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Factors Influencing Electricity Distribution using Interpretive Structural Modeling

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Abstract

The purpose of this paper is to identify, analyze and develop a structural model for the identified factors that can influence the electricity distribution using Interpretive Structural Modeling (ISM) approach. From this study, the results specify that the key factors are demand fluctuations, personal protection, uninterrupted distribution, location, construction activities, consumption charges perspective, electrical subsidiary industries. The ISM framework has been developed in this paper, which is a first attempt to analyse the interrelationship among the electricity distribution impacting factors. This study will be useful for practitioners and power distribution companies (DISCOM) to understand the factors influencing electricity distribution.

Keywords
Electricity distribution; ISM; MICMAC analysis; Demand fluctuations

1. Introduction

In recent times due to the impact of the pandemic caused due to the novel coronavirus (2019-nCoV) and it's resulting lockdown has made the electricity demand to drop quickly across India with the implications of confinement and safety measures (IEA 2021). Electricity distribution is considered as the significant area in the power sector operational chain, Indian Government has provided much assistance to states through various sponsored schemes by the state and central government for improving the distribution sector (MoP 2021). Electricity distribution in India is capable to supply around more than 20 crore consumers with a connected load capacity capable to handle higher than 400 GW spread out in 28 diverse states and 8 union territories. Such widely spread customers are connected by almost 73 distribution facilities (MoP 2016). In India, the primary problem is with the large amount of losses in energy that occurs with the electricity distribution, on comparison this is very huge than the other countries and with the worldwide average (Jamasb et al. 2021). For streamlining the maintenance of electricity distribution, networks face a number of obstacles, this is because of the consumer inclination for such services tend to alter disruptively, the number of distributed power resources that are connected to the grid has increased, and more advanced format data interpretation and communication technologies has become omni present day by day (Bovera et al. 2021).

The pandemic protection measures introduced by the government for the safety and well being of the citizens, has significantly brought down the workforce count that is available and also demands strict hygiene and social distancing protocols to maintain flawless and safe operations in their workplace. Reduction in the demand for electricity consumption in the commercial connections has its own challenges where the staff and engineers have to monitor and maintain voltage implications to foresee and meet the future demands, at the same time avoid any chances that can cause any kind of dangers at the grid and distribution levels. With the pandemic emergencies evolving with time, electricity utility companies have to plan ahead for options that can fit in various situations which can be the possibilities to unfold in different time frames making the organisation to be ready for fast and efficient decision-making. Also, it has become mandatory to operate in line with the government and regulating authorities to face the implications that can arises for sustainability, innovation, energy affordability, and security of supply (PWC 2021). The power supply distribution of India completely differs from the highly modernized, advanced and upgraded generation and transmission electric systems, distribution is in a deteriorated condition making the effective generation of power supply to drop. The pace of expansion and modernization of such systems did match with the generation and transmission of electricity; thus, the electricity distribution is now becoming the feeble link in the power sector operational chain (Verma et al. 2020). Yet, the states like Tamil Nadu and Kerala are quite different where the generation, distribution operations are centralized with Tamil Nadu Generation and Distribution Corp. Ltd.(TANGEDCO) whereas Kerala State Electricity Board Ltd.(KSEBL) operates the generation, transmission and distribution of electricity to the state respectively (Das and Srikanth

2020). With such prevailing conditions and challenges in the electricity distribution, as the pandemic safety measure imposing the lockdown and setting up containment zones for the people who are being treated must have uninterrupted power supply throughout. This situation has created an imbalance in the existing structure of electricity distribution for which this research focuses on the various possible factors that can affect the electricity distribution in this context.

The main objectives of this paper are as follows:
• To identify and establish interdependence of the factors that influences the electricity distribution
• To rank the factors based on driving power and dependence of each factors.

2. Literature Review

2.1 Demand fluctuations

The electricity load can be classified into three types, which are commercial, residential and industrial types. Such loads follow a reoccuring load pattern and power genenration is managed to match it accordingly. In the event of COVID-19 pandemic's safety regulations, the ratio of electricity consumption for these types altered drastically, also it has been noticed that the demand for power supply lowered for industrial and commercial types of load and raised for the residential type of loads, as the lockdown restricted many activities and people stayed at home and worked from home. This fluctuation on demand caused a significant change in the operation of power generation and utility operators to handle the situation. Overall the nation witnessed a variation in the demand for electricity distribution by around 10–30% than usual and this change had created not only a financial crisis on the power sector but also gave rise to many problems and challenges considering the socio-economic and practical perspectives (Elavarasan et al.2020).

