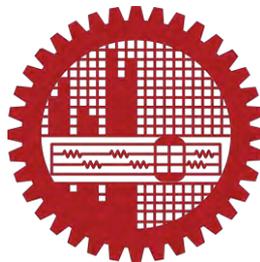


# **STRATEGIC PLANNING FOR ENRICHMENT OF OFFSHORE SOFTWARE DEVELOPMENT CENTRES IN BANGLADESH**

A Thesis  
submitted in partial fulfillment of the requirement for the degree of Master of Science in  
Management of Technology

*By*

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**June 2015**

# RECOMMENDATION

The thesis titled ‘Strategic Planning for Enrichment of Offshore Software Development Centres in Bangladesh’ submitted by Md. Abu Nahee Ibna Zahid, Roll No. 0413292078, Session- April, 2013, has been accepted as satisfactory in partial fulfillment of the degree of Master of Science in Management of Technology (MoT).

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I, hereby declared that this thesis or any part of it has not been submitted elsewhere for the award of any degree or diploma.

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## ABSTRACT

Software companies around the world have accepted offshore development strategy for last two decades. Many global players like, Samsung, Vizrt, Cefalo, etc. have established their development centers in Bangladesh in recent times for facilitating outsourcing activities. The objective of this research was to get a practical view on sustainable growth of offshore software development centers in Bangladesh. This research gives a guide line about major constraints of software development industry as well as how to overcome these to make ICT industry sustainable in the global market. In this research, quantitative and qualitative data were obtained by arranging face to face interviews from management personnel of offshore development center and the authority and opinion leader of the industry. SWOT analysis was done to understand the position of the industry in Bangladesh. Collected data were analyzed using Analytic Hierarchy Process (AHP), a decision making tool. According to SWOT analysis it was found, Bangladesh has good chance to promote business in offshore software development centers. Two main constraints were found, lack of adequate resources and lack of professional association. In addition, to resolve the constraints mainly three possible solutions were addressed, need proper industry attachment with academic institutes, need to set up IT parks with necessary facilities and need effective associations among the organizations.

Government has already taken initiative to set up IT parks by establishing Bangladesh High Tech Park Authority, BHTPA. Moreover, Government should take initiative to update our education. In addition industry attachment will help to develop professionalism. Findings of the research work match with the ICT policies taken by Bangladesh Government. However respective authorities must be very dynamic to be successful. By quick implementation of Government steps, it is possible to increase offshore development centers.

# LIST OF ABBREVIATIONS

AHP	Analytic Hierarchy Process
ATM	Automated Teller Machine
BASIS	Bangladesh Association of Software and Information Services
BPM	Business Process Management
BPO	Business Process Outsourcing
CMMi	Capability Maturity Model Integration
FGD	Focus Group Discussion
GDP	Gross Domestic Product
IBM	International Business Machines
ICT	Information and Communications Technology
ISO	International Organization for Standardization
ISP	Internet Service Provider
IT	Information Technology
ITeS	IT Enabled Services
KII	Key Information Interview
KPO	Knowledge Process Outsourcing
MNC	Multinational Corporation
ODC	Offshore Development Center
PC	Personal Computer
POS	Point-of-Sale
SLA	Service Level Agreement
SWOT	Strength Weaknesses Opportunity and Threat

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# CHAPTER 1

## INTRODUCTION

### 1.1 Background

Offshore outsourcing means organizations at low wage countries provide software development services to their offshore clients in developed countries based on the agreement, minimizing cost remarkably [1]. Software companies around the world have accepted this business strategy for last two decades [2]. Many global players like, Samsung, Vizrt, Cefalo, etc. have established their development centres in Bangladesh in recent times for facilitating outsourcing activities [3].

In Bangladesh both short and long term steps have been adopted by the government to enhance the export of ICT products and services [4]. Special facilities and venture capital are offered for ‘Thrust Sectors’ including agro-based industries, artificial flower-making, computer software and information technology, electronics, frozen food, floriculture, gift items, infrastructure, jute goods, leather, oil and gas, sericulture and silk industry, stuffed toys, textiles and tourism [5].

### 1.2 Problem Definition

IT sector has increased its contribution to our neighbor country, India's GDP from 1.2% in 1998 to 7.5% in 2012. Companies like, Infosys, Wipro, IBM, Intel, Tata Consultancy Services, Oracle and more on, are promoting this sector with aggregated revenues of US\$100 billion in 2012 [6].

According to Bangladesh Association of Software and Information Services (BASIS), over 800 registered ICT companies generated total revenues of approximately \$250 million in 2012 [4].

Compare to India, our business growth is not satisfactory. Because of cheap labor and talented manpower Bangladesh should create its own position in the global market of offshore outsourcing.

### **1.3 Thesis Objectives**

The objectives of this research are as follows:

- To find out the growth, necessary financial, technical and management strength in the ICT industry
- To find out major constraints, like, professionalism, resources, infrastructures, branding etc., for promoting offshore development centre
- To find out an acceptable and achievable model for reducing constraints

### **1.4 Scope**

More than 800 companies are operating in ICT industry of Bangladesh. Among the companies some are operating in local market, some are operating with overseas clients as well as some are offshore companies. In this research I tried to focus on offshore software development centres and their business domain.

### **1.5 Thesis outline**

Chapter two starts with the theoretical concept and provides an idea of relevant terminology, relating to outsourcing, offshoring and its features. It will also focus on the history of Information and Telecommunication sector study in Bangladesh.

Chapter three deals with the research process. This will be followed by the research strategy, questionnaire, sample selection, method of collecting data.

Chapter four starts with data sources, methodology, and data analysis of first phase interviews. This will be followed by the second phase data sources and analysis. Finally summary of total research will be presented.

Chapter five deals with the findings of entire research and recommendations.

# CHAPTER 2

## LITERATURE REVIEW

### 2.1 Offshore Software Development Centre

Offshore development centre (ODC) is one of the business models. A provision of offshore programming is undertaken by it.

A dedicated team of programmers and developers who have been selected to complement the customer's skill set and culture make up an offshore software development centre (OSDC). This customized team works exclusively on behalf of the customer at the service provider's site or their own captive site in a secure environment. The infrastructure and security is designed to meet the customer's specific standards and specifications. It may include co-branding also. In fact, the closer the synergy between an organization's own IT/development department & an offshore development centre the better. An offshore software development centres has the ultimate goal to be a seamless extension of an organization's IT department [7].

#### 2.1.1 Offshore Outsourcing

Transferring various operations to outside suppliers rather than completing internally is known as outsourcing. It is done in both domestic and overseas markets. There is always a third party involved in outsourcing. Offshore outsourcing is a combination of offshoring and outsourcing. It always involves a foreign location in contrast to local outsourcing operations [4].

#### 2.1.2 Reasons of Offshore Development Centre

There are several reasons why a company might outsource. Reasons for outsourcing and offshoring include:

- Expenses of IT professionals are significantly lower than those in the western developed countries
- It is easy to get direct access to skilled diversified set of professionals
- Companies concentrate on innovation, quality and continuous improvement

- ODC ensures minimum error rate and rework by operating at higher levels of efficiency, and reliability
- The ready infrastructure and manpower provided by an ODC is used to start any project. This certainly shortens project start-up time.
- As work allocation happens at a different location and task accomplishment happens at different location, the time taken for development reduces
- Involvement of experienced professionals and teams greatly ensures the success. This provides significant advantage during service level agreements (SLA).
- Additional or new infrastructure is not required to complete projects
- As expert professionals are involved, no need of much training
- Virtual expansion of high profile technical team [8]

### **2.1.3 Risks and Criticism of Offshore Development Centre**

Especially from political point of view offshoring and outsourcing have both been criticized heavily. Offshoring is often blamed by politicians and laid-off workers for ‘snatching jobs’. In contrast, most economists agree that offshoring saves costs for business firms & benefits consumers and shareholders. However, offshoring poses some risks, for example project failure due to poor communication, civil or political turmoil hampering service delivery, arbitrary changes in economic policy of governments forcing unnecessary restrictions on MNCs, and poor infrastructure in the developing country affecting quality or timeliness.

Outsourcing & offshoring do not have the same disadvantages though their benefits overlap to a great extent. Politicians don't criticize outsourcing within the country for loss of jobs. Vendor's lack of familiarity with the client's business mainly causes risks of outsourcing. Lack of alignment of long-term business objectives of the client and the vendor is another risk.

However, as today's organizations are trying to cut costs and obtain higher productivity from skilled manpower, offshoring projects are ideal choice [9].

## **2.2 History of ICT Sector**

An IBM mainframe 1620 series computer was the first computer in Bangladesh (then East Pakistan) was installed in 1964 at the Dhaka centre of the Pakistan Atomic Energy Commission (later the Bangladesh Atomic Energy Commission). In 1979, a computer centre was established at Bangladesh University of Engineering and Technology (BUET). Later it was renamed Department of Computer Science & Engineering. The department has been playing a pivotal role in Bangladeshi IT education since 1979. With the introduction of personal computers, the use of computers increased manifold in the late 1980s. Several individuals jointly invented the first Bengali script in computers in 1985. Internet was introduced and Bangladesh started to export software in 1995.

In 1983, National Computer Committee was established by the Ministry of Science and Technology to innovate the required policies. It was also the committee's responsibility to introduce programs for expanding and promoting this sector. National Computer Board replaced the committee in 1988. The board was reformed and reconstituted as the Bangladesh Computer Council by the ministry in 1990 to monitor computer- and IT-related works in the country. In 1997 the Bangladesh Association of Software and Information Services (BASIS) was established as the national trade body for software and IT service industry [10].

### **2.2.1 ICT Industry in Bangladesh**

The ICT industry has grown steadily in recent years at 20 to 30 percent per year according to the BASIS 2012 survey. Approximately \$250 million of revenues were generated by over 800 registered ICT firms. Among them customized application development and maintenance is offered by more than 75 percent, IT enabled services are offered by 50 percent, E-commerce/Web services are offered by 45 percent firms. Domestic market is the sole target of 60 percent companies according to the survey. It is estimated by the International Trade Centre that product & services are exported to international markets (US 68 percent, Britain 32 percent, and the Netherlands 9 percent) by approximately 200 farms. Moreover thousands of independent freelancers offer their services at online market places. More than 80 public and private universities are producing 5,500 ICT graduates per annum [4].

In a study in 2007–08, Japan International Cooperation Agency ranked Bangladesh first in software and IT services competitiveness and third in competencies among Asian countries, just after India and China [10]. The World Bank projected triple digit growth for Bangladesh in IT services and software exports in 2008. Gartner Inc., an American information technology research and advisory firm, listed Bangladesh as one of the top 30 Countries for Offshore Services in 2010–2011. The Internet penetration has also grown to 21.27 percent in 2012, which was 3.2 percent three years before. By 2021, the government expects the IT sector to add 7.28 percent to GDP [10].

IT sector has increased its contribution to our neighbor country, India's GDP from 1.2% in 1998 to 7.5% in 2012. Growth of the ICT sector in Bangladesh is not acceptable compared to India. Indian ICT policies and their IT hubs can be a role model for Bangladesh.

### **2.2.2 IT Firms in Bangladesh**

The major IT firms operating business in Bangladesh are as follows:

**LEADS Corporation Limited:** Since 1992, LEADS Corporation Limited has been supporting clients nationwide in managing the evolving role of information technology in business. Their services and solutions include custom application software development, network engineering, plastic card personalization, and delivery installation of PCs, servers, POS, ATMs [11].

**Agni Systems Limited:** Agni Systems Ltd. started ISP service in 1995. Initially only dial-up service was offered and later fiber to the premises (FTTP) and wireless broadband was added [12].

