2	0	0
The project addresses development of ICT support functions at schools or educational institutions	9	4	3	0	0
The project addresses development of ICT use for administrative tasks at schools or educational institutions	8	5	3	0	0
The project addresses development of digital content in pupils/ students' native languages	8	3	4	1	0
The project addresses deployment of ICT for teaching and learning	12	1	3	0	0

Sixteen out of the eighteen participants responded to these questions. Almost all considered national and organizational IT policies when implementing their change projects. Also, the inclusiveness of minority, minors, women, ICT illiterates and those with language limitations were considered as well. We also recorded the change agent's perception on the importance of the training program and the support from peers, which is shown in Figure 4.
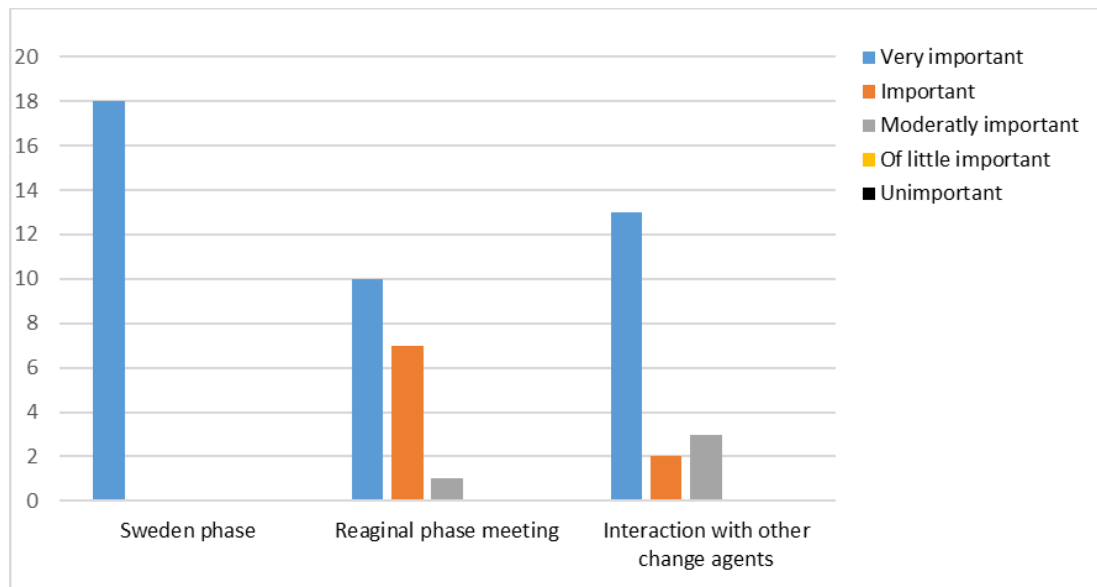
Figure 4: *Importance of the training program*

All the change agents agreed that the training offered to them was very important in implementing their projects. They also recognized the importance of having a review meeting in the middle of the program. Also, the participants recognized their peer collaboration and support.
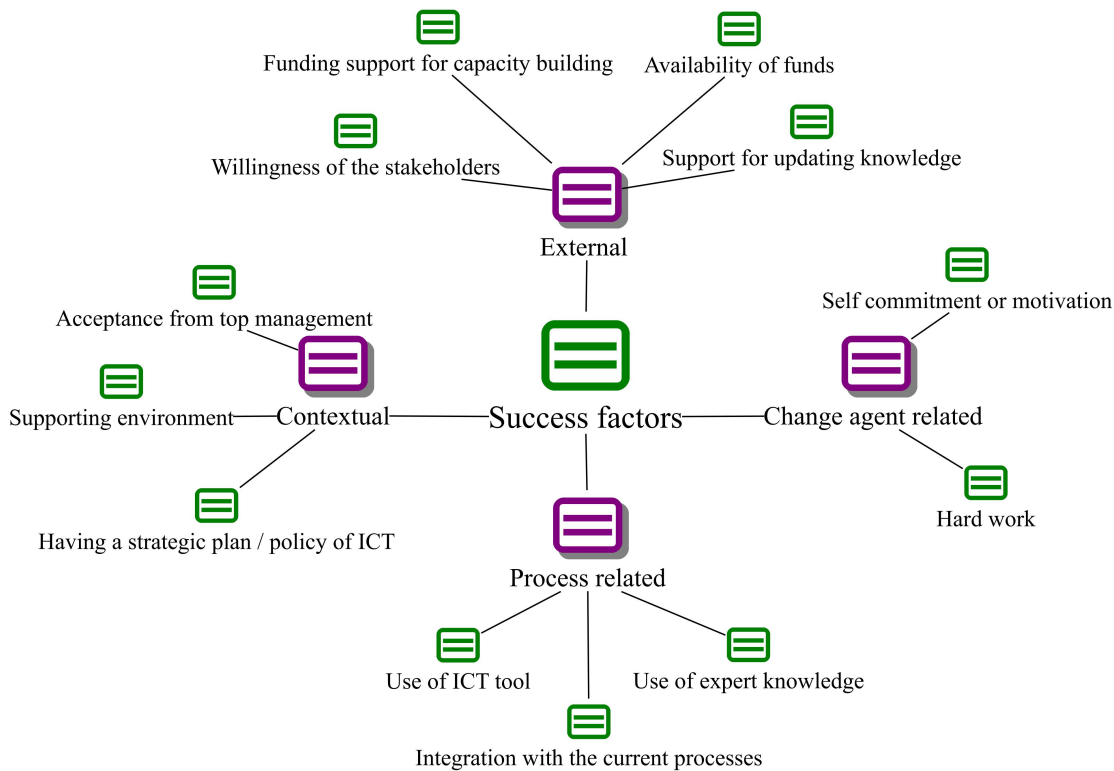
Analysis of the Interviews

