

**FORMULATION OF RELEVANCE TREE SCENARIO
GENERATION FOR SUCCESSFUL IMPLIMENTATION OF
HI-TECH AND SOFWTARE TECHNOLOGY PARK IN
BANGLADESH**

by

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A Thesis submitted to the Institute of Appropriate Technology (IAT), Bangladesh University of Engineering and Technology (BUET) in partial fulfilment of the requirement for the degree of
**Master of Science in Management of Technology
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Certificate of Approval

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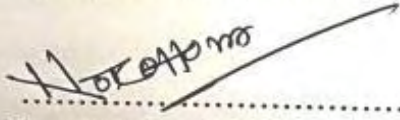
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ABSTRACT

Hi-Tech or Software Technology parks are being developed in many countries to create an efficient work environment for knowledge based industrial development. Major aim of these technology parks are to attract foreign companies to set up operations and to transfer the indigenous technological capability for the development of the local industries. The aim of this thesis work is to find out factors that influence technology park development and a suitable strategic framework for successful implementation of Hi-Tech (HTP) or Software Technology Park (STP) in Bangladesh.

A review of the existing technology parks in different countries such as India, Malaysia, Korea, Singapore, USA etc. and ongoing and finished technology park projects in Bangladesh is carried out through site visit and Internet. However, different parks have different features in respect of development priorities, management, operations and marketing strategies. Knowledge based industry mainly related to information technology and R&D have been considered as top priority sector for Bangladesh.

For this study Analytic Hierarchy Process is applied as a Multi-criteria Decision-Making Method (MCDM) which is a technology assessment tool. The assessment has been conducted by considering infrastructure, strategic & business support & governance as criteria. Under these criteria basic facility, digital facility, social facility, research & strategic facility, industrial chain & innovation facility, capacity development, policy support, operational modality and park management as sub criteria. SWOT analysis and IBM SPSS (Statistical Package for the Social Sciences) software also used for identifying the key variables. Again, relevance tree technique is used to represent tasks, approaches, criteria, sub criteria and variables as per the importance identified. Based on the relevance tree scenario it is found that, quality infrastructure carries slightly higher importance than other criteria but research and strategic facility within the technology park carries more importance than any other criteria. At the end operational modality-based process is suggested for HTP or STP development.

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List of Abbreviations

AHP	Analytic Hierarchy Process
GoB	Government of Bangladesh
HTP	Hi-Tech Park
STP	Software Technology Park
BHTPA	Bangladesh Hi-Tech Park Authority
ICT Division	Information and Communication Technology Division
ICTD	Information and Communication Technology Directorate
NBIA	National Business Incubation Association
TBI	Technology Business Incubators
PTD	Post & Telecommunication Division
BCC	Bangladesh Computer Council
CCA	Controller of Certifying Authority
IPS	Internet Service Provider
KHTP	Kaliakoir Hi-Tech Park
PPP	Public Private Partnership
KBE	Knowledge Based Economy
SDGs	Sustainable Development Goals
PSTP	Private Software Technology Park
SPSS	Statistical Package for the Social Sciences
GE	Government Employee

CHAPTER-1: INTRODUCTION

1.1 Background

Knowledge-based industries, particularly related to information technology have been recognised as the top priority sector by countries making transition from agro-industrial economy to information economy. Hi-Tech or Software Technology parks are being developed in different countries, both developed and developing, to provide a range of infrastructure and administrative support services to create an efficient work environment for development of IT/ITES enabled industry [1,2].

Considering the world trends, Bangladesh has also recognised that new directions must be set for the future prosperity of the country. Information technology has been identified as a "thrust sector" for the economy of Bangladesh. Strategic plans have been prepared to enable Bangladesh to embrace the information age and to become an important player in the global market in information and other high technology sectors. The Government of Bangladesh has declared **Vision 2021** with a target to transform Bangladesh into Digital Bangladesh [3].

Accordingly, the Government of Bangladesh (GoB) decided to establish Hi-Tech/Software Technology Park and IT Business Incubation center at different places of the country. These Hi-Tech/Software Technology Parks are envisaged as an integrated, ultra-modern techno-township that would be designed to attract some of the large transnational companies and to serve the world class business enterprises. Government has taken initiative to established 28 Hi-Tech/Software Technology Parks around the country to ensure knowledge-based industry. There are (a) Bangabandhu Hi-Tech City, Kaliakoir; Gazipur (Previously known as Kaliakoir Hi-Tech Park); (b) Janata Tower Software Technology Park, Karwan Bazar, Dhaka; (c) Sylhet Electronic City; (d) Bangabandhu Sheikh Mujib Hi-Tech Park, Rajshahi; (e) Sheikh Hasina Software Technology Park, Jessore; (f) CUET IT Business Incubator; (g) Sheikh Kamal IT Training and Incubation Centre (in 7 different location); (h) 12 IT Project (in 12 different location), (i) Mohakhali IT Village and (j) Sheikh Hasina Institute of Frontier Technology Park, Madaripur (proposed) [4].

1.2 Problem Definition

There is lack of experiences about implementation of international standards and sustainable criteria in the strategy of Technology Parks. In Bangladesh many initiatives have already been taken by the Government but there is lack of policies; monitoring and implementation. In this respect, the research will focus on strategy and recommendation for successful implementation of Hi-Tech or Software Technology Park and Business Incubator Centres in Bangladesh.

1.3 Thesis Objectives

The objectives and outcomes of this research are as follows:

- To identify the key factors that can influence success and failure of Hi-Tech and Software Technology Park projects for Bangladesh.
- To recommend strategy for successful implementation of Hi-Tech and Software Technology Park projects in Bangladesh.

1.4 Thesis Outlines

Chapter 2 starts with the theoretical concept and provides an idea of Hi-Tech or Software Technology and Incubation Centre. It will also focus on the literature of these industry in other countries. Standard practises and present conditions in Bangladesh. Chapter 3 deals with the research process. This will be followed by the research strategy, questionnaire, sample selection, method of collecting data. Data analysis and the related findings are discussed in chapter 4 and finally in chapter 5 includes the conclusion and future recommendations. Annexure-I, II & III includes SPSS calculation and Annexure-IV includes questionnaires.

CHAPTER-2: LITERATURE REVIEW

Technology park around the globe is known as Hi-Tech Park, Software Technology Park, Science Park, Research Park, Business Incubation Centers etc. based on their focus activities. These institutions provide the following facilities:

- a) Physical infrastructure
- b) Management support
- c) Technical support
- d) Research Facilities
- e) Access to finance
- f) Legal services
- g) Networking

Technology parks and Business incubators provide greater assistance than general financing, legal/intellectual property rights as well as marketing [5].

2.1 Hi-Tech Park/ Software Technology Park

Hi-Tech Park is for promoting innovation culture and to create technology-based eco-system for investor. It facilitates the industry to grow to achieve goals for financial sustainability and employment creation. Hi-Tech Park mainly focuses on large areas with expanding option in future. It is a combination of technological innovation, R&D, production, marketing, and technology transfer. It also maintains a strong linkage with research institution or university. On the other hand, software technology park requires less areas [5]. According to International Association of Science Parks, *“A science park is an organisation managed by specialised professionals, whose main aim is to increase the wealth of its community by promoting the culture of innovation and the competitiveness of its associated businesses and knowledge-based institutions. To enable these goals to be met, a Science Park stimulates and manages the flow of knowledge and technology amongst universities, R&D institutions, companies and markets; it facilitates the creation and growth of innovation-based companies through*

incubation and spin-off processes; and provides other value-added services together with high quality space and facilities.” [6]

Technology park commercialize the products of the park and draws the attention of international firms. It also supports for new firm creation. Besides job creation, it accelerates the local economic growth [7].

2.1.1 Business Incubators

Business incubators are designed to help start-up companies to improve survival rates, growth potential and competencies of the firms they serve. National Business Incubation Association (NBIA) refers to business incubation as follows:

“Business incubation is a business support process that accelerates the successful development of start-up and fledgling companies by providing entrepreneurs with an array of targeted resources and services. These services are usually developed or orchestrated by incubator management and offered both in the business incubator and through its network of contacts. A business incubator’s main goal is to produce successful firms that will leave the program financially viable and freestanding” [8].

Business Incubation is long established successful venture throughout the world in order to foster research, innovation and entrepreneurial culture. Batavia Industrial Centre (BIC) at New York first started incubation activity in the year 1959. More than 9000 business incubators are in operation worldwide. According to National Business Incubation Association (NBIA), USA, in the year of 2012, there are about 1200+ incubators in USA; about 300+ in UK and about 900+ in Europe functioning. NBIA statistics says, in 2005 alone North American incubators patronize more than 27,000 start-up companies, which created more than 10 million full time employment and generated annual revenues \$17 billion. The study further emphasizes that \$1 public investment in incubator generates \$30 tax revenue. There is a finding that 87% company nurtured in incubators can survive in the market. For instances, Google Inc. inception was made in the Stamford University, USA. Stamford graduates founded 12 world leading companies generate revenue of \$275 billion in the year 2011 that creates 6.66 million direct employments. In the year 2012, China has more than 1200 technology business incubator. They are contributing to the national economy through employment generation of 1.43 million people. The growth rate of

business incubator is about 25% in Chania [9,10]. Additionally, there are approximately 70 technology business incubators (TBI) in India sponsored by the Science & Technology Division, Government of India. Among them ICT is considered as third sector in about 50 incubators. 70% of the Incubators are situated at university level. Here, it is worth mentioning that the National Association of Software and Service Companies (NASSCOM), India has taken a program to create 10,000 start-up companies [11].

Based on the literature it is clear that world is focusing on innovation ecosystem development. Neighbour countries started their journey and institutionalised the system. But in Bangladesh it has just begun. Couple of projects are ongoing and more to come. One specialized university-based incubation project just started its infrastructural work. But along with infrastructural work, operational modalities and ecosystem need to be developed. Academic-Industry-Government collaboration is required to develop institutional system.

2.2 ICT Sector and Bangladesh

The government took some appreciable initiatives to ensure smooth journey towards implementation of Digital Bangladesh. Establishment of a separate Ministry of Information and Technology is one of such initiatives. A separate Ministry of Information and Technology was established on December 4, 2011.

Afterward, steps were taken to coordinate the activities of the Ministry of Post & Telecommunication and the Ministry of Information and Communication Technology. Because, the two ministries are closely related with each other. Many works on implementation of Digital Bangladesh are dependent on the joint decision of these two ministries. For this reason, two divisions have been created under the Ministry of Post, Telecommunication and Information Technology [12].

1. Information and Communication Technology Division (ICT Division)
2. Post & Telecommunication Division (PTD).

2.2.1 Information and Communication Technology Division

The Information & Communication Technology Division is responsible for developing the ICT sector in the Country. Some of their responsibilities are [13]:

- a) Formulate and update national policies on information and technology as well as aid the different Ministries/Divisions and Agencies regarding activities on information and communication technology;
- b) Implementation of recommendations of the National ICT Task Force;
- c) Provide grants and overall assistance to agencies in the information and communication technology sector including non-government ICT organizations/societies, undertake surveys, sampling, research and development in the information and communication technology sector and provide access to funding for such activities;
- d) Liaise with different countries and international organizations in the information and communication technology sector and also implement agreements and assistance programs in these relevant sectors;
- e) Assist in and co-ordinate the preparation of an integrated work-plan on service-oriented activities relating to e-governance, e-infrastructure, e-health, e-commerce etc.
- f) Formulate policy and instructions for commercialization of ICT services in order to reach people easily
- g) To attract local and foreign investment in the ICT sector through all infrastructure development including establishing software Technology Park, hi-tech park and ICT incubator, improving the competitiveness of local companies and increasing employment and export.
- h) Secure and give legal status to electronic records, ensure and implement reservation of all data and identity of senders and receivers.

The associated and statutory organizations under the Information and Communication Technology Division are:

- i) Bangladesh Computer Council (BCC)
- ii) Bangladesh Hi-Tech Park Authority
- iii) Information and Communication Technology Directorate (ICTD)
- iv) Controller of Certifying Authority (CCA).
- v) Digital Security Agency (DSA)
- vi) Access to Information (a2i) Programm

Bangladesh Computer Council (BCC): BCC is a statutory body under the Information & Communication Technology Division, Government of Bangladesh for encouraging and

providing support for ICT related activities in Bangladesh. It is established by Act No IX of 1990 passed by the Parliament. The function of the Council shall be [14]:

- a)** To encourage the use of Computer and Information Technology (CIT) for the socioeconomic development of the country;
- b)** To formulate and implement national strategic policies and plans on CIT and help developing infrastructural facilities for the introduction of CIT in Bangladesh and promote professional efficiency in the field of computer education and training;
- c)** To help build-up Bangladeshi nationals to compete in the growing CIT industry in the international market;
- d)** To encourage in developing human resources in the field of CIT and organize manpower export in the international market;
- e)** To formulate and implement national strategies and policies related to CIT;
- f)** To collaborate and co-operate with the Government and other organization and advise them for attaining the national CIT objectives;
- g)** To advise and encourage the Government and other organization in using Computers and Information Technology;
- h)** To advise organizations concerned regarding security measures to be adopted for using CIT;
- i)** To organize, equip and maintain Computer Training Institutes, Libraries and Laboratories for the overall development of CIT;
- j)** To collect, analyze, and publicize information related to CIT;
- k)** To collect, print and publish reports, periodicals, papers on CIT and related subjects;
- l)** To organize workshops, seminars, training on subjects related to Computers and Information Technology;
- m)** To give grants to initiate or conduct research, study, or training on subjects related to CIT;

- n) To collaborate and co-operate with the concerned Government organization, private sector organization, local and foreign bodies for attaining the national CIT objectives;
- o) subject to the approval of the government, to enter into any contract or agreement of any kind with foreign firms for the purposes of the Council;
- p) To discharge any other function assigned or delegated to it by the government from time to time;
- q) To develop specifications and standards for the CIT industry at a national level; and
- r) To do such other acts and things as may be necessary to be done in connection with; or conducive to, the performance of the aforesaid function.

Bangladesh Hi-Tech Park Authority: Bangladesh Hi-tech Park Authority under Information & Communication Technology Division, established in 2010, is the official body of the government to boost up Hi-tech industries in the country. The major functions of the BHTPA are as follows [15] :

- a) To establish Hi-tech Park in the potential locations in the country ensuring its efficient operational management.
- b) Provide policies for regulating its development, management etc.
- c) Provide policies for attracting local and foreign investors
- d) Provide space, lease term and fixing up of rental rate
- e) Fixing up terms and condition of Park developer for the PPP model projects.
- f) Provide one stop services as follows;
- g) Selection of Plot for the investor
- h) Allocation of Plot and contract for leasing
- i) Work permit for the investor
- j) Assist resident /nonresident Visa for investors
- k) Arrange Water, Gas, electricity, Telephone and Internet connection
- l) Other related works

In order to encourage the foreign investors, the government of Bangladesh offers one of the most liberal investment policies and attractive packages of fiscal, financial and other incentives. Major incentives to stimulate private sector direct investment are as follows:.

- a) 12 Year tax Holiday for Developers.
- b) Exemption of Income Tax for 10 years for IT/ITES company.
- c) 10 years accelerated Depreciation permissible
- d) Exemption from Import Duties for construction material/eqpt, software/hardware & vehicles
- e) Exemption from import duties on machinery used for maintenance
- f) Full repatriation of Dividends/Profits & Capital permissible
- g) 100% Equity (Ownership) is allowed for FDI companies
- h) No cap on FDI limits
- i) Hi-Tech Park will be treated as Custom Bonded Area
- j) Human Resources training/development will be undertaken for the Industry in the Hi-Tech Park to get right-skilled manpower at the Hi-Tech Park
- k) Hi-Tech Park Authority should work as a Single Window agency

Information and Communication Technology Directorate (ICTD): ICTD is established to ensure high speed e-Connectivity, e-Governance, skilled IT human resource, cyber security, generation and implementation of innovative ICT ideas, remarkable coordination, quality control and disseminating of digital notion among the citizen. Build ICT infrastructure, sustainable maintenance support and attractive ICT career path. Conduct research and development for acquisition of new technology. The major functions are as follows [16]:

- a) Ensure the proper utilization of ICT & coordination of ICT activities among all the Government offices for smooth functioning.
- b) Support to create appropriate ICT infrastructure and maintenance support of all government offices up to grass root level.

- c) Appointment, promotion, transfer/posting of ICT related officers to all government offices.
- d) Disseminate technical and special knowledge of ICT to all level.
- e) Constitute Rules, Regulation and its implementation for Government institutions.
- f) Constitute Rules & Regulation to create appropriate ICT related manpower.
- g) Take initiative to provide services through electronic system to the grass root level people and collect information, distribution & research for these purposes.
- h) Ensure requirement, quality, standardization and interoperability of ICT equipment.
- i) Research, develop & provide support to adopt modern technology for all level.
- j) Properly evaluate the merit, experience and capacity of ICT related man-power of ICT Directorate and provide proper recognition & protect their interest.

Controller of Certifying Authority (CCA): CCA to ensuring Secure Cyber Space. Ensuring secure transition of Information and eradicating cyber Crime through implementation of Digital Signature Certificate [17].

- a) Controlling Activities of Certifying Authority (CA)
- b) Issuing, suspending and repealing CA license according to ICT Act 2006 (Amendment 2013) and ICT (CA) Rules 2010.
- c) Leading and Maintaining of Public Key Infrastructure (PKI) activities.
- d) Making Rules, guideline and regulation for PKI and controlling its standard.
- e) Submitting investigation report before the Cyber Tribunal after investigating Cybercrimes under ICT Act, 2006.
- f) Constituting Audit firm for auditing IT.
- g) Prescribing rate of Digital Signature Certificate according to IT (CA) rules, 2010.

Digital Security Agency (DSA): Digital Security Bill 2018 was passed in parliament. This Act shall be called Digital Security Act 2018

Access to Information (a2i) Programme: Access to information in Bangladesh or a2i is a UNDP and USAID-supported Access to Information Programme. In May 2015, a2i signed a deal with the Norway-based telecommunications company Telenor Digital to develop digital services of the government in order to make public and private services to become more accessible to the people in remote areas [18].

2.2.2 Post and Telecommunication Division (PTD)

The primary function of the PTD is to provide a quick and modernized telecom and postal services to the people of Bangladesh and thereby facilitate the creation of a digital Bangladesh. The organizations under the Post & Telecommunication Division are [19]:

- i) Bangladesh Telecommunication Regulatory Commission (BTRC)
- ii) Bangladesh Telecommunications Company Limited (BTCL)
- iii) Bangladesh Submarine Cable Company Limited (BSCCL)
- iv) Telephone Shilpa Sangstha Limited (TSS)
- v) Bangladesh Cable Silpha Sangstha (BCSL)
- vi) Teletalk Bangladesh.
- vii) Department of Telecommunications
- viii) Bangladesh Post Office
- ix) Bangladesh Communications Satellite Company Limited
- x) Mailing operator and courier services licensing authority

Bangladesh Telecommunication Regulatory Commission: In order to facilitate a quick and stable socio-economic development and to provide a dependable telecommunication services, Bangladesh Telecommunication Regulatory Commission (BTRC) was formed on 31st January of 2002, under the Bangladesh Telecommunication Regulatory Act 2001. The Act has delineated its objectives as follows [20]:

- a) To encourage the orderly development of Telecommunication System that enhance and strengthens the social and economic welfare of Bangladesh
- b) To ensure in keeping with the prevalent Social and economic realities of Bangladesh, access to reliable, reasonably price and modern Telecommunication services and internet. Services for the greatest number of people as far as practicable;

- c) To ensure the efficiency of the national Telecommunication System and its capability to complete in both the national and international spheres;
- d) To prevent and abolish discrimination in providing telecommunication services, to progressively effect reliance and competitive and market-oriented system and in keeping with these objectives to ensure effective control of the Commission;
- e) To encourage the introduction of new services and to create a favorable atmosphere for the local and foreign investors who intend to invest in the Telecommunication Sector of Bangladesh.

Bangladesh Telecommunications Company Limited: The Telegraph branch under the Posts and Telegraph Department was created in 1853 in the then British India and was regulated afterwards under the Telegraph Act-1885. The Telegraph branch was reconstructed in 1962 in the then East Pakistan as Pakistan Telegraph and Telephone Department. In 1971, after the independence of Bangladesh, Bangladesh Telegraph and Telephone Department was set up under the Ministry of Posts and Telecommunications. This was converted into a corporate body named 'Telegraph and Telephone Board' by promulgation of Telegraph and Telephone Board Ordinance, 1975. In pursuance of an ordinance of 1979, Telegraph and Telephone Board was converted into Bangladesh Telegraph and Telephone Board (BTTB), as a Government Board. From 1st July, 2008, as per the Telecommunication policy, 1998, BTTB was converted into a public limited company - Bangladesh Telecommunication Company Limited through another ordinance. BTCL has a mandate to provide basic telecommunication services throughout the country. BTCL has the largest telecom infrastructure comprising of copper cabling, microwave links, satellite links, optical fibre networks etc. [21]

Bangladesh Submarine Cable Company Limited: Bangladesh Submarine Cable Company Limited (BSCCL) is a Core Telecommunications service provider and International Submarine Cable Operator of Bangladesh. It is also an IIG (International Internet Gateway). The service provided by BSCCL represents the Long-haul communication between Bangladesh and the rest of the world. The Company emerged in July 2008 as a public limited company under the Posts and Telecommunications Division of Posts, Telecommunications and Internet Technology Ministry, Government of Bangladesh. BSCCL is a party in both SMW-4 and SMW-5 Consortiums provide more capacity and redundancy in Submarine Cables for Bangladesh. BSCCL-IIG is helping the people of the Country to get broadband

Internet with cheaper rate and better quality of service. BSCCL is one of the growing companies in the Telecom sector of Bangladesh. It is a leading company for implementation of National ILDTs & ICT policies to develop modern tele-network and high-speed Broadband Internet in Bangladesh [22].

Telephone Shilpa Sangstha : Telephone Shilpa Sangstha (TSS) Ltd. was initially established in the year 1967 with the nomenclature of “**Telephone Industries Corporation**” under a joint venture agreement between the then Government of Pakistan and M/S Siemens AG, West Germany. After the independence, Telephone Industries Corporation has been incorporated as a limited company with its present name Telephone Shilpa Sangstha (TSS) Ltd. under the Companies Act, 1913, and under a fresh agreement with the other part of the joint venture M/S Siemens AG, West Germany in the year 1973 [23].

Bangladesh Cable Shilpa Limited: Bangladesh Cable Shilpa Limited, Khulna is a production based industrial organization under “Ministry of Posts, Telecommunications & Information Technology” Govt. of the People's Republic of Bangladesh. It was established in 1967 in Khulna City with joint collaboration of the then Pakistan Govt. and M/s. Siemens A.G., West Germany. After starting commercial production in 1972 [24].

Teletalk Bangladesh Limited: Teletalk Bangladesh Limited is a Public limited company, registered under the Registrar of the Joint Stock Companies of Bangladesh. All shares are owned by the Government of People’s Republic of Bangladesh. Objectives of the company which are highlighted here under [25]:

- a) To provide mobile telephone service to the people from the public sector;
- b) To ensure fair competition between public and private sectors and thereby to safeguard
- c) public interest;
- d) To meet a portion of unmitigated high demand of mobile telephone;
- e) To create a new source of revenue for the government.

Bangladesh Communication Satellite Company Limited: Bangladesh Communication Satellite Company Limited (BCSCL) is a state-owned satellite operating company of Bangladesh. The company is performing hard to be the leading satellite operator in home and abroad. Currently the company is operating Bangabandhu Satellite-1 (BS-1), named after the father of the nation, Bangabandhu Sheikh Mujibur Rahman. BS-1, manufactured by Thales

Alenia Space, is a modern geostationary communication satellite and located at 119. 1° East longitude. It has strong Ku beams on Bangladesh, Indonesia, The Philippines, and on South-East Asian countries. It also serves planned/ INSAT C band on earlier mentioned countries and in addition, on Stan countries (Afghanistan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan & Kazakhstan). The upcoming family members of BS-1 will have global beam. High Throughput Satellite (HTS) is also in the pipeline of the planning. BCSCL provides satellite telecommunication services like DTH, VSAT, Video Distribution, Broadband, Communication Trunks etc. BCSCL has Primary Ground Station at Gazipur, Bangladesh, and Secondary Ground Station at Betbunia, Rangamati, Bangladesh. Bangabandhu Satellite -1 (BS-1) is the first geostationary satellite of the country having strong footprint on Bangladesh, Indonesia, The Philippines, South-East Asian countries (India, Nepal, Bhutan, Sri Lanka, Pakistan), and on Stan countries (Afghanistan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan & Kazakhstan). It covers almost 2200 million of people which is almost 30% of the world population. The upcoming family members of BS-1 will have global beam. High Throughput Satellite (HTS) is also in the pipeline of the planning. Bangladesh Communication Satellite Company (BCSCL) provides satellite telecommunication services like DTH, VSAT, Video Distribution, Broadband, Communication Trunks etc. [26]

2.2.3 ICT industries in Bangladesh

ICT industries are dominated by the private sectors in Bangladesh while Public. In the private sector some of the apex bodies like as-

- (i) Bangladesh Association of Software & Information Services (BASIS)
- (ii) Bangladesh Computer Society (BCS)
- (iii) Bangladesh Association of Call center Out sourcing (BACCO)
- (iv) Bangladesh Computer Samity (BCS)
- (v) Bangladesh Computer Society (BCS) suppliers of computers and its accessories
- (vi) Internet Service Providers (ISP) and
- (vii) Cyber Café Owners' Association of Bangladesh (CCOAB)

A brief introduction about the activities of these organizations is given below:

Bangladesh Association of Software and Information Services (BASIS): Bangladesh Association of Software and Information Services (BASIS) is the national trade body for Software & IT Enabled Service industry of Bangladesh. Established in 1997, the association has been working with a vision of developing vibrant software & IT service industry in the country. Members of BASIS account for the lion share of the total software & IT services revenue of the country. Few well known companies like Aamra Technologies Limited, ADN Technologies Ltd, Bangla Trac Limited, bdjobs.com Limited, DataSoft Systems (BD) Limited etc. BASIS, through its regular programs and activities, works on the following broad objectives [27,28].

- a) Domestic market development by creating awareness among potential IT users from both private and public sectors, establishing market places for IT solutions and ensuring level playing field for local software and ITE service industry.
- b) International market development through networking and business linkage events as well as brand promotion of the industry at international level.
- c) Capacity building of the member companies as well as the industry through management/entrepreneurship development initiatives, technology training and resource sharing.
- d) Member service development and delivery in different operational and business support areas like financing, tax, export/import, remittance, foreign visit, contract & legal issues, IPR etc.
- e) Advocacy for business friendly and enabling government policies for the development of software and IT enabled service industry.
- f) Social contribution, as responsible citizen group, towards the long-term national vision of becoming a technology driven knowledge economy, particularly through engaging with the young generation for motivating and guiding them for becoming future technology leaders
- g) BASIS has already gained modest success in attaining the above-mentioned goals. For domestic market creation, BASIS has wide range of programs and activities. Every year BASIS organizes BASIS SOFTEXPO, the biggest software and ITES exposition in the country.

- h) There are over 1,000 software and IT enabled service (ITES) companies in Bangladesh (BASIS). IT enabled services provide a wide range of areas, from media and entertainment, engineering, process and infrastructure, consumer services, banking, insurance, travel, manufacturing, pharmaceuticals, and financial services.
- i) ITES companies in Bangladesh are primarily involved in software development, data digitization and processing, call centers, animation, and multimedia and desktop publishing. A comprehensive list of IT enabled services is provided in Annex A.

Bangladesh Computer Society (BCS): Bangladesh Computer Society is regarded as the leading professional and learned society in the field of computers and information systems in Bangladesh. It was established on 23 July 1979. The Bangladesh Government Register no. S-1638(53)/95. This is also a Sister Societies of IEEE Computer Society. Bangladesh Computer Society (BCS) is the national representative body of Computer Engineers, Scientists and Technologist of the country. It is a non-political, non-profitable organisation. From the first day, BCS was playing significant roles in providing consultation and policy making services to Bangladesh Government and also contributing directly to the progress of making the country computerised. As recognition of its contribution, the Government of Bangladesh has given it the power of certifying ICT professionals.

Bangladesh Computer Society is working with the following aims and objectives [29]:

- a) The aim of the Society is to advance professional excellence in Information Technology (IT)
- b) To promote, develop and monitor competence in the practice of IT by persons and organizations and to be the spokesman for IT professionals at international level
- c) To develop knowledge and skill of IT professionals in developing, application and maintenance of IT and IT related appliance i.e. to promote continuing professional development and lifelong learning process.
- d) To make data communication easy and to develop public opinion on it
- e) To help develop IT skills of IT related persons and organizations
- f) To maintain and promote the observance of standard of knowledge of IT for members of the Society
- g) To define and promote the maintenance of standard of knowledge of IT for members

- h) To promote the formulation of effective policies on information technology and related matters
- i) To promote the benefits of membership of the Society
- j) To promote the benefits of employing members of the Society
- k) To maintain morality of members of the Society and to monitor and maintain level and standard of IT knowledge of members of the Society
- l) To look after the welfare of the members of the Society
- m) To create and enhance the opportunities and status of members of the Society in the work area
- n) To create employment opportunities for the members of the Society
- o) To promote human network

Bangladesh Association of Call Centres outsourcing: The role of BACCO is to encourage creation of proper policies and regulations; ensure in place are fair and appropriate operating environment; and aid interested operators who want to enter the market. The role and objectives of BACCO are as follows [30]:

- a) To ensure fair and objective call center policies and regulations are in place within the shortest period of time.
- b) Advocate fair operating environment are in place from all government departments.
- c) To promote Call Centre and BPO services globally.
- d) Make Bangladesh a major competitive offshore contender for the MNCs.
- e) To ensure good governance is established.
- f) To open a new hi-tech sector in Bangladesh and thereby earn foreign currency.
- g) Assist in generating new employment and human resource for the call center market.

Internet Service Provider (IPS): The Internet Service Providers Association of Bangladesh was established in 1998. The general purpose of ISPAB is to improve business conditions of the Internet service providers operating in Bangladesh. It serves the common business interest of its members. Internet Service Providers are providing internet services to various types of clients including schools, colleges, universities, public and private offices, private individuals

etc throughout Bangladesh. ISP's outside Dhaka are mainly connected with VSAT. The operating License and other terms and conditions particularly the rent to the subscribers is determined by BTRC. Related works involved are:

- a) Promoting higher business standards Disseminating information
- b) Ensuring benefit for members (and their customers)
- c) Influencing the government for pragmatic policies
- d) Performing functions that are customary among trade associations

Cyber Café Owners' Association of Bangladesh (CCOAB): CCOAB is the trade association of the cybercafé businesses at the national level. Established in 2003, the association safeguards the rights and interests of the members and helps the ICT in Bangladesh through combined strengths of the members. At present there are about 4,000+ Cyber Cafes are in operation out of which 1,000+ are in Dhaka. Most of the Cyber cafe's provide initial training to the beginners. There is lack of standardized training in these organizations although very few are well organized.

2.3 Review of Technology Parks in World Wide

Technology Park is a new term in our country but this is very common in other country mainly developed country. Considering USA, Japan, EU, Singapore, technology park concept is not new. Even in India, technology parks related activity started more than 35 years back.

2.3.1 History of Technology Park Development

In 1950s, Technology Park can be traced as a form of Stanford Research Park in Palo Alto, California and Research Triangle Park in North Carolina. At present Stanford Research Park and Research Triangle Park are well known for their success and achievement. Stanford Research Park facilitates start-ups, established research and development companies and research branches of fortune 500 companies. On the other hand, more than 250 companies and 50 thousand experts working with Research Triangle Park [31,32]. There is an upsurge in the growth of technology park over the last few decades. Table 2-1 shows a review of technology park development characteristics in USA and a list of technology park around the globe:

Table 2-1: Technology Park Development Characteristics in USA [33]

SN	Time	Characteristics
1	Before 1990 models	• Existing business employment generation

		• Less linkage with university • Lack of innovation and research • Focused on infrastructural support • Limited support services
2	1990s models	• Focused on R&D • Strong university linkage • Incubation and Innovation centers • Support services and networking
3	2000 and beyond models	• Focused on entrepreneurship and start-ups • Global networking • Both Commercial and residential support • Facilitates tenants

Technology parks are vital for industrial development. From the history of technology park development, it is seen that the process of technology park development starts long back and many countries adopts the trend in their own form. Table 2-2 shows the approximate number of technology parks around the globe.

Table 2-2: Technology parks around the globe [34-36]

SN	Region/Country	Number of Technology Parks (Approximately)
1.	USA	300+
2.	UK	63
3.	France	60
4.	Finland	24
5.	Japan	120+
6.	China	80+
7.	India	40+
8.	Switzerland	7
9.	Sweden	12
10.	Singapore	14+
11.	Italy	6
12.	Malaysia	5+
13.	Germany	13
14.	Denmark	5
15.	Belgium	6
16.	The Netherlands	6
17.	Canada	13
18.	Africa	11
19.	Middle East	36
20.	Australia	9
21.	Thailand	6

According to recent study of International Association of Science Parks (IASP), technology parks and the innovations now a days are focusing on ICT and communications. After that biotech is the most priority sector. IASP study shows existing trends in technology park and the area of innovation in the parks. Table 2-3 shows the statistics.

Table 2-3: Technological Sectors Statistics in Technology Parks [8]

SN	Technological Sectors	Existing trends in the science and technology park (STP) and area of innovation (AOI) in Percentage (%)
1	ICT and communications	64.1
2	Biotechnology	35
3	Computer science and hardware	31.6
4	Electronics	29.1
5	Software engineering	29
6	Health and pharmaceuticals	27.4

2.3.2 Elements of Technology Parks

Technology park need to provide wide ranges of services to the company or investors. As a result, it requires a mixed eco system to operate efficiently and effectively for the client in the park. It depends on a close linkage with knowledge-based partners to ensure technology transfer, commercialization, education and training. Study suggest the following elements are very important for technology parks [33]:

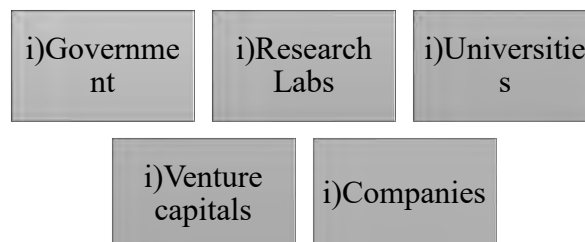


Figure 2-1: Basic elements of technology parks

2.3.3 Success Factors for Technology Parks

Technology parks attracts local and foreign companies to establish their business to boost economic growth through employment and industrial development. Many technology parks

offer financial incentives, public funded infrastructure, reduction in rent, public private collaboration but still hundreds of them stay unsuccessful. Many follows the process of Stanford Research Park and Silicon Valley model. But there is no fixed strategy that may consider as perfect model. It varies region to region depending on the regional strength and available resources like Cambridge science Park uses its facilities to attach companies. Some research shows the following factor are important for technology parks. Again, the factors shown below may vary based on the company types. Large companies' requirements may differ from SMEs and Start-ups. Success factors and relatives' remarks shown in the table 2-4;

Table 2-4: Technology Park Success factors [33, 34]

SN	Factors	Remarks
1.	Flexible Physical Resources	✓ Collaboration among various types of companies. ✓ Flexible use of resources ✓ Flexibility in space allocation
2.	Training and Mentorship	✓ Mentorship for start-up companies ✓ Business development, marketing planning, innovation management support ✓ Workshop
3.	Networking	✓ Creation of synergy among tenants ✓ Collaboration among start-ups and entrepreneurs ✓ Networking among tenants and investors ✓ University research linkage
4.	Support Services	Accounting, Food, Legal, Market Research, Patent, Intellectual property, technology transfer consulting, shared lab, transportation and ICT infrastructure.
5.	Access to early adopters	Early comers should be facilitating more.

From the table 2-4, it is seen that success factors are depended on many criteria. Based on the proper implementation on the criteria as stated remarks in the table, the success factor may be successful or a failure.

