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EMPIRICAL ANALYSIS AND FINANCIAL IMPLICATIONS OF THE IMPACT OF OUTAGES ON THE REVENUE LOSS: A CASE OF RELIANCE COMMUNICATIONS

MANMEET KAUR CHATHA
STUDENT
SYMBIOSIS INSTITUTE OF MANAGEMENT STUDIES
SYMBIOSIS INTERNATIONAL UNIVERSITY
KHADKI

SANCHARI DEBGUPTA
RESEARCH ASST.
SYMBIOSIS INSTITUTE OF MANAGEMENT STUDIES
SYMBIOSIS INTERNATIONAL UNIVERSITY
KHADKI

BRIG. RAJIV DIVEKAR
DIRECTOR
SYMBIOSIS INSTITUTE OF MANAGEMENT STUDIES
SYMBIOSIS INTERNATIONAL UNIVERSITY
KHADKI

ABSTRACT

On account of the substantial growth in the telecommunication sector of India, the service providers are expected to provide reliable and consistent network services to their customers. On top of that, the service providers have to struggle between managing their revenue which gets affected by increasing number of outages per day. The present study undertakes the case of Reliance Communications and attempts to analyze the impact of outages on their revenue generation. The data on outages per day and average revenue was obtained from three different tower sites of Reliance Communication in the Maharashtra-Pune-Goa circle; ‘Very High Revenue Earning Sites’, ‘High Revenue Earning Sites’ and ‘Moderate Revenue Earning Sites’. Findings show that revenue loss increases with every unit increase in the outages indicating a strong and positive association between outages and loss in revenue. The study also identifies the tower sites present in this circle which faces heavy losses due to frequent outages.

KEYWORDS

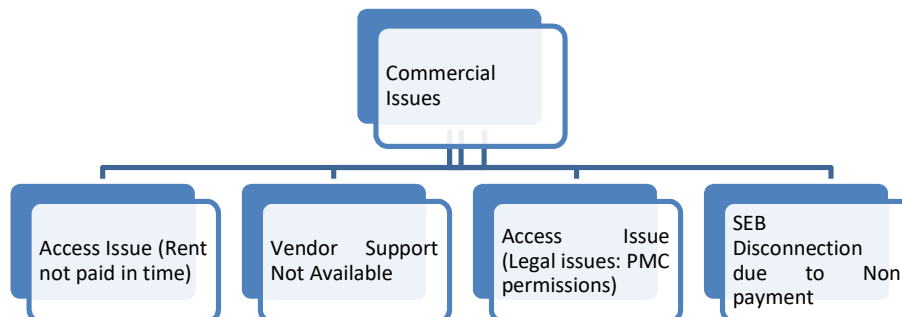
outage, revenue loss, Reliance Communications.

1. INTRODUCTION

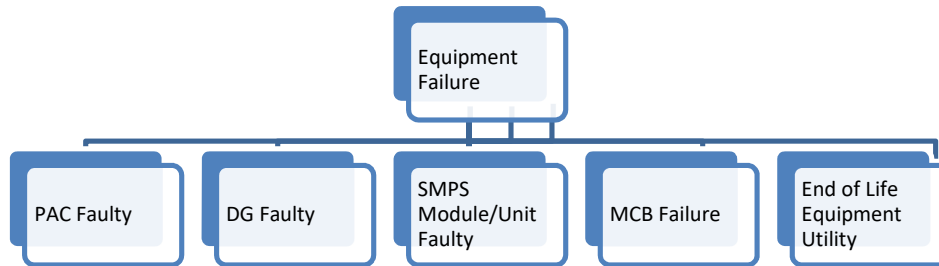
Since the last decade, there has been a substantial growth in telecommunication services in India which has resulted to an increase in demand for smooth, reliable and consistent network availability among the customers (Business Standard, 2014). The service providers, therefore, need to cater to this demand in order to survive in the industry, generate profit and improve customer satisfaction. According to the report published by the National Association of Software and Services Companies (2014), the telecom network has to be built and designed resilient enough that has low downtime and also low recovery time. One of the major challenges faced by this industry is dealing with frequent occurrence of outages (Business Standard, 2014). The term “Outage” refers to the occasions when mobile network is down or inaccessible. Outages are unplanned in nature and a usual-restoration process of outage involves several steps having prolonged lead times. There can be multiple field visits by the preventive maintenance team which are important to locate, identify, and fix the cause code of outages. Because of outages, the network services of the telecom providers become deficient that leads to increased dissatisfaction of the customers who may shift to other telecom providers. Therefore, the revenue lost by the telecom providers because of outages has to be analyzed and reduced so that the operational cost of the tower sites are kept under control and customer satisfaction is enhanced.