**Akij Online Ltd:** Akij Online Ltd. has been launched with a vision to render internet and application services, medical transcription, web hosting, e-commerce, call centre etc. being the largest ISP in Bangladesh [13].

**BASE Limited:** BASE Limited is a premier information and communication technology services company that provides real values to businesses and individuals from digital technology. Established in 1999, BASE offers ICT products, as well as

ICT services in areas such as business application development, IT education/training, and system integration and maintenance [14].

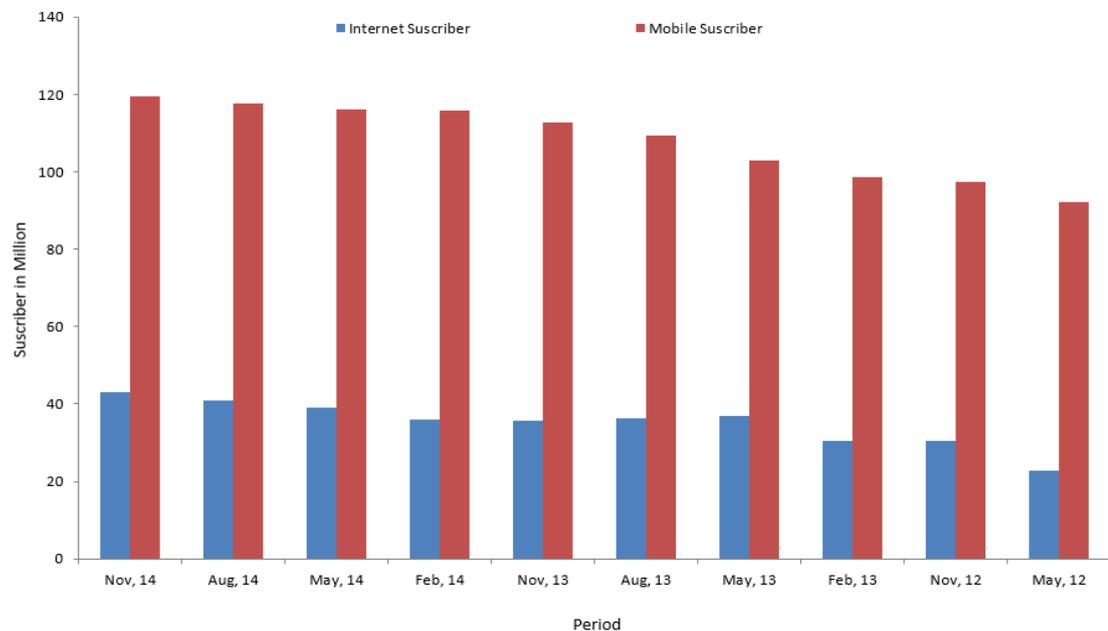
**dataedge limited:** Since its inception data edge limited (dataedge) has been a leading technology consulting firm in Bangladesh. Its ultimate goal is to understand, design, develop and/or outsource, and implement innovative technology solutions [15].

**DataSoft Systems (BD) Limited:** DataSoft has been a CMMi level 5 in progress, ISO 9001:2008 certified leading software product and services company in Bangladesh. Since 1998, DataSoft has successful track record of delivering innovative and cost-effective technical services to customers in both Corporate and public sectors undertakings [16].

**GraphicPeople:** GraphicPeople is an offshore production studio providing digital and print production services to some of the world’s largest brands and advertising agencies [17].

### 2.3 Telecommunication Industry in Bangladesh

In the last decade, Bangladesh saw a robust growth in its telecommunication Industry. Bangladesh adopted cellular technology first in South Asia in 1993[10].



Source: BTRC

Figure 2.1: Growth in Mobile and Internet Users in recent years [18] [19]

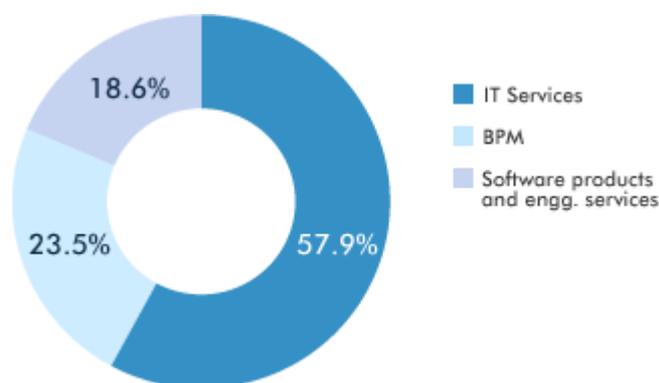
In figure 2.1, increase rate of telecommunication subscriber in Bangladesh is shown. During May 2012, 92.12 million people were familiar with mobile phone and 22.83 million people used internet. Hence in November 2014, the scenario was completely changed. Mobile phone and internet was used by 119.623 and 42.99 million people respectively [18] [19].

## 2.4 Information and Communication Technology (ICT) in India

India is the world's largest sourcing destination for the information technology (IT) industry, accounting for approximately 52 per cent of the US\$ 124-130 billion market [20]. The industry employs about 10 million Indians and continues to contribute significantly to the social and economic transformation in the country.

The IT industry has not only transformed India's image on the global platform, but has also fuelled economic growth by energizing the higher education sector especially in engineering and computer science. India's cost competitiveness in providing IT services, which is approximately 3-4 times cheaper than the US, continues to be its unique selling proposition (USP) in the global sourcing market [20].

The Indian IT and ITeS industry is divided into four major segments – IT services, business process management (BPM), software products and engineering services, and hardware [20].



Source: India Brand Equity Foundation

Figure 2.2: IT & ITeS Industry in India [20]

In figure 2.2, a relative comparison on service providers in Indian ICT sector is shown. Here it is found that, IT services are domination the industry.

Initiatives taken by Indian Government to encourage foreign investment in ICT sector are:

- The Public Private Partnership and several government initiatives have helped to curtail the gap between Research & Development and Infrastructure segments in ICT industry.
- 100% FDI is allowed in Indian IT sector under automatic route. The important fiscal incentives offered by the Indian government in this sector are Software Technology Parks (STP), Export Oriented Units (EOUs) and Special Economic Zones (SEZ).
- In recent time, R&D promotion has been encouraged by the Indian government in very aggressive and efficient way [21].

Recently, the Indian Cabinet has given approval to National Policy on Information Technology 2012. The objectives of the policy includes:

- To transform India into a global hub for the expansion of language technologies.
- To develop a pool of 10 million skilled manpower in the Indian ICT sector.
- To achieve significant market share in global technologies and services.
- To offer fiscal benefits to foreign investors and Small Medium Enterprises (SMEs).
- To promote adoption of ICTs in strategic and economic sectors to enhance the productivity and competitiveness of ICT [21].

To attract investors in ICT sector Indian Government has adopted followings:

- The constant rise in investment by Small and Medium Enterprises (SMEs) in the ICT Sector of India demonstrates the increase in the maturity levels in Indian businesses.
- In the last one year, the data consumption by 3G users has increased drastically which demonstrates the constant rise in mobile data consumption in the country. This will help many foreign and domestic players to penetrate into the market to create their presence in the ICT sector of India.
- Information Technology Investment Regions with effective policy environment and superior infrastructure will be established in the country. As per new reforms, all the Indian states including Union Territories will be allowed to establish integrated township to encourage the growth of IT, BPO, KPO and sunrise industries through top class infrastructure.

- One of the key drivers attracting foreign investment in India is the Indian workforce which is less costly from economic point of view and their skills are at par with the international standards.
- A number of reputed information technology companies from across the world have opened their branches in India in order to outsource most of their technical work.
- One more growth driver of Indian ICT sector is its diversification in new verticals, pricing model and utilization rate. India is also one of the most sought after destination by the foreign organizations which are planning to offshore their back-office and IT functions [21].

## **2.5 IT hub in India**

Bangalore is one of the fastest growing cities in India and is known as the 'Information Technology (IT) capital of the country'. It has also been referred to as the 'Silicon Valley of India'. During the 1990s, Bangalore gained this reputation based on a concentration of firms specializing in research and development, electronics and software production.

The following initiatives of Government made Bangalore the first IT hub in India:

- One of its most important projects was the first technology park initiative in India, which was established in Bangalore. The industrial park Electronics City was founded in 1977 on 335 acres of land.
- In the 1980s a number of private enterprises specialized in software production and system integration, led by Wipro and Infosys, set up in the Electronics City.
- With most people having access to the Internet in one form or another, software developers, website development and web application development companies have benefited and profited tremendously [22].

Following reasons make Bangalore the IT hub of India:

- The state of Karnataka has the highest number of engineering colleges and hence graduates in India

- Companies here have a huge cost advantage – an English-speaking, highly-educated workforce is available at less than a quarter of the wages paid in the United States or Europe
- Bangalore has a large, growing job market. According to ASSOCHAM, IT and IT related jobs accounted 67 per cent of the total 21,000 new jobs in Bangalore in Q2 FY14.
- The government support encouraged many large multinational companies to set up business in Karnataka, which in turn spurred networking and partnerships [22].

Nearly 40 per cent of India's IT industry is concentrated in Bangalore. It has become the home to many global powerhouses. The abundance of big ideas, talent, and technology infrastructure provides a fertile base to start and run a successful business here. Due to the flourishing IT atmosphere in Bangalore, it has also become a breeding ground for start-ups. Over 40 per cent of Indian startups reside currently in Bangalore, making this the fourth largest technology cluster after the original Silicon Valley, Boston and London.

Some of the recent successful startups include online grocery store ZopNow, gaming company MadRat games and MagnetWorks Engineering, which provides real time dashboards, custom reports and analytic tools to small and medium businesses (SMBs). Today, Bangalore is home to numerous IT companies including HCL Technologies, Infosys, Mahindra Satyam, Tata Consultancy Services, Wipro Technologies, ITC Infotech India Ltd, Mphasis among many others.

Following the successful model of Bangalore, several other cities in India are now coming up as IT hubs in their own rights. These include Chennai, Hyderabad, Pune, Mumbai, Kolkata and Gurgaon. I think we can follow this model for Bangladesh [22].

## **2.6 Bangladesh Government Steps to Promote ICT Sector**

In line with its target to build digital Bangladesh as declared in the vision 2021 Government put thrust on the use of ICT for improving productivity, employment, governance, service delivery and development of IT industry. The steps taken by the Government are given below:

- Government has created Information and Communication Technology Division under the Ministry of Posts, Telecommunications and Information Technology.
- Under ICT division, four organizations viz. Bangladesh Hi-Tech Park Authority (BHTPA), ICT Directorate and Controller of Certifying Authority (CCA) are relentlessly working to scale up this priority sector.
- 4547 Union Digital Centre and 3544 computer lab have been established under ‘Vision 2021’.
- Internet connectivity up to all upazilla and union level is underway.
- About 10,000 youth has already been trained under different skill enhancement programs to meet the demand of IT/ITeS sectors [23].

