



FISH SEED ENTREPRENEURS OF NAIHATI, WEST BENGAL: A CASE STUDY

Dissertation submitted in partial fulfillment
of the requirements
for the degree of

M. F. Sc. (FISHERIES EXTENSION)

by

RUMI SWARNAKAR, B. F. Sc.

(FEX-MA4-04)

ICAR-CENTRAL INSTITUTE OF FISHERIES EDUCATION

(University Established Under Section 3 of UGC Act 1956)

**Panch Marg, Off Yari Road, Versova,
Andheri (W), Mumbai – 400 061**

JUNE 2016

RUMI SWARNAKAR, 2016. Fish Seed Entrepreneurs of Naihati, West Bengal: A Case Study. M. F. Sc. Dissertation. ICAR- Central Institute of Fisheries Education (Deemed University), Versova, Mumbai-400061, India

DECLARATION

I hereby declare that the thesis entitled “**FISH SEED ENTREPRENEURS OF NAIHATI, WEST BENGAL: A CASE STUDY**” is an authentic record of the work done by me and that no part thereof has been presented for the award of any degree, diploma, associateship, fellowship or any other similar title.

Date: 30th June, 2016

Place: CIFE, Mumbai

(Rumi Swarnakar)

M.F.Sc Student

Central Institute of Fisheries Education

Mumbai

ACKNOWLEDGEMENTS

“Satisfaction and euphoria that a person has in the successful completion of any task would be, but incomplete, without the mention of the people who made it possible and whose constant guidance and encouragement served as a beacon of light and crowned the effort with success.” Thus I feel this is an extremely significant and joyous opportunity bestowed upon me by the goddess of learning, to think about and thank all those persons.

*At the onset of this epistle, I consider myself fortunate and greatly privileged to have worked under the supervision and guidance of **Dr. P. S. Ananthan**, Senior Scientist, FFES Division, CIFE, Mumbai and Chairperson of my advisory committee. I am feeling pleasure to express my sincere and deepest feelings of gratitude for his benevolent guidance, unflinching encouragement and support at every stage of this investigation and preparation of this manuscript. I am indebted to him more than he knows. My working under him will always remain an unforgettable experience of my life.*

*I extend my warm thanks to honorary members of my advisory committee, **Prof. S.S. Dana**, HOD, Fisheries Extension, WBUAFS, Kolkata and **Dr. Munil Kumar Sukham**, Principal Scientist, ICAR-CIFE, Kolkata centre, Kolkata for their constructive and valuable suggestions and guidance.*

*I wish to convey my hearty thanks to Hon’ble Vice Chancellor and Director, **Dr. Gopal Krishna**, CIFE, Mumbai, for providing all the necessary facilities and moral support for carrying out the research.*

*I shall remain grateful to **Dr. M. Krishnan**, HOD & Principle Scientist, has been helpful with valuable inputs and guidance whenever required.*

I would like to express my gratitude to all the Entrepreneurs of Naihati and DoF staff of WB for their cooperation and encouragement.

I gratefully acknowledge the valued opinion and help rendered by my seniors Pooja di, Neha di, Lloyd sir, Ramesh sir, Sweta di and Ranjita di

“A friend is one to whom you can pour your heart out”, so I want to express my special thanks and love to my loving friends Subhadip, Ria, Atmaprasanthi, Dipanwita, Somdutta. When I am talking about my friends then how can I forget support of my batch mates for which I am thankful to Suman, Anamika, Nandini, Green sea, Luigi, Chetan, Ubair,

Bikas, Ravi and Kranthi. In the serial of paying regards I am also thankful to my loving juniors.

Although, it is like a drop in ocean, yet I would like to achieve this opportunity to express my deep gratitude to all teachers and staff members of FEES Division faculty for the help rendered during the course of this work in one way or the others.

Finally I want to convey the profound gratitude to my affectionate Baba and Ma whose sacrifice, untiring help and unending support, love and affection have inspired me and kept me in high spirits during my studies. This dissertation was simply impossible without them. I am indebted to my Father, and Mother, for their care, love and undying support. I am deeply grateful to my dearest brother Rony for his everlasting affection for me.

I seize this opportunity to express my heartfelt feeling and deep sense of love to my family members for their unflagging love, blessings and support throughout my life and pray for success.

I shall ever, remain thankfully indebted to all those learned souls, my present and former teachers, known and unknown hands who directly motivated me to achieve my goal and enlightened me with the touch of their knowledge and constant encouragement.

I record my sincere thanks to all beloved and respected people who helped me but could not find separate mention.

Lastly I Bow my head before the almighty for making me blessed and giving me encouragement during adverse situation.

Date: 30 June

(Rumi Swarnakar)

Place: CIFE, Mumbai

सारांश

नैहाटी मत्स्य बीज बाजार एशिया के बड़े मत्स्य बीज बाजारों में से एक है और यह भारत के कुल मत्स्य बीज उत्पादन में महत्वपूर्ण योगदान दे रहा है। इसलिए एक अध्ययन इस बाजार के सभी पहलुओं पर इसके इतिहास से वर्तमान तक की स्थिति को बताने के लिए किया गया। अध्ययन में नैहाटी क्षेत्र के मत्स्य बीज उद्यमियों की प्रोफाइल का आकलन भी किया गया और उनके अभिनव प्रथाओं के दस्तावेज को भी दर्ज किया गया। इस अध्ययन से यह पता चला है कि 1990 के दशक तक भारतीय प्रमुख कार्प बीज बाजार पर हावी थी। धीरे-धीरे विदेशी प्रजातियाँ जैसे कि पंगासिउस प्रजातियाँ, पिरैकटस ब्रेकीपोमस और तिलापिया के प्रवेश से दोनों बाजार की संरचना में बदलाव आया है और वार्षिक लेनदेन की मात्रा (2737 लाख क्रमांक वर्ष) और मूल्य (4124 लाख रुपये / वर्ष) में कई परतों में वृद्धि हुई है। आईएमसी से विदेशी प्रजातियों के बीज उत्पादन में स्थानांतरण के प्राथमिक कारण मांग और लाभ का होना पाया गया है। हैचरी मालिकों के उद्यमी व्यवहार को स्वायत्तता, नेतृत्व, अनुकूलनशीलता, उपलब्धि की जरूरत, आत्म सशक्तिकरण की जरूरत, अभिनव, और लचीलेपन के एक समारोह के रूप में मूल्यांकन किया गया था। एक पूर्व परीक्षित किया गया प्रश्नावली जिसे क्रॉबैच अल्फा का उपयोग करते हुए आंतरिक स्थिरता के लिए परीक्षण किया है उसे इसके आकलन के लिए प्रयोग किया गया। इसके परिणाम से यह संकेत मिलता है कि स्वायत्तता (0.96) की उपलब्धि सबसे ज्यादा है जो उनकी उद्यमशीलता को बढ़ाने में सबसे अधिक योगदान दे रहा है और उसके बाद व्यवहार नेतृत्व (0.93), आत्म सशक्तिकरण की आवश्यकता (0.83) और लचीलापन (0.80) आते हैं। पियर्सन के सहसंबंध गुणांक परीक्षण से उद्यमी व्यवहार और हैचरी मालिकों की वार्षिक आय (0.291) के बीच सकारात्मक और महत्वपूर्ण संबंध दिखाया गया है। बीज उत्पादकों को काफी अभिनवपूर्ण पाया गया है क्योंकि उन्होंने अपने अभिनव से पिछले कुछ वर्षों में कई हैचरी प्रथाओं को उपयोग में लाये हैं जो मुख्य रूप से आसान, लागत को कम करने वाले और उत्पादकता और लाभ बढ़ाने वाले हैं। इनडोर कार्प मछली पालने का जहाज़, नर्सरी में जलीय कीड़ों के नियंत्रण, परिवहन के दौरान पानी के साथ दूध का मिश्रण कुछ उल्लेखनीय नवाचार दस्तावेज थे। हैचरी मालिकों को कुशल पाया गया और उन्होंने मछली बीज उत्पादन के पारंपरिक तरीकों के लिए खुद को सीमित नहीं किया। उनमें से कुछ को पुरस्कार और राज्य मत्स्य विभाग या आईसीएआर / राज्य कृषि विश्वविद्यालयों द्वारा बीज उत्पादन के अपने प्रगतिशील प्रकृति के लिए प्रमाण पत्र से सम्मानित किया गया।

ABSTRACT

Naihati fish seed market is Asia's one of the largest fish seed markets and is contributing significantly to India's total fish seed production. So a case study was conducted to understand the dynamics of this market from its early days to present scenario. The study also assessed the profile of fish seed entrepreneurs of Naihati region and documented their innovative practices. The study revealed that till early 1990s, Indian major carps dominated the seed market. Gradually entry of exotic species such as *Pangasius* sp. (Pangash), *Piractusbrachypomus* (Paku/Rupchanda), and tilapia altered both the market structure and increased the annual transaction volume (4038. 6 lakh no.) and value (3626.4 lakh rupees) several folds. Demand and profit were found to be the primary reasons for this shift seed production of IMC to exotics. Entrepreneurial behavior of hatchery owners was assessed as a function of Autonomy, Leadership, Adaptability, Need for achievement, Need for self-empowerment, Innovation, and Flexibility. A pre-tested questionnaire, tested for internal consistency using Cronbach alpha, was used for this assessment. The result indicated that Autonomy contributed most (0.96) in increasing their entrepreneurial behavior followed by Leadership (0.93), Need for self-empowerment (0.83) and Flexibility (0.80). Pearson's correlation coefficient test showed positive and significant relationship between entrepreneurial behavior and annual income of hatchery owners (0.291). Seed producers were found to be innovative as they have innovated many hatchery practices over the years mainly for ease of use or to reduce the cost and or to increase the productivity and profit. Some of the notable innovations documented were Indoor carp hatchery, Control of aquatic insects in nurseries, mixing of milk with water during transportation, scattering of feed in pond. The hatchery owners were found to be skilled and did not confine themselves to the conventional methods of fish seed production. Some of them were conferred with awards and certificates for their progressive nature of seed production by State Fisheries Department or ICAR/SAUs.

Contents

Chapter No.	Title	Page No.
1.	INTRODUCTION	1-5
2.	REVIEW OF LITERATURE	6-13
2.1	Dynamics of fish seed production and market in Naihati region	6-8
2.2	Profile of Fish Seed Entrepreneurs in Naihati Region	8-11
2.3	Innovations in fish seed production and marketing in Naihati region	13
3.	RESEARCH METHODOLOGY	14- 26
3.1	Locale of Study	13-15
3.1.1	Brief description about Naihati	13-14
3.1.2	Selection of study area	14-15
3.2	Method of data collection	15-16
3.3	Methods and tools used for data collection	16-23
3.3.1	Selection, Operationalisation and measurement of the variables	17-18
3.3.2	Representation of Market Dynamics	19-20
3.3.3	Measurement of Entrepreneurship profile of hatchery owner	20-22
3.3.3.1	Social profile of hatchery owners	19
3.3.3.2	Business profile of hatchery owners	19
3.3.3.3	Entrepreneurial behavior	20-22
3.3.4	Documentation of innovation	22-24
3.4	Statistical tools used	24-26
4.	RESULT AND DISCUSSION	26- 73
4.1	Dynamics of Fish Seed Production and Market	25-44
4.1.1	History of Naihati fish seed market	25- 27

4.1.2	Brief description of Naihati fish seed market	27-44
4.1.2.1	Operation of the market	28-32
4.1.2.2	Function of Market	33- 37
4.1.2.3	Market management	37- 38
4.1.2.4	Function of actors of the market	38- 42
4.1.2.5	Changes in the market	43
4.1.2.6	SWOT Analysis of Naihati Fish Seed Market	44
4.2	Profile of fish seed entrepreneurs in Naihati region	45-63
4.2.1	Social profile of entrepreneurs	45-48
4.2.2	Business profile of fish seed entrepreneurs	48- 55
4.2.2.1	Registration of Hatcheries	48-50
4.2.2.2	Farm profile	50-51
4.2.2.3	Benefit cost ratio to determine Economics of Fish Seed (IMC fingerling) Production of Naihati /Ha/Year	52-53
4.2.2.4	Benefit cost ratio to determine Economics of Fish Seed (Pangash) fingerling) Production of Naihati /Ha/Year	54-55
4.2.3	Entrepreneurship profile of fish seed entrepreneurs	55-63
4.2.3.1	Cronbach alpha test to measure the internal consistency of 3 point Likert scale	55-56
4.2.3.2	Standardization/ Normalization of Entrepreneurial behavior	56-58
4.2.3.3	Measurement of Correlation between entrepreneurial behavior and annual income	58-59
4.2.4	Success stories of Fish seed Entrepreneurs of Naihati	59-63
4.3	Documentation of innovations in fish seed production and marketing in Naihati region	64-68

4.3.1	Introduction of several fish seed production methods in Naihati	64-65
4.3.2	Innovations in seed production and nursing in Naihati	64
4.3.2.1	Indoor carp hatchery	65
4.3.2.2	Jars and circular tanks are available for use In the same hatchery	65
4.3.2.3	Control of aquatic insects in nurseries	66
4.3.2.4	Modified Chinese Hatchery-1	66
4.3.2.5	Modified Chinese Hatchery-2	66
4.3.2.6	Hapa-based' hatching system	68
4.3.2.7	Smaller versions of the Chinese hatchery model	68
4.3.2.8	Mixing of milk with water during transportation	68
4.3.2.9	Innovations in fish seed nursing operation	68
4.3.2.10	Large cemented jars in hatching purpose	69-70
4.3.2.11	Innovation in brood stock management	70-71
4.3.2.11	Scattering of feed in pond	71-72
4.3.2.12	Branded Seed	72-73
5.	SUMMARY AND CONCLUSION	74-78
6.	REFERENCES	78-84
7.	ANNEXURE - INTERVIEW SCHEDULE	
8.	LIST OF PLATES	

LIST OF TABLES

Table No.	Particulars	Page No.
1.1	Contribution of West Bengal in India's Fish Seed Production	2
1.2	District wise fish seed production data of W.B (million)	3
1.3	Terminology of various life stages of fish	4
3.1	Brief description of Naihati	13-14
3.2	Fish seed producing villages in Naihati	15
3.3	Operationalisation and measurement of the variables	17
3.4	Entrepreneurial behavioral factors	21-22
4.1	Brief overview of the market	27
4.2	Source of the market	28
4.3	Destination of the seeds	29
4.4	Seed preference of Different States	30
4.5	Composition of the market: In Peak season (May- September)	30
4.6	Composition of the market: Lean Season (November- April)	31
4.7	Species Composition of Carps (Fingerlings)	31
4.8	Species composition (Fingerling) other than IMC	32
4.9	Market Transactions (Quantity & Value / Day)	33-35
4.10	Annual transactions of the market	38
4.10	Journey of fish seed from Naihati fish seed market	42
4.11	Changes in the market over last 12 years	43
4.12	Distribution of fish seed entrepreneurs in Naihati	45
4.13	Details of RKVY scheme of Fish Seed Production	49
4.14	Details of Farm (Land,waterbody)	50
4.15	Total Fixed Investment (Rs./ha)-IMC, Pangash	52
4.16	Total variable cost (Rs/ ha)- IMC, Pangash	52
4.17	Total Cost (Rs./ha)-IMC, Pangash	53
4.18	Benefit cost ratio- IMC, Pangash	53
4.19	Result of Cronbach alpha test	56
4.20	Score of Entrepreneurial Behavior	56
4.21	RBQ of Indoor carp hatchery	64

4.22	RBQ of Jars and circular tanks, are available for use in the same hatchery	65
4.23	RBQ of Control of aquatic insects in nurseries	66
4.24	RBQ of Modified Chinese Hatchery-1	66
4.25	RBQ of Modified Chinese Hatchery-2	67
4.26	RBQ of Hapa-based' hatching system	67
4.27	RBQ of Smaller versions of the Chinese hatchery model	68
4.28	RBQ of Mixing of milk with water during transportation	68
4.29	RBQ of Innovations in fish seed nursing operation	69
4.30	RBQ of Large cemented jars in hatching purpose	70
4.31	RBQ of Innovation in broodstock management	70
4.32	RBQ of Scattering of feed in pond	71
4.33	RBQ of Branded seed	72

LIST OF FIGURES

Figure No.	Particulars	Page No.
1.1	Percentage share of West Bengal in India's Fish Seed Production	2
3.1	Map of West Bengal (Locale of study)	14
3.2	Map of N 24 Parganas District (Study area)	14
4.1	Mr. Nilaratan Ghosh (1 st private IMC hatchery owner)	26
4.2	Species composition (Volume wise)/ Day in peak season	35
4.3	Species composition (Value wise)/ Day in peak season	36
4.4	Species composition (Volume wise)/ Day in lean season	36
4.5	Species composition (Value wise/ Day) in lean season	37
4.5	Annual transaction of Market (in Volume)	39
4.6	Annual transaction of market (in Value)	40
4.7	Distant and local distribution of fish seed	39
4.8	Cartoon for keeping oxygen packed fish	41
4.9	SWOT Analysis of Naihati Fish Seed Market	44
4.10	Social profile of fish seed entrepreneur(Education)	46
4.11	Social profile of fish seed entrepreneur(Gender)	46
4.12	Social profile of fish seed entrepreneur(Family members)	47
4.13	Social profile of fish seed entrepreneur (Age)	47
4.14	Social profile of fish seed entrepreneur(Religion)	47
4.15	Social profile of fish seed entrepreneur (Caste)	47
4.16	Major Species in fish seed production (Naihati)	51
4.17	Score of Entrepreneurial Behavior	57
4.18	Entrepreneurial behaviors of hatchery owners	58
4.19	Comparison among the innovations based on their acceptance	67

1. INTRODUCTION

Fish seed is one of the main inputs in aquaculture production. Enhancement of fish seed both qualitatively and quantitatively is crucial for proper supply of table fish. Indian Government recognized the scarcity of sufficient fish seeds for production of desirable amount of table fish. According to an estimate, the total fish seed required for adequate stocking in existing pond and reservoir is around 48, 000 million fry (DAHDF, 2014- 15) . But the current fish seed production of India is 41, 450 million fry (DAHDF, 2014-15). To bridge this gap, Government is adopting positive initiatives by establishing hatcheries and brood bank across the country.

In India's total fish seed production, West Bengal contributes maximum. West Bengal occupies the leading position among all Indian states with the present production of 16,717 million (2014-15) fish seed. In West Bengal, fish seed entrepreneurs/ hatchery owners perform a significant role in increasing the fish seed production. The seeds produced in hatchery are distributed in several ways. Sometimes it includes direct transfer from hatchery or sometimes through fish seed market which is situated in Naihati of North 24 Parganas district of West Bengal. History depicts that in Naihati region fish seed production activity started with initiation, promotion and distribution of IMC seeds. Gradually entrance of *Pangasius* sp. (Pangash), *Piractus brachypomus* (Paku/ Rupchanda) acted as an important factor in economic up gradation of hatchery owners. While producing fish seed in commercial scale, hatchery owners have come across as well as innovated several kinds of methods and modified existing methods of fish seed production and distribution.

Table 1.1 Contribution of West Bengal in India's Fish Seed Production

Years	India	West Bengal	Share of West Bengal (%)
2004-05	20,790	12,200	58.7
2005-06	22,614	12,200	54
2006-07	31,688	13,200	41.7
2007-08	24,143	13,572	56.2
2008-09	32,177	14,181	44.1
2009-10	29,313	12,566	43
2010-11	34,999	13,453	38.4
2011-12	36,566	13,846	37.9
2012-13	34,922	15,002	43
2013- 14	34, 900	15, 890	45. 5
2014- 15	41, 450	16, 717	40.3

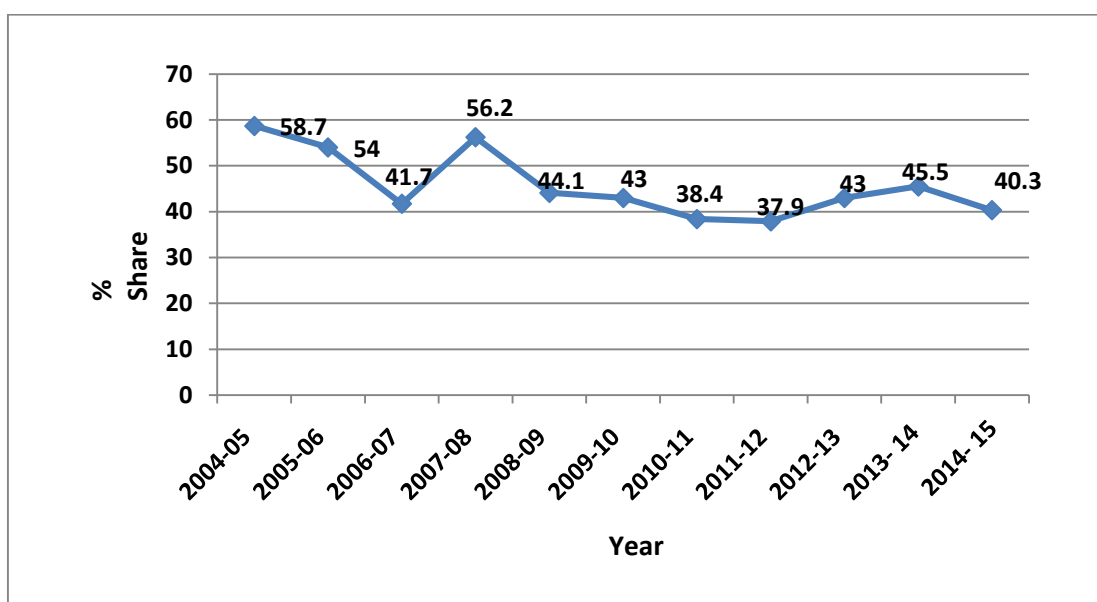


Figure: 1.1 Percentage share of West Bengal in India's Fish Seed Production

Table 1.2 District wise fish seed production data of W.B (million)

Districts	2011-12	2012-13	2013-14	2014- 15
Darjeeling	0	0	0	0
Jalpaiguri	170	173	181	104
Alipurduar	-	-	-	83
Cooch Bihar	35	37	36	38
Uttar Dinazpur	145	148	154	160
Dakshin Dinazpur	527	537	555	573
Maldah	208	214	224	238
Murshidabad	327	333	345	357
Nadia	1633	1684	1758	721
Birbhum	135	125	125	127
Burdwan	778	802	840	893
Hooghly	1069	1098	1156	1231
Howrah	206	218	232	239
North 24 PGS	3733	4191	4562	5271
South 24 PGS	116	121	133	131
Purulia	105	85	88	94
Bankura	3505	4031	4239	5112
Paschim Medinipur	337	356	363	391
Purba Medinipur	817	849	899	954
Total	13846	15002	15890	16717

Table 1.3 Terminology of various life stages of fish

Life stages of fish	Size (cm.)	Description
Fish Spawn	1	Freshly hatched fish
Fish Fry	2	After releasing the yolk sac, fish reach to the stage where they are capable of feeding themselves
Fish fingerling	3-5, 5-7, 7- 10	When the fry develops scale, fins and transform into juvenile fish
Brood fish	22-35	Matured fish which is used for breeding purposes.