Again, a study reports from Globustrat Consulting Group, Transnational Executive MBA, College of Business and Economics, California State University recommend twelve factors for as the success factor for technology park. They create a inter connected linkage within the twelve factors. This is known as GLOINTECH Technology Park Model. Figure 2-2 shows the model that includes 12 factors [35]:

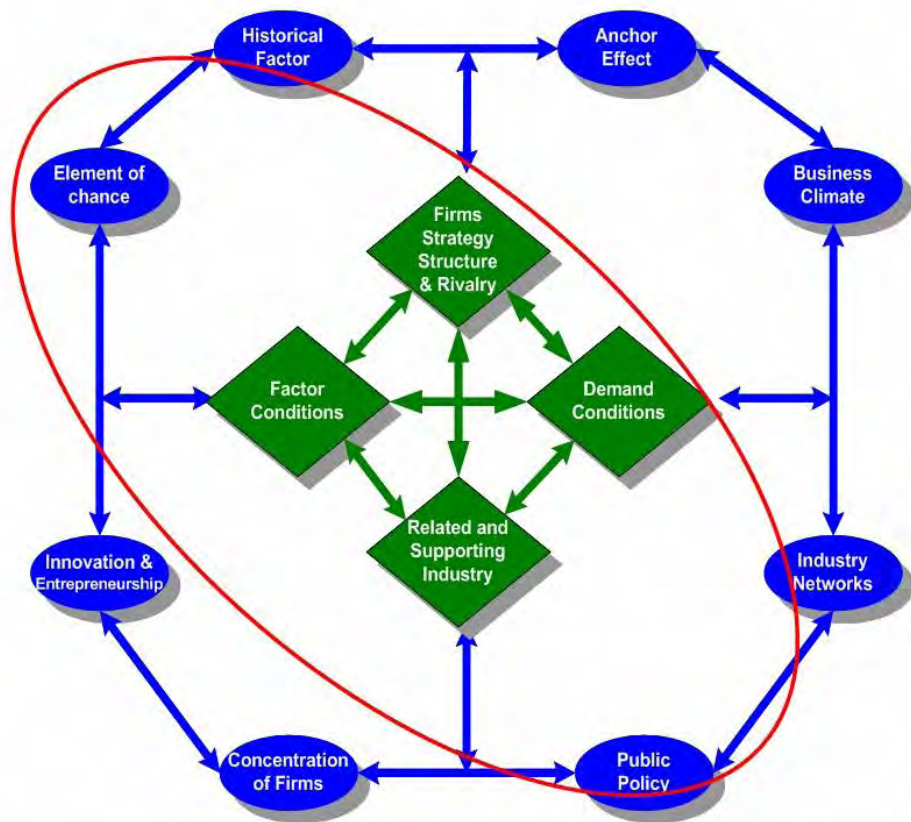


Figure 2-2: GLOINTECH Technology Park Model [35]

From figure 2-2 and table 2-4, it is found that there are many common elements but in GLOINTECH Technology Park Model historical factor and anchor are new elements. These elements may play a vital role for the success of any technology park. Any giant company office like Microsoft, Facebook, Google etc. in any park will attract many more to come and operate their business in the park area. Public policy, innovation & entrepreneurship, industry networks, business climate and element of chance are important factors for park development.

2.3.4 Case Studies of Technology Parks

Nations around the globe realised that innovation targets and transition economics requires appropriate technological infrastructures. Infrastructures that can add value to the society, can create employment, promote knowledge-based product with commercialization, transfer technology and ensure high return on investment. Technology park is such an eco-system. Nations understood the importance of knowledge industry for sustainable economic growth and commence for the establishment of technology park of different geographical scale. Many researchers studied the concept of technology park, its development history, working process, focus area, role & responsivity towards economic development, policy, R&D institution requirement and common services. Several models have been developed for technology park. However, technology park in developed country and developing country varies. Sometimes, it is seen that anchor tenants plays a vital role in developing country technology park [36].

Around the globe technology parks operates in various mode, i.e., Private, Government, Public-Private partnership model, Mixed model (university, government, industry). Whatever the model is, research and development play a vital role for sustainability. To understand the technology parks management and impact, few technology parks have been studied around the globe based on available information from internet. A summary of case study of various technology parks is presented in the table 2-5.

Table 2-5: Summary of Technology Park Case Study

SN	Park Name	Region	Year of Establishment	Approximate Size in acres (A) and Build up space (S)	Focus Sectors	University/ educational institution or Research Institute Linkage	Employment generation (E)/ number of companies (C)/Researcher (R)/ Start-up or students related directly/ indirectly (S)	Operation Model & ownership	Incubation
1	Stanford Research Park	USA	1951	A: 700 acres S: 9 M+ sq. m.	Electronics, biotechnology, computer hardware	Yes	E: 23000+ C: 150+	joint initiative between Stanford University and the City of Palo Alto	yes
2	Research Triangle Park		1959	A: 7000 acres S: 21 M+ sq. m.	R&D, manufacturing	Yes	E: 49000+ C: 250+ R: 5000+	private non-profit organization. Operation mode: mixed	yes
3	Cambridge Science park	UK	1970	A: 152 acres S: 0.25 M+ sq. m.	Telecommunications , Electronics, bio technology,	Yes	E: 35000+ C: 100+	University-led effort	yes
4	Daedeok Innopolis.	South Kores	1973	A: 17000 acres	IT, Bio technology, material science	Yes	E: 45000+ C: 400+ R: 6000+ S: 35000+	Public Operation mode: mixed	
5	LG science park		1955	A: 183 acres S: 1.1 M+ sq. m.	Electronics life science	Yes	E: 25000+	Public	yes
6	Sopia Antipolis	France	1972	A: 5900 acres S: 2M+ sq. m.	computing, electronics, pharmacology and biotechnology	Yes	E: 35000+ C: 850+ R: 4500+ S: 5000+	Semi public Operation mode: mixed	yes

7	Singapore Science park 1&2	Singapore	1982 & 1993	A: 74+86=160 acres	computing, electronics, pharmacology and biotechnology	Yes	E: 10000+ C: 300+	Govt.	yes
8	Kulim Hi-Tech Park	Malaysia	1996	A: 4400 acres	electrical and electronics manufacturing	Yes	E: 10000+ C: 37+	Govt.	yes
9	Zhangjiang Hi-Tech Park	China	1992	A: 6100+ acres	life sciences, software, semiconductors, and information technology.	Yes	E: 100000+ C: 3600+ R: 4500+ S: 5000+	Operation mode: mixed	yes
10	Zhongguancun Science Park, Beijing	China	1980	A: 57000+ acres	IT and electronic	Yes	E: 900000+ C: 20000+	Operation mode: mixed	yes
11	Tidel Park, Chennai	India	2000	A: 8 acres S: 0.1M sq. m	software		E: 12000+ C: 23+	Private	
12	Electronic City, Bangalore	India	1978	A: 800 acres	information technology	Yes	E: 100000+ C: 200+ R: 4500+ S: 5000+	private	yes
13	Adlershof Technology park	Germany	1991	A: 1000+ acres	R&D, basic and applied sciences	Yes	E: 16000+ C: 500+ S: 8000+	Operation mode: mixed	yes
14	Heidelberg Technology Park		1985	A: 1000+ acres	ICT, R&D and Life sciences	Yes	E: 16000+ C: 80+ S: 8000+	Operation mode: mixed	yes

2.3.5 Technology Park Best Practices

During the last couple of decades, technology parks practises different firework for success. The success or failure varies region to region. Based on technology parks case study and various research available shows that for long term success, high quality infrastructure is important. Specialized business infrastructure for targeted group; knowledge intensive work force; collaboration with University and research institution; R&D; Technology Transfer Support; Incubation facilities; Innovation & Patent support; Product Commercialization; Marketing Assessment; Financial Incentives are the vital player for the success. It requires a mixed eco-system.

2.4 Review Hi-Tech/Software Technology Park and Business Incubators in Bangladesh

Hi-Tech/Software Technology Park and Business Incubators is very common in many countries. But this seems to be a new initiative in Bangladesh. USA, Japan, EU, Singapore, Thailand and many more countries took initiatives to established technology park targeting sectoral development. Bangladesh started late but still government has taken many initiatives for the development of technology parks and incubation centres around the country.

2.4.1 Bangabandhu Hi-Tech City, Kaliakoir, Gazipur

The Government of Bangladesh is implementing “Support to Development of Kaliakoir Hi-Tech Park Project” under the Private Sector Development Support Project (PSDSP) financed by IDA and DFID. BHTPA is establishing various off-site infrastructures in Kaliakoir Hi-Tech Park. Kaliakoir Hi-Tech Park (KHTP) is the first ever Hi-Tech Park in Bangladesh, located at Kaliakoir upazilla in Gazipur district. It is situated only 40 km North from Dhaka city covering with 232 acres of land. Additional 97 acres of land is included for inclusion with the park. The park will be a world class business environment/investment zone for the investor especially foreign investors where they could utilize vast potential of young educated and technically skilled work force. The KHTP and other IT Parks are being established with a target to attract reputed foreign firm, which could increase employment, economic activities and contribute significantly to the GDP of the country.

It is also proposed to provide selected youth from Bangladesh to participate training programs in other countries as the Brand Ambassadors of Bangladesh to attract the IT/ITES industry to invest and locate in the country with the display of their capabilities and the skills in the sector at these companies. One such offer has been implemented as a goodwill gesture offered to the country by a leading multinational IT/ITES company Infosys Ltd by inviting 100 Computer Science Engineers /IT Graduates for Specific 3 months Training at Their Mysore campus. The project is supporting IT/ITES firms to improve their competitiveness in different ways 40 firms has been provided support for undertaking quality certification (2 firms-Capability Maturity Integration Model (CMMI) Level-5, 10 firms-CMMIL-3, 25 firms ISO: 9001, 3 firms-ISO:27001). Considering the high demand and impact for expansion of IT/ITES business in global market the World Bank agreed to support in this initiative by expanding up to 50 firms. Besides the CMMIL-3, 5, ISO-9001, 27001 the ISO-14001 could be considered with is relevant for IT/ITES manufacturing. In this circumstance, project is planning to extend the opportunity to support in quality certification program up to 50 IT/ITES firms.

Summit Technopolis Ltd. (JV of Summit and Infinity India) have been appointed for Block 2 and 5 of KHTP and JV of Fibre@Home and Technopark Malaysia has been selected for Block-3.

2.4.2 Janata Tower Software Technology Park, Karwan Bazar, Dhaka

Janata Tower software Technology Park is located at Kauran bazar, Dhaka. It is a 12 storied building with a capacity of 72 thousand square feet. 15 IT/ITES company and 12 start-ups companies have already started their operations in this software technology park. More than 800 people are working in this software technology park.

2.4.3 Sylhet Electronic City

Sylhet Hi Tech Park, known as Sylhet Electronic City is being established on a 162.83 acre area in Companiganj upazila of Sylhet. It is only 20 km off the city. The site includes specific zones for industrial belt, ICT business zone, administrative area, community facility, infrastructure zone while separate zone would be there as water body. Bangladesh Navy-operated Dockyard and Engineering Works Limited (DEW) is working with the authority to develop the park. It is expected that within 2020 the park will be operational.

2.4.4 Bangabandhu Sheikh Mujib Hi-Tech Park, Rajshahi

During Rajshahi visit dated 24.11.2011, Honorable Prime Minister declared to setup an IT Park in Rajshahi to expend and promote the opportunity of the IT/ITES as well as Hi-Tech industries. Due to this word of honour, in the meeting of the Executive Committee of Hi-Tech Park Authority, it was decided to establish IT Park in Rajshahi. Around 31 acres of land is selected for the project and it is expected that the construction work will be completed by 2020. In the figure 2-3 shows the tentative masterplan of the project area.



Figure 2-3: Master Plan of Bangabandhu Sheikh Mujib Hi-Tech Park, Rajshahi

2.4.5 Sheikh Hasina Software Technology Park, Jessore

Prime Minister Sheikh Hasina had promised to build a “world-class” IT Park in Jessore while inaugurating Jessore Science and Technology University on December 27, 2010. As a result, a project has taken and Jessore IT Park known as Sheikh Hasina Software Technology Park has formally started its journey. The park comprises around 232,000 square feet of space with modern facilities including a 15-storey MTB building, 12-storey three-star standard dormitory building, a state-of-the art convention Centre, parking, generator backup and 5MVA sub-station. Many companies started their work and many are at the preparation stage to start their work the present operation modality of the park is PPP (Public Private Partnership). Figure 2-4 shows the existing view of the project area.



Figure 2-4: Sheikh Hasina Software Technology Park

2.4.6 CUET IT Business Incubator

The main objective of this project is to construct the necessary infrastructures and provide equipment facilities to the university graduates to be entrepreneurs in the field of IT/ITES. Entrepreneurial culture help making boom in the action-based research and innovation activities. It also establishes strong bond between academics and industries. Consequently, business incubation will open a window of opportunities for strengthening nation's knowledge-based economy (KBE) in order to achieve the vision of Digital Bangladesh by the year 2021. The following are the specific objective of the project:

- a) To create conducive business environment with infrastructural and other facilities for university graduates turn to be entrepreneurs in IT/ITES/BPO sectors.
- b) To make strong bond between university and industries.
- c) To contribute for sustainable growth of IT based economy through promoting research and innovation at university level.
- d) To reduce the shortage of quality & skilled IT personnel and establish supply chain management on creation of successful national enterprises for Hi-Tech Parks and STP going to be established in the country.
- e) To help improve in global competitiveness ranking and knowledge economy index (KEI) of Bangladesh on ICT.

The area of the proposed site for the development of the IT Business Incubator is 4.7 acres. The proposed site is a Khas Land belonging to the university. The land has been legally transferred to the Bangladesh Hi-Tech Park Authority (BHTPA) for establishment of Incubator. There is also a proposal for transfer an additional adjacent 10 acres of land for future expansion of the incubator. Master plan of the project area is showed in the figure 2-5.

2.4.8 Private Software Technology Park (PSTP)

Government is taken many initiatives to establish Hi-Tech (HTP) /Software Technology Park (STP) around the country. At the same time welcome any initiatives taken by private organization to establish private HTP/STP. Bangladesh Hi-Tech Park Authority (BHTPA) circulated a guideline Private STP. Though there are no private HTP but based on the guideline 13 private STP is now operational. In this private STP more than five thousand people (as on December 2018) are working. Table 2-6 shows the list of private STP in Bangladesh.

Table 2-6: List of private STP

S.L	Company Name	Address	website
1	Augmedix BD Ltd	SS Steel Building, Suite 203, 17/C, Panthapath, Dhaka.	www.augmedix.com
2	Digicon Technologies Ltd.	Rajuk Trade Center, 4th Floor and 5th, Faruq Sorone Road, Nikonjo, Uttara R/A, Khilkhet Dhaka.	www.digicontechnologies.com
3	BJIT Ltd.	House-7, Road-2/c, Block-J, Baridhara, Dhaka-1212.	www.bjitgroup.com
4	Kazi IT Center Ltd.	House-1/B, Road -12, Nikunjo-2, Khilkhet, Dhaka-1229.	www.kaziitcenter.com
5	Mars solutions Ltd.	R.S No-22, J.L No. -296, Mouja-Dumni, U.P-Isapura, Thana-Khilkhet. District-Dhaka.	www.mars.com.bd
6	Hello World Communications Ltd	11th Floor, BGMEA Bhaban, Zawtala Road, Khulshi, Chittagonj.	www.helloworldbd.com
7	Aplombtech Tech BD Ltd	House No-3, Block-H, Boshundhora, Dhaka.	www.aplombtechbd.com
8	Service Enginee Ltd	House No-08, Abbas Garden, Mohakhali, Dhaka-1206.	www.sebpo.com
9	DataSoft Systems Bangladesh Limited	(18th, 19th, 20th, Floor), 23/6, Mirpur Road, Shyamoli, Dhaka-1207.	www.datasoft-bd.com
10	Service Solutions Pvt. Ltd.	BNS Center, 6th, 11th , & 12th Floor, Plot-87, Dhaka Mymensingh Road, Sector-7, Uttara, Dhaka-1230.	www.ssibd.net
11	Fair Electronics Limited	Kamargaon, Putia, Shibpur, Narshingdi	www.fel.com.bd
12	Divine IT Limited	House-29, Road-12, Sector-10, Uttara, Dhaka.	www.divineit.net
13	Devo Tech Technology Park Ltd	Niloy Mansion, Plot # 11, Road # 113/A, Gulshan-2, Dhaka-1212, Bangladesh	www.devo-tech.com

CHAPTER-3: METHODOLOGY

3.1 Research Design

To achieve the objectives of the thesis work, four steps are followed. Initially related literature reviewed from journals, book, thesis etc. Then ongoing project site and completed project site were visited. After that survey questioner used to collect the data. Various type of tools used to analyse the collected data and finally a frame work is developed. Details research methodology shown in the Table 3.1.

Table 3.1: Research Methodology

SN	Methods	Target Group/Source		Expected Outcome
1.	Literature reviews	Journals, Conference paper, books, thesis paper, articles, and websites.		General practises and clear understanding of technology park
2.	Site Visit	Site visit of completed and on-going HTP/STP project in Bangladesh and study the planning of upcoming project.		Practical experience and understanding of HTP/STP in the country and their situation.
3.	Survey Questionnaires + Application of Tools to analyse the survey data (AHP, SPSS and SWOT)	a	Companies working in ICT sector (both working within Hi-Tech/software Technology park and working Outside)	To understand the requirements and vision of the local company.
		b	Government officials	To analyse the existing facilities and setbacks.
		c	Experts related to this sector	Optimization of policy and framework for technology parks
4.	Relevance Tree	A graphical outline and mapping for HTP/STP components and technology parks framework.		

3.2 Tools

Tools and tetchiness are very essential to analyse values, attitudes, opinions, feelings and behaviours of individuals and understand how these affect the overall research outcome. In this

mathematically in the case of hierarchical model, to discover the important influences. The methodology of the AHP can be explained in following in figure 3-2.

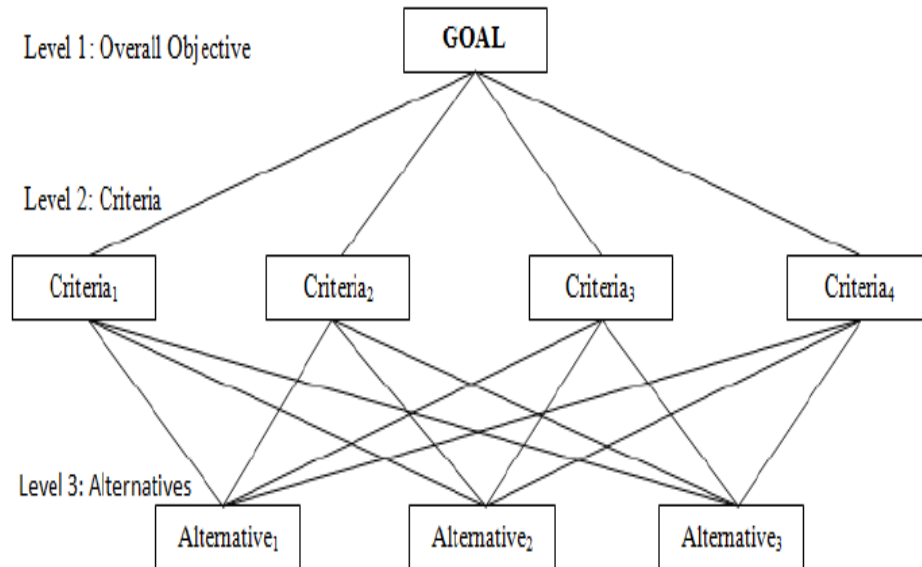


Figure 3-2: Generic hierarchic structure of AHP

This method used for both tangible and intangible factors analysis. for real world problems. again, mutual agreement can also be provided among decision makers prior to their final decision. Firstly, the alternatives, main and sub-criteria -if there is any- must be determined. In the next step the decision problem is modelled hierarchically by considering previously selected criteria. The decision-makers' judgments are collected through pairwise comparisons in the third step. In this step, the importance rankings of alternatives and criteria will be determined by analysing these data which are obtained from these comparisons. Hence comparisons must be performed among these criteria and alternatives [38-40]. This scale is given in Table 3-2.

3.2.5 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.

3.3 Questionnaire Design and Data Collection

Peoples capacity for information processing for solving any problem or to take decision is limited. The questionnaire design is important to facilitates data collection and statistical data management. For the criteria and sub criteria total 18 questions are developed to collect data.

3.3.1 Questionnaires

Questionnaires is developed to collect expert's opinion for AHP analysis. The AHP technique is a widely used and accepted method for gathering data from respondents within their domain of expertise. The technique is designed as a group communication process which aims to achieve a convergence of opinion on a specific real-world issue. It has been used in various fields of study such as program planning, needs assessment, policy determination, and resource utilization to develop a full range of alternatives, explore or expose underlying assumptions, as well as correlate judgments on a topic spanning a wide range of disciplines. In this study seven experts are chosen for selecting the criteria and sub criteria. The personal profile of expert panel is shown in table 3-8 below. Based on the interviews and interaction of relevant experts, observation and literature review, modalities, criteria and sub-criteria are included in this study. Sample questionnaires for the criteria are shown below and details questionnaires are included in the annexure.

Questionnaires for Criteria

1. Let given the frequency selection options, what is more important to you: Infrastructure (F1) or Governance (F2)? Please indicate the scale from 1 to 9 to determine the importance.
2. Let given the frequency selection options, what is more important to you: Infrastructure (F1) or Strategic & Business Facility (F3)? please indicate the scale from 1 to 9 to determine the importance?
3. Let given the frequency selection options, what is more important to you: Governance (F2) or Strategic & Business Facility (F3)? Please indicate the scale from 1 to 9 to determine the importance.

Table 3-3: Personal Profile of Expert Panel

SN	Designation	Overall Exp. (Years)	Relevant Exp. (Good, Better, Best)	Education Qualification	Organization
1	Project Director	25+	Best	Masters	Government
2	Project Director	25+	Best	B.Sc. Engr.	
3	Project Director	20+	Best	B.Sc. Engr.	
4	Professor	20+	Better	PhD	
5	Professor	20+	Better	PhD	Private University
6	Senior Consultant	30+	Best	Masters	Asian Development Bank
7	Managing Director	40+	Best	Masters	Private Company

Again, data and information collected from various company and related professionals of private and government sector. Thirty-four companies and seventeen government and related professionals are consulted to collect information. Structured questionnaires' developed to collect data. After collecting the information about important requirement of HTP/STP, again another set of questionnaires is prepared for collecting the data about the availability of the required facility as per market demand. List of the interviewed company and persons is attached as annexure.

In this study, the requirements or components for successful implementation of HTP/STP are identified through discussion and survey.

3.3.2 Main Attributes and their Sub-attributes

a) Infrastructure (main attributes): Infrastructure is one of the most important part for the development of HTP/STP. It is considered that within 2025 Bangladesh may require 20 million square feet buildup space for IT/ITEs sector. For HTP/STP infrastructures are considered in three way which are assumed as sub attributes i.e.,

i) Basic Facility (sub attributes):

Land, working space, meeting room, auditorium/conference room, cafeteria; utility like generator, sub-station, HVAC, fire safety, 24/7 working environment, good connectivity etc.,

ii) Digital Facility (sub attributes):

Networking, security surveillance, lab facilities/lab equipment for rent, video-conference room, software-based utility billing system and paperless management etc.

iii) Social Facility (sub attributes):

Dormitory, banking services, shopping facility, gymnasium, recreation zone, health care, library, day care facility etc.

b) Strategic and Business Support (main attributes): Strategic and business support is required to create the eco-system. This is the major forces shaping the initial investment to success.

i) Industrial Chain and Enterprise Development (sub attributes):

R&D facilities, industrial co-operation, international collaboration, university linkage, technology transfer center/ support etc.

ii) Innovation and Strategic Facility (sub attributes):

incubation/start up development facilities, innovation & patent support service, product commercialization, marketing assessment, financial incentives, business development/mentorship etc.

iii) Capacity and Market Development (sub attributes):

entrepreneurship development training, project and financial management, venture capital, co/shared workplace/ workforce facility, seminar/ symposium, professional membership, internship support, global standard certification support, need based on job training support, cyber security/latest technology support etc.

c) Governance (main attributes):

i) Policy Support (sub attributes):

ii) Operational Modality (sub attributes):

- Government
- Private

- Mixed Model
 - University-Industry
 - University-Govt.-Industry mixed type
 - Government- Industry

iii) Park Management (sub attributes):

- Administrative capability and employee structure
- Legal Service
- Social Service
- Innovation Culture development etc.

3.3.3 Expert Opinion and Profile

To build the pair-wise comparison matrices for the main attributes and sub-attributes, opinion of academic experts and professional experts are collected. The purposive sampling method is used. It is one where the sample is selected on need basis according to the specialization. The personal profile of the experts was shown in table 3-4:

Table 3-4: Personal Profile of Expert Panel

SN	Designation	Overall Exp. (Years)	Relevant Exp. (Good, Better, Best)	Education Qualification	Organization
1	Project Director (Joint Secretary)	25+	Best	Masters	Government
2	Project Director (Joint Secretary)	25+	Better	B.Sc. Engr.	
3	Project Director (Joint Secretary)	25+	Best	B.Sc. Engr.	
4	Project Director (Deputy Secretary)	20+	Better	Masters	
5	Project Director (Deputy Secretary)	20+	Best	B.Sc. Engr	
6	Director (Deputy Secretary)	20+	Best	Masters	
7	Professor	20+	Best	PhD	Government
8	Professor	20+	Best	PhD	Government
9	Assistant Professor	8+	Good	PhD	Private University
10	Senior Consultant	30+	Best	Masters	ADB
11	Managing Director	40+	Best	Masters	Private Company

12	Director	30+	Good	Masters	Private Company
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Based on the expert opinion after analysing the importance of main and sub facilities, again survey conducted to determine the components of sub attributes described in section 3.3.2. These components of the sub attributes are very important as these are directly related to field level. Based on the survey and importance of the components of sub attributes, third phase of survey conducted to identify the availability of these required facilities. Table 3-5 shows the list of organization both private and government which been surveyed:

Table 3-5: Local Company List

SN	Company Name	Company website/ Interviewers e-mail	Remarks
1.	Contessa Solutions and Consultants Ltd.	www.contessabd.com	COM-1
2.	Sine Pulse	www.sinepulse.com	COM-2
3.	Bangladesh Technosity Ltd.	www.technosity.com	COM-3
4.	Micro Dream IT	www.microdreamit.com	COM-4
5.	Huawei	chepeng@huawei.com	COM-5
6.	TechnoVista	www.technovista.com	COM-6
7.	Omega Exim Ltd.	www.omegaexim.com	COM-7
8.	AKR Technology	www.akrtechnology.com	COM-8
9.	Dcrowd IT Ltd.	www.dcrowd.net	COM-9
10.	Samrat IT	www.Samratit.com admin@samrtit.com	COM-10
11.	VICS IT	Victorsaha92@gmail.com	COM-11
12.	Technosoft Bangladesh	www.technosoft.com.bd info@technosoft.com.bd	COM-12
13.	Finest Web Geek	www.finestwebgeek.com ceo@finestwebgeek.com	COM-13
14.	Anika IT Corner	www.anikaitcorner.com support@anikaitcorner.com	COM-14
15.	Jessore IT	www.jessoreit.com info@jessoreit.com	COM-15
16.	Animatrix Animation Studio	www.animatrixbd.com info@animarix.com	COM-16
17.	Ongsho Ltd.	www.ongsho.com mohidul@ongsho.com	COM-17
18.	Chakladar	www.linkingcc.com	COM-18
19.	Chaldal.com	www.chaldal.com	COM-19
20.	My Light Host	www.mylighthost.com	COM-20

21.	Destiny Inc.	www.kkdestiny.com	COM-21
22.	Hasan International	www.hasaninternational.com	COM-22
23.	Borno IT	www.bornoit.com	COM-23
24.	REVE System Ltd.	www.revesystem.com	COM-24
25.	Virgo Contact Center Services Ltd.	www.virgoccs.com	COM-25
26.	EZZE Technology Ltd.	www.etl.com.bd	COM-26
27.	FIFO Tech	www.fifo-tech.com	COM-27
28.	Millennium Information Solution Ltd.	www.mislbd.com	COM-28
29.	CS Infotech Ltd.	www.csinfotechbd.com	COM-29
30.	Systech Digital Ltd	www.systechdigital.com	COM-30
31.	NRB Bazaar	www.nrbbazaar.com	COM-31
32.	Summit Technopolis Ltd	http://www.summittechnopolis.com/	COM-32
33.	Data Soft	http://datasoft-bd.com/	COM-33
34.	LEADS Training and Consulting Ltd.	www.leads-bd.com	COM-34

Alongside private company, data also collected from government organization and related experts who are working as a consultant within the government system or donor agency. Table 3-6 shows the list of these persons.

Table 3-6: Government Employee (GE)/Consultant (C) List

SN	Designation	Organization/Employer	Remarks
1.	Project Director	Government	GE-1
2.	Project Director		GE-2
3.	Project Director		GE-3
4.	Deputy Project Director		GE-4
5.	Deputy Project Director		GE-5
6.	Director		GE-6
7.	Deputy Director		GE-7
8.	Deputy Director		GE-8
9.	Assistant Director		GE-9
10.	Assistant Director		GE-10
11.	Deputy Project Director		GE-11
12.	Additional Director		GE-12
13.	Senior Consultant	World Bank	C-1
14.	Senior Consultant	World Bank	C-2
15.	Assistant Professor (PhD)	Private University	C-3
16.	Technology Transfer Officer	Putra Science Park, UPM, Malaysia	C-4
17.	Transaction Adviser	Ernst & Young, multinational	C-5

		professional services firm.	
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CHAPTER-4: FINDINGS AND ANALYSIS

4.1 Introduction

In this section, rigorous mathematical calculation of the pair-wise comparison matrices has been performed. To calculate the weightage of main and sub criteria, AHP is used for mathematical operation of matrices. The pair wise comparison matrices are developed by expert opinion. The detailed calculation is shown below.

4.2 Application of AHP

The matrix of pair-wise comparisons depicts the intensities of expert's preference/importance. Geo metric mean of the value of each pair wise comparison determined and then matrix is formed with respect to the goal. Initially the criteria and sub-criteria are defined with symbol as shown below. Here only one detail sample matrix and calculation are given.

• Infrastructure: F1 • Strategic & Business: F2 • Governance: F3	• Operational Modality: F3C2 • Park Management: F3C3 • Government: A • Private: B • Mixed: C • University-Industry: X • Govt.-University-Industry: Y • Government-Industry: Z
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From the questionnaire, data collected and the data inserted in the prescribed matrix format for the calculation of weightage of the criteria.

Criteria	F1	F2	F3	Matrix as per pair wise values from expert opinion					
Infrastructure (F1)	1	1	3						
Strategic & Business (F2)	1	1	7						
Governance (F3)	1/3	1/7	1						
Criteria	F1	F2	F3						
Infrastructure (F1)	1	1.000	3.000						
Strategic & Business (F2)	1	1	7.000						
Governance (F3)	0.333	0.142	1						
Criteria	F1	F2	F3	3rd Root of Product	Priority Vector				
Infrastructure (F1)	1	1.000	3.000	1.442	0.387				
Strategic & Business (F2)	1	1	7.000	1.912	0.514				
Governance (F3)	0.333	0.142	1	0.362	0.097				
			Sum	3.717	1				
3rd(nth) root of product is the value of multiplying each row together and then cubic root; Quality(F1) =(F1*F2*F3) ⅓									
Priority Vector is the normalized value of nth root of product; Priority Vector (Weight) = nth root of product/Sum									
Consistency Check									
Criteria	F1	F2	F3	3rd Root of Product	Priority Vector	PV (%)			
Infrastructure (F1)	1	1.000	3.00	1.442	0.387	38.794			
Strategic & Business (F2)	1	1	7.00	1.912	0.514	51.455			
Governance (F3)	0.333	0.142	1	0.362	0.097	9.749			
Column Sum	2.333	2.142	11	3.717	1.00	100			
Sum PV	0.905	1.102	1.072	3.080					
				Lambda Max	"Lambda Max" is the sum of all "Sum PV" values. "Sum PV" is the multiplying value of "Column Sum" and Corresponding "Priority Vector"				
	Consistency Index (CI) = (Lambda Max-n)/(n-1)								
	Consistency Index (CI) =	0.0401	as here n=3						
	Consistency Ratio (CR) =	0.069							
Random Index (RI)									
n	1	2	3	4	5	6	7	8	9
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45

After the calculation of criteria, priority vector/weights for the sub-criteria under infrastructure is calculated as follows:

Consistency Check						
Sub Criteria	F1A1	F1A2	F1A3	3rd Root of Product	Priority Vector	PV(%)
Basic Facility (F1A1)	1	1	5	1.709	0.435	43.526
Digital Facility (F1A2)	1	1	7	1.912	0.486	48.692
Social Facility (F1A3)	0.2	0.142	1	0.305	0.077	7.781
Column Sum	2.2	2.142	13	3.928	1	100
Sum PV	0.957	1.043	1.01161	3.0125		
				Lambda Max		

Sub Criteria	F1A1	F1A2	F1A3	3rd Root of Product	Priority Vector
Basic Facility (F1A1)	1	1	5	1.709	0.435
Digital Facility (F1A2)	1	1	7	1.912	0.486
Social Facility (F1A3)	0.2	0.14285714	1	0.305	0.077
Sum				3.928	1

Sub Criteria	F1A1	F1A2	F1A3
Basic Facility (F1A1)	1	1	5
Digital Facility (F1A2)	1	1	7
Social Facility (F1A3)	1/5	1/7	1

Sub Criteria	F1A1	F1A2	F1A3
Basic Facility (F1A1)	1	1.00	5
Digital Facility (F1A2)	1	1	7
Social Facility (F1A3)	0.2	0.142	1

Consistency Index (CI) = (Lambda Max-n)/(n-1)		
Consistency Index (CI)	0.006	as here n=3
Consistency Ratio (CR)	0.010	

Then priority vector/weights for the sub criteria under the strategy and business support is calculated as follows:

Sub Criteria	F2B1	F2B2	F2B3
Research & Strategic Facility (F2B1)	1	4	7
Industrial Chain & Innovation Facility (F2B2)	1/4	1	4
Capacity & Market Development (F2B3)	1/7	1/4	1

Sub Criteria	F2B1	F2B2	F2B3
Research & Strategic Facility (F2B1)	1	4.000	7
Industrial Chain & Innovation Facility (F2B2)	0.25	1	4.00
Capacity & Market Development (F2B3)	0.142	0.25	1

Sub Criteria	F2B1	F2B2	F2B3	3rd Root of Product	Priority Vector
Research & Strategic Facility (F2B1)	1	4	7	3.036	0.695
Industrial Chain & Innovation Facility (F2B2)	0.25	1	4.00	1.00	0.229
Capacity & Market Development (F2B3)	0.142	0.25	1	0.329	0.075
	Sum			4.36591	1

Consistency Check						
Sub Criteria	F2B1	F2B2	F2B3	3rd Root of Product	Priority Vector	PV(%)
Research & Strategic Facility (F2B1)	1	4	7	3.036	0.695	69.552
Industrial Chain & Innovation Facility (F2B2)	0.25	1	4	1.00	0.229	22.904
Capacity & Market Development (F2B3)	0.142	0.25	1	0.329	0.075	7.542
Column Sum	1.392	5.25	12	4.365	1	100
Sum PV	0.968	1.202	0.905	3.076		
				Lambda Max		

Consistency Index (CI) = (Lambda Max-n)/(n-1)		
Consistency Index (CI) =	0.038	as here n=3
Consistency Ratio (CR) =	0.065	

Then priority vector/weights for the sub criteria under the governance support is calculated as follows:

Sub Criteria	F3C1	F3C2	F3C3
Policy Support (F3C1)	1	1/3	7
Operational Modality (F3C2)	3	1	9
Park Management (F3C3)	1/7	1/9	1

Sub Criteria	F3C1	F3C2	F3C3
Policy Support (F3C1)	1	0.333	7
Operational Modality (F3C2)	3	1	9
Park Management (F3C3)	0.142	0.111	1

Sub Criteria	F3C1	F3C2	F3C3	3rd Root of Product	Priority Vector
Policy Support (F3C1)	1	0.333	7	1.326	0.289
Operational Modality (F3C2)	3	1	9	3.00	0.655
Park Management (F3C3)	0.142	0.111	1	0.251	0.0549
			Sum	4.577	1

Consistency Check						
Sub Criteria	F3C1	F3C2	F3C3	3rd Root of Product	Priority Vector	PV(%)
Policy Support (F3C1)	1	0.333	7	1.326	0.289	28.974
Operational Modality (F3C2)	3	1	9	3.00	0.655	65.535
Park Management (F3C3)	0.142	0.111	1	0.251	0.0549	5.490
Column Sum	4.142	1.444	17	4.57	1	100
Sum PV	1.200	0.946	0.933	3.080		
				Lambda Max		

Consistency Index (CI) = (Lambda Max-n)/(n-1)		
Consistency Index (CI)	0.0401	as here n=3
Consistency Ratio (CR)	0.0692	

Under the operational modality there are three types of process like government, private and mixed type. Data collected for these is inserted in the matrix format to find the priority vector/weights

Criteria	A	B	C
Government (A)	1	4	1
Private (B)	1/4	1	1/8
Mixed (C)	1	8	1

Criteria	A	B	C
Government (A)	1	4.000	1.000
Private (B)	0.25	1	0.125
Mixed (C)	1	8	1

Criteria	A	B	C	3rd Root of Product	Priority Vector
Government (A)	1	4.000	1.000	1.58740	0.40678
Private (B)	0.25	1	0.125	0.31498	0.08071
Mixed (C)	1	8	1	2.00000	0.51251
Sum				3.90238	1

Consistency Check						
Criteria	A	B	C	3rd Root of Product	Priority Vector	PV(%)
Government (A)	1	4.000	1.000	1.58740	0.40678	40.6778
Private (B)	0.25	1	0.125	0.31498	0.08071	8.07149
Mixed (C)	1	8	1	2.00000	0.51251	51.2508
Column Sum	2.25	13	2.125	3.90238	1	100
Sum PV	0.91525	1.04929	1.08908	3.05362		
				Lambda Max		

Consistency Index (CI) = (Lambda Max-n)/(n-1)		
Consistency Index (CI)	0.0268	as here n=3
Consistency Ratio (CR)	0.0462	

Again, under the operational modality there are three sub criteria. One of them is the mixed type. Under the mixed type process, there are the option like university-industry, government-university-industry and government-industry. Experts opinion taken for this condition is inserted in the matrix and weights for the respective criteria is calculated.