The reasons for outages in telecommunication industry are manifold. One particular reason/cause code cannot be assigned to the towers being non-operational. Rather a sequence of events is triggered by outages that lead to disruption of service. For instance, in case of late payment of electricity bill of a particular tower site to MSEB (Maharashtra State Electricity Board), MSEB will temporarily suspend the electricity services of that tower site. In order to make tower sites function, DG back up is used which has a maximum power back of 4 hours after the expiry of which it has to be shut down for the cooling period. Because of DG backup in resting period, the tower sites remain non-operational. As per the various reports of Reliance Communications, the reasons can be categorized as under:

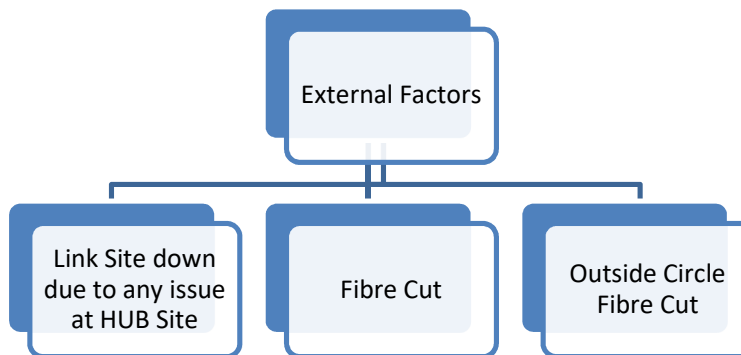
a. COMMERCIAL ISSUES



- **Access Issue (Rent not paid in time):** This issue mainly deals with the rent not being released on time to the owner of the tower sites of which Reliance is the tenant. This further has implications in terms of restricting the access to tower sites by the owner followed by closure of the tower sites leading to outages thus disrupting the network and therefore the services become deficient resulting in loss of revenue by Reliance.
 - **Vendor Support Not Available:** Sometimes the tower sites remain non-operational on account of non-availability of vendor support. The site maintenance work is on contractual basis with the vendors. Sometimes, the scheduled preventive maintenance audit of a particular tower site may be delayed which results in delayed identification of the potential faulty equipment requiring immediate replacement thereby leading to outages when actually the exchange equipment do turn faulty rendering the sites non-operational.
 - **Access Issue (Legal):** While drafting the agreement for tower sites taken on rent i.e. landowner’s agreement, there exits huge legalities to be finalized in order to take approvals and permissions from PMC (Pune Municipal Corporation) so as to make tower sites functional. The time lag between filing of requisite affidavits by the company and receipt of approvals from PMC accounts for the one of the reasons for the tower sites being non –operational.
 - **SEB Disconnection due to non-payment:** This is one of the major cause codes for the occurrence of outages. The prolonged delay in releasing the payments to MSEB (Maharashtra State Electricity Board) by the Reliance Infratel Team results in outages as MSEB temporarily suspends the electricity supply to the tower sites if payment is not received on time.
- b. **EQUIPMENT FAILURE**



- **PAC Faulty:** There are certain defined temperature bands for the equipments used in the telecom tower sites. BTS (Base Transceiver Station) equipment is used to facilitate wireless communications where all the communication networks & equipment are housed and protected. PAC equipment i.e. air conditioning equipment is used in the BTS in order to maintain the rising temperature band and humidity control beyond which the electrical equipment will not function properly, which if risen would lead to the disruption of the services resulting in outages.
 - **DG Faulty:** The foremost requirement of a BTS site is regular and consistent power supply, which could be available through MSEB (main line), Diesel Generator (DG) and batteries. When the power supply from the main line fails then DG is used as a back up to provide power supply to BTS but DG has a working life of 3-4 hours after which it needs to be shut down for cooling. DG faulty issue arises when DG has been overused or diesel i.e. lubricant oil required to operate DG is not filled in time leading to outages, thus resulting in tower sites being non-operational.
 - **SMPS Module/Unit Faulty:** SMPS stands for Switched Mode Power Supply which is used in telecom tower sites to convert AC power supply to DC. Most of the equipment installed in tower sites requires DC voltage for being operational. Therefore, if SMPS module becomes faulty, the other equipment that requires DC voltage will not function resulting in outages.
 - **MCB Failure:** MCB (Miniature Circuit Breakers) prevents the telecom equipments from breakdown to over power supply. MCB failure leads to breakdown of telecom equipments which are pertinent to the tower sites to be operational.
 - **End of Life Equipment Utility:** This equipment facilitates connectivity between HUB and link sites through fibre optical cable. On account of failure of this equipment at HU site, the link sites dependent on the HUB sites will become non-operational resulting in massive outages and will significantly impact the revenue of the company.
- c. **HUMAN ERROR**



- **Link Site down due to any Issue at HUB Site:** This issue arises when the HUB Site becomes non-operational due to any cause code mentioned above under different categories which significantly impacts the Link Sites as connectivity is disrupted rendering the services of the company deficient to the customers.
- **Fibre Cut:** There exists two types of connectivity between the telecom operator and the device (mobile handsets, landlines, modem, routers etc) that facilitates the delivery of network access and services to the customers: Fibre optical cable (underground connectivity) and microwave (airwave connectivity). If there is an occurrence of fibre cut in and around tower sites, then the connectivity is disrupted rendering the tower sites non-operational resulting in increased number of outages.
- **Outside Circle Fibre Cut:** Under this issue, sometimes the local/state authorities for the purpose of initiating any road work digs the land without identifying the fibre cable markings that further disrupts the service connectivity leading to outages thus rendering towers non-operational, Because of this reason, the telecom companies are incurring huge cable repairs and replacement costs thus significantly impacting their revenue.

