Project Completion Report

Assessment of R&D Impact on Socio-Economic Status of Rural India

Implemented by

Dr. G R Sinha,

CMR Technical Campus, Hyderabad

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Technology Bhawan, New Mehrauli Road, New Delhi-110016

Phone: 91-011-26567373

Website:www.nstmis-dst.org/

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Every care has been taken to provide the authenticated information. However, the onus of authenticity of data rests with the PI of the project.

Preface

Socio-economic development of rural India is sustainable development regulated by basic facilities; health facilities; schools; transport and road connectivity; good sanitation and pure water; and many more. To assess, the impact of all the amenities as to how the facilities are helping the needy and common masses of rural India in improving their quality of life; it becomes essential to understand how much research and development (R&D) has been carried out. The study of R&D impact on socio-economic development of rural India is limited and much has not been done as Doctoral or Master degree's.

Opportunities of development such as proper education, appropriate health facilities; facilities for awareness; electricity; approach roads; amenities; use of ICT Technologies; the sense of equality; gender equality; girl education; environment protection; helps to contribute to the larger benefits to the society. Indicators of the growth may involve the facilities provided or improved in rural areas as health centers; physicians and diagnostic centers. Education – primary, upper primary and high schools in all the villages with a sufficient number of teachers and training facilities extended to girls and women empowerment. Furthermore, the higher education system must be encouraged such as undergraduate, postgraduate and research degrees here, the use of technology in agriculture and farming, environment protection, ICT enabled services and tools for computing with Internet facilities. The financial services to be also offered by establishing the banking services to grow themselves. Employment was created for the villagers both in the public and private sectors. The awareness against Child marriage and dowry system; social change, respect for all irrespective of caste or religion etc.

The various subsequent outcomes of road development are (i) Agriculture Economy and Transport Sector: If proper roads are available the farmers can sell their products at better prices whenever they can, by using the road transport system. The connectivity improved by roads would also employ rural youth. (ii) Agriculture Industry and Trade Sector: The improved agriculture would directly impact the agriculture-based industries, such as fertilizers, tractors, auto parts etc. The small scale trades on agriculture-based and related products can be made available in selected villages and youth or farmers will get employment as well as generate employment in the trade for rural people. (iii) Improved Livelihood: The employment opportunities; education; access to health services through good roads; improved agricultural income will improve the quality of life and this will consequently curb the migration of rural folks to urban areas to great extent.

Different statistical and derived analyses were performed for analyzing data. Clustering is applied for the dynamic grouping of data. Survey and statistical models indicate that women education is key for woman empowerment. Well educated mother always helps young generation to grow the socio-economic status of the family. Women education helps in the social, economic and cultural development of the family which helps in the development of the village and in society too. Statistical results show that women impacts in cultivating values related to equality, woman empowerment and also changing tradition obvious male support are equally needed. Clear indications of Urbanization on specific indicators like Agriculture, Education, Facilities in both positive and negative.

Acknowledgements

Apart from the efforts of me, the success of any project depends largely on the encouragement and guidance of many others. I take this opportunity to express my gratitude to the people who have been instrumental in the successful completion of this project.

We are deeply indebted to NSTMIS Division of Department of Science & Technology, Govt. of India, for providing the Funds for carrying out the work. Our heartfelt thanks are due to Head, NSTMIS Division of DST along with Dr. HB Singh and Dr. Praveen Arora, whose helps, stimulating suggestions and encouragement helped us in all the time of research.

We are highly indebted to the chairperson of Local Project Advisory Committee (LPAC) and to other LPAC members for their constructive support, suggestions and guidance towards formulation, execution and the final accumulation of the project. We would like to extend our heartfelt thanks to experts Dr. C. Raghava Reddy, Professor, Dept. of Sociology, University of Hyderabad, Hyderabad in the field of Science Technology and Society Studies and Sociology of Disability for their valuable suggestions and providing the needed support from time to time.

Thank are also due to our colleagues from CMR Group of Institutions, NGOs, iknowlation Pvt Ltd and library staff for their help, support, interest and valuable hints. Last but not least, our gratitude to the administrative staff for their continuous support during this project.

Finally, I would like to take this opportunity to thank my family for their constant encouragement, without which this assignment would not be possible. I sincerely acknowledge and thank all those who gave support directly and indirectly in completion of this Project.

Dr. G.R. Sinha

Principal Investigator

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Executive Summary

Socio-economic development of rural India is sustainable development regulated by basic facilities; health facilities; schools; transport and road connectivity; good sanitation and pure water; and many more. To assess, the impact of all the amenities as to how the facilities are helping the needy and common masses of rural India in improving their quality of life; it becomes essential to understand how much research and development (R&D) has been carried out. The study of R&D impact on socio-economic development of rural India is limited and much has not been done as Doctoral or Master Degrees.

Opportunities of development such as proper education, appropriate health facilities; facilities for awareness; electricity; approach roads; amenities; use of ICT Technologies; the sense of equality; gender equality; girl education; environment protection; helps to contribute to the larger benefits to the society. Indicators of the growth may involve the facilities provided or improved in rural areas as health centers; physicians and diagnostic centers. Education – primary, upper primary and high schools in all the villages with a sufficient number of teachers and training facilities extended to girls and women empowerment. Furthermore, the higher education system must be encouraged such as undergraduate, postgraduate and research degrees here, the use of technology in agriculture and farming, environment protection, ICT enabled services and tools for computing with Internet facilities. The financial services to be also offered by establishing the banking services to grow themselves. Employment was created for the villagers both in the public and private sectors. The awareness against Child marriage and dowry system; social change, respect for all irrespective of caste or religion etc.

The current project report aims to highlight the role of research and development (R&D) and its impact on the socio-economic development of rural India (SEDORI).The real growth of any nation is evaluated by the all-around development of all the masses irrespective of caste, creed, sex, religion etc. The amenities and opportunities in urban and suburban areas are considered as advantageous for the demography who resides in this area and thus the opportunity of growth is relatively more in the urban areas as compared to rural areas. The larger percentage of masses lives in rural areas, especially in nations like India and thus the overall development of the country has to be inclusive with satisfactory development of the people of villages. It is rightly said that India lives in villages and thus the focus needs to be made on the development of the rural population living in villages.

We have explored numerous literatures on various aspects of socio-economic development, sustainable development and holistic growth of the rural population of India and the world. The focus of the review of literature is on the study of R&D impact on SEDORI and therefore we tried to concentrate majorly on R&D impact and policies for rural development where the people from villages can lead a happy and healthy life with food security, health facilities, good approach road, clean drinking water, proper sanitation, electricity, schools, skill development opportunities etc. We also explored how much work has been carried out as doctoral and master's research on the topic of the implemented project work. Unfortunately, the literature on the topic is limited and the amount of research work on the topic is not attempted much. The literature available focused on main rural economy,

sustainable development, agriculture productivity etc. and the study of R&D impact on these factors of development of society living in villages has not been carried out adequately. However, similar studies reported various factors, indicators of growth, policies and reports provide guidelines for mitigating the challenges and emphasizing key indicators so that socio-economic development can truly be achieved in rural India.

The major indicators are Education and Awareness, Health Amenities, Drinking Water and Sanitation, Approach Roads, Addressing Social Evils, Gender Equality and Female Education, Employment Opportunities and Employed youth, Understanding of ICT (information and communication technologies) tools and technologies, for youth as well as farmers, Agriculture productivity and marketability, Small scale industries nearby Villages, Small scale Trades, Women empowerment, and Skill Development Opportunities.

Data were captured for analysis via the online medium in the form of questions and answers. The questions are generated for different aspects considered for rural information gathering for R & D. The typical design for the MIS system for socio-economic is shown in figure1. Here, identified some key areas and indicators related to study the impact of socio-economic status of rural areas limited to Telangana State. There are different aspects by which the impacts can be measured they are represented in figure2.

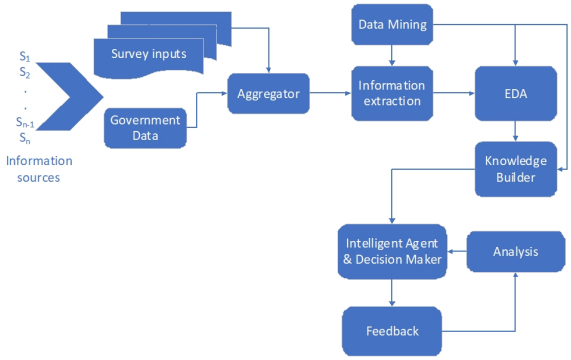

Figure1: The system design for Socio-economic MIS

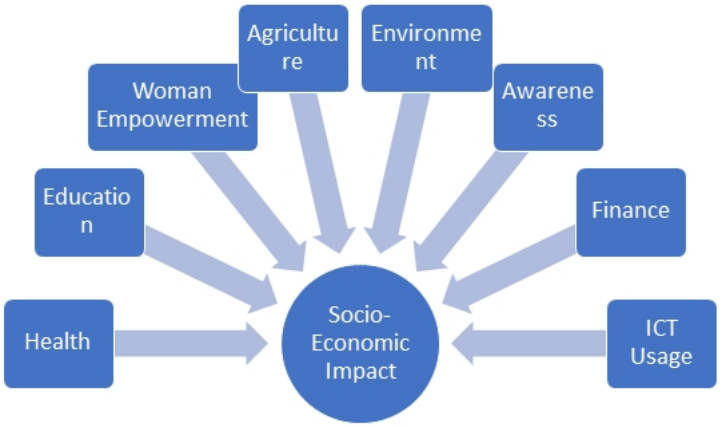

Figure2: Key Areas of Impact Measurement

The data is an important aspect to measure socio-economical growth. There are different means by which data can be captured shown below in figure3 like government reports,

independent studies, research projects or independent agencies. As Telangana is a new state the data is merely available for independence from Andhra Pradesh. The district expansion was also updated recently for the state. Hence new data is needed to be captured. As objectives stated to generate an MIS system, data analysis is a pre-requisites and intern data is needed. The new scenario demands new capturing of data for different domains for socio-economic study.

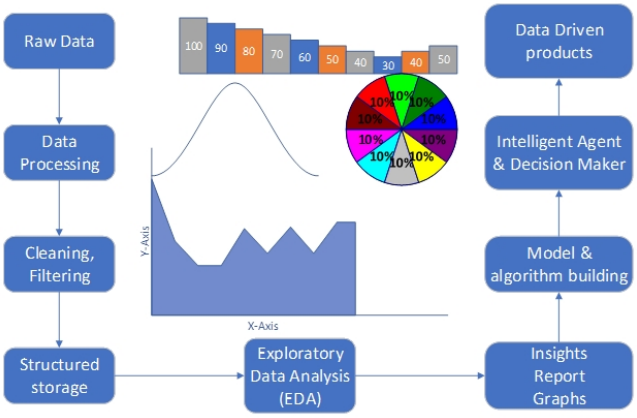

Figure3: The process of Exploratory Data Analysis

Different statistical methods are applied for data analysis captured by questioners discussed in the methodology. Results are shown in these sub-sections. These results are analyzed with expert's opinions and some observations are provided below.

The correlation matrix below figure4 explains the relationship between data and feature weight. It is taken here with a probabilistic dependency matrix, that is with a conditional probability value. In short major is probability value those features are dependent on each other, having any type of relationship with the data. Availability of - Primary School, Secondary School, Intermediate School, Degree College, Hospital, Health centres, Clinics, Police Location, Library, Markets, Post office.

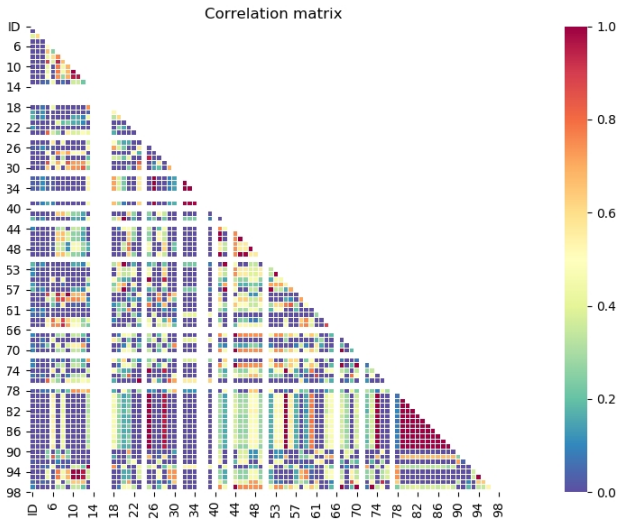

Figure4:The overall Correlation Matrix

Research indicates that improvement in lifestyle due to research and development in India and outside world improved lifestyle of women, education and health with different parametric. There is still a need for improvements in social culture especially for a woman like a dowry and other cultural issues. As diversified India and Telangana peer to peer association can major within the family which needed to be a different task. As Telangana is recently again divided into 33 districts, more segregation in data and peer analysis can improve in local policymaking and targeted development.

Survey and statistical models indicate that women education is key for woman empowerment. Well educated mother always helps young generation to grow the socio-the economic status of the family. Women education helps in the social, economical and cultural development of the family which helps in the development of the village and in society too. Statistical results show that women impacts in cultivating values related to equality, woman empowerment and also changing tradition obvious male support are equally needed. The health facility gives major satisfaction to people if they have basic to advance private or governmental facilities. Statistically, health services like private and government clinics (PHCs) are available in all villages from which data is collected. If villages havean ambulance, vaccination felicities, in addition, satisfaction for villagers are 100%. The commond is eases observed are mostly viral, diabetes, and blood pressure which is one of the national problems. This intern indicates that people are needing a higher level of health services even it may come up with the cost. Also, in the case of sanitization rural Indian sanitization is moderately equipped with services available especially drinkable water and water waste management.

Most of rural India was already knows the importance of these services since ancient times. Transport services are majorly dependent on road services available which connect to places for economic and other domain development. Because of schemes like Pradanmatri Gram Sadak Yojana, all the villages data represent the availability of road, which is a good indicator, but satisfaction to road quality is almost 70%. Education is another sector where most of the villages have primary and secondary schools, but missing advanced education system like college or intermediate schools, for that student needed to travel to nearest facilities. Similarly, basic village services like a police station, library, market place availabilities are, 60%, 45%, 75% respectively. While all villages are having post office services. Almost 40% of villages are having some socio-economic problems like dowry, child marriage etc.

People are still lacking with information about government facilities, which are these facilities, how to avail benefits for development, but they are well equipped with pair support available in rural places. The schemes like LPG Gas have been advertised very well and got100% usage represented in collected data. Similarly, services and information sources used by almost 100% of people are through telephone or internet facilities. If they know these government schemes, they are very much pleased and will surely avail themselves of these benefits.

Current welfare schemes and their distribution is 0 if statistically its compared. Most of the rural area has facilities of economic support by having baking and other support at the

village or nearby village facilities. These services will surely help in development in small scale and agriculture-based industries present in the area.

The agricultural land is shrinking with population growth. This is one of the main concerns, most of all are suffering from these challenges. As India is an agricultural country, this will be a future challenge but as the population growth curve indicates it may be solved with government schemes and facilities. ICT is another area of concern; most people are unaware of government schemes. Overall, it is indicating out of eight domains considered for the survey, six are having progressive development while some of them need more attention. Relation among them impacts socio-economical indexing. The schemes like Swacha Bharat, Every Person Bank Account, LPG Gas availabilities, etc. are advertised well enough as well as they implemented yearly by the government and they made a huge impact in development. Similar efforts are needed for other ICT schemes and development.

Some of the relative observations from data

a. There is separation in departmental activities, and development happens 360 degrees but some areas like the road are typically lacking in the development
b. Some of the data in the relevant department, could not contribute at this stage of analysis, the deep analysis will improve Classical methods are practiced for data collection as well as analysis, some of the non-classical unsupervised analysis will also contribute to the analysis

New Observations / Short fall if any.

Observations:

1. Clear indications of Urbanization on specific indicators like Agriculture, Education, Facilities in both positive and negative.
2. SHG are there but with less no of members.
3. Lack of knowledge in obtaining the information and help on various government schemes.

Shortfall:

1. We have to continue the survey to get more samples.
2. Telangana is now divided into 33 Districts.
3. To create an MIS, we need to increase the number of districts to be covered and a greater number of sample studies so that we can get a clear impact after the new state formation.

Research indicates that improvement in lifestyle due to research and development in India and outside world improved lifestyle of women, education and health with different parametric. There is still a need for improvements in social culture especially for a woman like a dowry and other cultural issues. As diversified India and Telangana peer to peer association can major within the family which needed to be a different task. As Telangana is recently again divided into 33 districts, more segregation in data and peer analysis can improve in local policymaking and targeted development.

Chapter 1

Introduction, Objectives and Limitations

It is said that India lives in villages and the growth of the country depends on agriculture which is contributed by rural population largely. Socio-economic development of the rural India is sustainable development regulated by basic facilities; *health facilities; schools; transport and road connectivity; good sanitation and pure water*; and many more. To assess, the impact of all the amenities as how the facilities are helping the needy and common masses of rural India in improving their quality of life; it becomes essential to understand how much research and development (R&D) has been carried out. The R&D and its analysis would help the policymakers to take corrective measures in mitigating the challenges and addressing the gap. This chapter presents an overview of socio-economic development; the key indicators of development; objectives of study of R&D impact; and the limitations of the studies.

1.1 Introduction

As mentioned above that the economy of any nation depends hugely on agriculture which is contributed mainly by rural masses, especially in country like India. The rural India [1], [2] has its diverse nature in performing towards contribution for nation-building. There are number of factors that can be seen in villages and we can decide if there is any development in the area. The factors or indicators of development needs to studied seriously so that corrective mechanism and remedial measures can be taken up in order to improve the quality of life of rural folks, which is the ultimate aim of any government. The R&D [3] on various studies reported on societal development, the economic development or socio-economic development [4], [5] can highlight the exact difficulties being faced by the rural people. When we discuss about the society progressing and developing then it has a broad sense which means that the society has got all avenues and opportunities of development such as proper education, appropriate health facilities; facilities for awareness; electricity; approach roads [1]–[3] etc. These are called as indicators of the growth, and few important indicators are listed below:

- Health facilities: This includes availability of health centers, physicians, and other diagnostic centers
- Education: Availability of Primary, Middle or Secondary schools in the villages; availability of teachers; training facilities etc.

- Girl Education and Women Empowerment: The ratio of girls to boys who are sent to schools and allowed to continue further studies; child marriages; empowerment of women; how many women are self-reliant and contributing in the development of family; gender equality etc. are major factors under the indicator.

- Agriculture: Use of modern practices and technology; availably of approach roads for better marketing of the agriculture products; use of agricultural equipment; percentage of farmers engaged in taking non-traditional crops; available of assistance and guidance to the farmers etc.

- Environment Protection: Awareness for protecting the nature and environment; understanding the importance of environment protection and fire hazards; fire safety; safe use of electrical products etc.

- Usage of ICT (Information and Communication Technologies) Tools: The number of users of smart phones and the impact of smart use of the technologies; ICT tools and computing facility in villages; Internet facility etc.

- Banking Facility: Availability of banks and other financial services for saving their incomes and getting assistance for various agricultural works such as loan; etc.

- Employment: The number of people who are employed in various public and private sectors; employment generating opportunities in villages etc.

- Societal Awareness: The awareness against Child marriage and dowry system; social change, respect for all irrespective of caste or religion etc.

1.1.1. Socio-economic Development

The rural development and progress depends on how society is elevating and leading a quality life. The development does not only rely on agricultural income and the growth but a number of other factors that make the villagers or rural population healthy, happy, aware, educated, sensitive and responsible citizen. One such scenario of socio-economic development is shown in Fig. 1.1 in which two important factors of development are seen as contributing towards development. The factors are:

- Amenities and Technologies: Different amenities are must in rural areas so that people from their can be part of main stream of the country and lead a respectful and healthy life. The

use of ICT tools and other technologies are also augmenting various sectors of villages especially the agriculture products and education. The use of modern technologies assists in empowerment of the students and youth of the villages.

- Awareness and Responsibilities: The amenities available in villages ease the life that demands for social responsibility and duties in return. The sense of equality, gender equality, girl education, environment protection etc. has also to be there. For this, the appropriate awareness programmes are important that encourage and demonstrate to the rural people in their native language how the society can contribute in the larger benefit of the nation and mankind.

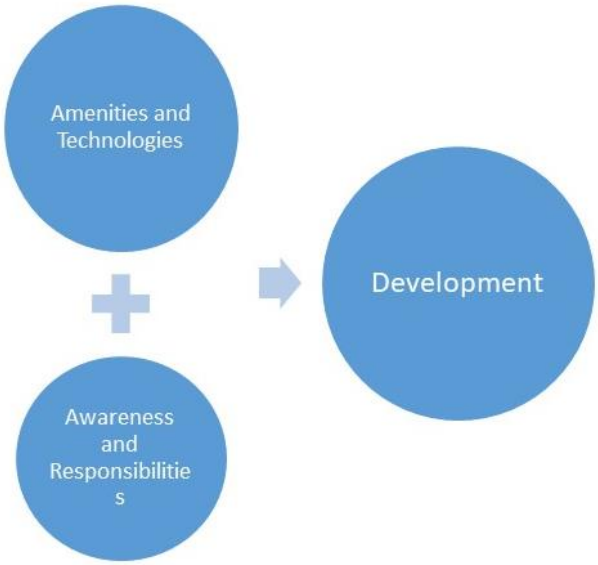

Fig. 1.1: Socio-economic Development.

Let us understand how can an approach road of good quality help in development of rural areas and augment the livelihood of the people. Fig. 1.2 highlights the significance of road development that can help in growth of transport sector and agriculture economy. The various subsequent outcomes of road development are briefly discussed as:

- Agriculture Economy and Transport Sector: If proper roads are available the farmers can sell their products at better prices whenever they can, by using road transport system. The connectivity improved by roads would also provide employment to rural youth.

- Agriculture Industry and Trade Sector: The improved agriculture would directly impact the agriculture based industries, such as fertilizers, tractors, auto parts etc. The small scale trades on agriculture based and related products can be made available in selected villages and

youth or farmers will get employment as well as generate employment in the trade for rural people.

- Improved Livelihood: The employment opportunities; education; access to health services through good roads; improved agricultural income will improve the quality of live and this will consequently curb migration of rural folks to urban areas to great extent.

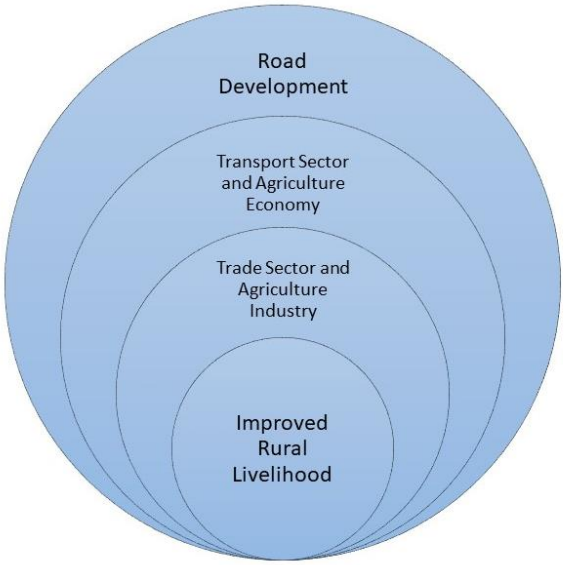

Fig. 1.2: Improved Livelihood in Rural India.

As highlighted above that the improved livelihood and quality life will stop the migration of rural people to nearby or far cities in the search of employment. This no-migration situation can be seen in Fig. 1.3.

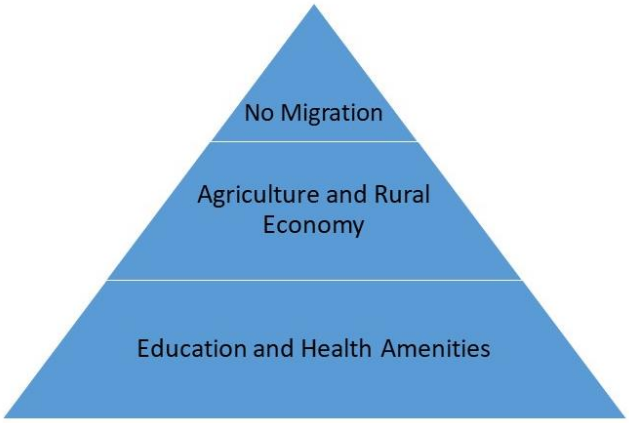

Fig. 1.3: Outcome of socio-economic development.

1.1.2. Research and Development (R&D) Impact

Now, assessment of quantum of initiatives taken up for the socio-economic development becomes essential and in order to get an exact idea of this, we need to study various reports, research studies and survey that have been carried out on various indicators of growth; best practices in villages; beneficiary schemes for rural people; impact of the schemes in villages etc. So, research and development (R&D) needs to be analyzed, which includes:

- How much work has been done as Ph.D. and Master Theses that aimed at studying and addressing various issues related to socio-economic development of rural India?
- Survey and Reports which have been carried out on some case studies reporting impact of R&D in any of the factors involved in rural development, such as education, health, employment, electricity, roads etc.
- Studies on impact analysis and recommendations for taking corrective steps if there is any gap reported in the initiatives taken by government.

Fig. 1.4 highlights a summary of R&D impact on the development of rural areas using different means.

Fig. 1.4: R& D Impact on Socio-economic Development.

There are a number of models of rural development highlighted in [2] which includes the following:

- Multipurpose approach
- Sectoral approach
- Employment oriented approach for integrated development
- Target based models
- Inclusive development that allows participation of all while working, implementation and benefits of the approaches
- Model based on Basic Needs

1.1.3. Agriculture based Research

Agriculture is the main source of livelihood in villages and also contributes towards national development in its gross domestic product (GDP). The food security is possible because of agricultural products and this is attributed due to laborers and farmers who work hard and assist in improved productivity. Agriculture research [6] and its policies are formulated by the government so that the maximum benefit of the agriculture can reach to common masses. The research on agriculture productivity, seed selection, crop monitoring, appropriate use of fertilizers etc. is carried out by numerous research works and the impact of the research on agriculture has been transforming the villages. The changes brought in lives of rural people and difficulties faced by them are to known so that the planning and corrective strategies can be further developed. This needs an appropriate assessment which can be done with the help of some relevant studies, surveys or research. Agricultural extension services, policies for farmers, beneficiary schemes for poor people, rural employment guarantee schemes are among a number of initiatives that are taken up for welfare of rural masses.

1.1.4. Key Indicators of Development

We have already discussed the number of factors in section 1.1, which can be considered as indicators of development of rural India. Few major indicators are shown in Fig. 1.5. If we can sum up all the indicators in some broad categories of key-indicators, then we can discuss them as follows:

- Education and Awareness: This component is most important among all indicators, that can open door to all opportunities and possibilities of sustainable growth in rural India. The sustainable growth is actually needed in the society that not only includes economic growth but growth in all different dimensions related to health, safety, environment etc. This is also

known as holistic development that improves quality of life for all. Awareness for using various beneficiary schemes and knowing their rights is equality important. In rural guarantee employment scheme and other governmental beneficiary schemes, the money is directly being transferred to their accounts. This needs proper awareness to make use of the facilities to avoid any corruption and malpractices involved.