Statement of the Problem

Little *et al*, (2002) observed that fish seed sold through Naihati Fish Seed Market is originated from approximately 1000 producers in West Bengal. The hatchery owners are progressing in such a way that they have extracted themselves out of the so called “farmer” term and can be renamed as ‘Entrepreneur’. But little (2002) indentified some needs of this sector like scarcity of relevant formal training which could assist their business with additional access to Government and institutional support. Lahiri (2006) also claimed that the Government should to provide market infrastructure facilities, sheds etc. for the functionaries. These infrastructural facilities has been absent in the markets. Modifications of existing practices, implementation of new technology and application of innovations in hatchery practice have created the need for its documentation. Besides catching attention of Government, educational and financial institution is also a prime need. So a case study has been performed to get a clear picture of fish seed production and distribution, displaying its history and forecasting its future. The plan of the study has been developed keeping in mind the following objectives:

- **To analyze the dynamics of fish seed production and market in Naihati region**
- **To assess the profile of fish seed entrepreneurs in Naihati region**

- **To document the innovations in fish seed production and marketing in Naihati region**
- **Scope of the Study**
- Updated status on fish seed production and market volume, major forces that drove changes over the years and the main actors involved in India's one of largest fish seed markets
- The entrepreneurship profile of seed producers and marketers in Naihati. This would help to recognize them as well as replicate their success in other regions
- Better understanding of innovation and the role of non-formal sector in furthering R&D in fisheries

Limitations of the Study

- Since the respondents do not keep any records of daily activities, the responses are based on their memory recall.
- The primary data is based on the expressed responses of the respondents which might not be completely free from individual's biases and prejudices.
- Since my data collection period was September-February (Lean season), peak seasonal activities could not be documented based on direct observation
- Despite of the above facts, sincere attempt and considerable thought has been exercised in making the study as deep, systematic and as objective as possible.

2. REVIEW OF LITERATURE

Thoroughly reading of the previous literature is essential to identify research problems and provide valuable suggestions in any scientific research. A further review of literature is also essential to plan the research as it helps in formulating the objective and methodology. A quick glance on the research work done on fish seed production and distribution system, entrepreneurship and innovation in this sector make it clear that much of the study I based on secondary information. The review of literature revealed that very limited research has been done on entrepreneurial behavior of fish seed producer and profile of fish seed entrepreneurs of Naihati region of West Bengal. Thus, the available relevant literature, which has a meaningful relation to the study were reviewed and presented under following sub-heads.

- Dynamics of Fish Seed Production and Market in Naihati Region
- Profile of Fish Seed Entrepreneurs in Naihati Region
- Innovations in Fish Seed Production and Marketing in Naihati Region

A case study is defined as the study of a social phenomenon, during a certain period; that aims at detailed descriptions, interpretations and explanations. In case study, the researchers start with a research question on an ongoing social process and uses available theories, but abstains from pre-fixed procedures of data collection and data analysis, and always keeps an eye open to the newly gathered data in order to smoothly adjust with subsequent research steps. The case study has its own position in the gallery of social science strategies. It is, associated with other strategies, based on a common methodological framework. (Harre, 1979)

2.1 Dynamics of fish seed production and market in Naihati region

Tikkanen *et al* (1999) studied that change is generally a non-linear dynamic process which should not be characterized simply as a reasonable series of decision-making activities and events. Due to interest and interdependence, business is continuously exposed to change and at same time it fosters change.

According to FAO, The increased demand for carp seed has created a great impact upon village level seed production activities in recent times. Farmers are now following induced breeding of carps. Transportation of seeds is mainly done by two systems. One is open system of seed transport for short distances and another one is closed system where transporting fish seed is done over long distances and from one country to another.

Lahiri (2006) stated that in West Bengal apart from growers many functionaries are directly and indirectly engaged in seed production and distribution and has earned their livelihood. According to him, classy technology is not required in transportation of seeds to the nearby states.

Islam *et al* (2005) reported that in Bangladesh, good quality fish seeds are produced in Government fish seed farm although its cost of production and sales price of fish seed both are higher compared to private fish seed farm. As a result, marketing margin and profit for market participants who purchased seeds from Government fish seed farm were relatively higher compared to those participants purchased seed from private fish seed farm. But the price of fish seeds varies according to seasonal fluctuation, changes in demand and supply of fish seed.

Little (2002) has given a statement that the fish seed marketing and distribution network within West Bengal is the classiest and developed in Asia. It is having various 'channels' and methods of supply according to the nature of the demand and transportation distances involved. Strong connection and cooperation between the 'actors' has enriched this sector. According to him, supply of adequate amount of fish seed satisfy the demand within and outside West Bengal. He studied on Naihati fish seed market and found that, it is an important trading point where based on type of fish species seasonal differences of several regions of India can be recognized. He claims that the transportation cost of fish seed should be reduced to increase imports of cultured fish towards urban areas of the State.

Hasan (2002) found that, there is a need for new carp seed markets throughout India. To reduce cost, there is a need of transformation of the earthen holding ponds into flow-through-tank systems for confinement/holding carp seed in the market before selling.

According to Basavaraja (2007) until the 1980s, the Fish Seed Syndicate in Kolkata was the only source of carp seed. Chinese type carp hatchery technology and the application of ready-to-use spawning agents increased fish seed production from the 1980s. Thereafter, several states started producing seed.

2.2 Profile of Fish Seed Entrepreneurs in Naihati Region

According to Vershney *et al* (1991) the fish seed production activity of India has emerged as a cottage industry, with the enhancement of controlled hatchery system. Economically weaker section of this country has been benefited by following this practice.

Kohli (2007) expects that, the emergence of entrepreneurship in fisheries and allied activities can boost fishers and farmers into self sustaining individuals as well as catalyzing development of rural economy. Being an entrepreneur, a person can engage himself/ herself to contribute in the creation of local wealth.

Job (1951) observed that in India Seed supplies have to be increased both in quantity and diversity mainly with reference to the autochthonous species. *Bundh* breeding is generally practiced in seed production of Indian major carps (IMC). In most of the cases artificial fertilization and Chinese hatchery is used significantly. He suggested that the fish seed trade should be controlled on an area basis to distribute the different types of fish seeds equally according to the requirements of the various regions. He identified the need of new markets and expansion of the existing ones. He recognized the role of nursery for preparing, maintaining and implementation of improved strains of fish seed.

According to Histrich *et al* (2005) entrepreneur is one who collects resources, materials, labor and other services into combinations that increase their value, and also one who creates something new in the field of his business.

Henderson (2002) suggested that rural communities must defeat the challenges of being small and isolated to encourage entrepreneurship. Besides they must support the existing entrepreneurs in their activities to facilitate growth.

Manocha (2012) observed that entrepreneurs are generally engaged in doing things that are generally not done in the ordinary course of business try to implement their findings in their field.

According to Robert *et al* (2005) entrepreneurship is the dynamic process of becoming enriched. Entrepreneurs earn money by hard work, taking risk to provide sustained value for some product or service. The product or service may or may not be new or unique, but value must somehow be enhanced by the entrepreneur by receiving and locating the necessary skills and resources.

Harper (1991) stated that financial literacy along with other business skills is necessary to run a business. Good financial planning encourages business growth.

Razea *et al* (2011) identifies that farm level entrepreneurship consists of innovativeness, risk taking, and dedication besides focusing to the future.

Nicole (1998) gave emphasis on the term “network”. According to him firms use networks for market development. Those firms are largely shaped by the interest of various network players. Influential network relationships may be both formal and informal. Networks generally share a particular portion of marketing activities.

According to Radheyshyam (2010) the availability of quality seed is must for rapid expansion and growth of aquaculture. Uncertainty in timely seed supply is one of the major constraints.

Shivakumar *et al* (2014) observed that the fish seeds rearing and farming is a Profitable business but the margins are very narrow. Since the input costs and labor costs are increasing significantly, one must know the availability of resources, capital and the projected profit before starting a new business in this sector.

Barker (1982) suggested that the operation of a successful Fish Hatchery and fry production system depend on correct initial planning for planned production. There should be proper design of the appropriate facilities to enable required production. Selection of skilled dedicated and experienced hatchery staff is essential. Hatchery owner should have a motto to produce only the highest quality seed under the best possible conditions.

Das et al (2015) reported that, it is too difficult to strictly divide rural from entrepreneurial fish seed producers. Generally, the farmers who have been involved in subsistence level carp seed production increased their production over the years, with the more inputs and better management skill, resulting in enhancing their resource base and gradually becoming entrepreneurial.

Mair (2002) stated that quality seed and fish feed are the essential components for the fish growth. Small localized hatcheries are more responsive to change trends in demand. They are more economically flexible, and have lower start up costs. They can thus play a vital role in the sustainability and equity of seed supply and, in many cases, may be more appropriate media for seed distribution than the larger, centralized seed supply systems.

George *et al* (2010)stated that the production of high quality fish seed requires improved breeding techniques and procedures, thus it is essential that fish seed hatchery operators invest in regular training and capacity building programmers that will improve their skills. He

pointed out the need for training workshops and seminars for hatchery operators by Government agencies and ministries.

Alam (2010) claimed that, due to unplanned breeding practices in hatcheries the quality of fish seeds, particularly carp seeds, falls rapidly resulting in poor performance in the culture system. Therefore, the demand of quality carp seeds is predominant. To overcome this problem, it is essential to establish quality breeding practices in new investment or existing farms.

Ingthamjitr (1997) stated that fish seed is mostly produced by private entrepreneurs who have supplanted Government fisheries stations. The size, scale and location of hatchery may affect both production and marketing of fish seed. Operators of small hatcheries in concentrated areas have significantly less experience in fish seed production than other groups.

According to Ghosh *et al* (2013) in the wetland day and fish farmers' day fish seeds of various endangered and indigenous species are distributed among fish farmers of West Bengal in the occasion of "Seed Mahotsab". Seeds of several indigenous species like *Anabas testudineus* (Koi), *Heteropneustes fossilis* (Singhi), *Notopterus notopterus* (Folui), *Puntius sarana* (Sorputi), *Mystus sp.* (Tangra) and IMC are distributed among farmers. In spite of having few constraints like lack of coordination, scarcity of water etc the scheme is looking forward to include hatchery practice of these indigenous fish species in commercial scale.

According to Nobin *et al* (2011) all type of hatchery techniques are modified by the farmers time to time according to the requirement and capability of investment.

Raina (2013) stated that entrepreneurs and future entrepreneurs could better develop effective leadership skills by becoming more aware of their strengths and weakness in the

area of emotional intelligence, along with improving their transformational leadership behaviors.

2.3 Innovations in fish seed production and marketing in Naihati region

Dalohoun *et al* (2009) stated that generally, innovations denote new goods and services that business produces and introduces into the market with the purpose of creating a new value for users as well as good financial returns. To be an innovation, new technologies or R&D results need to be profitable and society must discover through business that those are meaningful.

Andersen (1992) noticed that adoption of agricultural technologies often requires synchronized use of other inputs denoted as complementary technologies.

Goswami *et al* (2005) stated that farmers' innovation is based on their indigenous knowledge. The indigenous knowledge is the accumulated knowledge, skills and technology of the farmer. In rural areas, traditionally associated technical knowledge of fish farmers followed from generation to generation to cope up with different situational constraint. Thus, recording of indigenous innovation becomes important which would otherwise be obsolete and lost soon without recognition in future.

Nandeesh (2007) reported that farmers have been actively engaged in innovations in the field of aquaculture. In fact, farmers do not adopt any technology without innovations to best suit their farming conditions. This may be called as an adaptive research by farmers. There are also farmers who are willing to undertake risk to innovate using new ideas that have completely changed the scenario of aquaculture in many parts of the Asian region. There is need for building a database on farmer innovation. Reporting of farmer innovations may also be mandatory.

Scott *et. al*, (1994) advised that, Individuals do not need to be highly spontaneous problem solvers to be innovative, but being systematic problem solvers appears to inhibit high levels of innovative behavior.

3. Research Methodology

This chapter deals with methodology adopted in carrying out the present study. It describes the methods and procedure followed in carrying out specific objectives of present study. It includes locale of study, selection of respondents, methods and tools used for collection and analysis of data as presented under following sub headings:

3.1 Locale of Study

3.2 Procedure of data collection

3.3 Methods and tools used for data collection

3.4 Statistical tools used

3.1 Locale of Study

The study was conducted in Naihati region of West Bengal due to its preeminent role as the hub of fish seed production in India.

3.1.1 Brief description about Naihati

Naihati is a town and an important railway junction station on the Indian Railways network, in the district of North 24 Parganas, West Bengal. Naihati municipality is one of the oldest in the whole country and was established in 1869.

Table 3.1 Brief description of Naihati

Geography	Naihati is located at 22.9°N 88.42°E. It has an average elevation of 15 meters (49 feet).
Climate	Being situated in the tropics, the climate of Naihati is primarily hot and humid summers and cool and dry winters. The rain bearing clouds from the Bay of Bengal brings torrential rain in the monsoon. In the summer temperature goes as high as 40 degree Celsius and in the winter it may reach 8 degree Celsius.

Demography	As of 2011 India census, Naihati had a population of 221,762. Males constitute 50.87% of the population and females 49.13%. Naihati has an average literacy rate of 89.79%, higher than the national average of 75.06%: male literacy is 93.16%, and female literacy is 86.31%.
Aquaculture	Naihati, Battala area is notable for fish farming, rearing of sweet water fish seeds of various species like Rohu, Catla, Koi, Magur, Pabda, Silver Carp, Common Carp and many more. It was started under a training programme by Central Inland Fisheries Research Institute (CIFRI), It is an initiative of the Indian Government, handled by Indian Council of Agricultural Research (ICAR) to bring a control over the production and preservation of various breeds of sweet water fishes. In Naihati fish farming season starts from end of April, and continues till the monsoon lasts. But due to numerous political pressures, local goons, police and corruption, this industry is under serious threats.

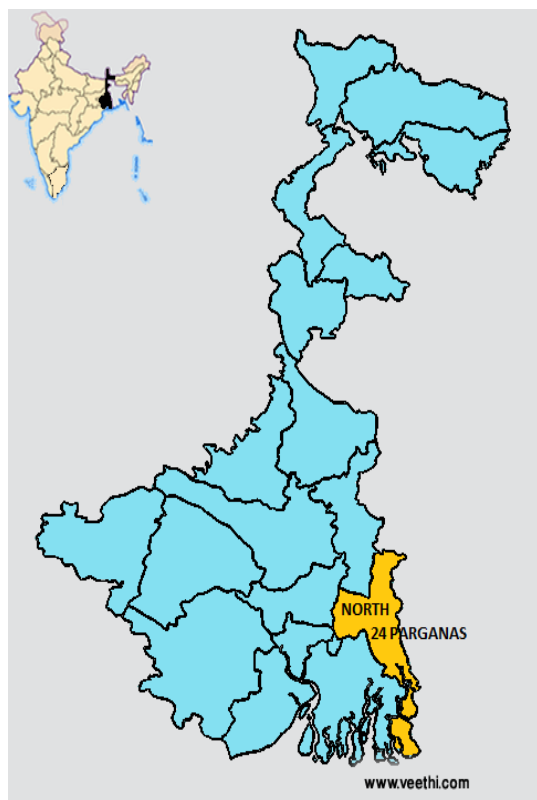


Figure: 3.1 Map of West Bengal

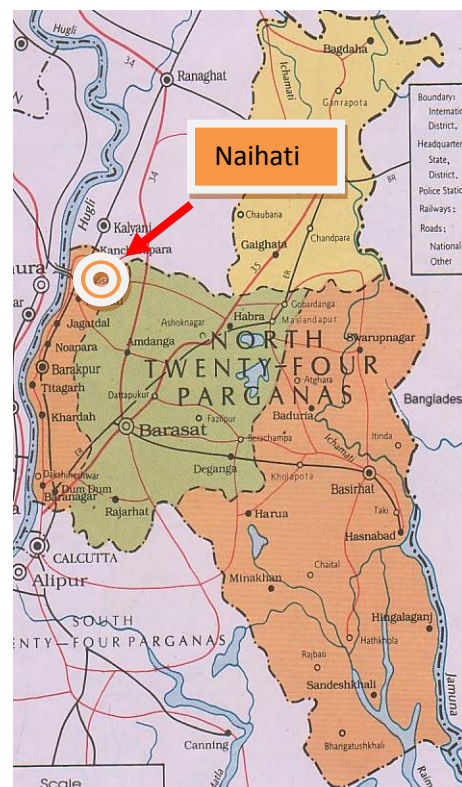


Figure: 3.2 Map of N 24 PGS District

3.1.2 Selection of study area

Naihati region was selected purposely for study due to the following reasons:

1. Rajendrapur village situated in Naihati is having the largest fish seed market in India
2. There is the presence of a bulk of hatchery owners in Naihati region who are engaged in fish seed production
3. Mr. Nilratan Ghosh who was the first private IMC hatchery owner in India is from Rajendrapur area of Naihati

The following 9 Villages of Naihati are engaged in fish seed: Rajendrapur, Salidaha, Shibdaspur, Ramchandrapur, Kuliagarh, Bora, Mitrabagan, Devok and Palashi

3.2 Method of data collection

Since the study is aimed at studying dynamics of fish seed production and distribution, profile of fish seed entrepreneurs and documentation of innovation of Naihati region, respondents were collected based on their participation in fish seed production and distribution. All the seed production units and the various actors involved in both production and marketing constituted the population for the study. Based on given information case study was prepared on fish seed entrepreneurs of Naihati region.

Case study method has been defined by different researchers in different ways. Stake(1995) defines case study as an enquiry and analysis of qualitative research which intend to capture the character of study. Meyer (2001) advised that case study can be studied in multiple method to provide freedom of creativity.

In this case study, data was collected from multiple source of information including observation, interview, and published documents and newspaper reports in order to understand the case in depth.

3.3 Methods and tools used for data collection

An unstructured interview schedule was developed to collect data from the respondents. An attempt was made to prepare an unbiased, clear, concise, complete and comprehensive interview schedule.

The interview schedule was pretested through pilot survey/ check list study and suitable modifications were carried out before it was finalized. The data were collected from September, 2015 to February, 2016. The selected hatchery owners were interviewed personally at their farms during the leisure time. Meanwhile all the laborers were also interviewed. Besides from the seed market sellers and buyers were also interviewed. Most of the information was also received from the president of the market through interview and information has also been collected from the available literatures. Sincere efforts were made to clarify the questions by repetition to ensure reliable data from the respondents. Few data which are obviously erroneous were deleted. Secondary data were collected from the published literature of the DoF and also from the personal discussion with the available DoF staffs.

Using snowball technique, the innovations were identified and documented. Key informant interviews and focus group discussion with the help of semi-structured interview schedules was used for the purpose of primary data collection. The secondary data was collected from published and grey literature.

Interview: The purpose of conducting of interview was to explore response of people and to gather detailed information.

Snowball technique: It is a non-probability sampling technique where existing study subjects recruit future subjects from among their acquaintances. Thus the sample group is said to grow like a rolling snowball.

3.3.1 Selection, Operationalisation and measurement of the variables

A list of independent variables was prepared. From the responses received during pilot study/ Check list, the following variables were selected for the study. Then those variables were coded according to response received.

Coding: Coding is an analytical process in which data is categorized to facilitate analysis.