2.2 Personal protection

The Electrical Personal Protective Equipment (PPE) are used inorder to ensure the safety of the staff and safe opertion of the equipments at the power plant and its premises, the use of disinfectants has become mandatory (Elavarasan et al.2020). The engineers and workers working at power supply facilities must have sufficient protective equipment to protect them from electrical hazards and protection against the exposure to the Covid-19 virus. This has made the use of masks, sanitizers, gloves etc compulsory for the staff.

2.3 Use of Renewable sources

The pandemic also has an impact on the "technological," "economic," and "environmental elements" of teh electric industry. After limitation rules were implemented, a decrease in electricity prices and a decrease in emissions from power generation were quickly noted. This was due to decrease in electricity consumption and an increase in the share of renewable generating. During the epidemic, hydropower and renewable energy sources have nearly replaced thermal power with large percentages of clean energy. Although the proportion of renewable energy increased, the epidemic also saw an increasing reduction in wind and solar output. (Zhong et al. 2020).

2.4 Payment policy

As per the Electricity Act, 2003, "the Central Government shall, from time to time, prepare the National Electricity Policy and tariff policy, in consultation with the State Governments and the Authority for development of the power system based on optimal utilization of resources such as coal, natural gas, nuclear substances or materials, hydro and renewable sources of energy (India Code, 2020)." Forecasting and planning for the power sector is executed by the Central Electricity Authority, under the Indian government. This agency is responsible for executing multiple plans, which includes the preparation of a National Electricity Plan for the country once in five years (Das and Srikanth 2020)..
In Tamil Nadu, the electricity board had offered the following waivers (Chaturvedi et al. 2020).
1) Providing more time duration for the paying the electricity bills
2) Reducing the fixed charges for consumers
3) Initiate an 1% refund for the consumers who pay their electricity bills by online modes of payment within the original due date.

2.5 Uninterrupted distribution

Due to the repeated pandemic, the distribution transformers have higher chances to get overloaded because of the unexpected rise in consumption from the residential distribution. Hence, it is mandatory to monitor and analyze its parameters to prevent any mishaps that can impact residential energy consumption and temporary camps for quarantine purposes through distribution transformers (Alam and Ali 2021). Furthermore, all 70 of the organization's power stations have been given strict instructions to adhere to and requirement social distancing

rules and lockdown guidelines to guarantee maximum safety, and NTPC has affirmed that sustaining an uninterrupted electricity allocation during the COVID-19 crisis is possible (NTPC 2020).

2.6 Location

There are five regional electricity power grids in India: the "Northern Region," "Western Region," "Southern Region," "Eastern Region" and "North Eastern Region." Due to lockdown and restricting movement between states, officials are unable to commute for maintenance and other purposes, in such situations transmission of power supply between the regional grid to create the balance and redundancy were affected to a greater extent during COVID, because of the reduction in regional electricity demand in the initial stages of the lockdown. Also regional electricity generation satisfied the power demand within the region and power distribution and transmission from the nearby regions were very minimal (Elavarasan et al. 2020).

2.7 Consumption charges perspective

The Tamil Nadu Generation and Distribution Corporation Limited, stated its inconvenience to record and note the metre readings during the lockdown due to the danger of the spread of the virus. Domestic customers were therefore requested to pay the same amount on their subsequent bills as they did in January-February 2020. And when the work started to resume after the lockdown consumers had to pay bills that were ten times than the normal as the consumption units were huge and leaving consumers puzzled but TANGEDCO claimed that there were no miscalculations (The New Indian Express 2020).

2.8 Electrical subsidiary industries

The electricity subsidiary industries that provide electrical equipment for the electricity board which are used in the transmission and distribution of electricity made a huge impact. Because of the lockdown the delay in the manufacturing of components to be used in distribution of electricity was unavoidable and transportation suffered time delays. Updating the software systems at remote offices had its own complications.

2.9 Staff salary and operating costs

Pandemic lockdown regulations altered the working hours into multiple shifts among the employees who were predominantly working at office, this had impacted the pay scale and the operating costs of the Electricity board and its effect in efficient distribution and maintenance of power supply to the end user.