- Health: Any contribution to development of family, society, nation or the whole world can be made only if health is good. Thus, health services play significant role in villages where properly health of farmers, seniors citizens, disabled persons, pregnant women, girls and everyone, is important. We need to make sure that there is no malnutrition in children in villages else it will be very difficult for them to lead good life throughout their life cycle. This also involves if the clean drinking water is available in villages or not. Proper sanitation and drinking water facility are essential for good health in rural population.

- Agriculture: This indicator is considered as backbone of rural economy that now only empowers the rural people but provides employment opportunities also. Applications of Science and Technologies (S&T) in the areas of agriculture aim at easing the difficulties of farmers and also getting enhanced productivity [7] . This includes mobilization, efficient utilization and energy efficient use of various agricultural equipment and tools. Financial support system, seed quality assessment monitoring, knowledge of non-traditional crops, pricing related information etc. are important factors under agriculture where the rural farmers need exposure and proper awareness through technology enabled services by the agencies. There are farmers who do lot of innovative parcatices to achive better productivity and this requires them to know about IPR (intellectual property rights) so that their contributions can attract the global market.

- Rural Roads, Connectivity and Electricity: The proper approach roads provide good connectivity to access higher education, modern healthcare services in nearby or far cities. The roads also make it possible to sell the forest and agriculture products at better prices in cities. Availability of electricity in households, hospitals and schools in villages, has become a primary requirement now and thus we need to assess whether all households and other buildings in villages have 24-hour electricity.

- Multifaceted Development: The rural development needs to be multifaceted [2] so that all round growth in different sectors of rural economy and society can be achieved. This development model should aim at increasing agriculture productivity; enhancing rural

employment opportunities; inculcating equality in all; removing some social behaviors which are orthodox in nature; adopting change as per the technology based rural needs; changing the attitude towards transformation of living standards and improving quality of life etc.

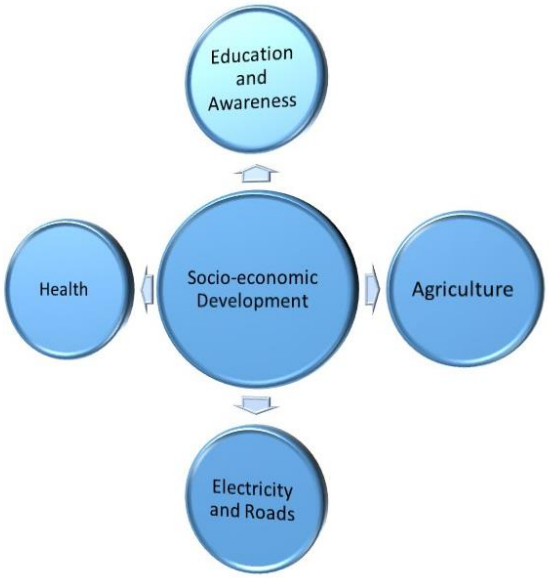

Fig. 1.5: Key Indicators of the Rural Development.

Food and agriculture organization of United Nations [8] also emphasizes on role of indicators for development of rural people. In [4], some methodologies and indicators were suggested but the context of the study is not based on rural India. In [5], tools for measuring socio-economic impact were presented that suggests using common used indicators and ICT tools for monitoring and assessment of R&D impact of the development for rural masses. There are other studies that have presented overview and some analysis of R&D impact of socio-economic development, which includes fostering rural development [1], role of information technology (IT) for rural development [9], digital transformation [10], harnessing technologies for development [11], and sustainable goals for rural development [12].

1.2. Objectives

The study of R&D impact on socio-economic development aims at specific objectives, which are as follows:

- To collect appropriate data on research survey and Ph.D. and Masters theses that have been carried out on sustainable development of villages;

- To recommend the key indicators of socio-economic development and growth of rural India, used in various research studies, reports, surveys etc.
- To analyze the gap in the sustainable growth, suggest few additional indicators of development
- To develop MIS for assessment of R&D work towards the socio-economic development of villages and their impact.

Putting the work in specific four objectives as stated above, is not an easy task which actually involves extensive studies and analysis of huge amount of data. The study of various theses work would give an insight how much of R&D has been studied by the research scholars. We will also attempt to find some surveys, reports of concerned agencies that have highlighted the role of R&D in the socio-economic development of rural population. It is extremely difficult to get all data of whole India and thus focus will be given to Telangana where our institute is located. However, we will include data from other parts of India as well through reports and research work.

Based on studies made in various literature and reports, we will identify what type of and how many broad indicators have been investigated and accordingly an attempt will be made in finding the gap in the growth of rural population. Subsequently, few indicators will be suggested to address the gap. So, the work is based a MIS system for assessing R&D impact on socio-economic development of rural India.

1.3. Limitations

The study of R&D impact on socio-economic development of rural India is limited and much has not been done as doctoral or Master research also. The major challenges in this area for reaching to certain conclusion are due to following limitations:

- The substantial amount of studies reporting R&D impact for rural development is not available.
- In few research and reports, which are available, the sample size is not enough.
- The indicators are not robust which can be applied as general purpose indicators for determining the impact highlighting how much of development has actually taken place in specific rural areas of the country.
- The patents, surveys and recommendations in this area are limited.

- This is difficult, indeed to cover the focus of study to whole India due to large geographical and demographical data.

Due to non-availability of adequate resources and awareness, the positive attitude of thinking globally and acting locally, needs to be encouraged in rural youth so that they can play an important role in contributing in their own villages, rather than moving to other parts of country in search of employment. Non-governmental organizations (NGOs) also are involved in various developmental activities in rural areas and for this the NGOs are allocated funds by government as well as other agencies. This has been also observed that the impact of the developmental activities has not been much researched. What is needed is to transform informed society to social capital [8], [9] so that society especially rural based society can become a great ass for the country.

1.4. Summary

We have discussed overview of socio-economic development of rural India in this chapter including objectives of the study. The development of rural people in elevating the societal status and improving the quality of life, requires certain number indicators which are required to assess the impact of the growth and thus we have also presented all major indicators of development.

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Chapter 2

Review of Literature

The current project report aims to highlight the role of research and development (R&D) and its impact on socio-economic development of rural India (SEDORI). The impact is analysed with the help of a MIS (management information system) that utilizes key-indicators (KIs) of the development especially rural India development. Therefore, a focus in this chapter is on how much similar work has been carried out in existing literature in various forms such as doctoral (Ph.D.) research, surveys, reports etc.

The components of related research presented in this chapter as highlighted in Fig. 2.1. The emphasis will be given to all components and the quantum and impact of research work under each of the components shown in the figure.

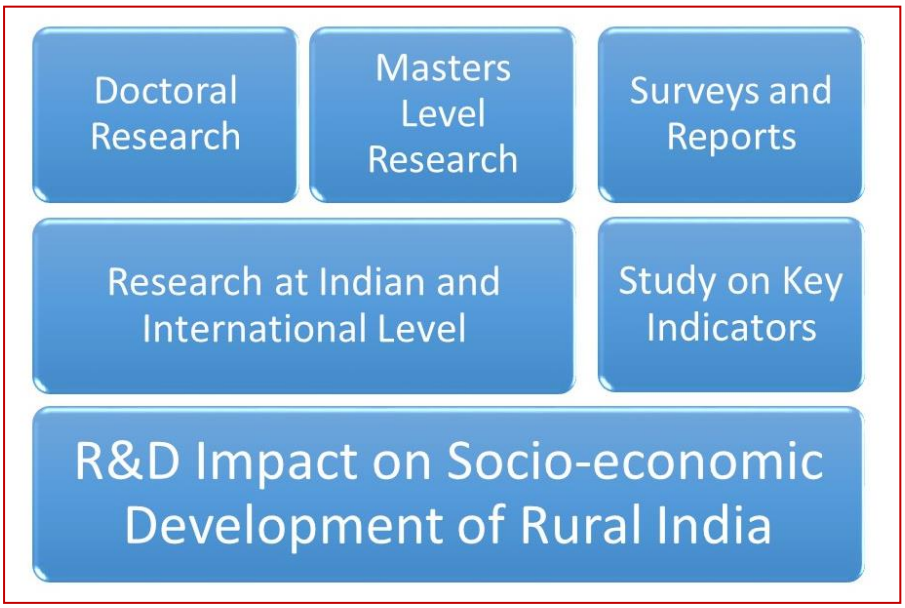

Fig. 2.1: The areas of literature review for R&D impact on SEDURI.

2.1. Study on Socio-Economic Development of Rural India

The real growth of any nation is evaluated by all-round development of all the masses irrespective of caste, creed, sex, religion etc. The amenities and opportunities in urban and sub-urban areas are considered as advantageous for the demography who reside in this area and thus the opportunity of growth is relatively more in the urban areas as compared to rural areas. The larger

percentage of masses lives in rural areas, especially in nations like India and thus the overall development of the country has to be inclusive with satisfactory development of the people of villages. It is rightly said that India lives in villages and thus the focus needs to be made on development of rural population living in villages. The socio-economic development [1]–[10] is a broad term which includes financial autonomy as well as societal elevation. The people can lead average livelihood without any financial difficulty as well as get recognized socially. This development also includes the social responsibility and duties for each other so that inclusive growth in rural area also can be achieved. The awareness for overcoming unnecessary social evils and adopting the changes as per the needs of the society are also important factor in the rural development. The emphasis on rural development in terms of education, health, electricity, sanitation, drinking water [11]–[15] etc. is needed to empower the rural people who are backbone to the economy of the country through their labor and agricultural contributions [7], [14], [16].

The SEDORI is controlled by various factors of development that can be also referred as growth metrics, or key indicators of development. Generally, some of the important indicators must be satisfactorily present in villages for the people so that the average livelihood with good health and education can be observed. These development indicators [17]–[20] play an important role in assessing the impact of various schemes and initiatives of governments for the upliftment and welfare of the rural parts of the country.

2.2. Research on Key Indicators of Development

As we have discussed and overview of the key indicators in previous chapters highlighting on role of each indicator that can be used to fathom the actual rural development of India. The major indicators are listed below upon which the literature review presented in this section is based:

- Education and Awareness [15], [21]
- Health Amenities [2], [20], [22], [23]
- Drinking Water and Sanitation [22]
- Approach Roads [14]
- Addressing Social Evils
- Gender Equality and Female Education [11], [24]
- Employment Opportunities and Employed youth [14]

- Understanding of ICT (information and communication technologies) tools and technologies, for youth as well as farmers [6], [22]
- Agriculture productivity and marketability [7], [14]
- Small scale industries nearby Villages [25]
- Small scale Trades [10]
- Women empowerment [3], [25], [26]
- Skill Development Opportunities

In [9], a select committee on rural economy suggested a number of recommendations for improved rural economy including indicators of rural development. The major indicators suggested in this report include *digital connectivity, housing for all; rural business support, skill development opportunity; rural transport for delivery of the agriculture and forest products*. In [2], International Labor Organization (ILO) has presented as study of economic security of better world in which the emphasis has been given on *skill development, work security, economy security, employment security, access to schools, training, attitude to economic justice* etc. These are actually indicators that can be used to measure the impact of economic security in creating better world where socio-economic development of rural population can be ensured. In [27], *human resource development, improved healthcare, agriculture productivity, rural infrastructural* growth are identified as development indices.

In [10], a report on digital economy is presented of United Nations (UN) in which stress on value creation has been given. This also suggests using ICT tools for enhancing the economy. However, any specific indicators are not reported. In [7], the role of agriculture economy in growth of the country is discussed. The share of agriculture economy in gross domestic product (GDP) of Indonesia, United Sates and Netherlands has been explained in the report. This work highlights the important of rural agricultural economy and its contribution in the overall development of the country and thus the *agriculture productivity* can be seen as major indicator of the development. In [1], ease of doing business in India and creating job opportunities are reported in the economic survey of year 2019-2020. The job creation is a factor that can help in assessing the development of rural youth. So, the literature on the topic in various reports of different countries including India, have suggested flowing indicators for rural development:

- Digital connectivity
- Housing for all
- Rural business support, rural transport for delivery of the agriculture and forest products
- Skill development opportunities
- Work security, economy security and employment security
- Access to schools and training
- Attitude to economic justice
- Human resource development
- Improved healthcare
- Agriculture productivity
- Rural infrastructural development

2.3. Research at International Level

In this section, we have included few major research studies and surveys on rural development and the role of R&D in the impact analysis. Though, there has not been much at Internal level also in the area of SEDORI but general purpose development factors and R&D impact on rural economy and growth are studied [2], [3], [28]–[31], [7], [10], [11], [14], [17], [21], [24], [27].

In [10], the migration was an important factor reported as an important indicator and when the development both economically and socially then the people migrate from one place to other. This study was based on Africa where the migration was attributed by a number of factors and one such factor was reported as skill set. If the skill development opportunities and awareness for these opportunities are not there and then people migrate. Migration always hampers the progress of the region from where the people have migrated. In [32], a thesis carried out an interested work on a wonderful topic "Can development traps be avoided?". In this dissertation, the obstacles in the path of socio-economic development were identified and few indicators were suggested to overcome the challenges due to the obstacles of growth. The work suggested structural transformation strategies for improving the development index by emphasizing the use of technology in agriculture and

manufacturing in rural economy. In [20], female empowerment and health services were seen as indicators of the development of rural India. In this Master's thesis of Georgia State University, following indicators were reported:

- Female empowerment
- Health Services
- Gender equality
- Education of Girls
- Women in economy and governance

The indicators for monitoring sustainability are presented in [19], a report of food and agriculture organization of United Nations. Though the indicators are not directly related to socio-economic development of rural India but being the indices of sustainability, the following indicators are commonly discussed:

- Food safety
- Water quality
- Human Health
- Working Conditions
- Gender Inequality
- Access to basic services
- Financial stability
- Linkages between urban and rural economy
- Re-use of waste
- Annual income

The above indicators are reported in the report of UN based organization and thus provide a general guideline that can be used for SEDORI. In [22], case study of Rwanda is presented on role of sanitation system for socio-economic development that leads to healthy masses. In this thesis

work, various types of low cost sanitation technologies have been suggested so that it can benefit the people living in villages. This dissertation focuses on:

- Accessibility to toilets
- Social barriers involved in sanitation
- Cleansing materials
- Facilities for washing hands after using toilets
- Ecological sanitation

In [11], rural transformation is studied in the context of Italy, which envisages achieving transformed rural population by eliminating poverty. The role of rural banking, labor availability, food security is among main components in the process of fostering the transformation of rural people.

2.4. Specific Research on Rural Development of India

This section presents specific research on R&D on SEDORI discussing about major contributions, studies, their impact, limitations and gap analysis [3], [11], [12], [14], [15]. This also highlights on other surveys [17], [20] and repots [10], [11], [33] on the topic of the project.

We have extensively searched various research and development works related to theses work at doctoral level and Masters level [15], [18], [20], [32], [34], [35] on study of R&D impact of any of the factors of SEDURI. The limited amount of literature is available and few major literatures on this area is discussed here in this section.

In [3], in a research paper on role of women in socio-economic development in Selama district of Malaysia was presented in which a qualitative data analysis was made that operated on data collected from smaller rural areas from different ethnicity The involvement of women in the development and number of women who are in entrepreneurship are studied and impact was claimed to be affecting the societal change and development of the whole country. This work reports that in few areas 51% of women are entrepreneurs but in remaining areas, the percentage is very low. Moreover, cultural and social diversities are also suggested as challenges in recommending a robust set of indicators for the development. In a doctoral thesis work [15] of East Tennessee State University, impact of socio-economic status on students was studied. This work suggested few interesting factors, which are listed below:

- Childhood poverty
- Location of residence
- Health and Mental care
- Cognitive development
- School achievements and relationship with development of family

The data analysis was based on questionnaire which was developed and sampled at large scale in order to find out how the achievements of students, education level, cognitive development and poverty can affect the growth of family as well as the region. In [14], the impact of rural roads is studied in the local rural development using empirical strategies. The roads were reported as major factor in achieving all around development of rural people. The factors involved in this research study are:

- Availability of primary school
- Medical center
- Electricity and irrigation
- Literacy and land ownership
- Type of house

In [36], a dissertation was carried out by Radboud University Nijmegen Netherland, which was based on Indian scenario and discussing about enrollment in primary schools and its interrelationship with socio-economic development. Various socio-economic models and characteristics were discussed. In another doctoral thesis work [26], women entrepreneurship was investigated and correlated with the development and the contribution of women in the growth process. This includes the following major factors:

- Women entrepreneurship
- Western and Indian research on role of women entrepreneurship
- Low income group women and their role in development
- Role of government and non-governmental organizations (NGO)

- Education level and marital profile
- Monthly income

In [37], human development index has been considered as most important factor because if the people are properly sensitized and aware about various social issues, ICT tools, and other good practices then true benefit of different schemes made for them can have greater impact. This report also highlights on some popularly used factors, such as:

- Agriculture
- Education
- Digital and physical connectivity
- Healthcare
- Financial services
- Creation of employment opportunities

2.5. Study on Impact of R&D

In this section, the literature on R&D impact on SEDORI and other development models of rural economy are discussed so that we can have an understanding of the topic of current project grant that how much of work has been actually investigated on similar area of research [1], [5]–[7], [18], [22], [35], [38] . In [5], the impact of R&D on economic development was presented. This study emphasizes on more pending on R&D that can impact the rural economy. In [39], research on agriculture was suggested for SEDORI and the challenges in agriculture sector in rural India were identified. The important factors involved in the agriculture research are:

- Allocation and mobilization of funds for agriculture
- Investment of agriculture R&D, both by public and private sectors
- Availability of seeds and fertilizers
- Agricultural machinery
- No breakthrough technologies for improved yield
- Financial support

- Lack of social science research

In [40], agriculture policies related to R&D have been presented in a well-documented report of National Institute of Agricultural Economics and Policy Research, that talks about various reforms in agriculture sector to promote the sustainable growth for empowering the farmers. However, the research is mainly based on expenditure on R&D for agriculture and there has not been any discussion on indicators for sustainable development.

2.6. Limitations of Existing Literature

We have explored numerous literature on various aspects of socio-economic development, sustainable development and holistic growth of rural population of India and the world. The focus of the review of literature is on study of R&D impact on SEDORI and therefore we tried to concentrate majorly on R&D impact and polices for rural development where the people from villages can lead happy and healthy life with food security, health facility, good approach road, clean drinking water, proper sanitation, electricity, schools, skill development opportunities etc. We also explored how much work has been carried out as doctoral and master's research on the topic of the implemented project work. Unfortunately, the literature on the topic is limited and the amount of research work on the topic is not attempted much. The literature available focused main rural economy, sustainable development, agriculture productivity etc. and the study of R&D impact on these factors of development of society living in villages has not been carried out adequately. However, the similar studies reported various factors, indicators of growth, policies and reports provide guidelines for mitigating the challenges and emphasizing on key indicators so that the socio-economic development can truly be achieved in rural India.

The major limitations of the review of literature are summarized as:

- The study of R&D impact of socio-economic development of rural people and areas is very limited at both Indian and International levels.
- The indicators suggested in various reports are generic but specific and substantial data analysis using the indicators are not available.
- The work in Indian context can be seen only in few government reports and some doctoral research. The research at Ph.D. and Master's level on the topic, has also been largely contributed in universities outside India.
- A framework or tools that can help in assessment of R&D impact are missing.

- A robust set of indicators for all diversity and demography have not been highlighted.

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Chapter 3

Methodology

In typical case of management information system, two major tasks are considered while designing; first is how information is collected and second is how it is stored for decision making support. There are typical information systems present in various fields like educational institutes, government agencies, private sector sells. These management systems are designed using clear thought of timely data coming to system and it is stored and used for different tasks. From small to large scale organizations, institutes have separate divisions for managing information. Typical MIS system is shown in figure 3.1.

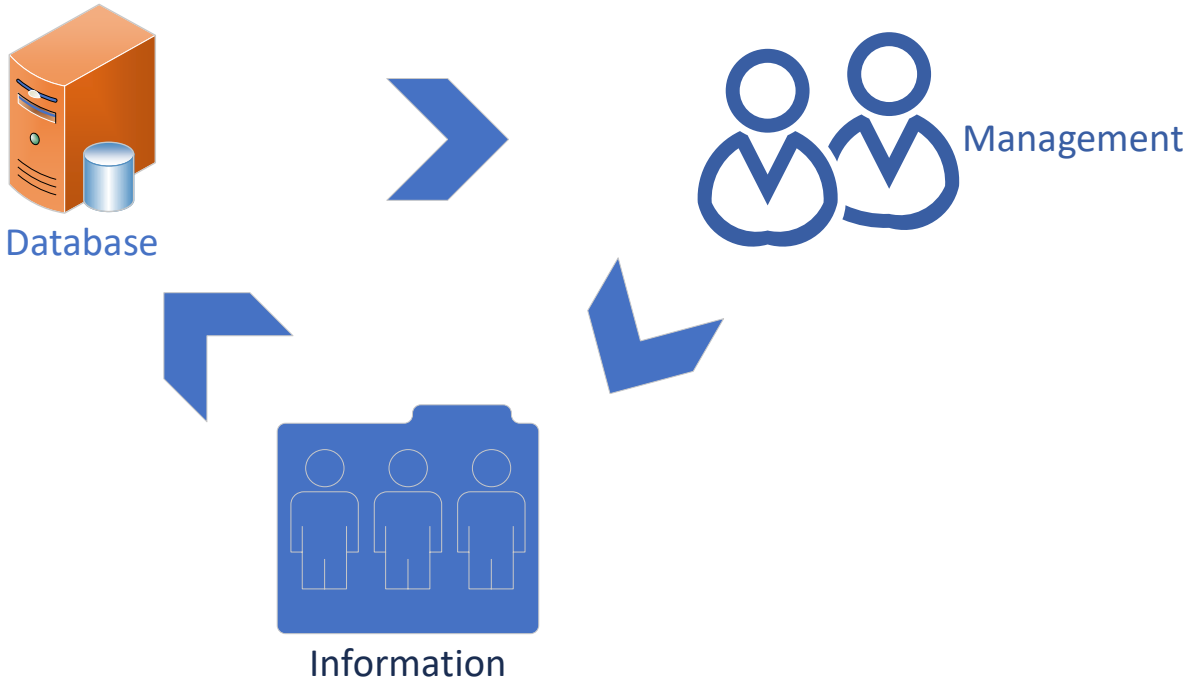


Fig. 3.1: MIS system structure

Based on literature survey, Socio-economic development of the rural India is defined as the sustainable development regulated by basic facilities; health and medical facilities; schools; transport and road connectivity; good sanitation and pure water; and many more. Socio-economic development comprises of economy growth and societal progress. The economic growth depends mainly on agriculture in rural areas of India and the sustainable agricultural growth can be

achieved through technology enabled, awareness driven and non-conventional approaches of farming.

As shown in figure 3.1 most of standard MIS systems are developed are managing data storages and observation from the data for R & D purpose. In same way process of MIS development is designed. To develop this MIS, we adopted the methodology as stated in the following flow chart figure 3.2 . typical design for MIS system for socio-economic is shown in figure 3.3.

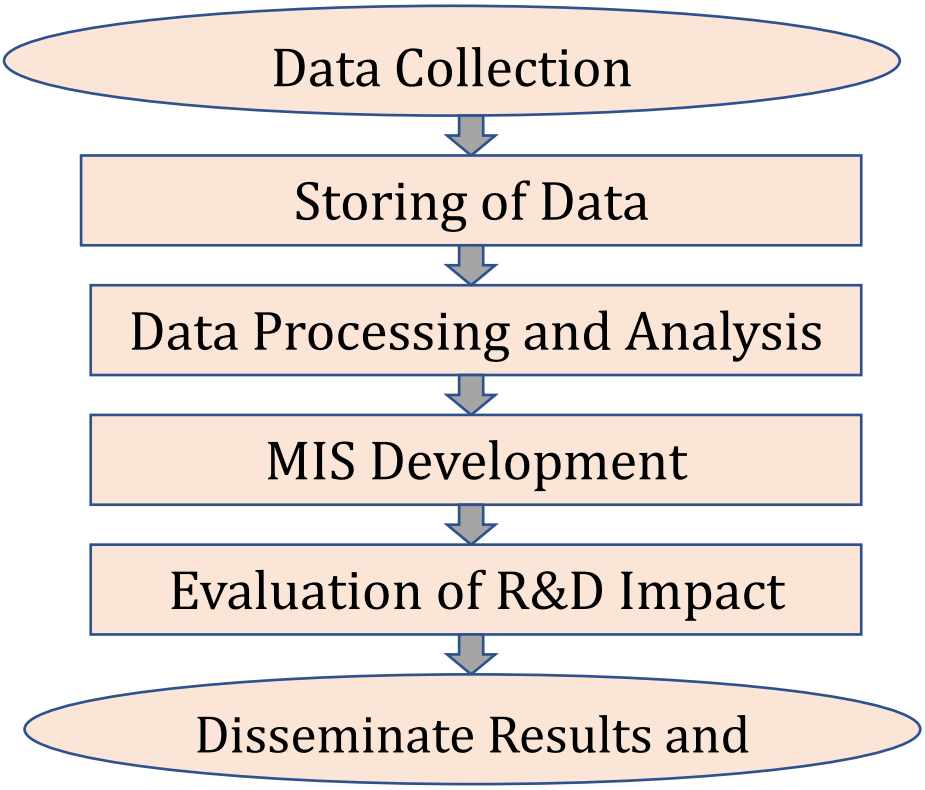


Fig 3.2 Methodology Flow Chart

The process of MIS development is mainly focusing of Data collection. The data collected for the system is through crowd survey. The data is collected using QA system where different aspects are considered for designing questions. MCQ types of questioners are designed so that most relevant categorical data are collected along with some text inputs. People from different villages in Telangana state are provided these survey form though online medium, and responses are collected and stored. The data collected is processed cleaned and filtered to

represent it in structured way. Different data mining approaches are applied for analyzing these data. Based on these analysis results are shown in different formats for actionable decision making.