This section contains the results drawn from the interviews conducted with the selected change agents. The idea was to explore the change agents' perceptions of the factors contribute to the success of small sale ICT and development project and the challenges one could expect in such an endeavor.

Factors contributing to success of the projects

After transcription, the participants' interview responses about the critical factors that lead the projects successful are summarised as in Figure 5. As presented in the methods section, we grounded the interview data in a framework that has four categories, i.e.

1. Process-related – factors associated with the implementation process of the change projects
2. Contextual – factors related to the organization the project is implemented
3. External – external supports received by the project and the change agent
4. Change agent related – factors about the change agent him/herself.

Figure 5: *Success factors as discovered by the interviews*

The four-category framework in Figure 5 is created using MaxQda©. The outcome of the analysis shows how different types of factors were related to each other. Several interviewees highlighted the importance of the role of the change agent in the project. For instance, following is a quote from one interview;

"The commitment: self-commitment meaning that you are not afraid that change cannot happen. You have to start from yourself. That´s my experience, first, I have to be aware of the use of ICT as a teaching tool. I have to explain to my colleagues and believe that ICT would be effective. I have to use on myself in my classroom. Sometimes I have issues with Internet access. I tried my best in any way I can. Either way, I asked my students to download a movie or video clip related to the topic that I teach the class so that way I try and everyone can see. Therefore, I would say that the commitment from the teacher is most the most important in order to make a change project."

Another response was "*The challenge that we received was a real trigger for us. And, so we needed to move up and wanted to be like developed countries*". Several participants mentioned that the practical skills are an important success factor. Many had the opinion that the change project has to be implemented within the change agent's organization to maintain the control of the project. Further, the projects directly impact on the efficiency and effectiveness of existing processes and activities. Accordingly, the success would be high if the change project could be integrated with the existing processes, activities and the users. Also, they stated that the project should try to improve collaboration among different stakeholders of the project to collectively succeed in their organizational tasks. Use of different ICT tools or applications is another important factor. For e.g., one of the participants said; "*I developed a website to use for participants; I used ICT tools in my change project…*" Further, the contextual factors such as getting acceptance for changes from the

top management and an environment that supports the change are of key importance. The willingness of stakeholders especially teachers in teaching-learning associated are important. However, "*without the support and recognition from the organization teachers are not motivated enough to actively participate in the training*". Having a strategic plan for the project is important, especially when the project activities are to be aligned with the typical activities of the organization, according to the experiences of many participants. Efficient communication within the project members, as well as the others in the organization, resolve many accountability issues. "*Collaboration is very important*" not only for the organization but also among the change agents from the other countries. "*There is a lot to learn from the other countries. Before I plan for teacher training activity I ask from my colleagues in the program about their experience. Sometimes they might not have had such an experience but always there was useful advice*". In addition, some external factors such as updated knowledge about ICT tools and technologies, financial support and opportunities for acquiring the knowledge of implementing the projects are also noted as important success factors.