2.10 Construction activities

When it comes to the constructional activities taking place in power plants it had no restrictions execpt for the use of personal protection, for the efficient functioning and operation of within the state and outside the state power transmission networks. Construction of industrial projects, equipments at thermal and hydro power generation projects in rural areas and municipalities were allowed with strict regulation to follow safety and precautionary methods (MoP 2020).

2.11 Sector wise distribution

State and Central governments are restricting the business activity to retailiate and reduce the threat of getting prone to coronavirus this has created business slow down leading to global economic recession, educational institutes incorporating online mode of education, transportation sector facing restrictions in aviation and railway modes of operation, closing of shopping complex, amusement parks and malls all leading to the impact of electricity distribution (Elavarasan et al. 2020).

2.12. Manpower

Throughout the day service and monitoring of power system equipments is necessary at the office and substations, staff are designated in shifts. If suppose a team/staff gets tested to be positive for the virus, then the entire team can be identified and quarantined, while the substituting teams can take over the operations (Elavarasan et al. 2020).

3. Research Methodology

3.1 Data collection

The comparison of factors by pair is captured from the opinions of twenty-two experts. The study conducted semi-structure interview with a standard questionnaire. The Purposive sampling technique was used in this study.

3.2 ISM

The link between the components that affect energy distribution is understood and realized using the Interpretive Structural Modelling (ISM) methodology. Many scholars use the ISM method to analyze the correlations between

various aspects in the manufacturing and service industry (Govindan et al. 2013; Kannan et al. 2014; Amrita and Suresh 2016; Keerthana and Suresh 2016; Renganath and Suresh 2016; Abinaya and Suresh 2016; Venkatesh and Suresh, 2016; Sudharsan and Suresh, 2016). For the applicability of the ISM model, the following procedures are used (Suresh et al. 2019a,b)

Finding the variables that affect India's energy distribution is the first stage. This was discovered through an examination of the literature and consultation with subject-matter experts. Table 1 includes a list of the influencing elements.

Table 1. Identified factors influencing electricity distribution

Factors	Description of the factors
Demand fluctuations (F1)	Because to the limitations on "commercial," "industrial," and "transportation" activities in the nation, it was anticipated that the lockdown would have an impact on electricity demand and generation. Additionally, as a result of people being confined to their houses, the demand profile naturally moved from commercial and industrial consumption to personal usage.
Personal protection (F2)	Non-medical frontline workers like police personnel, fire service personnel, sanitary staff, revenue officials, ambulance staff, media persons, official and unofficial volunteers were also affected as they come in contact with the public and except for masks, they are seen without PPE.
Usage of Renewables sources (F3)	How COVID-19 era might impact India's renewable energy transition
Payment policy (F4)	1) Providing more time duration for the paying the electricity bills 2) Reducing the fixed charges for consumers 3) Initiate an 1% refund for the consumers who pay their electricity bills by online modes of payment within the original due date.
Uninterrupted distribution (F5)	In order to regulate a continuous supply of electricity during the COVID-19 crisis, the Indian power provider NTPC has stated that it is doing so, and power stations are required to abide by lockdown and social distancing regulations.
Location (F6)	Electricity board officials have to commute to various household to take the consumptions reading of the users or even in their work place this puts both the EB staffs and the households at risk of transmitting the virus.
Consumption charges perspective (F7)	1)According to TANGEDCO, invoicing for accumulated readings is what causes residents to get shocked by their electricity bills, not a calculation error. 2) Consumers oppose opening of EB collection centres
Electrical subsidiary industries (F8)	Impact of subsidiary industries that provides electrical equipment's for the electricity board which are used in the transmission and distribution of electricity. (both hardware and software)
Staff salary and Operating costs (F9)	To relate the impact of pay scale and the operating costs of the Electricity board and its effect in efficient distribution and maintenance of power supply to the end user.
Construction Activities (F10)	When it comes to the constructional activities taking place in power plants it had no restrictions advised by the Ministry of Power, for the efficient functioning and operation of within the state and outside the state power transmission networks.
Sector-wise distribution (F11)	With lockdown restrictions continuing, the time span to recover for different economic activities for different sectors is doubtful. The level of impact on different sectors vary leading to a slowdown in the Indian economy, which can further influence the demand for electricity distribution.
Manpower (F12)	To relate the impact of number of staffs working under restrictions in EB offices and power plants and then those who are denied to work due to the implied restrictions of the lockdown along with their benefits.