Criteria	X	Y	Z
University-Industry (X)	1	1/7	3
Govt.-University-Industry (Y)	7	1	8
Government-Industry (Z)	1/3	1/8	1

Criteria	X	Y	Z
University-Industry (X)	1	0.143	3.000
Govt.-University-Industry (Y)	7	1	8.000
Government-Industry (Z)	0.33333333	0.125	1

Criteria	X	Y	Z	3rd Root of Product	Priority Vector
University-Industry (X)	1	0.143	3.000	0.753	0.153
Govt.-University-Industry (Y)	7	1	8.000	3.825	0.776
Government-Industry (Z)	0.333	0.125	1	0.346	0.0703
			Sum	4.926	1

Consistency Check						
Criteria	X	Y	Z	3rd Root of Product	Priority Vector	PV(%)
University-Industry (X)	1	0.143	3.00	0.753	0.153	15.303
Govt.-University-Industry (Y)	7	1	8.00	3.825	0.776	77.659
Government-Industry (Z)	0.333	0.125	1	0.346	0.0703	7.0370
Column Sum	8.333	1.267	12	4.926	1	100
Sum PV	1.275	0.984	0.844	3.104		
				Lambda Max		

Consistency Index (CI) = (Lambda Max-n)/(n-1)		
Consistency Index (CI)	0.052	as here n=3
Consistency Ratio (CR)	0.089	

Finally, after the calculation of all the criteria and sub-criteria for expert 1, the summary of the weightage is given below:

Level 1	weightage	Level 2	weightage
Infrastructure (F1)	0.387	Basic Facility (F1A1)	0.435
		Digital Facility (F1A2)	0.486
		Social Facility (F1A3)	0.0778
Strategic & Business Support (F2)	0.514	Research & Strategic Facility (F2B1)	0.695
		Industrial Chain & Innovation Facility (F2B2)	0.229
		Capacity Development (F2B3)	0.0754
Governance (F3)	0.0974	Policy Support (F3C1)	0.289
		Operational Modality (F3C2)	0.655
		Park Management (F3C3)	0.0549
Level 3	weightage	Level 4	weightage
Government (A)	0.406	University-Industry (X)	0.153
Private (B)	0.080	Govt.-University-Industry (Y)	0.776
Mixed (C)	0.512	Government-Industry (Z)	0.0703

After the calculation and analysis of all the criteria from expert-1, it is found that F2 is more important over F1 and F1 is more important than F3. Under F1, F1A2 and under F3, F3C2 has got the highest priority. Again, under most important criteria F2, F2B1 found most significant as per expert-1.

Again, in level-3, mixed operation modality and level-4, Government-University-Industry based process got highest weightage.

One details calculation for the criteria and sub criteria is showed and like this all the opinion and data collected from the experts are inserted in the matrix format and the weightage is calculated separately. After the calculation of all the expert's opinion, geometric mean of criteria and sub-criteria is calculated finally to get the final weightage. Final outcome is given below:

S.N.	Description	Weightage	Ranking
1.	Infrastructure (F1)	0.469	1
2.	Strategic & Business Support (F2)	0.433	2
3.	Governance (F3)	0.097	3

S.N.	Group	Description	Weightage	Ranking
1.	F1	Basic Facility (F1A1)	0.422	3
2.		Digital Facility (F1A2)	0.501	1
3.		Social Facility (F1A3)	0.076	2
4.	F2	Research & Strategic Facility (F2B1)	0.656	1
5.		Industrial Chain & Innovation Facility (F2B2)	0.253	2
6.		Capacity & Market Development (F2B3)	0.089	3
7.	F3	Policy Support (F3C1)	0.279	2
8.		Operational Modality (F3C2)	0.658	1
9.		Park Management (F3C3)	0.062	3

S.N.	Description	Weightage	Ranking
1.	Government (A)	0.443	2
2.	Private (B)	0.076	3
3.	Mixed (C)	0.480	1

S.N.	Description	Weightage	Ranking
1.	University-Industry (X)	0.216	2
2.	Govt.-University-Industry (Y)	0.709	1
3.	Government-Industry (Z)	0.073	3

After the calculation and analysis of all the criteria from expert-1, it is found that F2 is more important over F1. But after considering all the expert's opinion, geometric mean of criteria and sub-criteria it is found that F1 got higher weightage than F2. Difference of the weightage is 0.036. All the other values of other criteria and sub-criteria changed but their position remain same.

4.2.1 Result Analysis using AHP model

After the result calculations by AHP, based on the expert opinion from 12 experts (academician, industry and government professionals) it is observed that quality infrastructure is mostly preferable but at the same time strategic & business support is also important. While analyzing expert-1 opinion, it is seen that strategic & business support is more important than infrastructure. For the sub-criteria i.e., digital facility, research & strategic facility and operational modality are the most important factors. But among these three, operational modality carries the highest weightage. Again, govt.-university-industry collaboration type mixed operation method is mostly preferable by the experts.

4.2.2 Result Analysis for Criteria

From the analysis it is found that among the 3 criteria's, "infrastructure" having most priority as per the average value of all 12 expert's opinion and the second priority criteria is "strategic & business support". A comparison chart is as in figure 4-1;

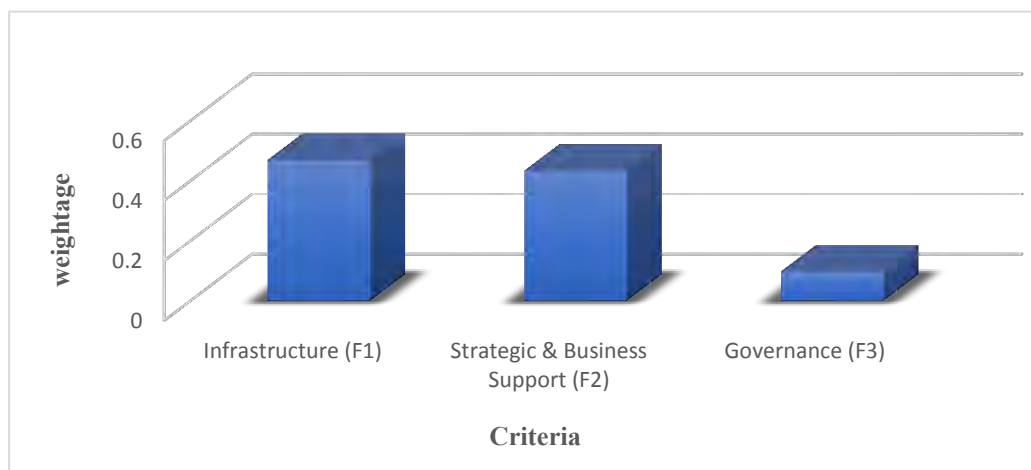
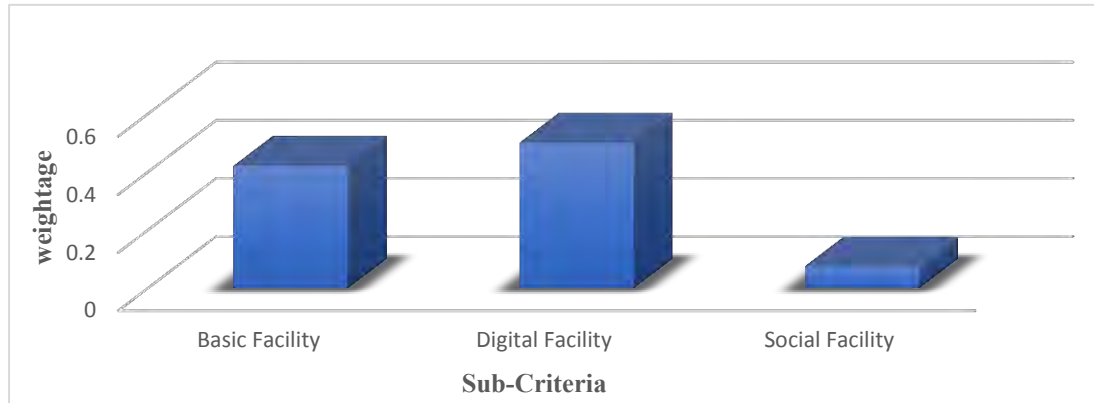


Figure 4-1: Priority of criteria

4.2.3 Result Analysis for Sub-Criteria

From the analysis it is found that sub criteria from infrastructure (F1) group, “digital facility” is more important than the other two. A comparison chart for the sub-criteria of F1 group is showed in figure 4-2



Again, it is Figure 4-2: Priority of criteria under infrastructure (F1) group having most importance, “industrial chain & innovation facility” is in second position and “capacity development” has least importance. It can be said that if “research & strategic facilities” along with innovation facilities are provided then capacity of the local company and start-up companies will be increased automatically. At present lots of capacity building training is going on around the country. This is required but if more focus given to “research & strategic facilities” then this may be more fruitful. On the other hand, for group F3, among three sub criteria “operational modality” carries the highest importance after that “policy support” and “park management”. A comparison chart for the sub-criteria of F2 and F3 group is showed in figure 4-3 and figure 4-4.

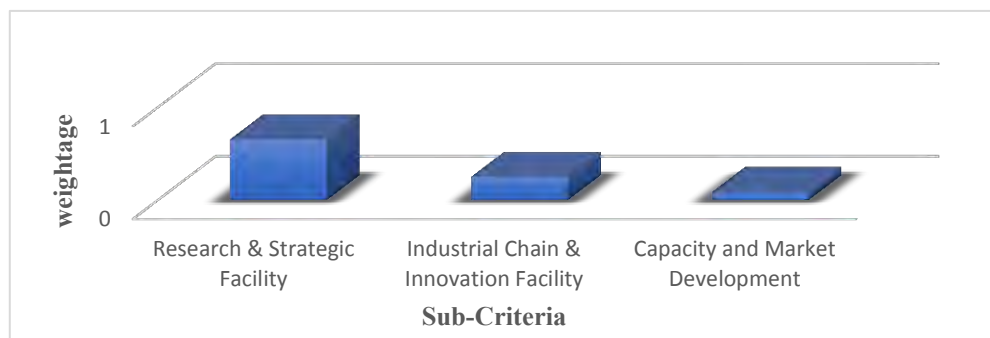


Figure 4-3: Priority of sub criteria under strategic & business support (F2)

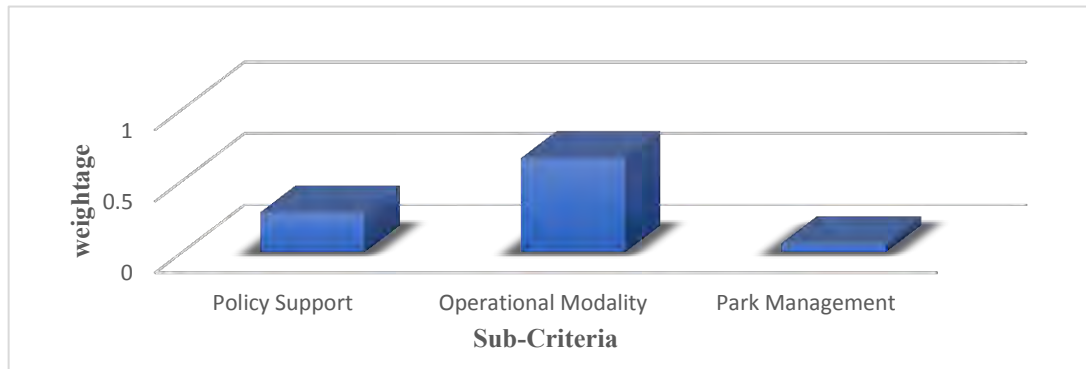


Figure 4-4: Priority of criteria under governance (F3) group

It is seen that park “operation modality” is very important for any technology park development and maintenance. Based on operation modality, park management and policy management will be determined. Suitable operation modality may lead a park to success. Here, three types of operation modality are identified, i.e., “University-Industry” based, “Govt.-University-Industry” based and “Government-Industry” based. After the analysis it is found that “Govt.-University-Industry” based combined operation model is considered most suitable for the technology park in Bangladesh. This will provide a synergy effect to the management and overall eco-system. A comparison chart is showed in figure 4-5.

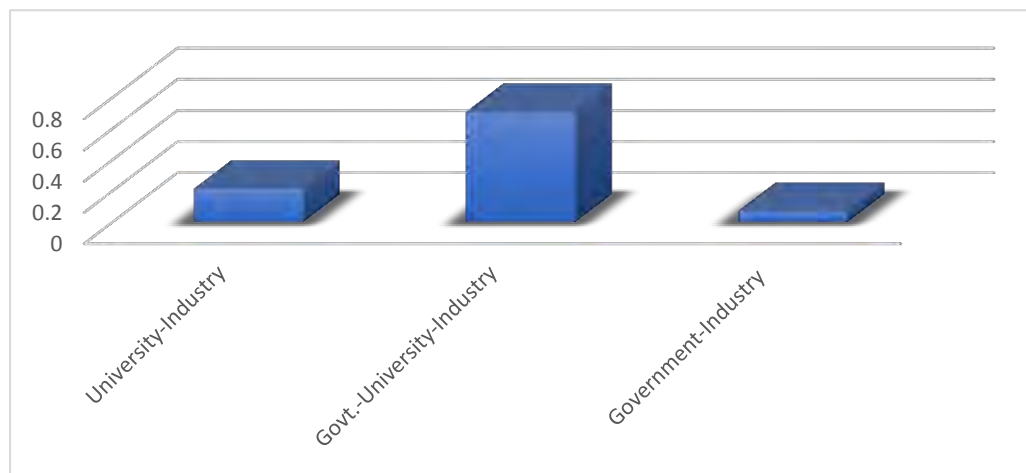


Figure 4-5: Priority of operational modality

4.3 Application of SPSS

SPSS (Statistical Package for the Social Sciences) software platform is used to analyse the elements/facilities required. Under infrastructure category basic facility, digital facility and social facility, industrial chain & enterprise development, innovation & strategic facility, capacity & market development and park management are divided into input variables. Through a survey (industry-government), SWOT analysis, literature survey and expert's opinion these variables are identified. Then SPSS is used to analyse the data. Table 4-1, table 4-2 and table 4-3 shows the variables considered under different criteria/group.

Table 4-1: Input variables for infrastructure

GROUP-1: INFRASTRUCTURE	
SN	Variables
G1a	meeting room/auditorium/conference room
G1b	dormitory
G1c	network
G1d	cafeteria
G1e	security surveillance
G1f	lab facilities/lab equipment for rent
G1g	video-conference room
G1h	bank office/banking services
G1i	shopping facility
G1j	generator
G1k	sub-station
G1l	hvac (air condition)
G1m	fire detection and protection system
G1n	software-based utility billing system
G1o	gymnasium
G1p	recreation zone
G1q	health check up
G1r	library /study room
G1s	24/7 working environment
G1	day care facility
G1u	good connectivity (road/rail/water/air)

Table 4-2: Input variables for strategic & business support

GROUP-2: STRATEGIC & BUSINESS SUPPORT	
SN	Variables
G2a	entrepreneurship development training
G2b	project and financial management support
G2c	business development/mentorship support
G2d	incubation/start up development facilities
G2e	innovation & patent support service
G2f	innovation and product commercialization support
G2g	R&D facilities
G2h	venture capital support
G2i	industrial co-operation support
G2j	international collaboration platform facility
G2k	university linkage
G2l	technology transfer centre
G2m	marketing assessment support
G2n	co/shared workplace
G2o	seminar/ symposium facility
G2p	professional membership facility
G2q	internship support
G2r	global standard certification support
G2s	need based on job training support
G2l	job placement support
G2u	financial incentives facility

Table 4-3: Input variables for Governance

GROUP-3: GOVERNANCE	
SN	Variables
G2a	well trained management team
G2b	dedicated operation and troubleshooting team
G2c	qualified staff for management (high educational qualification)
G2d	qualified staff for operation and troubleshooting
G2e	quick professional response towards any problem
G2f	experienced research staff
G2g	training for skill development of staff
G2h	cultural and social support
G2i	control of illegal issues
G2j	emergency support
G2k	security/safety
G2l	control over working hour

4.4 Result Analysis using SPSS

Here, a survey conducted from 51 source (academician, industry and government professionals). Among 51, 34 are the company working in this sector. As the variables are customer oriented and market driven, this survey is done from root level to policy level. Based on the survey, importance (1 to 7) of the variables determined. After the calculations by SPSS the comparison shown in figure 4-6. Figure 4-7 and figure 4-8. Detail analysis attached as annexure.

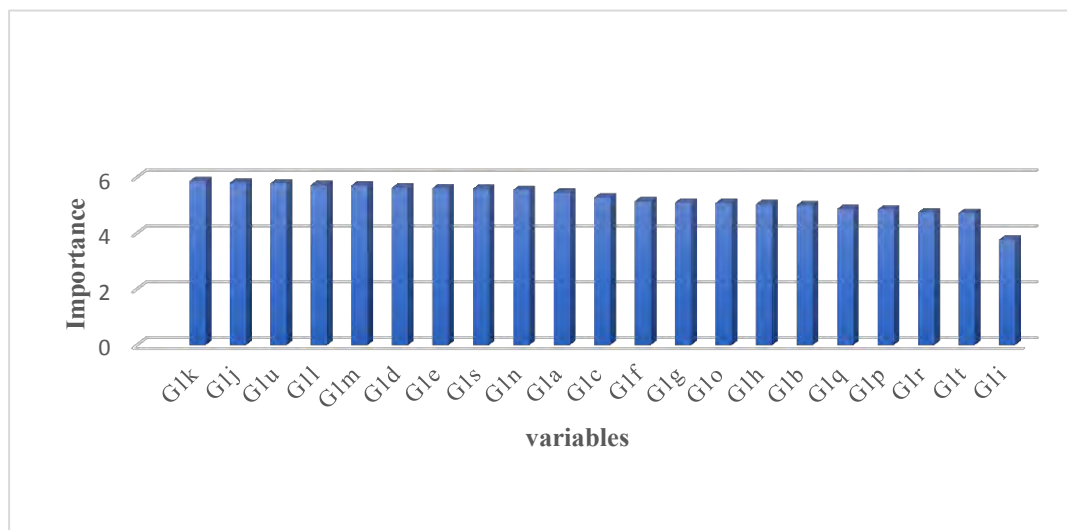


Figure 4-6: Importance analysis using SPSS of variables for infrastructure

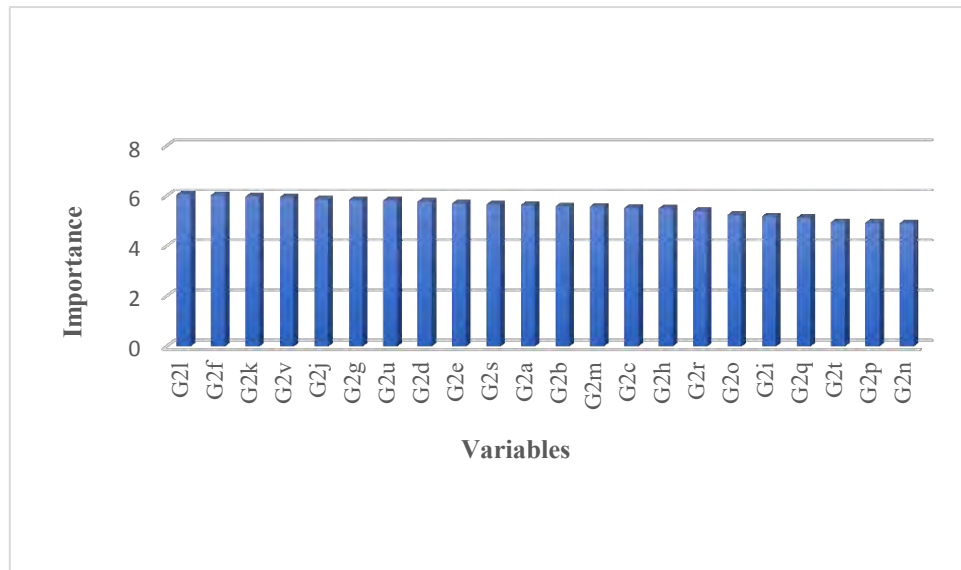


Figure 4-7: Importance analysis of variables for strategic & business support

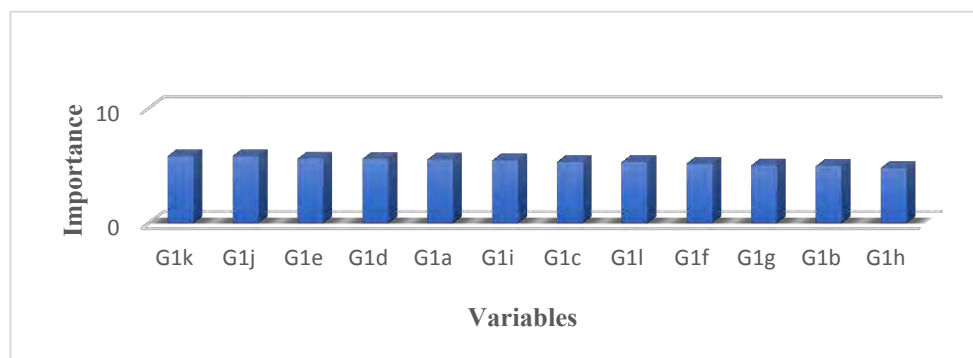


Figure 4-8: Importance analysis of variables for governance

4.4.1 Result Analysis for Variables Under Sub-Criteria

Variables are grouped under different sub-criteria as per focused group discussion with the related experts. For Infrastructure group, the requirements are divided in to three sub-criteria. Under these three sub-criteria identified twenty-one variables are distributed. Scenario of the variables under these sub criteria and their importance is shown in figure 4-9, figure 4-10 and figure 4-11.

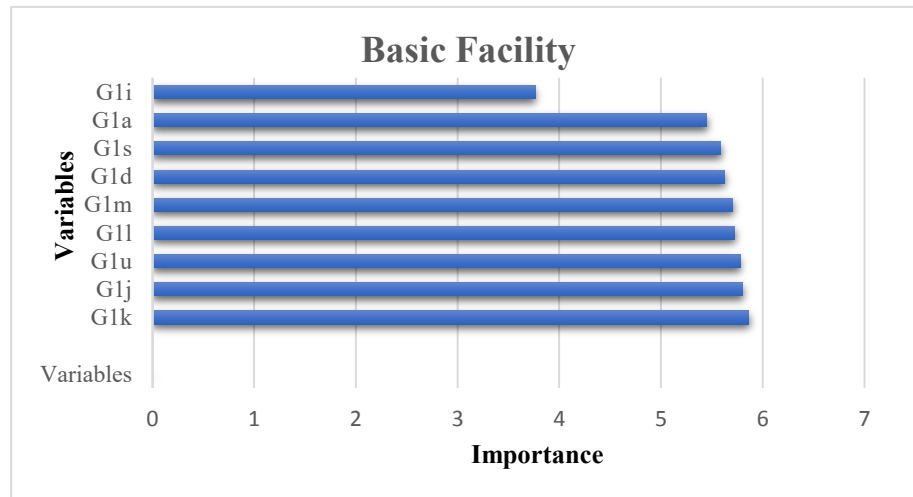


Figure 4-9: Importance analysis of variables for basic facility

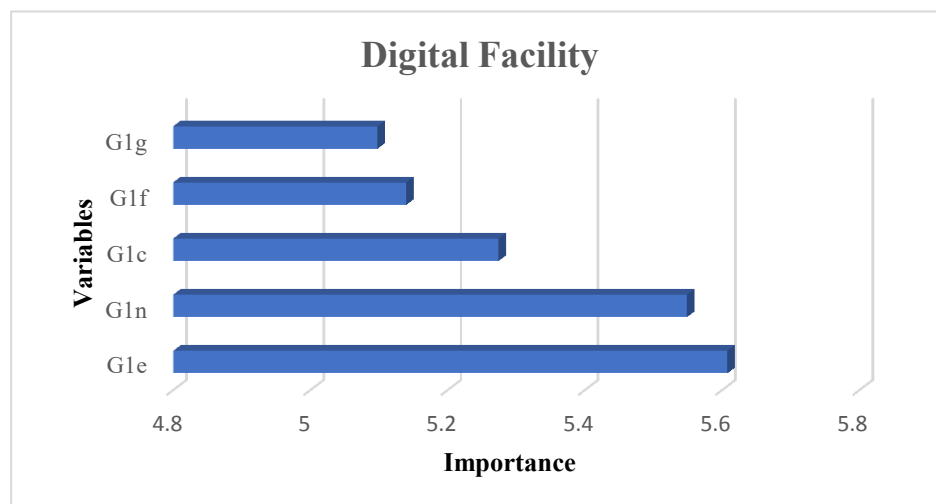


Figure 4-10: Importance analysis of variables for digital facility

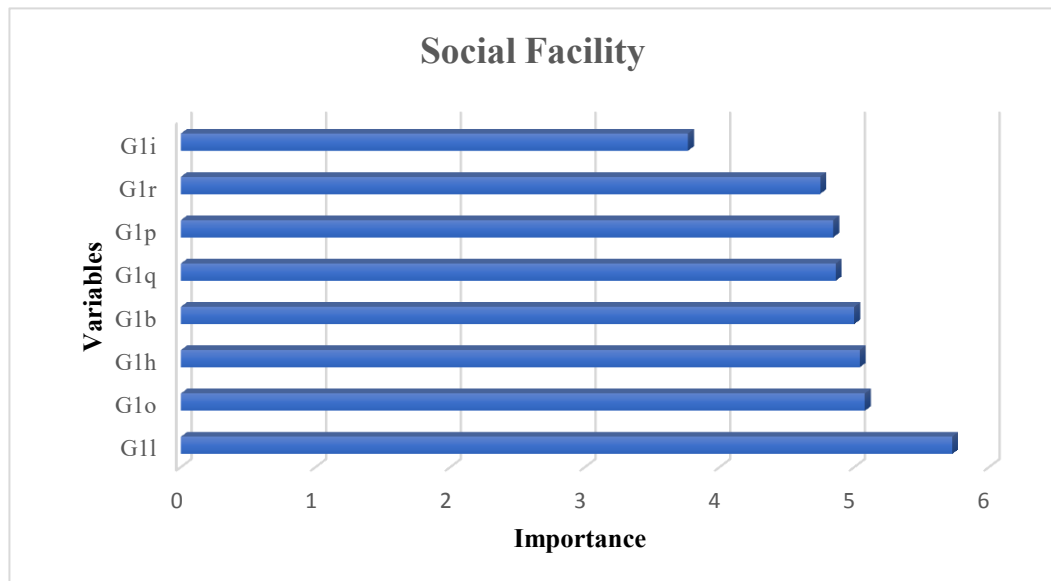


Figure 4-11: Importance analysis of variables for social facility

For “Strategic & Business Support” there are three sub criteria and under these three sub criteria there are twenty-one variables. These variables are distributed and analysed and showed in figure 4-12, figure 4-13 and figure 4-14.

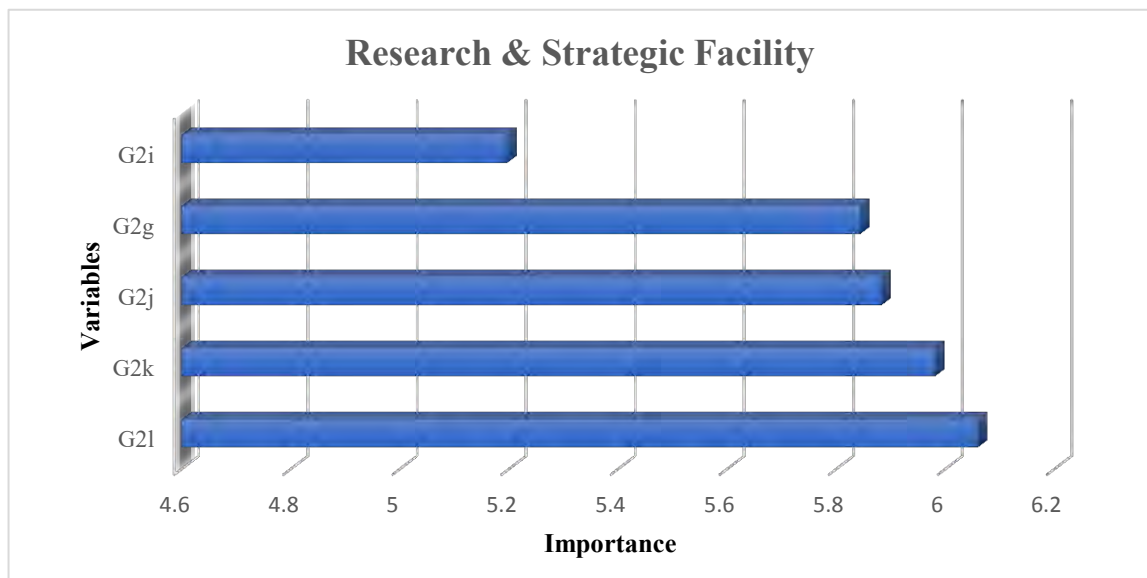


Figure 4-12: Importance analysis of variables for research & strategic facility

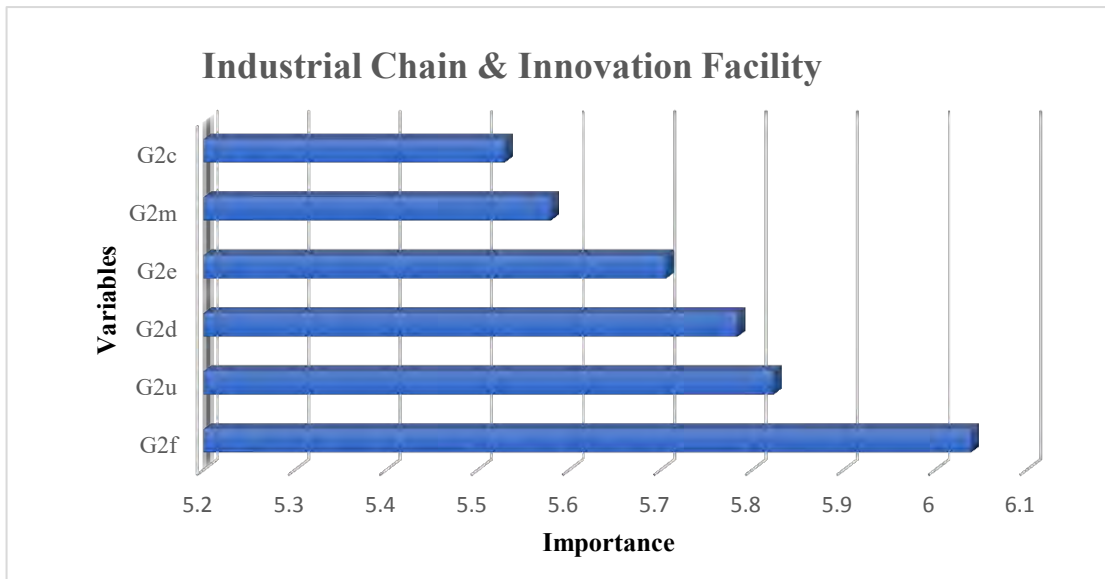


Figure 4-13: Importance analysis of variables for industrial chain & innovation facility

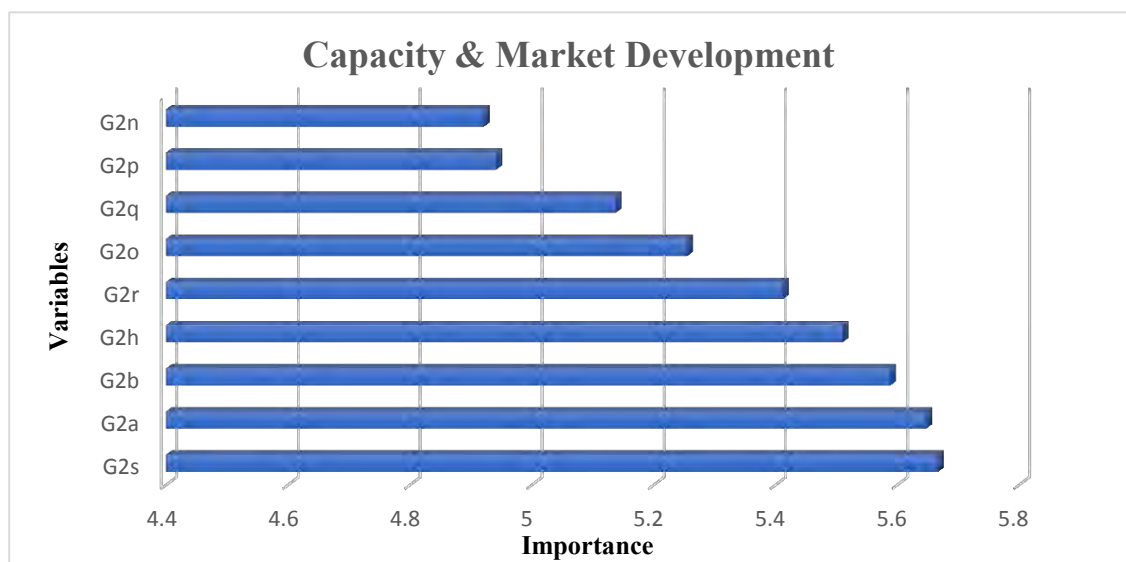


Figure 4-14: Importance analysis of variables for capacity & market

From the SPSS analysis of the variables it is found that for “research & strategic facility”, “technology transfer centre” is the most important criteria. Technology transfer centre can act as a bridge of transferring technology and to create a sustainable environment to develop the local technology. For “industrial chain & innovation facility” criteria “innovation and product commercialization” got the highest priority. On the other hand, for “capacity & market development; “need based job training” is considered most important variable.

Governance is a very important criteria for the management and development of HTP/STP. From the literature and expert survey, sub criteria like “policy” and “operational modality” are considered as top down approach. Weather park management is considered as customer depended. It varies from place to place depending on the socio-cultural environment and local requirements. So, variables from “operational modality” are analysed by AHP method using expert opinions. For “park management”, twelve variables are analysed using SPSS based on the local requirements. After the analysis the result is shown in figure 4-15.



Figure 4-15: Importance analysis of variables for park management

From the analysis it is found that, emergency support and security are the most concern elements for the investors and businessman along with other variables.

4.5 SWOT Analysis

A SWOT analysis is a useful tool to evaluate internal strength and external opportunities and threats. This analysis helps to create a roadmap for the reduction and weakness and threats. On the other hand, shows a way to increase the opportunities and strength. In this study after 1st and 2nd phase of survey; 3rd phase of survey is conducted among IT Industry. to identify. In SPSS analysis importance of the variables are determined and at the same time from the same questionnaires from another survey availability of the variables/ facilities are determined. Industry expert's opinion taken about the strength and weakness of HTP/STP in Bangladesh as they are directly or indirectly related with the development/business. From the survey, SPSS data analysis and from literature review the findings are given below:

STRENGTH

- **Human resources:** Bangladesh is enjoying the benefit of demographic dividend. At present more than 65 percent of the population is of working age and between 15 to 64 which is the highest in any country around the world. This demographic dividend is a potential economic benefit. The country is in the midway of dividend period. There are more 3 decades to pass on [44].
- **Infrastructural facility:** Government is providing infrastructural facilities for the IT/ITES industry. Several STP/HTP and Incubation cum training centers are being built around the country to provide a business environment. Along with the building, to support industry road connectivity electricity and internet facility are also being ensured. Again, a survey conducted and found that the existing HTP/STP also have good infrastructural facilities. Details are shown in Annexure-IV, Figure A-1.
- **Decentralized projects:** Projects are taken in various location of the country to ensure equal support. Based on the demand and allocation of resources, IT/ITES related projects are decentralized targeting all the 64 districts. This is a big opportunity and also strength. This will increase the technical capacity of local authority or people. Developmental functions and roles for these institutions are already in process [45].
- **Low cost labor:** According to World Bank, World Development Indicators, labor cost in Bangladesh is the low in Asia and compared to other country. This is a big strength for the country [46].

- **Geographical location:** Bangladesh is located between two economic giants. As a result, Bangladesh can become a regional hub and gateway of south, southeast and east Asia [47].
- **Policy support:** Bangladesh Government is providing various types of policy support as per the requirement. Again, it is also considering the modification of the policy as per the requirement of industry [48].
- **Financial incentives:** To ensure a proper environment for business and to attract foreign investment, financial incentives are provided through National Board of Revenue. Compared to financial incentives of other countries, existing incentives are more attractive. Government also thinking to increase the incentives and benefit stream further to attract more foreign investment [49].

OPPORTUNITIES

- **University Linkage:** University linkage with industry and other association is an important part of development. If considered various hi-tech or software technology park around the world, it is very common to see the university linkage where research collaboration plays a vital role. There should have an individual part of the university to maintain the linkage. There are few steps already taken by the government, i.e., incubation center project, specially one of a specialized project in Chittagang University of Engineering and Technology. It is known as IT Business Incubator. This will act as a bridge among university and other institution and act as a professional body to create an effective linkage. This can be seen clearly from SPSS analysis of group-2 variables also. For university linkage related facility, the analysis result got importance of 5.98 which is showed in figure 4-12.
- **Restructuring education system:** Lack of linkage with the industry and industry demand of present education system creates problems. Targeting fourth industrial revolution, present education process needs to be modified [50].
- **Technology transfer:** This can be seen clearly from SPSS analysis of group-2 variables also. For technology transfer or to create technology transfer center, the analyzed result got importance of 6.05 which is showed in figure 4-12. Technology transfer is a broad concept. But to be very specific exchange of information, materials, intellectual property rights, knowledge, research result or facility among institutions or government to facilitate further research and to commercialization for the

betterment of mankind. There is a huge opportunity to collaborate with the existing industry leaders who are working with the frontier technology to establish a linkage with the research organization around the word for intellectual knowledge shearing. Software and Hi-Tech park can be a suitable place to start. These parks can provide the required facility and platform for further development.

