



# The impact of the ICT4D project on sustainable rural development using a capability approach: Evidence from Bangladesh

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## ABSTRACT

Information and Communication Technology for Development (ICT4D) projects have shown a great promises in recent years. However, simply materializing of ICT4D projects is not enough for minimizing the prevalent digital divide in rural areas in developing countries. For the success of an Information and Communication Technology (ICT) intervention, it is important to consider the capabilities of users, who are responsible for converting ICT resources into outcome. While most of the ICT-related studies are focused on the adoption of actual technologies and influences of different internal and external factors on intervention outcomes, very few studies are focused on evaluating intervention outcomes and redesigning intervention strategies. In this study, I opted for using a conceptual framework following the Capability Approach that simultaneously identifies the influence factors for intervention outcome as well as evaluates the outcome based on Noble Laureate Amartya Sen's five freedoms concept. A qualitative technique has been chosen to conduct the study. As part of the impact evaluation of an ICT4D intervention, a project known as Union Digital Centres (UDCs) in Bangladesh was selected. A total of ten themes are identified indicating that the outcome of the intervention is contributing to socio-economic and human development. However, the study has revealed that lack of capabilities of users (e.g. prior knowledge and financial inability) bar the UDC programs to fulfill their goals at highest level. This study would practically help the UDC policy makers to adjust the UDC intervention design by addressing the shortcomings of the users to yield higher UDC program outcome. Additionally, this study theoretically contributes in ICT adoption literature by showing that there is a mutual influence between users' capabilities and ICT-related project outcomes. Finally, using specific case study (ICT4D project in Bangladesh), this study contextualizes Amartya Sen's five freedoms concept in the ICT-specific context.

## 1. Introduction

As the digital divide is caused by the unavailability of information and communication technology (ICT) facilities [1], simply materializing the projects for the provision of ICT facilities is not enough for minimizing the prevalence of digital divide, specially rural areas in developing countries. The availability of ICT services does not necessarily ensure that people are capable of using ICT [2]. In spite of having access to ICT facilities, the digital divide can still arise in certain social, institutional and cultural contexts due to the inability of the users to utilize digital services [3,4]. Such incapability or barriers are more prevalent in the socially excluded countries with overpopulation where a large part of the populace is deprived of basic education and skill essential to utilize ICT services. As a result, many ICT projects in rural areas in various countries can fail to reach their targeted outcomes and cannot sustain in the long run [5].

Existing literature defined the 'capabilities' of users as the combination of pre-required access along with skill(s) to use certain technologies [6,7]. It is stated by Slavova, Venter, & Baduza [8] that the use of ICT services mostly entail human-computer interactions and in absence of the capabilities of users, the users will fail to avail the benefits of these services in spite of having access to these technologies.

According to Slavova, Venter & Baduza [8]; the capabilities of users are complementary to the resources provided to attain functionality outcomes. There is a relationship between the capabilities of users and functionality outcome [9]. The achievement of functionality outcomes reflects the capabilities of users, which are prerequisite for the success of ICT4D services. Thus, the study of the capabilities of users with regard to functionality outcome is very important [10]. It is essential to understand how the capabilities of users affect the impacts of ICT4D initiatives. Hence, a valid question would be how successful an ICT4D project is in achieving its functionality outcomes where the capabilities of users

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act as deterministic factors.

While users' capability building or capability expansion enable them to use ICT4D facilities that they value and deem useful [11], the achievement of functionality outcomes improves their livelihoods and well-being in return. The improvement of well-being caused by the functionality outcomes can be evaluated based on the five freedoms concept: 1) economic freedoms (e.g. job creation), 2) social opportunities (e.g. better healthcare facilities), 3) political freedoms (e.g. freedom of expression), 4) transparency guarantees (e.g. disclosure of information), and 5) protective security (e.g. unemployment protection) [6,8,12–14]. Sen's five freedom concept evaluates how an intervention contributes as a basis of socio-economic development.

The success of ICT4D projects is determined by the capabilities of users in achieving the targeted functionality outcomes [6]. The relationship between capabilities of users and functionality outcomes is mutual, where certain capabilities are essential for achieving certain outcomes, which in turn enhance the capabilities of users to achieve more outcomes [6]. For ICT4D projects, a theoretical understanding of such mutual relationship is important to yield maximum project outcome [15]. It is also important to periodically evaluate the project functionality outcomes viz-a-viz Sen's five freedoms concept. Furthermore, a theoretical understanding can help to identify reasons why functionality outcomes differ for different users with different levels of capabilities.