The next step is to determine the contextual link between the pair characteristics listed in table 2.

Table 2. Development of SSIM

From factor	To factor	Action	Direction	SSIM
i	*j*	Influences	One direction	V
j	*i*	Influences	One direction	A
i	*j*	Influences	Both direction	X
i	*j*	No Influence	Both direction	O

Comparison of factors by pair is captured from the opinions of twenty-two experts. The mode is used for selection of opinion from these experts. SSIM is developed using the mode of opinion of each pair and shown in Table 3.

Table 3. SSIM for factors influencing electricity distribution.

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12
F1	1	O	O	O	X	O	O	O	O	X	O	V
F2		1	O	O	O	A	O	O	O	X	O	V
F3			1	V	O	O	A	O	X	O	O	V
F4				1	O	O	O	O	O	O	O	O
F5					1	X	O	O	O	X	V	V
F6						1	O	O	O	O	O	O
F7							1	X	O	O	O	V
F8								1	O	O	O	O
F9									1	O	O	O
F10										1	O	V
F11											1	V
F12												1

The IRM has been derived from SSIM and the rule of binary value steps are outlined in Table 4. (Stage 3)

Table 4. Conversion rule from SSIM to IRM

SSIM (*i, j*)	IRM		Entry value in IRM	IRM		Entry value in IRM
	From factor	To factor		From factor	To factor	
V	*i*	*j*	1	*j*	*i*	0
A	*i*	*j*	0	*j*	*i*	1
X	*i*	*j*	1	*j*	*i*	1
O	*i*	*j*	0	*j*	*i*	0

The IRM for factors influencing on electricity distribution is shown in Table 5.

Developing the Final Reachability Matrix (FRM) after checking for transitivity (Patri and Suresh 2018). Table 6 contains the FRM.

Partition of the factors from FRM into levels (Suresh et al. 2019a).

The digraph has been developed using level partitions and FRM (Suresh et al. 2019b) and the ISM model is depicted in figure1. The detailed interpretations have been discussed in Section 4.1.

Table 5. IRM for factors influencing electricity distribution.

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12
F1	1	0	0	0	1	0	0	0	0	1	0	1
F2	0	1	0	0	0	0	0	0	0	1	0	1
F3	0	0	1	1	0	0	0	0	1	0	0	1
F4	0	0	0	1	0	0	0	0	0	0	0	0
F5	1	0	0	0	1	1	0	0	0	1	1	1
F6	0	1	0	0	1	1	0	0	0	0	0	0
F7	0	0	1	0	0	0	1	1	0	0	0	1
F8	0	0	0	0	0	0	1	1	0	0	0	0

F9	0	0	1	0	0	0	0	0	1	0	0	0
F10	1	1	0	0	1	0	0	0	0	1	0	1
F11	0	0	0	0	0	0	0	0	0	0	1	1
F12	0	0	0	0	0	0	0	0	0	0	0	1

Table 6. FRM for factors influencing electricity distribution.

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	Driving Power
F1	1	1*	0	0	1	1*	0	0	0	1	1*	1	7
F2	1*	1	0	0	1*	1**	0	0	0	1	1**	1	7
F3	0	0	1	1	0	0	0	0	1	0	0	1	4
F4	0	0	0	1	0	0	0	0	0	0	0	0	1
F5	1	1*	0	0	1	1	0	0	0	1	1	1	7
F6	1*	1	0	0	1	1	0	0	0	1*	1*	1*	7
F7	0	0	1	1*	0	0	1	1	1*	0	0	1	6
F8	0	0	1*	1**	0	0	1	1	1**	0	0	1*	6
F9	0	0	1	1*	0	0	0	0	1	0	0	1*	4
F10	1	1	0	0	1	1*	0	0	0	1	1*	1	7
F11	0	0	0	0	0	0	0	0	0	0	1	1	2
F12	0	0	0	0	0	0	0	0	0	0	0	1	1
Dependence	5	5	4	5	5	5	2	2	4	5	6	11	