- **Specialized Technology hub/lab development:** Software or Hi-Tech park is the best opportunity to create technology hub. Linkage among software/hi-tech park with nearest educational institute to exchange knowledge and linkage with national/international institute to exchange technology. Targeting different educational zone, specialized technology hub targeting specialized sector can be developed, i.e., robotics, AI, IOT, etc. Each park can create its identity based on the technology i.e., software technology park pargeting robotics, Hi-Tech park that focuses industrial automation along with its normal development work [51].
- **Incentives for female entrepreneurs:** To create employment, specialized incentive packages may play an active role targeting female entrepreneurs. Female participants in the IT/ITES sector is still very low but this sector is very ecofriendly for the female entrepreneurs as they can work staying home. Government is providing various types of incentives for the industry/ park developers. This can be little bit reshaped targeting specifically industry that is suitable for female entrepreneurs.
- **Professional development certification support:** Young graduate starting their carrier and mid-level technology consultant are mainly working for the development of the sector. They are the main work force as they do the execution and give suggestion to the higher authority also. There should have an opportunity for these pools of technology user for professional development. Hi-tech or software technology park at present is providing a very little support and training with certification for their development. With the development of the park's professional development and international certification program will create scope and may increase the acceptance level in the international market. Figure 4-14 showed the importance of this support.
- **R&D:** From figure 4-12 and SPSS analysis it is clear that research and development is very essential for the development of Hi-tech and Software technology park. This is a great opportunity for the sectoral development. Parks collaborating with local engineering and technology university shall create an eco-system for localized

innovation. Again, these localized innovations can be used for the day to day life problems. Later, collaboration with the research organization in international level will create a sustainable platform for the local graduates and institutions.

WEAKNESS

- **Lack of strategic people:** Lack of strategic people is a problem. Again, placement of the proper person in proper place is also vital. To make the parks successful, need visionary person as well as qualified executer. Policy makers may create policy but to execute the policy in the field level, strategic and well technically qualified executer is essential. Lack of such executer is a problem in present situation. Figure A-3 in Annexure-IV showed the survey result about this issue.
- **Lack of technology transfer:** Figure 4-12 showed that technology transfer is very important. But from figure A-2 it is seen that this is a very weak point at present.
- **Shortage of innovation support:** There may be few supports for innovation and new upcoming entrepreneurs but still this is not enough. Figure A-2 represents a clear picture of the situation. One of the major weakness is the absence of private support the innovation and research. Considering the sectoral development, it is very difficult to support the whole eco system through government money. Private and foreign collaboration with financial support is very important.
- **Lack of product commercialization:** Figure 4-13 represents the importance of it and data analysis gives a value of 6.03. but figure A-2, shows that this is weak point for the sectoral development. Around the country there is a huge potential and lots of entrepreneurs who are developing products. These products are used in the lower level. But there is lack of proper nourishment and commercialization of the products. Patent support and product commercialization can be done from the nearest parks or incubation center. These types of policy and one stop service should be included. A single successful product can change the whole socio-cultural development scenario of an area.
- **Gaps between academics and companies:** This is a common thing nation is facing from a long time. There is gap between academics and the industry requirement. From figure 4-12, figure 4-13, literature survey, general interview and figure A-2 it is seen that requirements of the industry don't match with the existing academic curriculum.

Policy makers and academicians along with industry people may sit together to overcome the problem.

THREATS

- **Weak foreign investment:** Government is taking project with government fund. But there is lack of foreign investment for the sectoral development of the technology industry. Company are coming with a little investment till now within the park. For the development of the technological eco system within the park, foreign investment and giant company is required [52].
- **Unavailability of international collaboration:** Technology park shall have membership and collaboration with the park around the world. These may create awareness and technology transfer for the local company and entrepreneurs. Exchange program may be done with collaboration. This is totally absent at present situation [52].
- **Strong requirement for Innovation in Services & Business Processes:** Innovation can be done within the business process. But it is seen that funding and all other focuses are on the product development or e commerce. Business process innovation or service-related innovation work is very low. This is very alarming. Because day by day with the development of products, service also need to be effortless and easy going. People should get his/her problem solved easily and effortlessly [52].
- **Lack of government research fund:** For the development of the Hi-Tech and Software technology park, government should form a policy and research fund with the collaboration with the local institute. The utilization of the fund can be limited within the park area and for higher end technological innovation and commercialization. From the analysis of figure, A-2 and figure 4-12 it is clear about the importance of the research. But there is huge gap in the system for research fund [53].

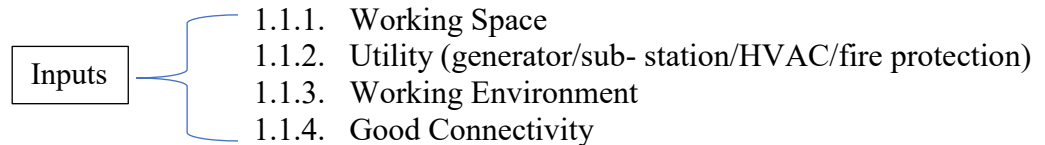
4.6 Relevance Tree Scenario

Technological forecasting bears a strong relationship to system analysis. A relevance tree is a hierarchic tree contains different level and entries identified as the elements of the dimensions. There are several ways to represent the relevance tree, i.e., horizontal relevance tree or objectives relevance tree. Relevance tree can be generated using preference matrix and technical evaluation of relevance number or DELPHI method [54]. Technological forecasting is used to get appropriate direction and to overcome the problems. Relevance tree scenario obtained from technical evaluation of relevance number can be validated by AHP [55]. In this study, AHP is used to identify the relative importance and to determine the most relevant path through the relevance tree. For the development of the HTP/STP or Incubation the relevance scenario can be described as follow:

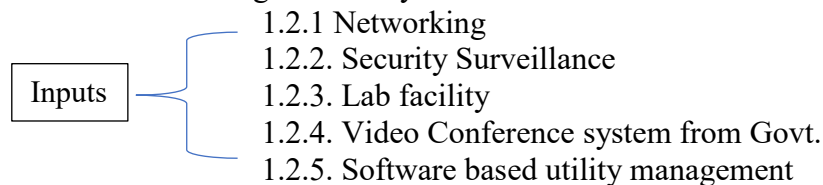
Objective: HTP/STP Development

Possible Solution: 1.0. Infrastructure Development
2.0. Strategic and Business Support
3.0. Governance

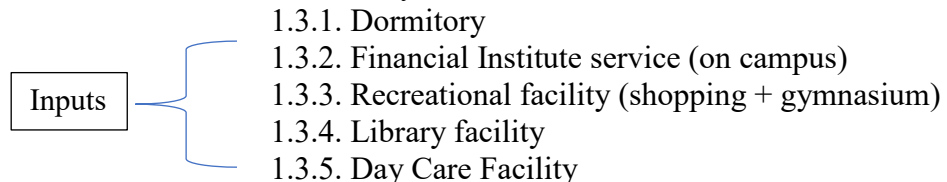
Functions: 1.1. Basic Facility



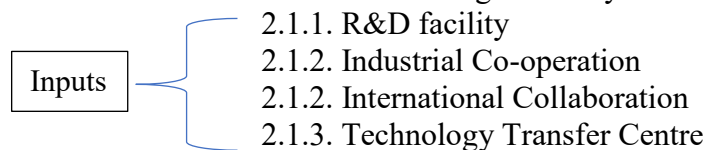
1.2. Digital Facility



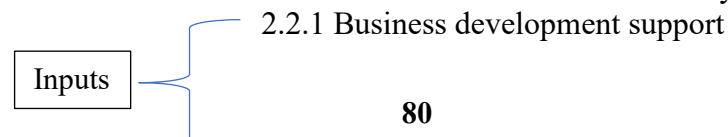
1.3. Social Facility



2.1. Research and Strategic Facility



2.2. Industrial Chain and Innovation Facility



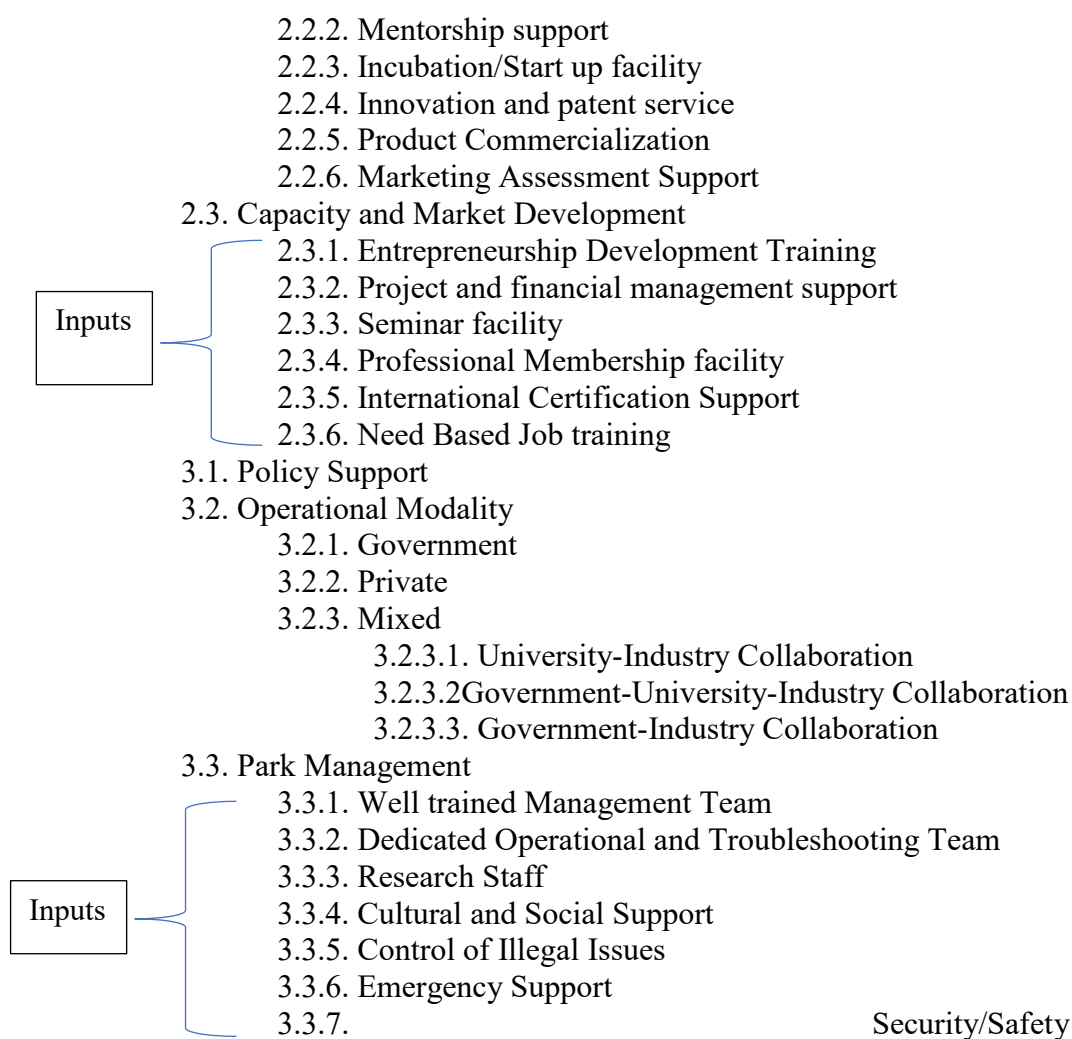


Figure 4-16: Relevance Tree Scenario

From the relevance tree scenario, it is seen that HTP/STP development is a complex process. It requires a blended system of infrastructure, strategic & business support and governance. At first, for technology park, world class infrastructure is required where digital facility plays the main role to make the infrastructure functional along with other facilities. Considering basic infrastructural requirements, utility i.e., dedicated sub-station for uninterrupted power supply, generator for emergency backup and HVAC for a nice working environment are most important variables. Investor working in IT/ITES sector also need 24/7 working environment which is not available now in present technology park in Bangladesh, but government is working to ensure the environment.

Along with the basic infrastructural facility, digital facility i.e., network (internet), security surveillance and automatic management like online or software-based management/billing system are the most required variables for the development of HTP/STP. On the other hand, social facility like dormitory, onsite banking and medical facility can boost up the working environment. For large technology park or park outside, main city needs more social facility.

Infrastructure provides a scope for the investor to invest but to convert the scope into success, structured strategic and business support is very important. Research & strategic facility is most necessary variables along with industrial chain & collaboration and capacity & market development. It is seen that research and development facility and technology transfer support are the most functional elements to create the eco system. Considering, successful technology park, it is seen that innovation eco system, incubation facility, patent and product commercialization support, entrepreneurship development training are the most focused variables. Here, from the study for the HTP/STP development in our socio-economic situation, same variables are identified. But without proper governance, these steps shall never bring esteemed success.

4.6.1 Comparison between Relevance Tree, AHP and SWOT Analysis

From the study it is seen that for the development of HTP/STP and incubation centre, great effort is required. Relevance tree scenario is generated and analysed to identify the problems and best solutions. Again, SWOT analysis also done for the present situation and condition of the hi-tech parks in Bangladesh. Based on the two analysis it is seen that, for the development of the HTP/STP, good quality infrastructure is required. At present there is enough project to support the upcoming requirement of the space but need more to build for the future.

Relevance tree scenario and AHP analysis showed the importance of research and strategic support. Again, technology transfer, product commercialization is very necessary for the park eco system development. But these are found as weak point in the SWOT. SWOT also showed threats as there is unavailability of international collaboration and research fund allocation. Relevance tree gives a wonderful view of the importance of university linkage and reduction of gap from industry and academic. SWOT analysis shows it as an opportunity, as if it would be done strategically. If done properly and strategically then it can create a world class business environment for the HTP/STP.

4.7 Result Analysis

- Government of Bangladesh (GoB) decided to develop Hi-Tech/Software Technology Park and IT Business Incubation centre around the country to create world class business enterprises. For doing so, it is important to identify the key factors that can influence success and failure of Hi-Tech and Software Technology Park projects and strategy for successful implementation. Within the data limitation, it is found through analysis and survey that for the successful implementation of HTP/STP infrastructure in technology park, operational modality of the park and research and strategic facility are the main factors. If these factors are identified and co ordinated properly then it is possible to ensure HTP/STP success. Figure 4-17 shows the success factors for HTP/STP. But doing so, proper strategy and pathway is required.

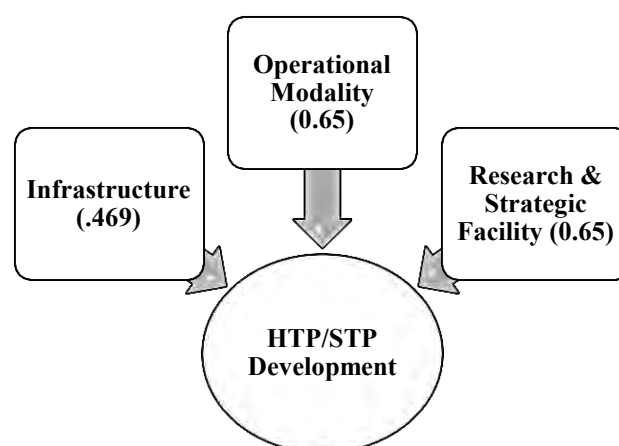


Figure 4-17: HTP/STP Development Factors

- Finally, it can be said, for the successful implementation of HTP/STP projects in Bangladesh a required scenario is generated and showed in the figure 4-16. In the scenario success factors and HTP/STP development process are showed in a strategic form where all the required elements including input variables for the success factors are stated clearly. From the scenario step by step strategy and its elements, sub elements and input variables can be identified that might help to take decisions for the successful implementation of HTP/STP in Bangladesh.
- There are limitations in this study, i.e., experts working to develop the sector are very limited, so source of data is limited. Again, company working in and out of HTP/STP not clear about long term goal and most of the company are still working on software and e-commerce sector. Only few are assembling/manufacturing new products. As a result, requirements and opinions for research and new product-based industry are missing.

CHAPTER-5: CONCLUSION

5.1 Conclusion

Technology park in Bangladesh is a new concept though various forms of technology park started to develop around the world since 1950s. In Bangladesh, ICT is a thrust sector and these technology park can surely create an economical revolution. Today is considered as part of 4th industrial revolution and 5th may come as an era of personalization. To keep up with this upsurge technological growth, technological and innovation hub is required, and technology park can play a vital role at that time. But to do so, a steady and long-term strategy is required. In this study, the main criteria sub-criteria and input variables are identified and represented to form strategy for the implementation of HTP/STP in Bangladesh. Here, various model around the world are studied and based on that local strategic elements are identified. It is seen that at first government need to create a functional structure. At the same time need to established relationship among functional structure and business strategy focusing innovation cluster. Basically, fusion of the elements is required for successful technology park development along with policy support.

At present based on the National ICT Policy and Government 7th fifth year plan, various development projects related to HTP/STP are taken. These projects infrastructural works go well but strategic eco system development is lack behind. To make the HTP/STP, need to establish innovation eco system focusing research and development, new product development, product commercialization and linkage with research institute and academia. HTP/STP shall have technology transfer centre with collaboration with academia for sustainable technology.

5.2 Future Recommendations

In this paper only strategic pathway is created and data collected in a mixed way. The followings can be done for further development of the work like.

- Sector wise analysis like hardware and software industry separately.
- Development of economic model.

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ANNEXURE-I

SPSS Calculation for Group-1: Annexure-I shows the calculation and graphical data analysis of SPSS software for Group-1. For group-1, there are many input variables. Set of questionnaires developed to identify the importance of the variables and interview of related persons also taken for collection of data. After that SPSS software is used to analyses the data and detail analysis for group-1 is showed in annexure-I

		Statistics					
		Company	G1a	G1b	G1c	G1d	G1e
N	Valid	51	51	51	51	51	51
	Missing	0	0	0	0	0	0
Mean			5.450980	5.000000	5.274510	5.627451	5.607843
Std. Error of Mean			.1755970	.1771230	.1941870	.1939492	.2097214
Std. Deviation			1.2540132	1.2649111	1.3867722	1.3850745	1.4977107

		Statistics					
		G1f	G1g	G1h	G1i	G1j	G1k
N	Valid	50	51	51	51	51	51
	Missing	1	0	0	0	0	0
Mean		5.140000	5.098039	5.039216	3.764706	5.803922	5.862745
Std. Error of Mean		.2441311	.2429474	.2581393	.2752371	.1879082	.1680794
Std. Deviation		1.7262677	1.7349917	1.8434835	1.9655863	1.3419331	1.2003268

		Statistics					
		G1l	G1m	G1n	G1o	G1p	G1q
N	Valid	51	51	51	51	51	51
	Missing	0	0	0	0	0	0
Mean		5.725490	5.705882	5.549020	5.078431	4.843137	4.862745
Std. Error of Mean		.1728162	.2156506	.2120187	.1977186	.2211779	.2376678
Std. Deviation		1.2341545	1.5400535	1.5141166	1.4119934	1.5795259	1.6972873

		Statistics			
		G1r	G1s	G1t	G1u
N	Valid	51	51	50	50

Missing	0	0	1	1
Mean	4.745098	5.588235	4.720000	5.780000
Std. Error of Mean	.2549020	.1943848	.2425039	.1964792
Std. Deviation	1.8203641	1.3881854	1.7147618	1.3893178

Frequency Table

Company

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	C-1	1	2.0	2.0	2.0
	C-2	1	2.0	2.0	3.9
	C-3	1	2.0	2.0	5.9
	C-4	1	2.0	2.0	7.8
	C-5	1	2.0	2.0	9.8
	COM-1	1	2.0	2.0	11.8
	COM-10	1	2.0	2.0	13.7
	COM-11	1	2.0	2.0	15.7
	COM-12	1	2.0	2.0	17.6
	COM-13	1	2.0	2.0	19.6
	COM-14	1	2.0	2.0	21.6
	COM-15	1	2.0	2.0	23.5
	COM-16	1	2.0	2.0	25.5
	COM-17	1	2.0	2.0	27.5
	COM-18	1	2.0	2.0	29.4
	COM-19	1	2.0	2.0	31.4
	COM-2	1	2.0	2.0	33.3
	COM-20	1	2.0	2.0	35.3
	COM-21	1	2.0	2.0	37.3
	COM-22	1	2.0	2.0	39.2
	COM-23	1	2.0	2.0	41.2
	COM-24	1	2.0	2.0	43.1
	COM-25	1	2.0	2.0	45.1
	COM-26	1	2.0	2.0	47.1
	COM-27	1	2.0	2.0	49.0
	COM-28	1	2.0	2.0	51.0
	COM-29	1	2.0	2.0	52.9
	COM-3	1	2.0	2.0	54.9
	COM-30	1	2.0	2.0	56.9

	COM-31	1	2.0	2.0	58.8
	COM-32	1	2.0	2.0	60.8
	COM-33	1	2.0	2.0	62.7
	COM-34	1	2.0	2.0	64.7
	COM-4	1	2.0	2.0	66.7
	COM-5	1	2.0	2.0	68.6
	COM-6	1	2.0	2.0	70.6
	COM-7	1	2.0	2.0	72.5
	COM-8	1	2.0	2.0	74.5
	COM-9	1	2.0	2.0	76.5
	GE-1	1	2.0	2.0	78.4
	GE-10	1	2.0	2.0	80.4
	GE-11	1	2.0	2.0	82.4
	GE-12	1	2.0	2.0	84.3
	GE-2	1	2.0	2.0	86.3
	GE-3	1	2.0	2.0	88.2
	GE-4	1	2.0	2.0	90.2
	GE-5	1	2.0	2.0	92.2
	GE-6	1	2.0	2.0	94.1
	GE-7	1	2.0	2.0	96.1
	GE-8	1	2.0	2.0	98.0
	GE-9	1	2.0	2.0	100.0
	Total	51	100.0	100.0	

G1a

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neither Significant not Insignificant	4	7.8	7.8	7.8
	Significant	8	15.7	15.7	23.5
	Very Significant	13	25.5	25.5	49.0
	Highly Significant	13	25.5	25.5	74.5
	Extremely Significant	13	25.5	25.5	100.0
	Total	51	100.0	100.0	

G1b

	Frequency	Percent	Valid Percent	Cumulative Percent
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Valid	Insignificant	2	3.9	3.9	3.9
	Neither Significant not Insignificant	5	9.8	9.8	13.7
	Significant	7	13.7	13.7	27.5
	Very Significant	20	39.2	39.2	66.7
	Highly Significant	11	21.6	21.6	88.2
	Extremely Significant	6	11.8	11.8	100.0
	Total	51	100.0	100.0	

G1c

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	2.0	2.0	2.0
	Neither Significant not Insignificant	5	9.8	9.8	11.8
	Significant	8	15.7	15.7	27.5
	Very Significant	11	21.6	21.6	49.0
	Highly Significant	16	31.4	31.4	80.4
	Extremely Significant	10	19.6	19.6	100.0
	Total	51	100.0	100.0	

G1d

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	2.0	2.0	2.0
	Neither Significant not Insignificant	3	5.9	5.9	7.8
	Significant	7	13.7	13.7	21.6
	Very Significant	7	13.7	13.7	35.3
	Highly Significant	17	33.3	33.3	68.6
	Extremely Significant	16	31.4	31.4	100.0
	Total	51	100.0	100.0	

G1e

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	2.0	2.0	2.0

	Insignificant	1	2.0	2.0	3.9
	Neither Significant not Insignificant	3	5.9	5.9	9.8
	Significant	6	11.8	11.8	21.6
	Very Significant	9	17.6	17.6	39.2
	Highly Significant	12	23.5	23.5	62.7
	Extremely Significant	19	37.3	37.3	100.0
	Total	51	100.0	100.0	

G1f

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	2	3.9	4.0	4.0
	Insignificant	3	5.9	6.0	10.0
	Neither Significant not Insignificant	4	7.8	8.0	18.0
	Significant	7	13.7	14.0	32.0
	Very Significant	8	15.7	16.0	48.0
	Highly Significant	13	25.5	26.0	74.0
	Extremely Significant	13	25.5	26.0	100.0
	Total	50	98.0	100.0	
Missing	System	1	2.0		
	Total	51	100.0		

G1g

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	4	7.8	7.8	7.8
	Insignificant	1	2.0	2.0	9.8
	Neither Significant not Insignificant	3	5.9	5.9	15.7
	Significant	5	9.8	9.8	25.5
	Very Significant	16	31.4	31.4	56.9
	Highly Significant	9	17.6	17.6	74.5
	Extremely Significant	13	25.5	25.5	100.0
	Total	51	100.0	100.0	

		G1h			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	5	9.8	9.8	9.8
	Insignificant	1	2.0	2.0	11.8
	Neither Significant not Insignificant	3	5.9	5.9	17.6
	Significant	6	11.8	11.8	29.4
	Very Significant	12	23.5	23.5	52.9
	Highly Significant	11	21.6	21.6	74.5
	Extremely Significant	13	25.5	25.5	100.0
	Total	51	100.0	100.0	

		G1i			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	10	19.6	19.6	19.6
	Insignificant	2	3.9	3.9	23.5
	Neither Significant not Insignificant	15	29.4	29.4	52.9
	Significant	5	9.8	9.8	62.7
	Very Significant	6	11.8	11.8	74.5
	Highly Significant	8	15.7	15.7	90.2
	Extremely Significant	5	9.8	9.8	100.0
	Total	51	100.0	100.0	

		G1j			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	2.0	2.0	2.0
	Neither Significant not Insignificant	2	3.9	3.9	5.9
	Significant	4	7.8	7.8	13.7
	Very Significant	12	23.5	23.5	37.3
	Highly Significant	11	21.6	21.6	58.8
	Extremely Significant	21	41.2	41.2	100.0
	Total	51	100.0	100.0	

G1k

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	2.0	2.0	2.0
	Significant	5	9.8	9.8	11.8
	Very Significant	10	19.6	19.6	31.4
	Highly Significant	17	33.3	33.3	64.7
	Extremely Significant	18	35.3	35.3	100.0
	Total	51	100.0	100.0	

G1l

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	2.0	2.0	2.0
	Neither Significant not Insignificant	1	2.0	2.0	3.9
	Significant	4	7.8	7.8	11.8
	Very Significant	14	27.5	27.5	39.2
	Highly Significant	15	29.4	29.4	68.6
	Extremely Significant	16	31.4	31.4	100.0
	Total	51	100.0	100.0	

G1m

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	2.0	2.0	2.0
	Insignificant	3	5.9	5.9	7.8
	Neither Significant not Insignificant	1	2.0	2.0	9.8
	Significant	3	5.9	5.9	15.7
	Very Significant	9	17.6	17.6	33.3
	Highly Significant	14	27.5	27.5	60.8
	Extremely Significant	20	39.2	39.2	100.0
	Total	51	100.0	100.0	

		G1n			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	2	3.9	3.9	3.9
	Insignificant	1	2.0	2.0	5.9
	Neither Significant not Insignificant	2	3.9	3.9	9.8
	Significant	4	7.8	7.8	17.6
	Very Significant	10	19.6	19.6	37.3
	Highly Significant	17	33.3	33.3	70.6
	Extremely Significant	15	29.4	29.4	100.0
	Total	51	100.0	100.0	

		G1o			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	2.0	2.0	2.0
	Insignificant	2	3.9	3.9	5.9
	Neither Significant not Insignificant	3	5.9	5.9	11.8
	Significant	9	17.6	17.6	29.4
	Very Significant	15	29.4	29.4	58.8
	Highly Significant	13	25.5	25.5	84.3
	Extremely Significant	8	15.7	15.7	100.0
	Total	51	100.0	100.0	

		G1p			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	2	3.9	3.9	3.9
	Insignificant	2	3.9	3.9	7.8
	Neither Significant not Insignificant	6	11.8	11.8	19.6
	Significant	9	17.6	17.6	37.3
	Very Significant	13	25.5	25.5	62.7
	Highly Significant	11	21.6	21.6	84.3
	Extremely Significant	8	15.7	15.7	100.0

Total	51	100.0	100.0	
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G1q

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	4	7.8	7.8	7.8
	Insignificant	1	2.0	2.0	9.8
	Neither Significant not Insignificant	5	9.8	9.8	19.6
	Significant	7	13.7	13.7	33.3
	Very Significant	13	25.5	25.5	58.8
	Highly Significant	13	25.5	25.5	84.3
	Extremely Significant	8	15.7	15.7	100.0
	Total	51	100.0	100.0	

G1r

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	3	5.9	5.9	5.9
	Insignificant	4	7.8	7.8	13.7
	Neither Significant not Insignificant	7	13.7	13.7	27.5
	Significant	5	9.8	9.8	37.3
	Very Significant	13	25.5	25.5	62.7
	Highly Significant	8	15.7	15.7	78.4
	Extremely Significant	11	21.6	21.6	100.0
	Total	51	100.0	100.0	

G1s

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Insignificant	3	5.9	5.9	5.9
	Neither Significant not Insignificant	2	3.9	3.9	9.8
	Significant	2	3.9	3.9	13.7
	Very Significant	15	29.4	29.4	43.1
	Highly Significant	13	25.5	25.5	68.6

	Extremely Significant	16	31.4	31.4	100.0
	Total	51	100.0	100.0	

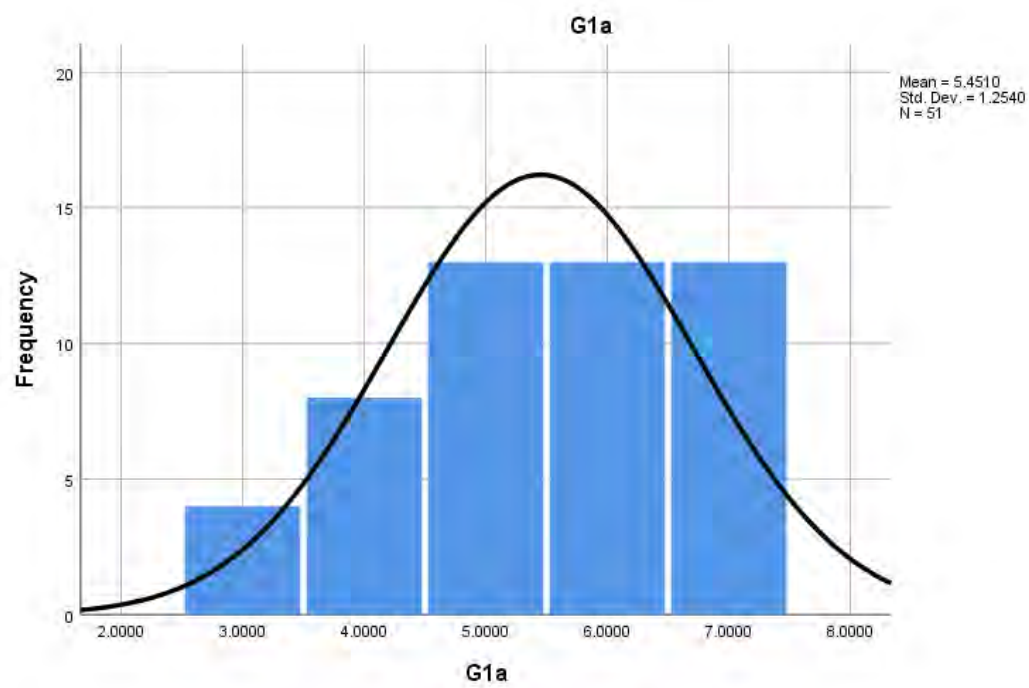
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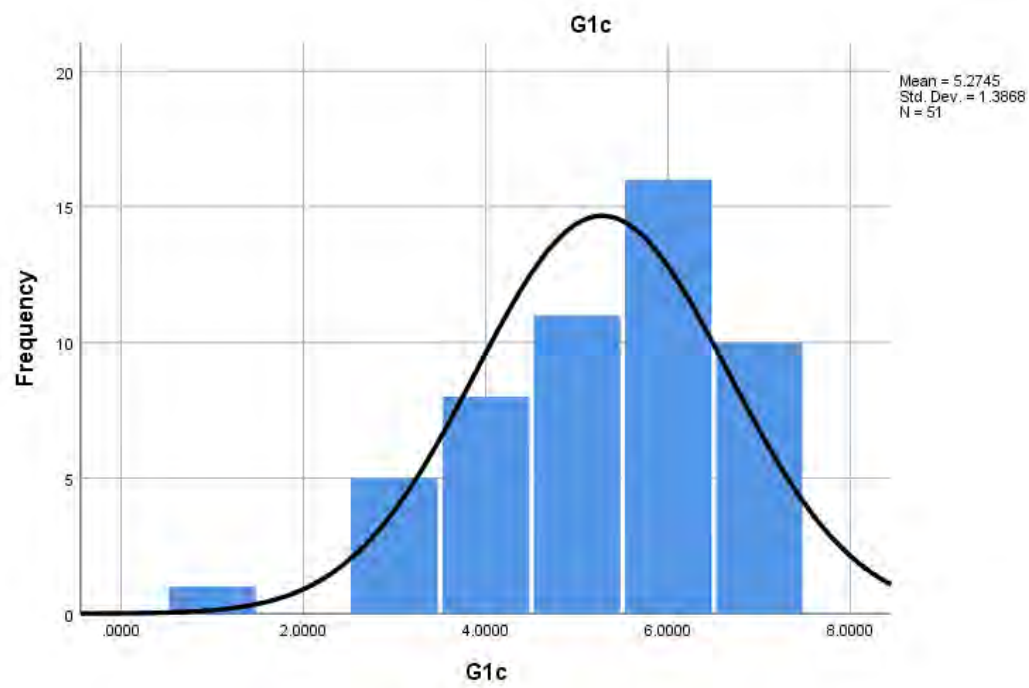
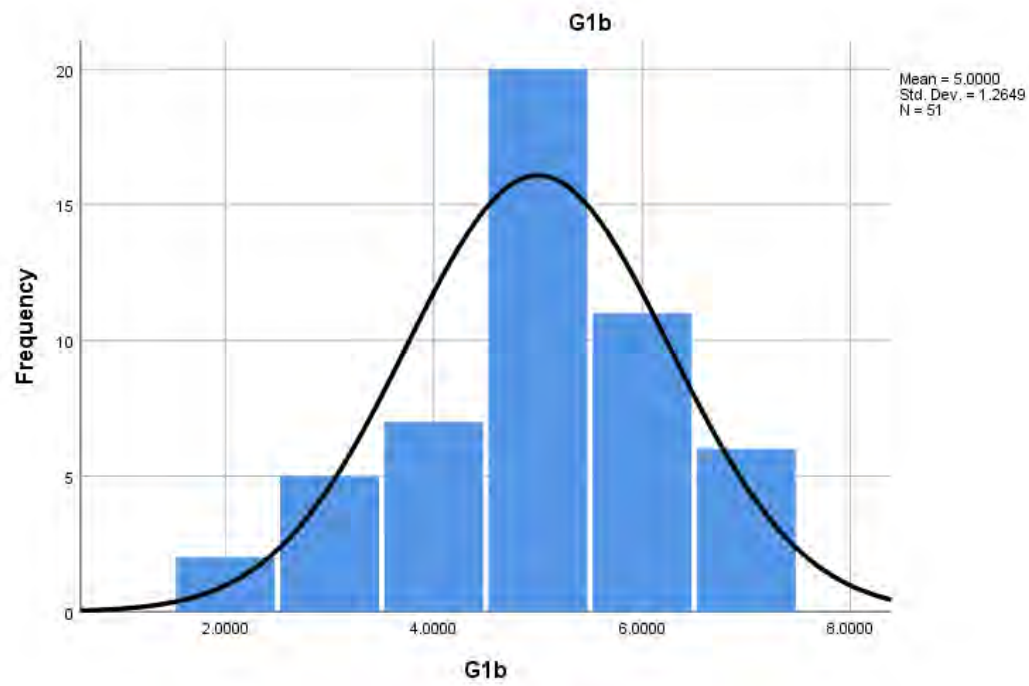
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	3	5.9	6.0	6.0
	Insignificant	3	5.9	6.0	12.0
	Neither Significant not Insignificant	6	11.8	12.0	24.0
	Significant	7	13.7	14.0	38.0
	Very Significant	13	25.5	26.0	64.0
	Highly Significant	10	19.6	20.0	84.0
	Extremely Significant	8	15.7	16.0	100.0
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Missing	System	1	2.0		
	Total	51	100.0		