Table 3.3 Operationalisation and measurement of the variables are outlined below

Variables	Operational definition	Categories	Code
Age	Age was operationalised as the number of completed years at time of inquiry and the chronological age was taken as measure. It was categorized in to five groups.	20- 30	1
		30-40	2
		40-50	3
		50-60	4
		60-70	5
Gender	Gender was operationalised as the number of men/ women involved	Male	1
		Female	2
Education	Educational qualification was operationalised as the extent of formal education (Class 8 th , Class 10 th , and Class12 th) attained by the respondent.	Upto class 8	1
		Upto class 10	2
		Upto class 12	3
Religion	It refers to the composition of respondents belonging to different religion such as Hindu, Muslim, Christian	Hindu	1
		Muslim	2
		Christian	3
Caste composition	It refers to the composition of respondents belonging to different caste categories such as Scheduled Caste, Scheduled Tribes, Other Backward Class.	ST	1
		SC	2
		OBC	3
		General	4
Family size	This refers to the number of family members in a family.	less than 5	1
		5	2
		more than 5	3
House type	It refers to the type of hatchery owner's house	1 Storied	1
		2 Storied	2
		3 Storied	3
Occupation	Occupation refers to any activity in which a person is engaged for earning his/her livelihood. Here we have to check whether he is only owning hatchery or involved in any allied activity	Hatchery owning only Hatchery owning and allied activities	1 2
Income	This refers to the total annual income of the hatchery owners	10,0000-50, 0000	1
		50, 0001-100, 000	2
		1000001-2000000	3

		2000001-3000000	4
Total land area	It refers to the total composition of land area of each hatchery owner	1ha-10 ha 11 ha- 20 ha 21 ha- 30 ha	1 2 3
Total No. of Chinese Hatchery	It refers to the total no. of Chinese hatchery owned by the hatchery owners	5-10 11-15 16-20	1 2 3
No. of staffs	Total no. of staffs attached in each hatchery	5-10 11-15 16-20	1 2 3
Attachment with ICAR institute	Whether the hatchery owners are attached with any ICAR institutes or not	Yes No	1 2
Partnership	Whether the hatchery owners are owning hatchery keeping partnership with others	Yes No	1 2
Species combination	Combination of different types of species are used for seed production in a particular hatchery	IMC IMC, Pangash, Paku Pangash, Paku Magur, Pangash, Paku, Monosex tilapia IMC, Pangash Magur, Pangash Pangash, Paku, Monosex tilapia, Gulsha tangra	1 2 3 4 5 6 7 8 9

3.3.2 Representation of Market Dynamics

Narration method:

Sarbin (1986) define narrative method as a way of organizing actions which brings together routine facts. The narrative method examines the actor's reasons for their acts, as well as the causes of happening. Lieblich (1998) reported that this method has been used in published studies in social science. Polkinghorne (1988) divides narrative investigations into two categories according to their purpose; first being descriptive research which describe narrative already held by individuals and groups. Second being explanatory research that explains the reason.

SWOT analysis: It is an acronym for strength, weakness, opportunity and threats. This structured planning method was performed to evaluate these four elements to understand existing condition of the market

3.3.3 Measurement of Entrepreneurship profile of hatchery owners

3.3.3.1 Social profile of hatchery owners

Social profile of the entrepreneurs were measured by calculating mean, maximum, minimum, Range, standard deviation of social variables (age, gender, house type etc) of hatchery owners. Percentage analysis was also performed to get a clear picture of social profile of hatchery owners.

3.3.3.2 Business profile of hatchery owners

- Business profile of hatchery owners were measured by calculating mean, maximum, minimum of farm variables (Land, No of Chinese cistern etc).
- Benefit cost ratio was analyzed to check the reason of shifting from seed production of IMC to Pangash.

Benefit cost ratio: A BCR is the ratio of the benefits of a business relative to its costs. Benefit cost ratio (BCR) was calculated to understand the gain realized by producing seeds of IMC and catfish (Pangash) versus the amount it costs to execute the business. If the value of BCR is high, the investment is better.

$$\text{Benefit cost ratio} = \frac{\text{Gross return}}{\text{Net fixed cost}}$$

Total Fixed Investment = Fixed Investment + Pond Construction + Electricity connection and motor+ Generator+ Aerator+ Pipes and accessories+ Other Expenses.

Total Variable Cost == Land leasing cost+ Cost of brooder+ Feed cost+ Fertilizer and medicine+ Labor including harvesting charges+ Diesel and electricity expenses

Net Fixed Cost= Depreciation on fixed investment

Total Cost= Total Fixed Cost+ Total Variable Cost.

Gross return=Unit × Value per unit

Net return over variable cost= Gross return- Total Variable Cost.

Net return over total cost=Gross return- Total Cost

3.3.3.3 Entrepreneurial behavior

Entrepreneurial behavior can be determined with regards to eight factors (Cavettoet al, 2003)

- *Goal orientation*– tendencies toward creativity and innovation, degree of determination in reaching goals, and personal perception as to overall handling of work situations.
- *Leadership*– aptitudes toward management and leadership.
- *Adaptability*– ability to perceive environmental change and adaptability.
- *Need for achievement*– the desire for fame, success and social affirmation and respect from others.
- *Need for self-empowerment*– the desire to realise oneself through one's job which, apart from any economic goals, must be enjoyable, satisfying and interesting.
- *Innovation*– curiosity for what is new.
- *Flexibility*– tendency to reorient one's goals according to external situation.
- *Autonomy* – necessity of having one's own independent space to make decisions and choices.

All these factors were measured on a 3 point scale and then score was given for each of them as detailed below:

Table 3.4 Entrepreneurial behavioral factors

Factors	Categories	Scores	Min. Score	Max. Score
Goal Orientation	High	3	1	3
	Medium	2		
	Low	1		
Autonomy	High	3	1	3
	Medium	2		
	Low	1		
Leadership	High	3	1	3
	Medium	2		
	Low	1		
Need for self empowerment	High	3	1	3
	Medium	2		
	Low	1		
Adaptability	High	3	1	3
	Medium	2		
	Low	1		
Need for achievement	High	3	1	3
	Medium	2		
	Low	1		
Innovation	High	3	1	3
	Medium	2		
	Low	1		
Flexibility	High	3	1	3
	Medium	2		
	Low	1		
			Total- 8	Total- 24

Standardization/ Normalization: It is the process of establishing standards of various kinds and improving efficiency. Here entrepreneurial behavior of hatchery owners is standardized

to check the number of hatchery owners who come under high entrepreneurial, medium entrepreneurial, less entrepreneurial behavior.

	Total score – Total Minimum score
Entrepreneurial Behavior =	$\frac{\text{Total Maximum Score} - \text{Total Minimum Score}}{\text{Total Maximum Score} - \text{Total Minimum Score}}$

>0.66= High entrepreneurial; 0.34-0.66= Medium Entrepreneurial; <0.33= Less Entrepreneurial

3.3.4. Documentation of innovation

Narration: This has been discussed in section 3.3.4

Radar Chart: A radar chart is a graphical method of displaying multivariate data in the form of a chart. It represents three or more quantitative variables represented on axes starting from same point. It consists of sequence of equi-angular spokes, called radii, with each spoke representing one of the variables. A line is drawn connecting the data values for each spoke. Radar diagram available in Microsoft excel were used to represent useful characteristics of innovations in a graphical format as ranked by hatchery owners.

3.4 Statistical tools used

To draw meaningful conclusion relevant statistical tools were used and the methods have been detailed below:

3.4.1 Percentage analysis: This helps in converting the gathered data into a tabulated grouped data. Here Percentage Analysis is applied to diagrammatically represent the social variable (age, religion, caste etc) for better understanding.

3.4.2 Descriptive statistical analysis: It quantitatively describes the main features of a collection of information. Here social and farm profile of hatchery owners were measured based on this method

3.4.3 Cronbach's alpha test: The test Cronbach's alpha was done to confirm reliability of the 3 point scale. It is the most common measure of internal consistency or reliability. It is a test reliability technique that requires only a single test administration to provide a unique estimate of the reliability for a given test (Gliem and Gliem, 2003). Its coefficient ranges from 0 to 1. Closer the value of Cronbach alpha coefficient is to 1 the greater the internal consistency of the item in scale. Formula of Cronbach 's alpha is

$$\alpha = r \times k \div [1 + (k-1) \times r]$$

Where,

r= mean of inter item correlation i.e. the correlation of each item with the sum of all remaining items

k= number of item considered

Here, Cronbach alpha was calculated using SPSS version 20 to test the reliability of scale of entrepreneurial behavior.

3.4.4 Pearson's Correlation Coefficient test: Pearson's correlation reflects the degree of linear relationship between two variables. It measures the strength and the direction of a linear relationship between two variables. Here the test was done see the correlation between entrepreneurial behavior and income of hatchery owners.

3.4.5 Rank based quotient test: Rank Based Quotient (RBQ) was used for analyzing factors that motivate the hatchery owners to get attracted towards the innovation. The hatchery owners were asked to rank the characteristics listed in the interview schedule and RBQ value was calculated

$$RBQ = \sum [F_i (n+1) - 1] \div (N \times n) \times 100$$

Where,

F_i = Number of hatchery owners giving the particular point at i^{th} rank

i = i^{th} rank; N = Total number of Hatchery owners; n = Number of factors

4. RESULT AND DISCUSSION

This chapter deals with the results of the analysis relating to the objectives of the study. The results and discussion is presented under the following headings:

4.1 Dynamics of Fish Seed Production and Market

4.2 Profile of Fish Seed Entrepreneurs

4.3 Documentation of Innovations in Fish Seed Production and Marketing

4.1 Dynamics of fish seed production and market

Naihati fish seed market is situated in Rajendrapur village of Naihati beside Barrackpore-Kalyani Expressway. This fish seed market is one of Asia's largest and important fish seed markets. The duration of the market is night 12 a.m. to morning 5 a.m. During peak season around 10,000 sellers and buyers transact in this market every day.

4.1.1 History of Naihati fish seed market

Mr. Nilratan Ghosh is the first Indian Major Carp (IMC) hatchery owner of India. He started this practice with seed production of IMC species. He contributed significantly in the formation and development of Naihati fish seed market

During division of Bengal Nilratan Ghosh reached from East Bengal (Bangladesh) to West Bengal (India) in the year 1950. Having little amount of money in hand he was able to buy only 3 *Bigha* land. While residing in East Bengal he used to capture wild seed with *gamcha* (cotton cloth) and used to grow those up to fingerling size and used to sell those in a profitable price. He tried to continue the same practice while staying in West Bengal. But the problem with wild seeds was mixing of unwanted varieties of seeds.

Meanwhile it was a period of inclusion of several scientific method of aquaculture. In the year 1957, Hiralal Chowdhury formulated the process of artificial fertilization. Scientists of

Central Inland Fisheries Research Institute (CIFRI) were trying to incorporate this practice in their research. Hearing Mr. Ghosh's skill and conception about fish seed production; they invited him for helping them to execute this new practice. Having collaboration with CIFRI, Mr. Ghosh ventured into new session of his work i.e. artificial fertilization. Gradually he tried and slightly modified different types of breeding methods, like breeding *hapa*, glass jar hatchery for ease of use. In the year 1960 Chinese hatchery was introduced in India by Central Inland Fisheries Research Institute (CIFRI). The modification of Chinese hatchery from oval to round was also corrected by Mr. Ghosh. Gradually he became so renowned that scientists, staffs of state department of fisheries, students used to come to him to get hands on training and clarifying their doubts.

From 1963 Mr. Ghosh's seed production started in a rapid rate. During 1964-65 Kalyani fish farm, West Bengal introduced seed production of *Cyprinus Carpio*. Nilu Ghosh learned that technique and implemented in his farm successfully.



Fig: 4.1 Nilratan Ghosh (Source: Miwain et al, 2002)

Naihati was not stable due to anti-social activities of Railway Wagon Breaker in the year 1976. Mr. Ghosh tried to improve the socioeconomic condition of youth in Naihati. He

arranged few young boys of village and told that he would sell fish seed to them in minimum price instead of selling directly to the growers and they can sell it to growers for a profit. This brilliant idea of Mr. Ghosh changed the socio-economic fabric of Naihati forever. Thus, he showed a dignified way of earning a livelihood to the people of Rajendrapur and nearby few villages.

Seeing the progress of Nilu Ghosh, others became interested to invest in this sector. Gradually Rajendrapur and nearby villages of Naihati started seed production in a rapid rate. During that time a group of people became exclusively engaged in buying seeds from primary seed producers and selling them in the market to retail seed vendors. In the year 1980 they decided to have a structured market and formed a committee. They decided Rajendrapur *battala* area as the permanent venue of the market and started their activities.

4.1.2 Brief description of Naihati fish seed market

Table 4.1 Brief overview of the market

Season	Sellers		Buyers	Operational time
Peak (April-October)	Permanent	670	10000-20000	12 a.m.- 6 a.m.
	Temporary	300		
Lean (November- March)	Permanent	670	4000- 5000	2 a.m.- 6 a.m.
	Temporary	0		

Sellers

Main actors of the market are not seed producers or seed growers. Middlemen/ Agent play the major role in distribution of seeds. There are 2 types of middlemen.

- **Permanent Agents:** A person, who is permanent member of the market and has the membership card after paying one-time membership fee of Rs.75, 000. He gets a space to sit and sell fish seed in the market. Every year he/she has to renew the membership card by paying Rs.650 as annual fee.

- **Temporary/Seasonal Agents:** They are relatively small scale sellers who have no life membership but pay only an annual / seasonal fee of Rs. 500 and given space to sell only during that specific peak season.
- **Partnership:** In partnership mode, either two or more people jointly take the membership and share the space alternately or the permanent member may sub-let or has an informal arrangement with another seller on payment of certain fee.

Operational time

Fish seeds are very delicate. It dies very quickly as it is exposed to sun, so it is preferred to sell those seeds as early as possible. This early operational time also helps to transfer the seeds to its destination in time.

4.1.2.1 Operation of the market

Table 4.2 Source of seeds

Districts	Species
North 24 Parganas	Pangash (<i>Pangasius sp.</i>), Paku(<i>Piractus brachypomus</i>), Desi Magur (<i>Clarius batracus</i>), Hybrid magur (<i>Clariu sgariepinus</i>), Monosex Tilapia (<i>Oreochromis sp.</i>), Tangra (<i>Mystus sp.</i>)
Bankura	IMC, Pabda (<i>Ompok sp.</i>)
Maldah	IMC, Grass Carp, Silver Carp, Common Carp
Midnapur	Vetki (<i>Lates calcarifer</i>), Mulletts (<i>Mugil sp.</i>)
South 24 Parganas	Chital (<i>Notopterus chitala</i>)
Nadia	IMC, Pangash, Paku

Fish seeds are brought to market from hatchery owners of Naihati as well as from several districts of nearby regions namely Chakdaha (Nadia), Pandua, Balagarh, Simlipal, Ramsagar (Bankura), Mogra(N 24 PGS), Kalna (Burdwan).Most of the freshwater fish seeds are

produced in North 24 PGS, Bankura, Maldah and Nadia and brackishwater fishes like *Lates calcarifer*, Mulletts, etc. are produced in South 24 PGS, and Midnapur districts.

Local distribution

From Naihati fish seed market Grass carp, common carp, *Clarius sp.*, *Pangash*, *Paku* are sent to Maldah, Bardwan and North-24-Parganas. Japanese Punti (*Puntius japonicus*), *Labeobata* are distributed in Midnapur, North 24 Parganas, Murshidabad, Howrah and North Bengal.

Distant distribution

Table 4.3 Destination of the seeds

State	Months in the year
Andhra Pradesh	All over the year
Assam, Jharkhand, Bihar, Orissa	April, May
Uttar Pradesh	June-July
Rajasthan, Haryana	July-August
Madhya Pradesh, Chhattisgarh, Karnataka, Kerala, Maharashtra	August-September
Nigeria	In the year 2013 a group of trainees came from Nigeria, with the initiation of them, seeds of Pangash and Paku was exported to their place.
Vietnam	In the year 2012

Table 4.4 Seed Preference of different States

Sl. No.	State	Species
1.	Andhra Pradesh	Pangash, Paku
2.	Bihar	Common Carp, Bighead carp
3.	Uttar Pradesh	Silver Carp, Grass Carp
4.	Orissa	Paku
5.	Delhi	Pangash

Preference of seeds:

Arrival of monsoon varies state to state. Based on monsoon, the states receive fish seeds for nursing and rearing. Besides, consumer preference also plays a vital role which includes taste, price, texture and ease of consumption of the fish. Here only few states have been mentioned because they show consistent preference towards any particular species.

Table 4.5 Species Composition of the market: In Peak season (May- September)

Species	Rate: Rs/ Thousand (Peak)								
Seed Stage& Size (cm.)	IMC (Mixed)	Catla	Rohu	Mrigal	Silver carp	Grass carp	Common carp	Bata	<i>Japani Punti</i>
Spawn (1 cm)	375	500	275	275	375	650	450	450	450
Fry (2 cm)	80	120	100	150	150	150	100	180	180

Table 4.6 Species Composition of the market: Lean Season (November- April)

Species	Rate: Rs/ Thousand (Lean)								
Stage& Size(cm)	IMC (Mixed)	Catla	Rohu	Mrigal	Silver carp	Grass carp	Common carp	Bata	<i>Japani Punti</i>
Spawn (1 cm)	450	600	375	375	600	850	450	450	450
Fry (2 cm)	120	200	120	120	200	250	100	250	200

Table 4.7 Species Composition of Carps (Fingerlings)

Species		Rate: Rs/ Thousand							
Stage	Size (cm.)	IMC (Mixed)	Catla	Rohu	Mrigal	Silver carp	Grass carp	Common carp	Bata
Fingerling	3-5	130	280	150	150	220	280	150	200
	5- 7	180	340	200	200	280	380	250	350
	7- 10	320	450	350	350	320	480	400	450
Advanced fingerling	10- 12	420	600	450	450	380	600	500	600
	13-15	430	-	-	-	-	-	-	-
	16-17	450	-	-	-	-	-	-	-

Table 4.8 Species composition (Fingerling) other than IMC

Seed Stage & Size (cm.)	Rate: Rs. / Thousand										
	<i>Pangash</i>	<i>Paku</i>	<i>Chital</i>	<i>Monosex tilapia</i>	<i>Ornamental fishes</i>	<i>Pabda</i>	<i>Koi</i>	<i>Black Carp</i>	<i>Mystus sp.</i>	<i>Clarius gariepinus</i>	<i>Clarias batrachus</i>
Fry (2-3)	300	300	-	-	-	-	300	-	-	-	-
Fingerling (3-5)	1500	1200	800	-	-	-	1500	-	1000	1000	5000
Advanced Fingerling (7- 10)	2000	1800	-	550	12000	3000	-	5000	5000	-	-

Price of fish seeds are based on the demand of particular species of fish. Price of IMC and other exotic carps are determined by West Bengal State department of fisheries. Price of other than these fishes is sometimes determined by market management committee, sometimes mutual discussion between seed growers and agents. Generally, fry and fingerlings are only sold through Naihati fish seed market. Spawn is packed and transported directly from hatchery. Seasonal price fluctuation is observed only in case of spawn and fry. Price of fingerlings remains almost same throughout the year.

4.1.2.2 Function of Market

Table 4.9 Market Transactions (Quantity & Value / Day)

SpeciesType& Seed Size (in cm)	Peak Season		Lean Season	
	Volume (Lakh Nos.)	Value (Lakh rs.)	Volume (Lakh Nos.)	Value (Lakh rs.)
IMC-Mixed (3-5)	27.5	3.6	7.5	1.0
IMC- Mixed (5- 7)	13.5	2.4	3.5	0.6
IMC – Mixed (7- 10)	27.25	8.7	0.75	0.2
IMC- Mixed (10- 12)	17	7.1	0	0.0
IMC – Mixed (13-15)	9.75	4.2	0	0.0
IMC- Mixed (16-17)	2.5	1.1	0	0.0
Catla (3-5)	12.25	3.4	7.5	2.1
Catla (5- 7)	11	3.7	0	0.0
Catla (7- 10)	15.75	7.1	4.25	1.9
Catla (10- 12)	5.24	3.1	1.35	0.8
Rohu(3-5)	14.2	2.1	0	0.0
Rohu (5- 7)	2.46	0.5	1.5	0.3
Rohu (7- 10)	11.25	3.9	0.25	0.1
Rohu (10- 12)	14.2	6.4	0	0.0
Silver carp (3- 5)	37.2	8.2	0	0.0
Silver carp (5- 7)	4.75	1.3	0	0.0
Silver carp (7- 10)	5.25	1.7	0	0.0
Silver carp (10- 12)	7.24	2.8	0	0.0
Grass carp (3-5)	11.57	3.2	0	0.0
Grass carp (5- 7)	5.25	2.0	3.25	1.2
Grass carp (7- 10)	26.5	12.7	0.34	0.2
Grass carp (10- 12)	8.45	5.1	0.20	0.1

Common carp (3- 5)	14.25	2.1	4.25	0.6
Common carp (5- 7)	2.25	0.6	0.75	0.2
Common carp (8- 10)	11.25	4.5	2.45	1.0
Common carp (11- 12)	15	7.5	7.2	3.6
Bata (3-5)	37.25	7.5	2.5	0.5
Bata (5- 7)	14.70	5.1	0	0.0
Bata (8- 10)	2.5	1.1	0	0.0
Bata (11- 12)	1.5	0.9	0.75	0.5
Pangash (3-5)	21.25	31.9	7.5	11.3
Pangash (7- 10)	11.23	22.5	0	0.0
Paku (3-5)	14.36	17.2	0.78	0.9
Paku (7-10)	11.2	20.2	2.5	4.5
Monosex tilapia (7- 10)	6.31	3.5	0.93	0.5
Aquarium fishes(7-10)	9.93	119.2	0	0.0
Pabda(7-10)	14	42.0	0.96	2.9
Koi(2-3)	31.47	9.4	0	0.0
Koi (3-5)	7	10.5	0	0.0
Black Carp (7-10)	17.38	86.9	0.35	1.8
<i>Mystus</i> sp.(3-5)	11.21	11.2	0.45	0.5
<i>Mystus</i> sp.(7-10)	11.45	57.3	4.1	20.5
<i>C.gariepinus</i> (3-5)	11.21	11.2	0	0.0
<i>C. batrachus</i> (3-5)	17.3	86.5	0	0.0
Chital(3-5)	21.5	17.2	2.52	2.0
Total	596.6	542.1	76.5	62.3

Table 4.9 depicts the volume sold and value earned in a day. The data has been collected for both lean season and peak season. And it is found that in peak season fish species of around 596 lakh no. is sold in a day with a value of 542 lakh rupees. Whereas in lean season around 76 lakh no. fish seeds are sold through this market with a value of 62 lakh rupees.