Major Functions of BHTPA are:

- To promote, progress, support, create, manage, facilitate and develop Hi-Tech Park and Software Technology Parks
- To formulate policy and instructions for commercialization of ICT services at mass level
- To attract local and foreign investment
- Improving the competitiveness of local companies and increasing employment and exports
- To optimize maximum benefits for the investors in the park
- Some initiatives of BHTPA are, Kaliakoir Hi-Tech Park at Gazipur, Jessore Software Technology Park at Jessore, Software Technology Park at Kawran Bazar, Barandra Silicon City at Rajshahi, Sylhet Electronic City at Sylhet, Freelancer Institute at Natore [23]

Bangladesh received number of prestigious awards and recognition for its outstanding contribution towards development of ICT sector for improved life and livelihood of the citizen. The awards and recognitions reflect a convincing message to investors to invest in Bangladesh. Some achievements are listed below:

- South-South Cooperation Visionary Award 2014
- World Summit on Information Society (WSIS) 2014 Prize
- Global ICT Excellence Award 2014
- International Telecommunication Union (ITU) Membership [23]

### Investment Opportunities in Bangladeshi ICT Sector:

- 10 years tax holiday
- Exemption of income tax for expatriate professionals
- 10 years accelerated depreciation permissible
- Exemption from import duties
- 100% exemption of taxes for all exports
- Full repatriation of dividends or profits and capital permissible
- 100% equity allowed for FDI companies
- No cap on FDI limits
- Park will be treated as custom bonded area [23]

# **CHAPTER 3**

## **RESEARCH METHODS**

### **3.1 Research Process**

Research was done by the following process:

1. Sample survey was conducted by a structured questionnaire
2. Quantitative and qualitative data were collected by arranging face to face interviews. Interviewees were management personnel of offshore development centre and related organizations
3. Collected data were analyzed with AHP method
4. Common problems and possible solutions were addressed
5. Again feedback was taken on the proposed solution. Comments were gathered by Expert Judgment and Key Information Interview (KII), who are the authority and opinion leader of the industry
6. Rreceived feedback was analyzed with AHP method
7. Recommendation was given based on the final result of AHP method

### **3.2 Questionnaire**

Two questionnaires were used. Objective of the first phase questionnaire was to find out common challenges as well as possible solutions for promoting offshore development centres in Bangladesh. Objective of the second phase questionnaire was to find out a way to implement solutions addressed in first phase.

#### **3.2.1 First Phase Questionnaire**

First part of the first phase questionnaire dealt with the constraints. Major constraints were divided among three parts. Each of these three parts again divided into two parts. Four common constraints were addressed among all six parts. Priority was calculated among four constraints, like, lack of adequate resources, lack of professional association, lack of business environment and lack of strategically planning.

In the second part of the questionnaire interviewees were requested to give possible solutions based on the working environment and their practical experiences.



Figure 3.1: Steps of first phase questionnaire

In figure 3.1, steps of first phase questionnaire are shown sequentially. The questionnaire was divided into five parts:

- Concept of Offshore Software Development Centre
- Concept of AHP priorities
- Priority setting among categories and sub-categories
- Priority setting among constraints
- Possible solutions are addressed by the management personnel of the companies to resolve the constraints

Questionnaire for first phase is given in appendix A.1.

### **3.2.2 Second Phase Questionnaire**

First part of the second phase questionnaire deals with SWOT analysis on offshore software development centres. Experts have given their personal opinion.

To implement the solutions responsibilities go to the organizations, government and both. Six possible solutions found in first phase are addressed among the three responsible categories. In the second part of the questionnaire priorities are calculated among six solutions, like, need effective associations and resource switching among the organizations, need proper professional training and industry attachment with academic institutes, need to set up IT parks with stable power, high speed internet, easy communication facility etc., need uninterrupted working environment for branding country image to global market, need to implement a future oriented ICT

policy to promote business and encourage foreign and local investors by reducing tax, bureaucracy, improving loan facilities etc.

In the third part of the second phase questionnaire interviewees are requested to give their personal comment on the impact of offshore software development centres in Bangladesh.



Figure 3.2: Steps of second phase questionnaire

In figure 3.2, steps of second phase questionnaire are shown sequentially. The questionnaire is divided into seven parts:

- Concept of Offshore Software Development Centre
- Strength, Weakness, Opportunity and Threat analysis on offshore development centres
- Concept of AHP priorities
- Major constraints and possible solutions
- Priority setting among solution providers
- Priority setting among the solutions
- Personal opinion of interviewee are asked on this industry

Questionnaire for second phase is given in appendix A.2.

### 3.3 Data Collection

First phase data is collected from face to face interview of representatives of offshore software development companies. Responders have shared personal opinion based on their experience. Company's view may not reflect on representative's own idea. I have concentrated on total twenty three interviewees' judgments.

Second phase data is collected from expert IT professionals working in both government and private sectors. Also feedback is taken from professional associations. Total eleven personnel are interviewed for the second phase. SWOT analysis also done based on expert opinion.

Output of first phase is used for second phase calculation. Hence total thirty four persons' judgments are reflected on my final output.

### **3.4 Tools**

#### **3.4.1 Analytic Hierarchy Process (AHP)**

The analytic hierarchy process (AHP) is a structured technique for organizing and analyzing complex decisions, based on mathematics and psychology.

It was developed by Thomas L. Saaty in the 1970s and has been extensively studied and refined since then. It has particular application in group decision making and is used around the world in a wide variety of decision situations, in fields such as government, business, industry, healthcare, shipbuilding and education.

Rather than prescribing a "correct" decision, the AHP helps decision makers to find out the best suits their goal and their understanding of the problem. It provides a comprehensive and rational framework for structuring a decision problem, for representing and quantifying its elements, for relating those elements to overall goals, and for evaluating alternative solutions [24].

The procedure for using the AHP can be summarized as below,

- Modeling the problem as a hierarchy containing the decision goal, the alternatives for reaching it, and the criteria for evaluating the alternatives
- Establishing priorities among the elements of the hierarchy by making a series of judgments based on pair wise comparisons of the elements
- Synthesizing these judgments to yield a set of overall priorities for hierarchy
- Checking the consistency of the judgments
- Finding a final decision based on the results of this process [24]

### **3.4.2 SWOT Analysis**

A SWOT analysis is a structured planning method used to evaluate the strengths, weaknesses, opportunities and threats involved in a project or in a business venture. Identification of SWOTs is important because they can inform later steps in planning to achieve the objective.

**Strengths:** Characteristics of the business or project that give it an advantage over others.

**Weaknesses:** Characteristics that place the business or project at a disadvantage relative to others.

**Opportunities:** Elements that the project could exploit to its advantage.

**Threats:** Elements in the environment that could cause trouble for the business or project [25].

### **3.4.3 Focus Group Discussion (FGD)**

A focus group is a form of qualitative research in which a group of expertise is asked about their perceptions, opinions, beliefs, and attitudes [26].

### **3.4.4 Key Information Interviews (KII)**

Key information interviews are qualitative in-depth interviews to collect information from a wide range of people including community leaders and professionals [27].

# CHAPTER 4

## DATA ANALYSIS

### 4.1 First Phase Data Calculation

In section 3.2.1, questionnaire required for first phase data collection has been discussed. Using this questionnaire data have been obtained by arranging face to face interviews. Collected data are analyzed with Analytic Hierarchy Process (AHP).

#### 4.1.1 Data Source

Different offshore software development companies are operating their business in Bangladesh. Among these companies twenty three companies have been visited and taken feedbacks. Visited companies were, APROSOFT, BJIT, BRAIN STATION, CEFALO, DESME, DSI, ESCENIC, IMPL VISTA, JAXARA, M&H INFORMATICS, NEW HORIZONS, ORBITAX, SAMSUNG R&D, SDSL, SELISE, SERVICE ENGINE, SGCSOFT, SOFTWARE PEOPLE, THERAP and VIZRT.

#### 4.1.2 Data Analysis of First Part

Based on their feedback AHP calculation has been done. Step by step calculation for a company, Com<sub>2</sub>, is given in appendix B.1. Similar calculation is done for rest twenty two companies. Here the term 'Com' is used to represent 'Company'.

Result of the final calculation for first phase is given in table 4.1. In the table, AHP priorities are shown for twenty three samples. As well as total value is calculated.

Table 4.1: AHP calculation for first phase

No	Company	Adequate Resources	Professional Association	Business Environment	Strategically Planning
1	*Com_1	0.5295	0.2287	0.1421	0.0997
2	Com_2	0.4629	0.3026	0.1375	0.097
3	Com_3	0.5848	0.2087	0.1267	0.0798
4	Com_4	0.5938	0.2026	0.1257	0.0779
5	Com_5	0.5403	0.2295	0.1366	0.0936
6	Com_6	0.5275	0.2621	0.114	0.0964
7	Com_7	0.5316	0.221	0.1425	0.1049
8	Com_8	0.5206	0.2337	0.1428	0.1028
9	Com_9	0.5469	0.217	0.1429	0.0932
10	Com_10	0.5099	0.2112	0.1692	0.1097
11	Com_11	0.582	0.2387	0.1024	0.0768
12	Com_12	0.5407	0.2237	0.139	0.0966
13	Com_13	0.5747	0.186	0.1517	0.0876
14	Com_14	0.5333	0.254	0.1174	0.0954
15	Com_15	0.5104	0.2507	0.1358	0.103
16	Com_16	0.5295	0.2287	0.1421	0.0997
17	Com_17	0.5918	0.2516	0.1023	0.0543
18	Com_18	0.5551	0.211	0.1406	0.0933
19	Com_19	0.5451	0.2537	0.1073	0.0939
20	Com_20	0.6074	0.2204	0.1117	0.0606
21	Com_21	0.5403	0.2295	0.1366	0.0936
22	Com_22	0.5176	0.206	0.168	0.1084
23	Com_23	0.5316	0.221	0.1425	0.1049
Total		12.5073	5.2921	3.0774	2.1231

\*Com = Company

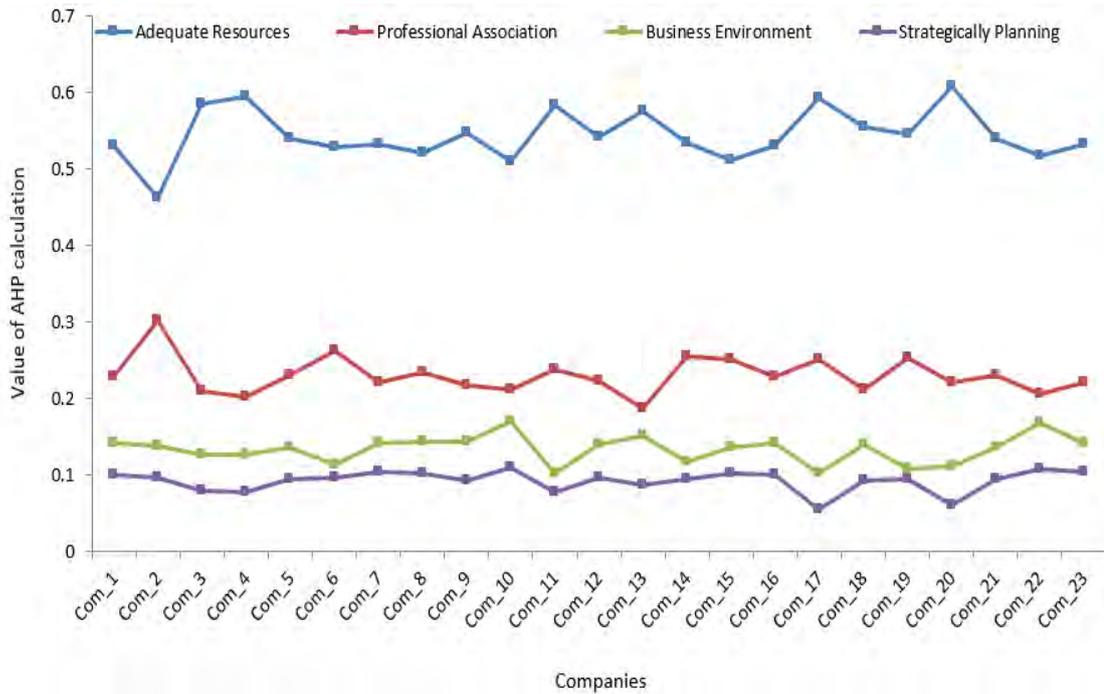


Figure 4.1: AHP calculation for first phase

In figure 4.1, the result of AHP priorities for twenty three companies are presented in a graph. Values for adequate resources, professional association, business environment and strategically planning are sequentially, 12.5073, 5.2921, 3.0774 and 2.1231. Different color is used for different categories.

