

# Roles of Information and Communication Technology (ICT) on Risk Management and Increased the Production of Fattened Live Crab in Southwest Coastal Region of Bangladesh

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**Abstract**—The crab fattening culture (CFC) is a more profitable source of livelihood for the coastal people of Bangladesh. More than 7000 metric tons fattened live crab are exported and 2.5-3.0 lacs people all over the country are earning livelihoods from crab collection, fattening and marketing. Around 40-50 thousand people of Shyamnagar of Satkhira district, southwest region of Bangladesh are engaged in the occupation. The risk of mortality in CFC was higher, about 40% during 2010-2011. The mortality rate has been reduced gradually. The ICT has played an important role to manage the risks of crab mortality. Shushilan, a National NGOs has been implementing a project named REE-CALL since 2010, which promoted the crab fattening culture in marginalized farmers developing crab fattening producer group consisted of both men and women. The capacity building support was provided to them for its risks management in view of increasing its production through conducting market extension and business plan of the producers. Capacity building with promotion of ICT was an important factor to reduce the risks associated with CFC. The study aims to investigate the roles of ICT on risk management system and making profits with increasing the live crab production. The study findings have revealed that at present crab mortality rate is reduced to 15% from 40%, 25% profits per person has increased, and crab producers are increased to 210%, which ultimately result to increase 184% live crab production on average and develop women entrepreneurs of crab fattening business. Woman's access to ICT has developed women's entrepreneur and also roles to their husband's enterprise. Both primary and secondary data was collected to analysis its findings and presented with trend analysis and justifying. It has concluded with recommendations to promote authentic and trustworthy ICT to challenges the existing and future risks and problems.

**Keywords:** Crab Fattening Culture, Crab Mortality, Crab Production, Gender, ICT, Risk Management

## 1. INTRODUCTION

Bangladesh is bestowed with a large coastal belt that supports the livelihoods of millions mainly through fishing and aquaculture related activities. In Bangladesh, mud crab is an export fishery that is playing an important role in national and international markets. It can generate employment directly and indirectly in terms of people employed in the collection, production, marketing and other associated business. More than 50,000 fishers, traders, transporters and exporters are found to be involved in this sector. Bangladesh began exporting mud crabs around 1977-8 and since 1982 the value of export earnings has been steadily increasing. In 2002, mud crabs ranked third in terms of frozen food export items. During 2005-2006, Bangladesh earned US\$3,668,000, compared with 2006-2007, when the total export value increased by 65% (Ferdoushi Z, et al. 2010:249). The total amounts of exported crab from Bangladesh in global market are collected from the coastal regions of its Khulna, Satkhir, Barisal, Cox's Bazar, and Chittagoan districts. The fields of the crab collection are the rivers, canals, and saline water bodies of Sundrabans areas, which are consisted of 6,28,780 hactor areas at 710 Kilomiter coastal line. There are 11 species of crab identified and observed in these areas, of which mud crab is recognized as a valuable export commodity for its characteristics of high nutrients and testy. As export commodity, it is playing very important roles to the country's economy. For this, crab has occupied second position of the exported commodities of fisheries sector. At present, the produced live crab and freezing soft crab in Saline water firms are being exported from Bangladesh in Chine, Tawan, Singapur, Malayasia, Thailan, Japan and Hongkong of Asia and different countries of Americal and Europe. (Rahman, et

al., 2012: 53; Chakraborty, 2015: 93). At present, 2.5-3.0 lacs people all over the country are earning their livelihoods collecting and marketing crabs. A largest section of poor households of the coastal regions of the country are engaged with crabs' fattening, collecting, and marketing. Among those, around 60-70 thousands of women and men of Sundarbans region under Khulna are engaged in such occupation. (Haque, 2010, Chakraborty, 2016:79). Generally poor women and men involved in crab fattening. Crab producers fatten the crabs through point systems, which is very popular. Producers/fatteners collect the soft shell crabs (water crab) and lean crabs from different depots and sometimes directly from the middleman and collectors and fatten them in 10-15 days.