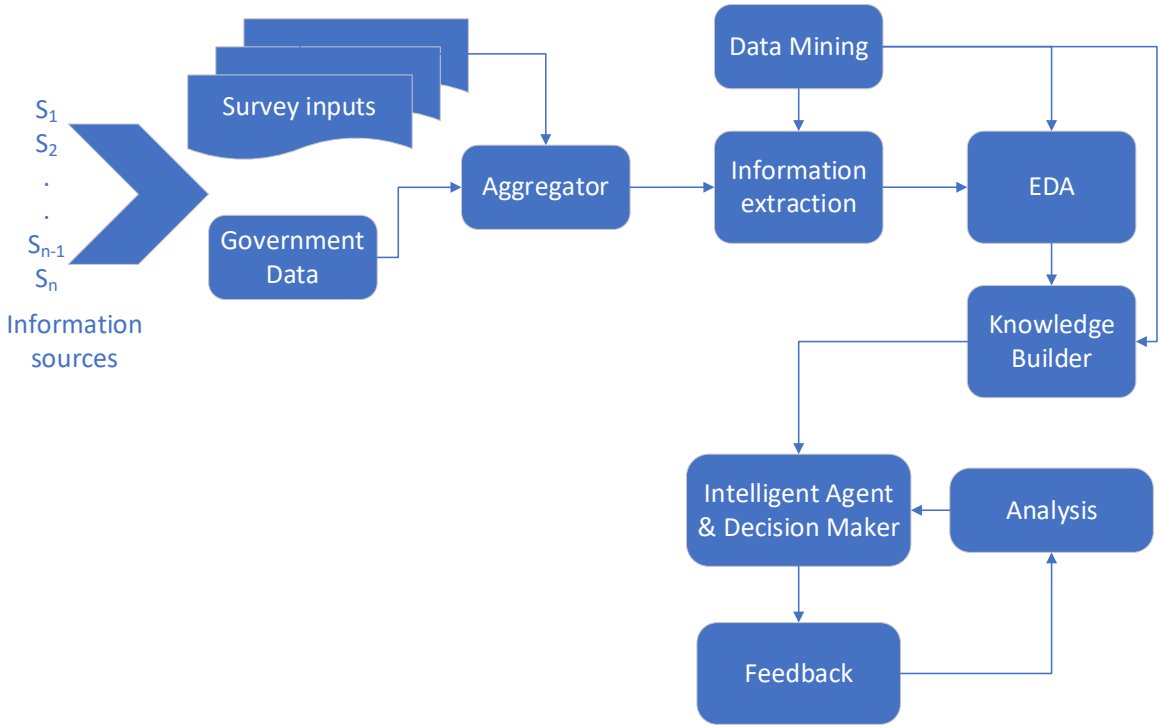


Fig 3.3 Socio-economic MIS System Design

The system design represents different sources of information such as survey reports, government data is aggregated to create sampling data for evaluation. Different data mining methods like cleaning, filtering, finding missing values methods are applied for completing information got from multiple sources. This information is extracted and stored in structured format. Various EDA methods are applied for knowledge building in the form of vectors, graphs, charts. Inferences from these graphs used to build knowledge. Intelligent agent and decision maker use knowledge for decision making, based on decision and associated feedback with analysis on it decision making can be improved.

3.1 Sampling Design

Data captured for analysis via online medium in the form of question and answers. The questions are generated for different aspects considered for rural information gathering for R & D. They are given as below. As per the project requirement and for further process we had the

LPAC meeting in which we decided the action plan to be implemented for this project to achieve outcome.

According to the discussion with Chairman LPAC we finalized the process and identified some key areas and indicators related to study the impact of socio-economic status of rural areas limited to Telangana State. There are different aspects by which the impacts can be measured they are represented in fig 3.4.

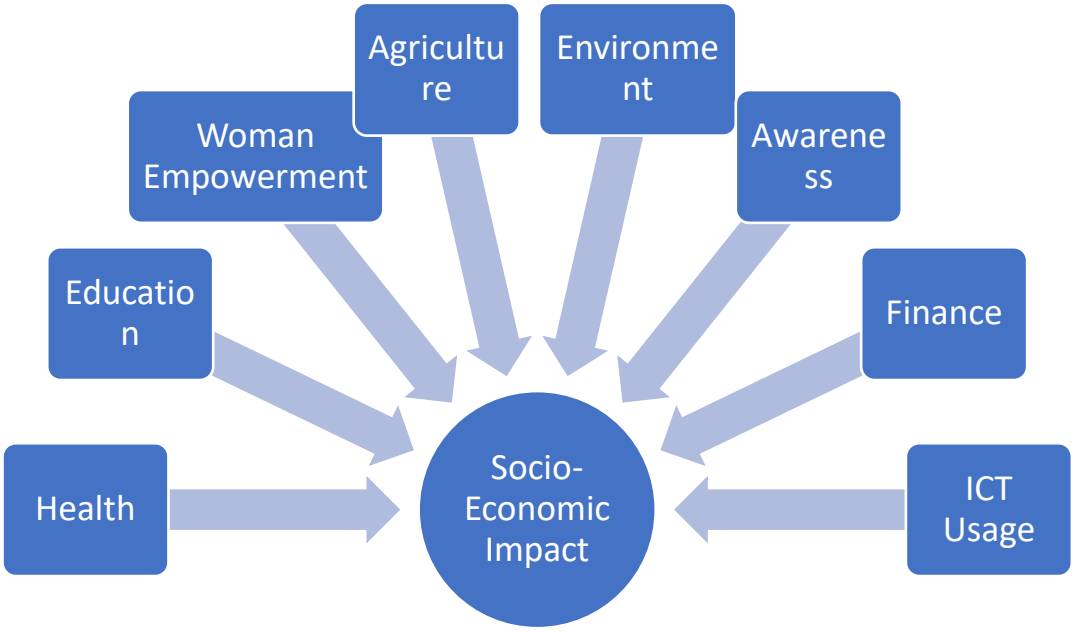


Fig. 3.4 Key Areas of Impact Measurement

In this process we decided to do a survey for which we have chosen the following key indicators and parameters related to it are as follows.

1. Health:
    a. Changes taken place of health for children, woman & others
    b. Immunization
    c. Simple disease to complex diseases
    d. Blood Tests
    e. Modern Technology used by villagers
    f. Diagnostics etc.…
2. Education:
    a. Primary Education
    b. Secondary Education

c. Higher Education

d. Job

For all boys and girls, etc.…

3. Women Empowerment:
   a. Self Help Groups
   b. Income generating activities
   c. Gender Equality etc.…
4. Agriculture
   a. Productivity
   b. Purchase inputs
   c. Use of equipments etc…
5. Environment
   a. Sensitization on protection of environment
   b. Usage of firewood / gas etc…
6. Awareness on other
   a. Social problem
   b. Child marriage
   c. Dowry
   d. Equality of gender
   e. Blind superstition etc…
7. Finance
   a. Bank Account
   b. Loans from Bank or other people
   c. Transactions
   d. Pension etc…
8. ICT Usage
   a. Having Smart phone
   b. Using of internet
   c. Member of groups (SHG) / community
   d. Information availability & Usage

Chapter 4

Data and Analysis

The data is important aspect to measure socio-economical growth. There are different means by which data can be captured like government reports, independent studies, research project or independent agencies. As Telangana is new state the data is merely available for independent from Andhra Pradesh. The district expansion also updated recently for the state. Hence new data is needed to be captured. As objectives stated to generate MIS system, data analysis is pre-requisites and intern data is needed. The new scenario demands new capturing of data for different domains for socio-economic study.

4.1 Data Capturing

After identifying the key indicatives, the survey was planned by creating a survey form with all the required parameters to collect the data from minimum of 100 villages of various districts of Telangana.

The process was initiated by creating a survey form with all these indicatives for development to collect data from 100 villages selected based on the population size of less than 1000 population, >1000 & < 2000 population, >2000 & < 5000 population or >5000 population of Adilabad, Nalgonda, MA haboob Nagar, Karimnagar, Medak, Ranga Reddy, and Warangal Districts.

As the data collection being the major task in this project the same is started by collecting the data related to the key indicators as decided in coordination with LPAC members. This process is carried out in both online (through Google form) & offline (Field survey) modes related to R&D for socio-economic development of Rural India. Till date, data from 5-7 villages is collected and the same is analysed by creating a data sheet from the collected data and developed a correlation matrix to analyse the impact on various parameters. Data collection questionaries is shown in table 4.1

Data Sheet Correlation
Overall: Yes=1, No=0
Feedback: Good = 2, Moderate/ satisfactory = 1, Poor = 0
Category: SC=1, ST=2, BC-A= 3, BC-B= 4, OC=5

Type of House ownership: Owner=1, Tenant=2, provided by employer =3 Information availability through: Radio = 4 Social Networks =3 Groups=2 Govt Servants=1 Television=0	
Legends	**ID**
District Name	1
Name of the Village	2
Category	3
2. Type of House ownership	4
3. No. of Family members: Male	5
3. No. of Family members: Female	6
4. No. of Adults (≥ 30 years of age): Male	7
4. No. of Adults (≥ 30 years of age): Female	8
5. No. of Children (< 30 years of age): Male [0-5]	9
5. No. of Children (< 30 years of age): Male [5-12]	10
5. No. of Children (< 30 years of age): Male [12-18]	11
5. No. of Children (< 30 years of age): Male [18-25]	12
5. No. of Children (< 30 years of age): Male [25-30]	13
5. No. of Children (< 30 years of age): Female [0-5]	14
5. No. of Children (< 30 years of age): Female [5-12]	15
5. No. of Children (< 30 years of age): Female [12-18]	16
5. No. of Children (< 30 years of age): Female [18-25]	17
5. No. of Children (< 30 years of age): Female [25-30]	18
6. No. of earning persons: Male	19
7. Nature of Occupation [Private]	20
7. Nature of Occupation [Government]	21
7. Nature of Occupation [Self Employed]	22
7. Nature of Occupation [Farmer]	23
8. Total earning income [< 1, 00,000]	24
8. Total earning income [> 1, 00,000]	25
8. Total earning income [> 3, 00,000]	26
8. Total earning income [> 5, 00,000]	27

8. Total earning income [> 8, 00,000]	28
9. No. of Unemployed	29
1. How many children going to school / College: [Boy]	30
1. How many children going to school / College: [Girl]	31
2. Any children who has dropped the education: 1 / NO	32
2. Any children who has dropped the education: 1 / NO	33
Dropout [Male]	34
Dropout [Female]	35
3 Parent Education: Father	36
3 Parent Education: Mother	37
1. Do you accessibility to hospital from your home	38
2. If Yes, How much far from your home _____Km	39
3. Any Chromic disease for any household member	40
4. Availability of medical facilities in the village: Health Center	41
4. Availability of medical facilities in the village: Government Hospital	42
4. Availability of medical facilities in the village: Private Hospitals/ Clinics	43
4. Availability of medical facilities in the village: Pathology Lab	44
4. Availability of medical facilities in the village: Vaccination Facilities	45
4. Availability of medical facilities in the village: Medical Shop	46
4. Availability of medical facilities in the village: Ambulance service	47
4. Availability of medical facilities in the village: Do you 1 with all services	48
5. Any Common diseases in village	49
1. Available in home	50
Type [Indian]	51
Within house	52
Flush	53
Do you have sewage system	54
2. Do you have Public Toilets	55
1. Water supply at home	56

if 1: b) Is water drinkable	57
2. Alternate Public water access facility	58
1. Government Jobs available	59
2. Industry / Private	60
2. Self Employed	61
1. Is agricultural Land available	62
1. How is the environment conditions of village	63
2. Cooking Using	64
3. Awareness on environment protection	65
1. Electricity at home	66
2. 1reet light availability	67
3. Power cuts	68
4. Quality of Power Supply during summer	69
1. Bank availability in your village	70
2. Do you have bank account	71
3. Loans facility from bank	72
4. ATM Availability	73
1. Self-help groups	74
2. Other income generative activities	75
3. Do you have gender discrimination at work	76
1. Availability of roads to village	77
2. Roads within village	78
3. Availability of - Primary School	79
3. Availability of - Secondary School	80
3. Availability of - Intermediate School	81
3. Availability of -Degree College	82
4. Availability of - Hospital	83
4. Availability of - Health centers	84
4. Availability of - Clinics	85
5. Availability of - Police 1ocation	86

5. Availability of - Library	87
5. Availability of - Markets	88
5. Availability of - Po1ice Office	89
1. Social and Economic problems	90
2. Child marriages	91
3. Dowry system	92
4. Equality of gender	93
5. Knowledge of government welfare schemes	94
6. Do you feel that govt. schemes are implementing successfully	95
1. Knowledge of government welfare Schemes	96
2. Availability of Public Di1ribution System	97
1. Telephone Network	98
2. Internet	99
3. Me-Sava	100
Information source	101

Table 4.1 Data Collection Questioners

4.2 Data Analysis

Before analysis data from different domain cleaning of data is performed as per data mining procedures. Sample data analysis with EDA is shown figure 4.1. The snapshot of data prepared for analysis is shown in table 4.2. different analysis is performed for intra to extra domain responses for questioners like regression, feature pair analysis, data points analysis etc. complete EDA performed for finding observations from captured data. In statistics, exploratory data analysis is an approach to analyzing data sets to summarize their main characteristics, often with visual methods. A statistical model can be used or not, but primarily EDA is for seeing what the data can tell us beyond the formal modeling or hypothesis testing task. Exploratory data analysis was promoted by John Tukey to encourage statisticians to explore the data, and possibly formulate hypotheses that could lead to new data collection and experiments. Statistical data analysis is carried on data captured. Probabilistic correlation matrices are found to be best method for inference drawing. The results are shown in results section. Other statistical methods are also used to find correlation like set and graph theory, variances and co-variances of probability theory.

Raw data is processed for cleaning, including parsing like categorical or non-categorical data processed in numerical format. Here, domain experts helped for pre-processing and cleaning for categorical data. Here district names, village names etc. needed to transform into numerical values. Also, non categorical data like income and other numbers are normalized to form the uniform values with other features. Similarly, for input features are processed for null value or some other categorical information missing. Input attributes are processed for analysing overall impact with different indices are computed as discussed in system design. These indices are computed as derived attributes from input features with domain expert's opinion. These derived attributes and its associated indices helped to find overall impact of different domain like health, education, agriculture etc. on development of village to district to states. This state information helped further for decision making like government schemes, or other data driven decision making. Clustering and classification and other models are developed on this EDA data analysis which helped in decision making. The insights, graphs, charts helped policy makers, for development of village to district.

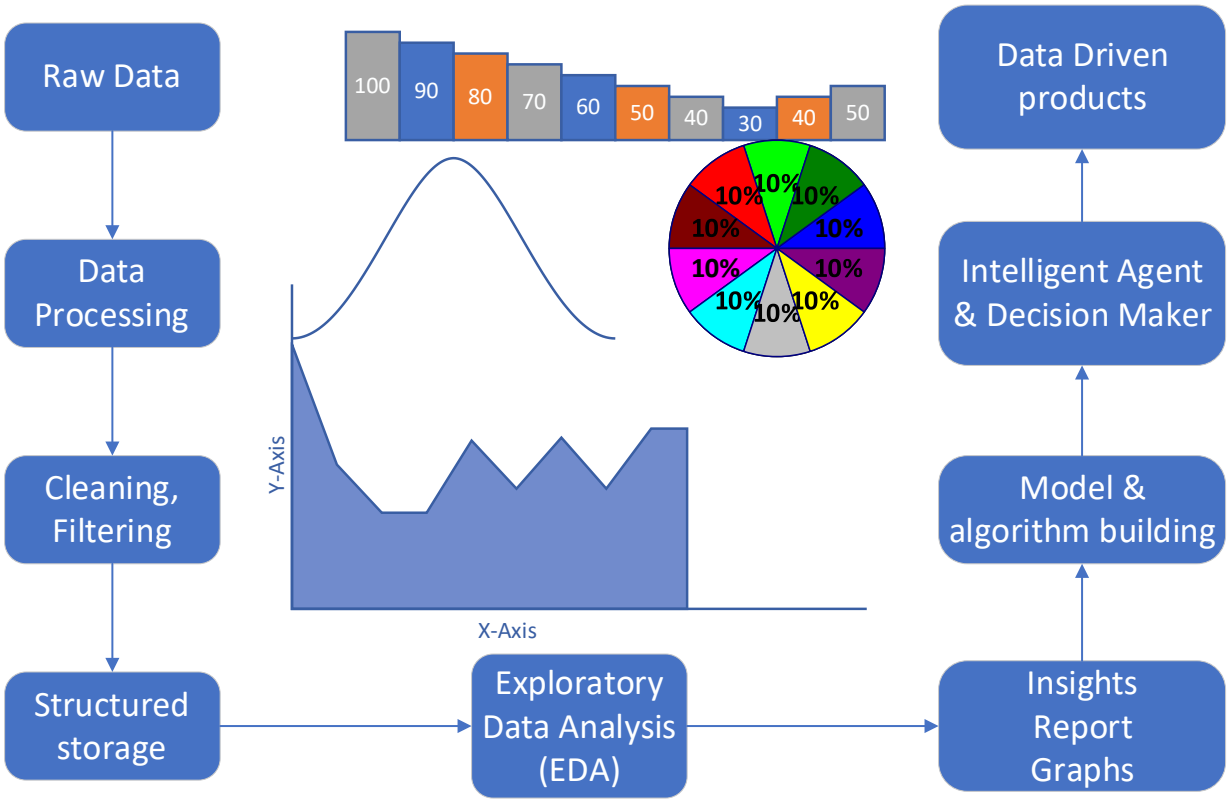


Fig 4.1 EDA Process

ID	District Name	Name of the Village	Category	2. Type of House 1ship	……	3. Me-Sava	Information availability through
1	Medchal	Medchal	5	1	……	0	4
2	Medchal	Shamirpet	5	1	……	1	2
3	Medchal	Keesara	5	1	……	1	3
4	Medchal	Ghatkesar	5	1	……	0	3
5	Medchal	Medchal	5	1	……	0	3
. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .

Table 4.2 Data Snippet

For the data represented in table 4.2 different EDA process steps are followed like cleaning data, getting in structured form, different association and relationship finding in data model building. These steps need different types of actions performed. The knowledge build after EDA helps in decision making for data driven division making.

4.3 Summary

Data set preparation on real life scenario helped in finding different aspects of development, social and other aspects in village as well as districts. These data collection is unbiased and independent as they are collected online through survey forms. Randomised data survey helps in finding minute to major missing attributes which will help in decision making. Exploratory data analysis on collected data, helped to finding different aspects in data points. These aspects are between data points to features association. These analysis helps in finding patterns and associated hidden knowledge which are built in associated processes.

Chapter 5

Results and Discussion

Different statistical methods are applied for data analysis captured by questioners as discussed in methodology. Results are shown in this sub sections. These results are analyzed with expert's opinion and some observations are provided below

5.1 Correlation Matrix

Correlation matrix explains relationship between data and feature weight. It is taken hear with probabilistic dependency matrix, that is with conditional probability value. In short major is probability value those features are dependent to each other, having any type of relationship with the data. As we can see in section 11, data shows following features are having covariance 0 means they are dependent so we can reduce them. Features are 2. Roads within village

3. Availability of - Primary School

3. Availability of - Secondary School

3. Availability of - Intermediate School

3. Availability of -Degree College

4. Availability of - Hospital

4. Availability of - Health centers

4. Availability of - Clinics

5. Availability of - Police Location

5. Availability of - Library

5. Availability of - Markets

5. Availability of - Po1ice Office

Similar feature "Availability of road within village" doesn't have any relation with others. It shows that if village have all government facilities listed above still they are independent on roads availabilities.

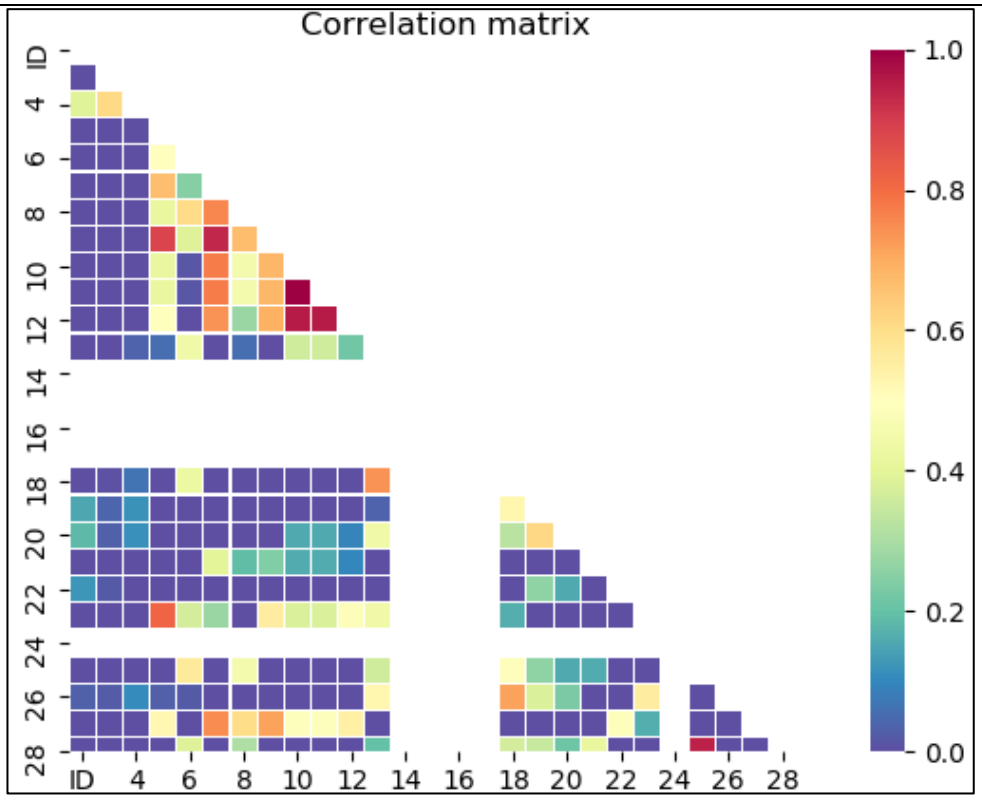
Also, for section 3, following features are dependent

4. Availability of medical facilities in the village: Government Hospital

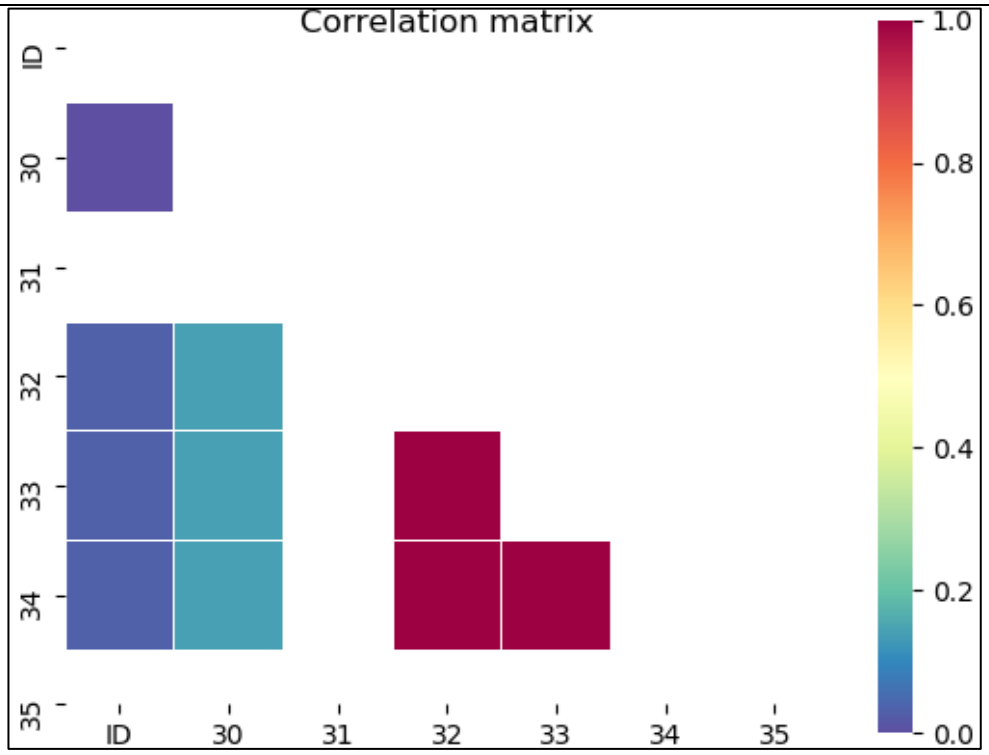
4. Availability of medical facilities in the village: Vaccination Facilities

4. Availability of medical facilities in the village: Medical Shop

It shows that if there is government hospital in village, thy have vaccination facilities as well as medical shops too.

Section	Graph
1.	 **Family Details** In this sectional correlation matrix, family economic relation with family details are associated. Some of clear observations • No family has income less than 1lakhs • Ownership of house is not dependent on most of any factor considered even family income is less most of family has their own house. • Similarly, family details are not having any relationship with village or place they stay.

2.

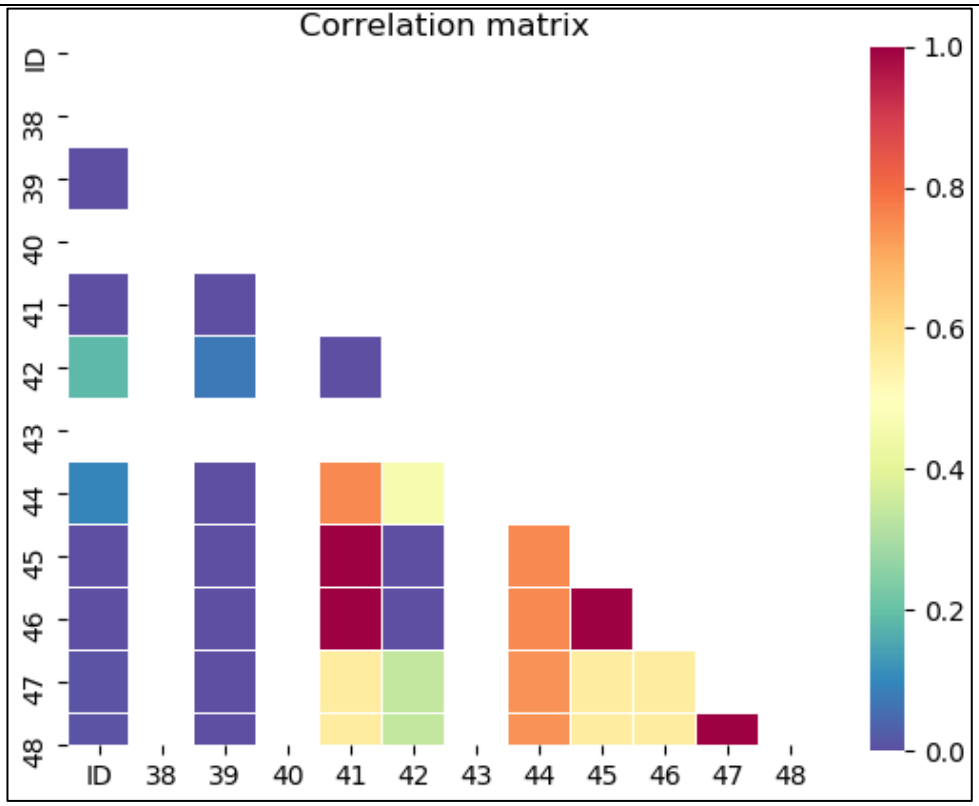


Educational Details

In this sectional correlation matrix, family education details are associated. Some of clear observations

- If anyone from family got dropout, mostly it is being male candidate
- There is no relationship found between dropout to girl education

3.