Based on the first part of first phase data analysis, major constraints are given below sequentially:

1. Adequate Resources
2. Professional Association
3. Business Environment
4. Strategical Planning

#### 4.1.3 Analysis of Second Part

Interviewees are requested to advice on the solutions of the challenges they are facing. Depending on their solutions given in the second part of the first phase questionnaire, following are found:

1. Need effective associations and resource switching among the organizations
2. Need proper professional training and industry attachment with academic institutes

3. Set up IT parks with stable power, high speed internet, easy communication facility etc.
4. Uninterrupted working environment for branding country image to global market
5. Implement a future oriented ICT policy to promote business
6. Encourage foreign and local investors by reducing tax, bureaucracy, improving loan facilities etc.

## **4.2 Second Phase Data Calculation**

In section 3.2.2, questionnaire required for second phase data collection has been discussed. Interview was taken with this questionnaire. SWOT analysis and AHP calculation was done on their feedbacks.

### **4.2.1 Data Source**

Second phase data were collected from experienced professionals working in both government and private sectors. Also feedback was taken from professional associations working to promote ICT in Bangladesh. Eleven personnel were visited to share their knowledge. Visited expert persons were, BASIS representative, ICT ministry representatives, AVP of private bank's IT department, senior IT Professionals of government organizations, IT head of private company

### **4.2.2 SWOT Analysis in First Part**

Interviewees were requested to do SWOT analysis on offshore software development centres in Bangladesh. Based on their feedback following analysis is presented.

Strengths of offshore software development centres are:

- Low wages
- Inclination to IT sector
- Enough talented manpower
- Foreign investment is increasing

Weaknesses of offshore software development centres are:

- Less technical skill & quality

- Lack of high speed internet & too costly
- Insufficient power
- Lack of proper planning
- Lack of business communication skill

Opportunities of offshore software development centres are:

- Interest of private sector is increasing
- Benefit due to geo-location, i.e., time
- Skilled manpower working in different countries
- Economic growth

Threats of offshore software development centres are:

- Weak association with government policy
- Other emerging countries, like, Vietnam
- Bureaucracy
- Political instability
- No well defined business structure
- Brain drain
- Low brand image

#### **4.2.3 Data Analysis of Second Part**

Based on expert judgments AHP calculation is done. Step by step calculation for a senior IT expert, KII\_1, is given in appendix B.2. Similar calculation is done for rest ten experts. ‘KII’ term is used to indicate key information interview.

Result of the final calculation for second phase is given in table 4.2. In the table, AHP priorities are shown for eleven samples. As well as total value is calculated.

Table 4.2: AHP calculation for second phase

No	Expert	Need effective associations and resource switching among the organizations	Need proper professional training and industry attachment with academic institutes	Set up IT parks with stable power, high speed internet, easy communication facility etc.	Uninterrupted working environment for branding country image to global market	Implement a future oriented ICT policy to promote business	Encourage foreign and local investors by reducing tax, bureaucracy, improving loan facilities etc.
1	*KII_1	0.1977	0.2350	0.2475	0.2	0.068	0.0518
2	KII_2	0.2464	0.2468	0.2765	0.1137	0.0657	0.051
3	KII_3	0.2026	0.2302	0.2389	0.173	0.0868	0.0684
4	KII_4	0.3354	0.2554	0.152	0.0999	0.0905	0.0668
5	KII_5	0.2056	0.2386	0.2506	0.1868	0.0666	0.0519
6	KII_6	0.1948	0.2351	0.2488	0.2004	0.0683	0.0525
7	KII_7	0.251	0.2592	0.2534	0.1077	0.0742	0.0545
8	KII_8	0.2484	0.2437	0.2754	0.1172	0.0641	0.0512
9	KII_9	0.2318	0.2078	0.1650	0.1725	0.1235	0.0994
10	KII_10	0.2524	0.2576	0.2541	0.1099	0.0723	0.0538
11	KII_11	0.2464	0.2468	0.2765	0.1137	0.0657	0.0510
Total		2.6125	2.6562	2.6387	1.5948	0.8457	0.6523

\* KII = Key Information Interview

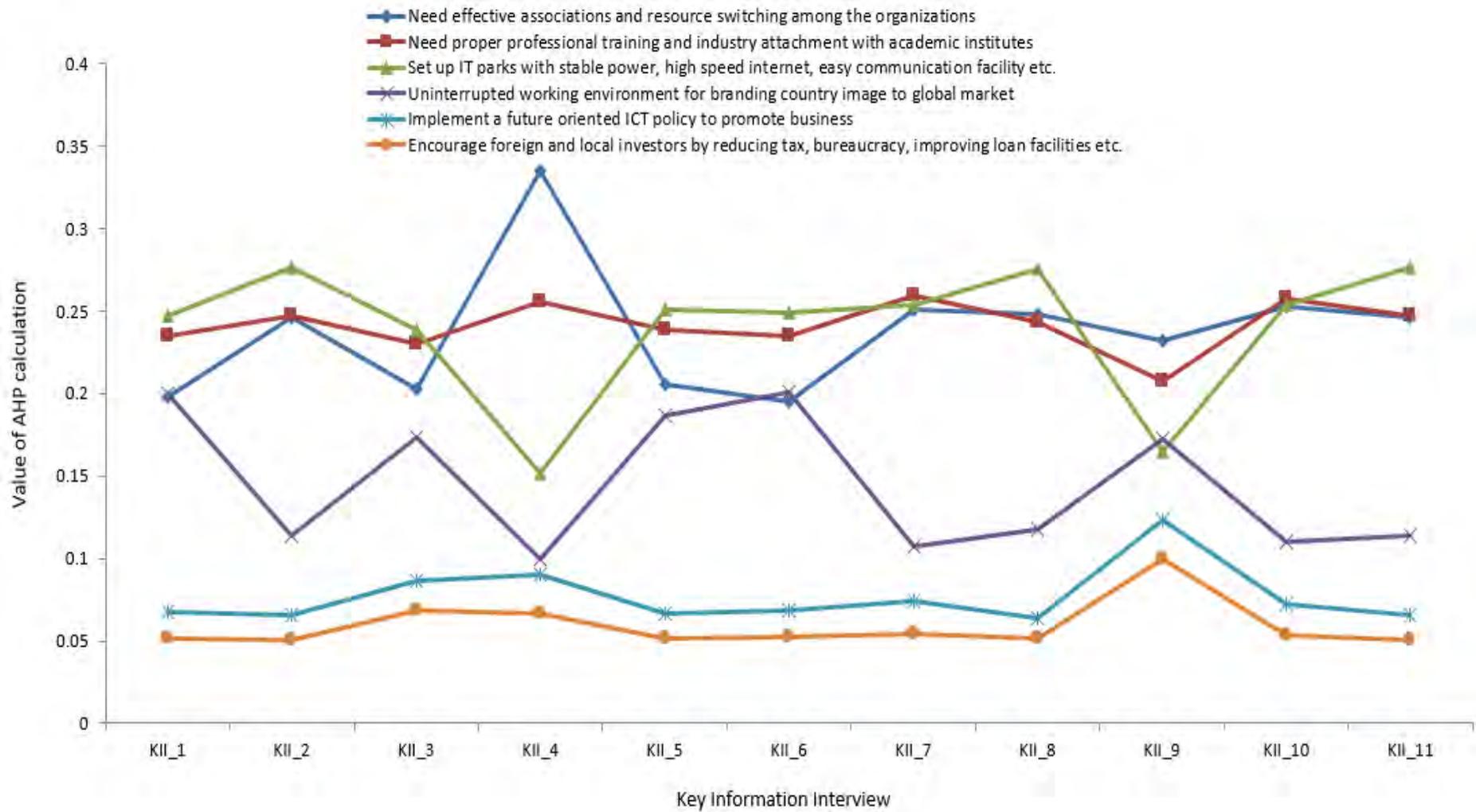


Figure 4.2: AHP calculation for second phase

In figure 4.2, the result of AHP priorities for eleven experts are presented in a graph. Values for effective associations, professional training, setting up IT parks, uninterrupted working environment, implementing ICT policy and encouraging foreign investors are sequentially, 2.6125, 2.6562, 2.6387, 1.5948, 0.8457 and 0.6523.

Based on the second part of second phase data analysis, possible solutions are given below sequentially:

1. Need proper professional training and industry attachment with academic institutes
2. Set up IT parks with stable power, high speed internet, easy communication facility etc.
3. Need effective associations and resource switching among the organizations
4. Uninterrupted working environment for branding country image to global market
5. Implement a future oriented ICT policy to promote business
6. Encourage foreign and local investors by reducing tax, bureaucracy, improving loan facilities etc.

### 4.3 Summary of Total Calculation

The first phase analysis was mainly focused on direct beneficiaries of the market. Here it has been tried to understand common challenges and possible solutions addressed by the beneficiary organizations. During second phase analysis, expert IT professionals have given their opinion on this specific business sector and achievability of the solutions found during first phase analysis.

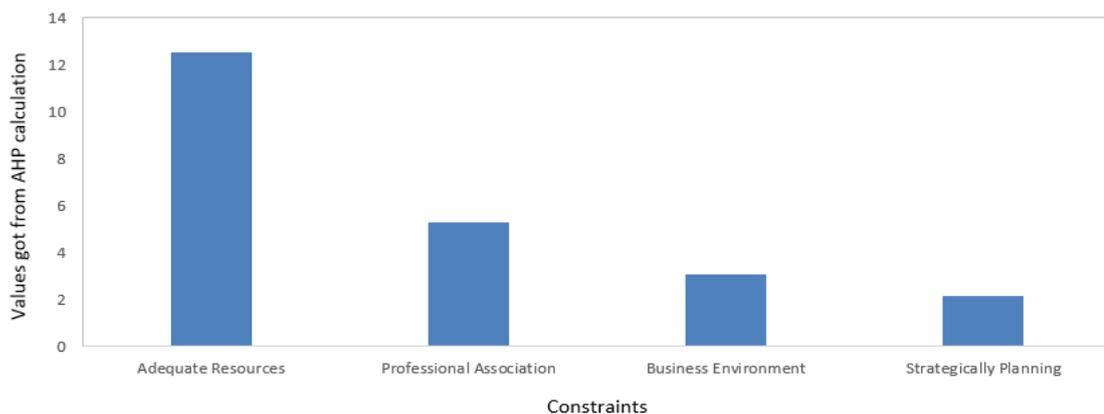


Figure 4.3: Comparison among major challenges faced by OSDC

In figure 4.3, total result of AHP priorities got in first phase data collection is presented in a graph. Values of the challenges, adequate resources, professional association, business environment and strategically planning are found 12.5073, 5.2921, 3.0774 and 2.1231 respectively.