2. REVIEW OF LITERATURE

Study conducted by Chayanum (2005) revealed human errors and operations failure to be the root causes behind outages. The study also explained that number of outages can be reduced only with best practice and this is important to ensure quality service. Townsend and Moss (2005) conducted a study on the issues with the telecommunication infrastructure and mentioned that outages caused due to disturbance in the infrastructure are more damaging and widespread. O’Reilly

et al (2005) talked about costs incurred by telecommunication service providers during a period of outage and also mentioned about its cascading impact on the infrastructure. Fernandes and Pakes (2008) conducted a study in India and found that firms that suffer from outage face heavy production losses. Isaksson (2009) In a report published by the Federation of Indian Chambers of Commerce and Industry (2012), it was mentioned that the power outages led to a revenue losses that went upto Rs 40000 per day. As per a report published by Intelligent Energy (2012), the Indian telecom industry has faced difficulties due to outages in excess of eight hours per day in the telecom sector. Alam’s study also revealed that industries that are electricity intensive, increase in the frequency of power outage lowers the output and revenue (Alam, 2013). In a study conducted by Allcott, Wexler, and O’Connellú (2014) on Indian textile plants, it was seen that frequent number of outages have a severe impact on the output generation of smaller plants. Delloite (2014) published a report on the growth of the telecom sector and focussed on the need for the service providers to be better equipped to reduce the number of outages. Study done by Fredrick and Selase (2014) on SMEs in Ghana revealed that more number of outages lead to a low profitability which in turn leads to a negative returns on assets. In a study done by Alban, Isaac and John (2014) among SMEs in Tanzania, it was found that the SMEs bear an enormous cost due to outages which in turn also affect their productivity. Matthewman and Byrd (2014) in their research mentioned about the fact that power outages lead to economic losses in terms of loss in sales and production. Siddiqui Ahmad and Athar (2015) conducted a study to find out outages impact the firm’s profit and in return the GDP of the country. They found that more outages lead to minimize the firm’s profit and in turn directly affects the GDP of the country. Forkuoh and Li (2015) showed a similar result which revealed that outages negatively impact the growth of the small and medium enterprises.

3. NEED FOR THE STUDY

The study is important to understand if the number of outage significantly affects the revenue loss incurred by Reliance. It is also important to analyze the reasons for outages in a comprehensive manner so as to reduce the frequency of occurrence in order to lower the financial impact of the outages on the revenue earned by the respective tower sites i.e. the part of the revenue that is lost because of outages that further leads to service disruption causing huge dissatisfaction among customers who might shift to some other telecom service provider thereby losing out the loyal as well as prospects customers for the company.

4. OBJECTIVES

- 4.1 find out if the change in daily outage impacts the change in the average revenue loss
- 4.2 identify the tower sites that face heavy losses due to outage

5. HYPOTHESIS FORMULATION

Based on the second objective, the following hypotheses have been formulated

H0: $\beta_1 = 0$

H1: $\beta_1 > 0$

Where, y = Revenue loss per day

x = Outage per day (in hours)

β_1 = Estimate of the effect of a unit change in outage per day (x) on the revenue loss (y)

6. RESEARCH METHODOLOGY

6.1 RESEARCH DESIGN

➤ **METHOD OF RESEARCH**

- The method adopted for the study is quantitative in nature based on secondary data received from Reliance Communication.
- The data regarding the network outages for the month of March 2016 (from 9th – 31st March 2016) was received from the network team of Reliance and the respective quantum of outage minutes for 23 days was calculated for the following three categories:

Category A (Very High Revenue Earning Sites) which consists of tower sites of Reliance used by RCOM (Reliance Communications), RJIO (Reliance JIO) & other operators.

Category B (High Revenue Earning Sites) which consists of tower sites of Reliance shared by RJIO i.e. RCOM+RJIO

Category C (Moderate Revenue Earning Sites) which consists of tower sites of Reliance shared by RCOM only. Categories mentioned above.