Figure:4.2 and Figure 4.3 depict, in peak season although volume wise Bata, Silver Carp are contributing more but a huge amount of value is earned by selling comparatively less amount (in no.) of ornamental fish seed.

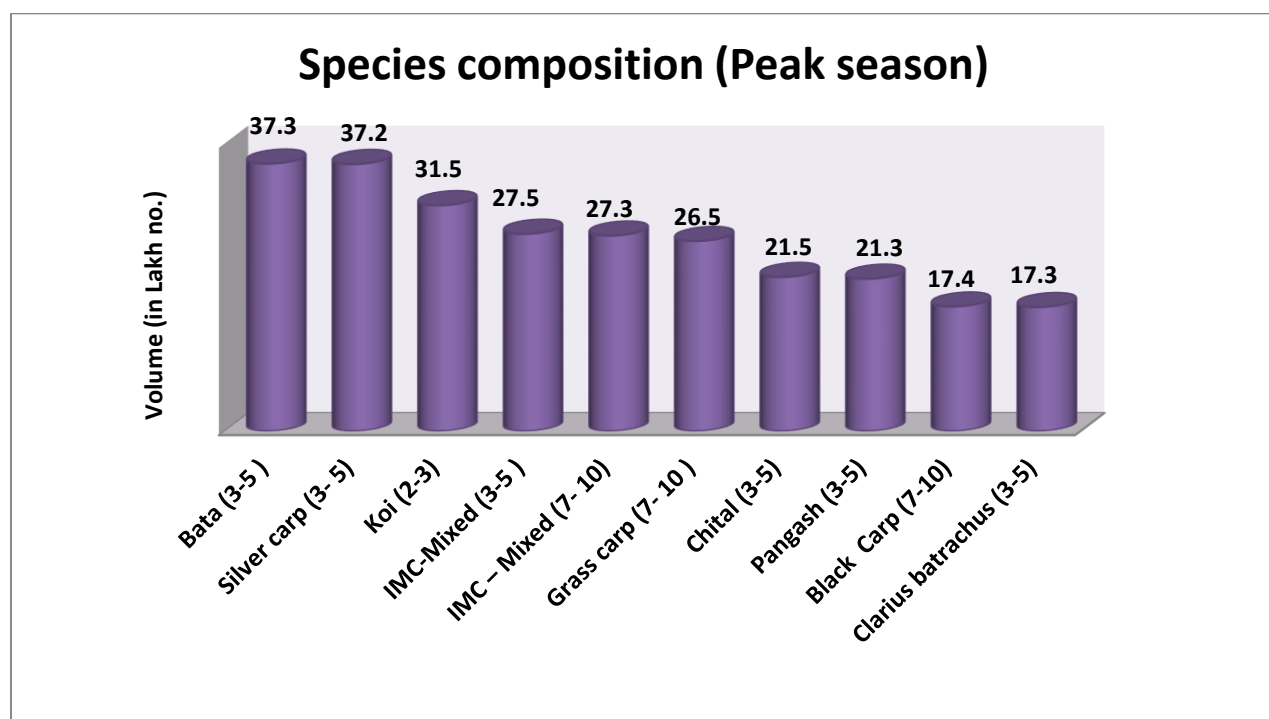


Figure: 4.2 Species composition (Volume wise)/ Day

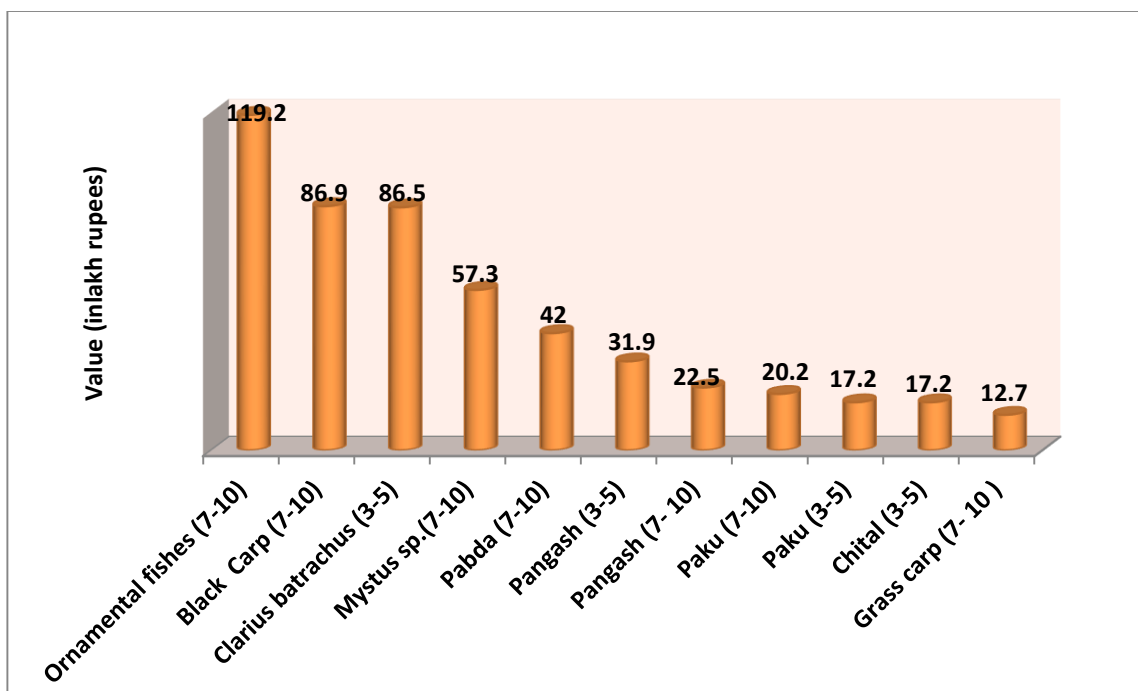


Figure: 4.3 Species composition (Value wise)/ Day

Figure 4.4 and Figure 4.5 depict that in lean season IMC-Mixed, Catla contribute more in volume wise but value wise *Mystus* sp., Pangash, Paku contribute the more in this sector

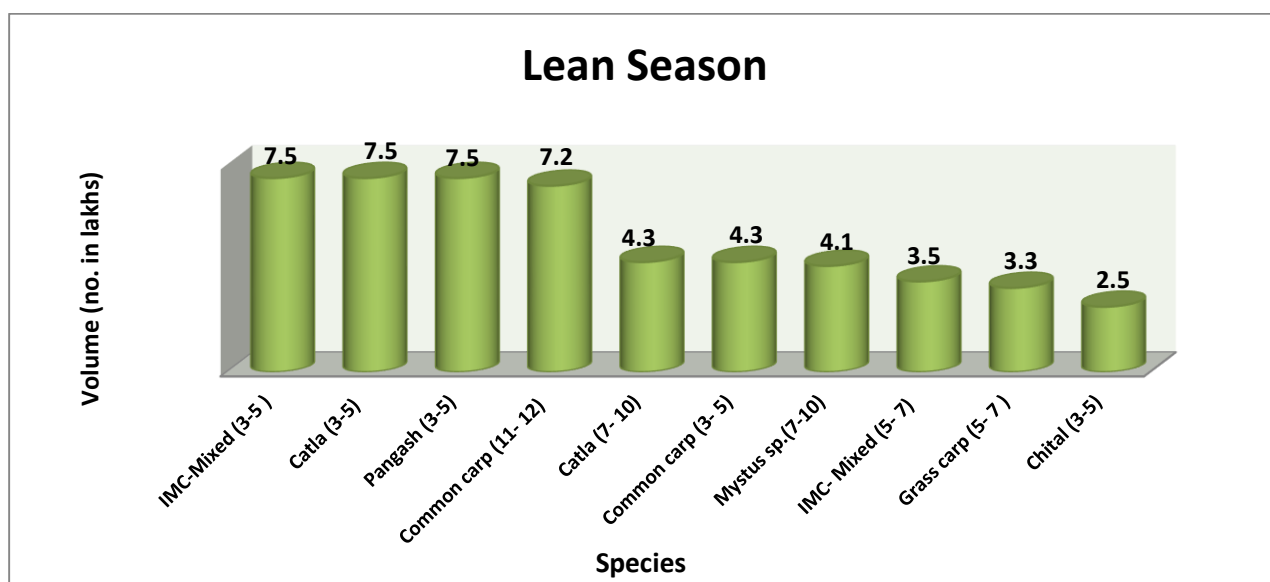


Figure: 4.4 Species composition (Volume wise)/ Day

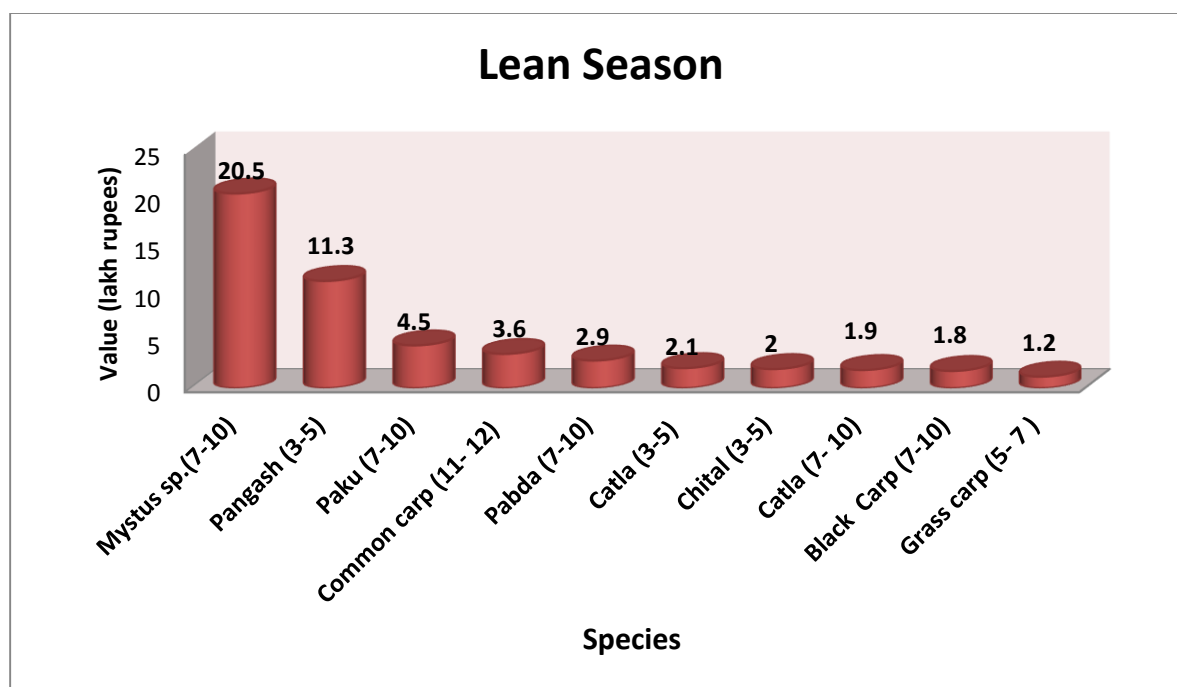


Figure:4.5 Species composition (Value wise/ Day)

Although volume wise ornamental fish seeds do not contribute much, but as their unit price is high, in peak season maximum amount of money is earned through selling of ornamental fish seeds

Table 4.10 Annual transactions

	Peak season	Lean season	Annual
Duration (Months)	6	6	12
Volume (in lakh no.)	3579. 6	459	4038. 6
Value (in lakh rupees)	3252. 6	373. 8	3626.4

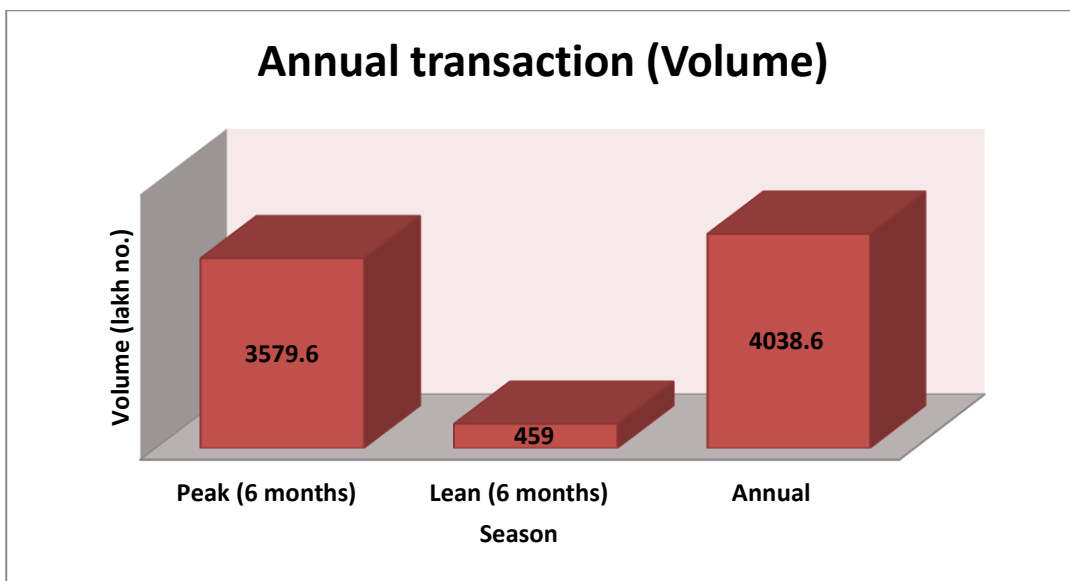


Figure: 4.6 Annual transaction of the market-Volume (lakh no.)

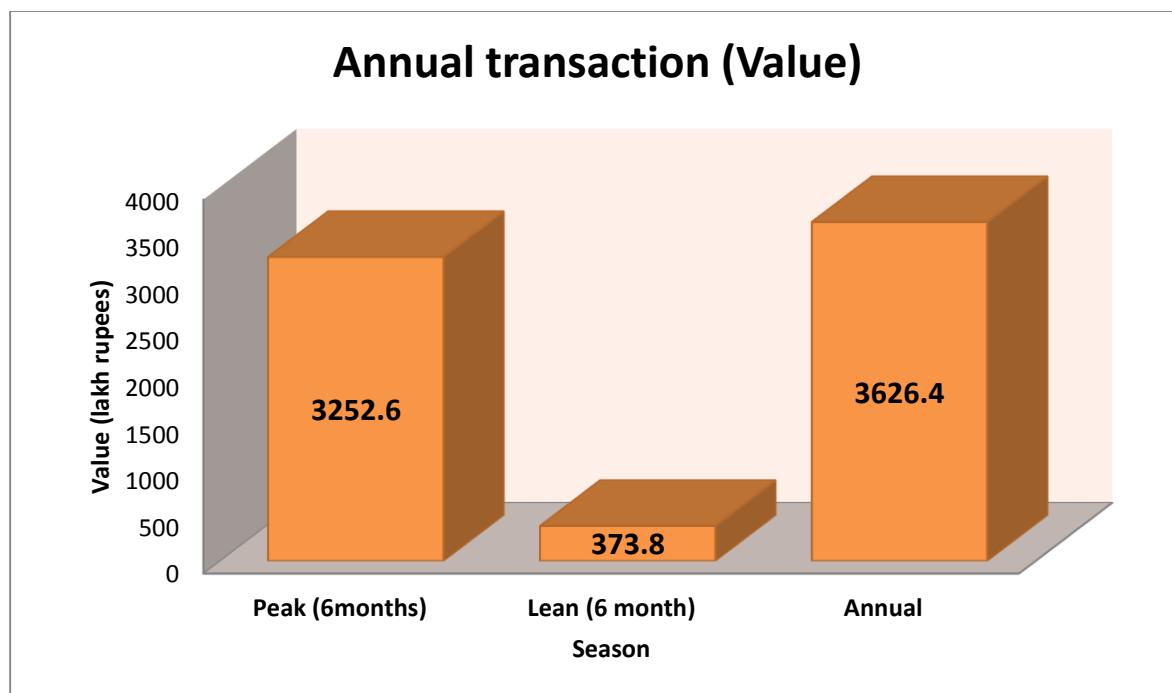


Figure: 4.7 Annual transaction of the market-Value (lakh rupees)

4.1.2.3 Market management

Naihati fish seed market is well managed by the agents as well as hatchery owners of Naihati region. They strictly follow the rules and regulation of market.

Rajendrapur Matsya Bazar Unnoyan Committee

This committee is mostly engaged in collecting and distributing the profits among the marketers. Membership in the market committee depends on directly or indirectly association with the market. The committee has to pay tax to government which is collected from the income of the committee members. The remaining money is utilized for maintenance, electricity, celebration etc.

Auditing: The auditing of the market is done by market management committee of the market. After auditing the market management committee displays a chart in front of the market. Thus the members find clear picture of the whole year's activity of the market.

Market Rules / Regulations:

- Farmers/ Hatchery owners can't sit in the market for selling fish seed
- To enter into the market sellers have to seek permission from market committee
- Every year the permanent sellers have to renew their cards.

Nilratan Ghosh fish farmers club: Nilratan Ghosh Fish Farmers club acts as a bridge between hatchery owners of Naihati and Central Institute of Freshwater Aquaculture (CIFA). They are involved in several developmental works among fish seed producers and distributors. They suggest hatchery owners and breeders on several matters like;

- To reduce inbreeding depression
- To prevent cross breeding
- To produce absolute seeds of IMC
- To enhance the quality of seeds
- To influence the hatchery owners to follow the rule and regulation of ICAR

Recent Activities:

- Hands on training on breeding practice of *Jayanti Rohu*. Monosex tilapia
- Providing knowledge about the process of cryopreservation to the hatchery owners

4.1.2.4. Function of actors of the market

Figure 4.6 depicts the process of distant and local fish seed distribution. Both of these distribution methods are prevalent in Naihati where middleman/ agents play the major role

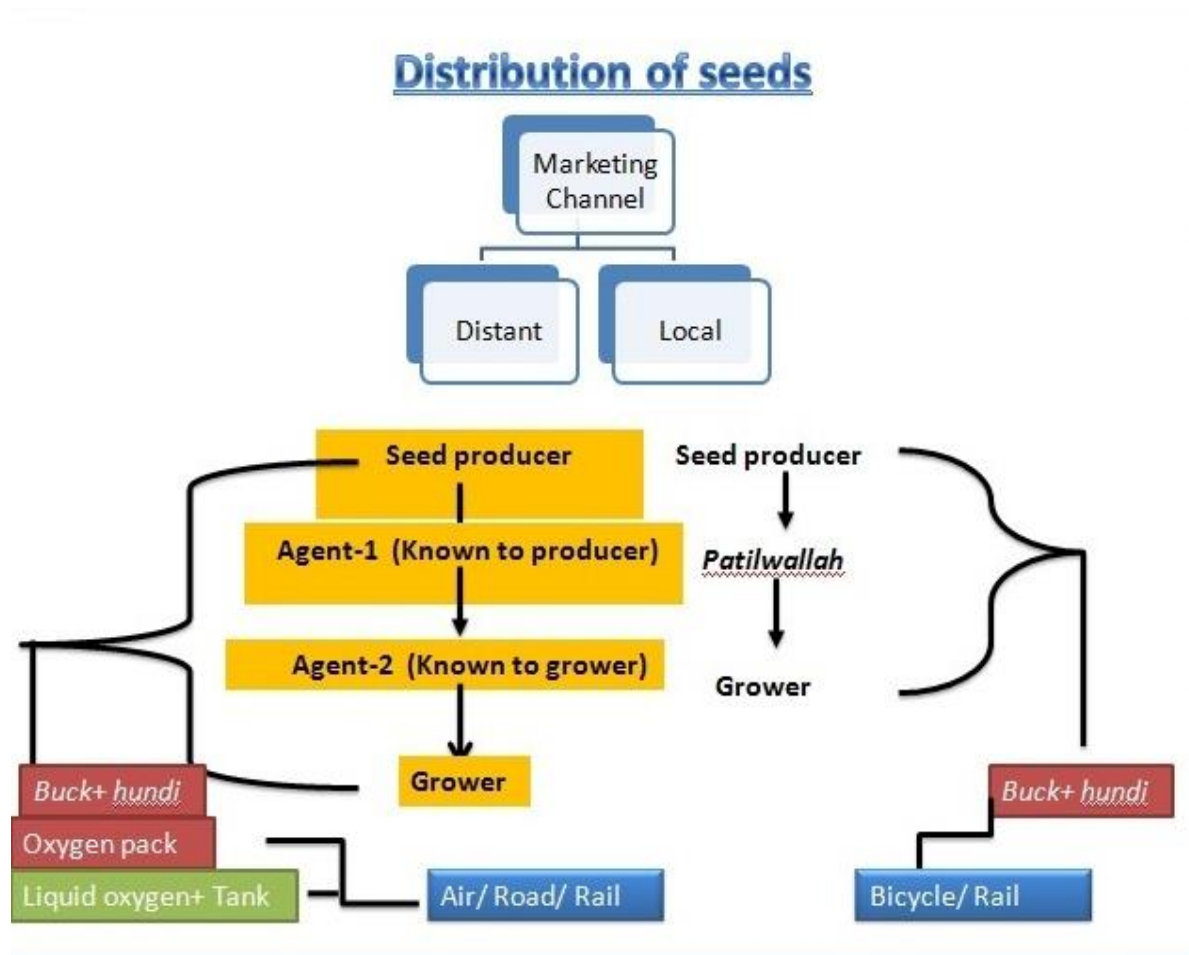


Figure: 4.8 Distant and local distribution of fish seed

Distant Distribution

Here main actors are Agent-1 and Agent-2, who are involved fish seed distribution in distant place.