The tropical cyclone 'Aila' on 25 May, 2009 along with storm surge has brought the change in coastal people's livelihood as a result of its massive effects on its traditional lives and livelihood, assets, livestock, agricultural systems and environment. Shushilan, a National NGOs has been implementing a project named Resilience through Economic Empowerment, Climate Adaptation, Leadership and Learning (REE-CALL) since 2010. It has been implementing in Atulia Union of Shyamnagar Upazilla under Satkhira district of Bangladesh, who was affected by the disaster. The project aims to men and men most at risk of disaster and climate change in Bangladesh are able to thrive in spite of shocks and change. It has been implemented through the development of community based organization (CBOs), conducting participatory vulnerability and capacity assessment (PVCA) and market extension plan (MEP) and developing producer groups of different products, which are inclusive and integrated approach. The promotion of crab fattening culture in marginalized farmers was an important intervention as livelihood option, which was identified by value chain analysis, MEP and PVCA.

The findings of value chain analysis, MEP and PVCA have revealed that crab fattening culture can be a potential livelihoods for the poor and marginal people affected by 'Aila' named disaster. The intervention revealed finding that the crab mortality was very high; about annually 40% crabs were died in the fattening process. The risks of crab mortality were associated with lack of technical knowledge, information and communication technology. As a result, the crab fattening producers would loss a huge amount of profits. The field findings demanded to provide ICT knowledge to the crab fattening producers. Under the project capacity building support to develop the technical knowledge and integration of information and communication were promoted among the crab fattening producers to reduce their loss in crab fattening culture.

## 2. OBJECTIVE

Information and communication technology (ICT) is regarded as very useful factor and an integral part of sustainable development. The ICT has played an important role to have

direct benefits. Here it aims to research, investigate and represent the roles of ICT towards risk Management and increased the production of crab fattening producers. It also represent the importance of crab fattening culture promotion, problems and trend of problems solution in different time frame to analysis the needs of future intervention to address existing challenges.

## 3. METHODOLOGIES AND SCOPES:

The study has been conducted analyzing the findings of PCVA and MEP and value chain analysis in the study areas. Both primary and secondary data are used to analyze and present the study findings.

**3.1. Study area and sample size:** The study was conducted purposively targeting the crab fattening producers of the villages named Borokupt, Magurakuni and Talbaria of Atulia union under Shyamnagar sub-district of the district named Satkhira of Bangladesh.

### 3.2. Data collection

**Literature review:** At first, Literature collected from the available source which is published by department of fisheries, research institution, and PCVA and MEP of producer groups of the study area. Preferences were given to document referring sustainable, resilience and adaptable agriculture. Then it was reviewed and verified from the available literature on specific concerns.

**Landscape analysis:** Landscape analysis was undertaken for content availability, stakeholders, existing ICT services, pricing and regulation for evidence-based intervention practices in the sub-district and identify key factors for sustainable content services beyond the project.

**Interview with stakeholders:** Individual in-depth interviews were conducted with crab fattening producers, Upazila Fisheries Officer by a predesigned questionnaire in view of justifying the study findings in the study areas and sub-district.

## 4. WORKING DEFINITION OF ICT

ICT means information and Communications Technology. The animators and crab farmers in participatory process have defined ICT as information, communication and technology as a mean of access to message delivery and application, communicate to have messages, and system of application to produce products.

## 5. STUDY FINDINGS:

### 5.1. Importance of crab aquaculture and uses of technology:

Mud crab has a huge demand in foreign market. The total amounts of exported crab from Bangladesh in global market are collected from the coastal regions of its Khulna, Satkhira, Barisal, Cox's Bazar, and Chittagoan districts. The fields of

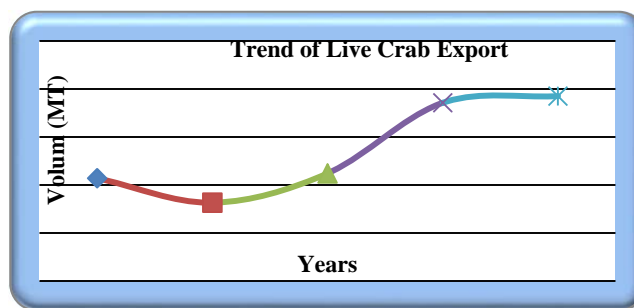
the crab collection are the rivers, canals, and saline water bodies of Sundrabans areas, which are consisted of 6,28,780 hactor areas at 710 Kilomiter coastal line. There are 11 species of crab identified and observed in these areas, of which mud crab is recognized as a valuable export commodity for its characteristics of high nutrients and testy. As export commodity, it is playing very important roles to the country’s economy. For this, crab has occupied second position of the exported commodities of fisheries sector. At present, the produced live crab and freezing soft crab in Saline water firms are being exported from Bangladesh in Chine, Tawan, Singapur, Malayasia, Thailan, Japan and Hongkong of Asia and different countries of Americal and Europe. (Rahman, et al., 2012: 53; Chakraborty, 2015: 93).