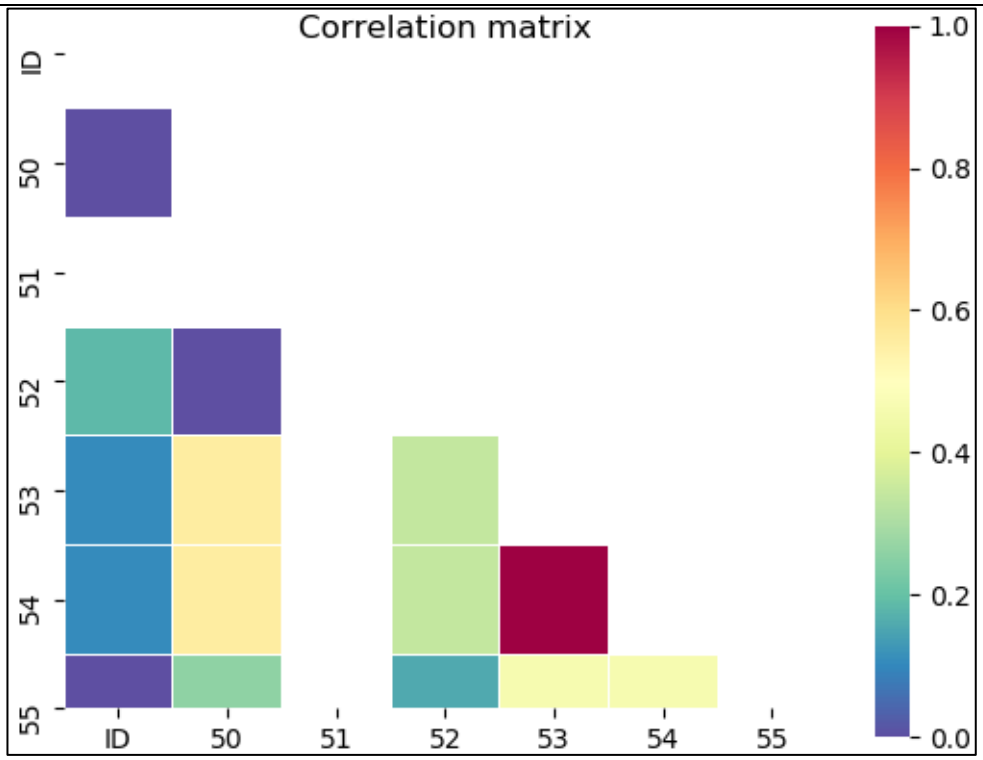


Health Details

In this sectional correlation matrix, family, village health details are associated. Some of clear observations

- If ambulance is present in village, feedback for health services are good, similarly with path lab is present most of other health services are available in village.
- Mostly no private clinics are available in rural area.

4.

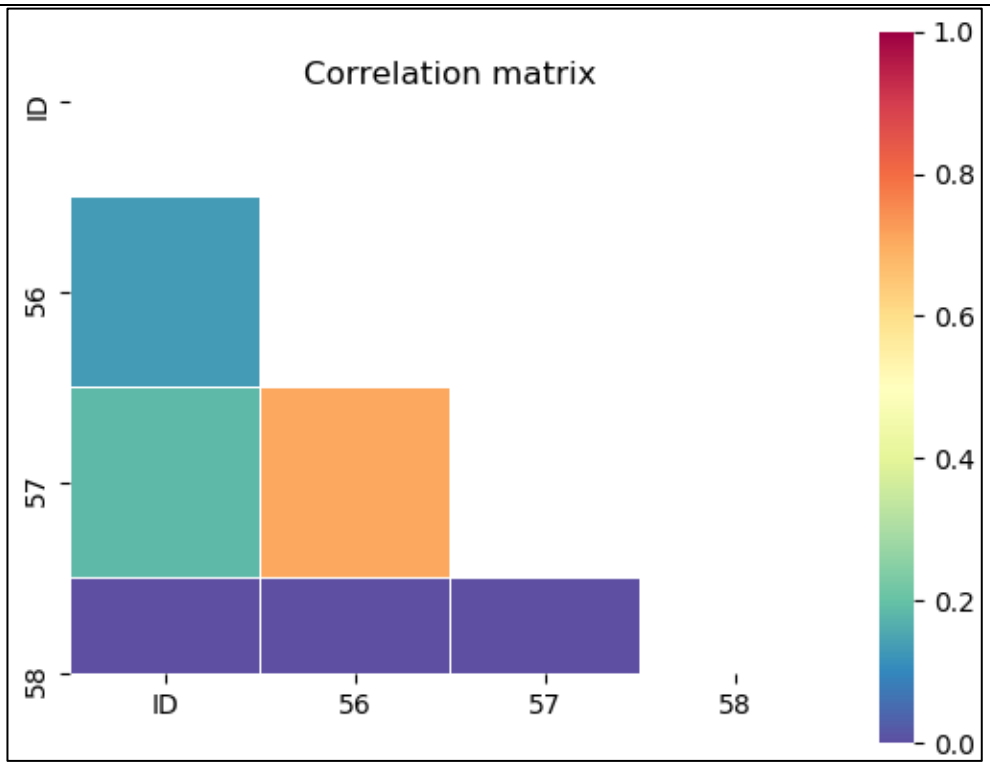


Sanitization Details

In this sectional correlation matrix, sanitization details are associated. Some of clear observations

- Availability Flush sewage system are closely associated.
- Indian style toilets are not making any contribution with other attributes in sanitization
- Availability of home and sewage, flush are moderately related.

5.

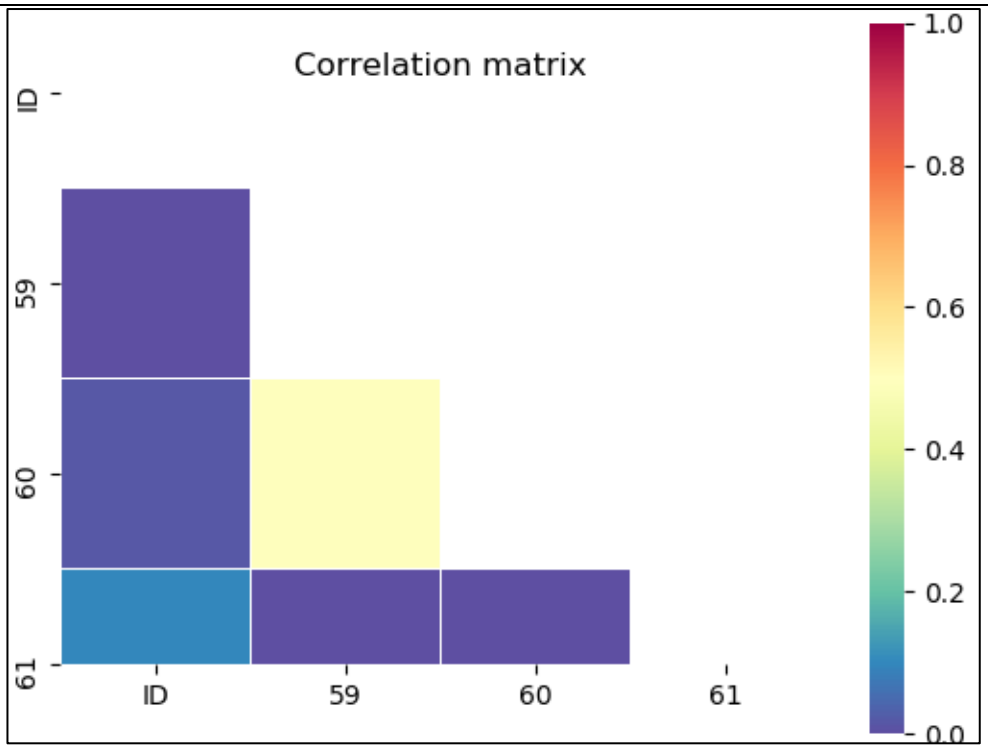


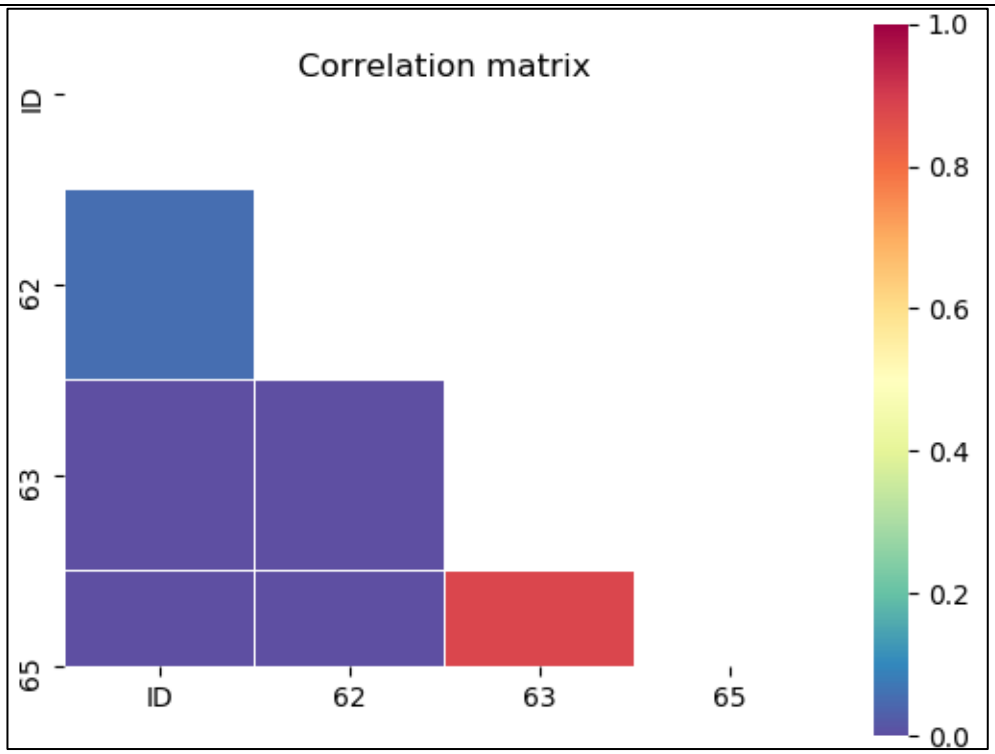
Water Details

In this sectional correlation matrix water details are associated. Some of clear observations

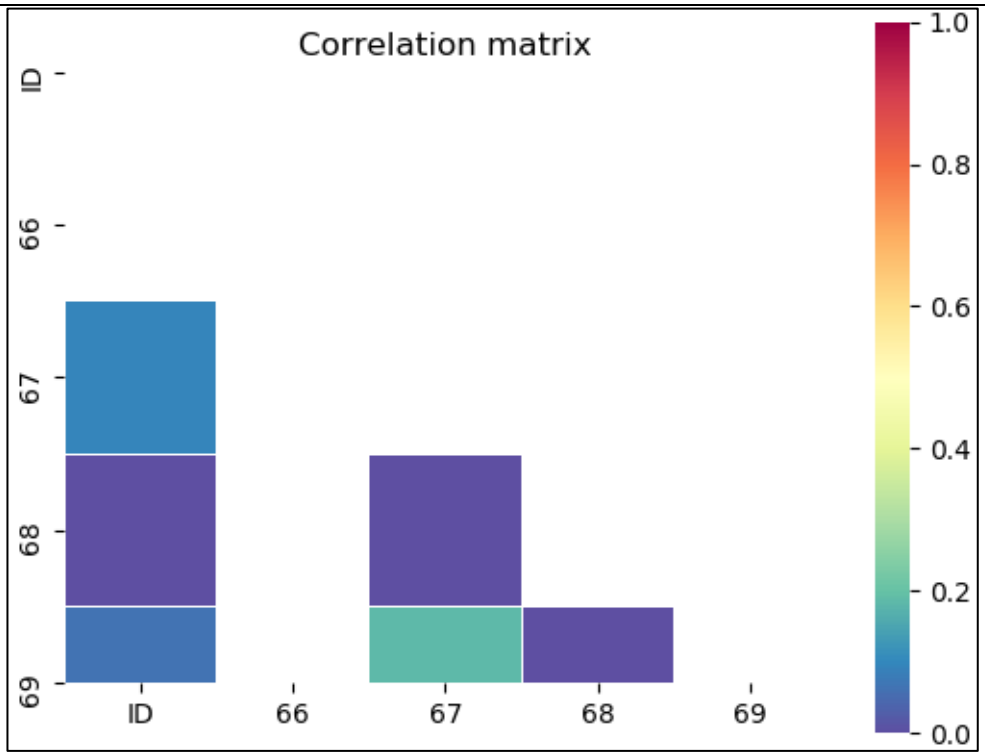
- Most of home if they have water connection its moderately linked as drinkable.

6.



	Jobs Details In this sectional correlation matrix, Jobs details are associated. Some of clear observations • Non such specific relation observed, but government and industry or private people are moderated associated, i.e. most of family have both type of people. Most of them are serving rather than self-employed.
7.	 **Environment Details** In this sectional correlation matrix, environmental details are associated. Some of clear observations • If village people have awareness about environment they try to improve environmental conditions. • Everyone is using gas for cooking.

8.

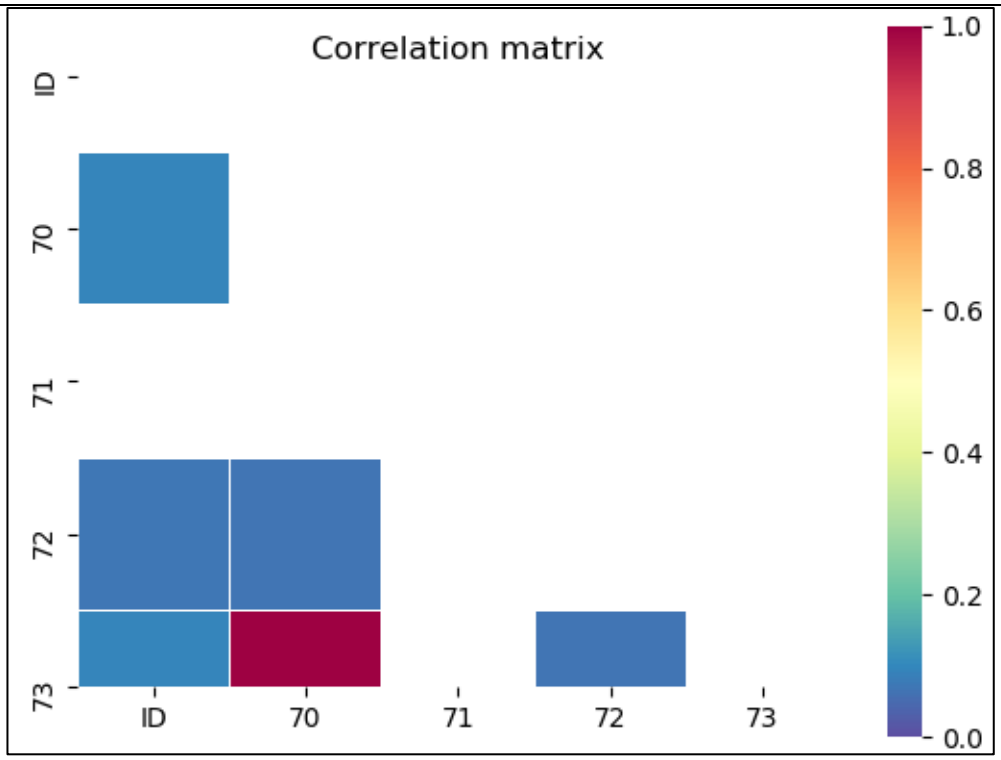


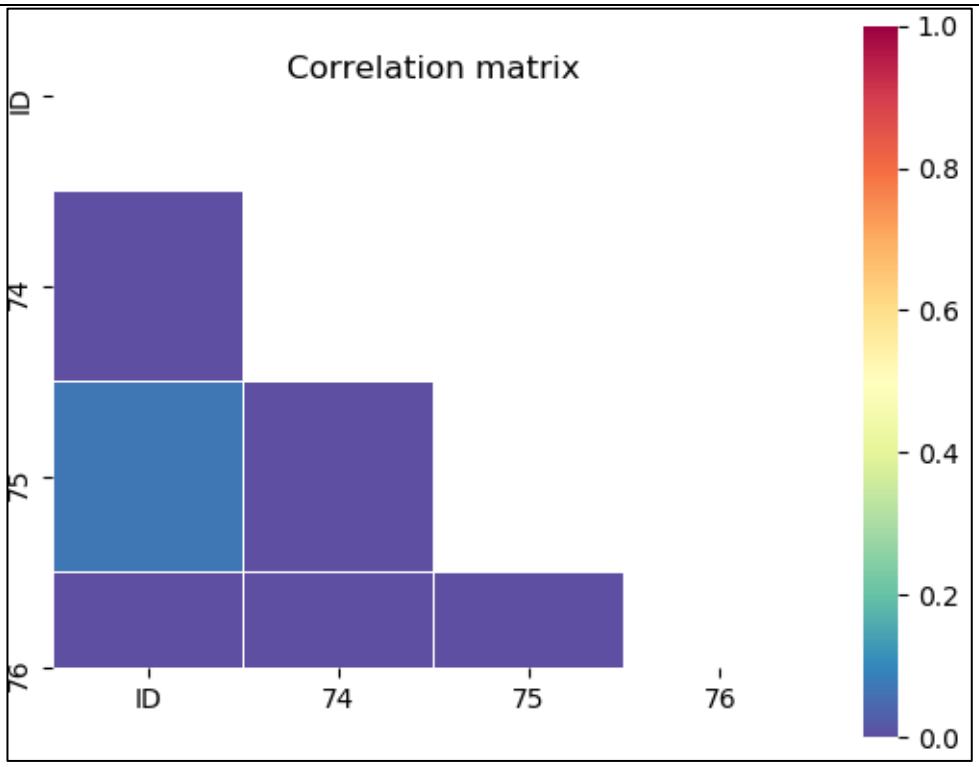
Electricity Details

In this sectional correlation matrix, power (electricity) details are associated. Some of clear observations

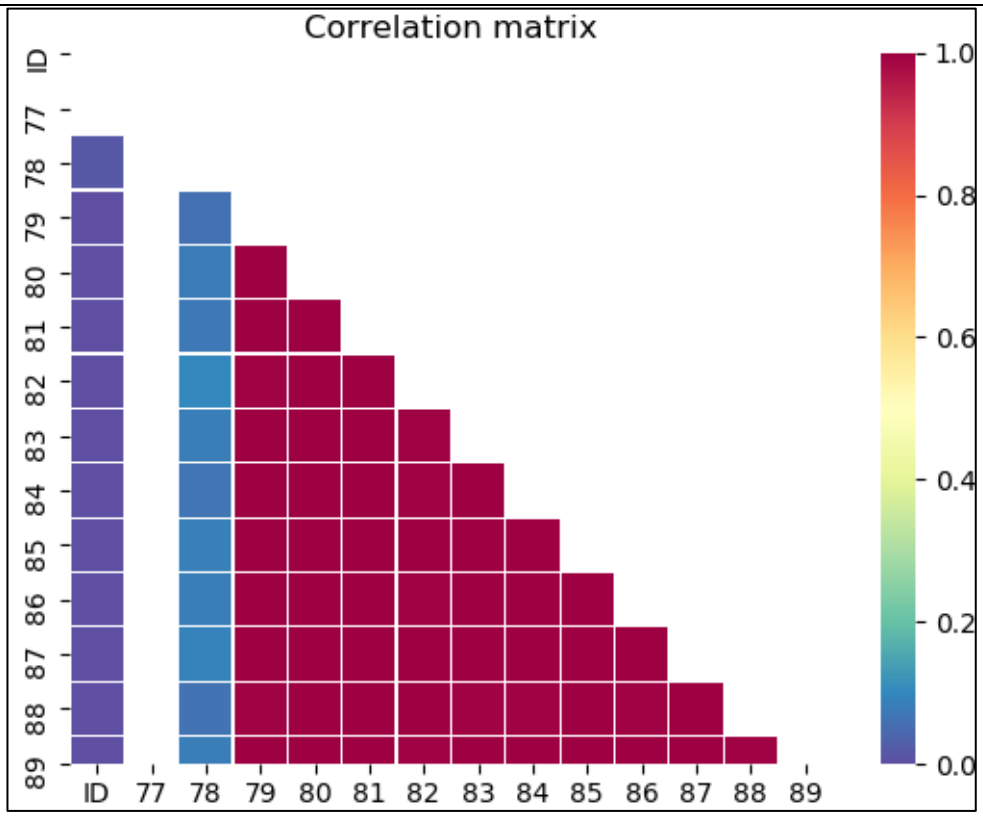
- Summer power cuts and electricity availability at homes are not related to any other public or street lights.

9.



	Finance Details In this sectional correlation matrix, financial services details are associated. Some of clear observations • If bank is available in village, they provide ATM services. • Account holding is not relevant to banking services.
10.	 **Social Details** In this sectional correlation matrix, Social details are associated. No such clear indication available in relationship.

11.

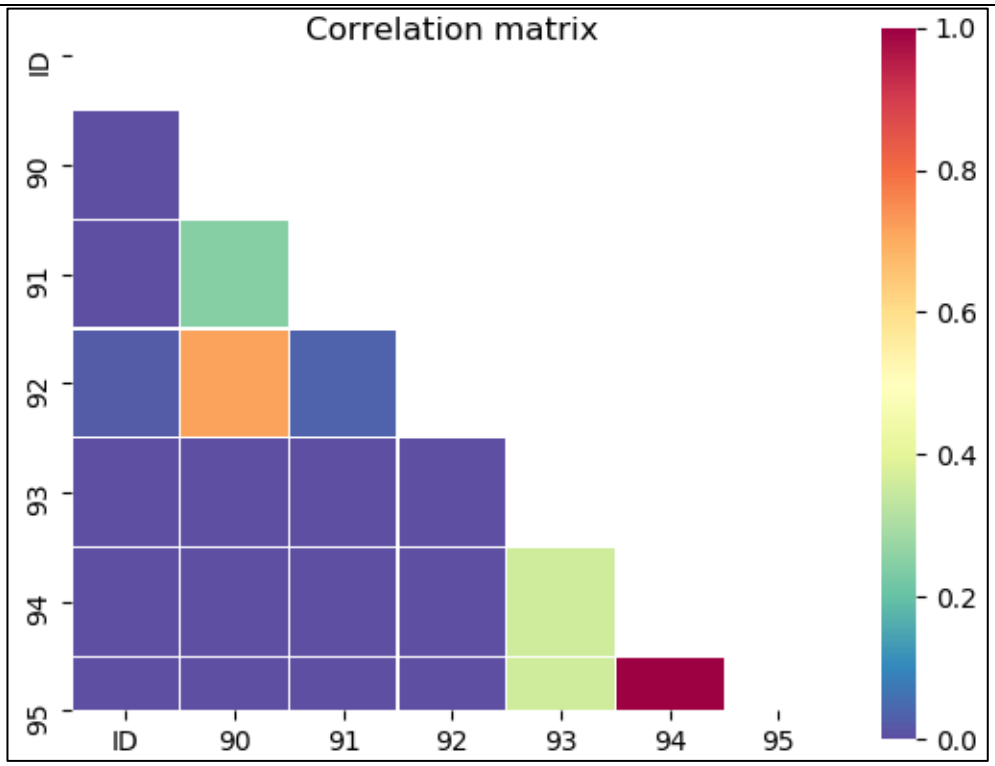


Development Details

In this sectional correlation matrix, availability of various services are associated. Some of clear observations

- Most of villages are equipped with basic necessary development like school, financial, trading and health services.
- Transport development like roads doesn't affect anything with other developments.

12.

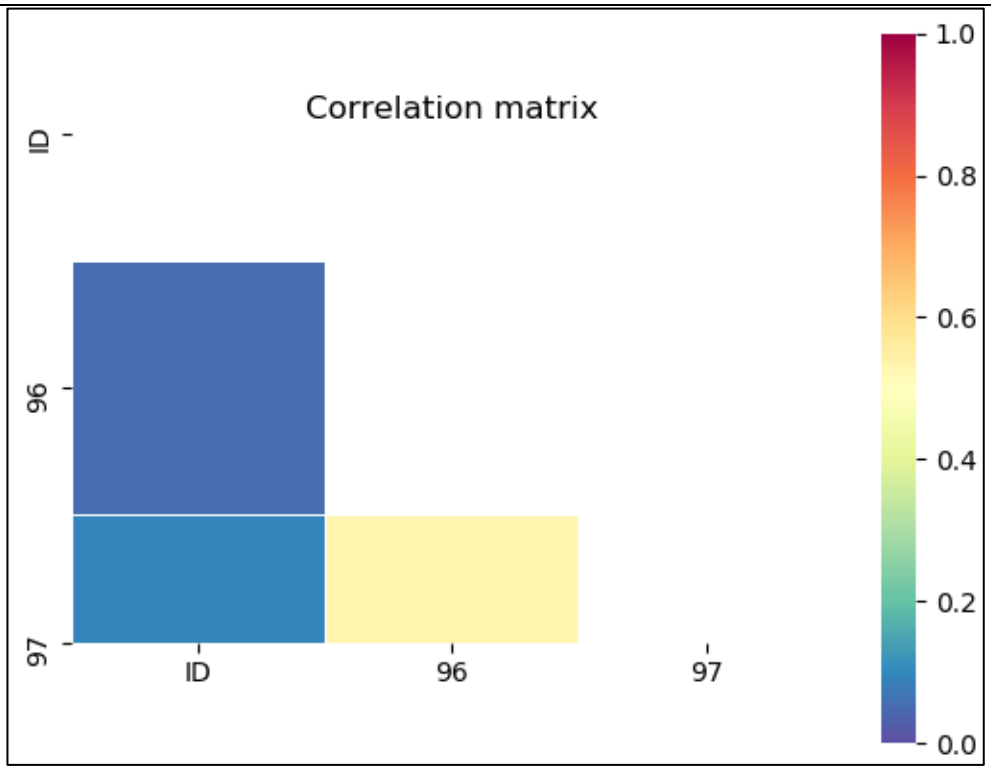


Awareness Details

In this sectional correlation matrix, awareness details are associated. Some of clear observations

- If village is aware about government schemes, most of them get benefits out of it.
- Most of village have social problem as dowery system.
- Also interesting fact if gender equality is observed in village they trend to get benefits of government schemes.

13.



Government schemes Details

In this sectional correlation matrix, government scheme details are associated. Some of clear observations

- If villages are aware of government schemes, most of people get benefits and public distribution for these benefits are served moderately.