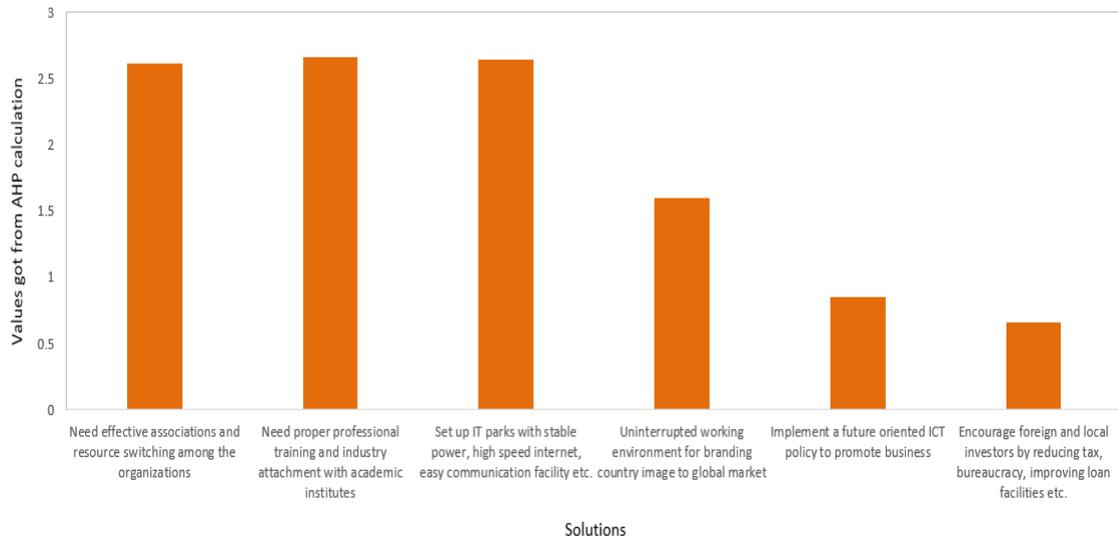


Figure 4.4: Comparison among possible solutions

In figure 4.4, total result of AHP priorities got in second phase data collection is presented in a graph. Values of the possible solutions, are found 2.6125, 2.6562, 2.6387, 1.5948, 0.8457 and 0.6523 respectively.

Here we see main two constraints are (depending on AHP calculation):

1. Lack of adequate resources and
2. Lack of professional association.

In addition, to resolve the constraints main three possible solutions are (depending on AHP calculation):

1. Need proper professional training and industry attachment with academic institutes,
2. Need to set up IT parks with stable power, high speed internet, easy communication facility etc. and
3. Need effective associations and resource switching among the organizations.

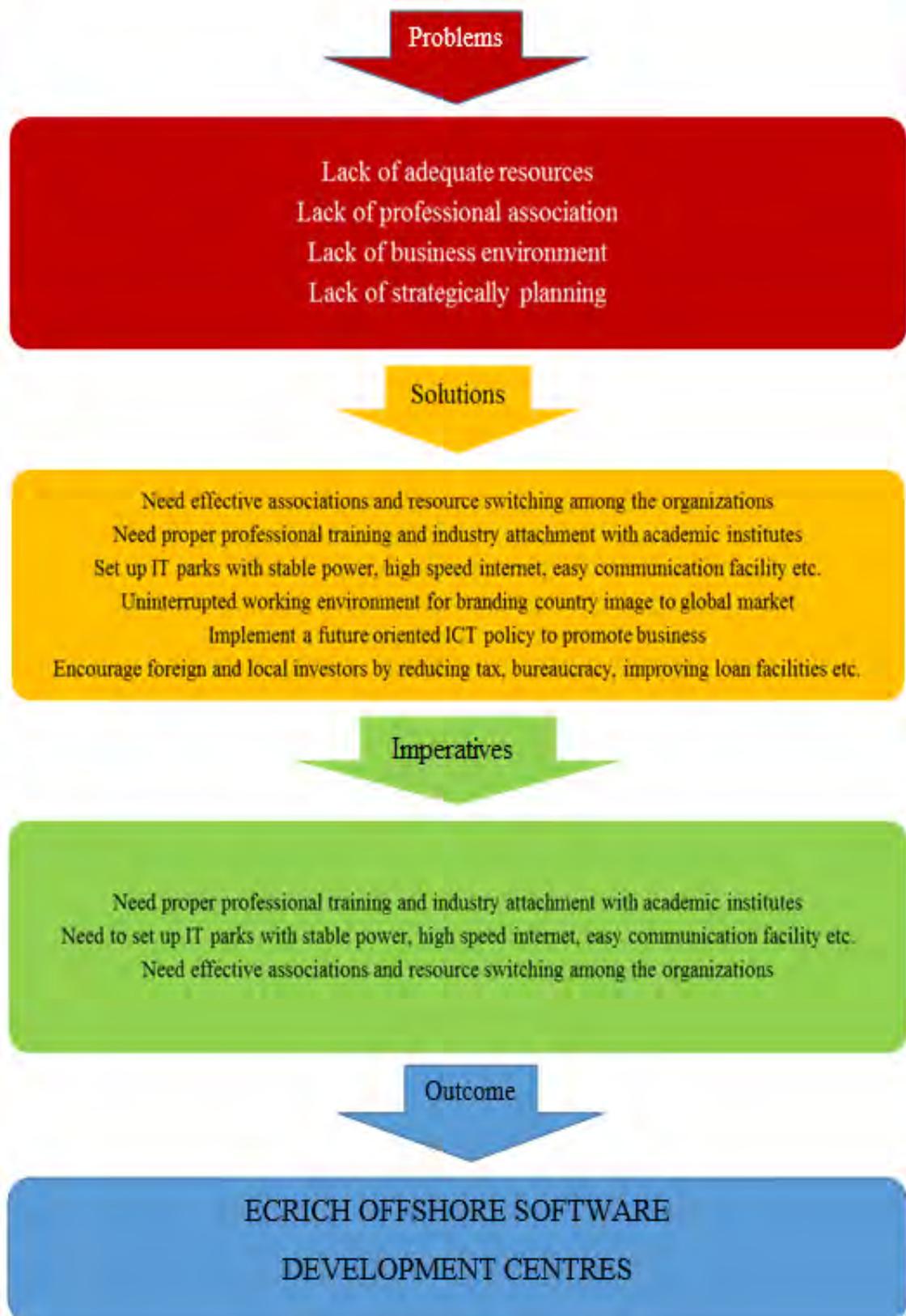


Figure 4.5: Research outcome

Figure 4.5, is helpful to understand total research result as well as the outcome in a single picture. It is started with problems and followed by the solutions.

In figure 4.6, a model for the development of ICT in Bangladesh, so that offshore software development centres can flourish in Bangladesh, is given.

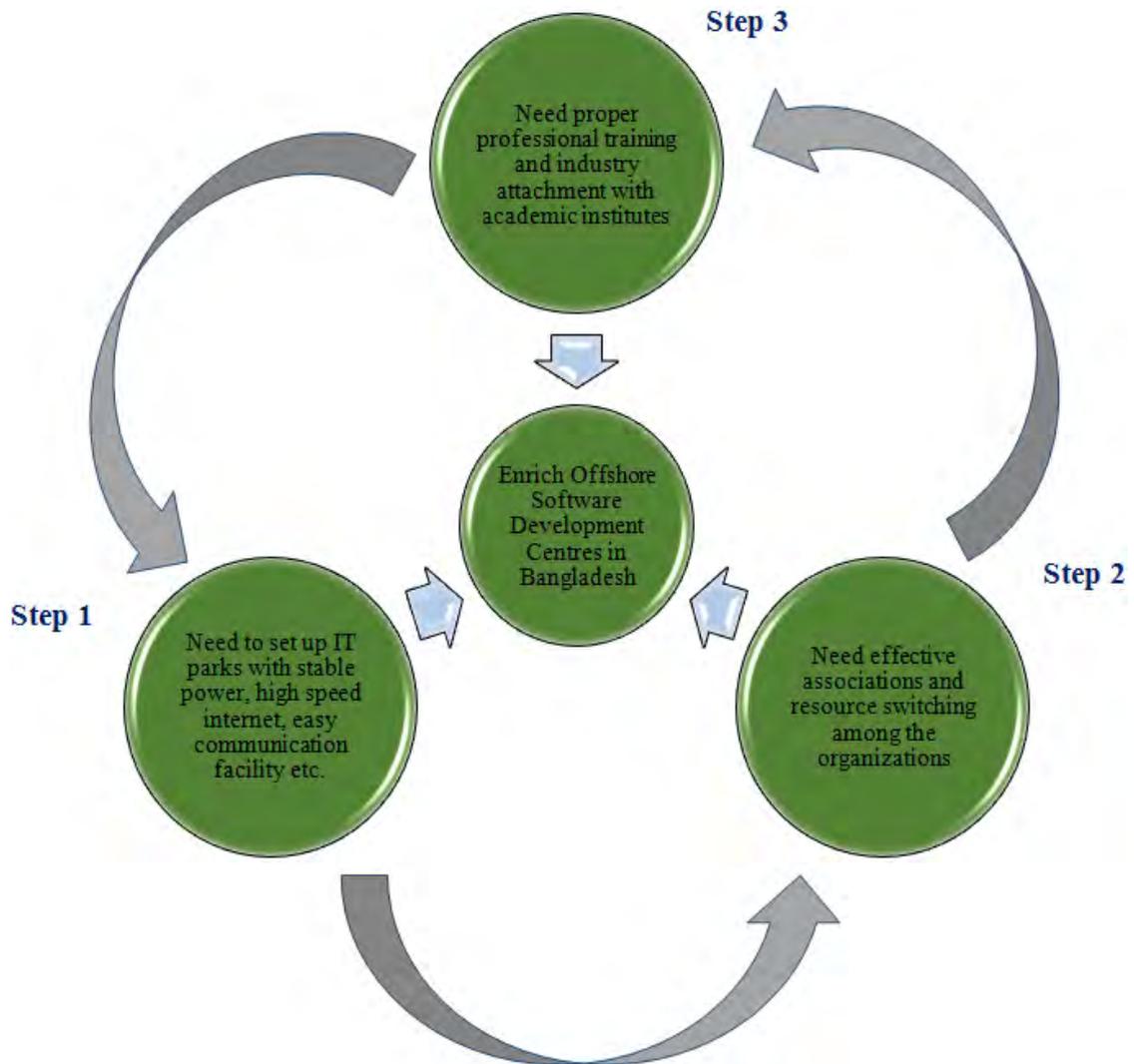


Figure 4.6: Model to flourish OSDCs

# CHAPTER 5

## CONCLUSION

### 5.1 Conclusion

Offshore development centre is one of the business models. In Bangladesh the ICT industry has grown steadily in recent years at 20 to 30 percent per year. Thousands of independent freelancers offer their services at online market places. More than 80 universities are producing 5,500 ICT graduates per annum. According to SWOT analysis it was found, Bangladesh has good chance to promote business in this specific arena.

Government has already taken initiative to set up IT parks. As Bangalore did in India, these IT parks will be able to attract foreign investors. In this research it was found, IT parks will be beneficiary for Bangladesh.

Based on this research it was also found that, Bangladesh can try to attract offshore companies by arranging professional training to grow skilled manpower. Moreover, offshore companies may maintain strong association among themselves in collaboration with the government.

Findings of this research work were matched with the ICT policies taken by Bangladesh Government. However respective authorities must be very dynamic to be successful. When the business platform becomes stable all surrounding facilities will be easier to achieve. In addition, by quick implementation of Government steps, we will be able to increase offshore development centres like India.

### 5.2 Recommendations

To implement the Vision 2021, we should establish IT parks as quick as possible. Hence Kaliakoir Hi-Tech Park should be started earlier with all required facilities. In the competitive global market, it is very urgent to secure own position immediately.