In 2007-2008 and 2008-2009 fiscal years the amount of exported crabs were 4283.27 and 3264.62 Matric ton respectively. Due to natural disasters caused by tropical cyclone ‘Aila’ the crab export in 2009 was reduced (Ferdoushi, et.al, 2010: 256). In 2010-2011 fiscal year, 4486.20 Matric tons crab of worthy BDT. 54.11 crore were exported in different countries (DoF, 2012). In 2012-13 7428 Matric tons of worthy BDT. 169.49 crores and in 2013-14 fiscal year 7707 Matric ton crab of worthy BDT. 164.75 crore were exported. In spite of increased 279 Martic ton crab export in 2013-14 fiscal years, the income of foriegn currency were decreased due to

lowering of market value and value of dollar’s fluctuation (Chakraborty, 2015: 94). At present, 2.5-3.0 lacs people all over the country are earning their livelihoods collecting and marketing crabs. A largest section of poor households of the coastal regions of the country are engaged with crabs’ fattening, collecting, and marketing. Among those, around 60-70 thousands of women and men of Sundarbans region under Khulna are engaged in such occupation. (Haque, 2010, Chakraborty, 2016:79). According to the supply of crab for export and extension of crab culture in Shyamnagar, it is expected that around 40-50 thousands of women and men are engaged in occupation associated with crabs’ collecting, culturing, fattening, and marketing in the region.

**Table 1: Feature of exported crabs in different fiscal years**

Fiscal years	Exported amount (M.T.)	Export value (crore)	Remarks
2007-2008	4283.27	-	Production decreased due to natural disaster at coastal areas
2008-2009	3264.62	-	
2010-2011	4485.20	54.11	Lowering of market value and dollar fluctuation
2012-2013	7428	169.49	
2013-2014	7707	164.75	



In point of fact crab culture means crab fattening in Bangladesh. Crabs are fattened as culture in two ways. One way of this crab culture is making pen/point in the shrimp firm of water bodies, which is called pen/point culture of mud crab. Another way of the crab culture is box/cage set up in deep water bodies, which is called cage culture. After feeding juvenile mud crab of 10-250 gram weights keeping in cage/box/ponds or firm, it was collected for sale while reaching to 300-500 grams weights. On the other hand, the thin crabs which gonad is not nourished are fattened and nourished by feeding them keeping in cage or boxes, or firm or point for 1.5 – 4 weeks. Because the mud crabs are able to aquaculture, developmental and fattening commercially. (Rahman, 2012:53; Chakraborty, 2015:96).

Considering this potentialities, government, private sectors, and non-government organizations have taken different initiatives and projects to promote and extend different techniques and technologies of crab culture as a strategy of climate change adaptation. The initiatives of technology application, providing skill training to use technology to crab fattening producers/farmers, materials and input supports, viable information and massages provided to crab farmers, capacity building to risk reduction in crab culture, development of market extension plan and communication and linkage building with market, etc. have increased the live crab production.