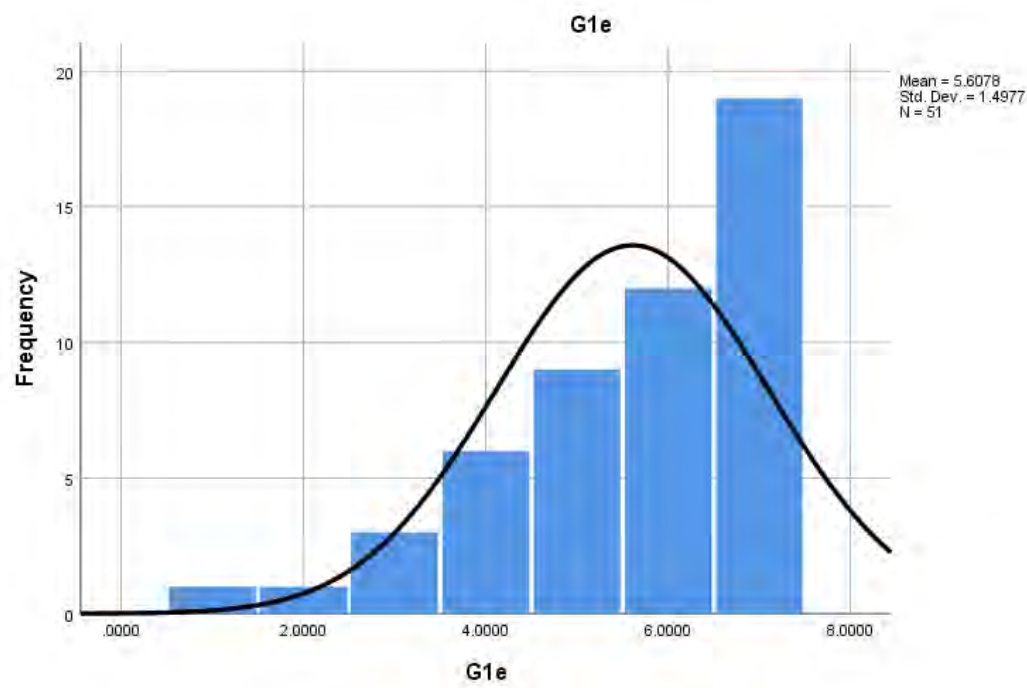
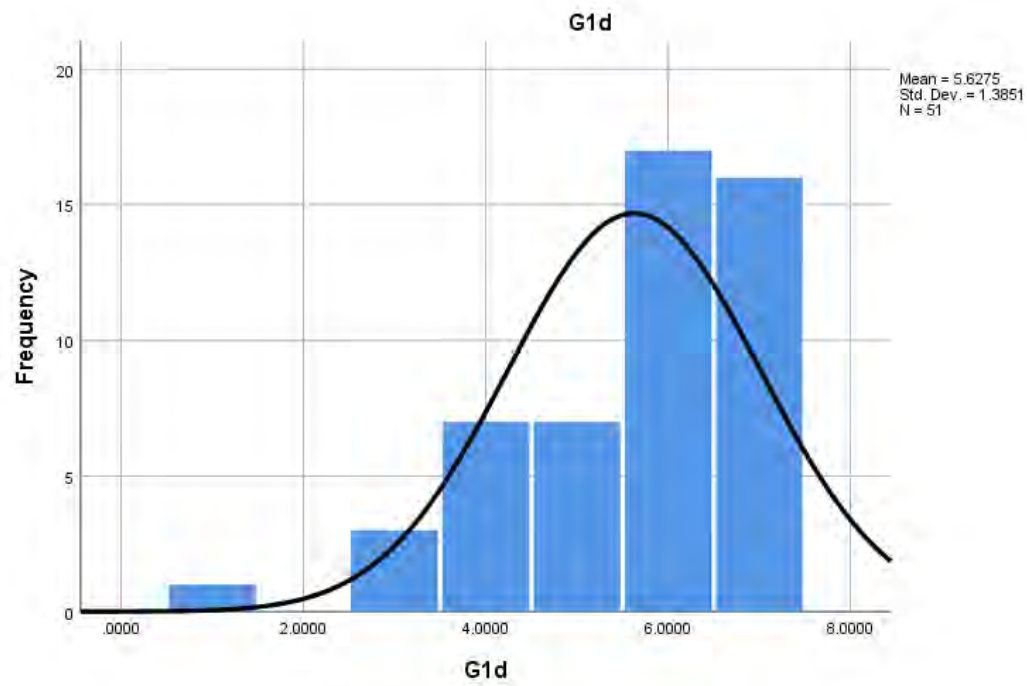
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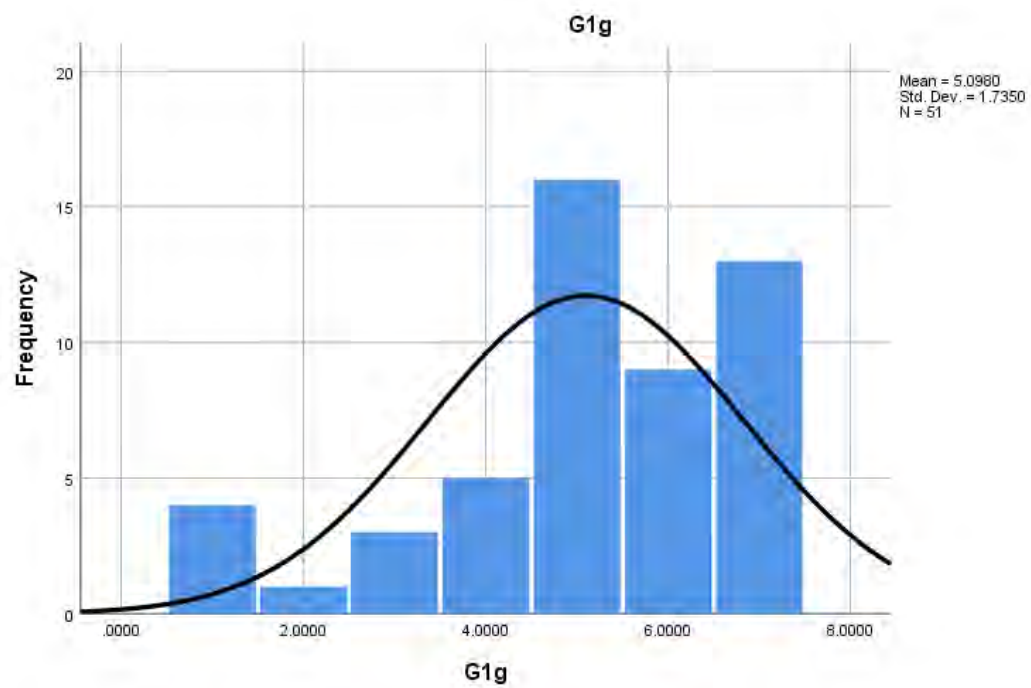
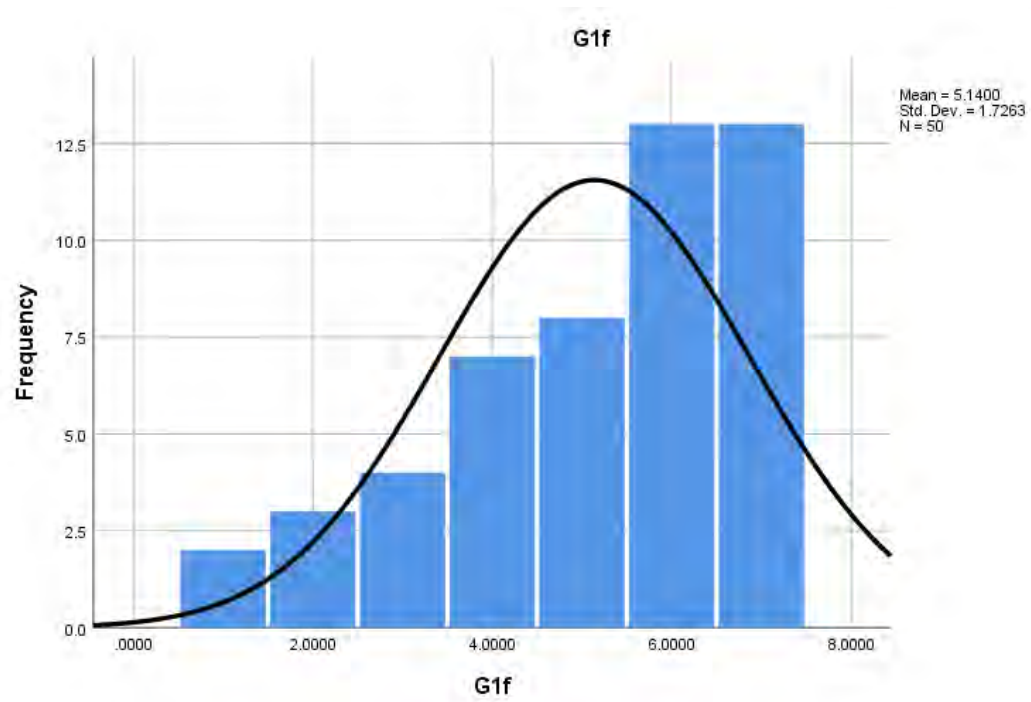
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	2.0	2.0	2.0
	Insignificant	2	3.9	4.0	6.0
	Significant	3	5.9	6.0	12.0
	Very Significant	10	19.6	20.0	32.0
	Highly Significant	16	31.4	32.0	64.0
	Extremely Significant	18	35.3	36.0	100.0
	Total	50	98.0	100.0	
Missing	System	1	2.0		
	Total	51	100.0		

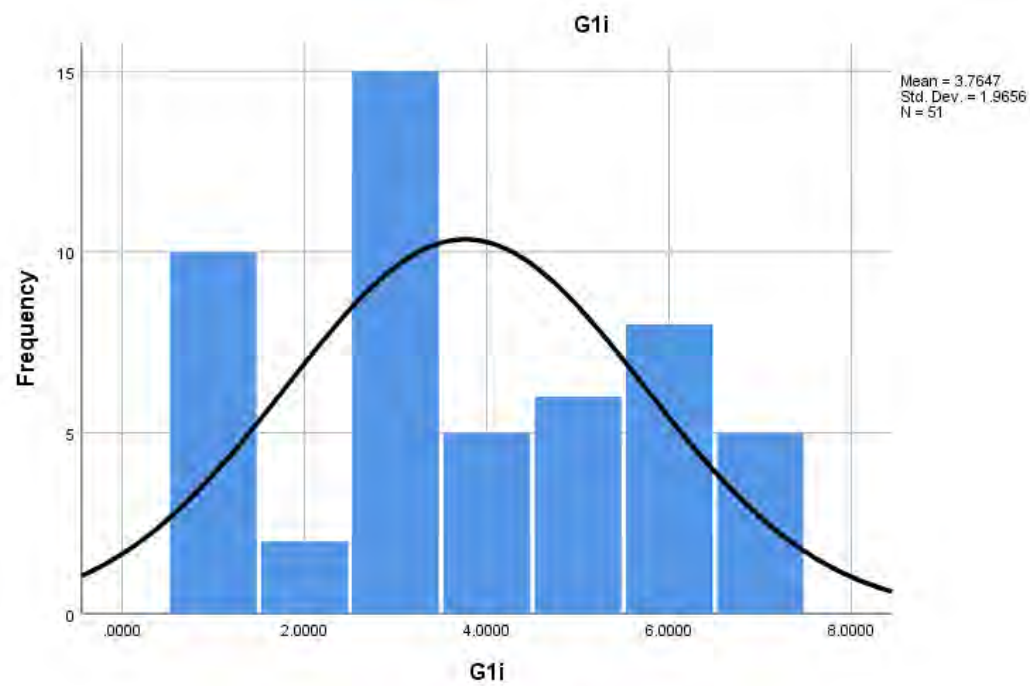
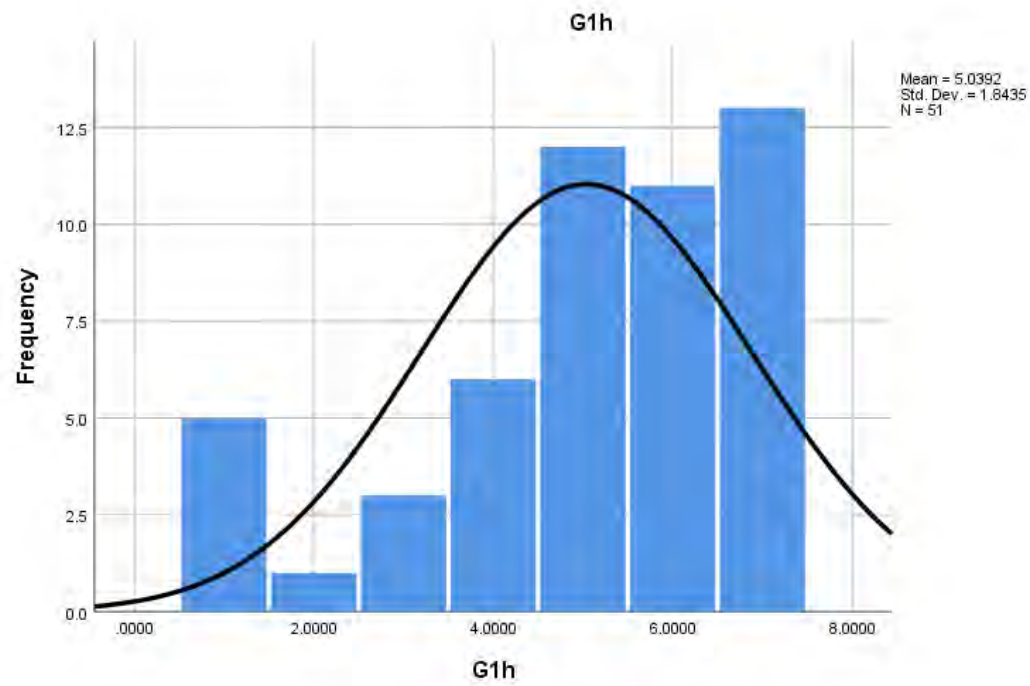
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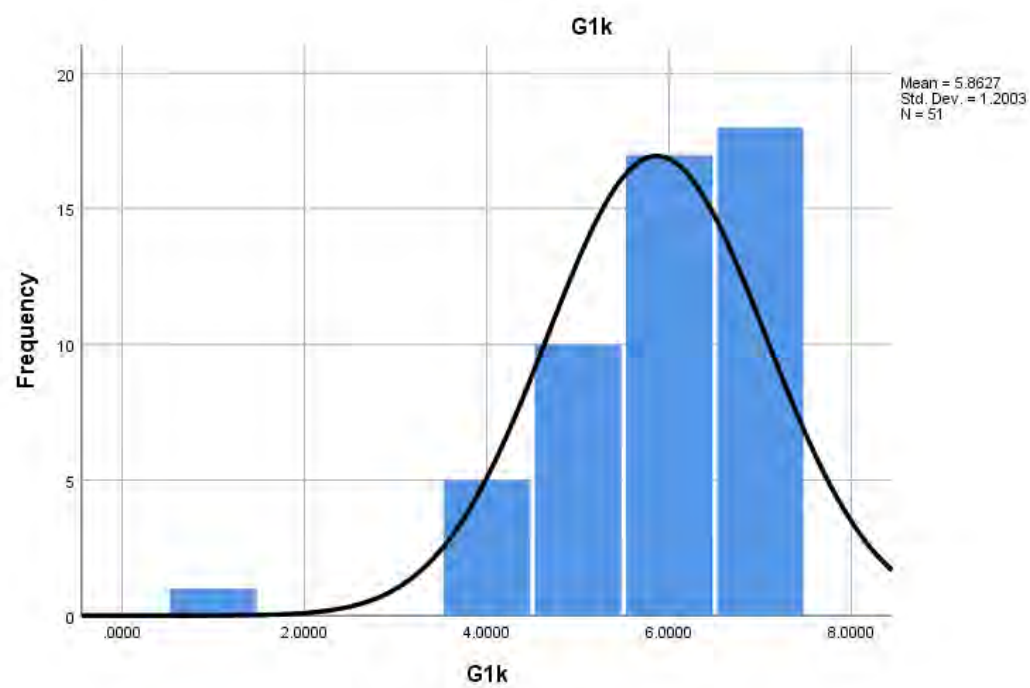
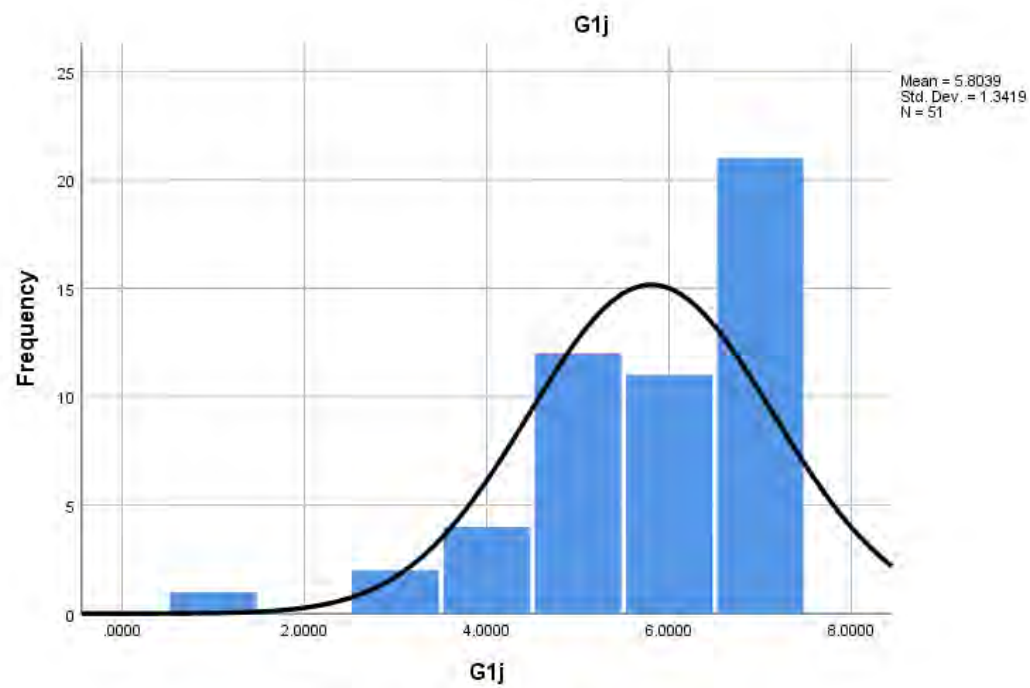


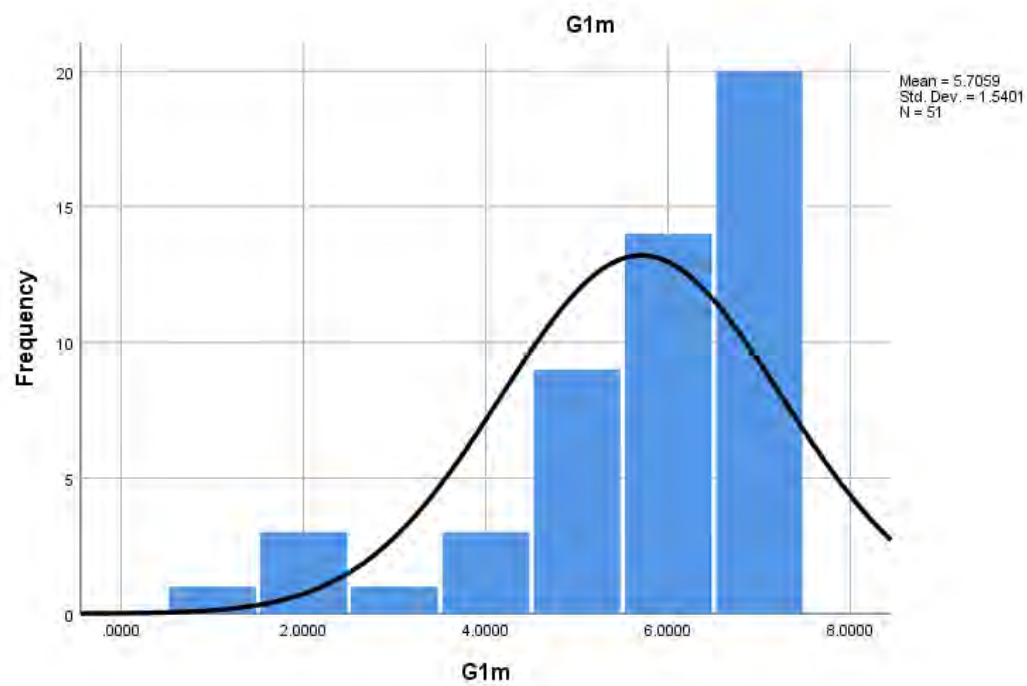
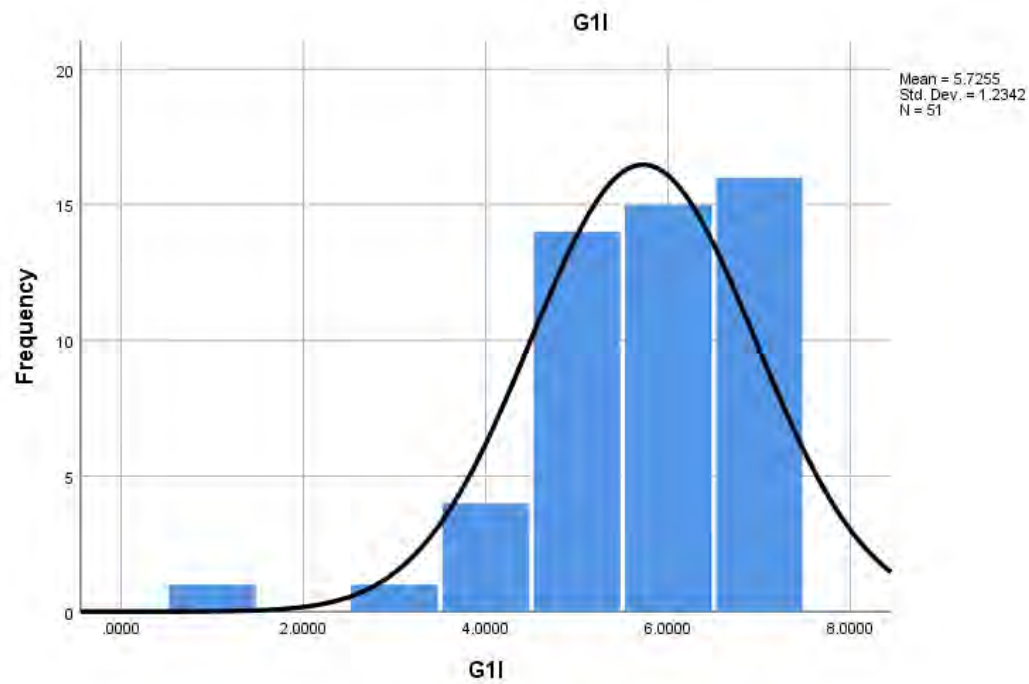


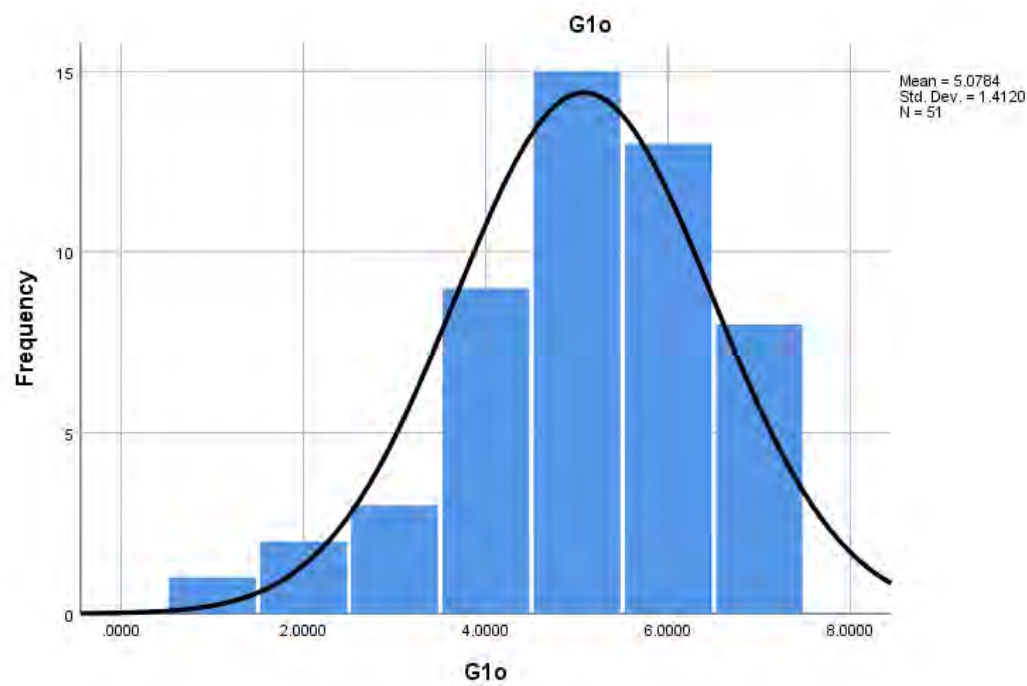
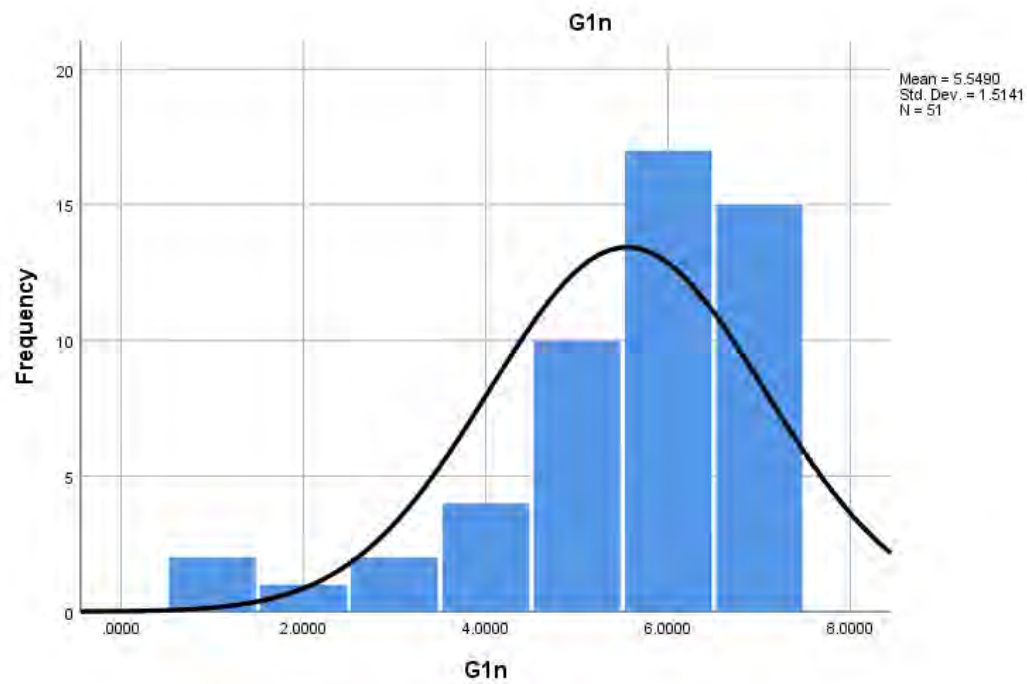


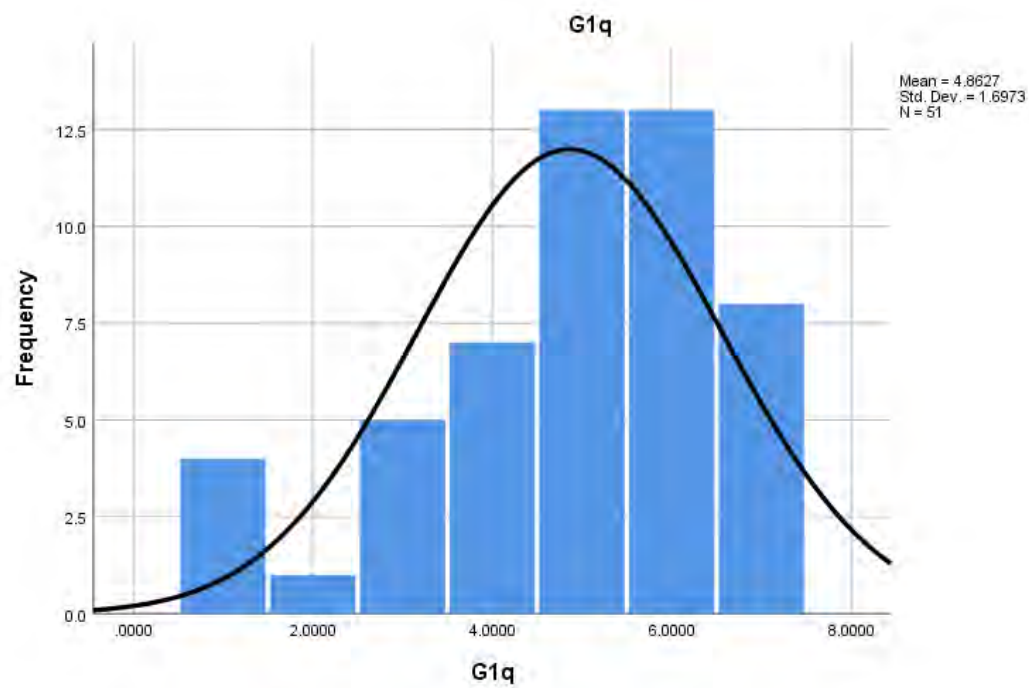
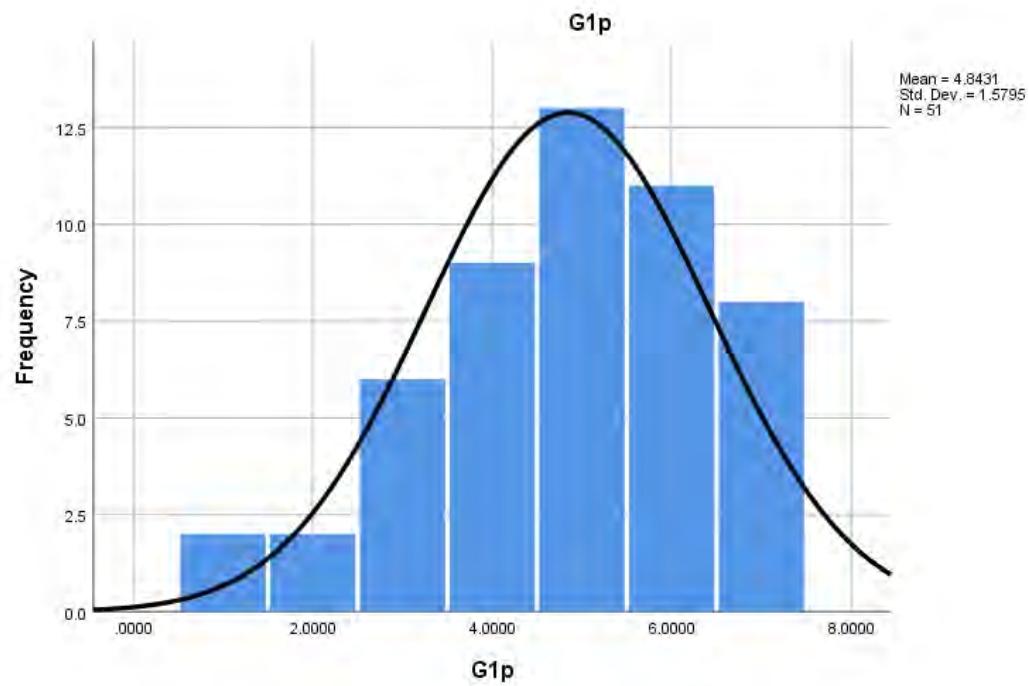


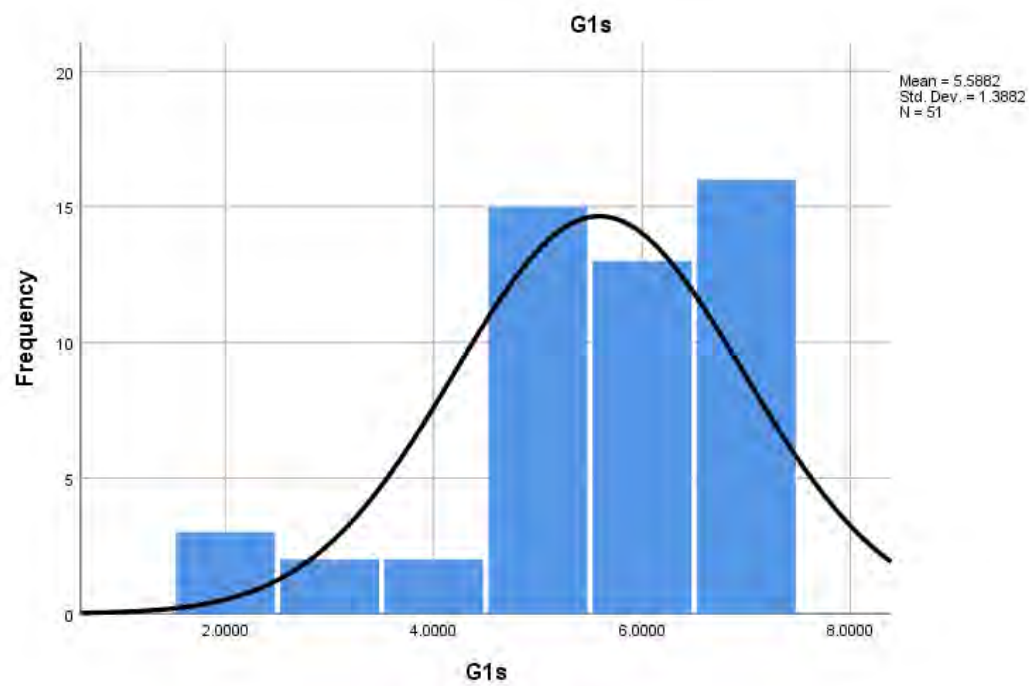
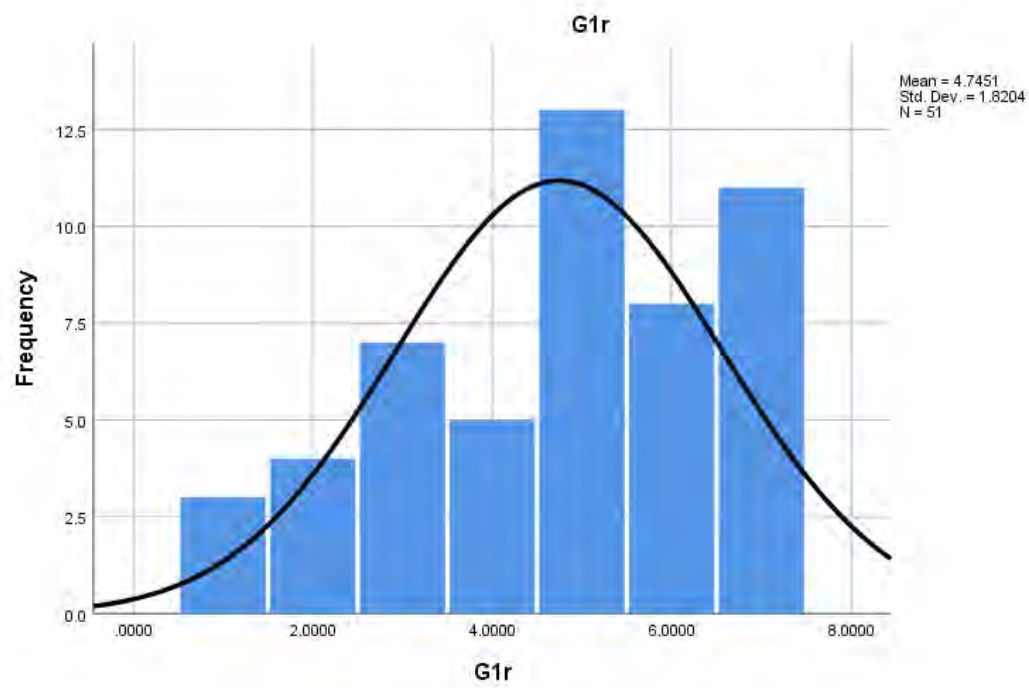