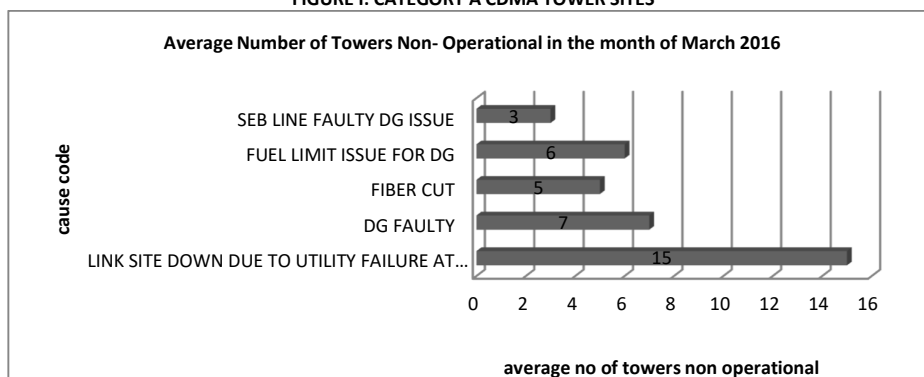
- The average revenue as per industrial average was calculated for the all respective 3 categories mentioned above. For the purpose of calculating the average revenue for each category, the following 3 assumptions based on industrial average were considered:
 - i. The average number of customers assumed for Category A was 500, Category B was 400 and Category C was 300.
 - ii. The average minutes a customer might use the services of Reliance, are assumed to be 60 minutes for each of the 3 categories mentioned above.
 - iii. The average revenue earned is ₹0.4 per customer per call.
- The revenue loss for each of the category was calculated based on the average revenue outage per day in hours that was calculated on daily basis from. 9th-31st March, 2016.

➤ **Statistical Tools and Technique:** Simple Linear Regression Technique was used to find out how a unit increase in outage per hour impacts the average revenue loss.

7. RESULTS AND DISCUSSION

7.1 REASONS BEHIND THE NUMBER OF NON-OPERATIONAL TOWERS IN THE MONTH OF OF MARCH (9th to 31st) 2016

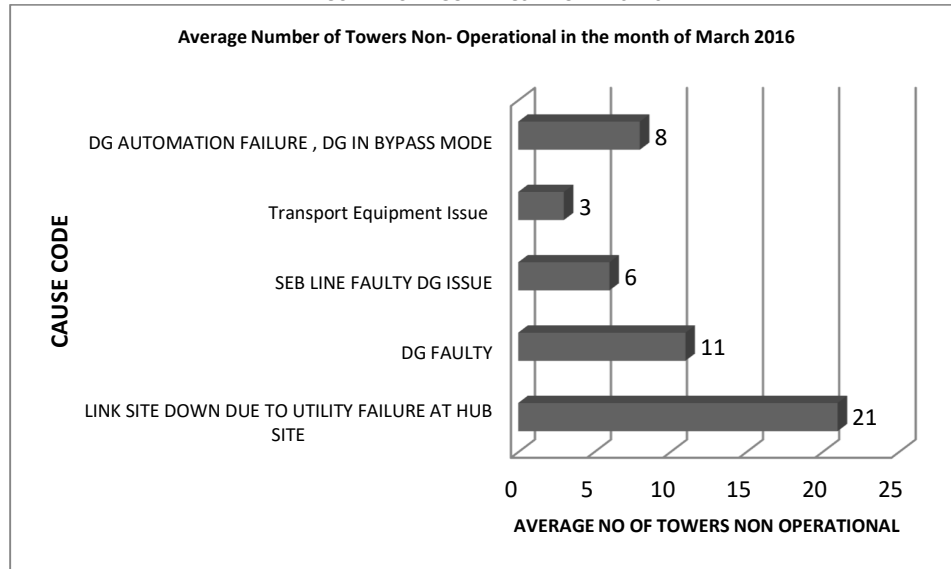
FIGURE I: CATEGORY A CDMA TOWER SITES



Source: Data collected from RCOM

For CDMA tower sites, the maximum proportion of average number of towers non-operational (41.67%) in the month of March 2016 has been attributed to the cause code "link site down due to utility failure at HUB Site" (FIGURE I). Out of 36 non-operational sites (being average for the month of March), 15 sites were non-operational because of Hub Site failure issue. HUB Site is basically a tower site on which atleast 5 other tower sites depends for signal transmission, so if 1 HUB Site is down or non-operational, then the sites which are dependent upon that particular HUB Site will be non-operational, thus losing out on the revenue for the time the sites remain non-operational. Other important reasons are DG Faulty, Fibre Cut and Fuel Limit Issue for DG.