By realizing the significance of a theoretical understanding, this study opts for using a conceptual framework (Fig. 1) informed by Capability Approach [16] to evaluate the functionality outcomes in relation to the capabilities of users and their mutual impact on each other. In this process, the objectives of this study are:

- to evaluate an ICT4D project to find how the capabilities of users and functionality outcomes influence each other, and
- to evaluate the impact of an ICT4D project on users' welfare and socio-economic development from the perspective of Sen's five freedoms concept.

This study was carried out using an ICT4D project known as Union Digital Centres (UDCs) in Bangladesh as the context of a developing country. While there exist a few studies (Table 1) on the impacts, effectiveness, barriers, users' perception and e-readiness of UDCs, there is a lack of conceptual framework-based study that particularly focuses on the objective on this study. The information about the context is discussed in the next section below.

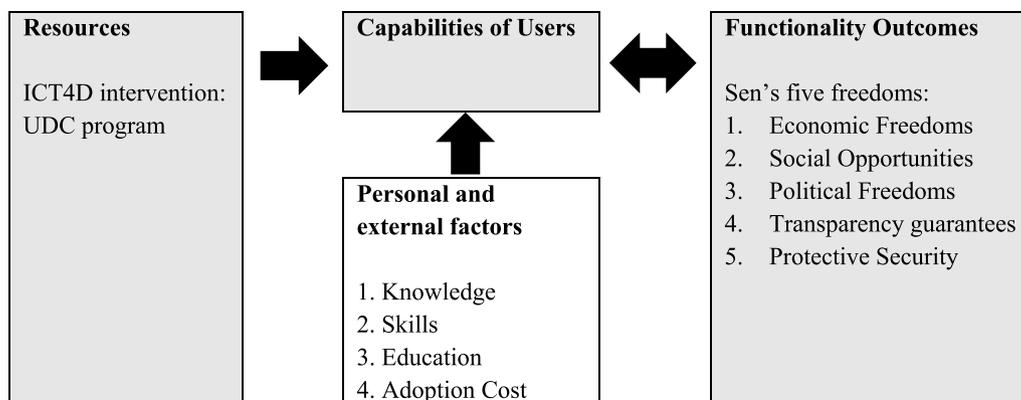
**2. Setting the context**

With the concept of 'Digital Bangladesh', the Government of Bangladesh (GoB) initiated the establishment of UDCs across

**Table 1**  
Important findings from the previous studies on the UDC program in Bangladesh.

Author (year)	Objective	Research Design	Key Findings (in Bangladesh)
[25]	To understand the potential developmental effect of UDCs in rural socio-economic sectors and perspectives of actual beneficiaries.	Theoretical Framework (Communications-for-Development)	UDCs have brought the opportunity to empower rural people in Bangladesh by providing access to information in various fields including agriculture, education, healthcare, and law.
[22]	To see the present status of UDCs and their capacity in delivering e-services at the doorstep of the rural community.	Qualitative descriptive	People are receiving government information, and forms related to education, agriculture, land, and population in an easier way than before.
[24]	To review the roles UDCs play in various socio-politico-economic sectors in rural Bangladesh.	Theoretical Framework (Communications-for-Development)	UDCs play significance developmental roles in socio-politico-economic sectors, and the health of rural people in particular.
[19]	To assess the impacts of UDCs in Bangladesh from a citizen's perspective.	Quantitative survey	UDCs are contributing to reduce the digital divide based on gender, education, and income, however, these are still to win geographical parity to reach all.
[12]	To understand how UDCs contribute to poverty alleviation in a rural area.	Case study	Most of the people in a rural area are satisfied with the services provided by UDCs. UDCs are making a change by women empowerment, better employment opportunity, and the chance of self-employment.

Bangladesh, which act as an ICT4D tool for socio-economic development. At the beginning of this initiative, UDCs were named as Union Information and Service Centres (UISCs) which were established by GoB with the assistance of United Nations Development Program (UNDP) to



**Fig. 1.** Conceptual framework based on the Capability Approach [16].

bring public services at the doorsteps of people [17]. Today, by following a public-private partnership model, the UDCs are run by the local entrepreneurs to mainly facilitate the use of ICT in the system of local government by providing easy access to information and ICT services to the people.