Factors that impede the success of the projects

The factors for success and failure are somewhat contrasting to each other (Andersson & Grönlund, 2009); when a factor is present, it leads to success in the project and when the same factor is missing that affects the project. Figure 6 shows the outcome of this analysis, again, using the Maxqda© tool. The same four-category framework is adapted here as well, i.e.
1. Contextual – challenges related to the organization that the project is implemented
2. Lack of resources (related to the process) – Challenges associated with the implementation process of the change projects
3. External – issues related to the factors external to the project and the team. This is mainly related to the issues related to stakeholders in the project, such as users and target groups
4. Change agent related challenges – the change agent's knowledge and commitment issues.
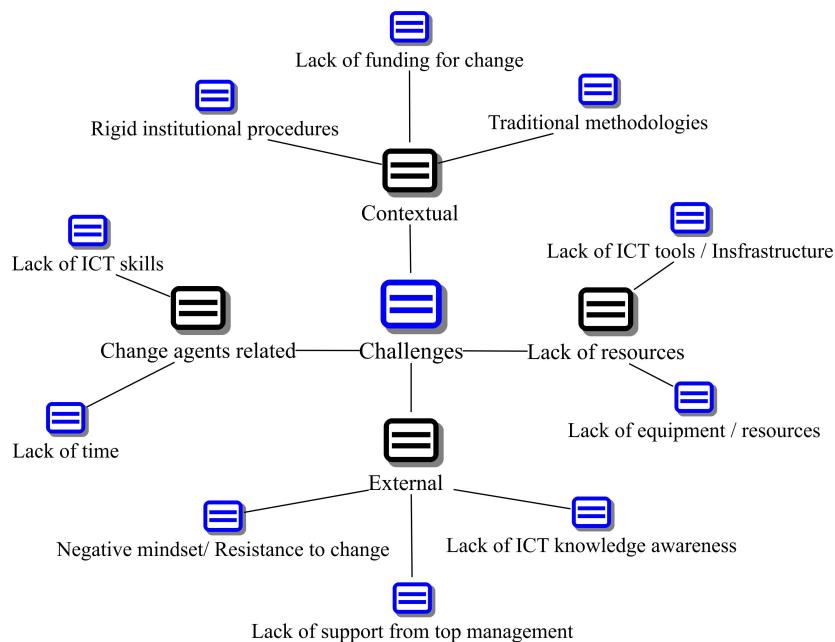
Figure 6: *The major obstacles when implementing projects, based on interviews*

According to the outcome of interviews, lack of resources was the greatest obstacle hindering the success. Almost all change agents stated that they experienced the consequences of not having enough resources such as computers, stable electricity, access to the Internet, reliable Internet connection and/or good Internet connectivity. It is important to note that many change agents mentioned limitations of resources, not only with respect to students but also for the teachers. Several stakeholder issues are noted as challenges to successful implementation of the projects, especially, lack of ICT knowledge of teachers, which resulted in resistance or fear of ICT integration with teaching. For instance, one change agent said*; "Rigidity of the mindset of the target audience; some of the lectures are not willing to change to adopt the new technology; hence it is not easy to implement.*" Also, lack of support from top management is another issue identified under this category. The most significant factor here is the reluctance of the teachers to deviate from traditional teaching methodologies, and consequently, lack of motivation as a whole. For example, one change agent explained; *"Existing teaching methodology; our lectures are presenting notes, students are going to sit down and learn what they can through the notes and sit for exams. This system is not adapted to participation."* The other category of obstacles is related to the change agents. They expressed that it is a challenge to implement the change project in the given time frame, in parallel with their other commitments at work. Lack of competency in using ICT tools also was mentioned. The outcome of this analysis was 12 success factors and 10 challenges, which are summarised as follows:

Success Factors:

Use of expert knowledge: The possibility of receiving advice from the experts in the organization the project is implemented, as well as getting support from the coach assigned by the SIDA training program.
Use of ICT tools: The change agents themselves should be able to use ICT to improve the efficiency and the effectiveness of project implementation. For example, use of project management tools, and audio/video editing tools, etc. These enable effective communication.

Integration with the current process: Being able to align the change projects with the processes in the organization. This allows the project to be integrated into the functionalities of the existing systems and processes.

Acceptance from top management: Getting the formal approval from the management of the organization regarding the integration of the project with the current processes in the organization.