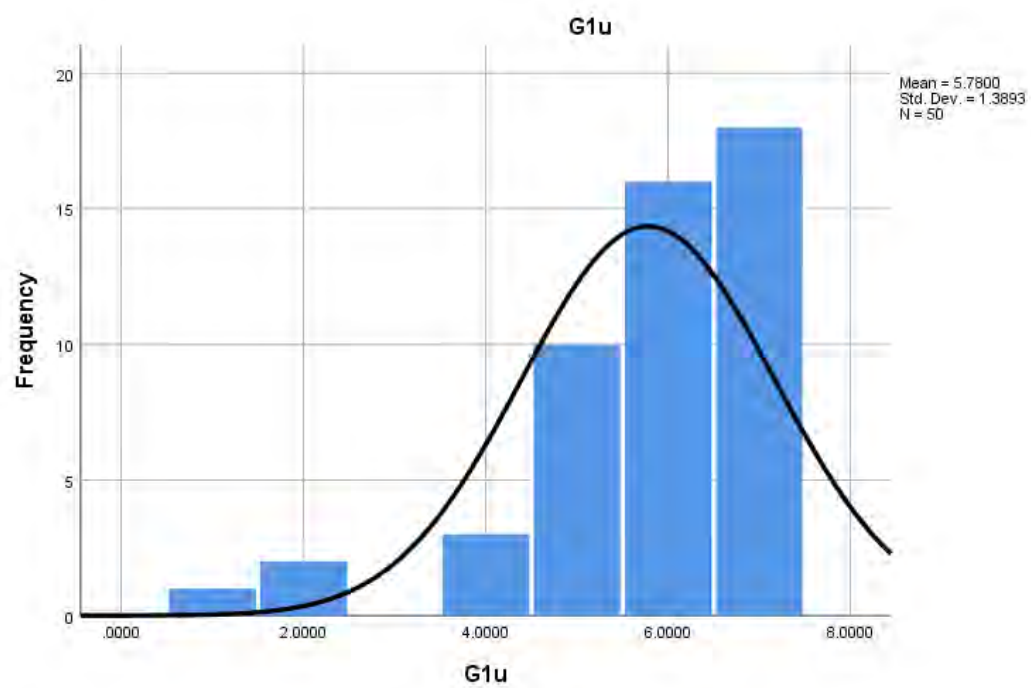
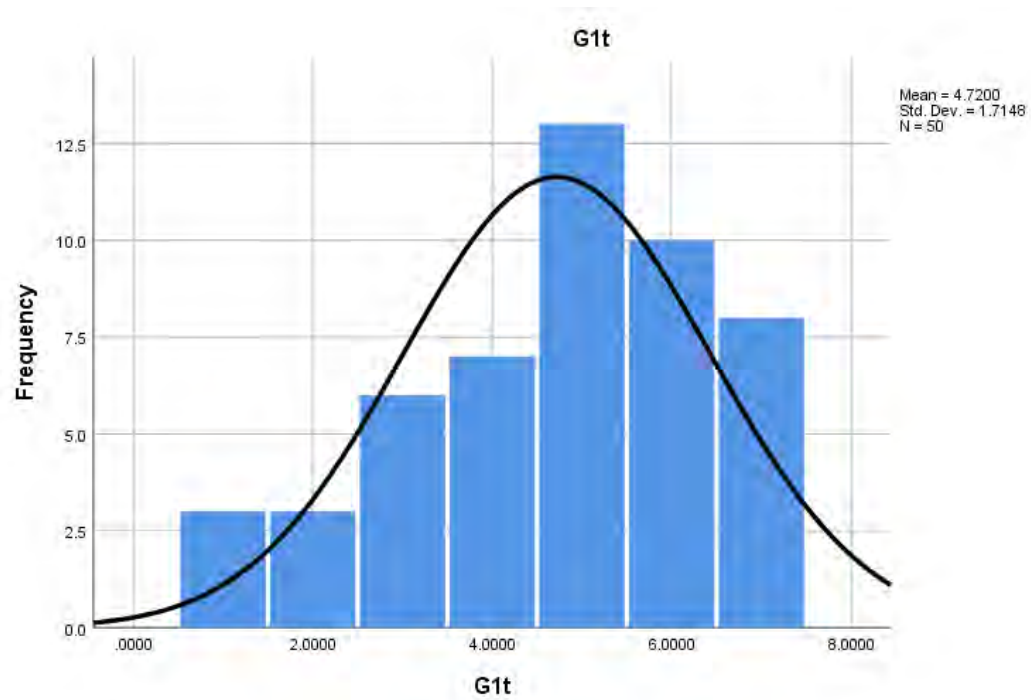












ANNEXURE-II

SPSS Calculation for Group-2: Annexure-II shows the calculation and graphical data analysis of SPSS software for Group-2. For group-2, there are many input variables. Set of questionnaires developed to identify the importance of the variables and interview of related persons also taken for collection of data. After that SPSS software is used to analyses the data and detail analysis for group-2 is showed in annexure-II

		Statistics					
		Company	G2a	G2b	G2c	G2d	G2e
N	Valid	51	51	51	51	51	51
	Missing	0	0	0	0	0	0
Mean			5.647059	5.588235	5.529412	5.784314	5.705882
Std. Error of Mean			.2054618	.1861403	.2026355	.2138604	.2044488
Std. Deviation			1.4672904	1.3293076	1.4471066	1.5272685	1.4600564

		Statistics					
		G2f	G2g	G2h	G2i	G2j	G2k
N	Valid	51	51	51	51	51	51
	Missing	0	0	0	0	0	0
Mean		6.039216	5.843137	5.509804	5.196078	5.882353	5.980392
Std. Error of Mean		.1835613	.2193977	.2298722	.2376678	.1850216	.1846888
Std. Deviation		1.3108895	1.5668127	1.6416157	1.6972873	1.3213184	1.3189419

		Statistics					
		G2l	G2m	G2n	G2o	G2p	G2q
N	Valid	51	50	51	51	51	51
	Missing	0	1	0	0	0	0
Mean		6.058824	5.580000	4.921569	5.254902	4.941176	5.137255
Std. Error of Mean		.2027493	.1939703	.2454977	.1977186	.2103438	.1980683
Std. Deviation		1.4479194	1.3715774	1.7532043	1.4119934	1.5021553	1.4144908

		Statistics					
		G2r	G2s	G2t	G2u	G2v	Remarks
N	Valid	51	51	51	51	51	51
	Missing	0	0	0	0	0	0
Mean		5.411765	5.666667	4.960784	5.823529	5.9608	
Std. Error of Mean		.2295374	.1993453	.2257203	.1974462	.18569	
Std. Deviation		1.6392251	1.4236104	1.6119651	1.4100480	1.32606	

Frequency Table

		Company			Cumulative Percent
		Frequency	Percent	Valid Percent	
Valid	C-1	1	2.0	2.0	2.0
	C-2	1	2.0	2.0	3.9
	C-3	1	2.0	2.0	5.9
	C-4	1	2.0	2.0	7.8
	C-5	1	2.0	2.0	9.8
	COM-1	1	2.0	2.0	11.8
	COM-10	1	2.0	2.0	13.7
	COM-11	1	2.0	2.0	15.7
	COM-12	1	2.0	2.0	17.6
	COM-13	1	2.0	2.0	19.6
	COM-14	1	2.0	2.0	21.6
	COM-15	1	2.0	2.0	23.5
	COM-16	1	2.0	2.0	25.5
	COM-17	1	2.0	2.0	27.5
	COM-18	1	2.0	2.0	29.4
	COM-19	1	2.0	2.0	31.4
	COM-2	1	2.0	2.0	33.3
	COM-20	1	2.0	2.0	35.3
	COM-21	1	2.0	2.0	37.3
	COM-22	1	2.0	2.0	39.2
	COM-23	1	2.0	2.0	41.2
	COM-24	1	2.0	2.0	43.1
	COM-25	1	2.0	2.0	45.1
	COM-26	1	2.0	2.0	47.1
	COM-27	1	2.0	2.0	49.0
	COM-28	1	2.0	2.0	51.0

	COM-29	1	2.0	2.0	52.9
	COM-3	1	2.0	2.0	54.9
	COM-30	1	2.0	2.0	56.9
	COM-31	1	2.0	2.0	58.8
	COM-32	1	2.0	2.0	60.8
	COM-33	1	2.0	2.0	62.7
	COM-34	1	2.0	2.0	64.7
	COM-4	1	2.0	2.0	66.7
	COM-5	1	2.0	2.0	68.6
	COM-6	1	2.0	2.0	70.6
	COM-7	1	2.0	2.0	72.5
	COM-8	1	2.0	2.0	74.5
	COM-9	1	2.0	2.0	76.5
	GE-1	1	2.0	2.0	78.4
	GE-10	1	2.0	2.0	80.4
	GE-11	1	2.0	2.0	82.4
	GE-12	1	2.0	2.0	84.3
	GE-2	1	2.0	2.0	86.3
	GE-3	1	2.0	2.0	88.2
	GE-4	1	2.0	2.0	90.2
	GE-5	1	2.0	2.0	92.2
	GE-6	1	2.0	2.0	94.1
	GE-7	1	2.0	2.0	96.1
	GE-8	1	2.0	2.0	98.0
	GE-9	1	2.0	2.0	100.0
	Total	51	100.0	100.0	

G2a					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	2.0	2.0	2.0
	Insignificant	1	2.0	2.0	3.9
	Neither Significant not Insignificant	3	5.9	5.9	9.8
	Significant	4	7.8	7.8	17.6
	Very Significant	11	21.6	21.6	39.2
	Highly Significant	12	23.5	23.5	62.7
	Extremely Significant	19	37.3	37.3	100.0
	Total	51	100.0	100.0	

G2b

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	2.0	2.0	2.0
	Insignificant	1	2.0	2.0	3.9
	Neither Significant not Insignificant	1	2.0	2.0	5.9
	Significant	4	7.8	7.8	13.7
	Very Significant	16	31.4	31.4	45.1
	Highly Significant	13	25.5	25.5	70.6
	Extremely Significant	15	29.4	29.4	100.0
	Total	51	100.0	100.0	

G2c

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	2.0	2.0	2.0
	Insignificant	1	2.0	2.0	3.9
	Neither Significant not Insignificant	3	5.9	5.9	9.8
	Significant	6	11.8	11.8	21.6
	Very Significant	9	17.6	17.6	39.2
	Highly Significant	16	31.4	31.4	70.6
	Extremely Significant	15	29.4	29.4	100.0
	Total	51	100.0	100.0	

G2d

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	3	5.9	5.9	5.9
	Significant	4	7.8	7.8	13.7
	Very Significant	8	15.7	15.7	29.4
	Highly Significant	16	31.4	31.4	60.8
	Extremely Significant	20	39.2	39.2	100.0
	Total	51	100.0	100.0	

		G2e			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	2.0	2.0	2.0
	Insignificant	1	2.0	2.0	3.9
	Neither Significant not Insignificant	3	5.9	5.9	9.8
	Significant	4	7.8	7.8	17.6
	Very Significant	8	15.7	15.7	33.3
	Highly Significant	15	29.4	29.4	62.7
	Extremely Significant	19	37.3	37.3	100.0
	Total	51	100.0	100.0	

		G2f			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	2.0	2.0	2.0
	Insignificant	1	2.0	2.0	3.9
	Neither Significant not Insignificant	1	2.0	2.0	5.9
	Significant	2	3.9	3.9	9.8
	Very Significant	5	9.8	9.8	19.6
	Highly Significant	18	35.3	35.3	54.9
	Extremely Significant	23	45.1	45.1	100.0
	Total	51	100.0	100.0	

		G2g			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	2	3.9	3.9	3.9
	Insignificant	1	2.0	2.0	5.9
	Neither Significant not Insignificant	1	2.0	2.0	7.8
	Significant	3	5.9	5.9	13.7
	Very Significant	11	21.6	21.6	35.3
	Highly Significant	7	13.7	13.7	49.0

	Extremely Significant	26	51.0	51.0	100.0
	Total	51	100.0	100.0	

G2h

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	2	3.9	3.9	3.9
	Neither Significant not Insignificant	4	7.8	7.8	11.8
	Significant	8	15.7	15.7	27.5
	Very Significant	8	15.7	15.7	43.1
	Highly Significant	8	15.7	15.7	58.8
	Extremely Significant	21	41.2	41.2	100.0
	Total	51	100.0	100.0	

G2i

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	2.0	2.0	2.0
	Insignificant	3	5.9	5.9	7.8
	Neither Significant not Insignificant	5	9.8	9.8	17.6
	Significant	9	17.6	17.6	35.3
	Very Significant	7	13.7	13.7	49.0
	Highly Significant	10	19.6	19.6	68.6
	Extremely Significant	16	31.4	31.4	100.0
	Total	51	100.0	100.0	

G2j

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	2.0	2.0	2.0
	Insignificant	1	2.0	2.0	3.9
	Significant	3	5.9	5.9	9.8
	Very Significant	13	25.5	25.5	35.3
	Highly Significant	11	21.6	21.6	56.9

Extremely Significant	22	43.1	43.1	100.0
Total	51	100.0	100.0	

G2k

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	2.0	2.0	2.0
	Neither Significant not Insignificant	1	2.0	2.0	3.9
	Significant	5	9.8	9.8	13.7
	Very Significant	8	15.7	15.7	29.4
	Highly Significant	11	21.6	21.6	51.0
	Extremely Significant	25	49.0	49.0	100.0
	Total	51	100.0	100.0	

G2l

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	2	3.9	3.9	3.9
	Neither Significant not Insignificant	1	2.0	2.0	5.9
	Significant	3	5.9	5.9	11.8
	Very Significant	6	11.8	11.8	23.5
	Highly Significant	11	21.6	21.6	45.1
	Extremely Significant	28	54.9	54.9	100.0
	Total	51	100.0	100.0	

G2m

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	2.0	2.0	2.0
	Insignificant	2	3.9	4.0	6.0
	Significant	4	7.8	8.0	14.0
	Very Significant	14	27.5	28.0	42.0
	Highly Significant	15	29.4	30.0	72.0
	Extremely Significant	14	27.5	28.0	100.0

	Total	50	98.0	100.0	
Missing	System	1	2.0		
	Total	51	100.0		

		G2n			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	2.0	2.0	2.0
	Insignificant	3	5.9	5.9	7.8
	Neither Significant not Insignificant	12	23.5	23.5	31.4
	Significant	2	3.9	3.9	35.3
	Very Significant	11	21.6	21.6	56.9
	Highly Significant	9	17.6	17.6	74.5
	Extremely Significant	13	25.5	25.5	100.0
	Total	51	100.0	100.0	

		G2o			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	2.0	2.0	2.0
	Insignificant	1	2.0	2.0	3.9
	Neither Significant not Insignificant	5	9.8	9.8	13.7
	Significant	6	11.8	11.8	25.5
	Very Significant	10	19.6	19.6	45.1
	Highly Significant	20	39.2	39.2	84.3
	Extremely Significant	8	15.7	15.7	100.0
	Total	51	100.0	100.0	

		G2p			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	2.0	2.0	2.0
	Insignificant	3	5.9	5.9	7.8
	Neither Significant not Insignificant	5	9.8	9.8	17.6

	Significant	7	13.7	13.7	31.4
	Very Significant	16	31.4	31.4	62.7
	Highly Significant	11	21.6	21.6	84.3
	Extremely Significant	8	15.7	15.7	100.0
	Total	51	100.0	100.0	

		G2q			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	2.0	2.0	2.0
	Insignificant	2	3.9	3.9	5.9
	Neither Significant not Insignificant	1	2.0	2.0	7.8
	Significant	13	25.5	25.5	33.3
	Very Significant	11	21.6	21.6	54.9
	Highly Significant	14	27.5	27.5	82.4
	Extremely Significant	9	17.6	17.6	100.0
	Total	51	100.0	100.0	

		G2r			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	2.0	2.0	2.0
	Insignificant	2	3.9	3.9	5.9
	Neither Significant not Insignificant	5	9.8	9.8	15.7
	Significant	6	11.8	11.8	27.5
	Very Significant	8	15.7	15.7	43.1
	Highly Significant	11	21.6	21.6	64.7
	Extremely Significant	18	35.3	35.3	100.0
	Total	51	100.0	100.0	

		G2s			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	2.0	2.0	2.0

	Insignificant	1	2.0	2.0	3.9
	Neither Significant not Insignificant	3	5.9	5.9	9.8
	Significant	2	3.9	3.9	13.7
	Very Significant	13	25.5	25.5	39.2
	Highly Significant	13	25.5	25.5	64.7
	Extremely Significant	18	35.3	35.3	100.0
	Total	51	100.0	100.0	

G2t

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	2.0	2.0	2.0
	Insignificant	2	3.9	3.9	5.9
	Neither Significant not Insignificant	8	15.7	15.7	21.6
	Significant	8	15.7	15.7	37.3
	Very Significant	12	23.5	23.5	60.8
	Highly Significant	8	15.7	15.7	76.5
	Extremely Significant	12	23.5	23.5	100.0
	Total	51	100.0	100.0	

G2u

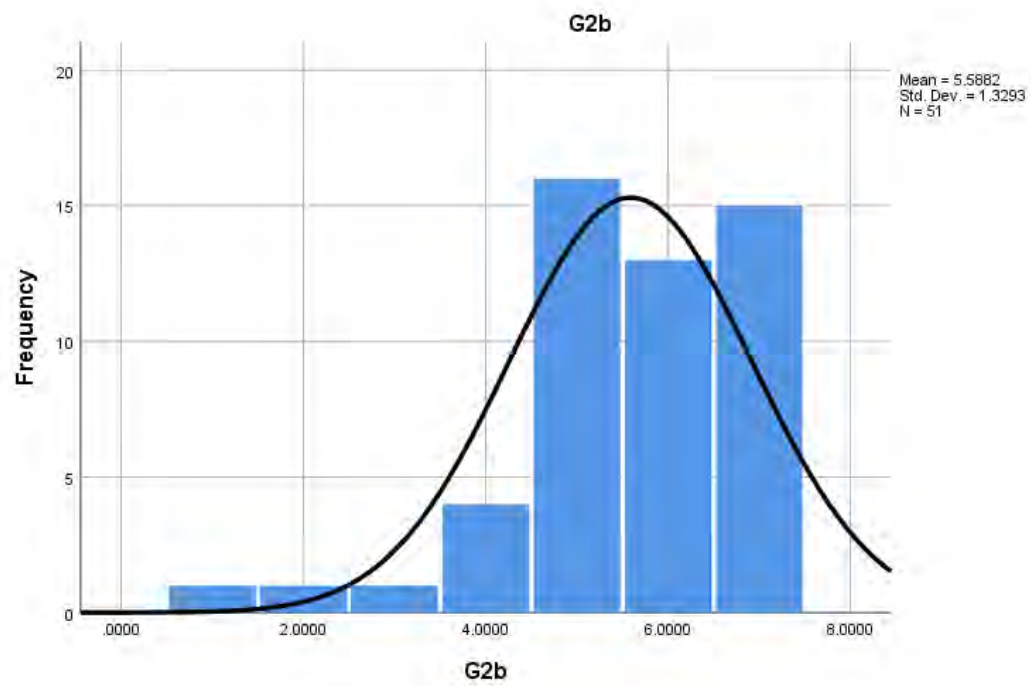
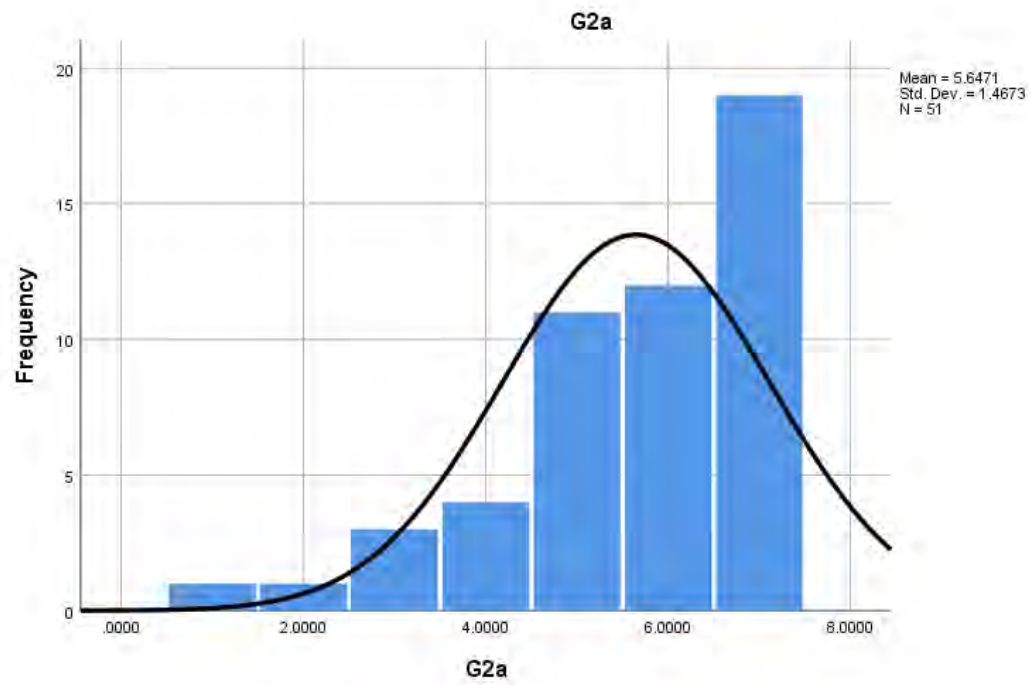
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	2.0	2.0	2.0
	Insignificant	1	2.0	2.0	3.9
	Neither Significant not Insignificant	1	2.0	2.0	5.9
	Significant	4	7.8	7.8	13.7
	Very Significant	12	23.5	23.5	37.3
	Highly Significant	9	17.6	17.6	54.9
	Extremely Significant	23	45.1	45.1	100.0
	Total	51	100.0	100.0	

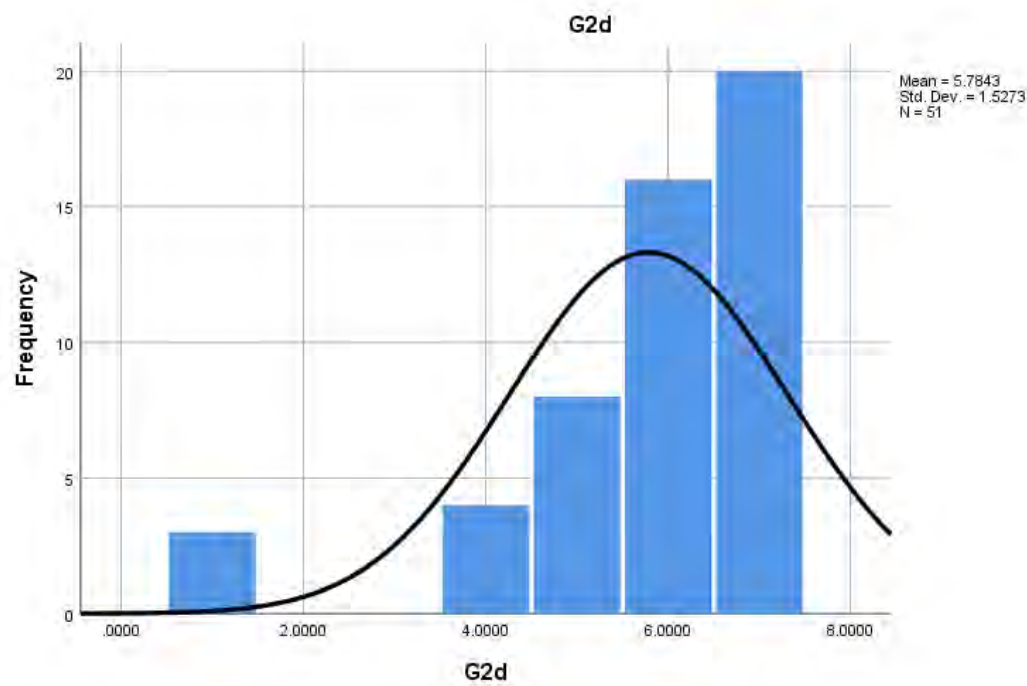
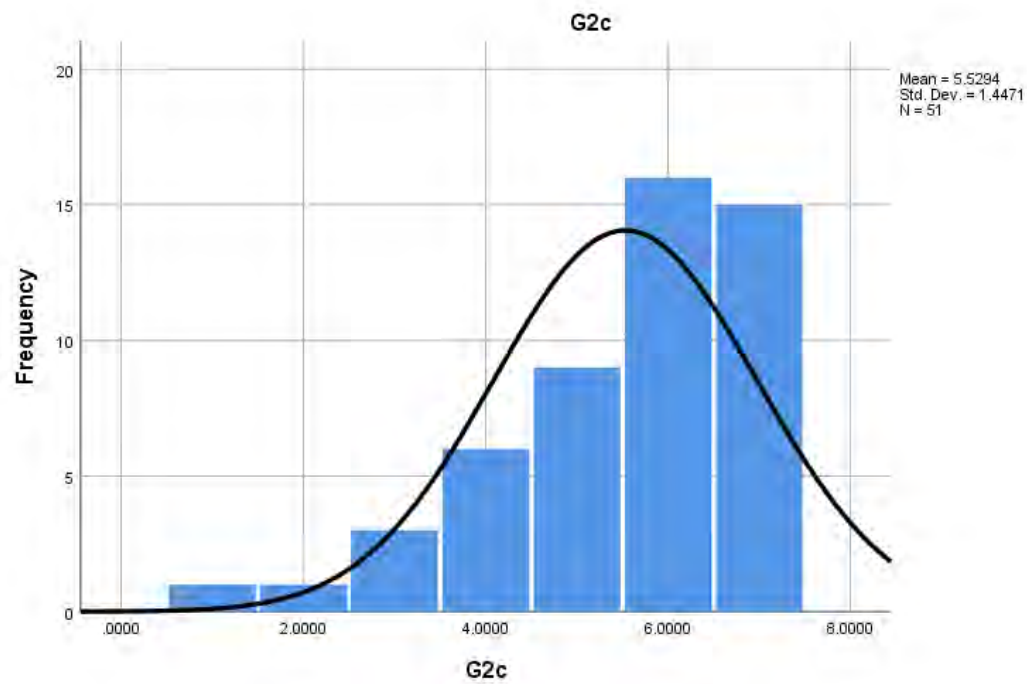
G2v

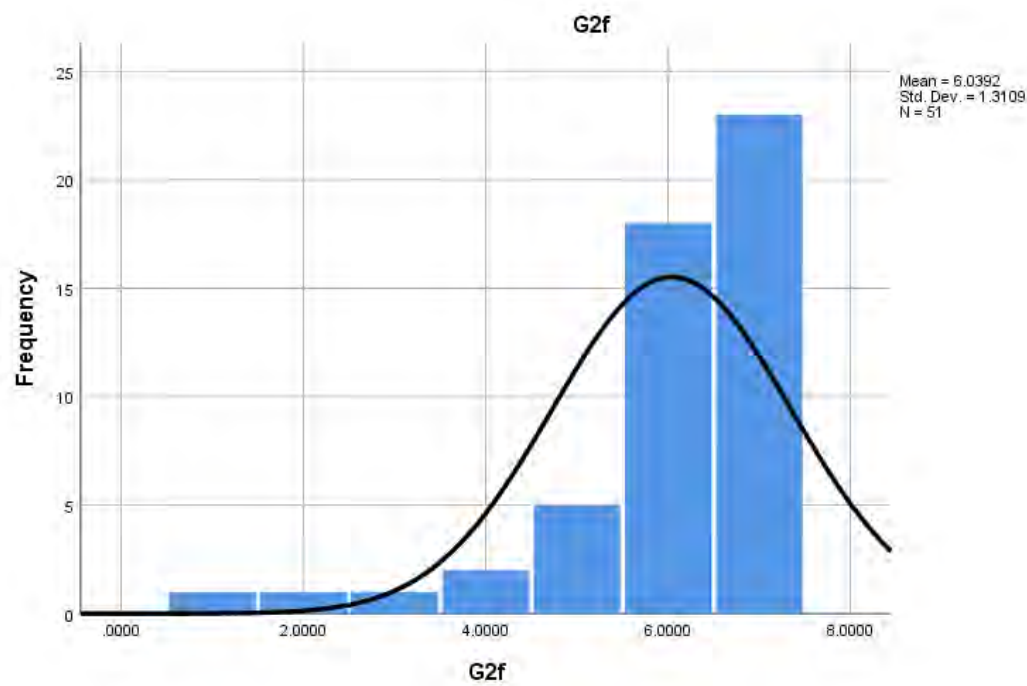
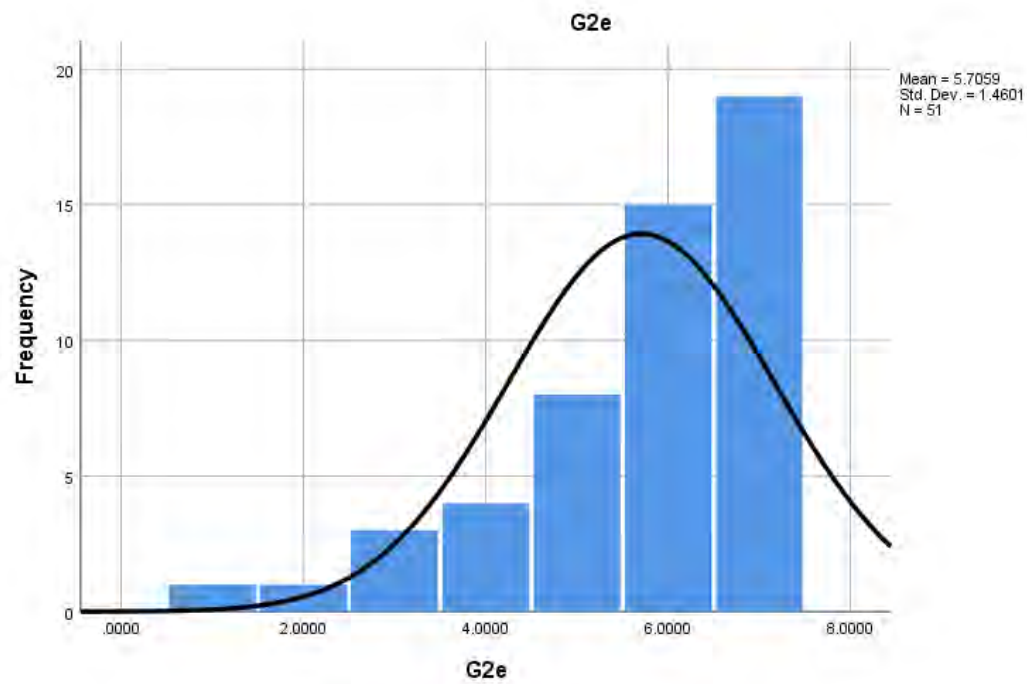
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	2.0	2.0	2.0
	Insignificant	1	2.0	2.0	3.9
	Significant	3	5.9	5.9	9.8
	Very Significant	11	21.6	21.6	31.4
	Highly Significant	11	21.6	21.6	52.9
	Extremely Significant	24	47.1	47.1	100.0
	Total	51	100.0	100.0	

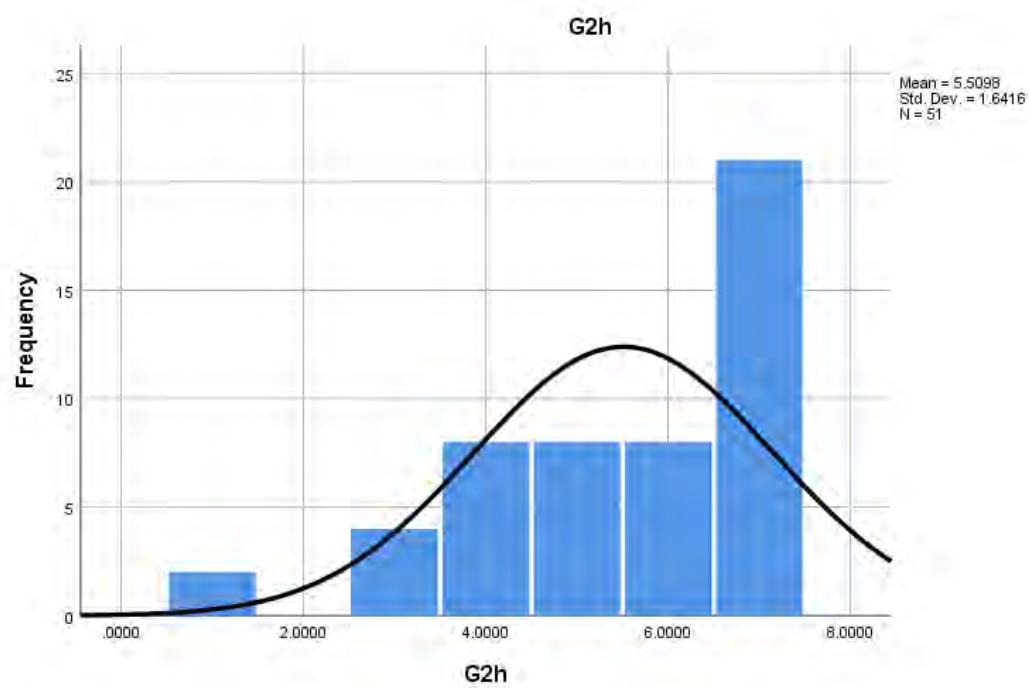
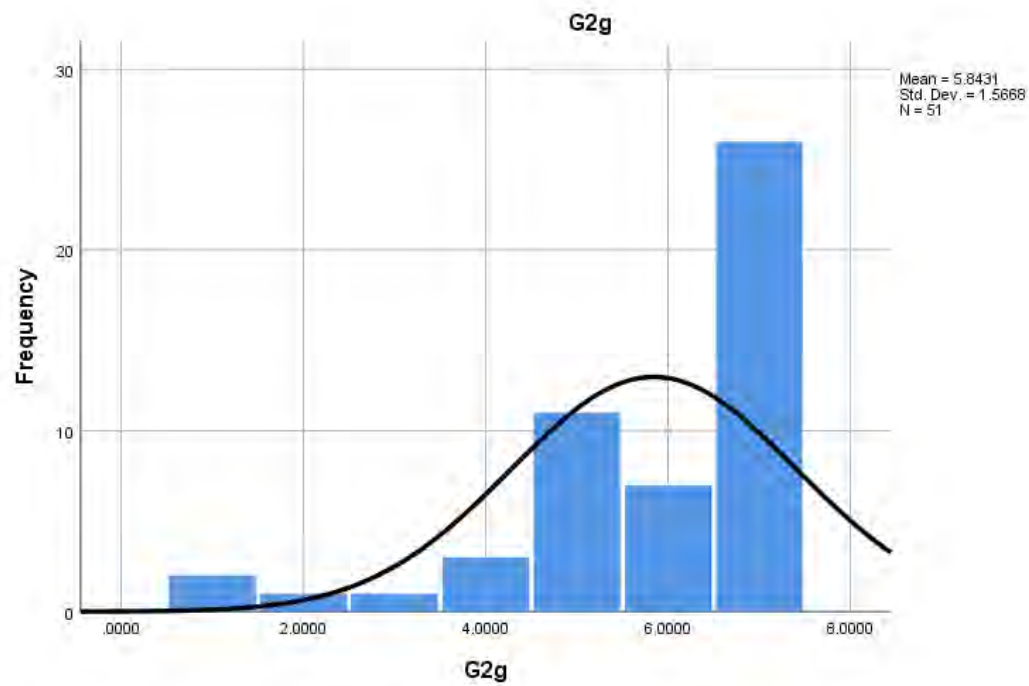
Remarks				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	51	100.0	100.0	100.0