The UDC program is imparting a lot of positive impacts by increasing the scopes of employment creation, manpower development, self-employment, women empowerment, community empowerment, and transparency and accountability in public services. There are 5292 UDCs across all the unions in Bangladesh. A union is the lowest tier of the Bangladesh government. Operated by more than 10,000 private entrepreneurs, these UDCs act as one-stop centres in providing about 150 public and private services that are more easily accessible, cost efficient, and reliable. Prior to the introduction of UDCs, the underserved citizens in rural areas had to travel a great distance to get access to these same services. Since the beginning of UDC initiative until the end of 2018, it was recorded that about 62 million underserved citizens have been provided with 443 million services.

The GoB's 'Digital Bangladesh' initiatives include connecting citizens, developing human resource, and digitizing government operations. To accomplish these goals, UDCs are improving the process by which public services are provided by transforming to digital or electronic services. In addition to e-services, economic opportunities are diversified and scopes for new job creation have been broadened [18]. In result of these initiatives, painstaking process of manual services have been eliminated and fifty percent of UDC entrepreneurs are women. Rural citizens are the beneficiaries of UDCs as these centres reduce their difficulty, time and cost, and bring transparency and efficiency in getting public services locally. The positive impacts of UDCs are reflected in the perception of people as an element of speedy socio-economic development and well-being to the people. UDCs are contributing in the six areas of development that include digital governance, human resource development, decentralization of the provision of public services, connecting citizens, service integration, and collaborating with the private sectors.

Before introducing UDC programs, people in rural areas across the country were in deprived of availing IT services for birth registration, labour registration, exam registration and so on. The UDCs empower the local entrepreneurs to expand their business by providing both private and government services to the rural people, and ultimately empowers the communities. Also, UDCs are minimizing the digital divide and increasing the gender, education and income parities [19]. According to the GoB, these UDCs would emerge as the center of knowledge by 2020 [20]. Table 1 summarizes some of the existing studies on the UDC program.

### 3. Conceptual framework

#### 3.1. Capability approach

The conceptual framework applied in this study is developed based on Capability Approach [7,16], which has been increasingly used in the area of ICT impact research. The Capability Approach investigates why and how functionality outcomes are achieved [21]. This approach has been developed based on different disciplines [6].

As shown in Fig. 1, the three constituents of Capability Approach are resources, capabilities and functionality outcomes [22]. According to this theory, the functionality outcomes are depended on the capabilities of users which are influenced by personal and external factors, such as adoption costs. According to Sen [12]; capabilities enable or restrict the achievement of functionality outcomes (e.g. social opportunities). However, the understanding of which internal or external factors influence the capabilities of users and then enable or restrict the functionality outcomes is problematic [16]. Because the influence of internal or external factors on capabilities is perceived differently by different individuals. For example, the influence of an individual user's

knowledge, skills, and education on capabilities is perceived differently by different users.

The Capability Approach can measure the quality of life of individuals with regrading to their progress in achieving functionality outcomes that they value [8]. This approach takes into account all the differences in point of views of individuals on the basis of their capability to achieve [10]. In this way, the Capability Approach informs us about what an individual can actually achieve using his or her capabilities.

Capability Approach is used to track the functionality outcomes resulted from any ICT project [8]. Its application is seen in various areas such as assessment of human development of a country, assessment of small-scale development projects and well-being assessments in advanced economies. In ICT4D research, the basic ways of applying the Capability Approach in a study are: 1) understanding the market structure and 2) measuring the influence of capabilities with regard to the functionality outcomes of any ICT service project.

#### 3.2. Sen's five freedoms

In our conceptual framework shown in Fig. 1, the Sen's five freedoms concept [12,13] have been included to evaluate the functionality outcomes of an ICT4D. Sen perceives that having capabilities being real opportunities to the users and give them the freedom to avail the facilities that they value [23]. According to Sen [11]; the achievement of functionality outcomes is the expansion of freedoms that he categorized into five categories. These are:

- 1) Economic freedoms: It connotes the scope of individuals to exploit, consume, produce and exchange economic resources. The examples of such freedom include being able to participate in the market and getting a job.
- 2) Social opportunities: It connotes the scope of individuals to avail opportunities related to social welfare, such as availing better healthcare and education facilities.
- 3) Political freedoms: It connotes the scope of individuals to exercise their freedom to be a participant in a deciding body or related system (e.g. governance). Such freedom of expressions can be the freedom of expression and having the right to elect and be elected.
- 4) Transparency guarantees: It connotes the guarantee of the practice of having accountable and transparent management and administration which reveal all the required information and create a trust to all the stakeholders. For example, prevention of corruption and financial mismanagement.
- 5) Protective security: It connotes the guarantee of the prevention of abject deprivation and distress among the socially excluded populace resulted from a dearth of market opportunities. It ensures social safeties, such as retirement benefits and grants for disabled people and specially challenged children.