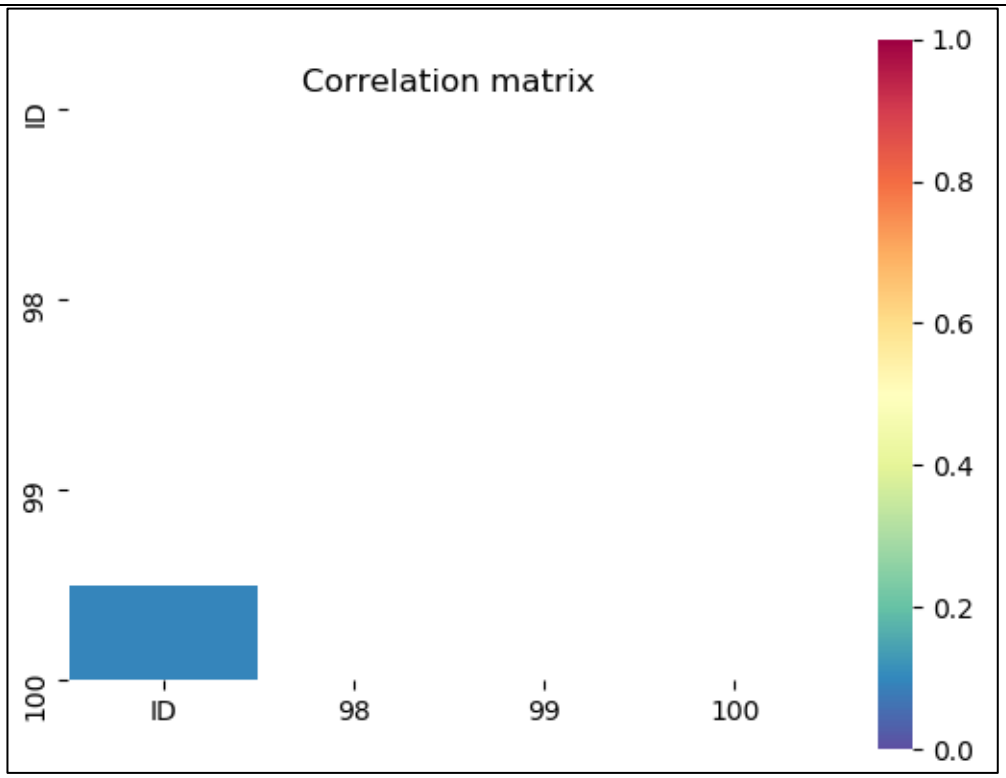
14.	 **Information Details** In this sectional correlation matrix, information details are associated. There are no exact relation available with source of information and information being percolated.

Table 5.1 Sectional Correlation Matrix

Table 5.1 shows sectional correlation matrix. These sections are as described in data analysis as health, education etc. The co-relation matrix represents association between features strong to weak with 1 being strongest 0 being weakest. The correlation between family education and income has strong connection similarly to sanitization, woman empowerment and other. These sectional graphs represent interdependent association between features within domain attributes selected. Entire graph for the correlation matrix is represented in figure 5.1 as Overall correlation matrix, and subsection of the graph is represented in figure 5.2. For overall we can easily detect feature set from 41 to 90 are dependent on 78 to 89. There also relationship may varies probabilistic values from 0 to 1 as shown in graph.

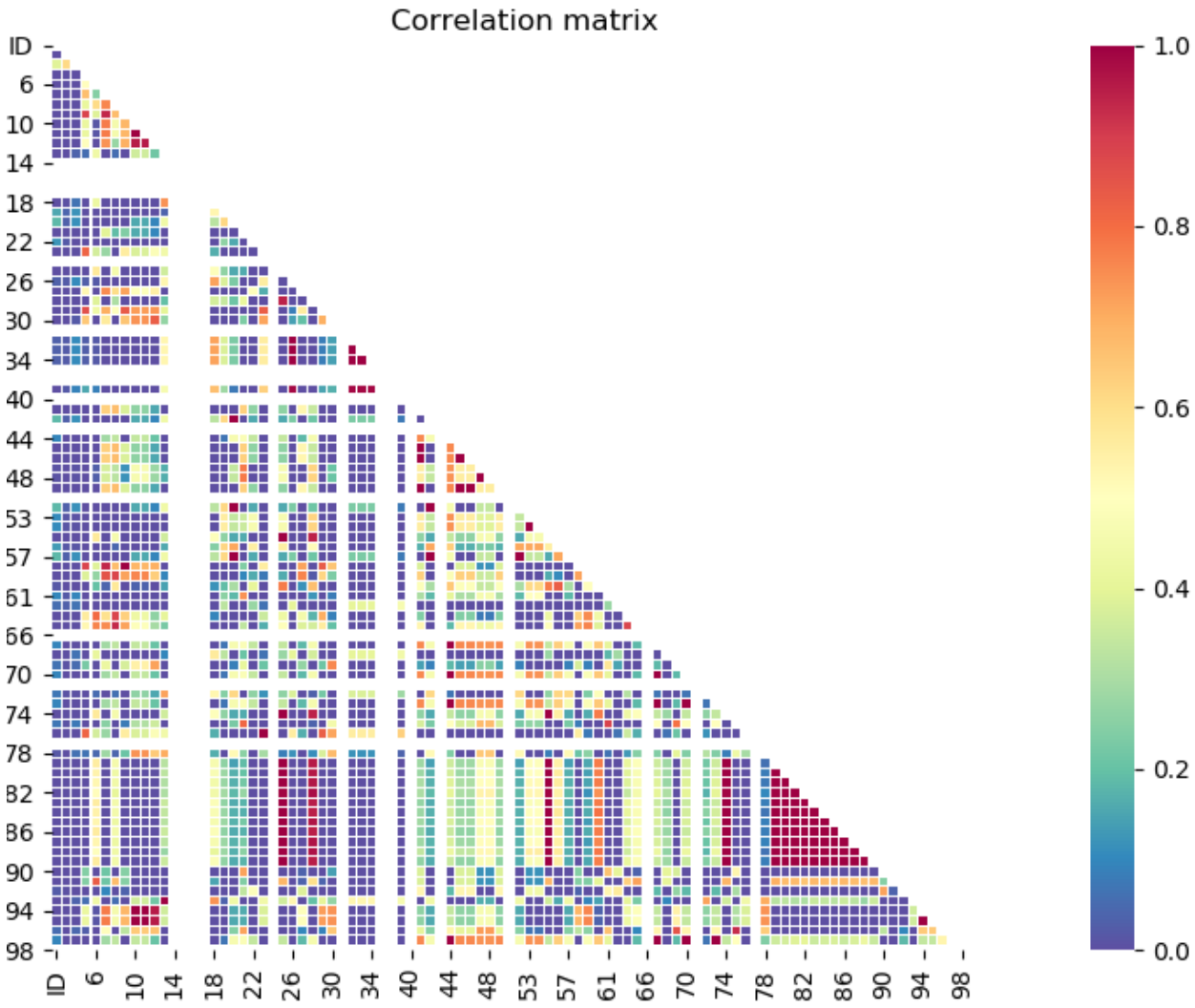


Fig 5.1 overall Correlation Matrix

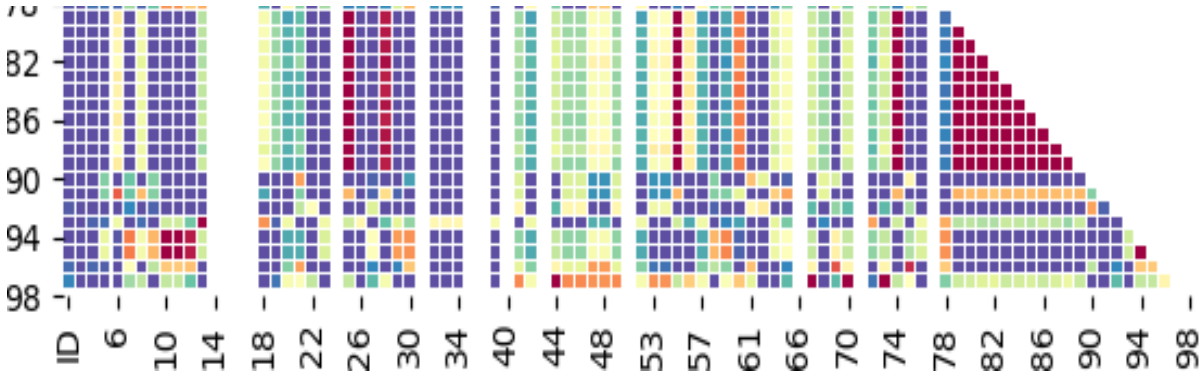


Fig 5.2 Sectional subgraph of correlation matrix

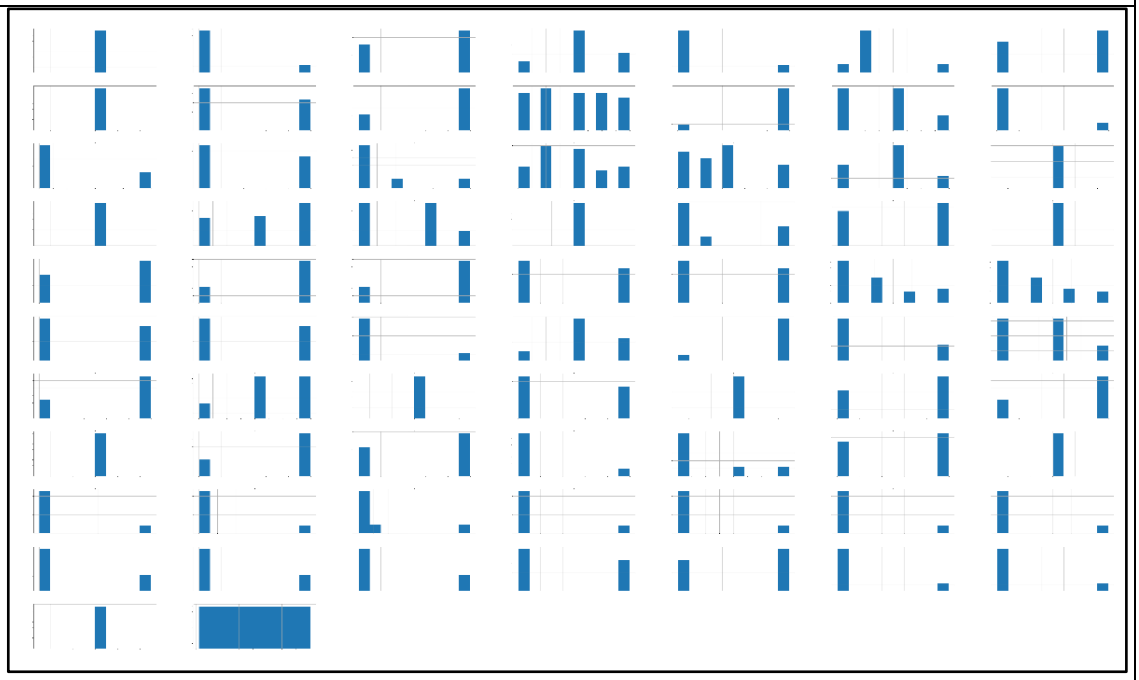
Some clear observation from entire association are

- Gender equality and awareness about government schemes are closely related.
- Most of them doesn't discriminated genders while providing information.

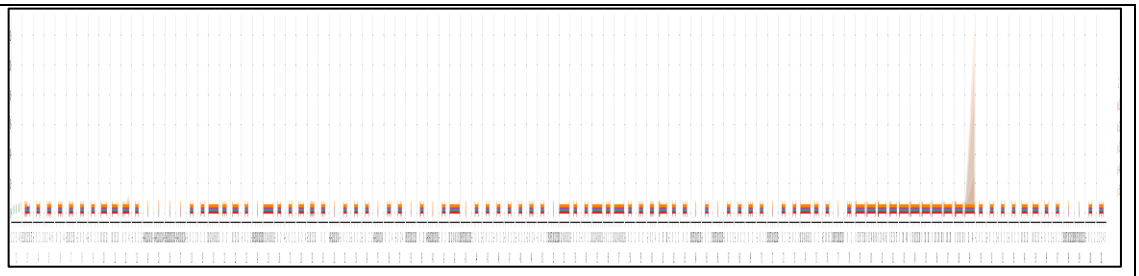
- Availability of multiple services in village improves other indices clearly
- Mothers education impacts at multiple indices improvements.

5.2 Statistical Results

If data is analyzed for each data point to each feature, there are different observations infer the socio-economic development. The initial thought of correlation matrix just provide relationship between features but between data point relationships are missing. Hence histograms are plotted to observe distribution in each feature set or data collected for each question. It is represented in table as histogram. Then different aspects association between data points are considered for analysis and they are plotted in table as distribution regression for each vs other data points and ultimately as each feature comparisons.

Sr. No.	Graph
1.	 **Histogram** • As data is mostly categorical, the observation only can be related to some of entities like if mother has good education all of children are welcome to learn even girl • Recent trends towards having hospital and basic needs are already established in most of villages • It is common for many people unaware of government opportunities and schemes. • Road and other developments are on moderate scale

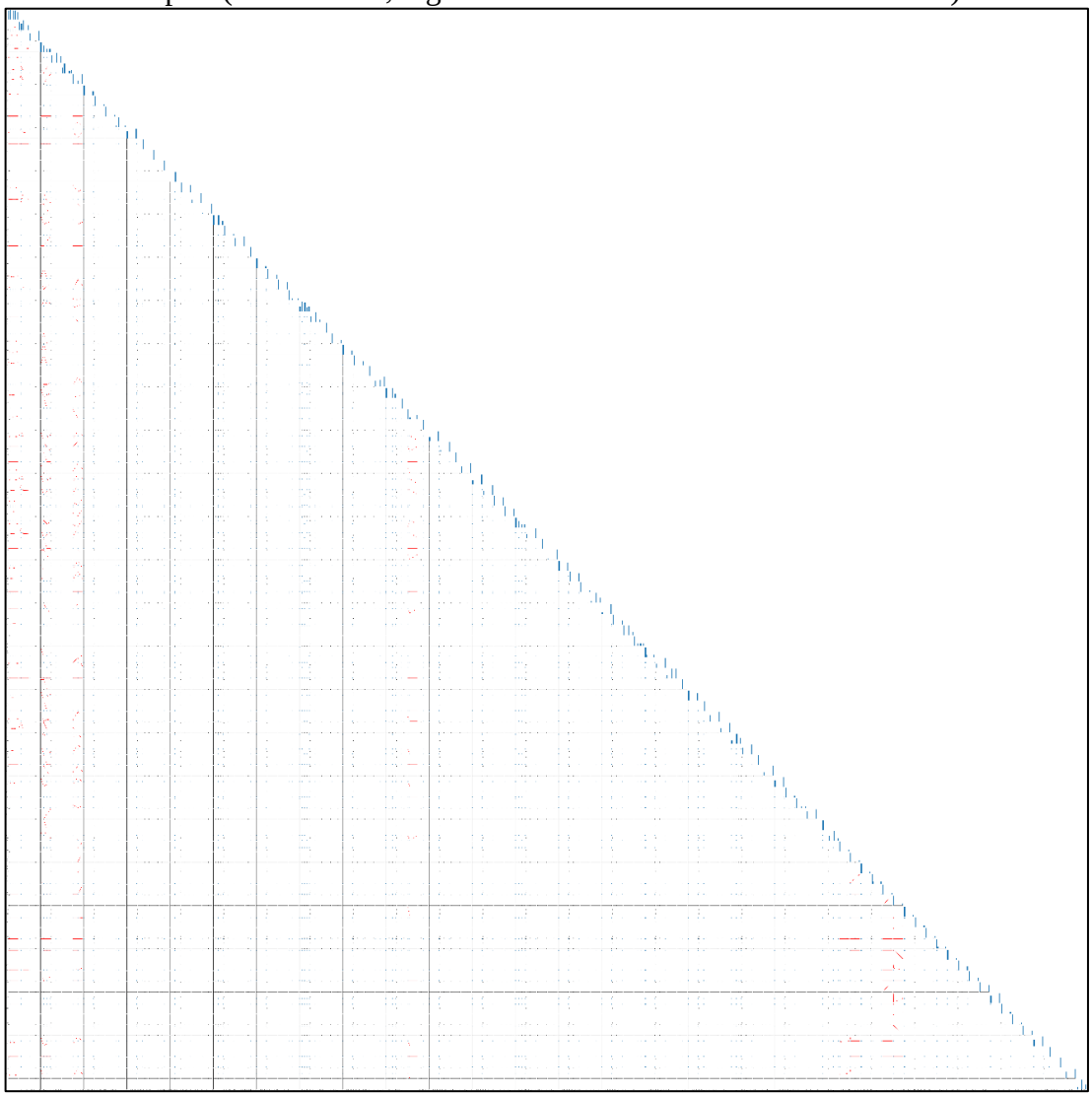
2.



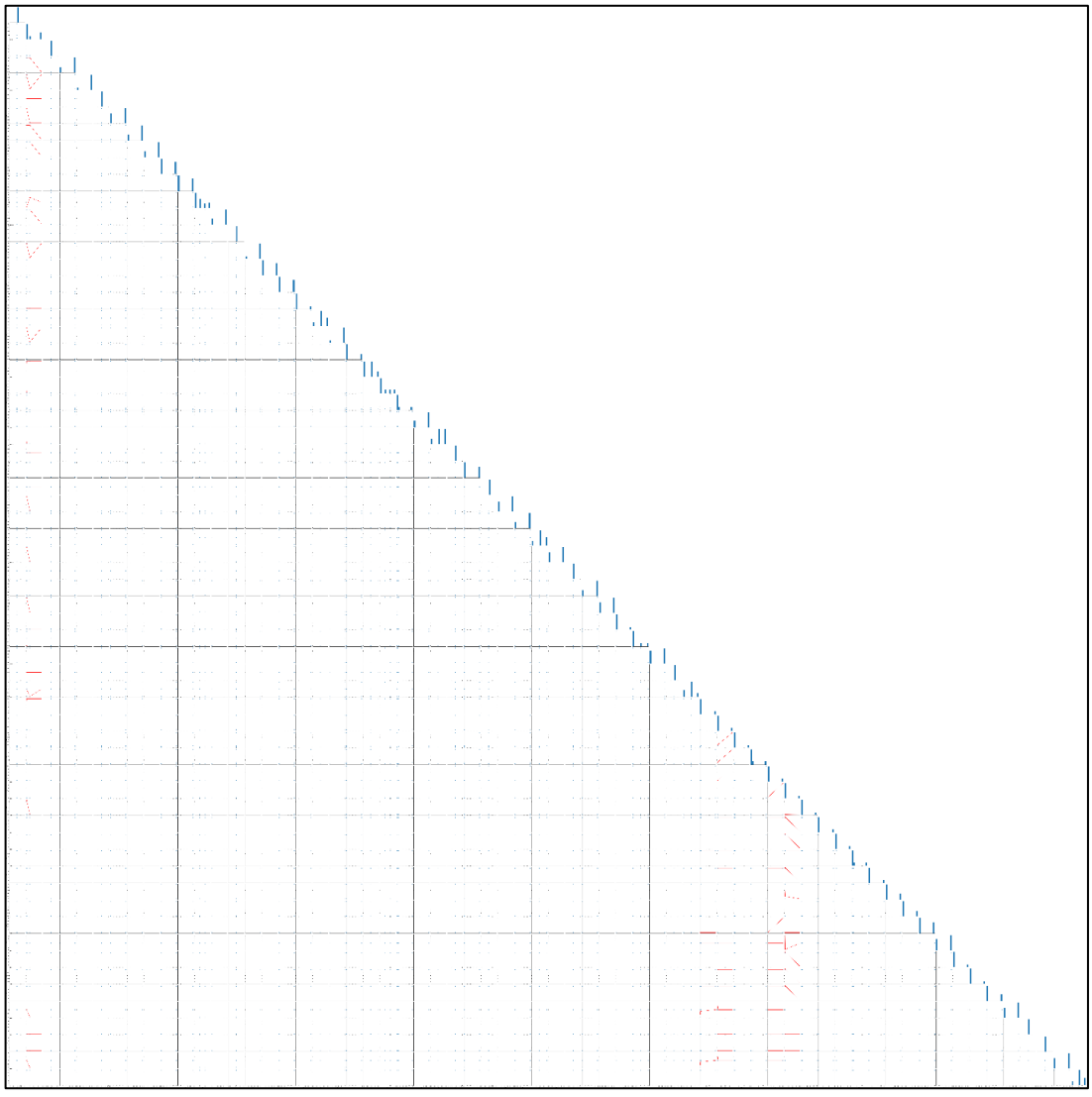
Sigle Feature comparison with other

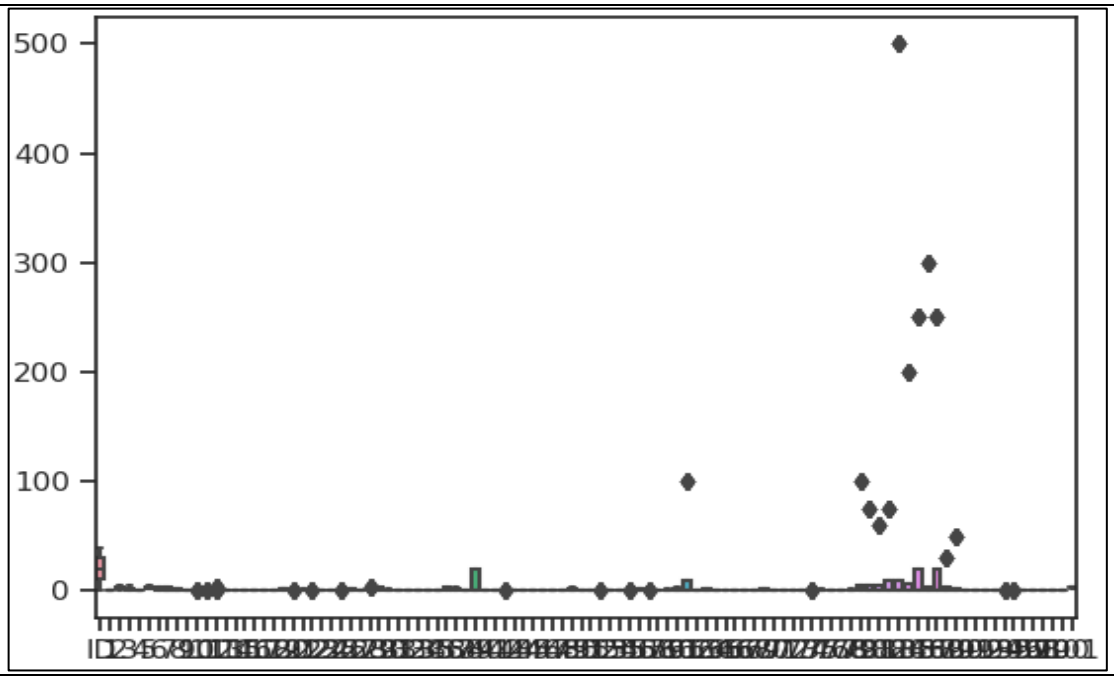
- District wise comparison plot is show in figure, typically the village development is similar in entire state especially the district data is available. Regression is applied on these data.
- Especially district regression with feature 89 is having great variance i.e. police availability has differences in district.

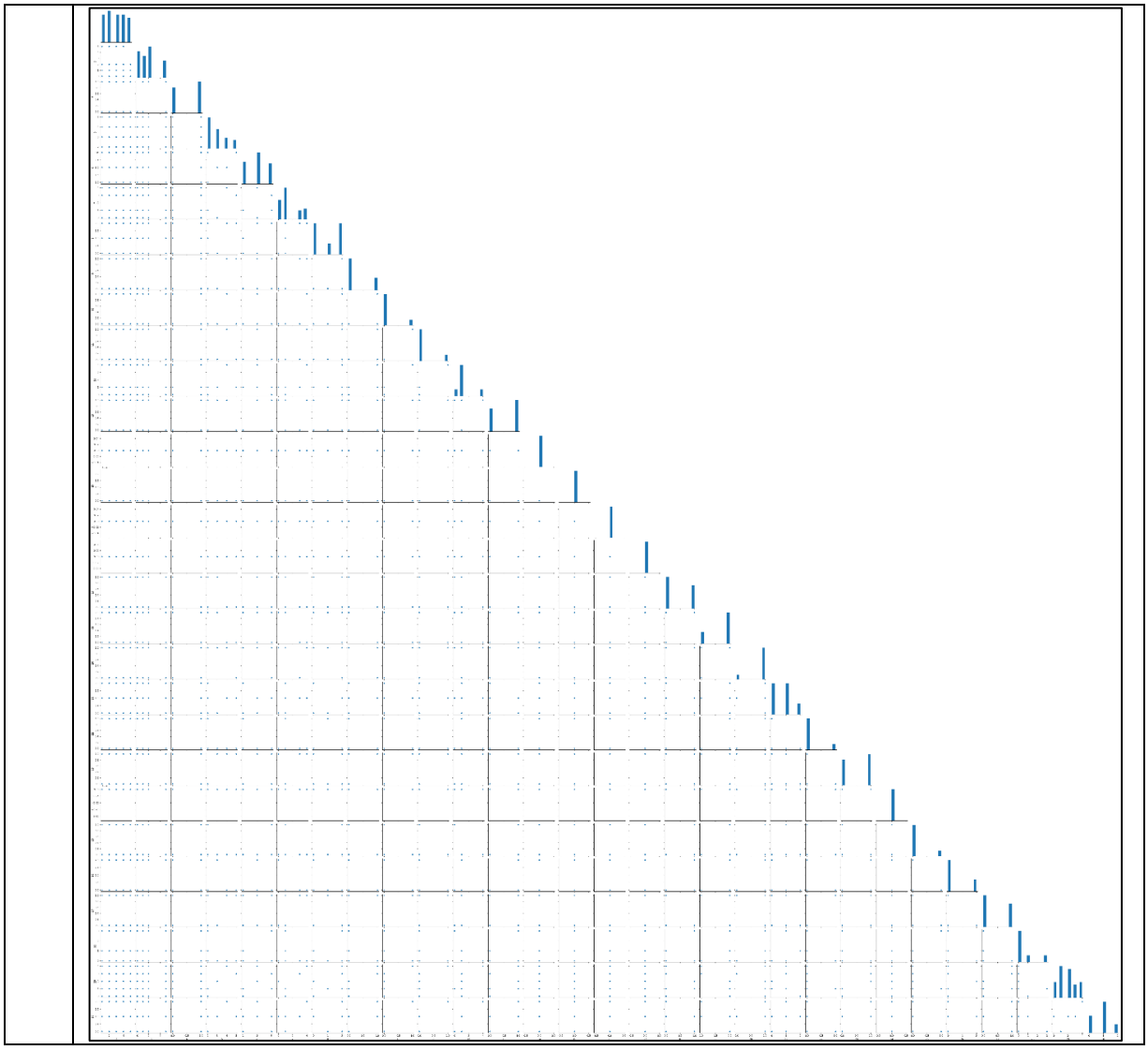
3. Data feature plot (Distribution, regression for features and their association)