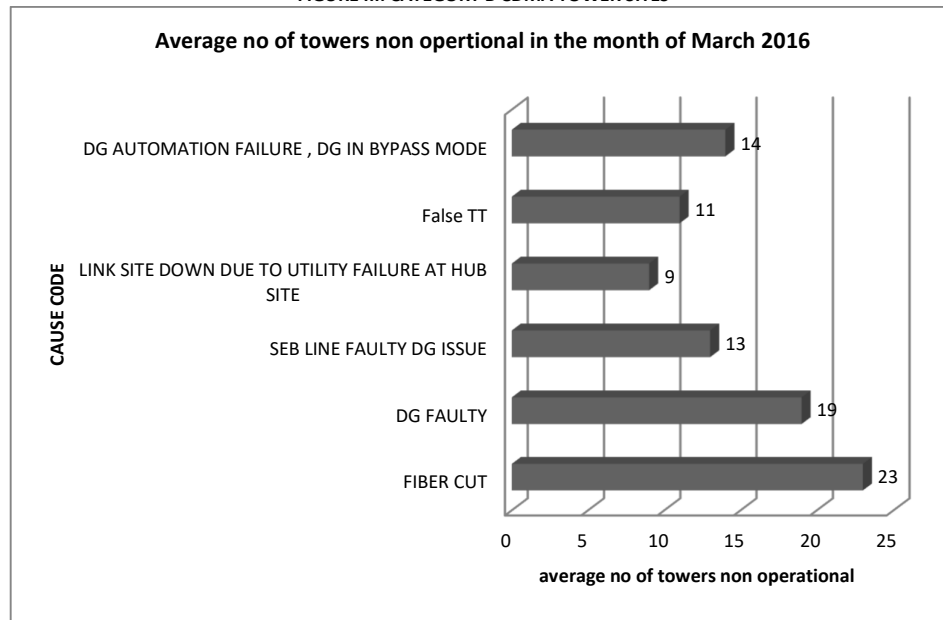
FIGURE II: CATEGORY A GSM TOWER SITES



Source: Data collected from RCOM

For GSM tower sites, the maximum proportion of average number of towers non operational (42.8%) in the month of March 2016 has been attributed to the cause code "link site down due to utility failure at HUB Site" (FIGURE II). Out of 49 non operational sites (being average for the month of March), 21 sites were non operational because of Hub Site failure issue. The other reasons constitutes: DG Faulty (22.4%), DG Automation Failure (16.3%) & SEB Line Faulty DG Issue (12.24%).

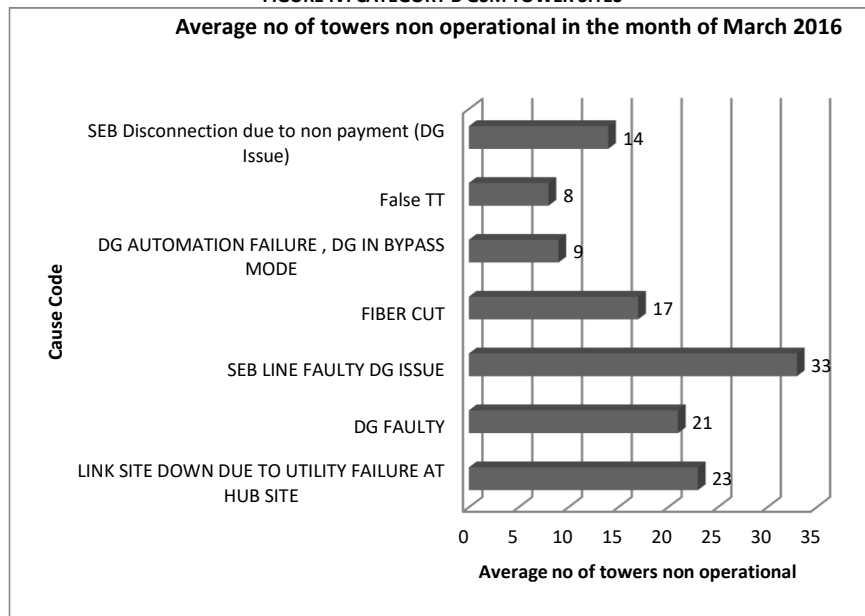
FIGURE III: CATEGORY B CDMA TOWER SITES



Source: Data collected from RCOM

For CDMA tower sites, the maximum proportion of average number of towers non operational (25.8%) in the month of March 2016 has been attributed to the cause code "Fibre Cut" (FIGURE III). Out of 89 non operational sites (being average for the month of March), 23 sites were non operational because of fibre cut around the tower sites, which results in tower sites internet and call outages thereby losing out on the revenue due to outages. The other prominent reasons constitutes as: DG Faulty (21.3%), DG Automation Failure (15.7%), SEB Line Faulty DG Issue (14.6%) and False TT (12.3%).