The conceptual framework (Fig. 1) has three units, namely: 1) Resources (i.e. ICT4D intervention), 2) Capabilities of users, and 3) Functionality outcomes. In the conceptual framework, capabilities of users are influenced by personal and external factors, namely the knowledge, skills, education of the individuals and adoption cost. On the other hand, the capabilities of users and functionality outcomes (i.e. Sen's five freedoms) mutually influence each other.

The personal and external factors included in the conceptual framework have been taken from the previous study on UDCs [24,25] that found the influence of these factors on the capabilities of users. The personal and external factors are also known as conversion factors that are important for enabling capabilities to convert ICT resources into functionality outcomes [9]. In the end, Sen's five freedoms concept is included in the conceptual framework to evaluate the functionality outcomes of the UDC program from the perspective of basic building blocks for socio-economic development.

#### 4. Research Methodology

Because of the abstract nature of Capability Approach [16], it is hard to apply this theoretical method on empirical data; however, it can be an effective tool for analysing case studies. For this reason, this study follows a qualitative interpretive study [26] based on in-depth interviews and focus group discussion by the participants as a case study. Such technique help researchers to reveal the information from the minds of the participants with greater details [6].

The aim of interview questions and topics in focus group discussion was to collect information regarding the research objectives. In this process, the open-ended interview questions and topics for Focus Group Discussion (FGD) were designed to evaluate UDC program's outcome according to the conceptual framework, where the personal and external factors pertaining to the capabilities of users influence the functionality outcomes. While developing these questionnaire, it was vital to obtain specific data that can be analysed from the perspective of Sen's five freedoms concept [6,27].

As a part of sampling, the purposive sampling technique was applied to, firstly, select three UDCs in rural areas of Bangladesh, and then secondly, to select the respondents who have used and experienced facilities from UDC program. The participants live in three unions adjacent to the riverine areas in the Jamalpur district in Bangladesh. These unions are comparatively remote areas where the people often have to struggle against natural disasters such as flood, riverbank erosion, heavy rainfall, and drought. The participants from these areas often utilize facilities from the three selected UDCs.

A flexible research tool was developed to support us to use questions that can capture the different point of views of the participants within their context. In total, 80 participants were interviewed (40 males including 3 male entrepreneurs, and 40 females including 2 female entrepreneurs). The respondents can be classified into two types as: 1) Service providers (i.e. the local entrepreneurs), and 2) the service receivers (i.e. the end users/people). The participants were requested to answer to various unstructured questions with regard to the use, challenges, outcome, and opportunities of UDCs. The data was gathered from three unions where the average literacy rate was 35.5%.

During the interview and FGD, the respondents shared their experiences and outlooks relating to experience and scopes of the facilities and services offered by the UDC program. The interviews were audio-recorded and then transcribed to extract stories. The respondents received a briefing about the research objectives and their rights to privacy before the interview.

In the data analysis part, the contents obtained from the interviews and FGD were subjected to the coding of the contents to obtain themes as a way to understand the impact (i.e. functionality outcomes) of UDC program. The researcher also analysed the data to evaluate the influence of personal and external factors on the capabilities of users. Later on, the triangulation technique [6] was followed which includes taking data from different sources (e.g. secondary data from the annual reports on UDC program) to increase the data reliability and decrease biasness.

#### 5. Findings and impact analysis

This section presents a course of discussion on the findings related to the research objectives of this study. The findings are grouped into five sections based on Sen's five freedoms concept. In this process, each group thematically presents the functionality outcomes of the UDC program, where the themes are derived from the coding of contents in data. In total, ten themes were derived which are presented in Table 2. These themes represent both the benefits and barriers, where the barriers are caused by personal and external factors. Table 2 also shows the numbers of the participants who commented on at least any of the ten themes during interview. These numbers or frequencies are counted based on the coding of the data content found in the interviews by the 80 respondents participated. Finally, for maintaining the reliability of our

**Table 2**

List of groups and themes present in the discussion and the numbers of the participants who commented on any of the ten themes.

Functionality outcomes	Groups (Sen's five freedoms)	Themes (Derived from coding data content)	Number of the participants who commented on at least any of the ten themes (Derived from coding data content)
Outcomes of the UDC program	Economic Freedoms	Economic empowerment	3
		Cost barriers	3
	Social Opportunities	Gender equity	9
		Individual empowerment	21
		Skill barriers	12
	Political Freedoms	Knowledge diffusion	18
		Knowledge barriers	10
	Transparency guarantees	Corruption reduction	16
		Knowledge barriers	14
	Protective Security	Capacity building	25
Education barriers		12	

interpretations, findings from the interview are presented below under each theme in form of short 'story-telling'.