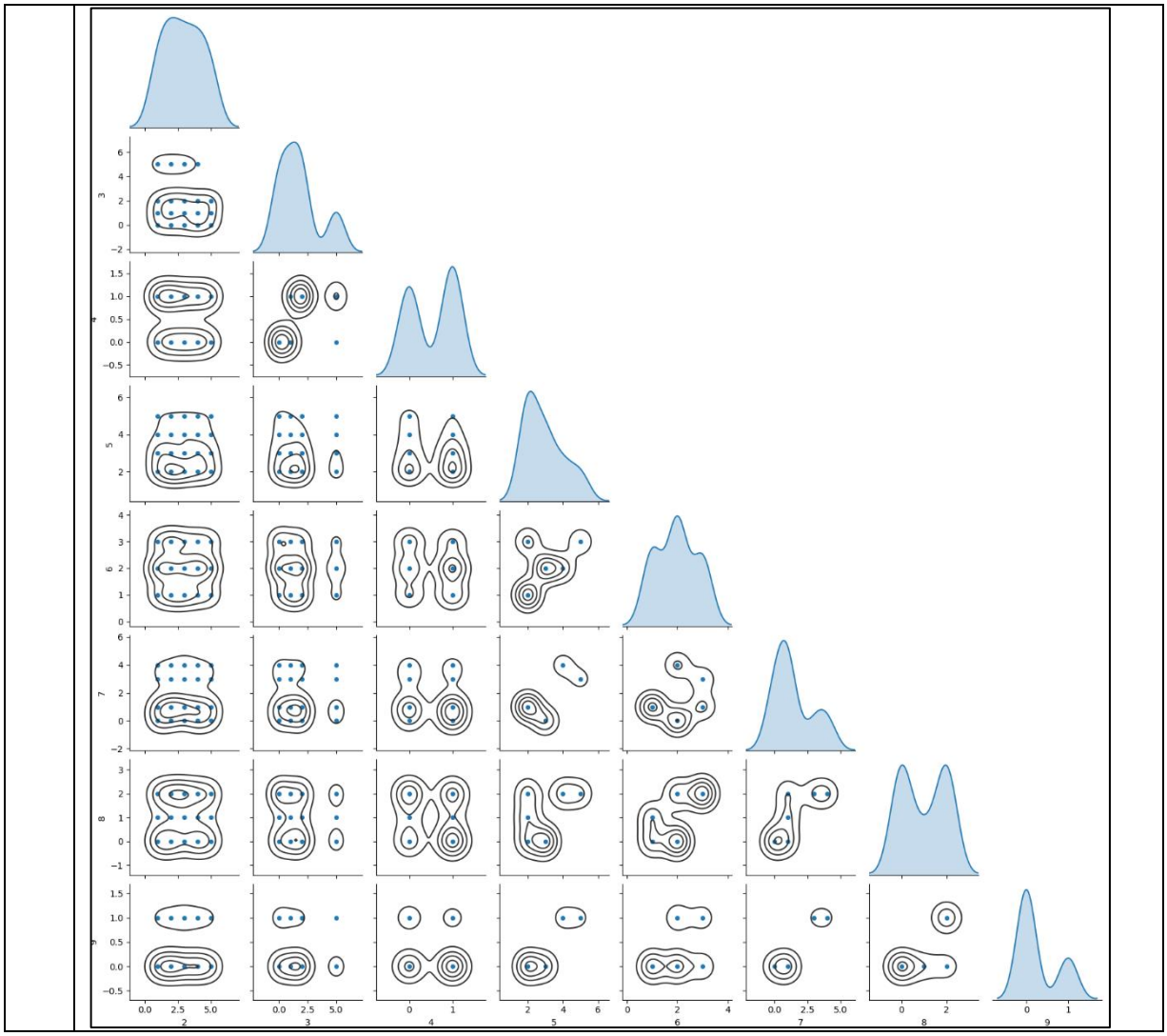


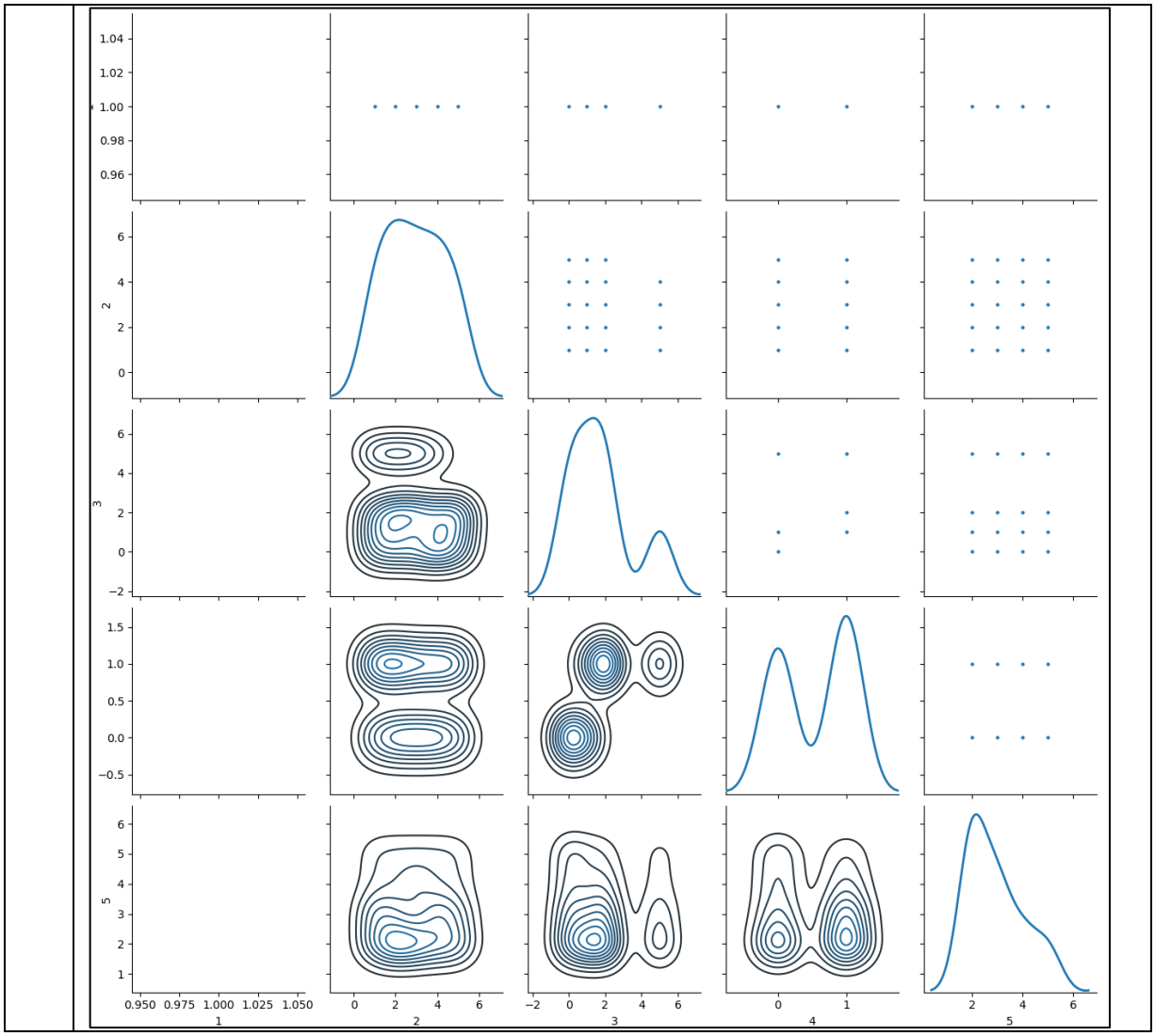
Multiple feature comparison

	• Regression distribution and histogram is considered for statistical analysis, some of them find multiple line regression data but these features are relevant to rest of features. • Features like 1,2,3,4,7, 21, 79,80,83,84 have multilinear relationship with other features, i..e. based on these features clear classification of population is observed
4.	Telangana Development relationships for socio-economic without considering family information just development is considered (Distribution, regression for features and their association) • Here only based on development is considered, population types are excluded and observations remain same as overall features considered. 
5.	Feature distribution plot • Here distribution is plotted most of data captured is of categories only distribution difference with income and distances measured

	
6.	Sample Pair plot between features set • Pairplot is plotted to see data point distribution with features comparison, the observations are observed in categories such as if mother or father has education higher some of their child also learning in higher education. The no of children and education of parents is also inversely proportional.



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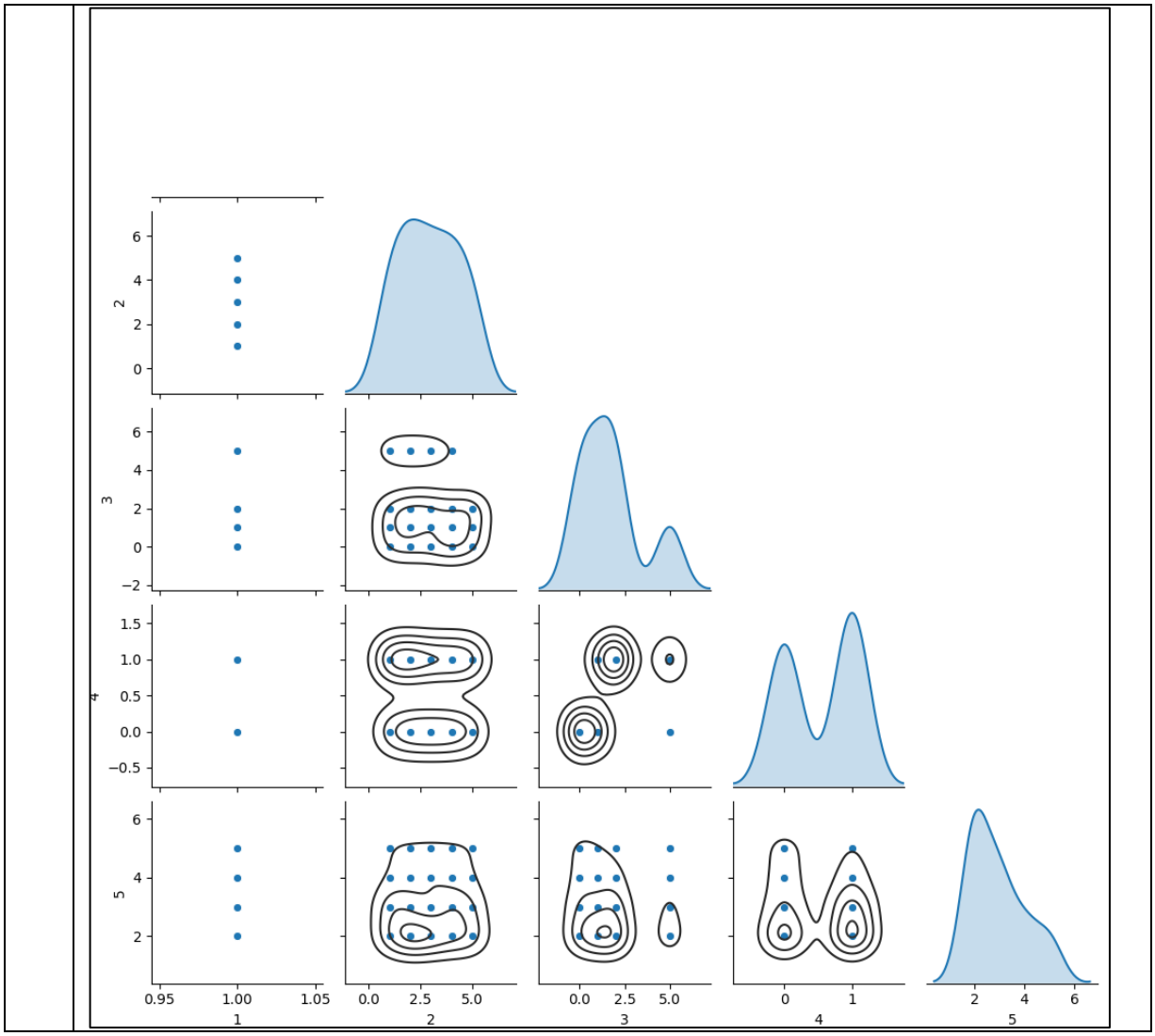
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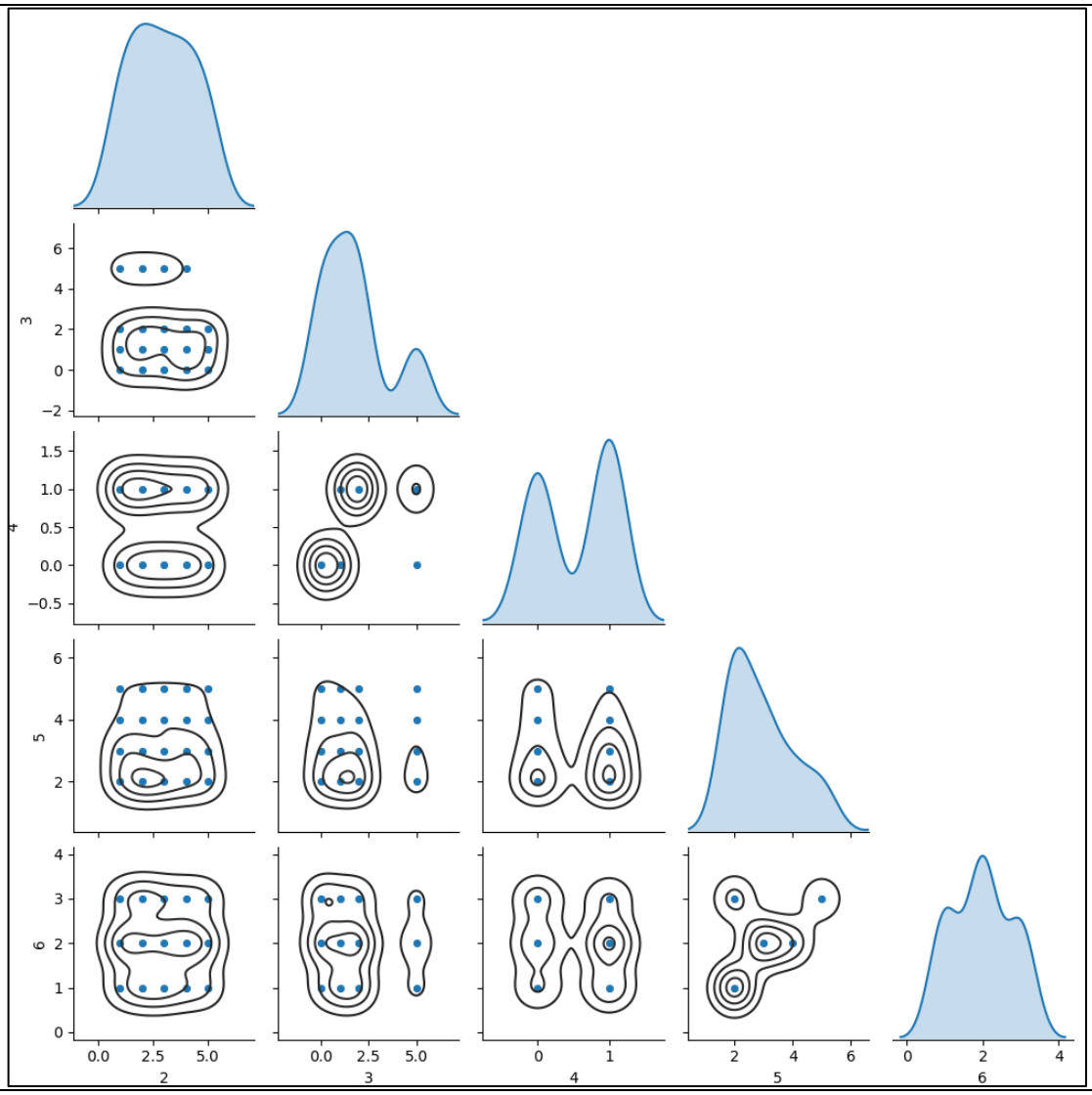
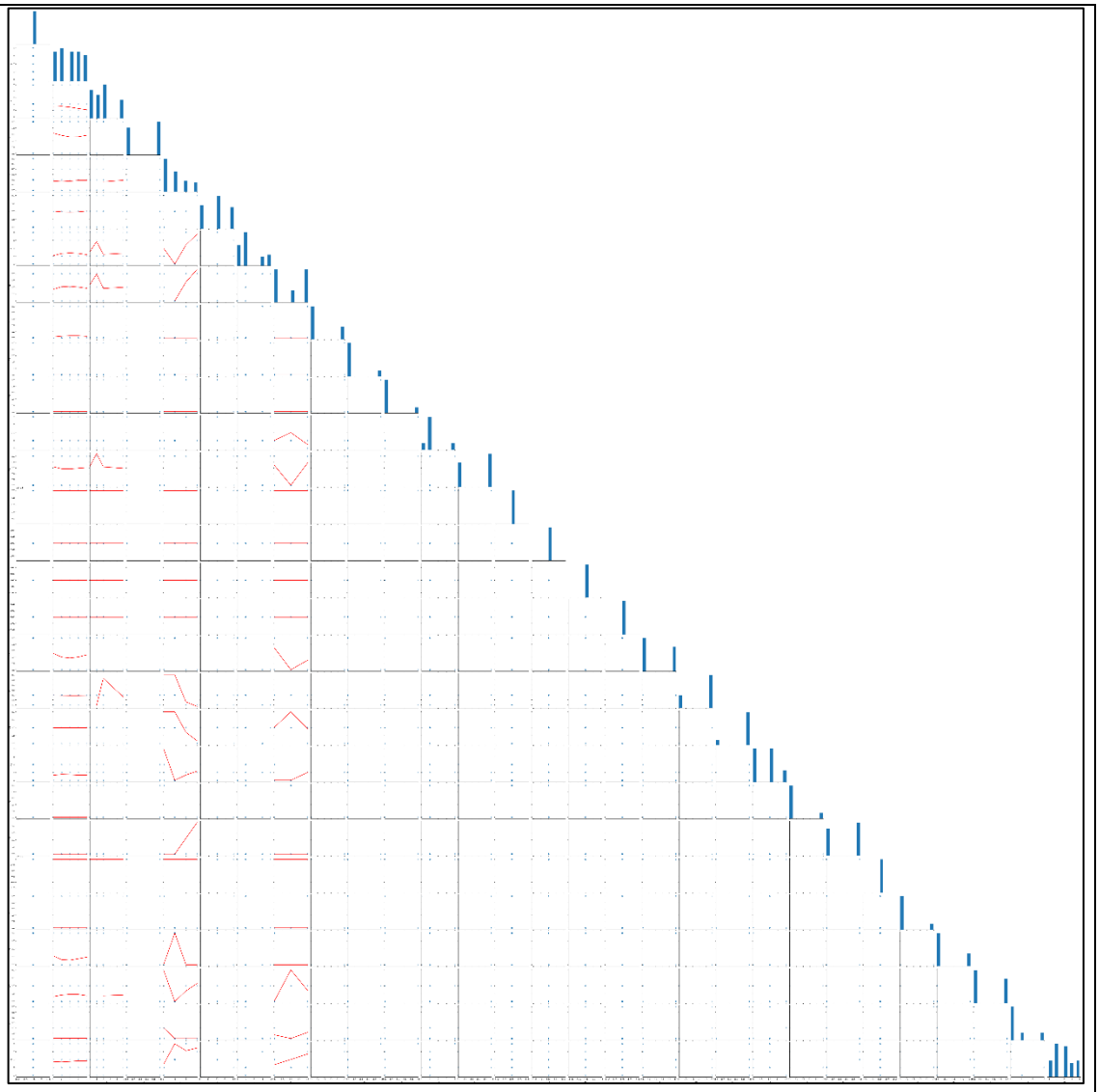
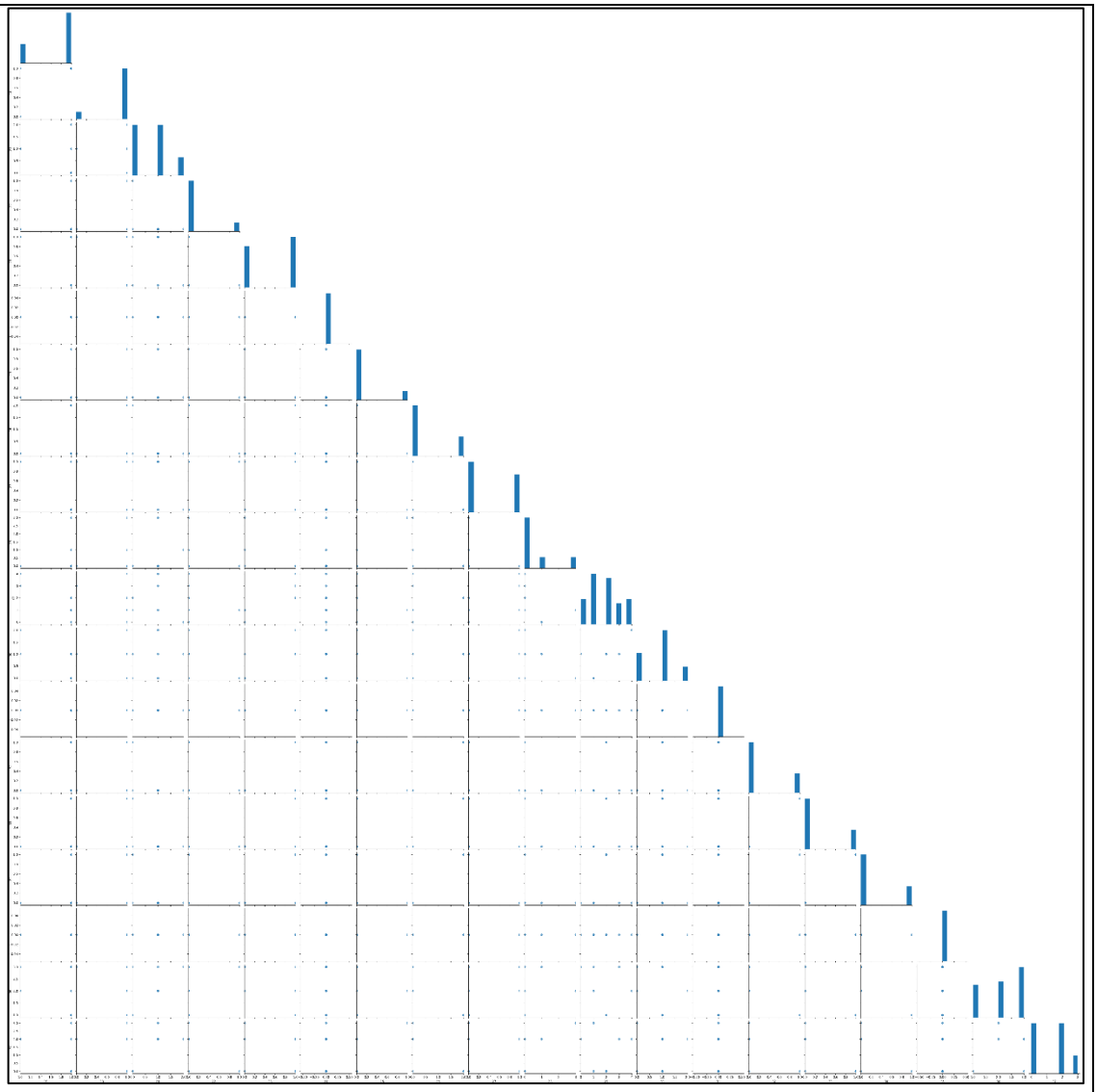
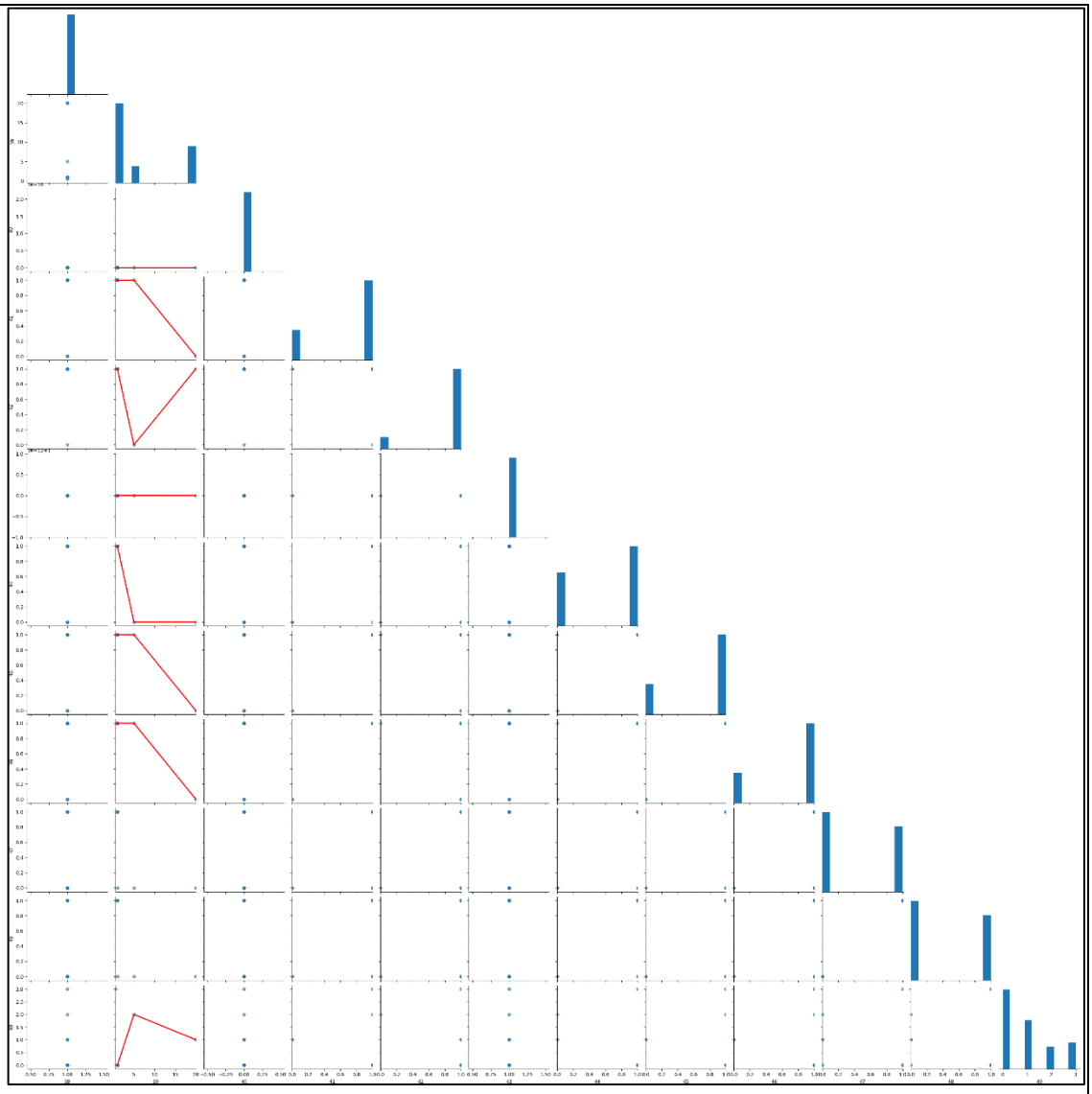
	
7.	Individual domain-based pair plots (Distribution, regression for features and their association) • Multiple domain wise feature comparison is done which provide some of the regression results as discussed in 3. Similar results are observed in these domains. • Clearly multilinear classification observed for population for district, social and economic vs education, environmental vs private jobs. Such observations are observed. Family details