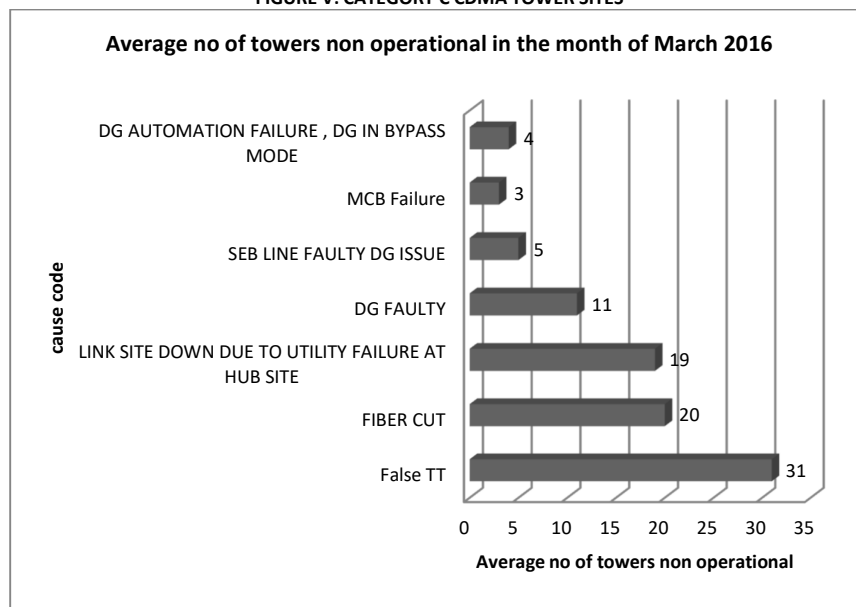
FIGURE IV: CATEGORY B GSM TOWER SITES



Source: Data collected from RCOM

For GSM tower sites, the maximum proportion of average number of towers non operational (26.4%) in the month of March 2016 has been attributed to the cause code "SEB Line Faulty DG Issue" (FIGURE IV). Out of 125 non operational sites (being average for the month of March), 33 sites were non operational because of SEB Line Faulty DG Issue. The other prominent reasons constitutes as: Link Site down due to utility failure at HUB Site(18.4%), DG Faulty(16.8%), Fibre Cut (13.6%), SEB Disconnection due to non- payment (DG Issue) (11.2%) respectively.

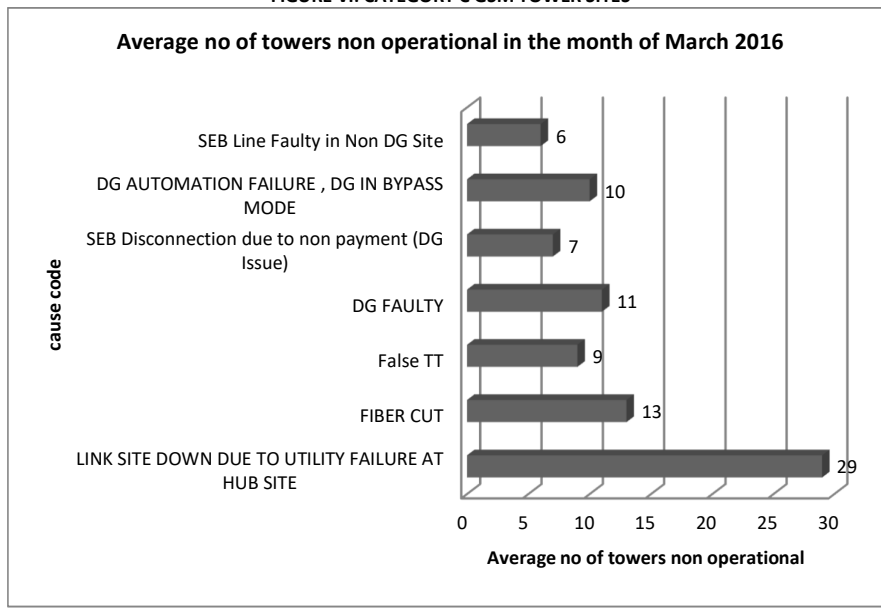
FIGURE V: CATEGORY C CDMA TOWER SITES



Source: Data collected from RCOM

In case of CDMA tower sites, the maximum proportion of average number of towers non operational (34%) in the month of March 2016 has been attributed to the cause code "False TT" (FIGURE V). Out of 93 non operational sites (being average for the month of March), 31 sites were non operational because of False TT Issue, which means that there has been a human error by the maintenance engineer (preventive maintenance team) in identifying the correct cause code for the outages and in ignorance other cause has been identified as the reason for the outage thereby generating the False TT (Trouble Ticket). As a result the real issue remains unidentified and is not rectified resulting in prolonged outages thereby substantially impacting the revenue collections from the tower sites. The other prominent reasons constitutes as: Fibre Cut (21.6%), Link Site down due to utility failure at HUB Site (20.4%)&DG Faulty (11.8%) respectively.