##### 5.1. Economic freedoms

###### 5.1.1. Economic empowerment

The economic empowerment by creating a new formal job is difficult in the context of developing countries, thus facilitating entrepreneurship is preferable [28]. Besides, there is always a big demand for entrepreneurship in emerging markets. However, in general, access to financial support to start a new small business is difficult. Today, because of the UDC program, more than 10,000 entrepreneurs across the country are able to earn a sustainable income [18].

Under various degree of public-private partnerships with the UDC program, the entrepreneurs are getting more scope to be financially included and attain economic empowerment. Our data include interviews with three male and two female entrepreneurs. They are franchisees of two separate projects by UDC. These are known as 'Ek-shop' and 'Agent Banking' project.

Under the Ek-shop project, a local entrepreneur can become a partner seller on Ek-shop eCommerce platform and sell his or her listed products across the country. From the study areas, we found one male and one female entrepreneur who are very successful as entrepreneur and sell their locally produced product across the country. In this regard, a male Ek-shop entrepreneur articulated in his interview as below:

"Earlier I used to be a small local seller of tailored clothes. My local customers base was very small that would generate very small demand for my products. It was hard for me to run my family by the income generated locally. Fortunately, one day I came to know about Ek-shop eCommerce platform that facilitates selling a locally produced product online. I showed interest and become a seller on this online eCommerce platform. They gave me a short training and then I started my business on Ek-shop. Today, my customer base in twenty times bigger and I can generate a good amount of money to run my family. I am grateful to that I am availing a better livelihood now."

Similarly, a female entrepreneur stated about her business experience being a seller on Ek-shop as below:

"I was jobless even being a graduate in Home Economics. I always wanted to use my knowledge and expertise in making handicrafts.

However, it was not easy for me to sell my products locally because of the low demand. Therefore, I was not motivated to start a business. However, after knowing about Ek-shop, I become interested and decided to make handicrafts of different kinds. Today, I receive about 250–300 orders online and can contribute to my family by earning from my online eCommerce business. I feel economically empowered now using my education and expertise in making handicrafts.”

While interviewing, we found another male entrepreneur who runs his business of Agent Banking. This project allows the provision of digital financial and banking services from UDCs. These banking services include ePayment, obtain loans and receiving government payments. Regarding Agent banking, the male articulated about his economic empowerment as the following way:

“I was looking for a job after completing my graduation. Because of the scarcity of any formal job in my local area, I became keen to start a business. However, starting a business would need a big amount of capital which I was deprived of. One day, learned about the business of agent banking that I thought as a good way to start a business. Earlier, people had to travel about 20–25 miles just to avail regular banking services. Now they can get various services because of the Agent Banking facilities I provide from UDC. I am happy that I can help in easing the various banking activities of people and earn well for a living.”

Financial inclusion is a very vital issue for the national economy. Facilities for savings and deposits in remote villages have been added by UDCs. Now villagers are more financially included because of agent banking. They can maintain a bank account, make deposit therein and make savings.

### 5.1.2. Cost barriers

While partnering with the UDC program, entrepreneurs often find it expensive in relation to revenue generation. While interviewing, few males stated that they want to be a banking agent but to them, the partnership cost is an entry barrier. One participant stated that:

“As a remote area, the capacity of young people living in these areas is very low for investing in new business. This difficulty bars people from starting a new business and becoming an entrepreneur. Although the UDC program offers various benefits after partnering with them as entrepreneurs, still the entry cost needs to be lower.”

## 5.2. Social opportunities

### 5.2.1. Gender equity

Rural social structure is combined with both male and female. This half portion of the social combination cannot be ignored and neglected. Thus, social exclusion plays a substantial hurdle in socio-economic development in developing countries. Issues, such as lack of gender equity prevents women from full participation in normal social and economic activities [29]. Women involvement, their participation, and social equity will be ensured if it is expected that sustainable development will carry its wellbeing over the year, overage. Union digital centres encourage women participation. For example, the number of women who obtain training in UDC is almost the same as the male. It is reported that among the entrepreneurs, about 50% are women.