Activities of Agent-1

They buy fish from breeders and keep for 24 hours in small *hapa*. At midnight they go for buying seeds from breeders (around at 10 p.m.). Then they keep those in holding *hapa* at around in 12 a.m. In next day morning between 5a.m. to 7 a.m. they apply medicine (CuSO₄

solution) and do netting. Then they feed those seeds. Then from morning 7 a.m. to 12p.m. they keep themselves busy in other household works. At 3p.m. in the afternoon they again feed those seeds and. evening 7 p.m. they set for selling those by *hundi* slinging from shoulder. Within 12a.m. to 1a.m. they reach Naihati fish seed market and starts selling. Generally, they are allowed to have land of 3ft × 3ft (minimum) inside the market to perform their business.

Activities of Agent- 2

They arrive from distant places (from other states, districts) to Naihati fish seed market to buy fish. They are also not grower of fish. They buy seeds and sell those to seed growers. These agent-1 and agent -2 are the main market operators.

Means of transportation:

As it is distant distribution of seeds, proper packaging and transportation method is adopted to increase the survivality of fish seeds. Generally spawn and fry are packed using these procedures

Table 17 Fish Seed Transportation Methods

Tank+ Cylinder: Here inside the tank adequate amount of fish seeds are stored and through cylinder O₂ is pumped into the tank. In this tank oxygen is generated with air stone. And the particle size of the air stone should be fine as such that it become capable to capture oxygen.

Oxygen Pack: Oxygen pack includes 30*44 cm polyethylene packet. Then 7 liter water is added to it. Then 300 gm seeds are added in each packet. Here survivality of seed is almost 32 hours. Oxygen cylinder is kept to pump oxygen. These packets are kept in corrugated board. Inside one packet around 20000 seeds can be kept. Standard oxygen pack can keep fish seed properly alive in 30 hours travelling. Standard amount of fish seed inside oxygen package is 300 gm. Capacity of small Oxygen Pack: 3 Kg Fish seed (Spawn) Capacity of big oxygen pack: 6 Kg Fish seed (Spawn)

Liquid oxygen pack: At first 2 tanks are taken and each tank is loaded with 25 liters of liquid oxygen. Then inside each tank 120 kg of advanced fingerling is poured. The approximate size of advanced fingerling is 80 mm. Here capacity is 100pc/ Kg

Packing strategy depends on cost of fish seed. If sellers expect more revenue from seed then they go for good quality packing. In this market middleman (agent-1) are having their own fish packaging centre. During packaging gut content of fish should be zero.

There are 2 types of carton for carrying fish seeds:

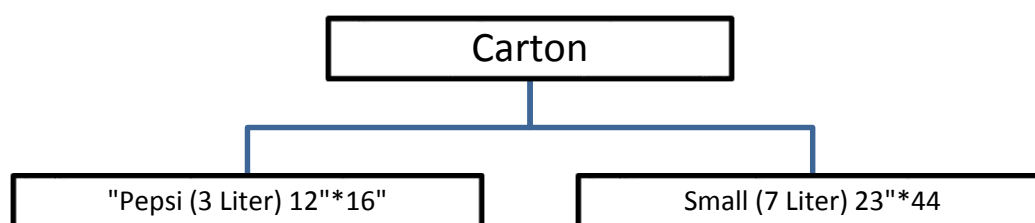


Figure: 4.9 Cartoon for keeping oxygen packed fish

Local Distribution

Patilwallah

In Bengali language “*Patil*” indicates “aluminium vessel”. As these middlemen are engaged in carrying seeds keeping in aluminium vessel, they are called *Patilwallah*. Generally fingerlings are carried using this method. In this process the transportation method is *Buck+ Hundi*

Means of transportation:

Buck: In this method, two aluminum vessels (Locally called *hundi*) are slung from bamboo pole. Size of each vessel is 20 inch. Then 25 lit of water is poured into the vessel. Then in each vessel 1 to 5 kg of seeds are poured. Survivality of seeds in the *hundi* is from 8 hours to 12 hours.

During transportation adequate attention is given to reduce the mortality as much as possible.

Ex: If the duration of total journey takes 40 hours by truck, then after each 10 hours, 1 time

water will be exchanged. In between journey, there is arrangement of water in few hotels and guest house. Sometimes those hotels are used by travelers after each 10 hours for exchanging water. The source of water may be motor pump, well or shallow water pump.

Table 4.11 Journey of fish seed from Naihati fish seed market

By Rail	By Road	By Air
Naihati is connected with several districts and with Bangladesh through railway. 1. Bongaon, 2. Bardwan 3. Kolkata 4. Bangladesh (Gede)	Through Kalyani Highway it is connected with G. T. road	Dumdum Airport is 2 hours distance from Naihati Through air seeds are transferred to respective buyers. By showing identity cards, buyers receive the seeds from airport/ railway station. By checking identity card of respective buyer, the seller shows the bill and the transportation procedure ends here.

4.1.2.5 Changes in the market:

Changes in the market are observed by comparing the findings with an earlier study by Milwain *et al* (2002). And following results were found:

Table 4.12 Changes in the market over last 12 years

Aspects	Upto 2002	2003-2015 (Addition)
Species	Common carp, Bighead carp, Catla, Grass Carp, Japanese Punt, Labeobata, Pangasius, Mrigal	Paku, <i>Mystus</i> sp., monosextilapia (<i>Oreochromis</i> sp.), thaimagur (<i>Clarius gariepinus</i>), pabda (<i>Ompok</i> sp.), koi (<i>Latescalcarifer</i>). Among ornamental fishes the species are Silver Shark, Barb, Tiger shark
Life stage of the species	Fry, Fingerling	Spawn, Fry, Fingerling
Method of seed distribution	Hundi, Oxygen Pack	Liquid oxygen pack, Cylinder+Tank

Structure	Sellers used to sit beside road for selling fish	Permanent cemented floor
Government intervention	In government fish farms (Kulia, Barasagardighi, Juput) of West Bengal training program used to be conducted by department of fisheries for skill development of fishermen	Registration of the hatcheries is based on RashtriyaKrishiVikasYojana Scheme during 11 th five year plan Auction platforms, Parking Space, Bank, Canteen, Restroom, Sick Room, Administrative Office, Conference Hall, Toilet Block, Fire fighting System, Boundary Wall and Security Room, etc. have been constructed under a project of government of West Bengal worth 742.54 Lakh

Problems faced during transportation

Public police related problems: In one truck more than 2-3 people can't travel according to rule of transportation department. But for keeping the seeds alive there is a need of continuous water splashing and replacement. For performing that activity around 5 people is needed. So it is very risky for the transporters to carry the seeds without making the security police officer known about the fact.

4.1.2.6 SWOT Analysis of Naihati Fish Seed Market

Strengths	Weaknesses
• 123 fish seed hatcheries in nearby villages • Farmers are very innovative & enterprising • Ideal Ecological conditions • Well established market • Locally available inputs • Ever increasing seed demand • Good transportation facilities. • Presence of 40 fish seed packaging centers • Efficient market management committee	• No IMC seed production in nearby hatcheries so arrival of less amount of IMC seeds • Increasing Fuel price increases the production cost. • Rapid increase in fish seed hatchery creates competition along with enmity among farmers
Opportunities	Threats
• Application of technology by market management committee, Ex-CCTV Camera, Web Portal • Entry of women and youths in this sector • Upliftment of economic condition of beneficiaries • More involvement of West Bengal State Department of Fisheries • Demand for branded seeds	• Climate changes. • Non availability of IMC seeds • Accident during transportation • Public-police problem • Syndicate system • Local goons, political problem Snatching, theft, robbery during lean season • No direct connection between seed producers and seed growers

Figure: 4.10 SWOT Analysis of Naihati Fish Seed Market

4.2 Profile of fish seed entrepreneurs in Naihati region

There are around 123 fish seed entrepreneurs in Naihati. Among them 25 are registered hatcheries. 51 hatchery owners were found to be the respondents of this study. Among them, social profile as well as entrepreneurship profile related information was found from 35 respondents. Business profile related information was found from 25 respondents. Rests were interviewed and some basic information related to market and hatchery owning was collected. They are scattered along the several fish seed producing villages of Naihati. As the fish seed market is situated in Rajendrapur, most of the hatcheries were found in that region. Most of them selected this business by getting influenced by success story of Mr. Nilratan Ghosh. Although few of them claimed that they have selected this occupation only because of Naihati's favorable location and climate condition.

Table: 4.12 Distribution of 51 fish seed entrepreneurs in Naihati

Name of the village	No. of hatchery owners
Rajendrapur	9
Salidaha	6
Kuliagarh	6
Mitrabagan	6
Bora	5
Shibdaspur	4
Palashi	4
Dariapur	4
Hamidpur	4
Ramchandrapur	2
Devok	1

4.2.1 Social profile of entrepreneurs

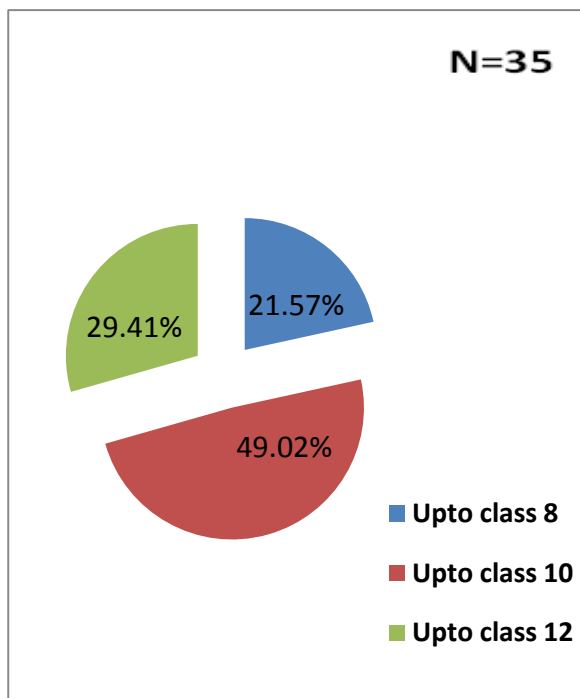


Figure: 4.10 Education profile

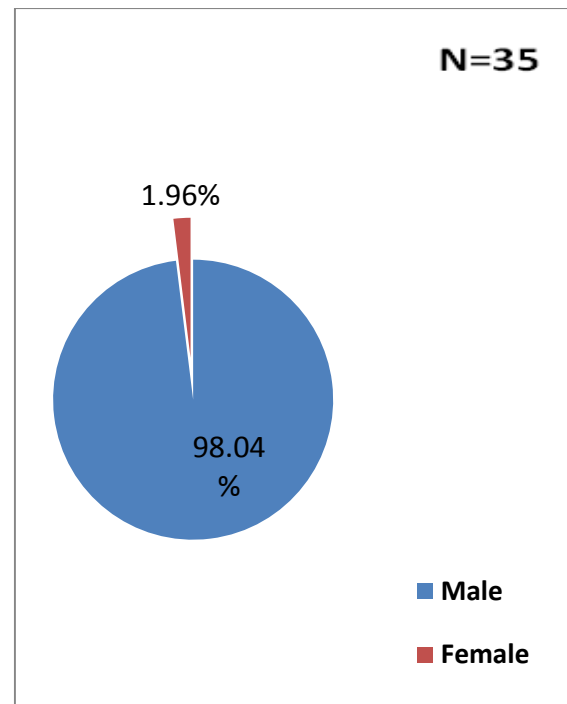


Figure: 4.11 Gender

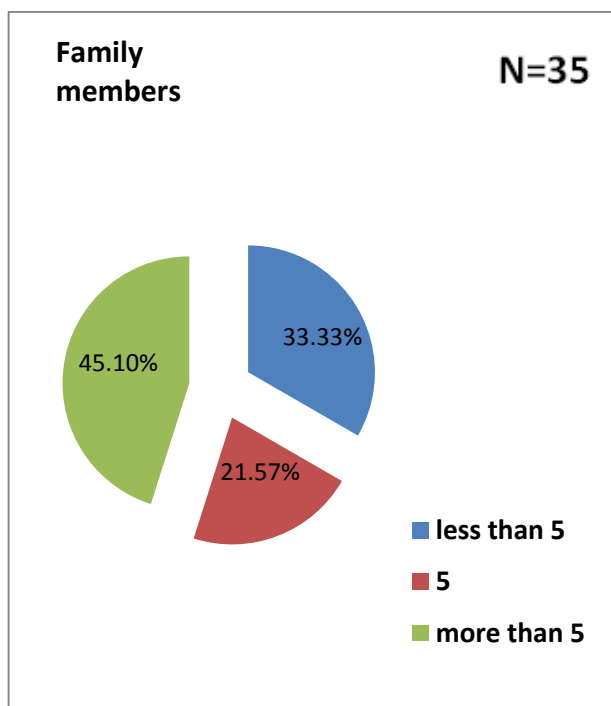


Figure: 4.12 Family members

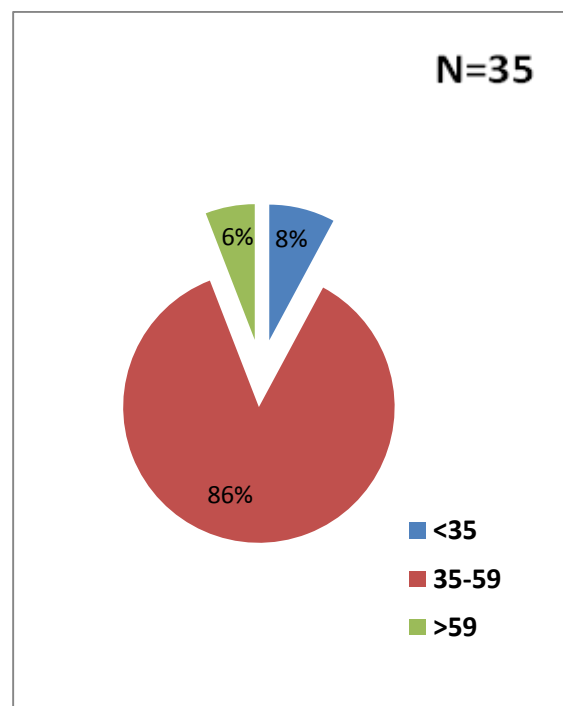


Figure: 4.13 Age

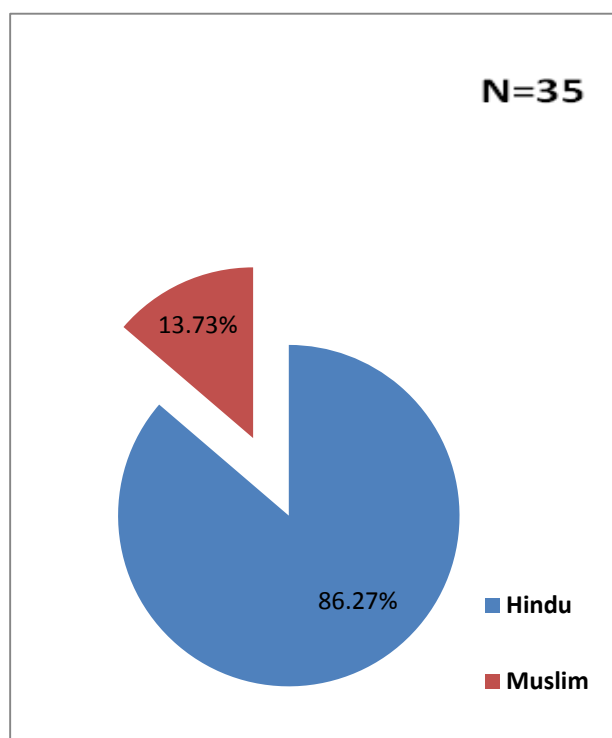


Figure: 4.13 Religion

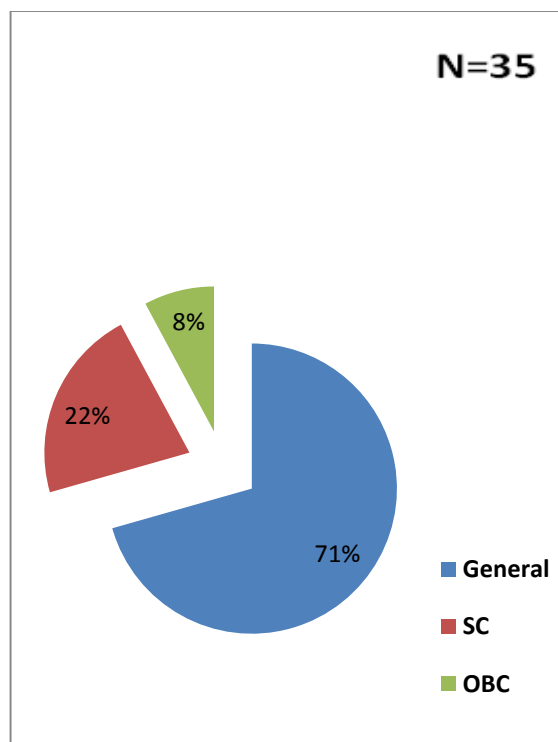


Figure: 4.14 Caste

All the hatchery owners are male, except one female (Widow). In Naihati region most of the hatchery owners have studied up to 12th Standard in school. It helped them to acquire fish seed production skill quicker than others. Most of the hatchery owners are having more than 5 family members. It generally includes hatchery owner, his wife and at least 2 children. Parents and siblings also live as joint family in many households.

Generally, the hatchery owners are having age in between 35-59 years. The hatchery owners who had their contribution in establishment of Naihati fish seed market are no longer alive. Young generation is also getting attracted towards this business. Most of the hatchery owners belong to Hindu religion although there is significant number of Muslim hatchery owners in Naihati region. Majority of fish seed producers belong to general caste category while nearly one fourth belongs to schedule Caste category. Most of the Muslim hatchery owners are OBC by caste.

4.2.2 Business profile of fish seed entrepreneurs

In Naihati, hatchery owners are mainly involved in production of seeds of *Pangash* and *Paku*. *Clarius gariepinus* entered in that region but due to govt. restriction its breeding practice did not proceed further. All the adjacent places of Naihati like Jaguli, Shimurali, Chakdah are associated with fish seed production.

Practices: All the entrepreneurs are associated with artificial method of seed production. It is an improvisation of natural method of seed production. Although quality of seed is not as good as produced in natural method (natural method of seed production is mainly practiced in Bankura district of West Bengal). Two main drawbacks of artificial fish seed production method are: 1. Eggs do not mature properly. 2. Rate of mortality is high.

4.2.2.1 Registration of Hatcheries:

Registration of the hatcheries is based on a state plan scheme known as *Rashtriya Krishi Vikas Yojana* Scheme. It is State Plan Scheme in the form of Additional Central Assistance in the 11th Five Year plan. It is also continued in 12th Five year Plan. The broad objective of RKVY is to increase annual growth in agriculture and allied sectors by ensuring a holistic development of Agriculture and allied sectors. State Agriculture Department is the nodal Department for implementation of the scheme. The Fisheries Department is one of the stakeholders under RKVY.

Objectives of scheme:

- To produce good quality fingerlings
- Quick supply of fingerlings to the farmers producing table/big size fish
- To bring more seasonal small water bodies under seed production
- Application of supplementary feed for better survival and growth

In Naihati region, it was noticed that only 20% hatchery owners have registered under this scheme. To get registration IMC seed production is required. As it is less profitable for them, they have not registered to the scheme.

Table 4.13 Details of scheme:

Unit area	0.10 hectare
Culture period	4 months
Stocking size of brooder	Average 1.5 kg and above
Stocking rate of brooders	180 kg (1800 Kg / hectare)
Species	IMC
Application of supplementary feed	Preferably a mixture of groundnut/mustard oil cake and rice bran at 1:1 ratio by weight for 75 days Application of High Quality CIFA Brood feed: 45 days for 200 kg Brooder
Targeted production of spawn	112.50 lakh /unit
Targeted Beneficiaries	IMC hatchery owner
Process of registration	• Registration is given by directorate of fisheries/ <i>meen bhavban</i> • At first a form will be taken from F.E.O • After filling the form properly and fulfilling the requirements they submit the form and get fish seed accreditation certificate.
Inspection	According to the rule of seed certification, the authority should check the relevant condition of market. But generally this process is not regular. In the year 2016 they came. They organized a meeting in the common room of the market and distributed form/ questionnaire which was to be filled and submitted along with few important documents and 500 rupees renewal money.

4.2.2.2 Farm profile:

In Naihati, entrepreneurs occupy total 560 ha of land area, 626 ha of water area. Among this 484 is used for aquaculture and the remaining are unused *beel* (waterbody). Each hatchery owner is having around 11 no. of Chinese cistern/ jar, 11 no. of nursery pond, 5 no. of rearing pond and 10 no of ponds for growing brooders.

Table: 4.14 Details of Farm

	Minimum	Maximum	Sum	Mean
Land area (ha)	5.00	18.00	560.00	10.98
Water area (ha)	6.00	25.00	626.00	12.27
Area under aquaculture (ha)	5.00	30.00	484.00	9.49
No. of Chinese cistern/ jar	7.00	21.00	557.00	10.92
No of nursery ponds	7.00	18.00	561.00	11.00
No. of rearing ponds	3.00	9.00	288.00	5.64
No. of brood stock pond	7.00	25.00	522.00	10.23

Species production:

Almost all the hatchery owners of Naihati are engaged in production of seeds of Catfishes rather than IMCs. The simple reasons behind the shifting are less profit in case of IMC than Catfishes (Pangash, Paku). But history depicts that the reason was production surplus. In the year 1993 there was huge production of IMC seeds in West Bengal (almost fish seed of rupees 100 crore). Due to this reason producer had to sell fish in a very low cost. Since then hatchery owners decided to shift to some other species for gaining more profit. Other than Pangash and Paku they are now producing seeds of Monosex tilapia, Vietnam Koi, Chital(*Notopterus* sp.), Pabda, Desi Magur: North 24 parganas is famous in seed production of Magur. Among aquarium fishes seed producer are now producing seeds of Silver shark

Mostly produced fish species in Naihati region

Figure 4.1 depicts that fish seed producers of Naihati region are not engaged in production of seeds of a single species. They are engaged in production of combination of species. The combination of 51 seed producers is clubbed and it was shown that almost all the hatchery owners are engaged in seed production of *Pangash* and *Paku*.