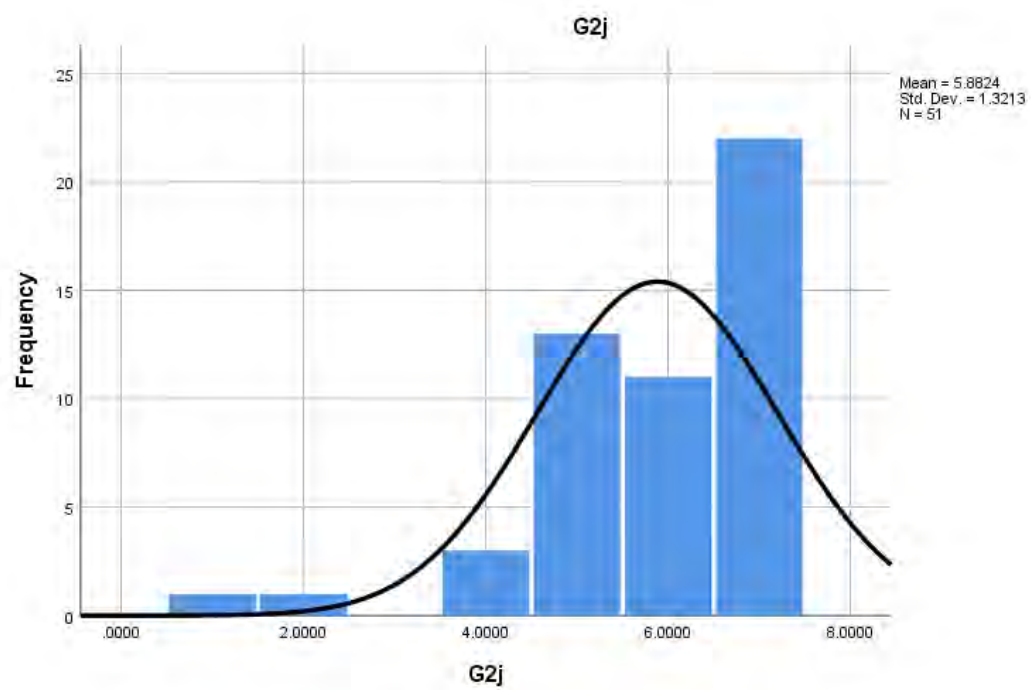
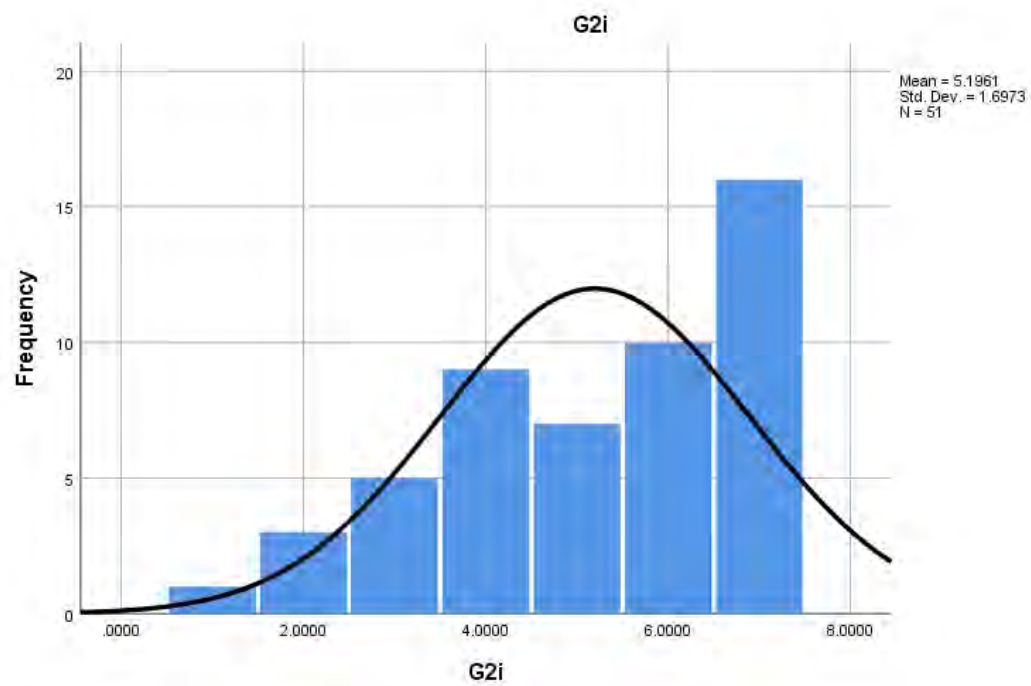
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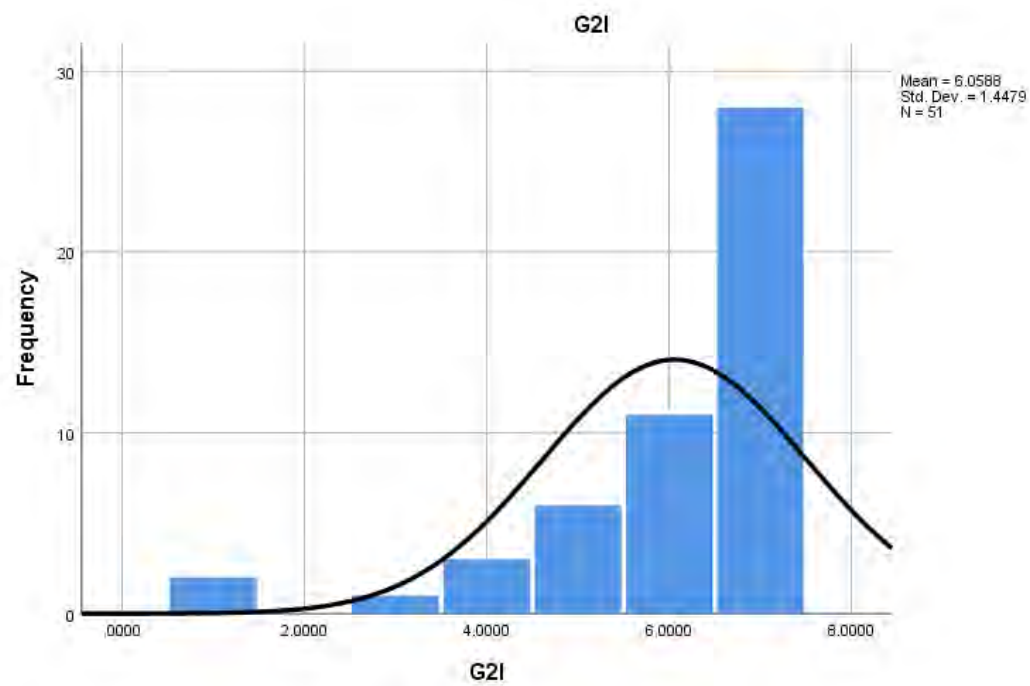
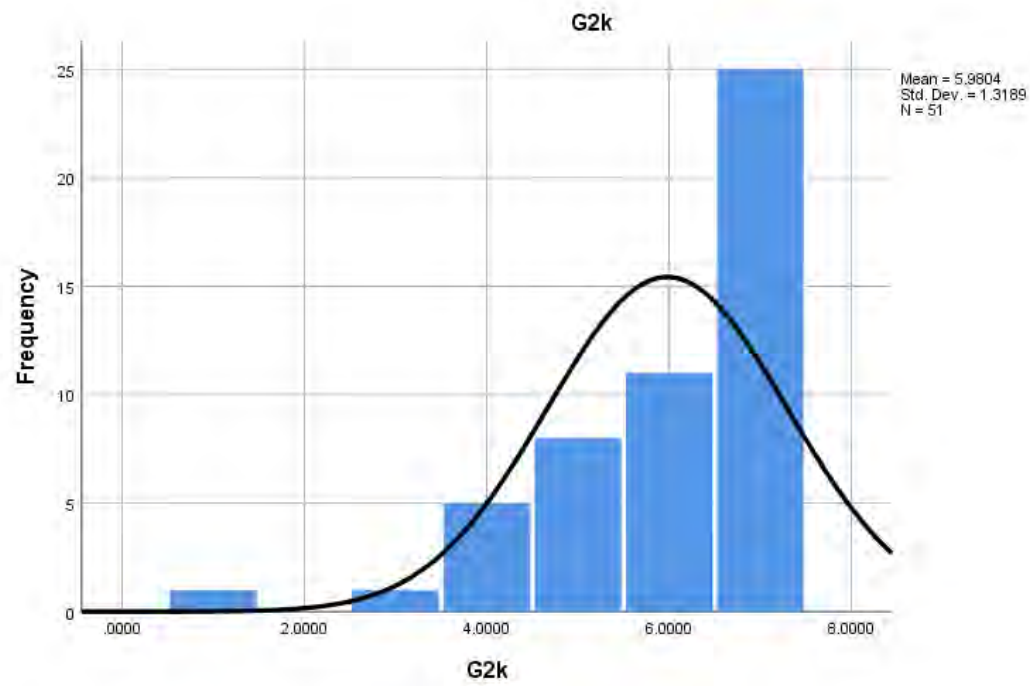


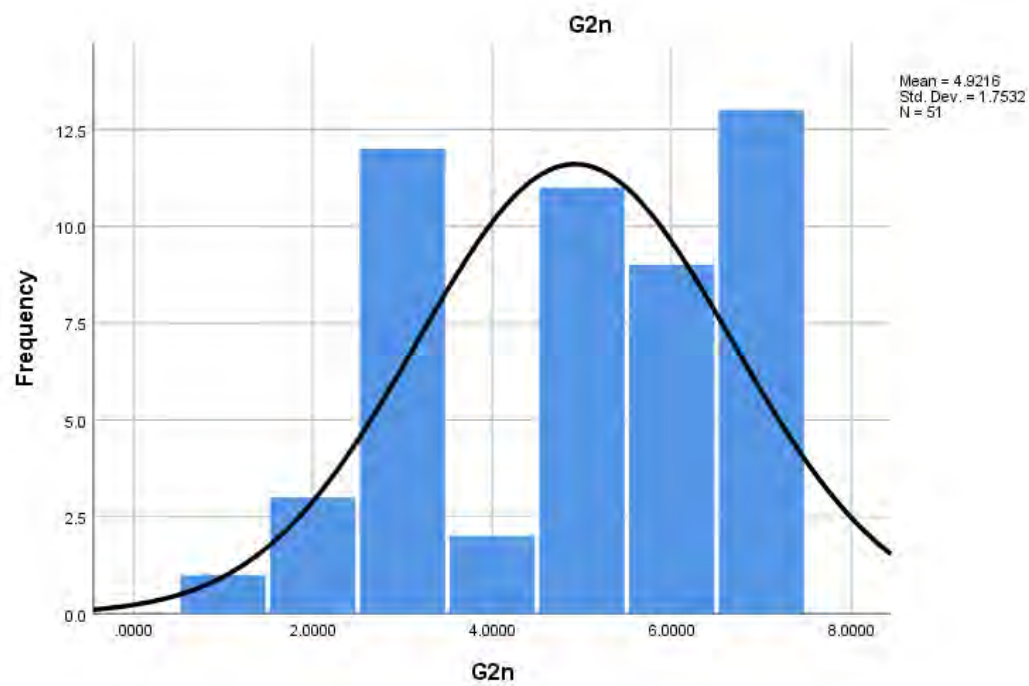
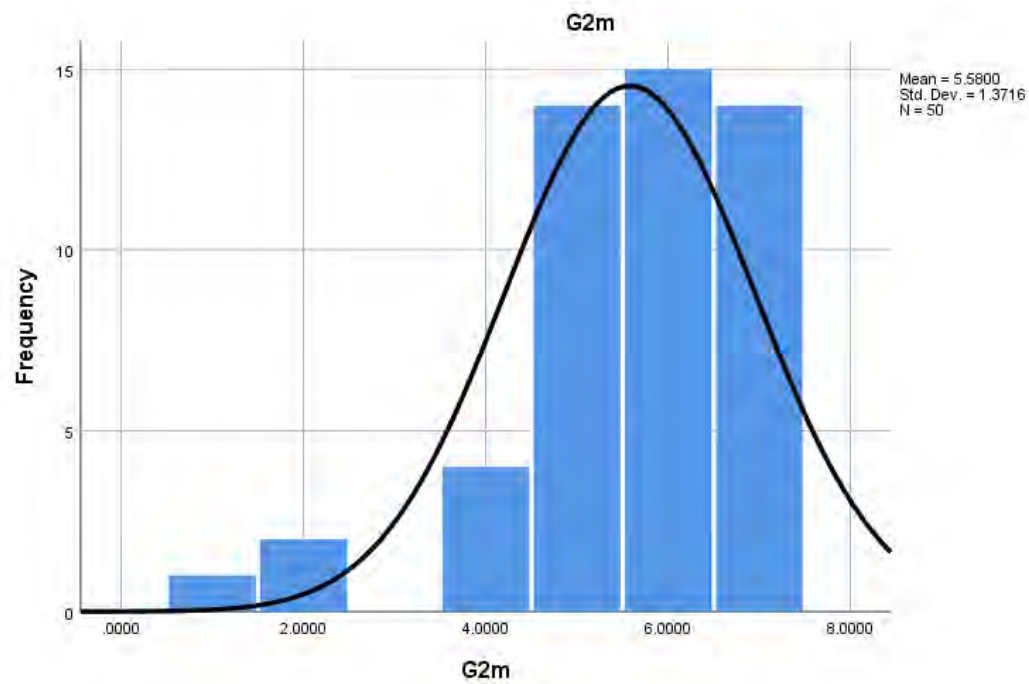


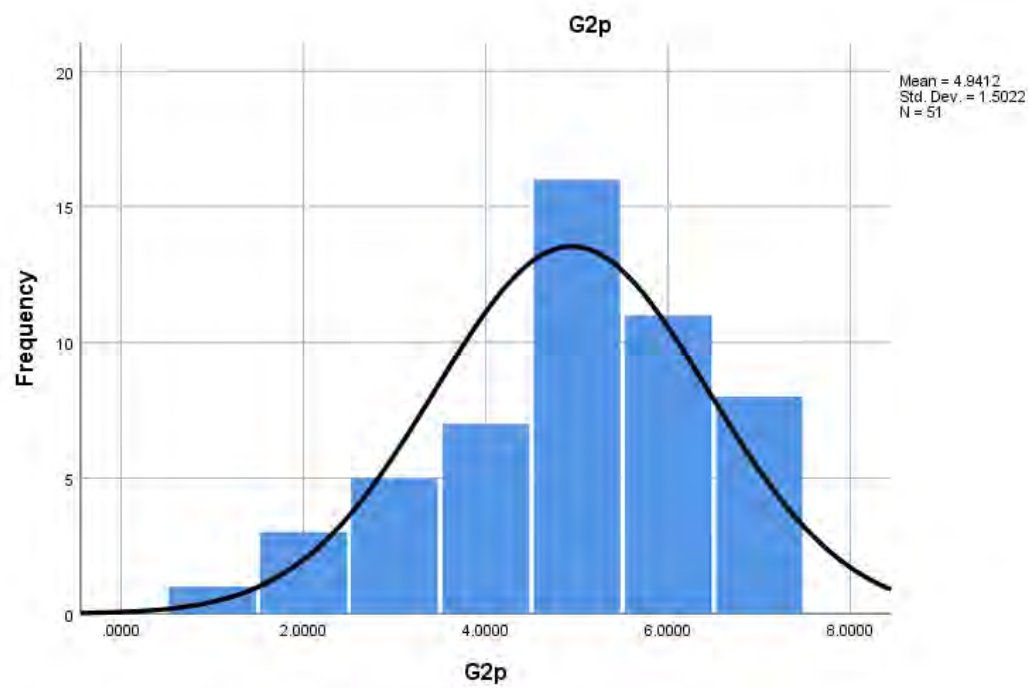
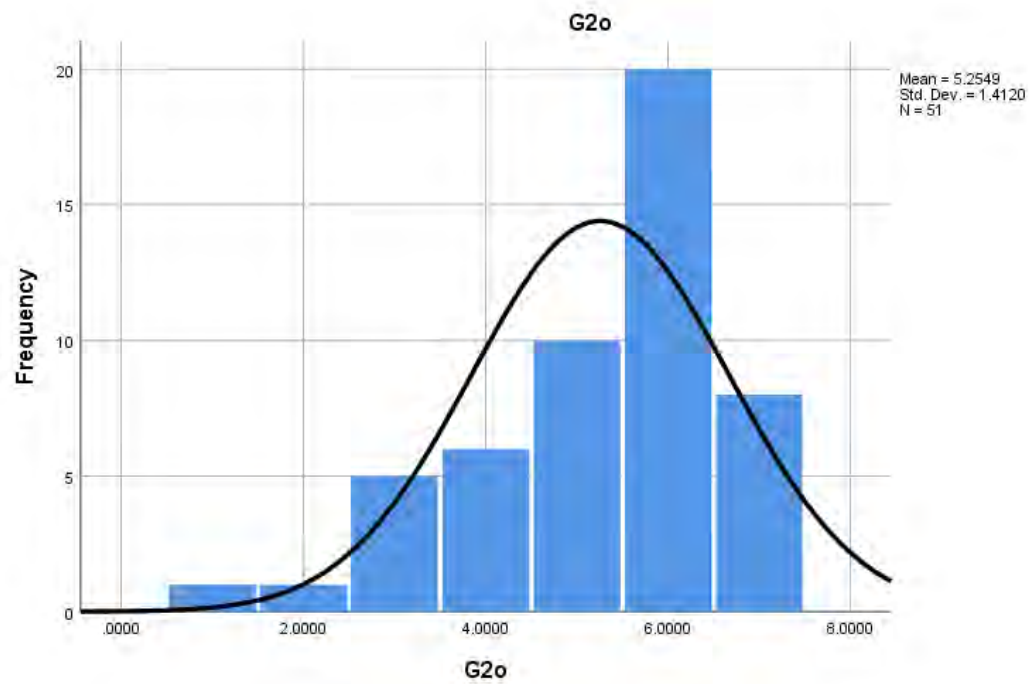


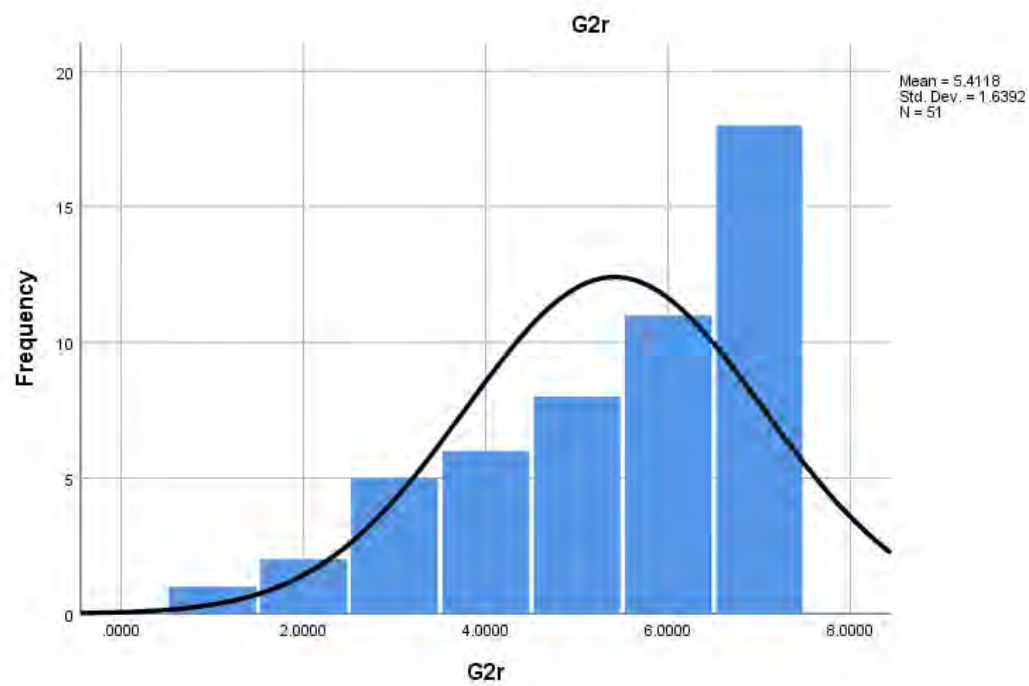
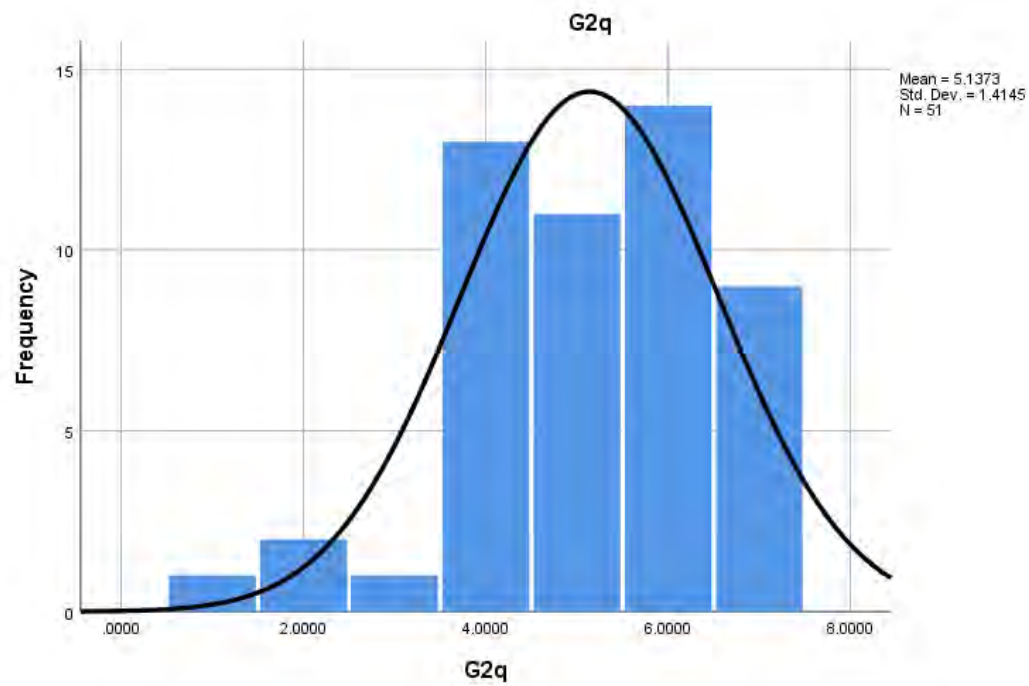


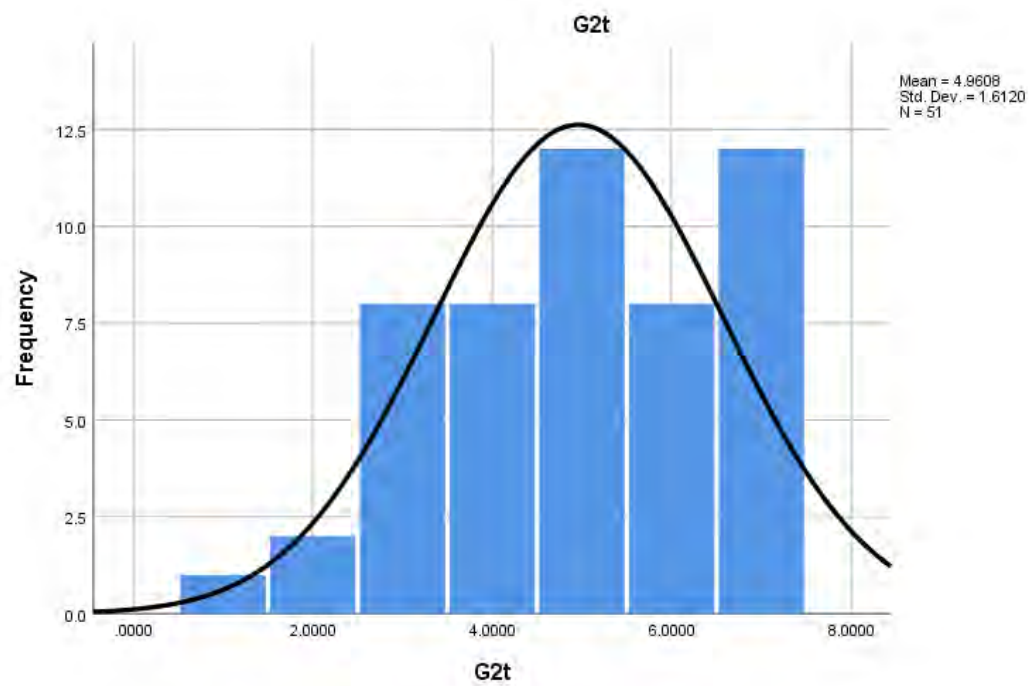
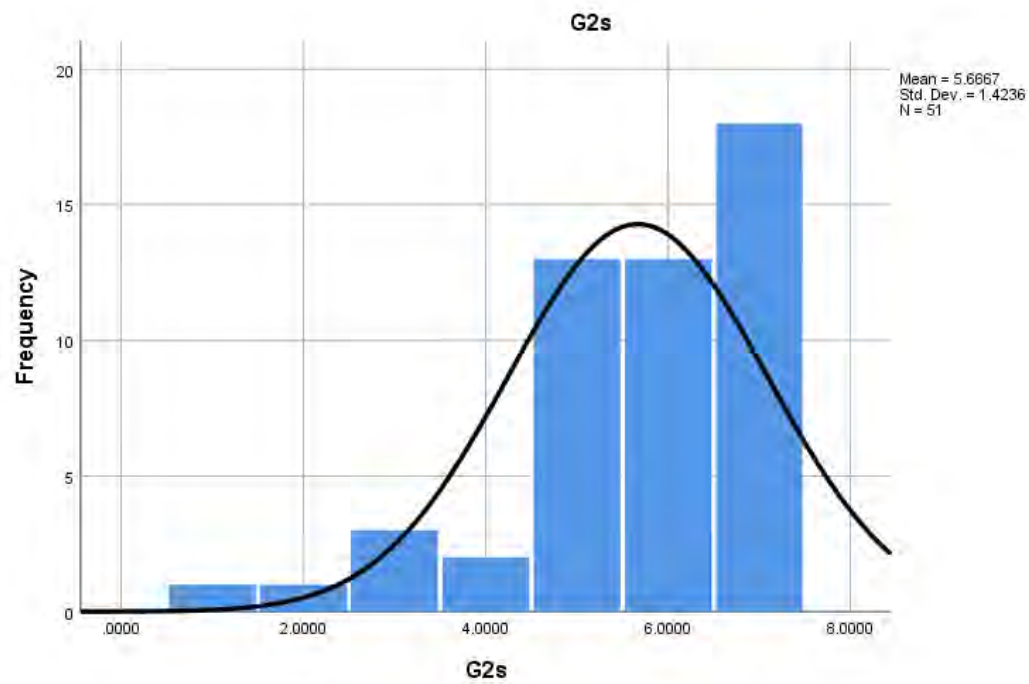


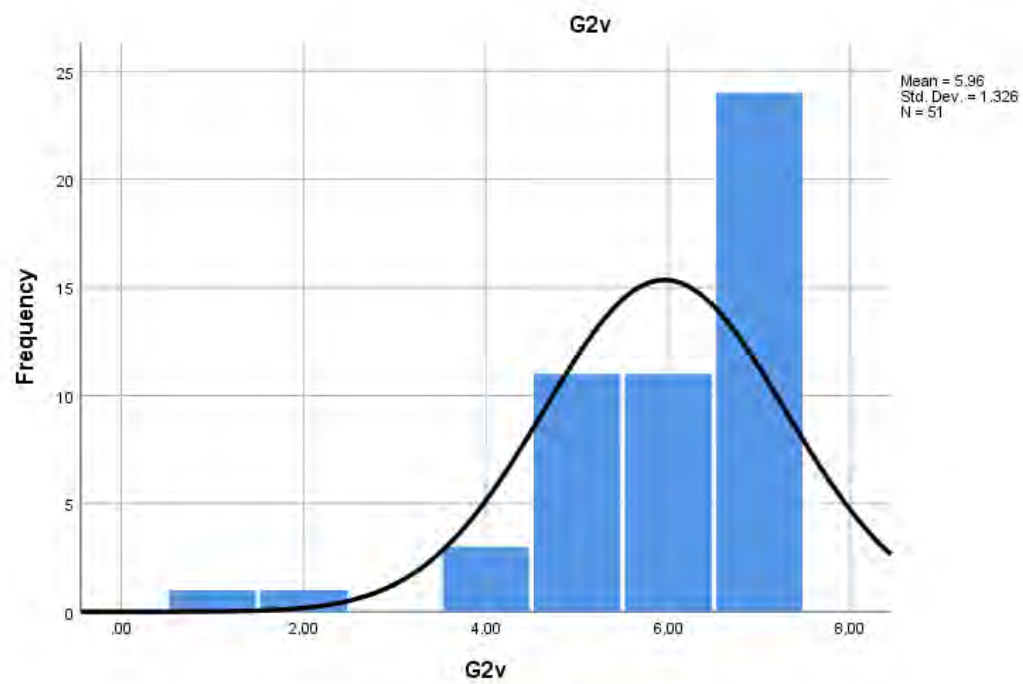
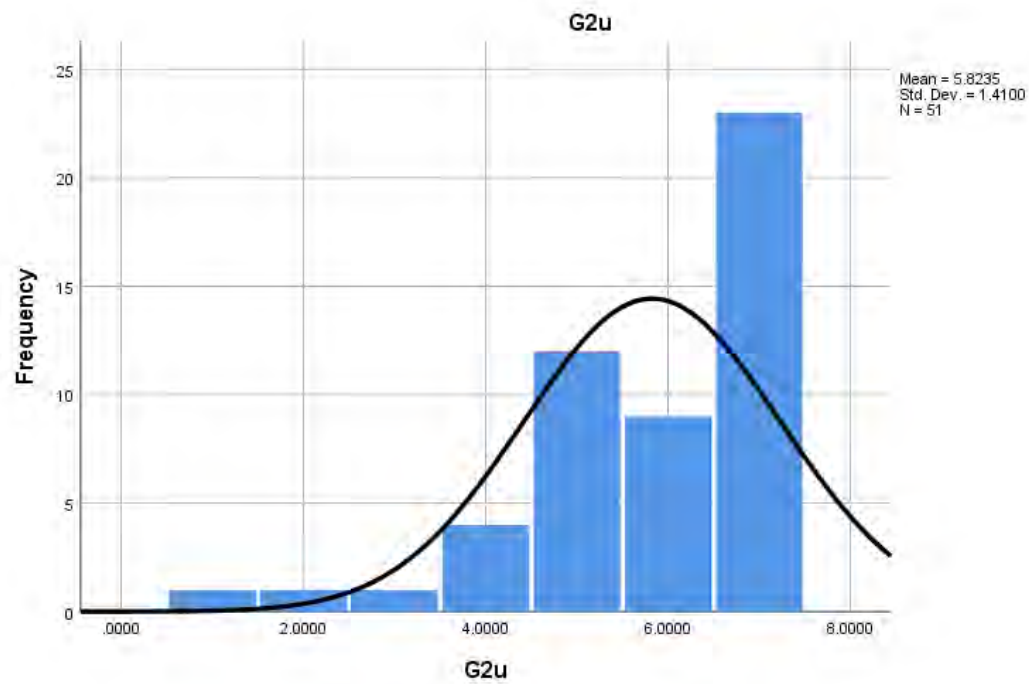












ANNEXURE-III

SPSS Calculation for Group-3: Annexure-III shows the calculation and graphical data analysis of SPSS software for Group-3. For group-3, there are many input variables. Set of questionnaires developed to identify the importance of the variables and interview of related persons also taken for collection of data. After that SPSS software is used to analyses the data and detail analysis for group-3 is showed in annexure-III

		Statistics					
		Company	G1a	G1b	G1c	G1d	G1e
N	Valid	52	51	51	51	51	51
	Missing	0	1	1	1	1	1
Mean			5.549020	4.980392	5.352941	5.607843	5.627451
Std. Error of Mean			.1616429	.1803922	.1895785	.1901051	.2057236
Std. Deviation			1.1543609	1.2882577	1.3538616	1.3576219	1.4691601

		Statistics					
		G1f	G1g	G1h	G1i	G1j	G1k
N	Valid	51	51	51	51	51	51
	Missing	1	1	1	1	1	1
Mean		5.196078	5.039216	4.803922	5.470588	5.862745	5.862745
Std. Error of Mean		.2376678	.2392157	.2715527	.1061000	.1793662	.1771664
Std. Deviation		1.6972873	1.7083417	1.9392742	.7577055	1.2809310	1.2652211

		Statistics		G1l
N	Valid			51
	Missing			1
Mean				5.333333
Std. Error of Mean				.2354248
Std. Deviation				1.6812694

Frequency Table

		Company			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		1	1.9	1.9	1.9
	C-1	1	1.9	1.9	3.8
	C-2	1	1.9	1.9	5.8

C-3	1	1.9	1.9	7.7
C-4	1	1.9	1.9	9.6
C-5	1	1.9	1.9	11.5
COM-1	1	1.9	1.9	13.5
COM-10	1	1.9	1.9	15.4
COM-11	1	1.9	1.9	17.3
COM-12	1	1.9	1.9	19.2
COM-13	1	1.9	1.9	21.2
COM-14	1	1.9	1.9	23.1
COM-15	1	1.9	1.9	25.0
COM-16	1	1.9	1.9	26.9
COM-17	1	1.9	1.9	28.8
COM-18	1	1.9	1.9	30.8
COM-19	1	1.9	1.9	32.7
COM-2	1	1.9	1.9	34.6
COM-20	1	1.9	1.9	36.5
COM-21	1	1.9	1.9	38.5
COM-22	1	1.9	1.9	40.4
COM-23	1	1.9	1.9	42.3
COM-24	1	1.9	1.9	44.2
COM-25	1	1.9	1.9	46.2
COM-26	1	1.9	1.9	48.1
COM-27	1	1.9	1.9	50.0
COM-28	1	1.9	1.9	51.9
COM-29	1	1.9	1.9	53.8
COM-3	1	1.9	1.9	55.8
COM-30	1	1.9	1.9	57.7
COM-31	1	1.9	1.9	59.6
COM-32	1	1.9	1.9	61.5
COM-33	1	1.9	1.9	63.5
COM-34	1	1.9	1.9	65.4
COM-4	1	1.9	1.9	67.3
COM-5	1	1.9	1.9	69.2
COM-6	1	1.9	1.9	71.2
COM-7	1	1.9	1.9	73.1
COM-8	1	1.9	1.9	75.0
COM-9	1	1.9	1.9	76.9
GE-1	1	1.9	1.9	78.8
GE-10	1	1.9	1.9	80.8
GE-11	1	1.9	1.9	82.7

	GE-12	1	1.9	1.9	84.6
	GE-2	1	1.9	1.9	86.5
	GE-3	1	1.9	1.9	88.5
	GE-4	1	1.9	1.9	90.4
	GE-5	1	1.9	1.9	92.3
	GE-6	1	1.9	1.9	94.2
	GE-7	1	1.9	1.9	96.2
	GE-8	1	1.9	1.9	98.1
	GE-9	1	1.9	1.9	100.0
	Total	52	100.0	100.0	

G1a

				Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neither Significant not	Insignificant		2	3.8	3.9	3.9
	Significant			8	15.4	15.7	19.6
	Very Significant			14	26.9	27.5	47.1
	Highly Significant			14	26.9	27.5	74.5
	Extremely Significant			13	25.0	25.5	100.0
	Total			51	98.1	100.0	
	Missing	System		1	1.9		
Total				52	100.0		

G1b

				Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Insignificant			2	3.8	3.9	3.9
	Neither	Significant	not	5	9.6	9.8	13.7
	Insignificant						
	Significant			8	15.4	15.7	29.4
	Very Significant			20	38.5	39.2	68.6
	Highly Significant			9	17.3	17.6	86.3
	Extremely Significant			7	13.5	13.7	100.0
	Total			51	98.1	100.0	
Missing	System			1	1.9		
Total				52	100.0		

G1c

				Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant			1	1.9	2.0	2.0
	Neither	Significant	not	4	7.7	7.8	9.8
	Insignificant						
	Significant			8	15.4	15.7	25.5
	Very Significant			10	19.2	19.6	45.1
	Highly Significant			18	34.6	35.3	80.4
	Extremely Significant			10	19.2	19.6	100.0
	Total			51	98.1	100.0	
Missing	System			1	1.9		
Total				52	100.0		

G1d

				Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant			1	1.9	2.0	2.0
	Neither	Significant	not	3	5.8	5.9	7.8
	Insignificant						
	Significant			6	11.5	11.8	19.6
	Very Significant			9	17.3	17.6	37.3
	Highly Significant			17	32.7	33.3	70.6
	Extremely Significant			15	28.8	29.4	100.0
Total				51	98.1	100.0	
Missing	System			1	1.9		
Total				52	100.0		

G1e

				Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant			1	1.9	2.0	2.0
	Insignificant			1	1.9	2.0	3.9
	Neither	Significant	not	3	5.8	5.9	9.8
	Insignificant						
	Significant			5	9.6	9.8	19.6
	Very Significant			9	17.3	17.6	37.3

	Highly Significant	14	26.9	27.5	64.7
	Extremely Significant	18	34.6	35.3	100.0
	Total	51	98.1	100.0	
Missing	System	1	1.9		
Total		52	100.0		

G1f

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	2	3.8	3.9	3.9
	Insignificant	3	5.8	5.9	9.8
	Neither Significant not Insignificant	4	7.7	7.8	17.6
	Significant	5	9.6	9.8	27.5
	Very Significant	10	19.2	19.6	47.1
	Highly Significant	14	26.9	27.5	74.5
	Extremely Significant	13	25.0	25.5	100.0
	Total	51	98.1	100.0	
Missing	System	1	1.9		
Total		52	100.0		

G1g

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	4	7.7	7.8	7.8
	Insignificant	1	1.9	2.0	9.8
	Neither Significant not Insignificant	3	5.8	5.9	15.7
	Significant	6	11.5	11.8	27.5
	Very Significant	15	28.8	29.4	56.9
	Highly Significant	11	21.2	21.6	78.4
	Extremely Significant	11	21.2	21.6	100.0
	Total	51	98.1	100.0	
Missing	System	1	1.9		
Total		52	100.0		

G1h

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	6	11.5	11.8	11.8
	Insignificant	2	3.8	3.9	15.7
	Neither Significant not Insignificant	4	7.7	7.8	23.5
	Significant	6	11.5	11.8	35.3
	Very Significant	9	17.3	17.6	52.9
	Highly Significant	14	26.9	27.5	80.4
	Extremely Significant	10	19.2	19.6	100.0
	Total	51	98.1	100.0	
Missing	System	1	1.9		
Total		52	100.0		

G1i

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Significant	4	7.7	7.8	7.8
	Very Significant	23	44.2	45.1	52.9
	Highly Significant	20	38.5	39.2	92.2
	Extremely Significant	4	7.7	7.8	100.0
	Total	51	98.1	100.0	
Missing	System	1	1.9		
Total		52	100.0		

G1j

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	1	1.9	2.0	2.0
	Neither Significant not Insignificant	1	1.9	2.0	3.9
	Significant	4	7.7	7.8	11.8
	Very Significant	12	23.1	23.5	35.3
	Highly Significant	12	23.1	23.5	58.8
	Extremely Significant	21	40.4	41.2	100.0
	Total	51	98.1	100.0	
Missing	System	1	1.9		