Moreover, we need to change our education system to grow efficient manpower. A good number of Indians are working in Bangladesh. These happen mainly due to the shortage of adequate professionals. Government should take initiative to update our education standard. Industry attachment will help to develop professionalism.

In addition, to attract foreign investors in software development sector following steps can be taken,

- Reduce bureaucracy
- Ensure equal opportunity to all
- Provide incentives in export, like light engineering industry
- Reduce complexity in money transfer among foreign and local banks
- Arrange exhibition and fair on local software firms

Hence a combined initiative among government organizations and software development companies will be beneficial.

## **5.2 Future Proposed Work**

In future, if possible, it will be tried to focus on each department or area of all the offshore software firms operating in Bangladesh. As well as the government policies and all related associations need to be visited to get detail views.

Special facilities and venture capital are offered for ‘thrust sectors’ including computer software and information technology. As the government is aware we hope this business model will become more popular in our economy.

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# APPENDIX A

## A.1 Questionnaire for First Phase

### A.1.1 What is Offshore Software Development Centre (OSDC)?

An offshore software development centre is made up of a dedicated team of programmers and developers who have been hand-picked to complement the customer's skill set and culture. This customized team works exclusively on behalf of the customer at the service provider's site or their own captive site in a secure environment. The infrastructure and security can be designed to meet the customer's specific standards and specifications, and may include co-branding. Indeed, the closer the synergy between an offshore development centre and an organization's own IT/development department the better. The ultimate goal is for an offshore software development centres to be a seamless extension of an organization's IT department.

### A.1.2 AHP Priority Setting

Symbol	AHP Scale of Importance for comparison pair	Numeric Rating	Reciprocal (decimal)
A	Equal Importance	1	1 (1.000)
B	Equally to Moderately	2	1/2 (0.500)
C	Moderate Importance	3	1/3 (0.333)
D	Moderately to Strong	4	1/4 (0.250)
E	Strong Importance	5	1/5 (0.200)
F	Strongly to very strong	6	1/6 (0.167)
G	Very strong Importance	7	1/7 (0.143)
H	Very strong to extremely	8	1/8 (0.125)
I	Extreme Importance	9	1/9 (0.111)

Interviewees are requested to select any symbol (among A to I) or numeric value (among 1 to 9 or 1 to 1/9) for marking priority of the comparisons.

### A.1.3 Priority Setting among Categories or Sub-categories

Category	Comparison between Categories or Sub-categories
Major Constraints	Severity of ‘Constraints related to Start-up Business’ over ‘Constraints related to Business Operation’
	Severity of ‘Constraints related to Start-up Business’ over ‘Constraints related to Business Development’
	Severity of ‘Constraints related to Business Operation’ over ‘Constraints related to Business Development’
Start-up Business	Severity of ‘Constraints related to Manpower’ over ‘Constraints related to Infrastructure’
Business Operation	Severity of ‘Constraints related to Resources’ over ‘Constraints related to Management’
Business Development	Severity of ‘Constraints related to Market Positioning’ over ‘Constraints related to Financial Support’

### A.1.4 Priority Setting among Constraints

Category	Sub-category	Comparison between Constraints
Start-up Business	Manpower	Severity of ‘Lack of adequate resources’ over ‘Lack of professional association’
		Severity of ‘Lack of adequate resources’ over ‘Lack of business environment’
		Severity of ‘Lack of adequate resources’ over ‘Lack of strategically planning’
		Severity of ‘Lack of professional association’ over ‘Lack of business environment’
		Severity of ‘Lack of professional association’ over ‘Lack of strategically planning’
		Severity of ‘Lack of business environment’ over ‘Lack of strategically planning’

	Infrastructure	Severity of 'Lack of adequate resources' over 'Lack of professional association'
		Severity of 'Lack of adequate resources' over 'Lack of business environment'
		Severity of 'Lack of adequate resources' over 'Lack of strategically planning'
		Severity of 'Lack of professional association' over 'Lack of business environment'
		Severity of 'Lack of professional association' over 'Lack of strategically planning'
		Severity of 'Lack of business environment' over 'Lack of strategically planning'
Business Operation	Resources	Severity of 'Lack of adequate resources' over 'Lack of professional association'
		Severity of 'Lack of adequate resources' over 'Lack of business environment'
		Severity of 'Lack of adequate resources' over 'Lack of strategically planning'
		Severity of 'Lack of professional association' over 'Lack of business environment'
		Severity of 'Lack of professional association' over 'Lack of strategically planning'
		Severity of 'Lack of business environment' over 'Lack of strategically planning'
	Management	Severity of 'Lack of adequate resources' over 'Lack of professional association'
		Severity of 'Lack of adequate resources' over 'Lack of business environment'
		Severity of 'Lack of adequate resources' over 'Lack of strategically planning'
		Severity of 'Lack of professional association' over 'Lack of business environment'

		Severity of 'Lack of professional association' over 'Lack of strategically planning'
		Severity of 'Lack of business environment' over 'Lack of strategically planning'
Business Development	Market Positioning	Severity of 'Lack of adequate resources' over 'Lack of professional association'
		Severity of 'Lack of adequate resources' over 'Lack of business environment'
		Severity of 'Lack of adequate resources' over 'Lack of strategically planning'
		Severity of 'Lack of professional association' over 'Lack of business environment'
		Severity of 'Lack of professional association' over 'Lack of strategically planning'
		Severity of 'Lack of business environment' over 'Lack of strategically planning'
		Severity of 'Lack of business environment' over 'Lack of strategically planning'
	Financial Support	Severity of 'Lack of adequate resources' over 'Lack of professional association'
		Severity of 'Lack of adequate resources' over 'Lack of business environment'
		Severity of 'Lack of adequate resources' over 'Lack of strategically planning'
		Severity of 'Lack of professional association' over 'Lack of business environment'
		Severity of 'Lack of professional association' over 'Lack of strategically planning'
		Severity of 'Lack of business environment' over 'Lack of strategically planning'
		Severity of 'Lack of business environment' over 'Lack of strategically planning'

**A.1.5 Possible solutions may be taken to resolve the constraints:**

Suggestions based on personal opinion of interviewee are asked.

## **A.2 Questionnaire for Second Phase**

### **A.2.1 What is Offshore Software Development Centre (OSDC)?**

Offshore outsourcing means organizations at low wage countries provide software development services to their offshore clients in developed countries based on the agreement, minimizing cost remarkable. Software companies around the world have accepted this business strategy for last two decades.

### **A.2.2 SWOT Analysis for Offshore Software Development Centre**

Strength, weakness, opportunity and threat of OSDC are asked.

### **A.2.3 Major Constraints of OSDC facing in Bangladesh:**

Findings on the Survey- Constraints are, Lack of adequate resources, professional association, business environment & strategically planning.

Possible solutions mentioned by the OSDC personnel to resolve the constraints are,

Symbol	Possible solutions
A	Need effective associations and resource switching among the organizations
B	Need proper professional training and industry attachment with academic institutes
C	Set up IT parks with stable power, high speed internet, easy communication facility etc.
D	Uninterrupted working environment for branding country image to global market
E	Implement a future oriented ICT policy to promote business
F	Encourage foreign and local investors by reducing tax, bureaucracy, improving loan facilities etc.

These solutions may be considered by the organizations, government and both jointly.

### **A.2.4 AHP Priority Setting**

Same as A.1.2

### A.2.5 Priority Setting among Categories

Category	Comparison between Categories or Sub-categories
Possible Solutions	Importance of 'Provided by Organizations' over 'Provided by Government'
	Importance of 'Provided by Organizations' over 'Provided by Organizations and Government jointly'
	Importance of 'Provided by Organizations' over 'Provided by Organizations and Government jointly'

### A.2.6 Priority Setting among Constraints

Category	Comparison between Solutions
Organizations	Importance of 'Solution A' over 'Solution B'
	Importance of 'Solution A' over 'Solution C'
	Importance of 'Solution A' over 'Solution D'
	Importance of 'Solution A' over 'Solution E'
	Importance of 'Solution A' over 'Solution F'
	Importance of 'Solution B' over 'Solution C'
	Importance of 'Solution B' over 'Solution D'
	Importance of 'Solution B' over 'Solution E'
	Importance of 'Solution B' over 'Solution F'
	Importance of 'Solution C' over 'Solution D'
	Importance of 'Solution C' over 'Solution E'
	Importance of 'Solution C' over 'Solution F'
	Importance of 'Solution D' over 'Solution E'
	Importance of 'Solution D' over 'Solution F'
	Importance of 'Solution E' over 'Solution F'
Government	Importance of 'Solution A' over 'Solution B'
	Importance of 'Solution A' over 'Solution C'
	Importance of 'Solution A' over 'Solution D'
	Importance of 'Solution A' over 'Solution E'

	Importance of ‘Solution A’ over ‘Solution F’
	Importance of ‘Solution B’ over ‘Solution C’
	Importance of ‘Solution B’ over ‘Solution D’
	Importance of ‘Solution B’ over ‘Solution E’
	Importance of ‘Solution B’ over ‘Solution F’
	Importance of ‘Solution C’ over ‘Solution D’
	Importance of ‘Solution C’ over ‘Solution E’
	Importance of ‘Solution C’ over ‘Solution F’
	Importance of ‘Solution D’ over ‘Solution E’
	Importance of ‘Solution D’ over ‘Solution F’
	Importance of ‘Solution E’ over ‘Solution F’
Organizations and Government Jointly	Importance of ‘Solution A’ over ‘Solution B’
	Importance of ‘Solution A’ over ‘Solution C’
	Importance of ‘Solution A’ over ‘Solution D’
	Importance of ‘Solution A’ over ‘Solution E’
	Importance of ‘Solution A’ over ‘Solution F’
	Importance of ‘Solution B’ over ‘Solution C’
	Importance of ‘Solution B’ over ‘Solution D’
	Importance of ‘Solution B’ over ‘Solution E’
	Importance of ‘Solution B’ over ‘Solution F’
	Importance of ‘Solution C’ over ‘Solution D’
	Importance of ‘Solution C’ over ‘Solution E’
	Importance of ‘Solution C’ over ‘Solution F’
	Importance of ‘Solution D’ over ‘Solution E’
	Importance of ‘Solution D’ over ‘Solution F’
Importance of ‘Solution E’ over ‘Solution F’	

### **A.2.7 Personal Comment on OSDC and its impact on Bangladesh**

Comments based on personal opinion of interviewee are asked.