UDC program has been contributing to gender equality. One female participant conveyed her experience of availing services from UDC as in the following way:

“Everyone can get UDC services. There is no discrimination in getting services from UDC. Nobody forbids anyone to go to Union council. Everyone has equal access. But sometimes priority may differ in case of personal, social, political significances. We do not know all the

services which UDC offers. But we know what we need: Birth certificate, NID, Passport, Job advertisement, driving licenses, etc. from UDC. Until today, there is no gender disparity reported in getting UDC service; male and female get service equally what they need.”

People basically women are now more active in economic activities because of the UDC program. By gathering information, they are getting educated. They are taking a family decision or taking part in the family decision. They are learning about computer, getting technical training, also aware of physical and mental health, raising children and educating them. A forty-year-old woman expressed her own opinion as below:

“Once I was excluded from the family decision. My duty was to cook and feed my family only. Now I am an active participant in my family. I have started a small ranch in my locality with 3 goats. The idea of ranching came from while I was commuting in UDCs. They helped me and showed me how I could run that firm. I can now have contributed to my family. My children are pursuing their study in schools. My father in law and mother in law give me priority today.”

### 5.2.2. Individual empowerment

Local individuals are getting empowered as they are being the active part of society. As local people of union council are more engaged in social and economic activities with the help of UDCs they are able to exploit the experience, knowledge, expertise to convert in socio-economic benefits. UDC offers various training arrangement, various options of the job for the unemployed and unskilled people who are socially excluded. They come to get training from UDCs and engaged in respective works. As a participant stated that:

“Earlier many new economic activities were unknown to us and we could not get job offers or work’s news. We would spend time idly. Now people are busy in various jobs, such as farming, small business, teaching, technical activities, etc. The UDC program is contributing to the social inclusion of the people with lower skills and education. These activities have increased our income. People with knowledge and skill are now respected in society. Some of us have created their own value in society. They are now socially included. Local people are now more vocal than earlier as a social being. They can opine on important issues occurring in society. Moreover, they can also challenge the government officials and local representatives if any fraudulence happens. No one can deceive each other.”

### 5.2.3. Skill barriers

Because of the low socio-economic condition and low literacy rate, people often lack all the skills to utilize all the services which UDC offers. When asked about online Ek-shop, it was found many young women are not conversant with the skill needed to run an online business. One female participant who is also expert in making handicraft products stated that:

“I never owned a computer and used the internet. I do not know how I can make a partnership with UDC program and sell my beautiful handicraft products online.”

## 5.3. Political freedoms

### 5.3.1. Knowledge diffusion

Political freedom is a significant area of development studies. It is a prerequisite for socio-economic development [30]. However, to exercise political freedoms, awareness building is important that can happen by knowledge diffusion or transfer. Knowledge transfer or diffusion is the process that happens by seeking, organizing, creating, capturing and distributing information and ensures that it is available to the individuals in a society to use when needed. The more countries diffuse its

knowledge among its population the earlier and faster it reaches its goals for sustainable development.

The UDC program acts as a change-maker is sharing vast knowledge among the people and taking participation. Local people are now keeping updated news regarding national and international issues. They are not lagging now in case of information gathering regarding agriculture, health care, government services, and social services. An older female participant said:

“We live in the age of digital Bangladesh, you cannot deceive us about our human and citizen rights. We know our right very well. Today people are very much conscious about their rights, such as the right of education, knowledge, legal and women rights, food safety, residence, freedom of expression, etc. Digital Bangladesh motivates women to know their rights, and from UDCs, all these are possible easily by knowledge diffusion to all walks of lives in rural areas.”

Knowledge diffusion has enabled the citizen to understand their roles and rights in society. They can raise their voice to establish their rights which were difficult earlier. UDCs have made people aware of their involvement in societal issues. Now they can express their voice against any issue because of having adequate awareness through acquiring knowledge. A participant said:

“Once a union member deceived us, made us ignorant about the services to be provided by union council. We could not protest and protect our right. But now they cannot say anything else they want. Villagers are getting knowledgeable about the service available from UDCs, and alert about the activities of the union council and other agent people”.

### 5.3.2. Knowledge barriers

Knowledge barrier acts as a border between knowledge acquisition and knowledge use. It shows the utilisation of innovation and application of technology in different contexts. Without knowledge, the new information cannot be understood or applied. If an individual does not have the knowledge, he or she cannot avail the facilities provided by the UDC program. In this regard, one of the participants informed us how he would not exercise his political freedom using UDC facilities before know about his right. The statement was like:

“Previously I did not know about the legal obligations regarding business setup. Thus, I was unable to use the service of trade licensing provided from UDCs.”