FIGURE VI: CATEGORY C GSM TOWER SITES

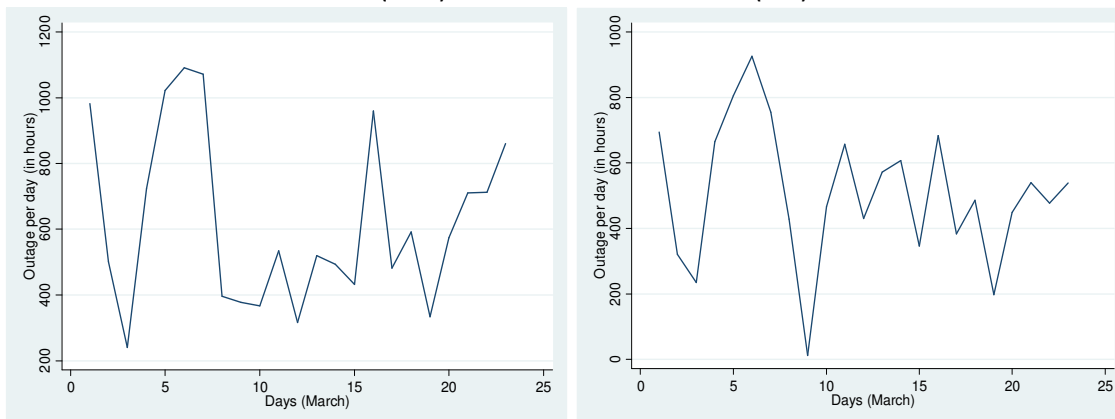


Source: Data collected from RCOM

In case of Category C GSM tower sites), the maximum proportion of average number of towers non-operational (34.1%) in the month of March 2016 has been attributed to the cause code "link site down due to utility failure at HUB Site" (FIGURE VI). Out of 85 non-operational sites (being average for the month of March), 29 sites were non-operational because of Hub Site failure issue. The other prominent reasons constitute as: Fibre Cut (15.3%), DG Faulty (12.9%) & DG Automation Failure (11.76%) respectively.

7.2 PATTERN OF CHANGES IN DAILY OUTAGE PER HOUR FOR THE MONTH OF MARCH (9th to 31st) 2016

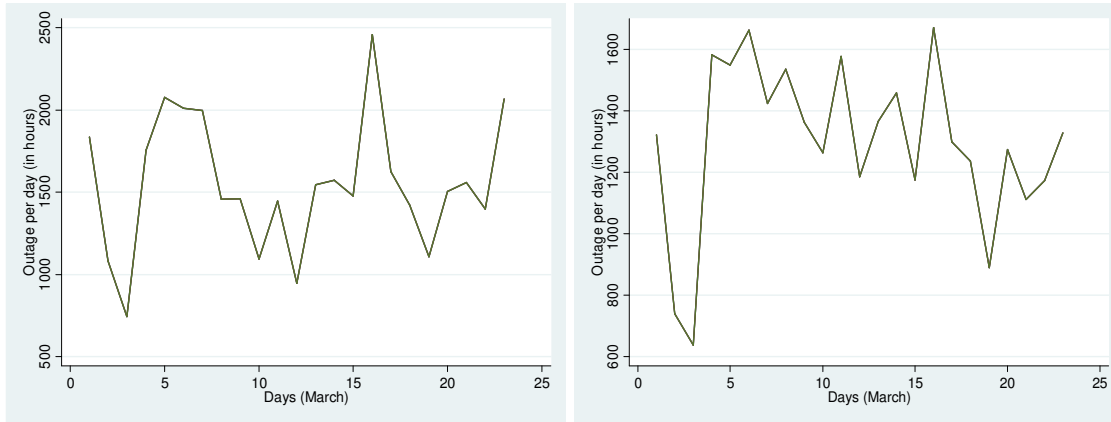
FIG. 1: CATEGORY A (CDMA) TOWER SITES & FIG. 2: CATEGORY A (GSM) TOWER SITES



In Category A CDMA Tower Sites (Fig 1), the highest combined outages of all sites per day in hours have been observed between 13th and 15th March, 2016, the reason being the "link site down due to utility failure at HUB Site". As a result, the combined revenue so lost i.e. ₹ 497400 has been the highest in this month. Against combined average revenue earned i.e. ₹ 9720000, of all the non-operational sites on per day basis, on an average, ₹2335074 has been lost on account of outages resulting in closure of tower sites. For this category, the combined proportion of revenue lost on account of non-operational sites due to outages has been 24.02% of the average revenue earned from those sites.

For Category A GSM Tower Sites (Fig 2), the highest combined outages of all sites per day in hours have been observed between 13th and 15th March, the reason being the "link site down due to utility failure at HUB Site", & "DG Faulty". As a result, the combined revenue lost i.e. ₹ 637080 has been the highest in this month. It can be concluded from the above table that against combined average revenue of ₹ 13608000 earned of all the non-operational sites on per day basis, ₹2859570 on an average has been lost on account of outages resulting in closure of tower sites. For this category, the combined proportion of revenue lost on account of non-operational sites due to outages has been 21.01% of the average revenue earned from those sites.