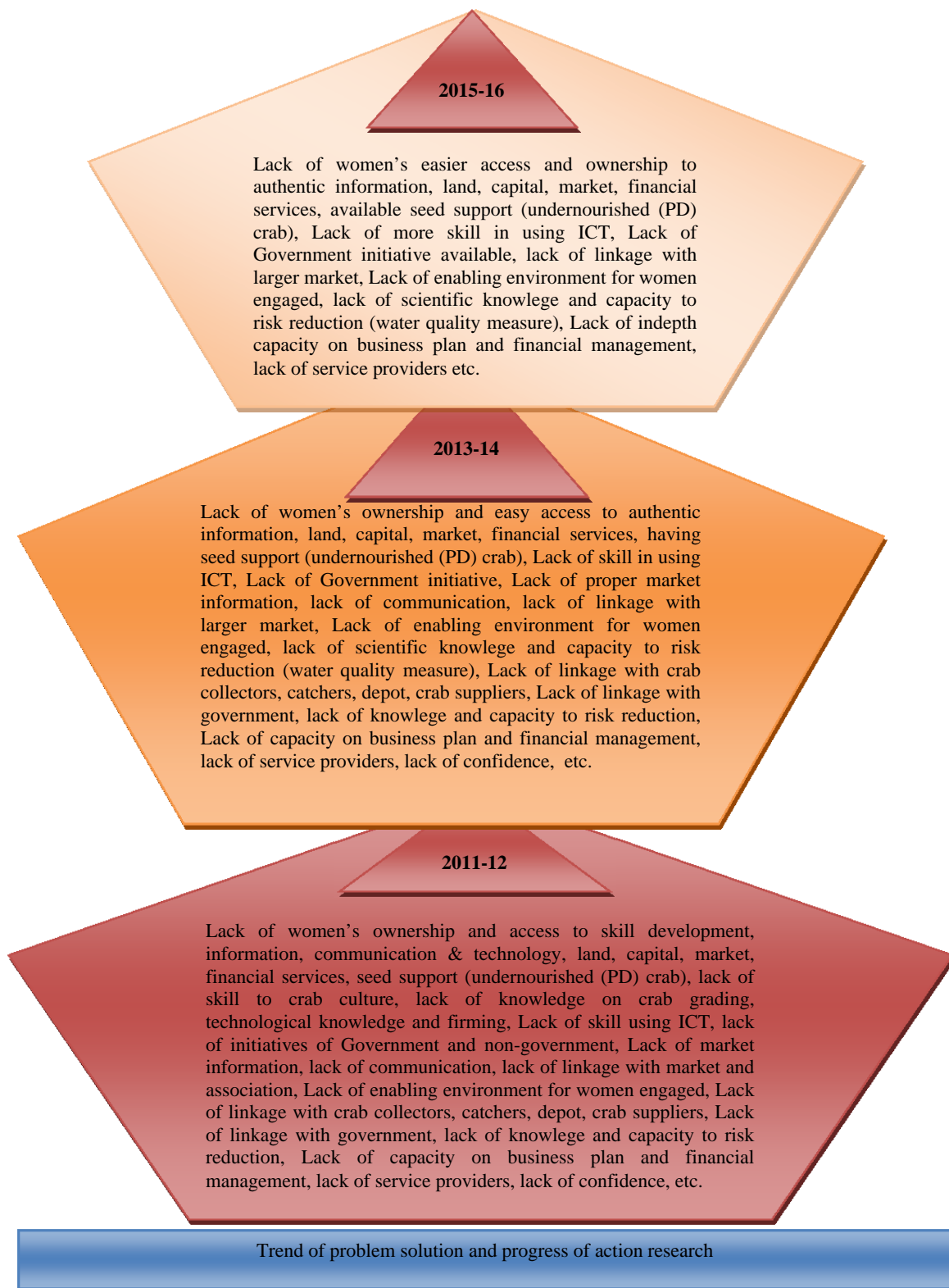
At present there are observed different cultures using different technologies such as (a) juveline crab culture, (b) thin crab fattening in pen and cage) and (c) producing soft cell crab (which is exported after freezing). In application of technology and empirical evidence of crab farmers, it has been observed that developmental rate of crab is comparatively more, observed good results of crab culture in more than 5 PPT saline water but it is best if the water’s salinity is 10-25 PPT, crab can alive more days in dry place, so its mortality rate is low, it can transfer in so far areas easily and live crab can be exported, high demand in foreign markers, increased crab demand in local market and aristocrat restaurants in country, created opportunities of marketing in short time period, more profitable, technology of crab culture is applicable in short space, crab culture is not harmful for

environment, etc. (PCVA, 2014 & 2016; MEP, 2012 & 2015; Chakraborty, 2016:80; Rahman et al. 2012:53 & 55).

Bangladesh Fisheries Research Institute has been conducting different research activities to intervene the improved technologies of crab culture in view of utilizing the potential resource to contribute to the national economic development. Different non-government organizations with the financial support of international development and also the private sectors have extended the crab fattening culture that is crab culture. Already different technological intervention of crab culture have been applied, practiced and extended among the crab farmers of the coastal areas through capacity building training, input support and other necessary support to extend it.