The willingness of the stakeholders: Positive attitudes of persons who are going to use/benefit from the outcome of the project. Both service providers' and service receivers' attitudes are important. For example, teachers as the service providers and students as the service receivers are willing to accept the learning activities conducted online.

Supporting environment: Ease of implementation of the change in the organization. The organization and the stakeholders support and encourage the change. The flexibility of adapting to changes, or being less rigid in terms of the organization bureaucracy.

Having a strategic plan/policy of ICT: Availability of a long-term and short-term plan of how to align the ICT in relation to the organization's master plan*.*

Support for updating knowledge (capacity building): The support the stakeholders receive to develop their skills and knowledge required for adapting to the change. For example, teachers are free from their daily teaching activities for participating in teacher training workshops.

Financial support for capacity building: This is regarding the possibility of getting funds from various sources for capacity building activities. For example, covering the traveling costs and per diems of the teachers when they participate in ICT skills development workshops*.*

Availability of funds: The costs incurred by the implementation of the change projects can be covered by the funds in the change agent's organization (internally or externally). If there are funds exist in the change project to cover the expenses of holding activities, all the stakeholders in the project will be motivated to participate.

Challenges:

Lack of ICT knowledge/awareness: The lack of knowledge of the use of the ICT tools and technologies. Some teachers attend workshops or training sessions of how to use Learning Management Systems, but they do not have basic computer literacy.

Negative mindset/ resistance to change: Some stakeholders do not like the change. Also, they have negative attitudes towards ICT initiations and show resistance due to various reasons. For example, teachers may not be comfortable in changing their traditional style of classroom teaching.

Lack of support from top management: Management of the organization doesn't like or approve the change. This also includes the lack of support from authorities to integrate ICT as a part of the formal work environment.

Lack of ICT skills: Change agents may try to implement a project, but the change agent him or herself doesn't have the required expertise. This also could relate to the lack of experience and competences to adopt ICT initiations*.*

Lack of time: If the change agent doesn't manage their time well in implementing the projects there could be issues in obtaining the expected outcome. However, when implementing ICT projects in developing countries, infrastructure and other problems will damp the time scheduling of the project as well.

Traditional methodologies: Already established procedures and methodologies block opportunities to introduce changes*.* Organisations resist to changes due to many reasons, including additional commitment and time required to make the change etc.

Lack of funding for a change: In general, developing countries allocate funds for maintaining current processes in organizations, but rarely reserve funds for changes and try out new initiatives.

Rigid institutional procedures: In order to control frauds and corruptions, institutions implement rigid procedures, which allow monitoring and controlling the organizational behavior. Those rigid procedures may reduce the flexibility and create barriers for implementing changes and innovative ideas.

Lack of ICT tools/infrastructure: ICT tools and infrastructure involve substantial initiation and maintenance cost. Therefore, lack of required tools and a properly updated infrastructure is a commonly found challenge.

Lack of equipment/resources: In addition to ICT tools and infrastructure, there is lack of general resources, such as technical support and equipment, such as space and materials.

Analysis of the questionnaires

The purpose of the survey questionnaire is to find out how severe the factors discovered by the interviews. All the participants responded to the questionnaire, but 3 change agents who did one project together have submitted one response. Therefore, the total number of responses became 18. Table 3 below summarises the perspectives of these change agents about the factors resulted from the analysis of interview data.

Table 3: *Change agents' perceptions of success factors and challenges of implementing ICT projects (based on the responses to the questionnaire)*

|	Category	Factor	Score
Success factors	Process-related	Use of expert knowledge	14
		Use of ICT tools	11
		Integration with the current processes	11
	Contextual	Acceptance from top management	15
		Supporting environment	14
		Having a strategic plan/policy of ICT	10
	External	Support for updating knowledge (capacity building)	17
		Willingness of the stakeholders	14
		Funding support for capacity building	18
		Availability of funds	16
	Change agent related	Self-commitment/motivation	17
		Hard work	15
Challenges	External	Lack of ICT knowledge/awareness	14
		Negative mindset/ resistance to change	11
		Lack of support from top management	15
	Change agent related	Lack of ICT skills	5
		Lack of time	6
	Contextual	Traditional methodologies	13
		Lack of funding for change	14
		Rigid institutional procedures	9
	Lack of resources (Process related)	Lack of ICT tools/infrastructure	16
		Lack of equipment/resources	17