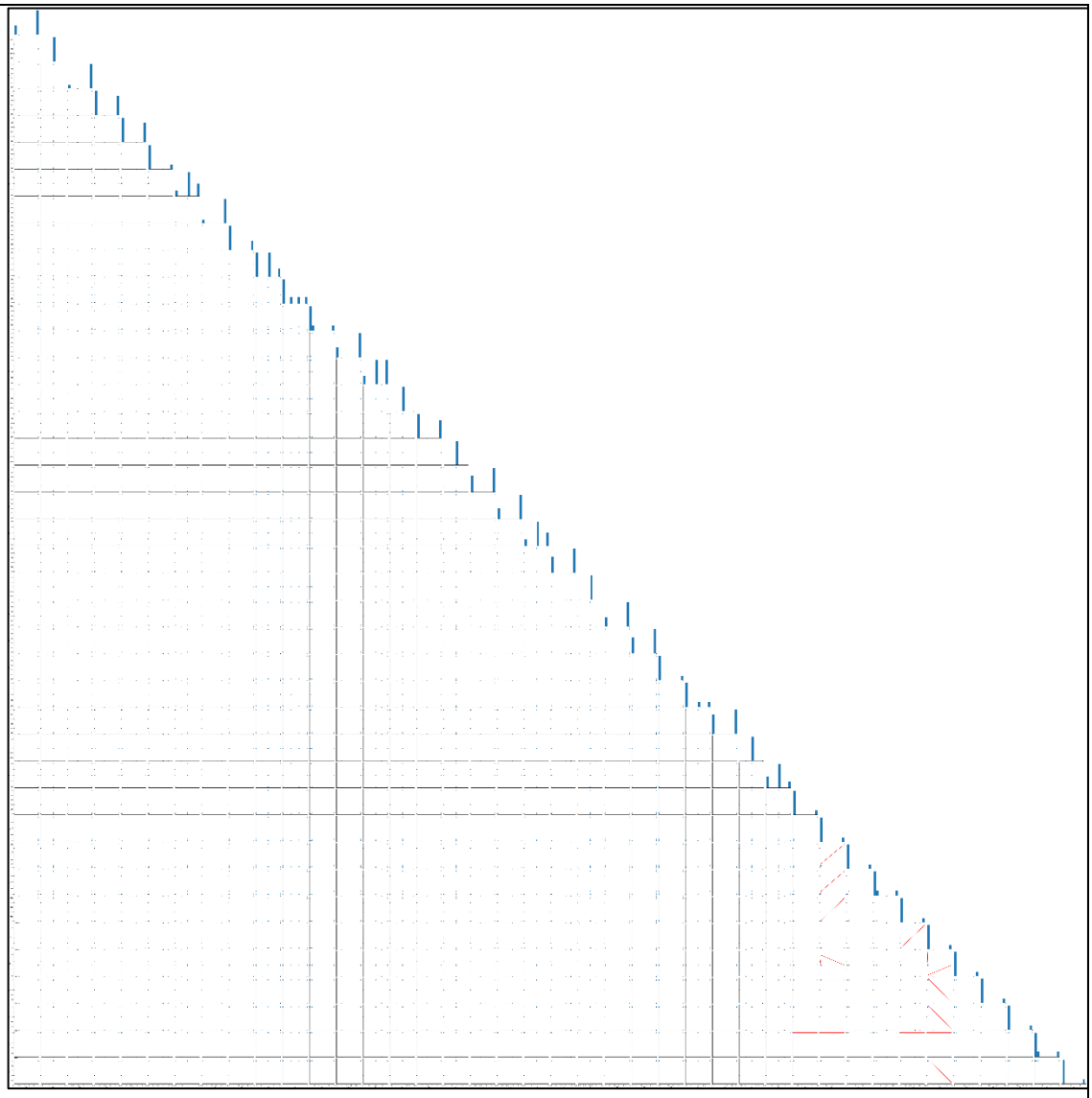
Economics and education



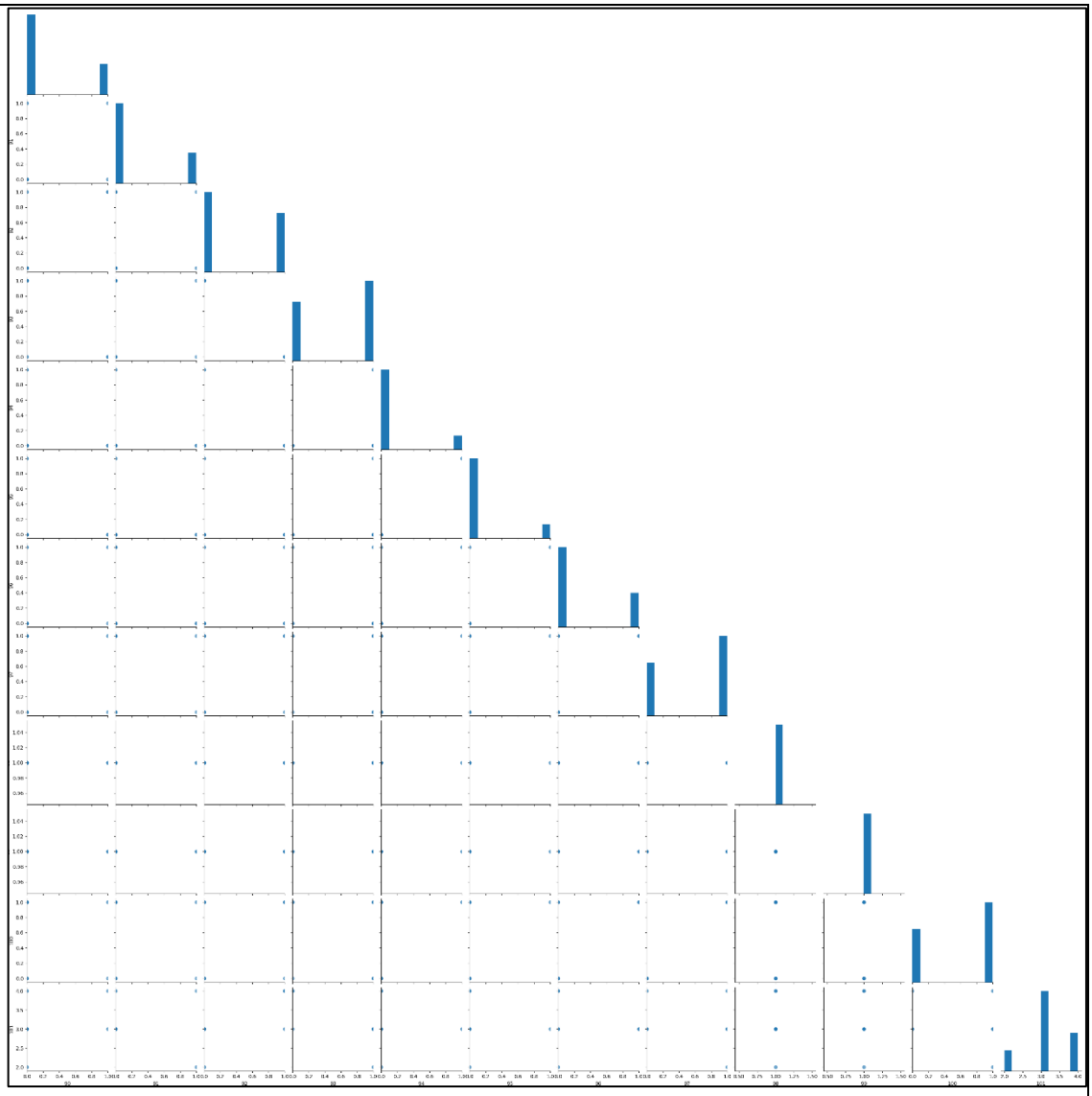
Health Domain



Development domain



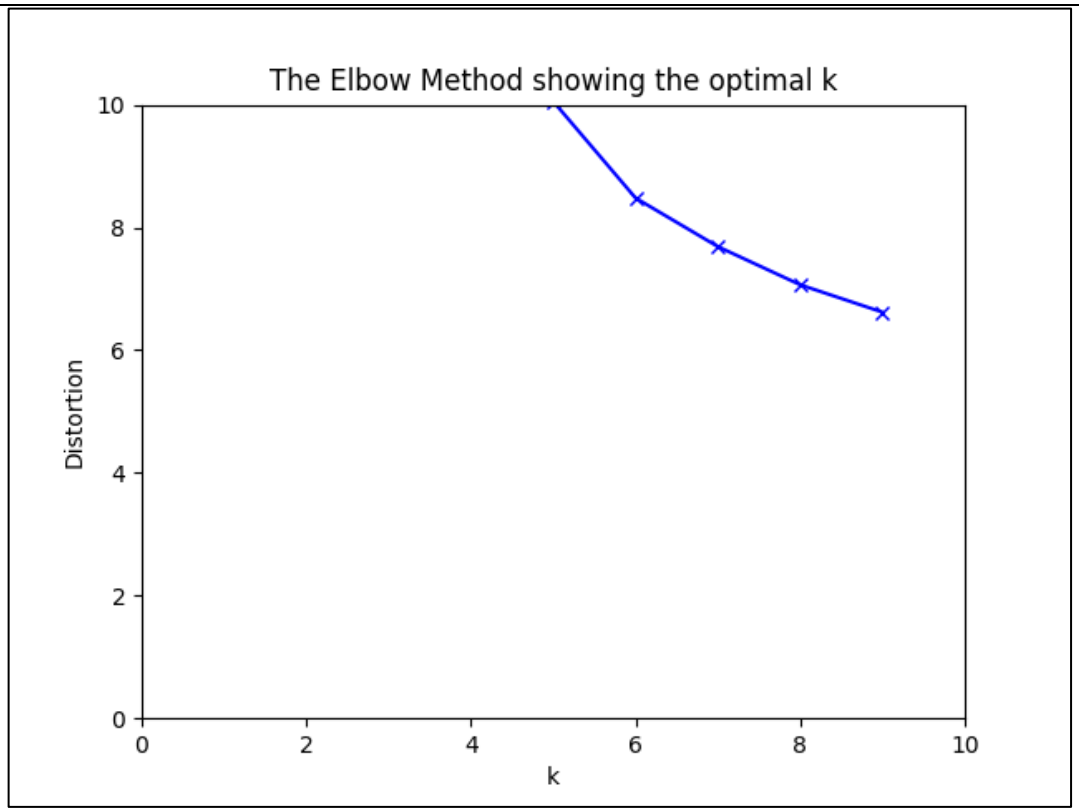
Information available



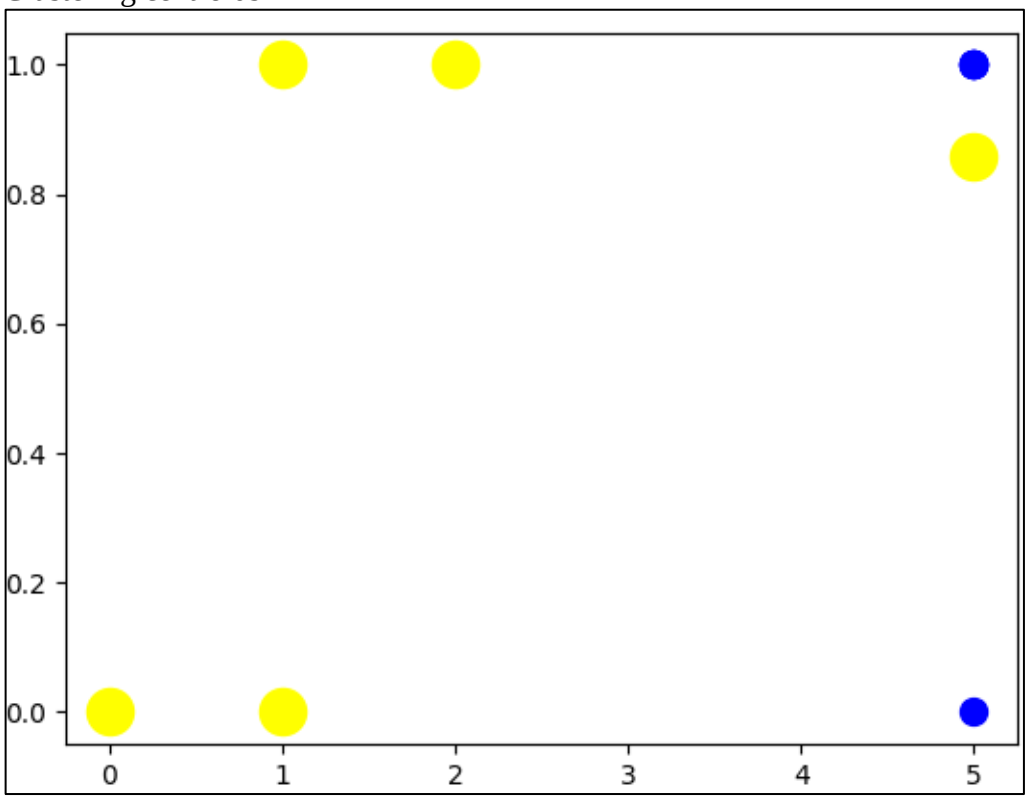
8. Clustering Results

- Clustering is applied on collected data to find out grouping between data. It is clearly seen that grouping on categorical data is not observed well as no of clusters increased. That does not mean lesser clusters are good. The reason is simple categorical data doesn't perform well.

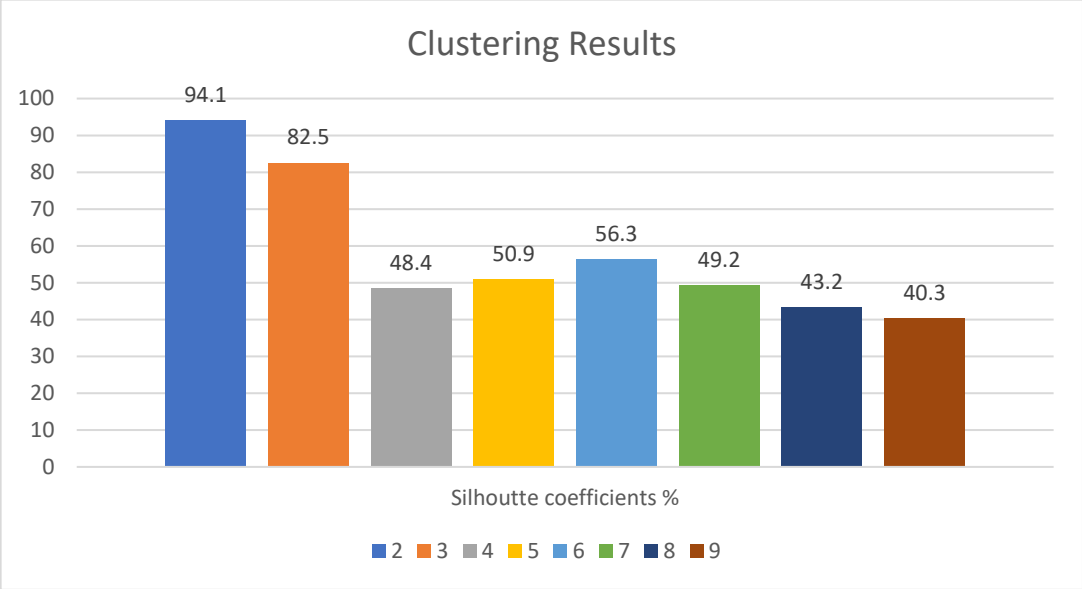
Elbow Results for no of clusters finding: 6



Clustering centroids



Silhouette coefficients are calculated for clusters shown in graph



9. Derived features are generated as follow (to generate these features experts opinion and data captured are considered)
(Table legends 1:Village 2:Category 3:Houseown 4:#familymembers 5:#earningmembers 6:TotalIncome 7:Learningchild 8:FathersEducation 9:MothersEducation 10:Healthserviceindex 11:Sanitizationindex 12:Environmentalindex 13:Economyindex 14:Developmentindex 15: Socialindex 16:Awarenessindex)

- As direct comparison and clustering may not provide holistic picture, hence we derived new feature set based on same data and we observe now social categories, income, parents' education vs other socio-economic indices comparisons.
- These derived features are computed with opinion of expert, features like total income and earning parents has deviation clearly, i.e. no of person income increases clear classification in health and other indices are observed in family. For village development, it isn't making that much difference.

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
1	5	1	8	1	5	1	3	2	3	15	28	0	7	0	6
2	5	1	5	2	25	0	2	3	11	28	18	37	13	30	6
3	5	1	6	1	5	2	2	2	15	21	30	35	14	40	6
4	5	1	5	2	6	1	1	0	1	7	20	5	5	40	6
1	5	1	5	2	6	1	1	0	1	7	20	5	5	40	6
2	5	1	3	2	8	1	3	2	15	22	23	45	13	10	6
3	5	0	3	2	5	0	3	0	15	24	28	30	20	20	6

4	0	0	8	1	5	1	3	2	3	15	28	0	7	0	6
2	0	0	5	2	25	0	2	3	11	28	18	37	13	30	6
3	0	0	6	1	5	2	2	2	15	21	30	35	14	40	6
4	0	0	5	2	6	1	1	0	1	7	20	5	5	40	6
5	0	0	5	2	6	1	1	0	1	7	20	5	5	40	6
1	0	0	3	2	8	1	3	2	15	22	23	45	13	10	6
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3	0	0	8	1	5	1	3	2	3	15	28	0	7	0	6
4	0	0	5	2	25	0	2	3	11	28	18	37	13	30	6
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5	1	1	3	2	8	1	3	2	15	22	23	45	13	10	6
1	1	1	3	2	5	0	3	0	15	24	28	30	10	20	6
2	2	1	8	1	5	1	3	2	3	15	28	0	7	0	6
3	2	1	5	2	25	0	2	3	11	28	18	37	13	30	6
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5	2	1	5	2	6	1	1	0	1	7	20	5	5	40	6
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3	2	1	5	2	6	1	1	0	1	7	20	5	5	40	6
4	2	1	3	2	8	1	3	2	15	22	23	45	13	10	6
5	2	1	3	2	5	0	3	0	15	24	28	30	10	20	6

Pair plots are generated on these derived features

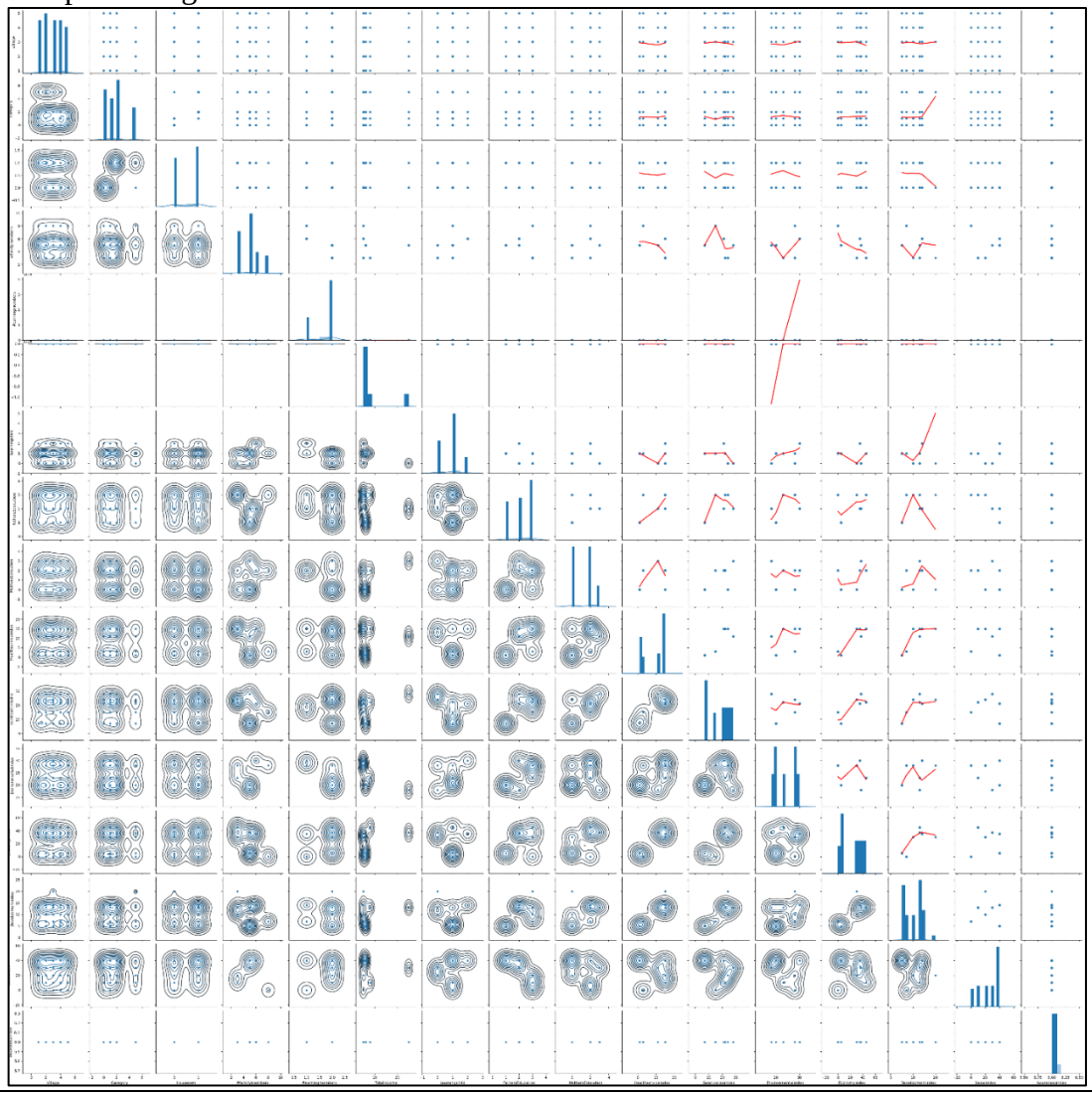
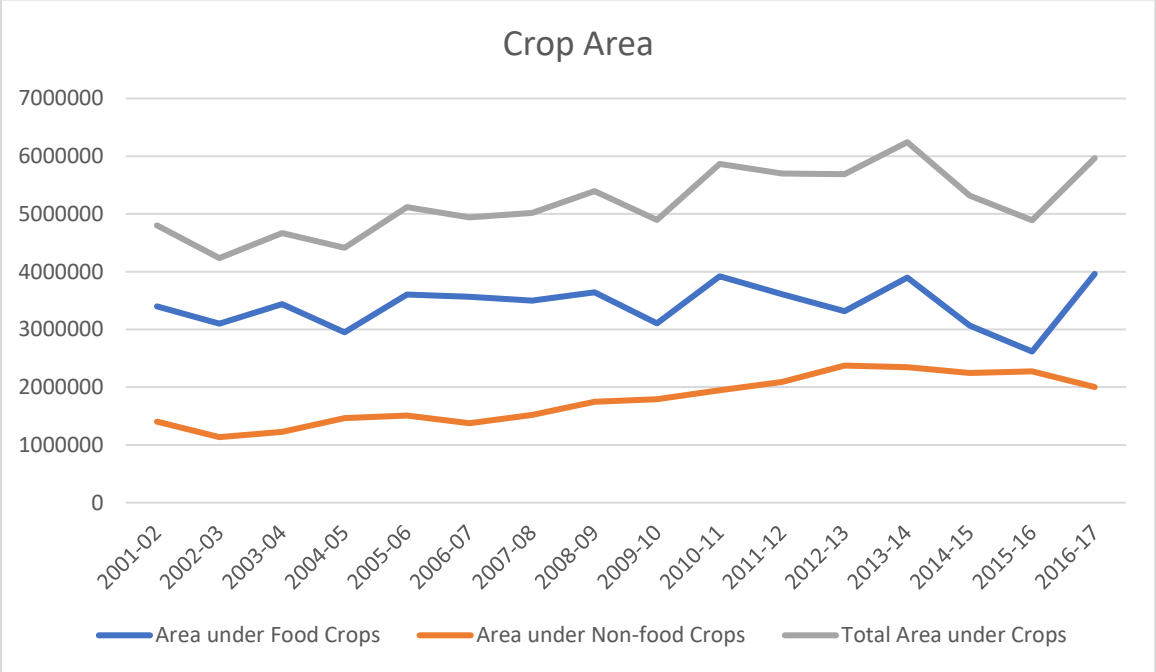
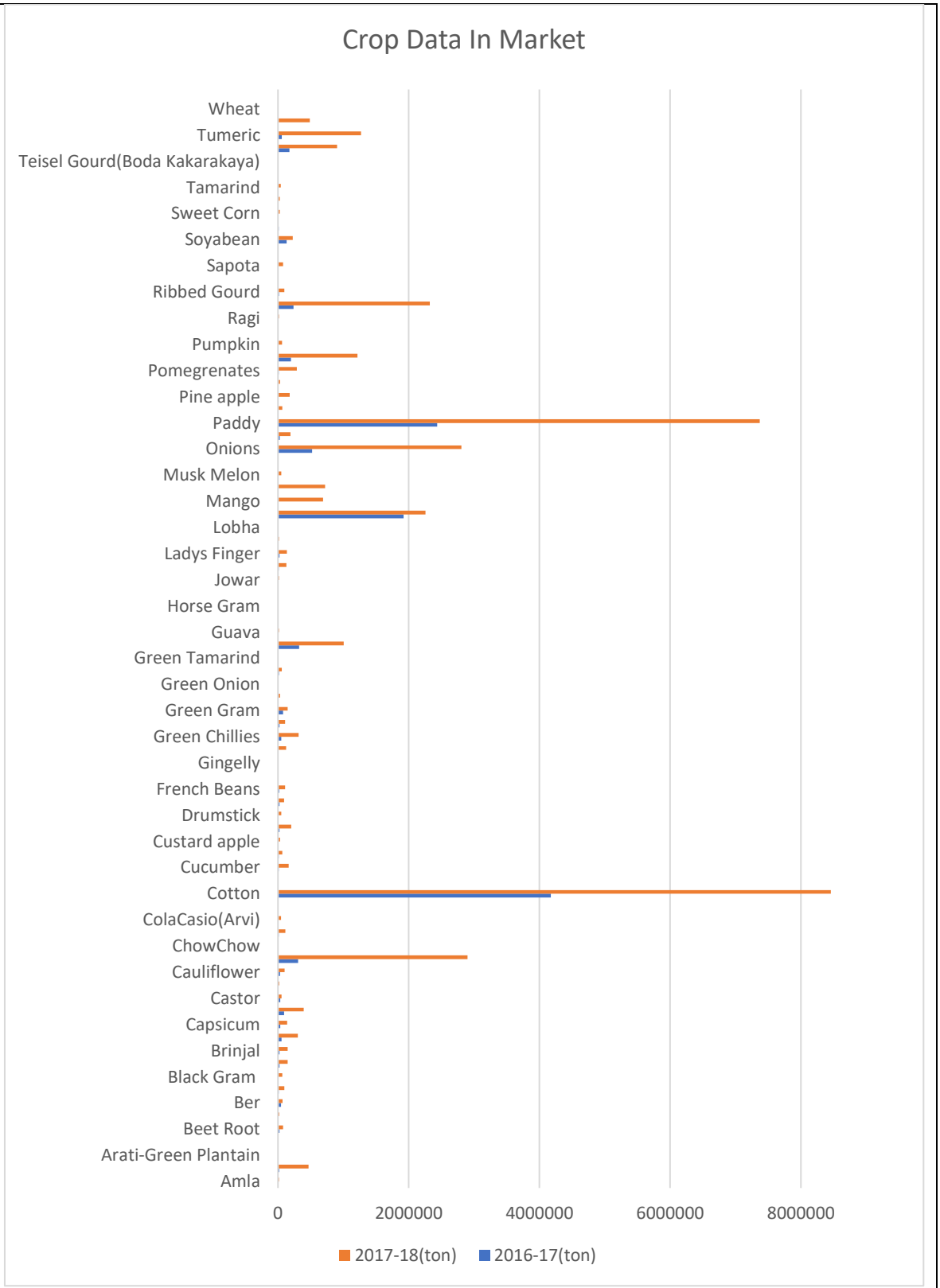


Table 5.2 Results statistical analysis and models

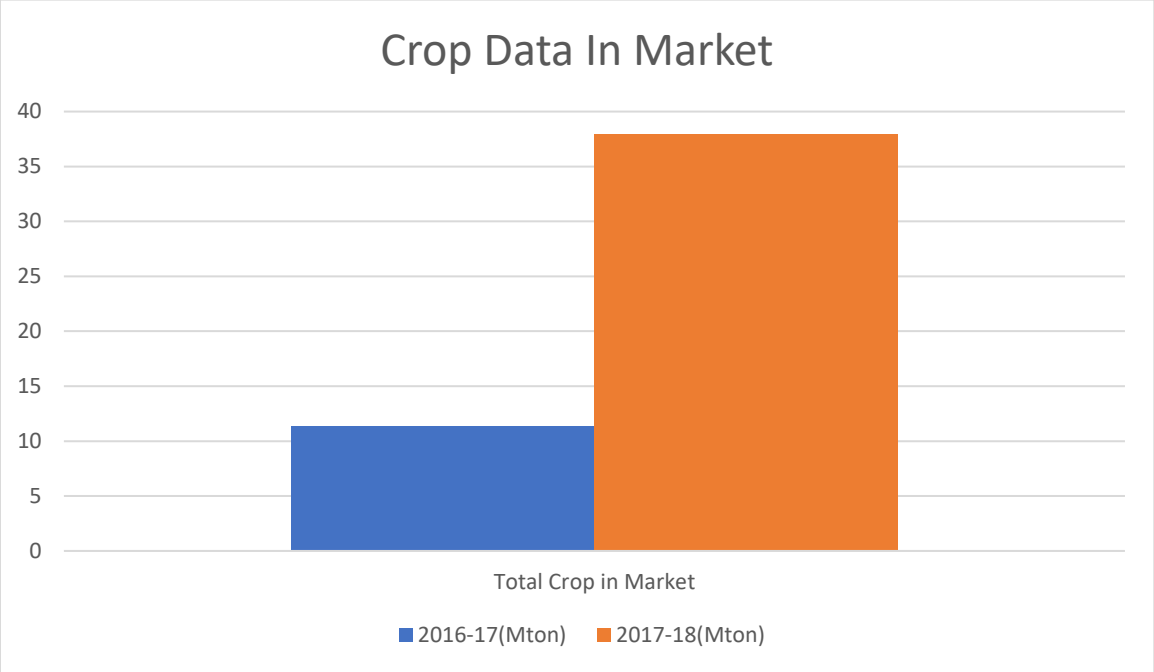
Sr. No	Statistical Results Yearly
1.	 Area for food and non-food crop comparison given which clearly indicate non crop area is increasing as they are providing commercial aspect for farmer

2.