The experimental evidences of crab farmers revealed that a poor crab farmer get net benefits of amount BDT. 2,500 – 3000 per month from only one (1) decimal land culturing 20 Kg. gonad undernourished crab to gonad nourished crab by two cycles in a month. The technical matter is easy and very relevance to their traditional approach of fish culture, and it has revealed that only BDT. 13000 needs to start up such a crab culture business and only one (1) hour per day can be spent in this culture. The learning revealed that a woman can also do such a business within their households and can be an additional income for their economy development. The REE-CALL project assessed and extended the learning organizing the men and women in producer groups with market extension plan (MEP) and market survey. In addition, along with crab production, they were linked with depot, crab catchers, middle men, local traders, and financial service providers to expend the crab fattening culture business as profitable business of women.

**Trend problems and solutions**



Fattened live crab production business is particularly risk due to its nature of business. The risk is crab mortality in CFC. The study has revealed that the risks are related to increased salinity, flooding, erratic rainfall, heavy rainfall, high temperature, extreme cold, water logging, etc. The risks identified in crab culture in the region are associated with flooding, pH of water, dissolved oxygen in water, heavy rainfall, high temperature, extreme cold, water logging, water source, etc. The risks are fluctuated by weather conditions and also human induced causes. The production of live crab is fluctuated by the risks. If any risk created, the mortality rate of crab will be higher. As a result it will reduce their benefits. Another matter to increase the production is firm management of crab culture, the risks here are associated with technical knowledge for firm management, nature of the pond, water salinity since mud crab grows faster in low salinity water, the range of pH will be 7.5 – 8.5, dissolve oxygen is >4 PPM, there must be available source of water, and there will have a system of controlling water of firm and also the place must be saved from natural disaster. The study finding has revealed that annually 40% crabs on average were died due to the mentioned risk factors, which affects their profits.

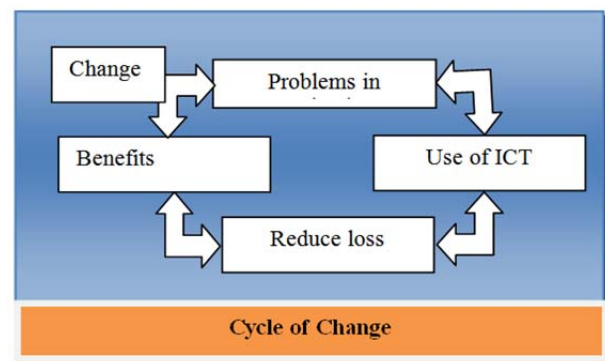
#### Addressing ICT to risk reduction in crab fattening culture (CFC)

ICT is not static; it is regularly updated, advanced and disseminated to the public. Mobile phone as an ICT device is very useful driving factors to communicate in education, personal relation, economic, political and ethical perspectives. An article on internet using in Bangladesh produced by Abul Hasbath published in a daily Newspaper named Prothom Alo dated on 22 March, 2015 revealed that 76% people use mobile phone in Bangladesh, 6% of those people have own smart phone. United State based research institute PU research center sourced that 65% of mobile phone holders capture picture or video by their phone. After all mobile phone is now regarded as daily using device for communication and information dissemination to reach specific purpose.

The research findings have revealed that the crab fattening producers used mobile phone collect and disseminate the authentic information of the crab fattening culture. It is regarded a driving factor of women's economic empowerment paved by the action research implemented in the village. Through the action research it has been revealed that the information and communication technology is most driving factors to promote business benefits. Thus the mobile phone is being used to get decision making way of women.

The technical knowledge and information are served to the crab fattening producers to increase their skill to adapt the crab culture technology. The women are known and learnt to new something in any moment, and they apply in their business with a will, which was the main cause of gaining their success. They learn technology of crab culture startup by training but they learn to reduce their loss by communication

and information from message dissemination. The capacity of men and women producers on the uses of ICT has been gradually increased to bring the solutions of their problems and thereby reduced their risks and loss. The research finding revealed that when they face challenges of crab production in point culture system, they communicated with experts, especially department of fisheries and PROTIC call center to get immediate solution and thereby they applied their suggestion in their crab culture field. Here, it is observed that the mobile phone device has benefited them by two ways, one is saved their time and another one is they have social and economically benefits. The specific findings are they are being the messages of problem solution CFC in short time from the experts. They do not go to the experts by transport, which is far from 10-25 Killometers needs BDT. 100-300 as transport cost, they could know some new expert, and also they get idea and sources of learning. As a result, they are being able to coping with changing situation, and immediate new risks associated with crab mortality as well as getting social and economically benefits reducing the risk of crab mortality in CFC firm.