# APPENDIX B

## B.1 Calculation for First Phase of Com\_2

### B.1.1 AHP priorities

Category: Major Constraints

Comparison	Rating
Severity of 'Constraints related to Start-up Business' over 'Constraints related to Business Operation'	4
Severity of 'Constraints related to Start-up Business' over 'Constraints related to Business Development'	7
Severity of 'Constraints related to Business Operation' over 'Constraints related to Business Development'	3

AHP priorities

- Constraints related to Start-up Business = 0.705
- Constraints related to Business Operation = 0.211
- Constraints related to Business Development = 0.084

Category: Start-up Business

Comparison	Rating
Severity of 'Constraints related to Manpower' over 'Constraints related to Infrastructure'	1

AHP priorities

- Constraints related to Manpower = 0.5
- Constraints related to Infrastructure = 0.5

Category: Business Operation

Comparison	Rating
Severity of 'Constraints related to Resources' over 'Constraints related to Management'	4

AHP priorities

- Constraints related to Resources = 0.8
- Constraints related to Management = 0.2

Category: Business Development

Comparison	Rating
Severity of 'Constraints related to Market Positioning' over 'Constraints related to Financial Support'	1

AHP priorities

- Constraints related to Market Positioning = 0.5
- Constraints related to Financial Support = 0.5

Category: Start-up Business

Sub-category: Manpower

Comparison	Rating
Severity of 'Lack of adequate resources' over 'Lack of professional association'	2
Severity of 'Lack of adequate resources' over 'Lack of business environment'	3
Severity of 'Lack of adequate resources' over 'Lack of strategically planning'	2
Severity of 'Lack of professional association' over 'Lack of business environment'	2
Severity of 'Lack of professional association' over 'Lack of strategically planning'	2

Severity of 'Lack of business environment' over 'Lack of strategically planning'	2
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AHP priorities

- Lack of adequate resources = 0.423
- Lack of professional association = 0.266
- Lack of business environment = 0.174
- Lack of strategically planning = 0.137

Category: Start-up Business

Sub-category: Infrastructure

Comparison	Rating
Severity of 'Lack of adequate resources' over 'Lack of professional association'	3
Severity of 'Lack of adequate resources' over 'Lack of business environment'	3
Severity of 'Lack of adequate resources' over 'Lack of strategically planning'	5
Severity of 'Lack of professional association' over 'Lack of business environment'	3
Severity of 'Lack of professional association' over 'Lack of strategically planning'	2
Severity of 'Lack of business environment' over 'Lack of strategically planning'	2

AHP priorities

- Lack of adequate resources = 0.518
- Lack of professional association = 0.248
- Lack of business environment = 0.14
- Lack of strategically planning = 0.094

Category: Business Operation

Sub-category: Resources

Comparison	Rating
Severity of 'Lack of adequate resources' over 'Lack of professional association'	1
Severity of 'Lack of adequate resources' over 'Lack of business environment'	3
Severity of 'Lack of adequate resources' over 'Lack of strategically planning'	5
Severity of 'Lack of professional association' over 'Lack of business environment'	9
Severity of 'Lack of professional association' over 'Lack of strategically planning'	9
Severity of 'Lack of business environment' over 'Lack of strategically planning'	4

AHP priorities

- Lack of adequate resources = 0.327
- Lack of professional association = 0.52
- Lack of business environment = 0.107
- Lack of strategically planning = 0.046

Category: Business Operation

Sub-category: Management

Comparison	Rating
Severity of 'Lack of adequate resources' over 'Lack of professional association'	4
Severity of 'Lack of adequate resources' over 'Lack of business environment'	8
Severity of 'Lack of adequate resources' over 'Lack of strategically planning'	8

Severity of 'Lack of professional association' over 'Lack of business environment'	9
Severity of 'Lack of professional association' over 'Lack of strategically planning'	3
Severity of 'Lack of business environment' over 'Lack of strategically planning'	1

AHP priorities

- Lack of adequate resources = 0.62
- Lack of professional association = 0.259
- Lack of business environment = 0.054
- Lack of strategically planning = 0.067

Category: Business Development

Sub-category: Market Positioning

Comparison	Rating
Severity of 'Lack of adequate resources' over 'Lack of professional association'	4
Severity of 'Lack of adequate resources' over 'Lack of business environment'	8
Severity of 'Lack of adequate resources' over 'Lack of strategically planning'	8
Severity of 'Lack of professional association' over 'Lack of business environment'	9
Severity of 'Lack of professional association' over 'Lack of strategically planning'	3
Severity of 'Lack of business environment' over 'Lack of strategically planning'	1

AHP priorities

- Lack of adequate resources = 0.62
- Lack of professional association = 0.259

- Lack of business environment = 0.054
- Lack of strategically planning = 0.067

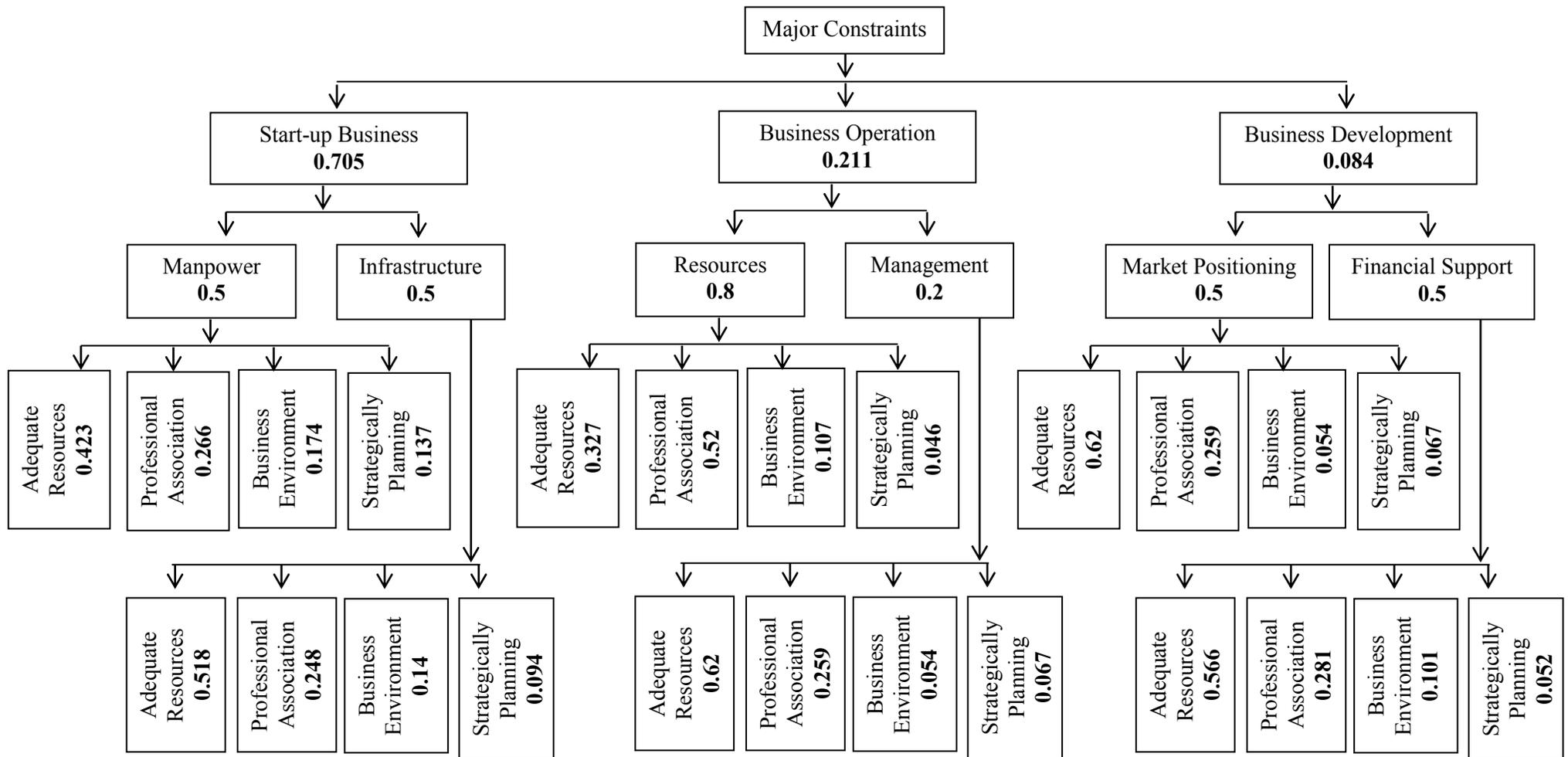
Category: Business Development

Sub-category: Financial Support

Comparison	Rating
Severity of 'Lack of adequate resources' over 'Lack of professional association'	3
Severity of 'Lack of adequate resources' over 'Lack of business environment'	5
Severity of 'Lack of adequate resources' over 'Lack of strategically planning'	9
Severity of 'Lack of professional association' over 'Lack of business environment'	5
Severity of 'Lack of professional association' over 'Lack of strategically planning'	4
Severity of 'Lack of business environment' over 'Lack of strategically planning'	3

AHP priorities

- Lack of adequate resources = 0.566
- Lack of professional association = 0.281
- Lack of business environment = 0.101
- Lack of strategically planning = 0.052



Figure, Decision hierarchy for Com\_2

Final result for Com\_2 is calculated as below,

$$\text{Adequate Resources} = 0.705 \times 0.5 \times 0.423 + 0.705 \times 0.5 \times 0.518 + 0.211 \times 0.8 \times 0.327 + 0.211 \times 0.2 \times 0.62 + 0.084 \times 0.5 \times 0.62 + 0.084 \times 0.5 \times 0.566 = 0.4629.$$

$$\text{Professional Association} = 0.705 \times 0.5 \times 0.266 + 0.705 \times 0.5 \times 0.248 + 0.211 \times 0.8 \times 0.52 + 0.211 \times 0.2 \times 0.259 + 0.084 \times 0.5 \times 0.259 + 0.084 \times 0.5 \times 0.281 = 0.3026.$$

$$\text{Business Environment} = 0.705 \times 0.5 \times 0.174 + 0.705 \times 0.5 \times 0.14 + 0.211 \times 0.8 \times 0.107 + 0.211 \times 0.2 \times 0.054 + 0.084 \times 0.5 \times 0.054 + 0.084 \times 0.5 \times 0.101 = 0.1375.$$

$$\text{Strategically Planning} = 0.705 \times 0.5 \times 0.137 + 0.705 \times 0.5 \times 0.094 + 0.211 \times 0.8 \times 0.046 + 0.211 \times 0.2 \times 0.067 + 0.084 \times 0.5 \times 0.067 + 0.084 \times 0.5 \times 0.052 = 0.097.$$

## B.2 Calculation for Second Phase of KII\_1

### B.1.1 AHP priorities

Category: Major Categories

Comparison	Rating
Importance of 'Provided by Organizations' over 'Provided by Government'	1/3
Importance of 'Provided by Organizations' over 'Provided by Organizations and Government jointly'	1/9
Importance of 'Provided by Organizations' over 'Provided by Organizations and Government jointly'	1/7

AHP priorities

- Provided by Organizations = 0.066
- Provided by Government = 0.149
- Provided by Organizations and Government jointly = 0.785

Category: Provided by Organizations

Comparison	Rating
Importance of 'Need effective associations and resource switching among the organizations' over 'Need proper professional training and industry attachment with academic institutes'	2
Importance of 'Need effective associations and resource switching among the organizations' over 'Set up IT parks with stable power, high speed internet, easy communication facility etc.'	1
Importance of 'Need effective associations and resource switching among the organizations' over 'Uninterrupted working environment for branding country image to global market'	1
Importance of 'Need effective associations and resource switching among the organizations' over 'Implement a future oriented ICT policy to promote business'	2
Importance of 'Need effective associations and resource switching among the organizations' over 'Encourage foreign and local investors by reducing tax, bureaucracy, improving loan facilities etc.'	3
Importance of 'Need proper professional training and industry attachment with academic institutes' over 'Set up IT parks with stable power, high speed internet, easy communication facility etc.'	3
Importance of 'Need proper professional training and industry attachment with academic institutes' over 'Uninterrupted working environment for branding country image to global market'	2
Importance of 'Need proper professional training and industry attachment with academic institutes' over 'Implement a future oriented ICT policy to promote business'	1
Importance of 'Need proper professional training and industry attachment with academic institutes' over 'Encourage foreign and local investors by reducing tax, bureaucracy, improving loan facilities etc.'	1
Importance of 'Set up IT parks with stable power, high speed internet, easy communication facility etc.' over 'Uninterrupted working environment for branding country image to global market'	2