## 5.4. Transparency guarantees

### 5.4.1. Corruption reduction

Transparency is the key concept of good governance without corruption. Service such as e-Governance ensures the transparency and accountability of the government service process and financial activities [31]. E-governance eliminates the scope of taking bribe and involving in corruption. Previously, there are many services such as e-payment, e-tender, passport application, bank loan application, driving license application and so on which would involve corruption at most of the time. Currently, these services are available from UDCs that are executed online with few clicks with transparency. Corruption reduction also reduces dependency on others. Observing the benefits of the e-Governance that provide many public and private services, one of the young participants stated that:

“Previously people from rural areas were subjected to give bribe to the brokers for passport application. Now because of the availability of online passport application facility, people can easily complete the hassle-free online application process. Also, to obtain other types of government information, earlier people had to spend money and

time; but they could not even necessary information. In my opinion, UDC services are great for transparency and many corruption-free public services. Also, the young generation from rural areas often moves to foreign countries for a job. In this process, they require legal VISA and appointment letter for a job. Earlier manpower brokers used to exploit the ignorance of rural people. They would charge higher cost, manipulated VISA and job categories.”

### 5.4.2. Knowledge barriers

While asking about the barriers to avail e-Governance, the statement of a respondent was like:

“Earlier I did not know about the system and measurement of land recording. So, I was unable to obtain information about land issues which is 20 years old.”

## 5.5. Protective security

### 5.5.1. Capacity building

Social protection and social assistance are two very important elements for ensuring protective security in developing countries [32]. Protective security safeguards one's safety in both present and future. For example, it could be done by capacity building of young people to reduce their vulnerability. The capacity building can happen through the means of skills development, knowledge enrichment, and training. Bangladesh government is not exceptional in this process and trying its best to make proper use of time and human resource for capacity building. For this purpose, UDCs act as a big platform for common people to work locally in order to increase their knowledge and skills by giving them training both in formal and non-formal ways.

UDCs provide necessary training on agriculture to socially excluded people. Other capacity-building activities of UDCs are helping young people to apply for jobs abroad after training. With this regard, one of the respondents expressed his own opinion as below:

“Union digital center provides us some services. We, the people live in rural areas, were deprived of modern agricultural information. After getting training from UDC in our union, I have started a cattle firm with my two other friends which are highly profitable. Also, after getting a basic computer training, we can now find and learn about modern agriculture and livestock from internet. The modern services from UDCs are making us independent of others and increasing our capacity to get more benefits to form the UDC program.”

Another mid-age man described how he built the capacity to secure his future. He told:

“Computer skill has changed my life. I am running my printing and stationery business very well. I took computer training from UDC; with the proper help of computer operator of UDC I have learned many things and now providing computer related service to local people such as printing, internet service from the shop, etc. People value me and my family now. I am very happy”.

### 5.5.2. Education barriers

Education makes local people stronger, active and independent. Because of education, people are alert about their lack of ability to gain capability in various ways. They can look into their land mutation, land clarification, and other legal issues. Lenders and influential people cannot exploit them now. They directly reach to a local court or district judge and file case in case of any injustice.

While asking about the barriers to capability building, the statement of a respondent was:

“I know that I can get various training on computer and agriculture to build my capability to learn about modern agriculture by myself. However, unfortunately, as I am illiterate, I do not think get the benefits of the UDC program. People need to be educated for getting UDC services and increase their capabilities subsequently.”

Table 3 below shows the respondents' types (i.e. service providers and receivers) and the frequently mentioned key phrases by them which have helped the interviewers to create ten themes based on the analysis interview content, and Table 4 below summarizes the overall findings of the UDC program outcome.

## 6. Conclusion and limitation

Unlike previous studies on UDC program, this study is based on a conceptual framework by Capability Approach to evaluate the outcome of UDC program through the lens of Sen's five freedoms concept and identify the personal and external factors that influence the capabilities of users. In this paper, we have described and summerised the benefits and barriers in the UDC program. It clearly shows that the barriers are caused by personal and external factors that restrict the capabilities of users.

From the result, it is apparent that UDC program resources require to use the capabilities of users to achieve its targeted outcomes. It is also noticed that the outcome of the UDC program again expands the capabilities of users, which is a manifestation of mutual influence between the capabilities of users and outcome of the UDC program. The understanding of this mutual influence is important for further policy development regarding UDC program and future ICT4D studies. In addition, it is also important that the ICT4D projects have long-term and wide-ranging evaluation plans for the capability building of the users to

**Table 3**

Frequently mentioned key phrases by the respondents (both service providers and receivers) during interview.