#### Impact of ICT to risk reduction in crab fattening culture (CFC)

**Created scopes of capacity building and ICT uses:** To create enabling environment of women was a very challenging job in terms of promote their livelihood and sustainable job options engaging them in market out of their household. Organizing community to form inclusive CBO was the starting point to engage women in development. CBO was formed giving the scope of women in leadership position and considering more than 60 percent women member with men of total CBO members in each household. Producer group was formed with the labored household. REE-CALL project facilitated the CBO members and members of producer group to undertake market survey. The project facilitated to solve the identified need and rights based problems engaging women and men.

**Capacity building and access to women to crab fattening culture:** The problems were solved by taking step by step initiatives. Organizing and forming producer group consisted

of men and women, startup initiatives were undertaken through a practical training, inception and communication. The project facilitated to solve the identified need and rights based problems engaging women and men. In the working process the following solutions and achievement was reached to increased production

- Women’s skill and education increased to identify crab grading
- Increased women’s access to skill development training
- Increased women’s access to seed (PD undernourished crab) availability
- Increased women’s access to information and communication
- Increased women’s technical knowledge and firm management
- Increased women’s capital and thereby they leased land to develop firm
- Increased women’s access to financial services from bank, NGOs BRDB with low interest
- Increased skill of women to use SMART phone
- Established Government’s commitment, initiatives and recognition to crab culture, research and project piloting
- Accessing market information to women
- Linkage developed with market and association
- Linkage strengthened with crab collectors, catchers, depot, crab suppliers,
- Linkage developed with government and non-government actors
- Increased knowledge and capacity to risk reduction
- Developed confidence of women to run a business, verify market value and bargaining,

**State of Production and Capital of Women Crab Farmers:**

The crab fattening culture was started up with only 10 crab producers (men: 4 and women: 6) forming two (2) Crab Producer Groups of crab fattening culture in the village at early stage of the years 2011. It was a cage culture introduced within the producers as technology. Their success came in 2012 by making profit and increased crab fattening producers (CFP) and crab fattening producer groups in participatory approach through conducting MEP and marker survey. The study findings have revealed that on average 210% producers have been increased in each year and reached 200 producers in 2015, who are continuing the crab production. It has been revealed that increased capacity and promotion of ICT has resulted to increase the producers and production with net benefits increased to 25% in 2015.

**Table 2: Increased production and sale volum**

Particular	Year					Remarks
	2011	2012	2013	2014	2015	
Total numbers of CFP	10	84	105	145	200	
Producers increased		74	21	40	55	
Percent of producer increased		740	25	38	38	210% on average
Women members of CFP	6	21	104	104	104	
Men members of CFP	4	63	96	96	96	
Total invest crab for fattened (10kg per cycle per person)	1500	12600	16800	24650	38000	
Total annual production (in Kg.)	900	8316	12600	20213	32300	7850 (average) 249%
Annual investment (DBT)	405000	3742200	5670000	9095850	14535000	
Annual Sale Volume	477000	4490640	6804000	11117150	18184900	
Annual profit	72000	748440	1134000	2021300	3649900	
Annual Profit/person	7200	8910	10800	13940	18249.5	
% of profit increased	18	20	20	22	25	



Figure- 2 Trend of crab production  
1= 2012, 2= 2013, 3=2014, 4=2015

The findings and data analysis of the last three years (2012, 2013, 2014 and 2015) have revealed that the annual production of fattened live crab has increased 7850 Kg. on average per year and the average annual increase rate of the products is 249 percent. There are observed women's contributions in the production process is 100%. 52% women of total producers are directly involved in crab production and market system, and the rest 48% women help their husbands by feeding, nursing and processing live crab. As a result the findings have revealed that 100% women are skilled and capacitated to crab fattening culture (CFC).