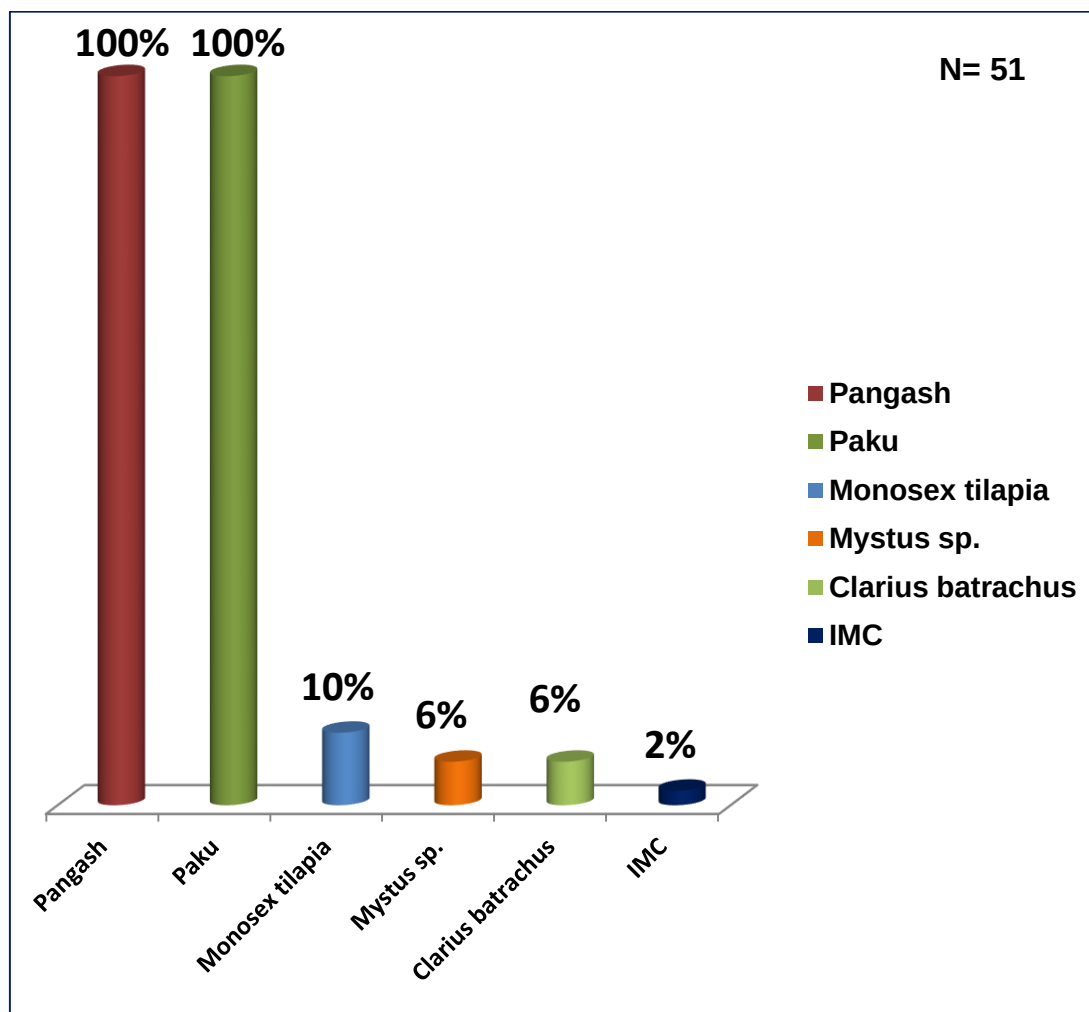


Figure: 4.15 Major Species in fish seed production (Naihati)

4.2.2.3 Economics of Fish Seed (IMC fingerling) Production of Naihati /Ha/Year

4.2.2.4 Table: 4.15 Total Fixed Investment (Rs./ha)

Fixed Investment	Rs/ ha
Pond construction	141667
Electricity connection and motor	415500
Generator	38750
Aerator	75465
Pipes and accessories	7553
Other Expenses	2550
	6,81,485

Fixed cost is same for both IMC and Pangash production, while the Variable cost is different.

Table: 4.16 Total variable cost (Rs/ ha)

Variable Cost	For IMC	For Pangash
Land leasing cost	-	
Cost of Brooder	15750	45200
Feed cost	105500	105500
Fertilizer and medicine	7316	6316
Labor including harvesting charges	24500	24500
Diesel and Electricity expenses	1 31750	1 01750
Total variable cost (Rs/ ha)	1,53,066	1,81,516

Table: 4.17 Total cost (in Rs./ha)

Cost	For IMC	For Pangasius
Depreciation on fixed investment@20%/ Year	136297	136297
Total Fixed Cost	136297	136297
Total Variable cost	153066	181516
Total Cost	2,89,363	3,17,813

Table: 4.18 Benefit cost ratio

Returns	For IMC	For Pangasius
Fish(IMC) Seed Production (Million fingerling/ ha)	1.8	1.5
Hatchery Gate Price(Rs/ Million)	1,70,000	15,00,000
Gross Returns	3,06,000	22,50,000
Net return over variable Cost	1,52,934	20,68,484
Net return over Total Cost	16,637	19,32,187
Benefit Cost Ratio	1.06	7.08

These benefit cost analysis indicate that there is comparatively more profit in seed production of Pangash / Ha/ Year than seed production of IMC /Ha/ Year. Thus it shows the reason behind shifting from IMC to Pangash.

Entrepreneurship profile of fish seed entrepreneurs

4.2.3.1 Cronbach alpha test to measure the internal consistency of 3 point Likert scale

Cronbach alpha test was performed to measure the internal consistency of 3 point scale which measured 8 factors of entrepreneurial behavior like Goal orientation, Autonomy, Leadership, Need for self empowerment, Adaptability, Need for achievement, Innovation and Flexibility.

Table: 4.23 Result of Cronbach alpha test

Goal orientation	0.689
Autonomy	0.786
Leadership	0.712
Need for self empowerment	0.734
Adaptability	0.63
Need for achievement	0.64
Innovation	0.727
Flexibility	0.737

The result of Cronbach alpha test for these 8 factors indicates internal consistency of the scale which is going to be used to measure entrepreneurial behavior of hatchery owners.

4.2.3.2 Standardization / Normalization of Entrepreneurial behavior:

Table: 4.24 Score of Entrepreneurial Behavior

Elements of Entrepreneurial Behavior		Normalized Mean score	% of Entrepreneurs		
			High	Medium	Low
1	Goal Orientation	0.74	47%	53%	-
2	Autonomy	0.96	92%	8%	-
3	Leadership	0.93	86%	14%	-
4	Adaptability	0.70	39%	61%	-
5	Need for achievement	0.58	29%	57%	14%
6	Need for self-empowerment	0.83	69%	29%	2%
7	Innovation	0.69	41%	55%	4%
8	Flexibility	0.80	67%	27%	6%
	Entrepreneurial Behavior Index	0.78			

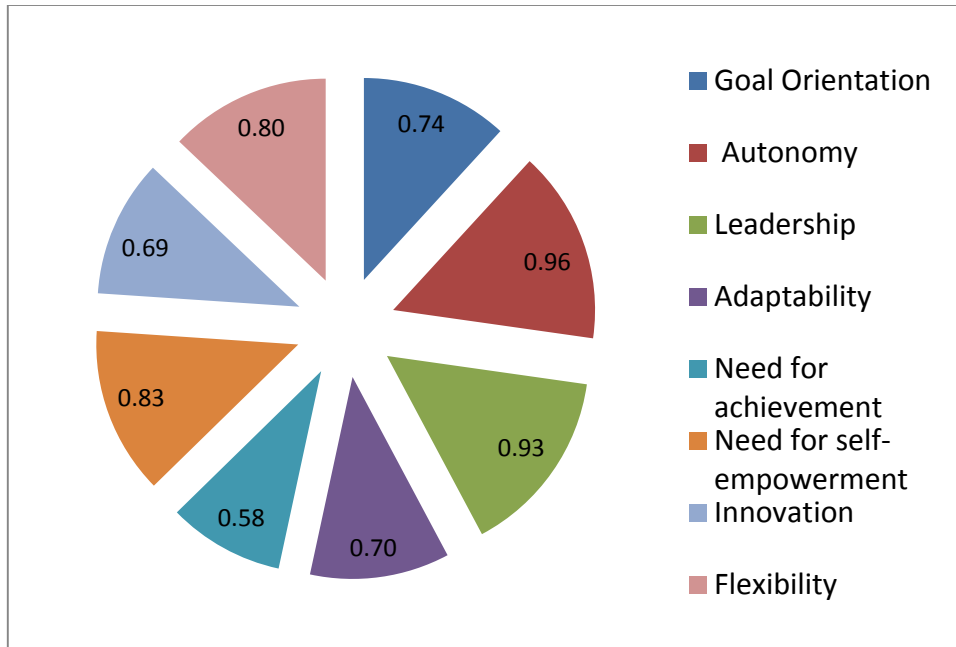


Figure: 4.16 Index Score of Entrepreneurial Behavior

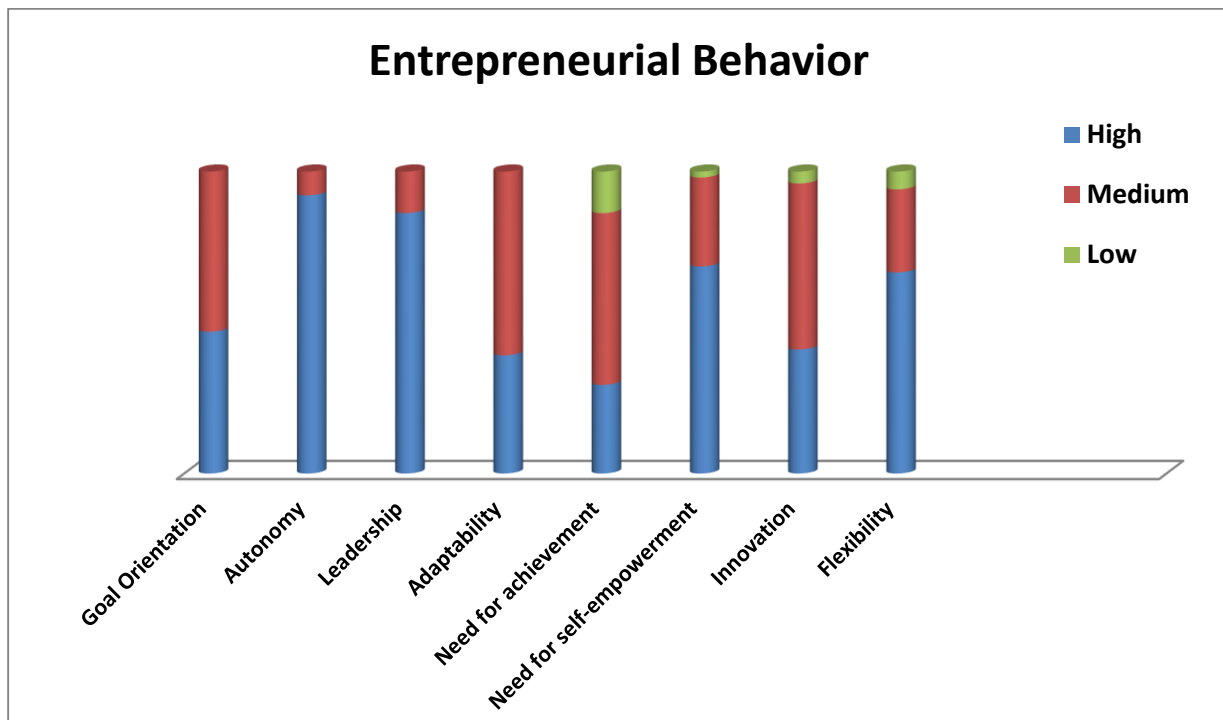


Figure: 4.17 Entrepreneurial behaviors of hatchery owners

Factors contributing most in increased entrepreneurial behavior of hatchery owners of Naihati:

Standardization was performed for each factors of Entrepreneurial behavior. And the result was found that around 47 % hatchery owners are highly goal oriented, But almost all the hatchery owners (92%) are highly autonomous. 86% people are having highly leadership ability. Only 39% hatchery owners can highly adapt themselves with existing condition. The entrepreneurs are not too ambitious having only 29% hatchery owners who are highly ambitious. But around 69% hatchery owners are highly eager for self empowerment. 41% of hatchery owners are interested to do something new being highly innovative

4.2.2.5 Relationship between entrepreneurial behavior and annual income:

Pearson's correlation test was used to check whether there is any relationship between entrepreneurial behavior and annual income of entrepreneurs. The r value of $+0.291^*$ [significant at the 0.05 level (2-tail test)] revealed that entrepreneurial behavior is significantly correlated with annual income of entrepreneurs with higher income levels positively associated with higher degree of entrepreneurship. It indicates that hatchery owners of Naihati region are focused towards their occupation, they play leadership role in their farm. Besides they can withstand the sudden changes in their business and have the curiosity toward any new species and method of seed production. If any new production method shows trouble, quickly they can reorient their goal towards another destination.

4.2.4 Success stories of Fish seed Entrepreneurs of Naihati

a) Messrs. Bablu Ghosh and Abhijan Ghosh

Mr. Bablu Ghosh is son of respected Mr. Nilratan Ghosh. Now he is successfully running the fish seed hatchery which was constructed and nourished by his father Mr. Nilratan Ghosh. Besides he is the president of Rajendrapur Matsya Bazaar Unnayan Committee, Nil Ratan Ghosh Fish Farmers Club and Bengal Aquaculture and Allied Producer Association. His son Mr. Abhijan Ghosh is also in this field and currently he is engaged in manufacturing and

marketing of commercialized technologies of Central Institute of Freshwater Aquaculture (CIFA). Most of the CIFA product made and marketed by them are:

- CIFAX: It is a chemical formula and first commercialized technology of CIFA
- CIFACURE: It is used for controlling common bacterial and fungal infection of freshwater ornamental fishes
- Jayanti Rohu: It was selected by selective breeding of Rohu from different population of North Indian rivers
- The Portable Magur Hatchery: It is used and designed by CIFA using FRP
- Immunoboost-C: It is an immunostimulant which improves brood fish health and seed production in carps
- FRP Carp Hatchery: It is an effective tool in producing quality carp seed for benefit of farmers
- CIFACRYO: Manually operated handy cryofreezer for gamete preservation
- CIFABROOD: Exclusive carp broodstock diet, adequately rich in essential nutrients

According to him this sector can get more improvement if they incorporate scientific way of water treatment, and use medicated oxygen for packaging purpose.

b) Mr. Bipul Majumdar:

He is very renowned hatchery owner of Rajendrapur area (Seoragachihaat). He entered in this profession in the year of 1982. After passing matric examination, he started to help his elder brother Mr. Bablu Ghosh. Previously he used to provide several types of ideas to his elder brother. That time he found that there should be any technique through which they could reduce the mortality of seeds. Through his initiative they met Laxman Babu who used to supply pituitary gland for artificial breeding. That time Bipul Babu used to observe several techniques and all the positive and negative sides of artificial breeding. Then in the year of 1983, he started his own hatchery. He had already experienced hapa breeding method in his elder brother's hatchery. According to him hapa breeding technique is mainly applicable in case of running water. But in enclosure seeds get died very quickly.

So in first attempt he tried Chinese hatchery and got far better result. But in Chinese method there was also evidence of mortality. Once in the year of 2008 he faced huge loss of rupees 8 lakhs. Then he started searching of reasons. They found that the main reason behind mortality of seeds is low level of dissolved oxygen in water. So as a preventive measure they paid more attention in aeration. It reduced mortality but not perfectly. Then they thought that water should be treated to get rid of abnoxious gases which used to be formed beneath the pond. In the year 1985 he tried to modify his own hatchery. The modification was, 1. A well set of hatchery and nursery unit, 2. Slope: Hatching unit in the top and nursery unit in the bottom. 3. Interconnectedness among the units were little bit innovative 4. It reduced both manpower and time.

Brief description of the process:

- In each season cleaning of pond bottom after making it fully dried
- Proper utilization of Earth's gravity: The hatcheries will be set in such a way that fertilized eggs will directly reach to the nursery unit without usage of any manpower

Activities other than regular breeding, nursing, rearing:

- Among the 14 rearing ponds , 2 ponds will be selected. Then those will be made dried and after preparing the 2 ponds, fingerling and advanced fingerlings are stocked in high density.
- If toxicity occurs then there is arrangement of alternative pond. If any problem occurs in one pond, immediately they shift the seeds into an readymade pond.
- Now from Orissa he has brought the seeds of Milk fish (*Chanos chanos*). His belief is that people will get attracted towards these species because of its simple taste and texture.
- To reduce inbreeding depression, he generally uses 1 brooder only once. His experience says that if brooder is 1 year old then during breeding, success rate of 1 brooder is 100%.

Experience: According to him, to run this business successfully timely selling is very crucial, to get maximum profit. His hatchery is not registered to department of fisheries, West Bengal. According to him it is not compulsory to register. Actually registration does not create a matter.

Bipul babu has is a very successful entrepreneur. Besides, his mentality is to help others, friends, coworkers. People engaged in his hatchery are satisfied with 24 hours fooding, lodging and immediate medical help.

c) Mr. Sujay Biswas

He is one of the renowned fish seed entrepreneurs in Naihati region. He is not trained form any institute regarding fish seed production but his conception in fish seed production is very transparent. He has learnt Chinese hatchery method of fish seed production from his father Mr. Bimal Biswas. Bimal Biswas was very near and dear of Mr. Nilratan Ghosh and learnt the proper procedure of seed production of IMC. But his son has not confined himself only in seed production of IMC, he is now producing several varieties of seeds like Pangash, Paku, Gulsha tangra (*Mystus sp.*), ornamental fish (Koi carp), Monosex tilapia etc.

Activities:

- Generally fish breeding season is from March to September but till October they are engaged in fish seed production
- He is not having any permanent laborer. No. of laborer is not fixed. Skill of laborers
- Like all others he also follows artificial (stripping) method
Previously during the production of IMC seeds, they used to follow natural method of fish seed production only in case of Mrigal (*Cirrhinus mrigala*)
- To get rid of in breeding depression he suggests to discard the brooders after using it 3- 5 times during breeding
- Water used for breeding purpose is mainly groundwater. Using pump machine water is drawn and used.

Experience:

- According to him IMC seed production is more time consuming than Pangash and Paku.
- According to him risks associated with this business are high rate of mortality if proper care is not taken
- Hatchery owners are not aware of fluctuation of exact market value of seeds. So there is a chance of hatchery owners being cheated by dalals
- His hatchery is registered to department of fisheries, government of West Bengal.
-

d) Mr. Bablu Majumder

Mr. Bablu Majumder is a well established and well recognized fish seed producer in Naihati region. We can say that he is an expert of fish seed production in India. He uses his practical experience not only to develop own domain but also to develop the resources of our country. In one hand he trains trainees of ICAR institutes besides the employees of Fisheries department of West Bengal. He is attached with aquaculture since last 37 years. That is why he has made good interaction with dignitaries in the field of fisheries of our country like Dr. S. S. Ayappan (former D.G. of ICAR), P. Jayasankar (D.G. CIFA). He is source of earning to those 30 people and their families who are engaged actively in his hatchery. It is noticeable that he appointed 3- 5 women in hatchery as laborers. It is the first initiative in Naihati region to appoint women in hatchery related activities He has attend Hilsha conservation project which held in Diamond harbor. According to him production capacity of 1 Chinese Jar hatchery is almost equal to 20 glass jar hatchery. At a time 1 Chinese jar contains approximately 12 brooder"s eggs. To reduce inbreeding depression 1 brooder of Paku is used 3 times for stripping. He produced some amount of seeds of monosex tilapia on trial basis. He tried to produce it with pangash keeping those in same place. Carnivorous habit of panasgh resisted this activity. Taking advice from CIFA, Bhuwanewar, he started Pabda breeding. But the water was not at all suitable to produce pabda seeds. It needs rainwater fed waterbody, which was not available.

4.3 Documentation of Innovations in fish seed production and marketing in Naihati region

Farmers' innovation in Naihati is based on their indigenous knowledge. The indigenous knowledge is the accumulated knowledge, skills and technology of the seed producers. In Naihati, traditionally associated technical knowledge of fish seed producers followed from generation to generation in a serial basis. Thus, recording of innovation is very important.

Fish seed production is itself an innovation which took place around 55 years ago. Previously fishers were dependent on wild capture of fish seeds. Hatchery owners tried innovations as a necessity driven by economy to earn their livelihood.

4.3.1 Introduction of several fish seed production methods in Naihati

Bundh breeding method (1960- 1970): Farmers of Bankura and Midnapur districts of West Bengal developed a method of fish breeding called the "bundh breeding". This technique involved artificial simulation of the natural breeding environment observed in rivers. This breeding method was not used in Naihati. In West Bengal, fish seed breeders of Bankura district used to breed fish applying this method.

Hapa breeding (1970- 75):

This breeding was prevalent in Naihati. Here protection from predation is afforded by installing a traditional hatching hapa. But this practice was not been continued because of several reasons; mortality was increased because of rise of water temperature as well as a drop of water level.