Total	52	100.0		
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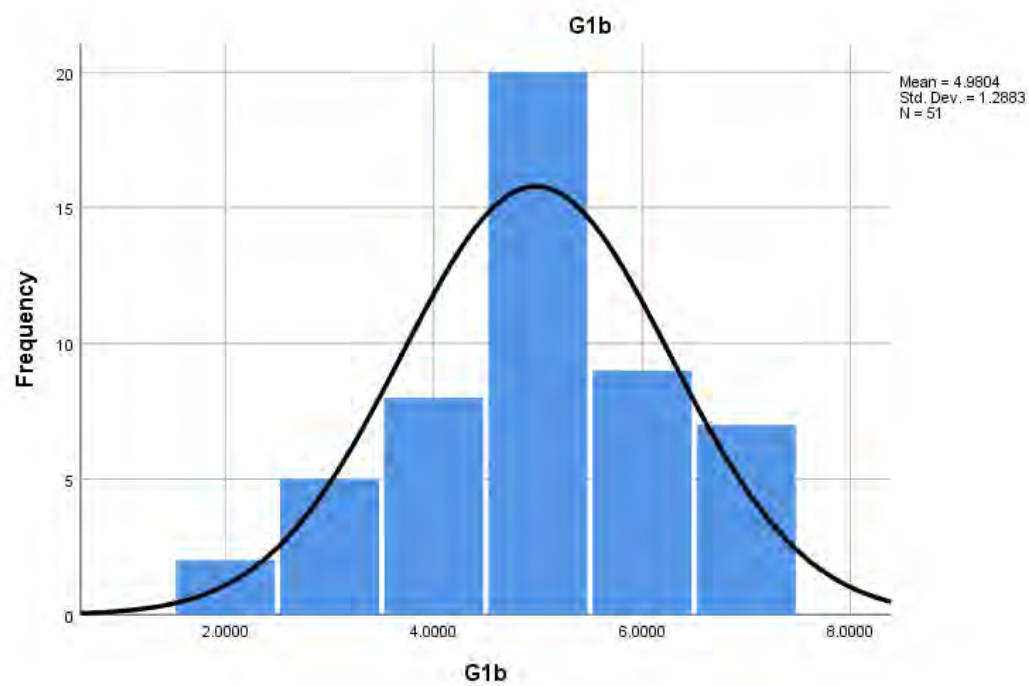
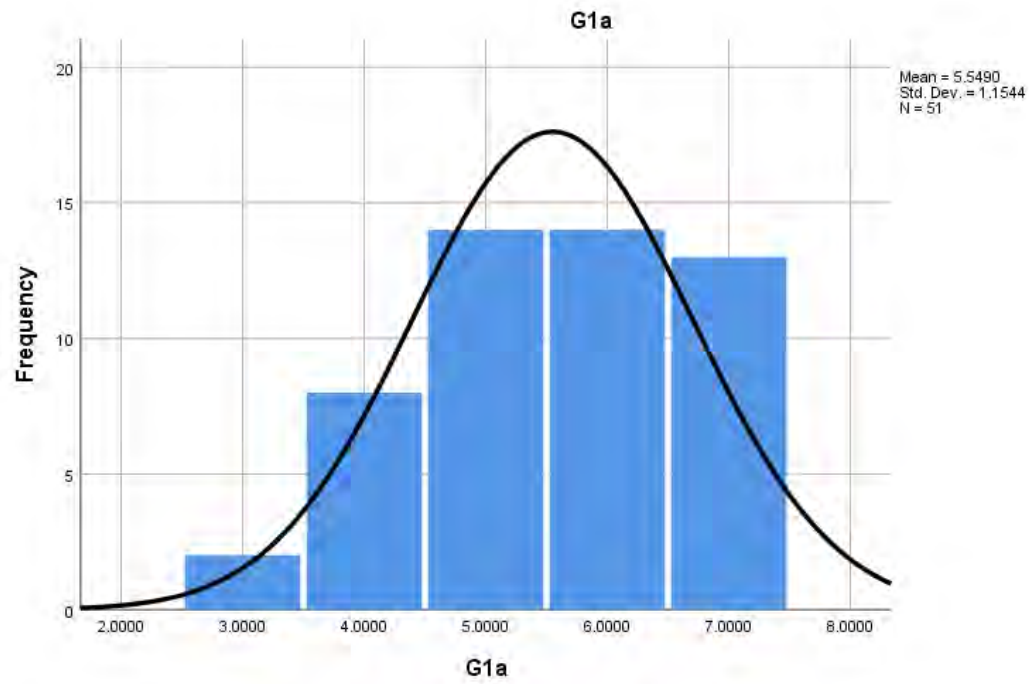
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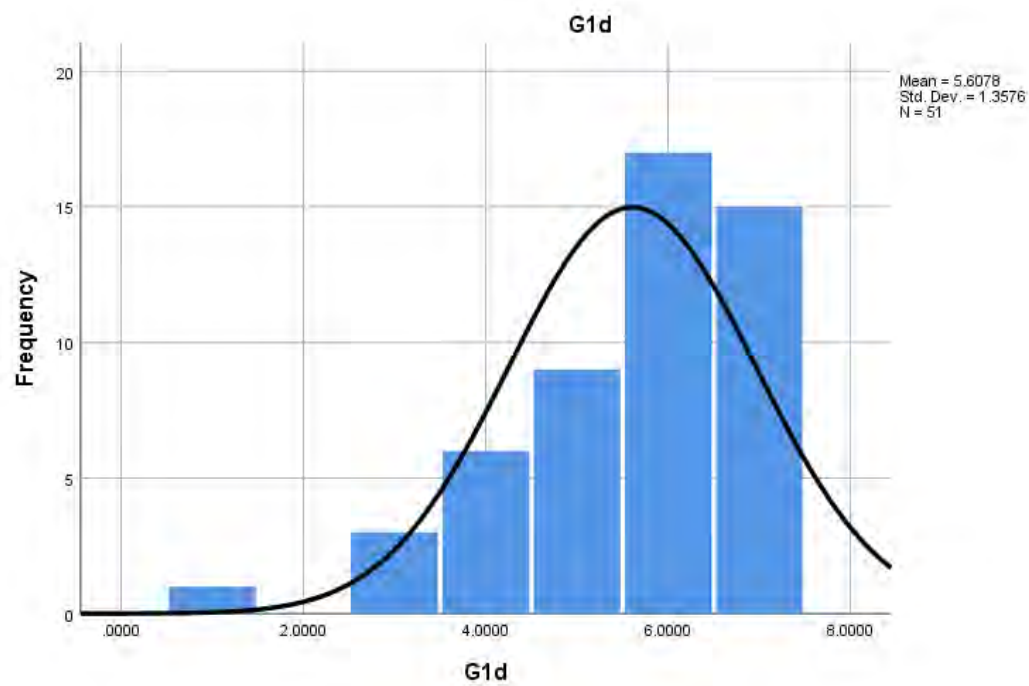
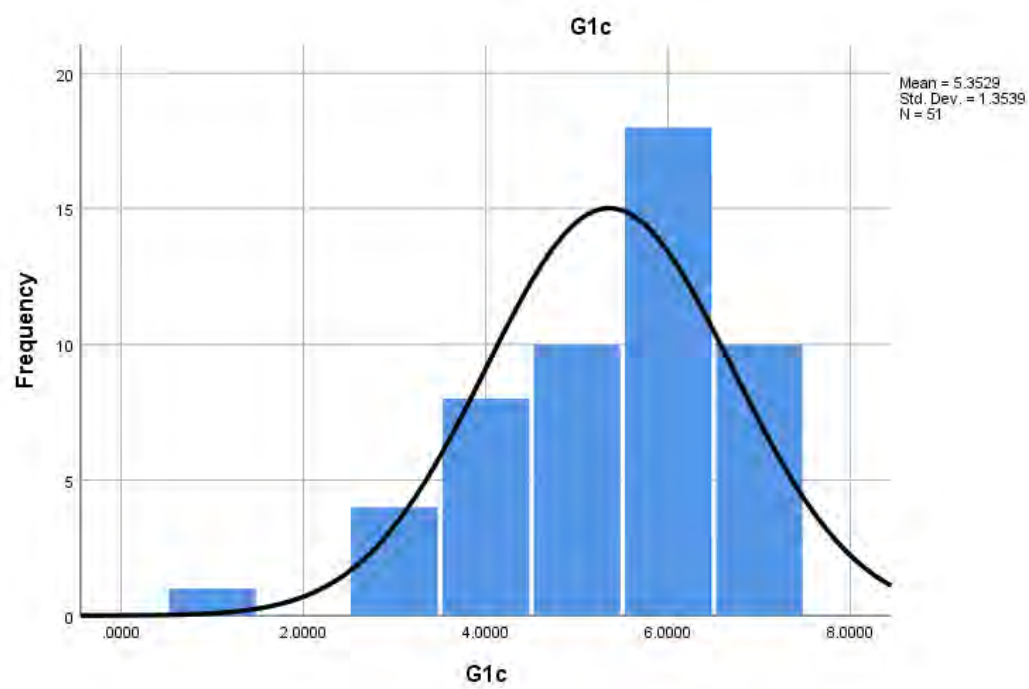
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Valid	Highly Insignificant	1	1.9	2.0	2.0
	Significant	7	13.5	13.7	15.7
	Very Significant	8	15.4	15.7	31.4
	Highly Significant	15	28.8	29.4	60.8
	Extremely Significant	20	38.5	39.2	100.0
	Total	51	98.1	100.0	
Missing	System	1	1.9		
	Total	52	100.0		

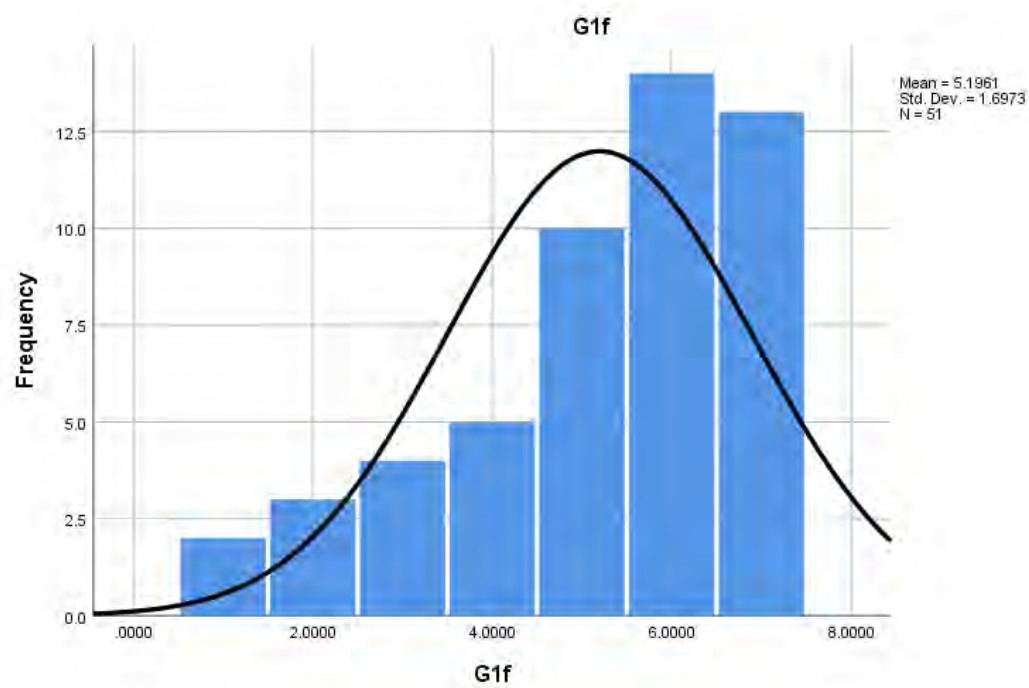
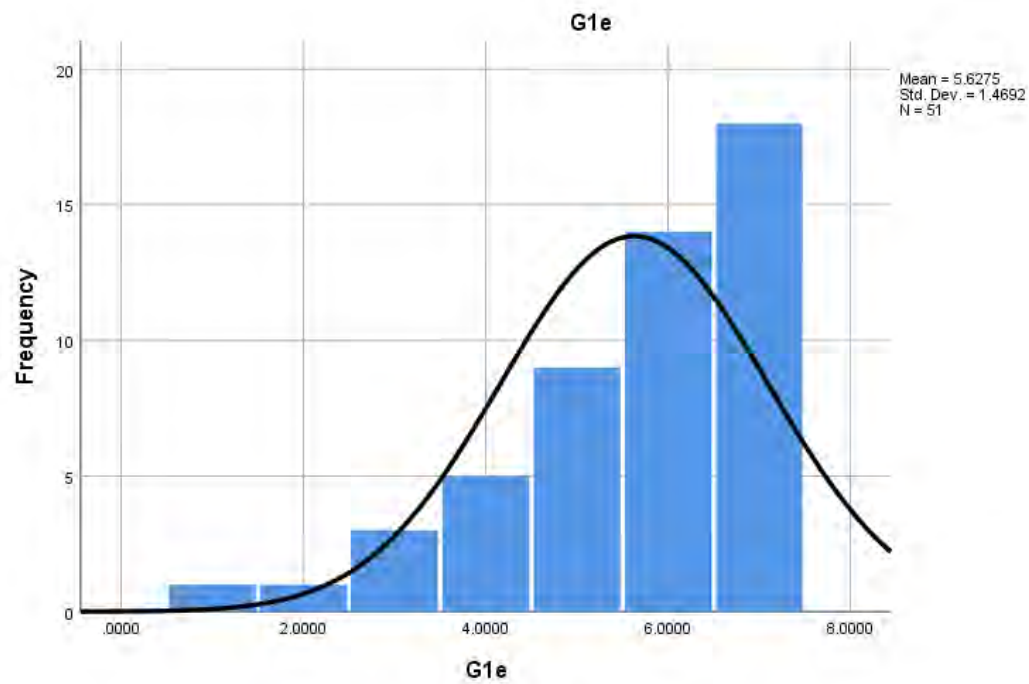
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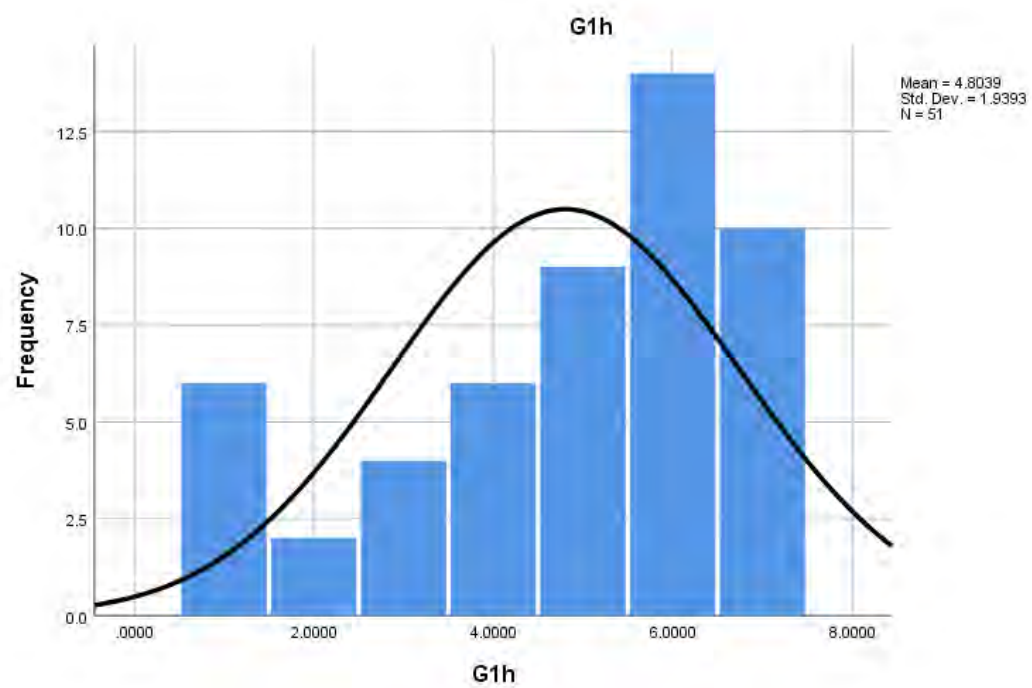
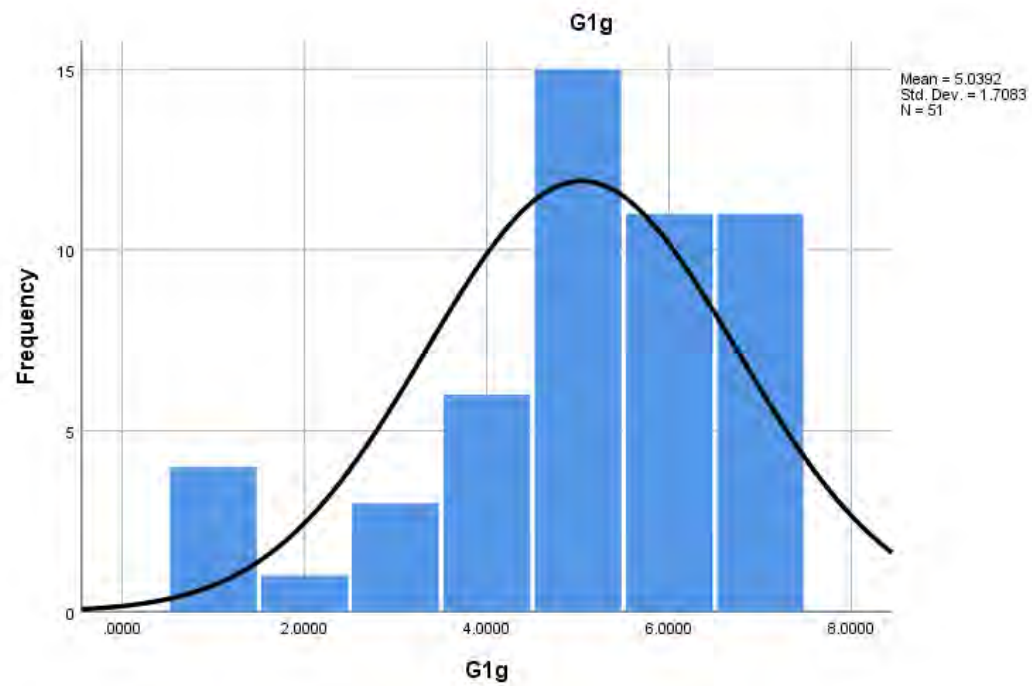
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Highly Insignificant	2	3.8	3.9	3.9
	Insignificant	1	1.9	2.0	5.9
	Neither Significant not Insignificant	5	9.6	9.8	15.7
	Significant	7	13.5	13.7	29.4
	Very Significant	8	15.4	15.7	45.1
	Highly Significant	11	21.2	21.6	66.7
	Extremely Significant	17	32.7	33.3	100.0
	Total	51	98.1	100.0	
Missing	System	1	1.9		
	Total	52	100.0		

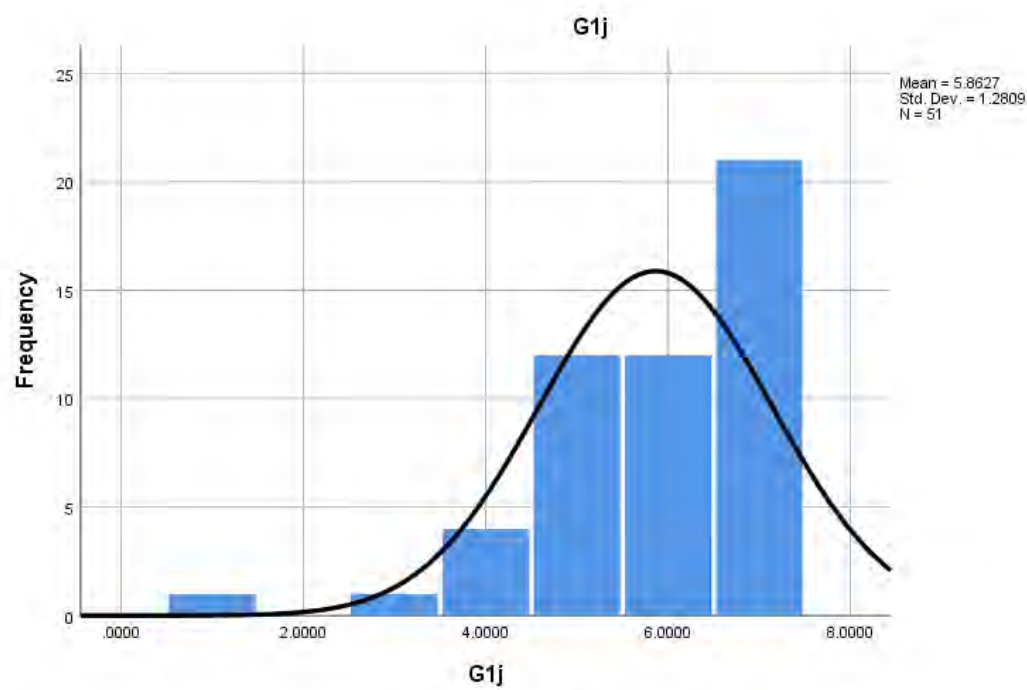
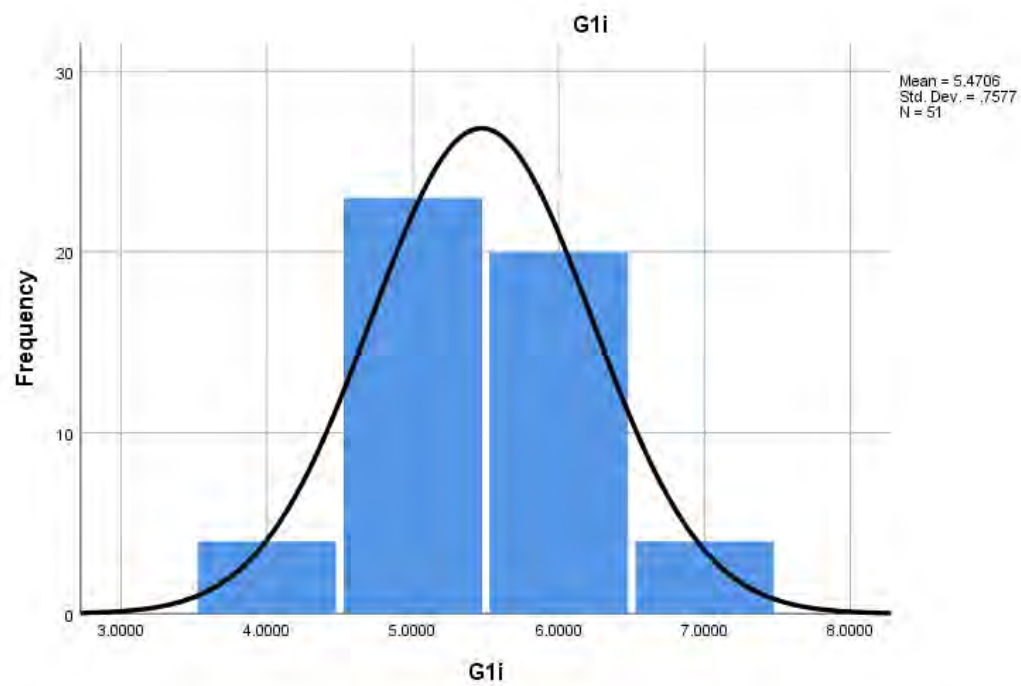
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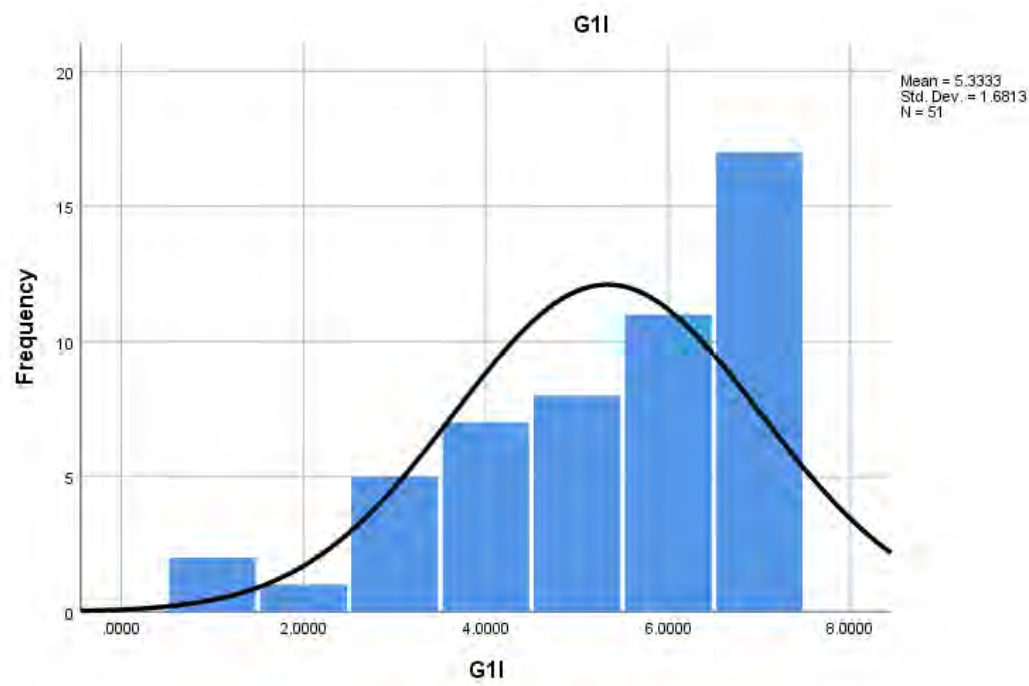
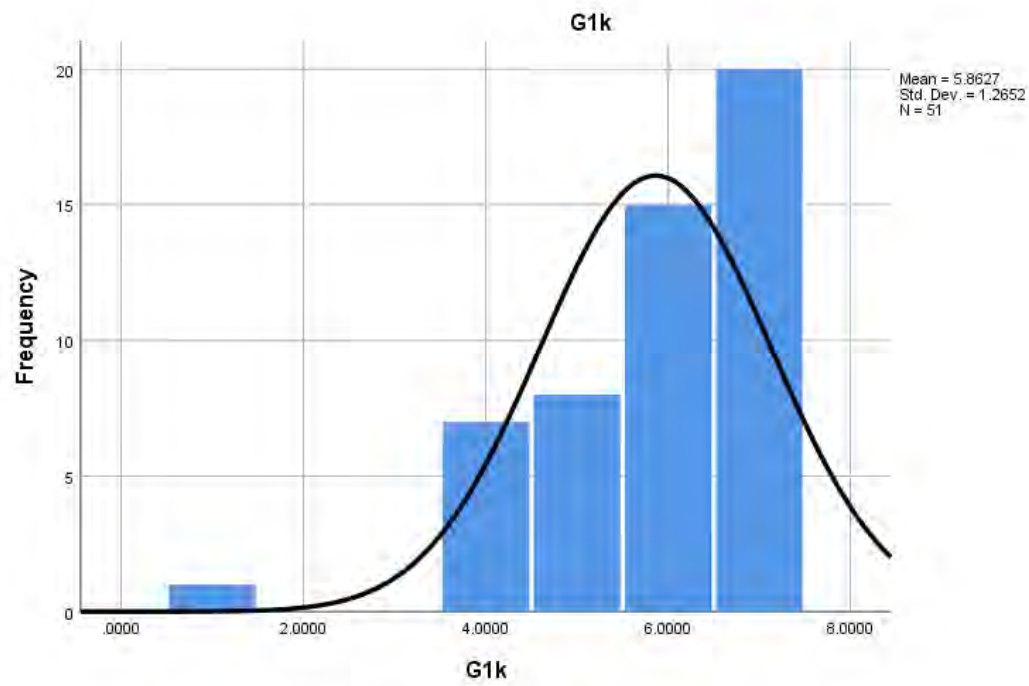












ANNEXURE-IV

Facility Information

For the facility analysis of existing HTP/STP, the facilities are identified and divided in three group. Group-1,2 and 3. Details facilities are described in table 4-1, table 4-2 and table 4-3. From the table 4-1 means group-1 that is related to infrastructure, survey is done to identify the existing facility of the HTP/STP from various company working within the HTP/STP or directly related with HTP/STP. Based on the survey, it is found that existing facility related to infrastructure is a strong point till now along with few lacking. After the survey, it is seen the figure A-1 that most of the infrastructural facilities are available in the existing HTP/STP as most of the question got positive answer. Again, considering table 4-2 means strategic & business support and table 4-3 for governance, availability of the facilities is determined and the outcome showed in figure A-2 and figure A-3. Here, the number of responses varied. This may happen because company working within the HTP/STP may feel hazy to give negative answer. But based on the responses got the analysis is conducted.

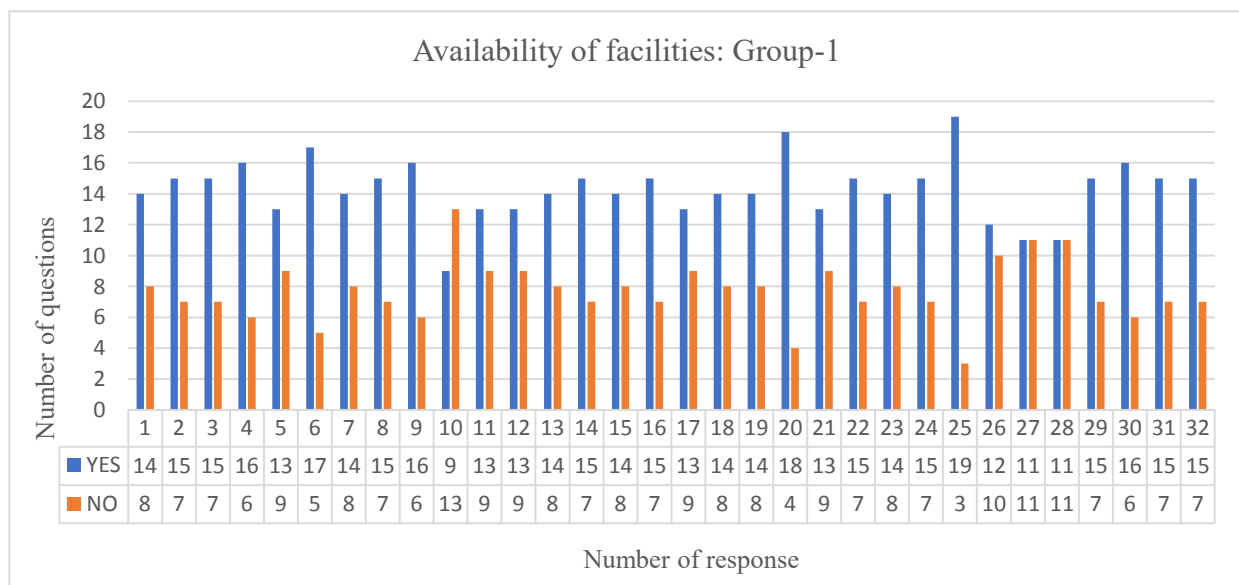


Figure A-1: Availability of infrastructural facilities

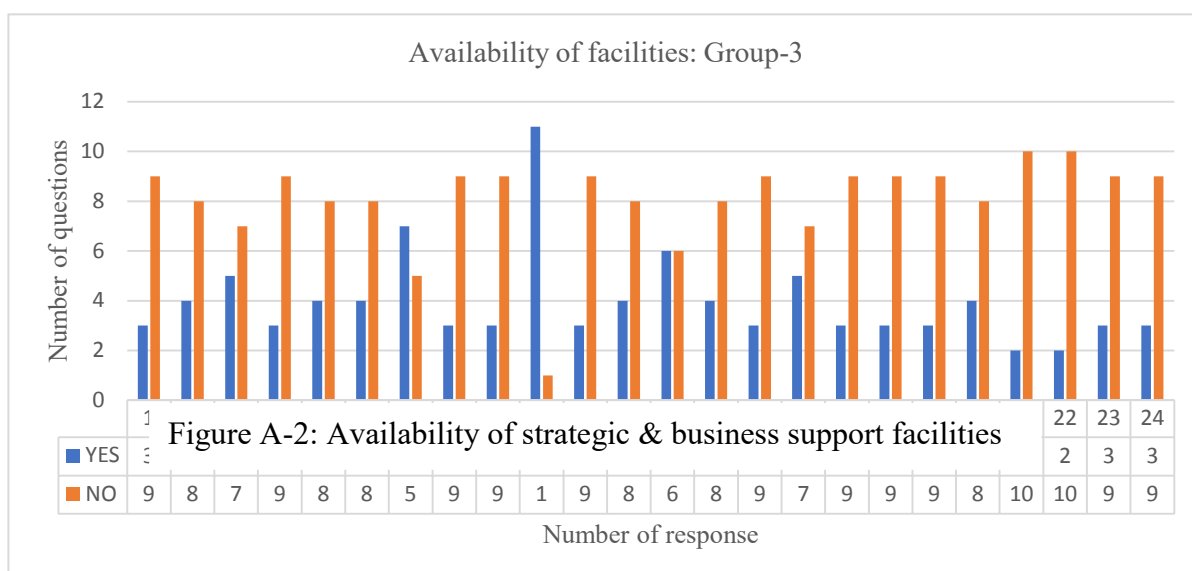
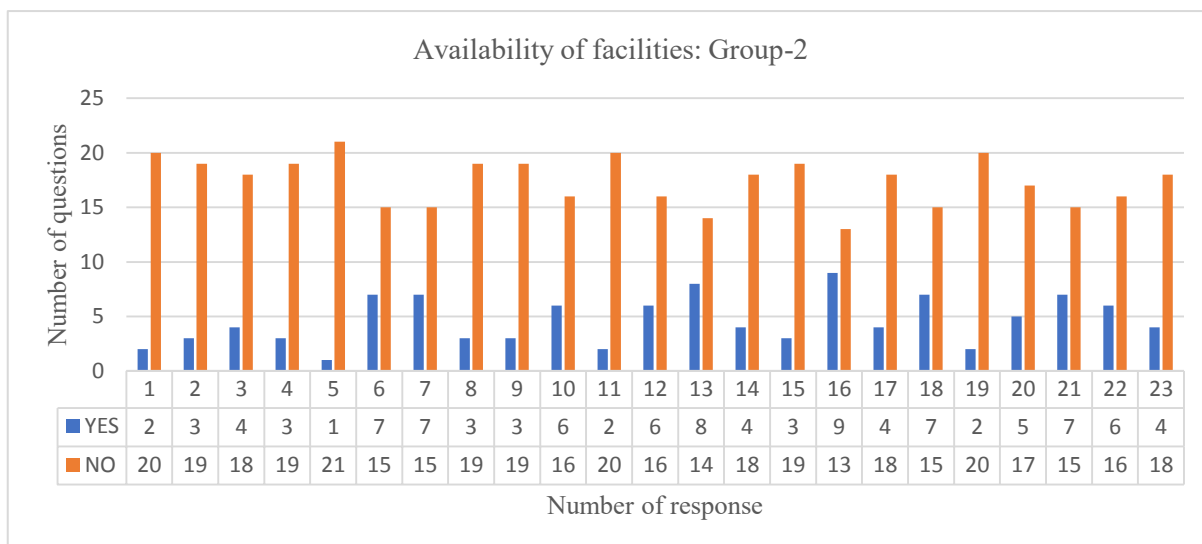


Figure A-3: Availability of governance

ANNEXURE-V

Questionnaire for AHP Analysis

The questionnaires' and scale considered for the research is from 1 (equally preferred) to 9 (extremely preferred). As bellow criterion and sub-criteria options are chosen to form questionnaires' for the pair wise comparisons.

Scale	Judgement of Preference
1	Equally Preferred
2	Equally or Moderately Preferred
3	Moderately Preferred
4	Moderately to Strongly Preferred
5	Strongly Preferred
6	Strongly Preferred to Very Strongly Preferred
7	Very Strongly Preferred
8	Very Strongly Preferred to Extremely Preferred
9	Extremely Preferred

Questionnaires for Criteria

4. Let given the frequency selection options, what is more important to you: **Infrastructure (F1) or Governance (F2)**? Please indicate the scale from 1 to 9 to determine the importance.
5. Let given the frequency selection options, what is more important to you: **Infrastructure (F1) or Strategic & Business Facility (F3)**? please indicate the scale from 1 to 9 to determine the importance?
6. Let given the frequency selection options, what is more important to you: **Governance (F2) or Strategic & Business Facility (F3)**? Please indicate the scale from 1 to 9 to determine the importance.

Questionnaires for Sub-Criteria

1. Let given the frequency selection options, what is more important to you: **Basic Facility (F1A1) or Digital Facility (F1A2)**? Please indicate the scale from 1 to 9 to determine the importance.
2. Let given the frequency selection options, what is more important to you: **Basic Facility (F1A1) or Social Facility (F1A3)**? Please indicate the scale from 1 to 9 to determine the importance.

3. Let given the frequency selection options, what is more important to you: **Social Facility (F1A3) or Digital Facility (F1A2)**? Please indicate the scale from 1 to 9 to determine the importance.
4. Let given the frequency selection options, what is more important to you: **Research & Strategic Facility (F2B1) or Industrial Chain & Innovation Facility (F2B2)**? Please indicate the scale from 1 to 9 to determine the importance.
5. Let given the frequency selection options, what is more important to you: **Research & Strategic Facility (F2B1) or Capacity Development (F2B3)**? Please indicate the scale from 1 to 9 to determine the importance.
6. Let given the frequency selection options, what is more important to you: **Capacity Development (F2B3) or Industrial Chain & Innovation Facility (F2B2)**? Please indicate the scale from 1 to 9 to determine the importance.
7. Let given the frequency selection options, what is more important to you: **Policy Support (F3C1) or Operational Modality (F3C2)**? Please indicate the scale from 1 to 9 to determine the importance.
8. Let given the frequency selection options, what is more important to you: **Policy Support (F3C1) or Park Management (F3C3)**? Please indicate the scale from 1 to 9 to determine the importance.
9. Let given the frequency selection options, what is more important to you: **Operational Modality (F3C2) or Park Management (F3C3)**? Please indicate the scale from 1 to 9 to determine the importance.
10. Let given the frequency selection options, which operation modality for HTP/STP is preferable to you: **Government (A) or Private (B)**? Please indicate the scale from 1 to 9 to determine the importance.
11. Let given the frequency selection options, which operation modality for HTP/STP is preferable to you: **Government (A) or Mixed type (C)**? Please indicate the scale from 1 to 9 to determine the importance.
12. Let given the frequency selection options, which operation modality for HTP/STP is preferable to you: **Private (B) or Mixed type (C)**? Please indicate the scale from 1 to 9 to determine the importance.
13. Let given the frequency selection options, which Mixed Type operation modality for HTP/STP is preferable to you: **University-Industry Based (X) or Government-University-Industry Based (Y)**? Please indicate the scale from 1 to 9 to determine the importance.
14. Let given the frequency selection options, which Mixed Type operation modality for HTP/STP is preferable to you: **University-Industry Based (X) or Government-Industry Based (Z)**? Please indicate the scale from 1 to 9 to determine the importance.
15. Let given the frequency selection options, which Mixed Type operation modality for HTP/STP is preferable to you: **Government-University-Industry Based (Y) or Government-Industry Based (Z)**? Please indicate the scale from 1 to 9 to determine the importance.