, represents transitive links*

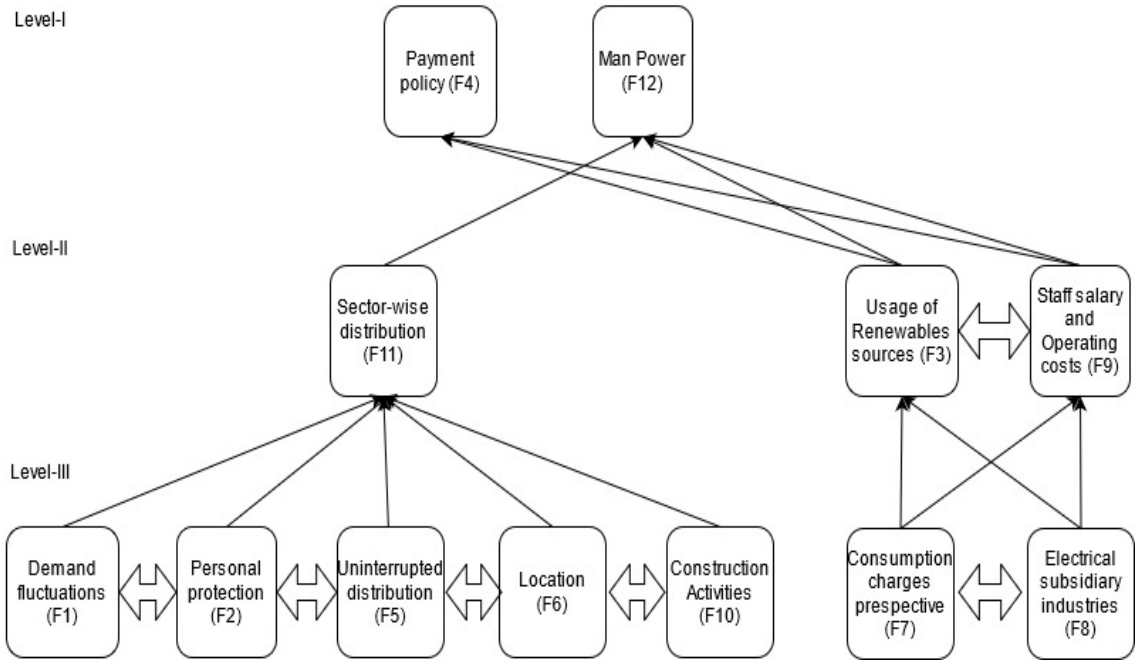

Figure 1. ISM model for the factors influencing electricity distribution.

4. Results and Discussion

4.1 Interpretation of ISM Di-graph

Figure 1 shows the graphical representation of ISM analysis of the identified factors having influence in the electricity distribution.

Level III: Level three has seven factors, which are factor 1, 2, 5, 6, 10, 7, 8.

Factor 1 influencing F5: Demand fluctuation influences uninterrupted supply as the temporary quarantine camps and hospitals and other medical services need 24x7 power supply without any potential drop.
Factor 1 influencing F10: Demand fluctuation influences construction activities because such activities were not kept on hold and proper monitoring was done so that it follows the safety norms.

Factor 1 influencing F11: Demand fluctuation influences sector wise distribution because the medical and health care sector was the top priority for the government and all other industrial sectors, service sectors and residentials were given the secondary importance.
Factor 1 influencing F12: Demand fluctuation influences manpower because sufficient number of staff have to be present at the office and at the substations at all times because at such uncertain situations any failure due to negligence and insufficient manpower is disastrous and costs lives.

Factor 2 influencing F10: Personal protection influences constructional activities because the safety regulations and equipment have to be well sanitized, and any contamination would lead to the suspension of the work.
Factor 2 influencing F12: Personal protection influences manpower greatly because everyone should be provided with safety equipment and masks, gloves, sanitizers etc. to ensure protection from both the virus and electricity.

Factor 5 influencing F1: Uninterrupted distribution influences demand fluctuations to provide 24x7 supply to all areas and healthcare centers without any potential drop in the lines.
Factor 5 influencing F6: Uninterrupted distribution influences location because according to the different areas where hospitals and other healthcare services are established uninterrupted supply has to be ensured but whereas for most of the residential areas this can be compromised a little.

Factor 5 influencing F10: Uninterrupted distribution influences constructional activities because such activities could be delayed when there is a shortage of power supply, based on the priority.
Factor 5 influencing F11: Uninterrupted distribution influences sector wise distribution because only the sectors that are of the top priority like health care, FMCG, food and beverage were focused to have uninterrupted supply.
Factor 5 influencing F12: Uninterrupted distribution influences manpower greatly because all the systems have to be monitored and recorded for safe functioning of the equipment to ensure supply.