According to Table 3, financial support for capacity building and the change agent's motivation in implementing the project was highlighted as the most critical factors that contribute to the success of a project. The project partners' (stakeholders) commitment is also ranked high. Acceptance of the change and the support from the top management of the organization, as well as the knowledge gained by consulting experts in the field, are the other important factors emerged. The main challenges involved in implementing the projects were corresponding to the limitations of ICT infrastructure and related services in their organizations. In addition, project cost and time constraints were highlighted. It is interesting that, although they mentioned in the interviews that there could be a risk that the change agent lacks ICT literacy, not many of the respondents were ranking it as a big challenge for them. A similar result is observed for lack of time to implement the project as well. The respondents were asked also about their thoughts regarding how severe the following issues highlighted as obstacles in related research when implementing their own change projects;
Internet connectivity,
1. Availability of computers for the target groups,
2. ICT skills of the target groups,
3. The change agent's own skills of ICT,
4. The time constraints (the project was meant to be completed within one year),
5. Was designing the project challenging

6. Was it difficult to monitor the progress of the project
7. Was it difficult to evaluate the project

The outcome is shown in Figure 7.
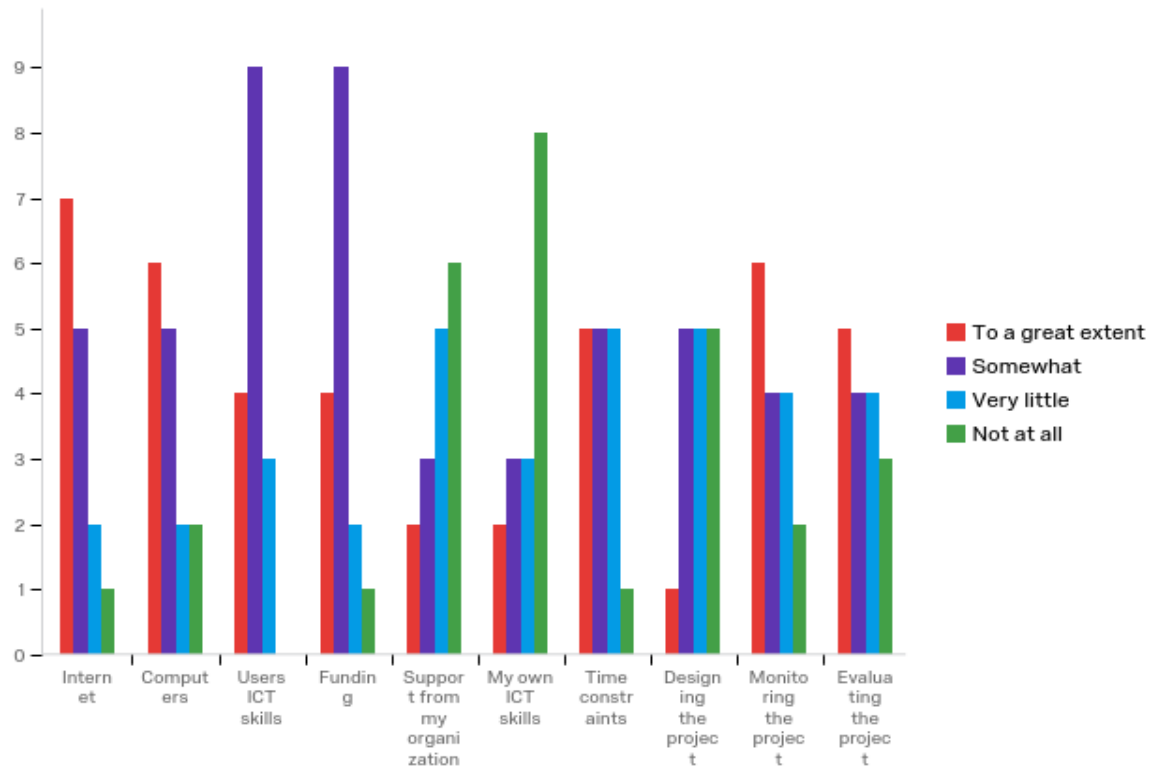
Figure 7: *To what degree has the given critical factors been challenges when implementing your change project?*

The ranks presented in Table 3, and the frequencies of the bar chart in Figure 7, show that most of the change agents do not think the lack of ICT skills and lack of time were problems for them in implementing their own projects. They also did not find the designing stage of the project challenging. This outcome justifies that the SIDA training program has been very effective in helping them to bridge the gap of ICT literacy as well as with time management. Further, the program helped them to design the project. However, Internet, Computers, ICT skills of the users (Target groups/Stakeholders), and funding were distinct issues they had. It is interesting to investigate why they found monitoring and evaluation of their projects are challenging.