Respondents' types	Frequently mentioned key phrases	Frequency
Service provider (i.e. five entrepreneurs)	Better Living hood	3
	Financial inclusion	3
	Job creation	5
	Cost issue	2
	Equal opportunity for females	2
	Women empowerment	2
	Sustainable Development	2
	Manpower transformation	2
	Business expansion	3
	Encourage entrepreneurship	5
	Serving rural citizens	5
	Socio-economic development	4
	Poverty reduction	3
	Service receiver (i.e. end users or general people)	Online/Digital service
Time saving		60
Service process simplification		72
Bringing innovation		10
Market expansion		8
Socio-economic development.		15
Lack of ICT knowledge		24
Lack of ICT skill		30
Lack of literacy		12
Receiving knowledge		41
Transparency in government service		49
Legal help		37
Corruption reduction		13
Capacity and skill development		10
Skill gap reduction		16
e-Learning		21
Human development	16	
Easy public services	59	

**Table 4**

Summary of findings based on the perspective of Sen's five freedoms concept.

Groups (Sen's five freedoms)	Summary of findings
Economic Freedoms	<ul style="list-style-type: none"> <li>• Benefits: UDC programs are creating entrepreneurs, giving easy access to entrepreneurship trainings and making them economically empowered.</li> <li>• Barriers: Cost of capital to become an entrepreneur is still not enough considering the economic conditions in remote rural areas.</li> </ul>
Social Opportunities	<ul style="list-style-type: none"> <li>• Benefits: UDC programs are contributing to gender equity and individual empowerment by integrating the socially excluded and marginalized people.</li> <li>• Barriers: Not having prior skill prevents availing social benefits given by the UDC program.</li> </ul>
Political Freedoms	<ul style="list-style-type: none"> <li>• Benefits: UDC programs are contributing to increasing political freedom by the means of awareness building and knowledge diffusion.</li> <li>• Barriers: Not having prior skill prevents availing social benefits given by the UDC program.</li> </ul>
Transparency guarantees	<ul style="list-style-type: none"> <li>• Benefits: By introducing e-Governance services and eliminating corruption, the UDC program is contributing to transparency.</li> <li>• Barriers: Lack of knowledge is still a barrier for some users to use the e-Governance system for public and legal services.</li> </ul>
Protective Security	<ul style="list-style-type: none"> <li>• Benefits: UDC programs are contributing to capacity building that is useful for social protection of the people in both present and future.</li> <li>• Barriers: Lack of education is a barrier for some users to receive training on computer, internet, and modern agriculture.</li> </ul>

facilitate them in availing projects benefits and for the maximum achievement of project targets.

This Capability Approach based conceptual framework not only finds the influence of the capabilities of users on project outcome but also evaluates the outcome on the basis of Sen's five freedoms concept to learn whether the users can avail the facilities that are valuable for socio-economic and human development. For this reason, this conceptual framework is a more comprehensive instrument for measuring the impact of ICT4D intervention that can help the policymakers to adjust intervention design according to the needs of socio-economic development of the context.

It was known that the UDC program have been increasing social inclusion and sustainability in people's socio-economic condition. The result of this study confirms this suggesting that different types of outcomes of the UDC program are having positive and concerted impacts in the domains of Sen's five freedoms concept. This concerted impact is significant for the sustainability of economic, social, and environmental welfare. Furthermore, this study shows that the impact of the UDC program is shrinking social discrimination fast. Also, UDCs are making awareness among people regarding their scopes and rights that can be exploited and exercised using ICT facilities. It is very evident through participants' responses that UDCs have solved a wide range of issues pertaining to their quality of lives. It is also important to keep note that UDCs are not only providing necessary daily life supports but also identifying and fulfilling new service gaps using ICT. Thus, the UDC program is incessantly evolving.

The main limitation of this study is that this a qualitative study with a small sample size and within only three demographic areas. To extrapolate and confirm the findings of this study, a few more studies are needed, including a comprehensive quantitative study. Secondly, to

check the consistency and validity of the conceptual framework, a series of few longitudinal studies are recommended. Thirdly, as different levels of user capabilities yield different levels of outcomes, hence, in future study, it would be important to figure out the differences and commonalities among the respondents to identify any new unique capability of users that can make think of a new dimension to evaluate UDC program by going beyond Sen's five freedoms concept.

### CRedit authorship contribution statement

**Md. Rakibul Hoque:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing - original draft, Writing - review & editing.

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### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.techsoc.2020.101254>.

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