At present on average a woman earning BDT. 1521 per month from crab fattening culturing in one (1) decimal land. The data collected from the field have revealed that 38% women of 104 women have been fattening crab in more than 15 decimal land. In peak season (December to march of each year) of crab culture and exporting, the sixteen women produced more than 100 Kg. crab per month on average. The findings that revealed that their investment capacity has increased in each year. In the last years, their investment capital has increased drastically more than from the year 2011 due to the increased of financial support, increased women's access to crab market and linkage building with traders, and the services financial service providers (NGO, BRDB, and Bank), the women extended their crab business by taking loan with low interest. They are also repaying the loan in due time from their benefits. The women crab farmers are now small entrepreneurs. They are now economically well-off and free from the course of poverty. The information and communication has contributed to build a trustworthy relationship with the market actors and financial service providers.

**Technical knowledge building areas to reduce crab mortality:** The women crab fatteners are skilled and capacitated to reduce the risks. They are known to crab culture firm management, its environment, quality of mud, level of

temperature, pH and Oxyzen of water, etc. The control and manage its water according to their knowledge sharing with each other. Their increased capacity has promoted the women to fatten the crab in their local ponds, also and develop small points in water bodies. As a result of increasing capacity of risk mitigation, their production has been increased. The research findings by focus group discussion have revealed that at the start up stage of crab fattening business, the mortality rate were more than about 40%. Now the mortality rate is reduced to 15% percent as a result of increasing capacity and ICT promotion.

Table-3: Reducing mortality

	Year					Remarks
	2011	2012	2013	2014	2015	
Mortality rate	40%	34%	25%	18%	15%	FDG

However, the mortality rate depends on quality seed, capacity of nursing and realization, instrument of crab carrying, communication, monitoring & observation, etc. Due to lack of knowledge, involving in market chain, and good relation, wastage was higher. In a time, where a women lost a huge benefits in crab fattening due to mortality now their losses has been decreased due to increased their capacity and knowledge on the use of technology. They have been able now to reduce the live crab mortality to 15 percent from 40% of in 2011. It is the women who prepared their firms by group, prepared mud, control its water's salinity, pH, and oxyzen.

According to their opinion of Shunita Rani Mondal, a crab of 200 gram weight, we have to loss 30-50 taka. So we test water and mud regularly to justify the pH and Oxyzen of water enable to survive. We monitor crab and water in two (2) times in a day, one is morning time and another one is when we provide food at evening. If we observe any problem, then we take immediate action. Such as in summer if the temperature is high, we keep more water in firm, in heavy cool, we pick out slush and keep more water. If water oxyzen became less we provide oxalate tablet. To control gass in water, we use ultramax. We wipe alga out to control sunlight, water nutrient, and oxyzen. They also said that climate change is related to temperature and daily weather condition, so we have to know and apply the information and knowledge to have more benefits to increase our benefits.

## 6. CONCLUSION

The mud crab fattening culture has been popular due to it is profitable and crab has huge market demand, and high value in foreign market as food. Entrepreneurship has been developed as it is exported. The access to capacity building support and ICT has developed entrepreneur and created employment opportunities of young men and women. The performance of CFC has changed the socio-economic conditions of disaster affected communities. Accessibility of information, built up



communication linkage, and technological updated and disseminated in the rural communities has increased the women's engaged in CFC, production, reduce the risks of crab mortality, and making profits. Ultimately it is reducing the poverty of the vulnerable communities. But there is remaining challenges of conservation of bio-diversity and environment. Because the crab of CFC is collected from wild, which has been creating the loss of bio-diversity. On the other hand, the risks of crab fattening culture are related to climate variables, and ICT is yet provide authentic and trustworthy information according to the changing situation of global situation. In this situation, the followings issues are recommended to reduce 100% risks of crab fattening business.

- Enhance easier access and ownership to authentic and trustworthy information and communication technology
- Enhance easier access to land, capital, market, financial services, available seed support (undernourished (PD) crab),
- Provide more skill on using ICT,
- Strengthen government initiative available
- Linkage with larger market,
- Promote enabling environment for women engaged,
- Enhance scientific knowledge and capacity to risk reduction (water quality measure),
- Promote in-depth capacity on business plan and financial management,
- Service providers etc.
- Develop APPs for crab culture

To challenge the conservation of bio-diversity, it needs to develop hatchery for crab seed production and make the public aware. As a result, the crab fattening and crab culture would be sustainable livelihood option.

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