Factor 6 influencing F2: Location influences personal protection as many places have become containment zones and staff has to commute to various places within and even outside the city for regular maintenance purposes.
Factor 6 influencing F5: Location influences uninterrupted distribution due to the fact that urban areas, specifically locations where the concentration of healthcare services are being provided has to get more priority than other services.

Factor 10 influencing F1: Constructional activities influences Demand fluctuation was very less because such activities were continuing and proper monitoring was done so that it follows the safety norms and demand shift was affected to a small amount due to it.
Factor 10 influencing F5: Constructional activities influences uninterrupted distribution because there is sufficient generation of power and building more equipment is an added advantage to improve the efficiency of the distribution.
Factor 10 influencing F11: Constructional activities influences sector wise distribution minimally because there are no specific equipment for specific sectors and majority of them are common.
Factor 10 influencing F12: Constructional activities influence manpower so that enough staff are present to ensure smooth operations of the construction.

Factor 7 influencing F3: Consumption charges perspective influence use of renewable resources because consumers can be self-reliant on their own energy sources and get clean energy, thereby reducing
Factor 7 influencing F8: Consumption charges perspective influence the electrical subsidiary industry because the cost at which they procure the components influence the costs.
Factor 7 influencing F9: Consumption charges perspective influence staff salary and operating costs as there is no income to the government from the consumers there can be a crisis in allocation of funds and charges.
Factor 7 influencing F12: Consumption charges perspective influence manpower because it has direct relation with consumers being able to get more knowledge on the charges and services provided for power distribution.

Factor 8 influencing F3: Electrical subsidiary industry influences use of renewable sources as the manufacturing has been stopped for production of such equipment and transportation issues faced while commissioning the project.
Factor 8 influencing F7: Electrical subsidiary industry influences consumer charges perspective because when such services become costly it can reflect in the consumers mindset of being charged with consumption high rates.

Level II: Level two is having three factors; they are the factors 3,9 and 11.

Factor 3 influencing F4: Use of renewable sources influences payment policy, as a consumer they are self-dependent for energy and they can offer excess power to the grid in such cases the policies makes them enjoy their monetary benefits and encourage more of such use.
Factor 3 influencing F9: Use of renewable sources influences staff salary and operating costs in a way so that the operating costs for the effort needed to give connections for households and industries which depend on renewable sources are minimal.
Factor 3 influencing F12: Use of renewable sources influences manpower because it has no much maintenance required and so the manpower required is significantly reduced.

Factor 9 influencing F3: Staff salary and operating costs influences use of renewable sources by minimizing the amount of effort needed by the staff for maintenance purpose and the chances for overtime operational costs are very low.
Factor 9 influencing F4: Staff salary and operating costs influences payment policy because more policies favoring the staff enables them to grant permissions and act more effectively and ensure that there are no overdue and reduces operational costs.
Factor 9 influencing F12: Staff salary and operating costs influences manpower because more the manpower more will be the operational costs and ensured salary for each individual which can either be in excess to the need of manpower or being not sufficient.

Factor 11 influencing F12: Sector wise distribution influences the manpower by the concern of which sector needs more priority and more manpower being used for distribution and regulation purposes relating to that sector. By this method individual focus on sectors can be achieved.

Level I: Level one is having two factors, they are factor 4 and factor 12.
Factors 4 and 12 are related to the objective of the problem.

4.2 MICMAC analysis

MICMAC involves categorization of the identified factors into four classes (Menon and Suresh 2020a; Suresh and Arun Ram Nathan 2020; Lakshmi Priyadarsini and Suresh 2020; Vaishnavi et al. 2019a), and it's shown in Table 7.

Table 7. Factor's classification using MICMAC.

Class	Factor's classification	Driving power	Dependence	Factors
Class-I	Autonomous	Weak	Weak	• Usage of renewable sources • Payment policy • Staff salary • Operating costs
Class-II	Dependent	Weak	Strong	• Sector-wise distribution • Man-power
Class-III	Linkage	Strong	Strong	• No linkage factor
Class-IV	Driving	Strong	Weak	• Demand fluctuations • Personal protection • Uninterrupted distribution • Location • Construction activities • Consumption charges perspective • Electrical subsidiary industries

As per the MICMAC analysis, the factors influencing the last mile delivery is ranked (Vaishnavi et al. 2019b; Vaishnavi and Suresh 2020; Menon and Suresh 2020b; Lakshmi Priyadarsini et al. 2020) in Table 8.