Importance of ‘Set up IT parks with stable power, high speed internet, easy communication facility etc.’ over ‘Implement a future oriented ICT policy to promote business’	1
Importance of ‘Set up IT parks with stable power, high speed internet, easy communication facility etc.’ over ‘Encourage foreign and local investors by reducing tax, bureaucracy, improving loan facilities etc.’	2
Importance of ‘Uninterrupted working environment for branding country image to global market’ over ‘Implement a future oriented ICT policy to promote business’	2
Importance of ‘Uninterrupted working environment for branding country image to global market’ over ‘Encourage foreign and local investors by reducing tax, bureaucracy, improving loan facilities etc.’	1
Importance of ‘Implement a future oriented ICT policy to promote business’ over ‘Encourage foreign and local investors by reducing tax, bureaucracy, improving loan facilities etc.’	2

#### AHP priorities

- Need effective associations and resource switching among the organizations = 0.236
- Need proper professional training and industry attachment with academic institutes = 0.207
- Set up IT parks with stable power, high speed internet, easy communication facility etc. = 0.169
- Uninterrupted working environment for branding country image to global market = 0.144
- Implement a future oriented ICT policy to promote business = 0.139
- Encourage foreign and local investors by reducing tax, bureaucracy, improving loan facilities etc. = 0.105

Category: Provided by Government

Comparison	Rating
Importance of ‘Need effective associations and resource switching among the organizations’ over ‘Need proper professional training and industry attachment with academic institutes’	1
Importance of ‘Need effective associations and resource switching among the organizations’ over ‘Set up IT parks with stable power, high speed internet, easy communication facility etc.’	1
Importance of ‘Need effective associations and resource switching among the organizations’ over ‘Uninterrupted working environment for branding country image to global market’	1
Importance of ‘Need effective associations and resource switching among the organizations’ over ‘Implement a future oriented ICT policy to promote business’	3
Importance of ‘Need effective associations and resource switching among the organizations’ over ‘Encourage foreign and local investors by reducing tax, bureaucracy, improving loan facilities etc.’	3
Importance of ‘Need proper professional training and industry attachment with academic institutes’ over ‘Set up IT parks with stable power, high speed internet, easy communication facility etc.’	1
Importance of ‘Need proper professional training and industry attachment with academic institutes’ over ‘Uninterrupted working environment for branding country image to global market’	2
Importance of ‘Need proper professional training and industry attachment with academic institutes’ over ‘Implement a future oriented ICT policy to promote business’	4
Importance of ‘Need proper professional training and industry attachment with academic institutes’ over ‘Encourage foreign and local investors by reducing tax, bureaucracy, improving loan facilities etc.’	3

Importance of ‘Set up IT parks with stable power, high speed internet, easy communication facility etc.’ over ‘Uninterrupted working environment for branding country image to global market’	2
Importance of ‘Set up IT parks with stable power, high speed internet, easy communication facility etc.’ over ‘Implement a future oriented ICT policy to promote business’	4
Importance of ‘Set up IT parks with stable power, high speed internet, easy communication facility etc.’ over ‘Encourage foreign and local investors by reducing tax, bureaucracy, improving loan facilities etc.’	5
Importance of ‘Uninterrupted working environment for branding country image to global market’ over ‘Implement a future oriented ICT policy to promote business’	4
Importance of ‘Uninterrupted working environment for branding country image to global market’ over ‘Encourage foreign and local investors by reducing tax, bureaucracy, improving loan facilities etc.’	8
Importance of ‘Implement a future oriented ICT policy to promote business’ over ‘Encourage foreign and local investors by reducing tax, bureaucracy, improving loan facilities etc.’	2

#### AHP priorities

- Need effective associations and resource switching among the organizations = 0.195
- Need proper professional training and industry attachment with academic institutes = 0.237
- Set up IT parks with stable power, high speed internet, easy communication facility etc. = 0.253
- Uninterrupted working environment for branding country image to global market = 0.204
- Implement a future oriented ICT policy to promote business = 0.063
- Encourage foreign and local investors by reducing tax, bureaucracy, improving loan facilities etc. = 0.048

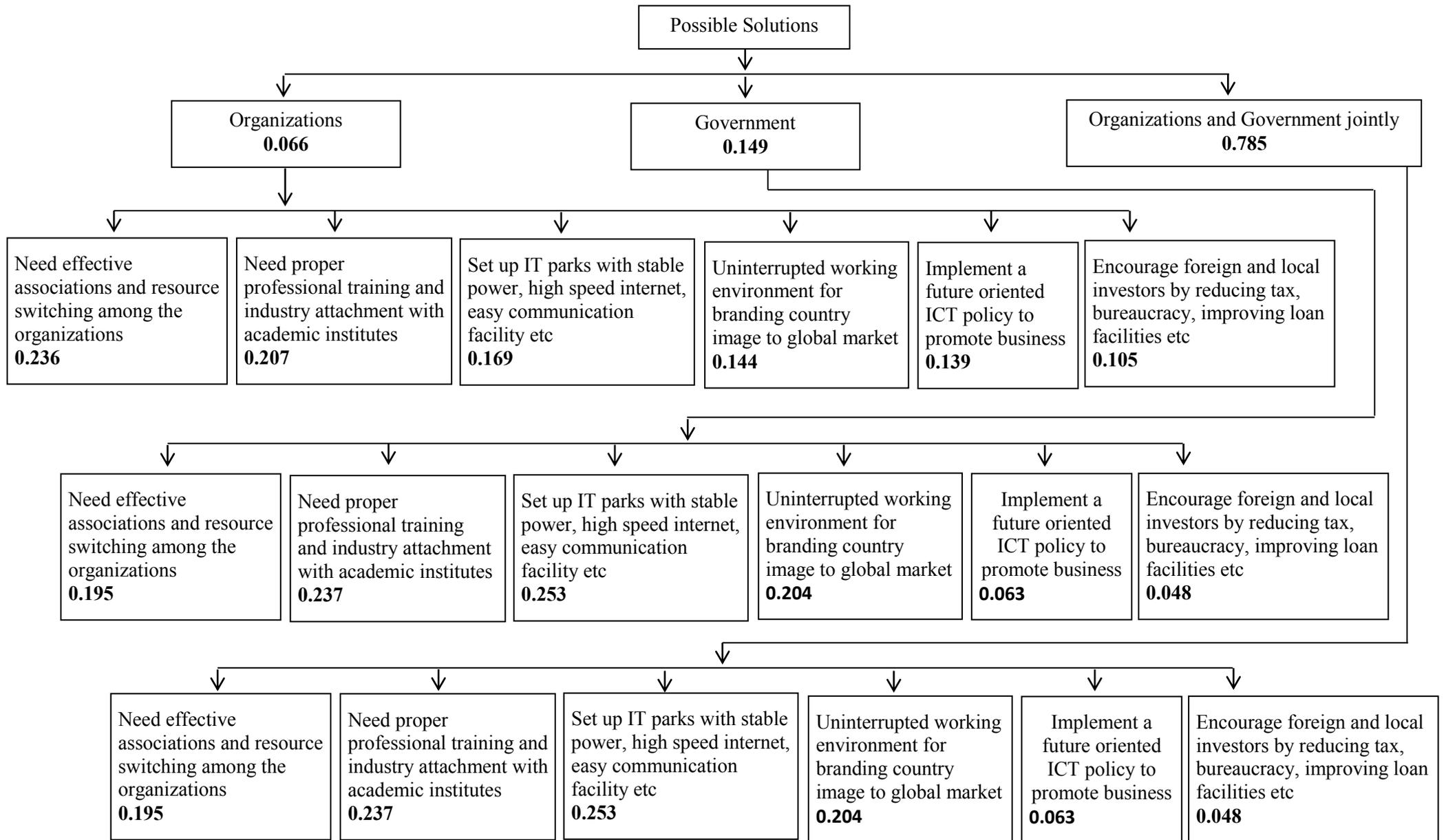
Category: Provided by Organizations and Government Jointly

Comparison	Rating
Importance of 'Need effective associations and resource switching among the organizations' over 'Need proper professional training and industry attachment with academic institutes'	1
Importance of 'Need effective associations and resource switching among the organizations' over 'Set up IT parks with stable power, high speed internet, easy communication facility etc.'	1
Importance of 'Need effective associations and resource switching among the organizations' over 'Uninterrupted working environment for branding country image to global market'	1
Importance of 'Need effective associations and resource switching among the organizations' over 'Implement a future oriented ICT policy to promote business'	3
Importance of 'Need effective associations and resource switching among the organizations' over 'Encourage foreign and local investors by reducing tax, bureaucracy, improving loan facilities etc.'	3
Importance of 'Need proper professional training and industry attachment with academic institutes' over 'Set up IT parks with stable power, high speed internet, easy communication facility etc.'	1
Importance of 'Need proper professional training and industry attachment with academic institutes' over 'Uninterrupted working environment for branding country image to global market'	2
Importance of 'Need proper professional training and industry attachment with academic institutes' over 'Implement a future oriented ICT policy to promote business'	4
Importance of 'Need proper professional training and industry attachment with academic institutes' over 'Encourage foreign and local investors by reducing tax, bureaucracy, improving loan facilities etc.'	3
Importance of 'Set up IT parks with stable power, high speed internet, easy communication facility etc.' over 'Uninterrupted working environment for branding country image to global market'	2

Importance of ‘Set up IT parks with stable power, high speed internet, easy communication facility etc.’ over ‘Implement a future oriented ICT policy to promote business’	4
Importance of ‘Set up IT parks with stable power, high speed internet, easy communication facility etc.’ over ‘Encourage foreign and local investors by reducing tax, bureaucracy, improving loan facilities etc.’	5
Importance of ‘Uninterrupted working environment for branding country image to global market’ over ‘Implement a future oriented ICT policy to promote business’	4
Importance of ‘Uninterrupted working environment for branding country image to global market’ over ‘Encourage foreign and local investors by reducing tax, bureaucracy, improving loan facilities etc.’	8
Importance of ‘Implement a future oriented ICT policy to promote business’ over ‘Encourage foreign and local investors by reducing tax, bureaucracy, improving loan facilities etc.’	2

#### AHP priorities

- Need effective associations and resource switching among the organizations = 0.195
- Need proper professional training and industry attachment with academic institutes = 0.237
- Set up IT parks with stable power, high speed internet, easy communication facility etc. = 0.253
- Uninterrupted working environment for branding country image to global market = 0.204
- Implement a future oriented ICT policy to promote business = 0.063
- Encourage foreign and local investors by reducing tax, bureaucracy, improving loan facilities etc. = 0.048



Figure, Decision hierarchy for KII\_1

Final result for KII\_1 is calculated as below,

Need effective associations and resource switching among the organizations =  $0.066 \times 0.236 + 0.149 \times 0.195 + 0.785 \times 0.195 = 0.1977$

Need proper professional training and industry attachment with academic institutes =  $0.066 \times 0.207 + 0.149 \times 0.237 + 0.785 \times 0.237 = 0.235$

Set up IT parks with stable power, high speed internet, easy communication facility etc. =  $0.066 \times 0.169 + 0.149 \times 0.253 + 0.785 \times 0.253 = 0.2475$

Uninterrupted working environment for branding country image to global market =  $0.066 \times 0.144 + 0.149 \times 0.204 + 0.785 \times 0.204 = 0.200$

Implement a future oriented ICT policy to promote business =  $0.066 \times 0.139 + 0.149 \times 0.063 + 0.785 \times 0.063 = 0.068$

Encourage foreign and local investors by reducing tax, bureaucracy, improving loan facilities etc. =  $0.066 \times 0.105 + 0.149 \times 0.048 + 0.785 \times 0.048 = 0.0518$