Chinese hatchery breeding (1975-Continuing):

Chinese hatchery: From China CIFRI brought new technology of carp seed production i.e. Chinese hatchery. It was introduced in the year 1966. For applying it successfully they shared the concept with Mr. Nilratan Ghosh. Mr. Nilu Ghosh minutely observed the infrastructure

and found out that the operation of Chinese hatchery would be better if the oval structure get converted into circular. In this way rotation will be easier.

Glass Jar Hatchery (1980- 1985)

Instead of allowing the fish to spawn naturally, farmers identified brood fishes, selected, stripped and fertilized with milt and placed in jars for hatching. Cement jars were used to carry out hatching operation for small volume of eggs of different species simultaneously and reduced usage of water. Later glass jar was not also suitable because during that process eggs used to get clogged in the wall of jar. It was more laborious than Chinese hatchery.

4.3.2 Innovations in seed production and nursing in Naihati

4.3.2.1 Indoor carp hatchery: A running water supply in a flow-through system, where the rate of flow of water, its temperature and dissolved oxygen content can be controlled, and treatment to control bacterial and fungal infections given are requisites of an efficient carp hatchery. Clean, oxygenated -air of the right temperature at a flow rate of 1- 2 liters/minute is maintained in the flow-through system.

Table:29 Shows that according to the hatchery owners of Naihati indoor carp hatchery can be used in hatchery because it is economic advantageous as well as very easy to use. But according to some hatchery owners it cannot replace conventional outdoor carp hatchery. It is not durable as well as it is not a unique practice.

Table: 4: 26 RBQ of Indoor carp hatchery

Factors	RBQ Value	Rank
Economic advantage	97%	1
Ease of use	77%	2
Replicability	65%	3
Durability	40%	4
Uniqueness	20%	5

4.3.2.2 Jars and circular tanks are available for use in the same hatchery: Normally, jars may be used for small-scale operations and circular cement tanks for larger-scale ones. The volume of fully swollen and water hardened laid eggs of different species may be used in deciding the number of jars or 59. Carp hatchlings shortly after hatching showing the yolk sac hatching tanks that are to be put to use assuming enough eggs are added to fill the jars up to about 1/2 their individual capacities.

Table: 4.27 RBQ of Jars and circular tanks, are available for use in the same hatchery

Factor	RBQ Value	Rank
Economic advantage	93%	1
Ease of use	87%	2
Durability	55%	3
Replicability	45%	4
Uniqueness	20%	5

4.3.2.3 Control of aquatic insects in nurseries:In carp nurseries, aquatic insects (e.g.*Notonecta*) are the major problems that damage the carp spawn. The ditches or paddy fields are heavily loaded with back swimmers. Though various chemical methods are available for the control of insects, farmers are unable to adopt the technologies either because of the cost factor or oftensuch technologies do not resolve the problems. Aquatic insects depend on atmospheric oxygen through their tracheal tube. Preventing

insects to come to the surface for drawing air is one of the mechanical ways for the control of insects. Farmers devised a trap box for controlling back-swimmers. The trap box covered with fine mesh net with a size of 10 x 10 ft showed that insects trapped in such a box would die within 30-40 min. The dead insects in turn became a source of good nutrition as they contain high amount of protein.

Table: 4.28 RBQ ofControl of aquatic insects in nurseries

Factor	RBQ Value	Rank
Ease of use	95%	1
Replicability	75%	2
Economic advantage	71%	3
Durability	37%	4
Uniqueness	23%	5

4.3.2.4 Modified Chinese Hatchery-1:The modification is, 1. A well set of hatchery and nursery unit, 2. Slope: Hatching unit in the top and nursery unit in the bottom.3. Interconnectedness among the units were little bit innovative 4. It reduces both manpower and time.

Table: 4.29 RBQ ofModified Chinese Hatchery-1

Factor	RBQ Value	Rank
Economic advantage	96%	1
Ease of use	84%	2
Replicability	51%	3
Durability	49%	4
Uniqueness	20%	5

4.3.2.5 Modified Chinese Hatchery-2

In the hatching pool of Chinese hatchery the extract of water-immersed catechu nut is used in proper dose to make the eggshell hard. It helps in shell hardening and prevents immature release of hatchlings. Its purpose is to obtain higher hatching rate

Table: 4.30 RBQ of Modified Chinese Hatchery-2

Factor	RBQ Value	Rank
Economic advantage	33%	4
Ease of use	97%	1
Durability	27%	5
Uniqueness	78%	2
Replicability	65%	3

4.3.2.6 Hapa-based' hatching system

In case of tilapia fingerling production, this hapa based hatching system is used. Fry and brooders can be easily handled. Production on a per unit area is high. There is assurance of uniform fry of relatively the same age. Minimized lose of fry. Hapas can be set up in ponds stocked with fish.

Table: 4.31 RBQ of Hapa-based' hatching system

Factor	RBQ Value	Rank
Economic advantage	93%	1
Ease of use	87%	2
Durability	55%	3
Uniqueness	20%	5
Replicability	45%	4

4.3.2.7 Smaller versions of the Chinese hatchery model

The farmer was able to build the smaller versions of the Chinese hatchery model and was able to produce seed of silver barb, silver carp, and common carp using the revised technology.

Table: 4.32 RBQ of Smaller versions of the Chinese hatchery model

Factor	RBQ Value	Rank
Economic advantage	91%	1
Ease of use	89%	2
Durability	51%	3
Replicability	49%	4
Uniqueness	20%	5

4.3.2.8 Mixing of milk with water during transportation

When carp seed are carried in *hundi*, mortality is known to occur due to high temperature. Farmers have found a solution to this problem by using milk with water. It is believed that milk brings down the temperature and also provides nutrition to the fish during the course of transportation, besides preventing fish from the direct exposure to sunrays.

Table: 4.33RBQ of Mixing of milk with water during transportation

Factors	RBQ Value	Rank
Ease of use	85%	1
Uniqueness	84%	2
Replicability	61%	3
Durability	40%	4
Economic advantage	32%	5

4.3.2.9 Innovations in fish seed nursing operation

Seeds which are stocked in the nursery pond are fed with cooked pea. Pea is boiled and scattered

Table: 4.34 RBQ of Innovations in fish seed nursing operation

Factors	RBQ Value	Rank
Economic advantage	81%	2
Ease of use	99%	1
Durability	40%	4
Uniqueness	20%	5
Replicability	60%	3

4.3.2.10 Large cemented jars in hatching purpose

Farmers have not only used the technique of Chinese hatchery technology to improve seed production; they have also modified the glass jar technology for building large cement jars that help to hatch small amount of eggs. Cement jars constructed almost like glass jars are used for hatching eggs by ensuring adequate supply of water to keep the eggs under constant motion until hatching and post-hatching to keep the yolk-laden spawn under constant movement. This simple adoption of glass jar principles has helped the hatcheries to produce seed of different species simultaneously.

Table: 4.35large cemented jars in hatching purpose

Factors	RBQ Value	Rank
Durability	88%	1
Replicability	75%	2
Ease of use	61%	3
Economic advantage	52%	4
Uniqueness	32%	5

4.3.2.11 Innovation in brood stock management

Brood fish are fed with feeds containing additives like eggs known to improve the quality by providing some of the essential nutrients. In addition, farmers also balance the feed given to fish with such ingredients that will have good amount of protein and provide other essential nutrients.

Table: 4.36Innovation in brood stock management

Factors	RBQ Value	Rank
Replicability	100	1
Ease of use	72	2
Economic advantage	56	3
Durability	52	4
Uniqueness	20	5

4.3.2.11 scattering of feed in pond

In Naihati most of the hatchery owners do not go for feeding bag method. They scatter the feed standing in the corner of the pond.

Table: 4. 37 Scattering of feed in pond

Factors	RBQ Value	Rank
Economic advantage	87	1
Replicability	72	2
Ease of use	67	3
Uniqueness	48	4
Durability	33	5

4.3.2.12 Branded Seed

In Naihati region branded seeds are mainly farmed by Nilratan Ghosh Fish Farmers Club. This seeds are produced with special care. This seeds are found in searly period of breeding season (April End- Beginning of May). Mainly IMC seeds are branded seeds. Its specialty is , these are absolute seeds, that is there is not any cross between species. For breeding purpose brooders of proper age and weight are taken/ selected. For example, in case of Rohu, for breeding purpose exactly brooders of having exactly 3 Kg. weight are taken. In case of Catla brooders of 4*1/2 of weight are taken. Rapidly these seeds grows in such a way that, seeds which are produced in April end or May get 400 gm size within the month of November. Besides, there is no mortality of the seeds. But the problem is, the seeds are relatively costlier. Per lakh spawn costs 1300 rupees. In Naihati whoever produces branded seeds, they are also having proper nursery facility and supply of feed is also given by them. Specialty of these seeds is the good quality and 100% survivality because these are prepared by maintaining proper condition.

Mr. Nil Ratan Ghosh Fish Farmers Club started production of branded seeds in the year of 2013. They continued it in 2014 and 2015 also. Though the seeds are relatively costlier, its acceptability is better in few villages of South Bengal. Those villages are Sagar, Kakdwip, Mathurapur, Sandeskhali, Gosaba.

Table: 4.38 Branded seed

Factors	RBQ Value	Rank
Ease of use	77	1
Durability	40	2
Replicability	14	3
Economic advantage	13	4
Uniqueness	4	5

4.3.3 Specific Advantages / Major Reasons for Usage of the innovations

Figure 17 has shown a comparison among the performance of farmer's innovations. It shows that indoor carp hatchery is accepted because it is more economic advantageous, trap box it accepted because it is very easy to use, large cemented jars have been adopted because it is having high durability. Hapa based hatching, smaller Chinese jar, elevated water jar, boiled pea as feed, scattering method of feed distribution are all economic advantageous. Using milk during transportation is very unique method according to them. Egg as feed ingredient can replicate other protein source of fish feed.

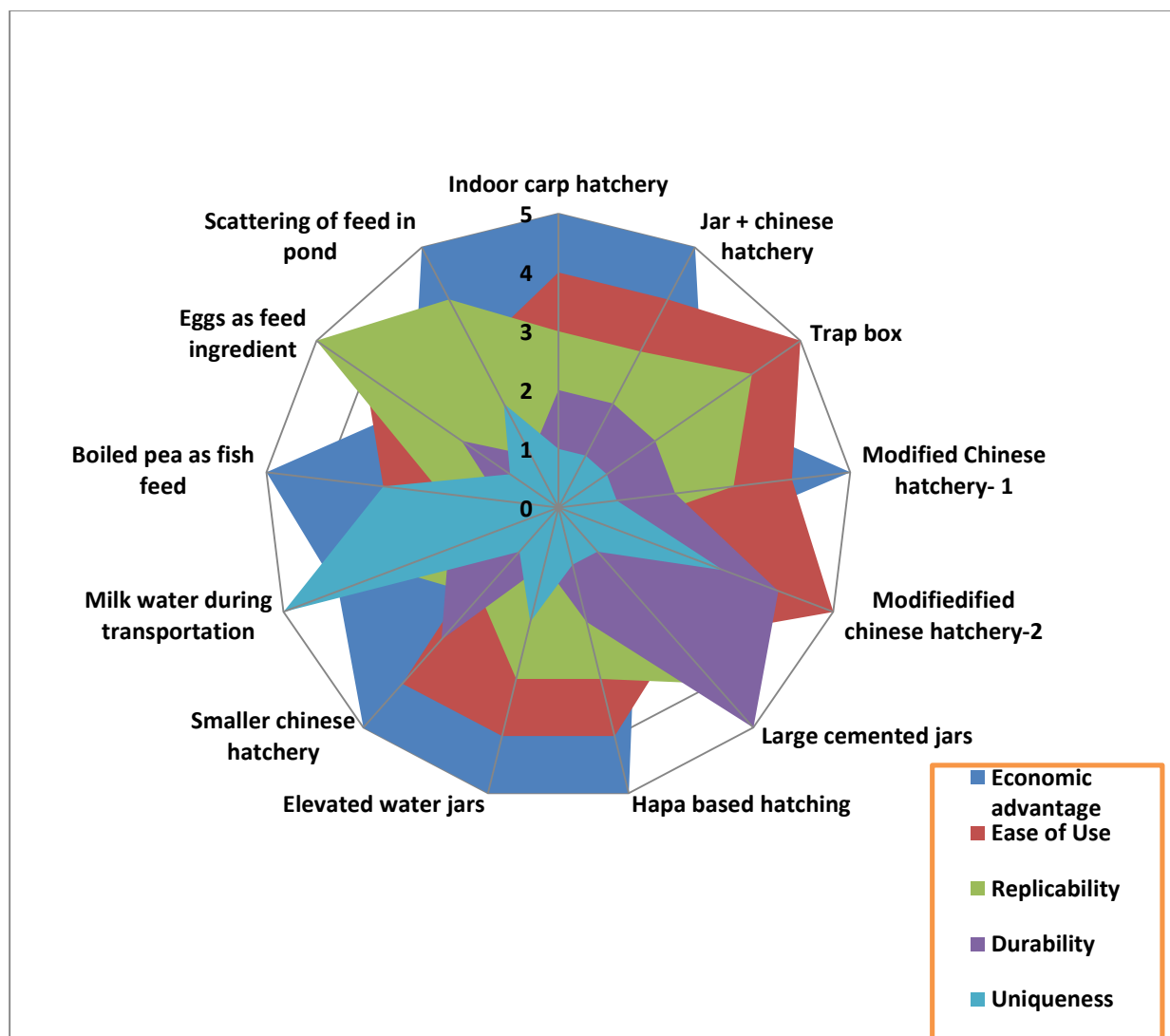


Figure: 4.18 Comparison among the innovations based on their acceptance

Stimulating and recognizing farmer innovations

There are many ways by which innovations of farmers or groups can be recognized. One of the best methods that have been found is to provide a platform for farmers to share their observations with other farmers. Organization of farmers meet, fish mela, reward giving ceremony in the celebration of “Fish farmers day”, at the state level as well as central level wherein innovative farmers could share their innovation with other farmers and scientific community boost their morale and build confidence.

5. Summery and Conclusion

Naihati fish seed market is Asia's One of the largest fish seed market which was established in the year 1975 in Rajendrapur Village of Naihati, West Bengal. The first intensified fish seed production initiated through the government in 1962-63 at CICFRI, Barackpore used an adapted form of the Chinese cistern system. Consequently, the first private hatchery in West Bengal was established in 1966 in Rajendrapur, Naihati by a seed producer, Mr. Nilratan Ghosh who worked in collaboration with CICFRI in 1966 to spawn Indian Major Carps (IMC). For ease of selling and providing livelihood to the villagers an unstructured fish seed market was established in the year 1976. In the beginning there was only dominance of fish seed of Indian major carps. Gradually several other varieties of fish species entered in the market like Pangash (*Pangasius sp.*), Paku (*Piractus brachypomus*), Desi Magur (*Clarius batracus*), Hybrid magur (*Clarius gariepinus*), Monosex Tilapia (*Oreochromis sp.*), Tangra (*Mystus sp.*) etc. Fish seeds in this market arrives from several districts of West Bengal like North 24 Parganas, Bankura, Maldah, Midnapur, South 24 Parganas, Nadia etc, From this market fish seeds are sold to Andhra Pradesh, Assam, Jharkhand, Bihar, Orissa, Uttar Pradesh, Rajasthan, Haryana, Madhya Pradesh, Chhattisgarh, Karnataka, Kerala, Maharashtra. In Naihati, fish seed production is carried out in artificial method using Chiese cistern pool. In Naihati around 123 fish seed hatcheries are there. Among those, 20% hatchery owners have registered their hatchery under the Rashtriya Krishi Vikash Yojana state plan scheme. The hatchery owners have not confined themselves to the conventional methods of fish seed production. They discovered several methods of hatchery practice and has incorporated in their profession. Some of them are directly or indirectly associated with Indian Council of Agricultural Research (ICAR) institutes, and State Agricultural Universities (SAUs).

This present study entitled "Fish seed hatchery owners: A Case Study" was carried out to explore the following objectives:

- To analyse the dynamics of fish seed production and market in Naihati region
- To assess the profile of fish seed entrepreneurs in Naihati region
- To document the innovations in fish seed production and marketing in Naihati region

Salient findings

- Mr. Nilratan Ghosh ventured into artificial fish seed production, succeeded and became an example in aquaculture sector. Besides enriching skills and knowledge, he offered the proposal of the formation of the seed market in the year 1976
- Almost all freshwater varieties of fish seeds are sold through this market. But nowadays *Pangash*, *Paku*, *Mystus sp.* reaches to this market from local hatcheries. All other fish seeds are brought from Bankura, Nadia, Purulia, Maldah and are sold to several states like Andhra Pradesh, Assam, Jharkhand, Bihar, Orissa, Uttar Pradesh, Rajasthan, Haryana, Madhya Pradesh, Chhattisgarh, , Karnataka, Kerala, Maharashtra
- In peak season fish seeds of 550 lakh rupees are sold per day. In lean season the no. decreases up to 65 lakh/ day. As most of the people of this area is dependent on fish seed production and marketing so in lean season laborers of the hatchery face scarcity of money. During lean season snatching, theft, and robbery happens in this region
- There are two types of sellers of this market. A person, who is permanent member of the market, pays 65000 rupees every year and a temporary seller sits in the market for 1 year (only during peak season) by paying 500 rupees/ day and after selling leave the place
- Middleman plays a vital role in distribution of fish seeds from Naihati. All the hatchery owners of Naihati sell seeds through them. They have direct contact with the local seed grower and distant seed buyers
- All the expanses of the market are run by *Rajendrapur Matsya Bazar Unnayan Committee*. The *Unnayan* Committee regulates fund which was create from the share of the permanent sellers.
- Nilratan Ghosh fish farmers club is involved in several developmental activities among fish seed producers and distributors. They provide skill developmental training about improved breeding methods, usage of beneficial feed, fertilizer and

medicine. They discuss with farmers about several critical matters like of inbreeding depression, cross breeding to get rid of problems faced in hatcheries

- In the year 2012 West Bengal State Department of fisheries has successfully implemented a project cost 742.54 lakh rupees for Naihati fish seed market. Auction platforms, Parking Space, Bank, Canteen, Restroom, Sick Room, Administrative Office, Conference Hall, Toilet Block, Fire fighting System, etc. have been provided considering safe and hygienic operation of the fish seed market
- There are around 123 fish seed entrepreneurs in Naihati. Among them 25 are registered hatcheries. Registration of the hatcheries is based on *Rashtriya Krishi Vikas Yojana* Scheme. The scheme is aiming to produce good quality fingerlings, steady supply of fingerlings to the farmers producing table/big size fish, bring more seasonal small water bodies under seed production, application of supplementary feed for better survival and growth
- Fish seed transportation of Naihati is a two way process. Generally spawn and fry are sold directly from hatchery. Those are packed in oxygen pack/ liquid oxygen pack/ tank+ cylinder and are carried by truck or air. Those are loaded in carrier van with the supervision of agent and are taken for selling. In this distant distribution of fish seed, two middlemen are involved. One is having contact with seed producer and another person is having contact with ultimate customer/ Seed Growers. Fingerlings arrive in this market and are carried in *buck* (Alluminium vessel) by train. In this local distribution only one middleman is engaged called "*Patiwallah* "
- In Naihati hatchery owners are mainly involved in production of seeds of *Pangash* and *Paku*. But on experimental scale now they are engaged in seed production of Milkfish (*Chanos chanos*), Pabda (*Ompok sp*), Koi(*Anabus testudinus*). Although previous they were engaged in fish seed production of IMC, now due to its high mortality, comparatively long duration for maturation, less profit they have shifted to seed production of *Pangash*, *Paku*
- In Naihati region most of the hatchery owners have studied up to class 12. So learning any new method, scientific term and procedure is not tough for them.

There is not any significant evidence of participation of woman in hatchery owning occupation. Majority of hatchery owners are having family member more than 5 and they all are middle to older aged (35-59)

- Major risks associated with this business are high rate of mortality if proper care is not taken, Hatchery owners are not aware of fluctuation of exact market value of seeds because of they do not get access to contact with the ultimate buyer
- Threats involved in this sector is climate changes, non availability of IMC seeds, accident during transportation, public-police problem, syndicate system, local goons, political problem, snatching, theft, robbery during lean season, no direct connection between seed producers and seed growers
- The hatchery owners of Naihati region are focused towards their occupation, they play leadership role in their farm. Besides they can withstand the sudden changes in their business and have the curiosity toward any new species and method of seed production. If any new production method shows trouble, quickly they can reorient their goal towards another destination. And all these inherent qualities of entrepreneurs are having direct relationship with their income
- In Naihati, traditionally associated technical knowledge of fish seed producers is followed from generation to generation. Most of the innovations are associated with hatchery practice. The reason for the acceptance of most of the innovations are economic advantageous as well as those were very easy to use
- Most of the innovations are environment friendly as hatchery owners employ materials are easily available. All the innovations lead to replicability and dissemination

Suggestion and recommendation

- “Entrepreneurship” is having a potential to make a person independent in his work environment. This fish seed production sector of India takes a remarkable position to create economic growth of this country. But the need is to bring these pathfinders into light.
- They should be given the platform to share their success story, to teach their methods of seed production and marketing.
- They can be considered as professionals and the link between these fish seed entrepreneurs and ICAR and SAUs should be stronger
- The marketing activities may attract investor of this sector to distribute the seeds across the boundary of the country.
- The profile and success story of the entrepreneurs will attract young generation to pay their attention in this sector. Their new ideas and thoughts may enrich the sector qualitatively.
- Financial institutions as well as governing agencies also will be aware about the demand and need of the seed producers.
- The innovations which have been practiced since long back as well as the newly flourished innovations of these seed producers will create interest among Scientists/ Researchers to represent the innovation scientifically and different direction of innovations will emerge from this.