Table 8. MICMAC rank for factors influencing electricity distribution.

Factor	Driving power	Dependence	Driving power / Dependence	MICMAC rank
F1	7	5	1.4	2
F2	7	5	1.4	2
F3	4	4	1	3
F4	1	5	0.2	5

F5	7	5	1.4	2
F6	7	5	1.4	2
F7	6	2	3	1
F8	6	2	3	1
F9	4	4	1	3
F10	7	5	1.4	2
F11	2	6	0.33	4
F12	1	11	0.09	6

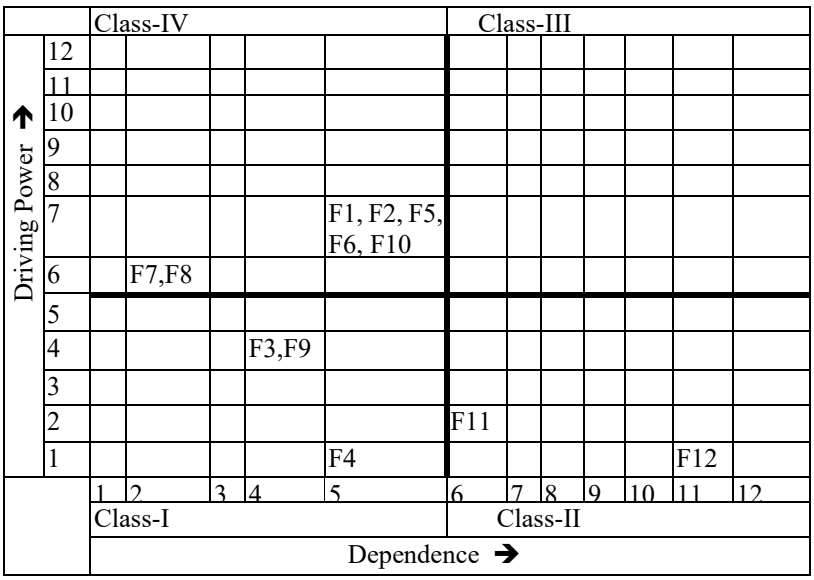

Figure 2. MICMAC graph

Figure 2 depicts the MICMAC graph. Table 8 displays the ranking of the factors influencing electricity distribution. According to the ranking, consumption charges perspective, electrical subsidiary industries are the triggering factors, that ranked one. The factor that is ranked sixth in the MICMAC analysis ranking is manpower.

5. Managerial/ Practical Implications

This research paper has studied and analyzed the interrelationship of factors. The results would help to understand the influencing factors for the electricity distribution among the employees and consumers during repeated pandemic to implement effectiveness in electricity distribution service. ISM and MICMAC analysis help to rank each of the factors based on their influencing level, so that government and distribution centres can concentrate on the top most influencing factor first, and subsequently move on and focus on the rest of the other influencing factors. The first significance is towards the consumption charges perspective and electrical subsidiary industries. The next importance is towards the demand fluctuations, personal protection, uninterrupted distribution, location, construction activities. The usage of renewable sources, staff salary and operating cost are given further importance. After these factors the importance is towards sector wise distribution. Finally the least and last importance has been given to the rest of the factors. Hence, this flow of analysis and rankings would help the government for better effectiveness in distributing electricity.

6. Conclusion

The present study helps the government and DISCOMs to identify the important factors that influence the distribution of electricity. This research paper has applied the ISM approach to identify the factors and the developed model leads to the successful analysis of factors that influences in the electricity distribution sector. The factors consumption charges perspective and electrical subsidiary industries play a significant role in the electricity distribution. The key factors that are identified from this study supports the DISCOMs for the effective distribution of power. This study would assist in identify dependent, independent, linkage and driving factors that influences electricity distribution. The demand fluctuations, personal protection, uninterrupted distribution, location, construction activities, consumption charges perspective, and electrical subsidiary industries are the key factors that are more important for influencing the electricity distribution. Sector-wise distribution and manpower has more significant dependence factors involved in this study. This is because the changes in any of the other factors shows noticeable changes in the manpower and sector wise distribution. Also factors like usage of renewable sources, payment policy, staff salary and operating costs are autonomous factors. Extension of this study can deal with more specific regions so that challenges can be further reduced in future research. And

extending further from the ISM model, the structural equation modeling approach can be used to analyse the structural relationships of the factors identified.

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