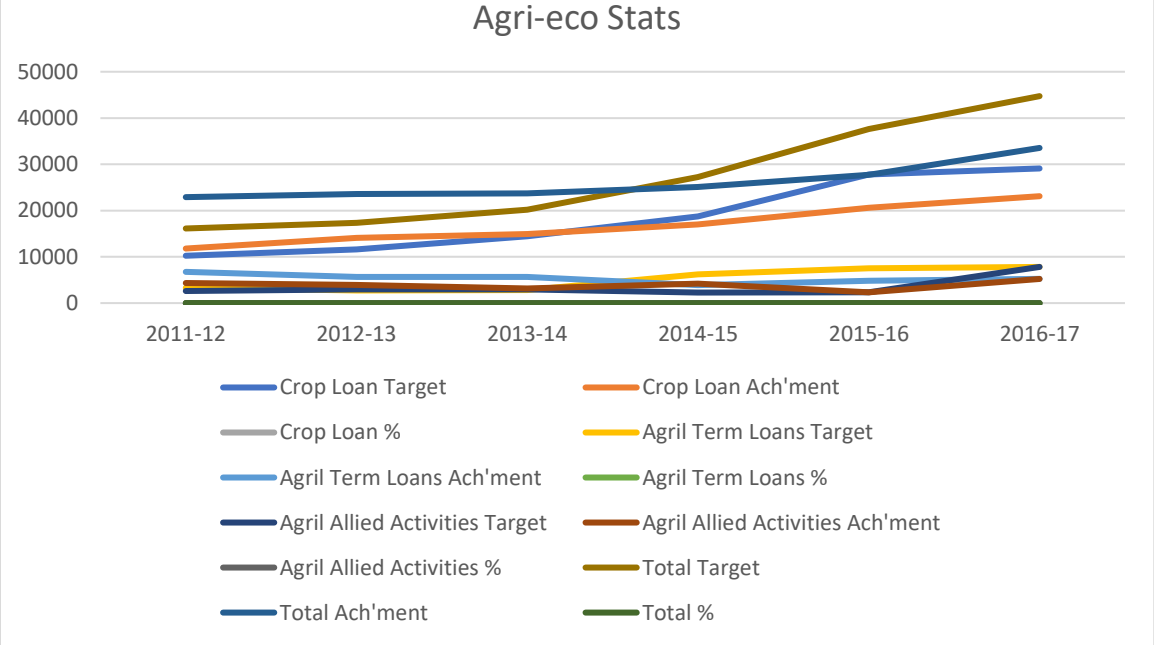
Crops data is increased in consecutive year, it represents improvement in agri-eco index improvement

3.



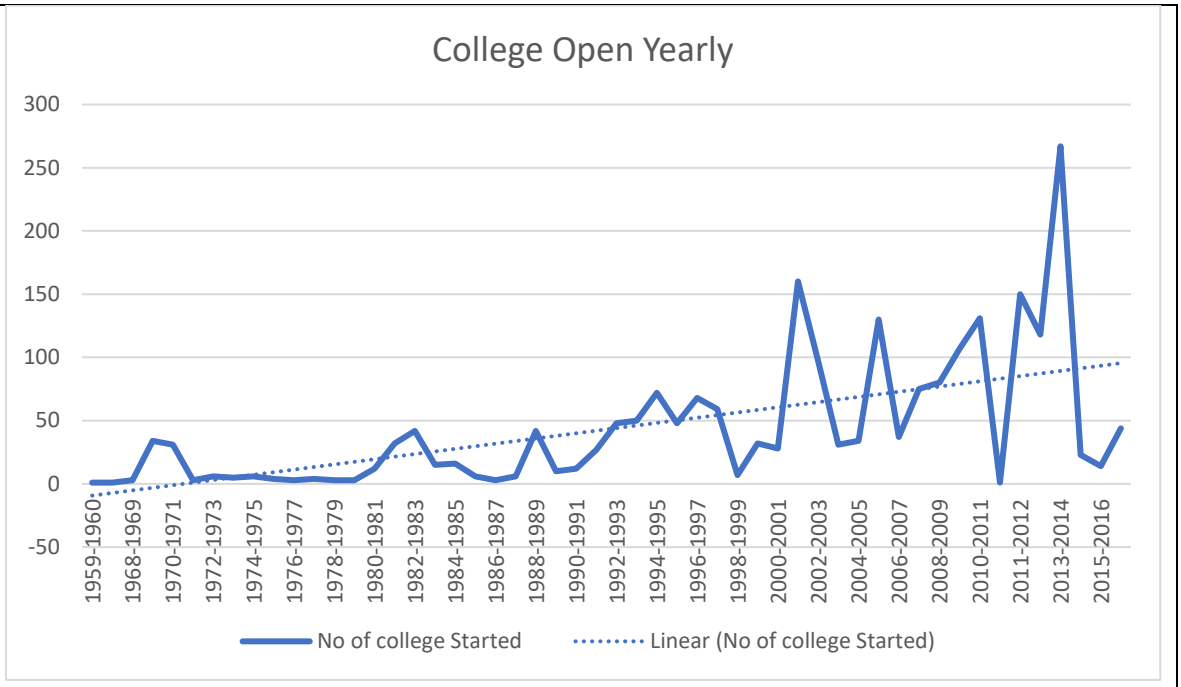
Total crops come in market data in metric ton is given which clealy indicate significant rise.

4.



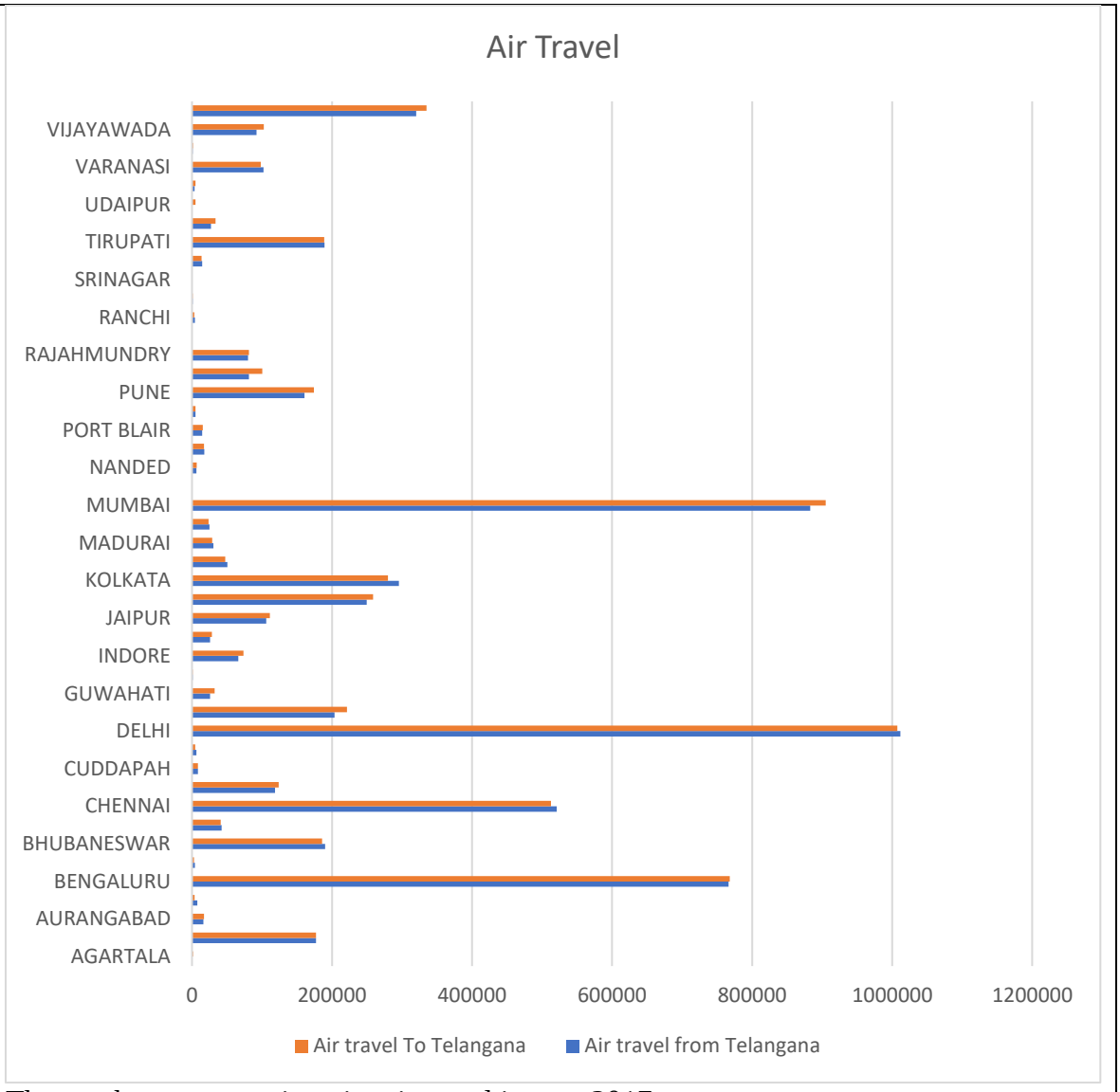
Financial support over the years has been improved for agriculture sector as various policies are adapted by government

5.



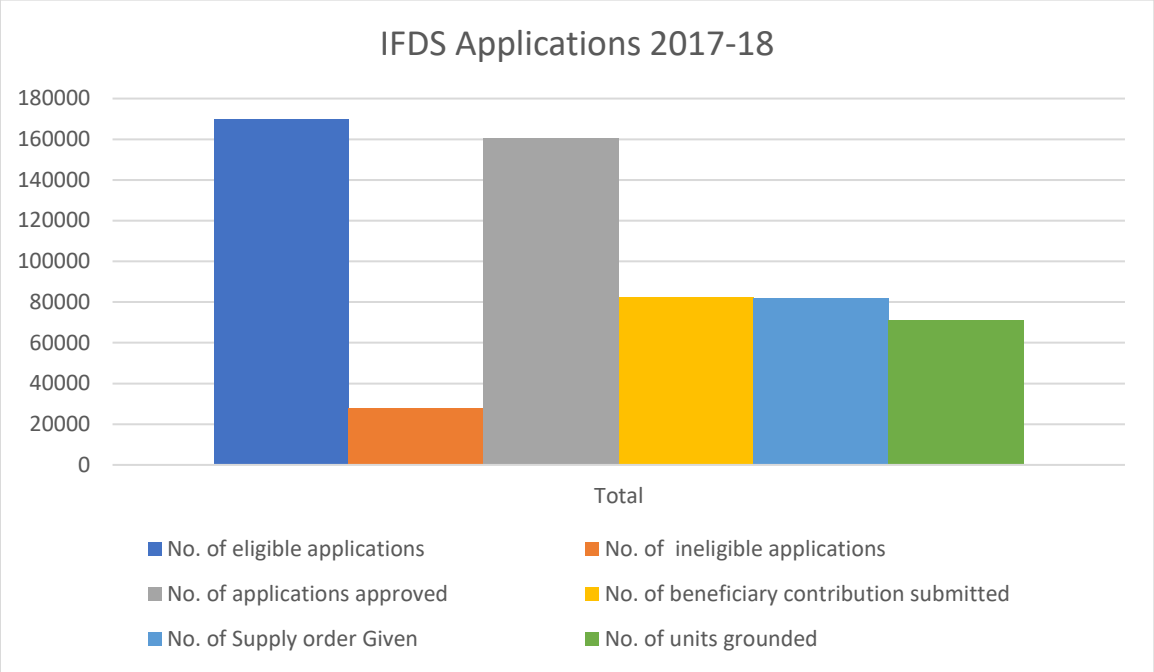
University affiliated Colleges are increased yearly, which indicate good investment in education sector

6.



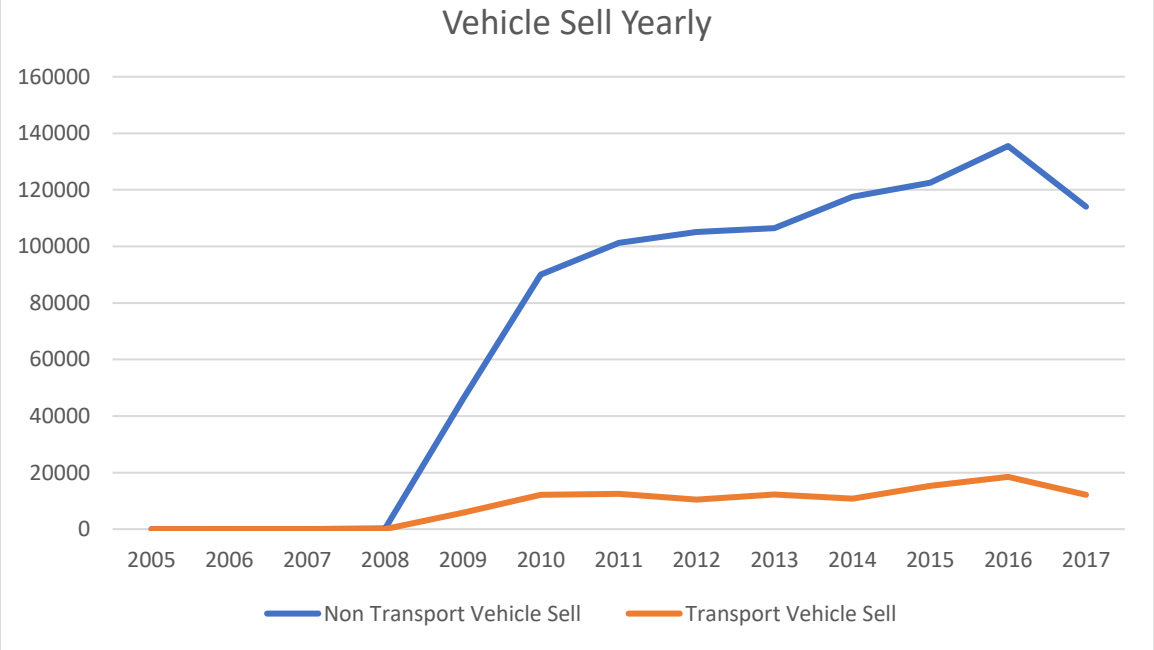
The graph represents city wise air travel in year 2017.

7.



It represents the status of IFDS application received and processed, the no of people are getting aware for new policies of governance and benefits are served.

8.



Graph represents vehicle sell over the year, which clealy indicate transport improvement.

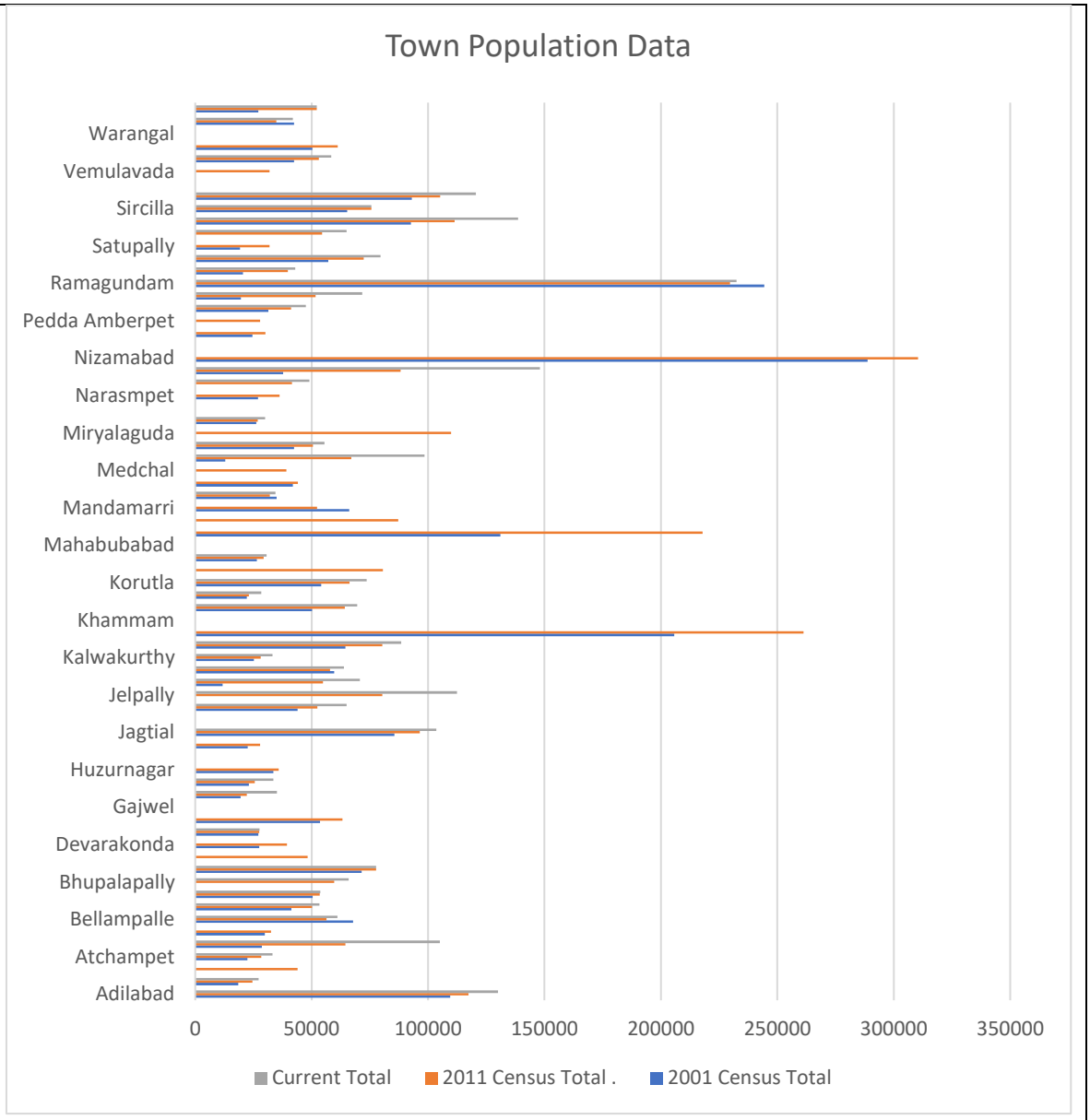
9.	 The graph indicates population in town data.

Table 5.3 Statistical Results

5.3 Summary

Different statistical and derived analysis performed for analyzing data. Clustering is applied for dynamic grouping of data. The results and observations described in section help in decision making in future. The correlation matrix, histogram, regression and other statistical methods finds relationship and different association between data points, as well as it will help in feature association. Hence, different sectors can be targeted for future development and policy making. These feature association also help in prioritizing decisions.

Chapter 6

Summary

Research clearly indicates that improvement in life style due to research and development in India and outside world improved life style of woman, education and health with different parametric. There is still need for improvements in social culture especially for woman like dowry and other cultural issues. As diversified India and Telangana peer to peer association can be majored within family which needed to be different task. As Telangana is recently again divided in 33 districts, more segregation in data and peer analysis can improve in local policymaking and targeted development.

Survey and statistical models clearly indicate that woman education is key for woman empowerment. Well educated mother always helps young generation to grow the socio-economic status of family. Woman education helps in social, economical and cultural development of family which helps in development of village and in society too. Statistical results show that woman impacts in cultivating values related to equality, woman empowerment and also changing tradition obvious male support is equally needed.

The health facility gives major satisfaction in people if they have basic to advance private or governmental facilities. Statistically, health services like private and government clinic (PHCs) are available in all villages from which data is collected. If villages have ambulance, vaccination felicities in addition, satisfaction for villagers are 100%. The common diseases observed are mostly viral, diabetes, and blood pressure which is one of the national problems. This intern indicates that people are needing higher level of health services even it may come up with cost. Also, in case of sanitization rural Indian sanitization is moderate equipped with services available especially drinkable water and water waste management. Most of rural India was already knows importance of these services since ancient time.

Transport services majorly dependent on road services available which connect to places for economic and other domain development. Because of schemes like Pradanmatri Gram Sadak Yojana, all the villages data represent availability of road, which is good indicator, but satisfaction to road quality is almost 70%.

Education is another sector where most of villages has primary and secondary schools, but missing advance education system like college or intermediate schools, for that students

needed to travel to nearest facilities. Similarly, basic village services like police station, library, market place availabilities are, 60%, 45%, 75% respectively. While all villages are having post office services. Almost 40% of villages are having some socio-economic problems like dowery, child marriage etc.

People are still lacking with information about government facilities, which are these facilities, how to avail benefits for development, but they are well equipped with pair support available in rural places. The schemes like LPG Gas have been advertised very well and got 100% usage represented in collected data. Similarly, services and information sources used by almost 100% people are through telephone or internet facilities. If they have knowledge of these government schemes, they are very much pleased and will surely avail these benefits. Current welfare schemes, and its distribution is 0 if statistically its compared. Most of rural area has facilities of economic support by having baking and other support at village or near by village facilities. These services will surely help in development in small scale and agriculture-based industries present in the area.

The agricultural land is shrinking with population growth. This is one of main concern, most of alpabhudarak are suffering from these challenges. As India is agricultural country, this will be future challenge but as population growth curve indicates it may be solved with government schemes and facilities. ICT is another area for concern, most of people are unaware of government schemes. Overall, it is clearly indicating out of eight domains considered for survey, six are having progressive development while some of them need more attention. Relation among them clearly impact socio-economical indexing. The schemes like Swacha Bharat, Every Person Bank Account, LPG Gas availabilities, etc. are advertised well enough as well as they implemented yearly by government and they made huge impact in development. Similar efforts are needed for other ICT schemes and development.

Research Summary

Some of relative observations from project analysis and description

a. There is separation in departmental activities, and development happens 360 degrees but some areas like road is typically lacking in the development
b. Some of the data in relevant department, could not contribute at this stage of analysis, deep analysis will improve
c. Classical methods are practiced for data collection as well as analysis, some of non-classical unsupervised analysis will also contributes in the analysis

According to the time line of the project stated in the submitted proposal we have done

a) LPAC meeting was conducted and modification in objective, key indicators, area of coverage, name of districts to be covered, total no. of villages to be covered and criteria of selection of villages were finalized.
b) The required hardware has been procured
c) Two JRF have been appointed after advertisement for the same.
d) The Questionnaire form for the survey has been finalized covering all the key indicators to get the information about Socio-Economic development status
e) As per the discussion in first LPAC meeting, total 100 villages from 8 districts have been identified for the survey on the basis of finalized population criteria.

New Observations / Shortfall if any.

Observations:

1. Clear indications of Urbanization on specific indicators like Agriculture, Education, Facilities in both positive and negative.
2. SHG are there but with less no of members.
3. Lack of knowledge in obtaining the information and help on various government

schemes.

Short fall:

1. We have to continue survey to get more samples.
2. Telangana is now divided into 33 Districts.
3. To create an MIS, we need to increase the number of districts to be covered and a greater number of sample study so that we can get a clear impact after the new state formation.

Research clearly indicates that improvement in life style due to research and development in India and outside world improved life style of woman, education and health with different parametric. There is still need for improvements in social culture especially for woman like dowry and other cultural issues. As diversified India and Telangana peer to peer association can be majored within family which needed to be different task. As Telangana is recently again divided in 33 districts, more segregation in data and peer analysis can improve in local policymaking and targeted development.

Deliverables

Following are the deliverable

- **Data collection**

  Data is collected from various sources government and in house survey. The data has local sampling as well as global sampling for Telangana State. The data has captured considering socio-economic development of 33 district of the state.

- **Data analysis**

  In-depth analysis is provided for the captured data. The different EDA tools are applied to find interdependencies and interdependent relationships. Preprocessing filtering of captured data is performed. On filtered data information is extracted through various data mining techniques. Analytical, statistical and non-statistical analysis are performed to extract knowledge from information.

- **MIS System developed**

  Management Information system helps to manage data and provide relevant data to decision maker. MIS developed for Telangana State has parametric data as well as analysis of the data. This data can be used for various planning scheme for effective utilization of schemes.

- **Results and discussion**

  The results obtained on analysis performed on captured data, indicates various observations for policy makers. These results are plotted in various graphs for 33 districts of Telangana state. These graphs clearly indicate sector to sector diversity in district. These results can be used for strategic planning.

- **Publications**

  Couple of research articles are published for these case studies.

- **Report**

  In-depth analysis and graphical reporting of the study is documented in the for of detailed report.

- **Suggestion for policy makers**

  Some suggestions, observations are enlisted with the report for further policy making.

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