This study highlights the current situation, achievements and problems faced by the seed producers and actors of market. It also points out the need to promote innovation by providing scientific analysis and support for a healthy innovation culture. Thus the role of non formal sector in furthering the research and development in fisheries has been brought in to the focus

6. REFERENCES

- Ahmad, N. and Hoffmann, A., 2008. A framework for addressing and measuring entrepreneurship.
- Ahmed, T., Chetia, S.K., Chowdhury, R. and Ali, S., 2011. Status paper on rice in Assam. *Rice Knowledge Management Portal*. Directorate of Rice Research, Hyderabad: Rice State Wise, 1-49.
- Baghel, D. and Gupta, M., 2011. Innovation in Indian Small Scale Industries: Case Study of Cosmetics Small Scale Industry in Mumbai. *ASCI Journal of Management*, 41(1).
- Barker, H.C., 1987. Investment opportunities in fish seed technology.
- Barte, R., 2012. Financial Literacy in Micro-Enterprises: The Case of Cebu Fish Vendors. *Philippine Management Review*, 19.
- Basavaraja, N. and Basavaraja, N., 2007. Freshwater fish seed resources in India. *Assessment of freshwater fish seed resources for sustainable aquaculture*, 24(501): 267.
- Baxter, P. and Jack, S., 2008. Qualitative case study methodology: Study design and implementation for novice researchers. *The qualitative report*, 13(4): 544-559.
- Cubico, S., Bortolani, E., Cubico, A. and Favretto, G., 2008. Entrepreneurial choice: aptitudes, motivations and behavior. In *Proceeding of the World Meeting 2008 of IAREP-The International Association for Research in Economic Psychology and SABE-The Society for Advancement of Behavioral Economics*.
- Cubico, S., Bortolani, E., Favretto, G. and Sartori, R., 2010. Describing the entrepreneurial profile: the entrepreneurial aptitude test (TAI). *International Journal of Entrepreneurship and Small Business*, 11(4): 424-435.
- Dalohoun, D.N., Hall, A. and Van Mele, P., 2009. Entrepreneurship as driver of a self-organizing system of innovation: the case of NERICA in Benin. *International Journal of Technology Management & Sustainable Development*, 8(2): 87-101.

- Das, R.N., Shit. A.N. and Ghosh, A. R., 2015. Carp Seed Production Factors in India. *Journals of Environment*, 2: 1-10.
- Dey, M.M., Spielman, D.J., Haque, A.M., Rahman, M.S. and Valmonte-Santos, R., 2013. Change and diversity in smallholder rice–fish systems: Recent evidence and policy lessons from Bangladesh. *Food Policy*, 43: 108-117.
- Garaway, C., Lorenzen, K., Chamsingh, B., Province, S. and Lao, P.D.R., 2000. Developing fisheries enhancement in small waterbodies: lessons from Lao PDR and Northeast Thailand. In *ACIAR PROCEEDINGS*, 227-234.
- George, F.O.A., Olaoye, O.J., Akande, O.P. and Oghobase, R.R., 2010. Determinants of aquaculture fish seed production and development in Ogun State, Nigeria. *Journal of Sustainable Development in Africa*, 12(8): 22-34.
- Ghosh, A., Sharma, A. and Ambulkar, R., 2013. Seed Mahotsav scheme for increasing the scope of indigenous fish marketing in West Bengal: Perception and constraint analysis. *Indian Journal of Marketing*, 43(9): 25-31.
- Goldsmith, R.E. and Foxall, G.R., 2003. The measurement of innovativeness. *The international handbook on innovation*, 321-330.
- Goswami, B., Mondal, S. and Dana, S.S., 2006. Indigenous technological knowledge in fish farming. *Indian Journal of Traditional Knowledge*, 5(1): 60-63.
- Grunert, K.G., Fruensgaard Jeppesen, L., Risom Jespersen, K., Sonne, A.M., Hansen, K., Trondsen, T. and Young, J.A., 2005. Market orientation of value chains: A conceptual framework based on four case studies from the food industry. *European Journal of Marketing*, 39(5/6): 428-455.
- Hejazi, S.A.M., Malei, M.M. and Naeiji, M.J., 2012. Designing a scale for measuring entrepreneurial leadership in SMEs. In *International Conference on Economics, Marketing and Management, IPEDR*, 28: 71-77.
- Henderson, J., 2002. Building the rural economy with high-growth entrepreneurs. *Economic Review-Federal Reserve Bank of Kansas City*, 87(3): 45.
- Islam, M.S., Rahman, M.H., Sharmin, S., RAHMAN, M.H. and MIA, M., 2005. Fish seed marketing system in Bangladesh. *Bangladesh Journal of Agricultural Economics*.

- Job, T.J., David, A. and Das, K.N., 1955. Fish and fisheries of the Mahanadi in relation to the Hirakud Dam. *Indian Journal of Fisheries*, 2(1): 1-3.
- Johansson, R., 2003. Case study methodology. *Methodologies in Housing Research, Stockholm*.
- Justo, R., De Castro, J.O. and Maydeu-Olivares, A., 2008. Indicators of entrepreneurship activity: Some methodological contributions. *International Journal of Entrepreneurship and Small Business*, 6(4): 604-621.
- Kaplinsky, R. and Morris, M., 2001. *A handbook for value chain research*, Ottawa: IDRC, 113.
- Kumar, A., Katiha, P.K. and Joshi, P.K., 2003. A profile of people, technologies and policies in fisheries sector in India. *Proceedings Series*, 170.
- Lahiri, D., 2006. Market of Fish Seeds and Fingerlings in West Bengal, India-An Empirical Analysis.
- Lieblich, A., Tuval-Mashiach, R. and Zilber, T., 1998. *Narrative research: Reading, analysis, and interpretation*, Sage, 47
- Little, D.C., Niertes-Satapornvanit, A. and Barman, B.K., 8.3 Seed networks and entrepreneurship.
- MANOCHA, M.S., 2012. Innovation and Entrepreneurship in Today's Scenario. *International Journal of Marketing, Financial Services & Management Research*, 1(8).
- Mattsson, L.G., 2003, September. Understanding Market Dynamics. Potential Contributions to Market (ing) Studies from Actor-Network Theory. In *19th IMP Conference*.
- Meyer, C.B., 2001. A case in case study methodology. *Field methods*, 13(4): 329-352.
- Milwain, G., Little, D.C., Kundu, N. and Immink, A.J., 2002. Overview of fish seed production and distribution in West Bengal, India. *Stirling*, UK: Institute of Aquaculture, University of Sterling and Kolkata, India: Institute of Wetland Management and Ecological Design (Working Article).
- Nandeesh, M.C., 2007. Asian experience on farmer's innovation in freshwater fish seed production and nursing and the role of women.
- Nasr-Allah, A.M., Dickson, M.W., Al-Kenawy, D.A., Fathi, M., El-Naggar, G.O., Azazy, G.E., Grana, Y.S., Diab, A.M., Belton, B., Bush, S.R. and Farnworth, C.R., 2014. Value

- chain analysis of Egyptian fish seed production. In *4th Conference of Central Laboratory for Aquaculture Research* , 351-72.
- Obschonka, M., Silbereisen, R.K. and Schmitt-Rodermund, E., 2010. Entrepreneurial intention as developmental outcome. *Journal of Vocational Behavior*, 77(1): 63-72
- O'Donnell, A., Gilmore, A., Cummins, D. and Carson, D., 2001. The network construct in entrepreneurship research: a review and critique. *Management Decision*, 39(9): 749-760.
- Polkinghorne, D.E., 1995. Narrative configuration in qualitative analysis. *International journal of qualitative studies in education*, 8(1), pp.5-23.
- Rahaman, S.M., Bera, B.K. and Ananth, G.S., 2013. A study on problems and constraints in production and marketing of fish in West Bengal. *Journal of Crop and Weed*, 9(1): 110-113.
- Raina, A.K. and Sharma, N.K., 2013. The relationship among emotional intelligence, transformational leadership and effectiveness: An empirical assessment of entrepreneurs in Rajasthan. *European Journal of Business and Management*, 5(6): 59-68.
- Rauch, A., Wiklund, J., Lumpkin, G.T. and Frese, M., 2009. Entrepreneurial orientation and business performance: An assessment of past research and suggestions for the future. *Entrepreneurship theory and practice*, 33(3): 761-787.
- Rezaei, J., Ortt, R. and Scholten, V., 2012. Measuring entrepreneurship: Expert-based vs. data-based methodologies. *Expert Systems with Applications*, 39(4): 4063-4074.
- Roy, D.D., 2009. Self-Efficacy of Agricultural Farmers: A Case Study. *Journal of the Indian Academy of Applied Psychology*, 35(2): 323-293.
- Santhi, N. and Kumar, S.R., 2011. Entrepreneurship Challenges and Opportunities in India. *Bonfring International Journal of Industrial Engineering and Management Science*, 1:14.
- Sarbin, T.R., 1986. *Narrative psychology: The storied nature of human conduct*. Praeger Publishers/Greenwood Publishing Group.

- Sarker, M.A., Chowdhury, A.H. and Itohara, Y., 2006. Entrepreneurships barriers of pond fish culture in Bangladesh: A case study from mymensingh district.
- Schmitt-Rodermund, E., 2004. Pathways to successful entrepreneurship: Parenting, personality, early entrepreneurial competence, and interests. *Journal of Vocational Behavior*, 65(3): 498-518.
- Shivakumar, M., Bala, S., Rajanna, C. and Naveenkumar, B.T., 2013. Economics of seed rearing and farming of carps. *Labour*, 1: 8-750.
- Stake, R.E., 1995. *The art of case study research*. Sage.
- Sutter, R. and Stough, R.R., 2009. Measuring entrepreneurship and knowledge capital: Metropolitan economic efficiency in the USA 1. *Entrepreneurship and Regional Development*, 21(4): 351-373.
- Swanborn, P., 2010. *Case study research: what, why and how?*. Sage.
- Tikkanen, J. and Tuominen, P., 2000. Studying change and dynamics in business relationships—the processual case study approach. In *16th Annual IMP Conference. Bath, United Kingdom*.
- Touré-Tillery, M. and Fishbach, A., 2014. How to measure motivation: A guide for the experimental social psychologist. *Social and Personality Psychology Compass*, 8(7): 328-341.
- Varshney, P.K., Mitra, S.D., Upadhyay, R.K. and Chowdhury, D.K., 1990. Fish seed production under controlled hatchery system: a cottage industry. *Journal of the Indian Fisheries Association*, 20: 11-14.
- Vora, M.B., 2005. *A study of Corporate Governance Practices of Corporate Sector in India* (Doctoral dissertation, Saurashtra University).
- Williams, M.J., Porter, M., Choo, P.S., Kusakabe, K., Vuki, V., Gopal, N. and Bondad-Reantaso, M., 2012. Gender in aquaculture and fisheries: Moving the agenda forward. *Asian Fisheries Science* 5, 25.

Website References:

http://dahd.nic.in/sites/default/files/Animal%20Husbandry%20English%202014-15%20%201_0.pdf

<http://www.wbfisheries.gov.in/wbfisheries/do/Forwordlink?val=32>

<http://wbfisheries.gov.in/wbfisheries/do/ViewSchemePDF>

<http://www.fao.org/docrep/field/003/AC182E/AC182E01.htm>

Interview schedule for market operators/Agents/Secretary or members of market committee

1. Structure of fish seed production and marketing

Respondent Name:

Contact address:

Role in the market:

Mobile No:

Basic idea about Naihati:

Contents	Nos.		Contents	Nos.
School			Pond	
College			Unused waterbody	
Road			Fish market	
Electricity			Fish seed market	
Health centre			Fish feed/fertilizer/aerator shop	

Actors of the market:

Name of market	Address	Sellers	Customers		Operational time	Year of establishment	Governing body/Ownership	Secretary	Role of DoF
			Peak season (.....)	Lean Season (.....)					

Species being sold		1.		2.		3.		4.		5.	
Size											
Quantity(No.s/Kg)											
Quantity being sold/Day	Peak Season										
	Lean Season										
Unit price(Price/Kg)	Peak season										
	Lean Season										
Source of arrival											
Type of packaging											
Destination											
Means of transportation											
No of buyers/Day	Peak season										
	Lean Season										

Infrastructure

Sr. No.	Infrastructure	Condition					
		Not at all	Very Poor	Poor	Moderate	Good	Very good
1.	Water source						
2.	Electricity supply						
3.	Sanitation/Drainage system						
4.	Cemented floor						
5.	Toilet facilities						
6.	Accommodation for buyers						
7.	Transportation facilities						

Condition of market

Condition for entry into market	Free entry/Need licence
Market competitiveness	Not at all/poor/moderate/strong/very strong
Producer's activity in market	Compelled to sell/not compelled to sell/does not have any activity in market
Marketing channel	Very short/short/medium/long/very long
Quality of seeds	Judged by eye inspection/Others
Producer's bargaining power	Low/moderate/high
Prospects of seeds	High demand high price/low demand low price/high demand low price/low demand high price
Mechanism of market information	Organized market intelligence/Unorganized market intelligence
Price discovery	Based on demand/Others
Scope of development	Yes/No

Seed producers/Hatchery owners

No. of aquaculture related villages in Naihati									
Village-1	Flasherspopulation(...)								
	Migrants-	Religion			Caste				Sex
		Hindu-	Muslim-	Others-	General-	SC-	ST-	OBC-	Male/Female
Village-2									
Village-3									
Village-4									
Village-5									

Villages	Total No. of hatcheries	Registered	Hatchery owners who have renewed their cards	List of the names
Village-1				
Village-2				
Village-3				

Village-4				
Village-5				

Occupation status

Occupation:	Vill-1	Vill-2	Vill-3	Vill-4	Village-5
Hatchery owner/Golder					
Full time/part time labour					
Dallal/Agent					
People involved in allied activities-Hatchery making, water ,aerator, feed suppliers.					

What are the different factors affecting cost of seed?	
What is the role of women in the market?	
Brief description of the history of the market	
Brief description of the roles of actors in the market	
Significant changes of the market till now	
Does the market sell fish seeds through online?	

Constraints

Constraints	Not at all	Poor	Moderate	Strong	Very strong
High transportation cost					
High commission charge					
Improper weighing					
Improper payment					
Uncertainty and high fluctuation in market price					
Lack of proper packaging facility					
Lack of proper supply					
Lack of marketing information system					
Lack of sufficient no. of buyers					
No availability of small marketable quantity selling					
Malpractices prevailing in market					
Others constraints?...If any					

Interview schedule for fish seed producers or hatchery owners

Respondent No. :

Interview Date:

Respondent Name:

Name of enterprise:

Address and contact details:

Socio cultural, economic profile

Sl no.	Head of household and family members	Sex	Age	Education	Occupation		Annual income	
					Primary	Secondary	Primary	Secondary

Religion	Language	Community	House Type	House area:
Hindu/Muslim	Bengali/ Hindi	General/ SC/ST/OBC	1 storied/2storied/3 storied	

1.Business performance

Land/Pond/tank/hatchery area available:

	Total land area	pond/Water spread area	Area under aquaculture	No. of pond/tank/hatchery		
Own area				Nursery	Rearing	Brooders
Leased area						

Materials and machinery used:

Content	Brand\Material	Amount/Month	Cost/Month
Fish Feed			
Fertilizer			
Medicine			
Aerator			
Feeding device			
Water pump set			
Materials for construction and repairing of hatchery			
Electricity			
Utensils			
Computer	Yes/No		
Internet	Yes/No		
Advertising	Yes/No		

Species being produced		1.	2.	3.	4.	5.
Source of brooders						
(Price/Production cost) of brooders used for producing 1 Kg. of fish seed						
Marketable Size						
Quantity(No.s/Kg)						
Cost of production/Kg	Feed/Kg-					
	Medicine/Kg-					
	Fertilizer/kg-					
Quantity being sold/Month	Peak Season					
	Lean Season					
Unit price(Price/Kg)	Peak season					
	Lean Season					
Type of packaging						
Cost of packaging/Kg						
Destination						
Means of transportation						
Cost of transportation /Kg						

Profit/Kg	Peak season										
	Lean Season										

Entrepreneurial characteristics

When did you start this business?	
From where do you collect brooders?	
Breeding method?	Natural/Artificial
What has been done to increase productivity?	
What is the reason behind shifting from IMC to catfish?	
Have ever experimented with new varieties of species?	
Are you able to satisfy the needs of your customers?	
Who are your competitors?	
What improvements can you make to do even better	
How many staffs you have?	Permanent
	Temporary
Briefly describe your experience	

Entrepreneurs were asked these questions. Based on their answers 3 categories were made. And later according to their answers they were put in a particular category.

Goal Orientation

	High	Medium	Low
What is your vision?	- Prevention of breeding of banned species - To expand business across the country - Farming hilsha in commercial scale - To discover more in terms of technique and species	- Qualitative increase of seeds - Both qualitative and quantitative increase of seeds - Production of different varieties of species	Quantitative increase of seeds Earning more money
What is the best road map to	Skill development, awareness building	Meeting among farmers, group discussion	Support from financial institution

reach your vision?			
What are the problems you are looking to solve?	No direct contact with buyers Decrease in market of IMC	Syndicate system	Less institutional support Relatively less earning during lean season Political Disturbance, local goons
Measures taken to overcome risk/problems	Being updated using internet	Training Farm visit	Precaution while working Infrastructure development

Leadership

Almost always true-3

Occasionally true-2

Almost never true-1

Questions	Almost always true	Occasionally true	Almost never true
I always retain the final decision making authority within my hatchery			
I always try to include one or more labourer in determining what to do and how to do it. However I maintain the final decision making authority.			
I and my labourers always vote whenever a major decision has to be made.			
I do not consider the suggestions made by my co workers .			
For a major decision to pass, it must have the approval of each individual and the majority.			
I tell my labourers what has to be done and how to do it			
I tell my labourers what has to be done and how to do it			

I tell my labourers what has to be done and how to do it			
When things go wrong and I need to create a strategy to keep the process running on schedule, I call a meeting to get advice.			
I allow my labourers to participate in decision making process			
My workers know more about their work than me, I allow them to carry out the decision to do the work.			
When something goes wrong, I tell my employee that a procedure is not working correctly and I establish a new one.			

Adaptability

	High	Medium	Low
What is the reason behind shifting from IMC to catfish?	Working on experimental basis to grow and sustain fresh variety of IMC seeds	Breeding procedure requires less time	More profit
Are you comfortable with this shift	Yes	Managed to cope up with it	No
Experimentation with new varieties of species	Yes	Trying	No

Need for achievement

Progressive changes of this sector Ability to take risk Role model	High	
Limited Resource Experience	Average	
Suggestions from friends or fellow farmers Family background	Low	

Innovativeness

	High	Medium	Low
--	------	--------	-----

I try new idea and new approaches to problem			
I take things or situations apart to find a new use for existing method and existing equipment			
Among my co workers, I am usually the 1st person to try out a new idea or method			
I plan on developing contacts with experts in my field			

Flexibility

	High	Medium	Low
In case of severe flood, any how I try to continue production			
In crisis of any chemical/ instrument I do not stop my production			
In crisis of any chemical/ instrument I do not stop my production			
I consider buyers suggestion/ complains towards the seeds sold by me			

Autonomy

Almost always true-3

Occasionally true-2

Almost never true-1

I always retain the final decision making authority within my family	3	2	1
I and my family members always vote whenever a major decision has to be made.			
I do not consider the suggestions made by my family members			
I allow all my family members to participate in decision making process			
My family members helps me in my hatchery			
I allow the women of my family to do hatchery related works			
I discuss with elders before starting a new venture			

Need for self-empowerment

Almost always true-3

Occasionally true-2

Almost never true-1

	3	2	1
I like to give myself a challenge when I try new business			
I am fairly at ease in difficult situations			
I am always worry about what others will think before doing something			
I want to build something that will be recognized publicly			
When faced with difficulties, I look for alternative solutions			
I am capable of imagining how we can make things work			
I shoot for excellence in everything I do			
According to me, we somehow make our own luck			
I try to be the first or the best in my area of competency			
For me, taking risks is like buying a lottery ticket: it's a question of chance			
I am capable of seeing many solutions to a problem			
I always try to learn lessons from my failure			
For me, everything is possible if I believe I can do it			
I prefer using the good old ways of doing thing			
Success is mostly luck			
A certain level of stress stimulates me			
It is easy for me to motivate others to work with me			
I often feel stuck by a difficult situation			
After a failure, I am able to pick myself up and start over			
To be satisfied with myself, I take on easy goals.			
I like to lead others			
I always try to take calculated risks			
There is a time for thought but action is more important			
I am not afraid to take on initiatives			
I prefer being my own boss			
I don't consider myself more ambitious than others			
I always give the best of myself in everything I do			
I manage my stress well in ambiguous and uncertain situations			
I try new idea and new approaches to problem			
I plan on developing contacts with experts in my field located in different companies or departments			
I comment at meetings on new ways of doing thing			

Innovations(If any)

Have you innovated any product or practice related to fish seed production? If any then type of innovation.-----

Problem faced that led to innovation:

Detail of innovation:

Specification of innovation:

- Economic advantage
 - Ease of use
 - Durability
 - Replicability
 - Uniqueness
-
- Since how long are you using the innovation?
 - How many people are using your innovation?
 - Is there any other important specification?
 - What did motivate you to innovate?



1. Rajendrapur fish seed market (Building made by DoF)



2. Fish seed(Pangash) hatchery: Glass Jar hatchery& Chinese hatchery (Innovation)



3. Advanced Fingerlings



4. Seller (Middleman) selling fingerlings of Magur



5. Fish feed (boiled pea)



6. Interconnected carp seed hatchery



7. Fingerling collection



8. Fish seed selling in market



9. Scattering of boiled pea



10. Award achieved by Mr. Bablu Majumder



11. Fish seed seller while interviewing



12. Fingerlings kept in aluminum vessel