In addition to the investigation of the success factors and the challenges, there was also an open question where they could describe how they mitigated the challenges if they did. The mitigation actions were as follows:

1. External: "*For traditional mindset, I have conducted orientation workshops to change their views, conducted training*" Many other respondents have taken the same approach in motivating the target groups. Arranging consultation meetings and recognizing engaged users (offering incentives), and having closer collaboration with the policy makers to convince them the importance of the project are also some actions taken by the change agents to overcome the challenges.

Linking the training with professional development courses in the organization also found helpful according to the respondents.

2. Lack of resources: For internet and electricity connection related problems, "*we found alternative ways, e.g. offline version of resources, internet modem, solar-based solution for unstable electricity, etc*." The change projects were aligned with other projects in the organization to upgrade infrastructure/ computer network and purchasing equipment. Seeking other funds and resources for the production of courses and materials, providing efficient troubleshooting for technology related issues etc. were also mentioned.

3. Organisation related issues: ICT integration has given priority in the strategic plan. "*I used the head of departments and some lecturers (Especially from ICT Department) to be involved and be part of implementers*" one change agent stated. Another mitigation approach was to have "*Regular discussion with the supervisor so that necessaries for project implementation have been planned for following fiscal year, ICT Policy within the institution draft has been presented and will facilitate the project sustainability*". Working closely with the administration for raising and allocating funds, advising the institution to purchase right equipment, communicating with the instruction heads, make all the information exposed to everybody engaged in the project were helpful to mitigate the organization related issues.

However, the respondents did not mention about mitigating the change agent-related issues. A possible reason could be that they have not recognized it as a prioritized challenge. Nevertheless, all the respondents said that their projects are sustainable and were continued after the SIDA program has ended.

IMPLICATIONS OF FINDINGS

ICT solutions are always expensive and require additional workforce and competencies. Therefore, awareness of the factors affecting its success is considered as a vital when such initiatives are taken. As stated in Section 2, irrespective of the target population and the focus, the previous studies resulted in overlapping outcomes. In this study, we have focussed on what challenges did the project managers (change agents) of small-scale ICT and education projects experienced when they are implementing their projects. The factors supported for making their projects successful in their perception were thereby investigated. Comparison of the outcome of the previous studies, we can find a common denominator of critical factors, namely user's characteristics, technology and the organization's strengths and willingness. However, the project manager (change agent) characteristics that are, the skills and the competences of the change agents themselves were not recognized as a challenge.

The strength of the results of this study relies on the homogeneity of the projects considered, compared to the related literature. All the projects were given the same timeframe. Equal amounts of coaching and guidance are provided during the implementation of the projects by external experts. The size of the projects is nearly equal although the range of the projects varies from simple e-learning approaches to use of ICT for other stakeholders in education such as the administration and the management. This study also covers experience from many countries in the developing region, namely, Bangladesh, Cambodia, Ethiopia, Rwanda, Tanzania, and Uganda. Furthermore, the similarity of the compared projects in the size, purpose, and framework of initiation, make grounds to compare and/ or assign equal weight to all the projects.

It also showed that the training of the change agents helped them to build their capacity to a level of an expert in handling ICT projects, and therefore, the capacity building program is effective in supporting the change agents from developing countries to be resourceful in serving their capacity.

However, according to the respondents to the survey, they have not received adequate knowledge of evaluating and monitoring projects. This may be something that the capacity building program could address.

CONCLUSIONS

The perceptions of change agents captured by interviews and follow up questionnaire resulted in interesting factors that could be useful for future small-scale ICT and education projects. Typical limitations in related studies were the lack of resources and lack of competencies. The latter was addressed by the SIDA funded training program. From the change agents' perspective, their skills were improved to a significant degree as a result of the training they received. However, lack of skills among the other stakeholders, that is, teachers, students and managers involved from the home country as well as infrastructure limitations were emerged as challenges according to the change agent's perspective. It is highly likely that in future projects these challenges may arise and, therefore solutions needed to be sought out even at the planning level of the projects. Successes are highly dependent on the strength and commitment of the change agents as well as the support received by the peers and the decision makers in the organizations. Strong policies and strategies alone may not fulfill the requirements for succeeding ICT development projects without the presence of institutional support and individual commitment.

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