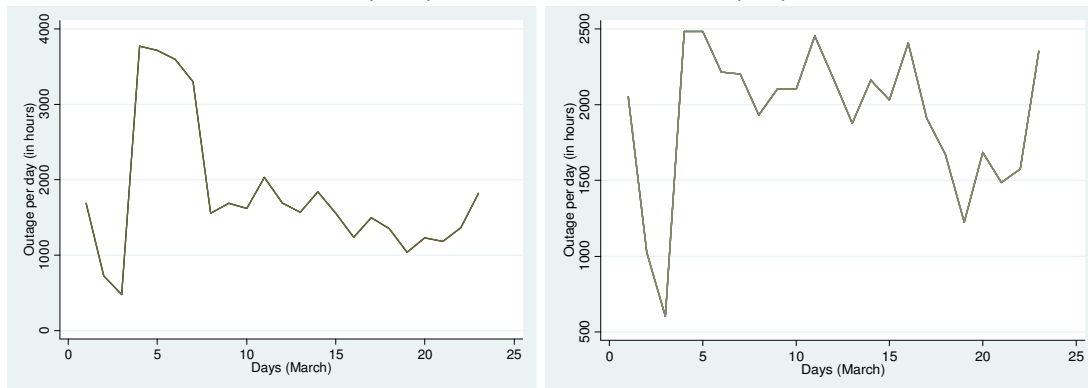
FIG 3: CATEGORY B (CDMA) TOWER SITES & FIG 4: CATEGORY B (GSM) TOWER SITES



For Category B CDMA Tower Sites (Fig 3), the highest combined outages of all sites per day in hours have been observed whole of the month except 10th, 11th & 27th March, the reason being the Fibre Cut, DG Faulty, DG Automation Failure, SEB Line Faulty DG Issue and False TT. Against combined average revenue earned i.e. ₹ 19507200, of all the non-operational sites on per day basis, ₹4772369.8956 on an average has been lost on account of outages resulting in closure of tower sites. For this category, the combined proportion of revenue lost on account of non-operational sites due to outages has been 24.47% of the average revenue earned from those sites.

For Category B GSM Tower Sites (Fig 4), the highest combined outages of all sites per day in hours have been observed whole of the month except 11th March and 19th March, the reason being the Link Site down due to utility failure at HUB Site, DG Faulty, Fibre Cut, SEB Disconnection due to non- payment (DG Issue) and SEB Line Faulty DG Issue. Against a combined average revenue earned i.e. ₹ 26236800, of all the non-operational sites on per day basis, ₹5702122.133 on an average has been lost on account of outages resulting in closure of tower sites. For this category, the combined proportion of revenue lost on account of non-operational sites due to outages has been 21.74% of the average revenue earned from those sites.

FIG 5: CATEGORY C (CDMA) TOWER SITES & FIG 6: CATEGORY C (GSM) TOWER SITES



For Category C CDMA Tower Sites (Fig 5), the highest combined outages of all sites per day in hours have been observed from 12th -15th March, the reason being the False TT, Fibre Cut, Link Site down due to utility failure at HUB Site & DG Faulty. It can be concluded from the above table that against combined average revenue earned i.e. ₹ 13219200, of all the non-operational sites on per day basis, ₹4984763.6 (on an average) has been lost on account of outages resulting in closure of tower sites. For this category, the combined proportion of revenue lost on account of non-operational sites due to outages has been 37.71% of the average revenue earned from those sites.

For Category C (GSM Tower Sites), the highest combined outages of all sites per day in hours have been observed whole of the month except 11th March, the reason being the Link Site down due to utility failure at HUB Site, Fibre Cut, DG Faulty, DG Automation Failure_It can be concluded from the above table that against combined average revenue earned i.e. ₹14011200, of all the non-operational sites on per day basis, ₹5306475.467 (on an average) has been lost on account of outages resulting in closure of tower sites. For this category, the combined proportion of revenue lost on account of non-operational sites due to outages has been 37.87% of the average revenue earned from those sites.

7.3 TESTING OF HYPOTHESIS

Tower Sites	Beta Coefficients	t stat	p-value
Category-A CDMA	203.283	9.304	.000
Category-A GSM	153.285	5.101	.000
Category-B CDMA	167.629	35.089	.002
Category-B GSM	153.941	13.256	.000
Category-C CDMA	119.353	16.362	.000
Category-C GSM	121.945	6.947	.010

The regression results reveal that in case of:

- Category A CDMA tower sites, a unit increase in the outage per day leads to an increase in the revenue loss by 203.283 units.
- Category A GSM tower sites, a unit increase in the outage per day leads to an increase in the revenue loss by 153.285 units.
- Category B CDMA tower sites, a unit increase in the outage per day leads to an increase in the revenue loss by 167.629 units
- Category B GSM tower sites, a unit increase in the outage per day leads to an increase in the revenue loss by 153.941 units
- Category C CDMA tower sites, a unit increase in the outage per day leads to an increase in the revenue loss by 119.353 units
- Category C GSM tower sites, a unit increase in the outage per day leads to an increase in the revenue loss by 121.945 units

At 95% level of confidence, the one tail t-value (for $\beta > 0$) and the corresponding p-values show that the beta coefficients are significant allowing to a rejection of the null hypothesis and acceptance of the alternate hypothesis.

7.4 TOWER SITES FACING HEAVY LOSSES DUE TO OUTAGE

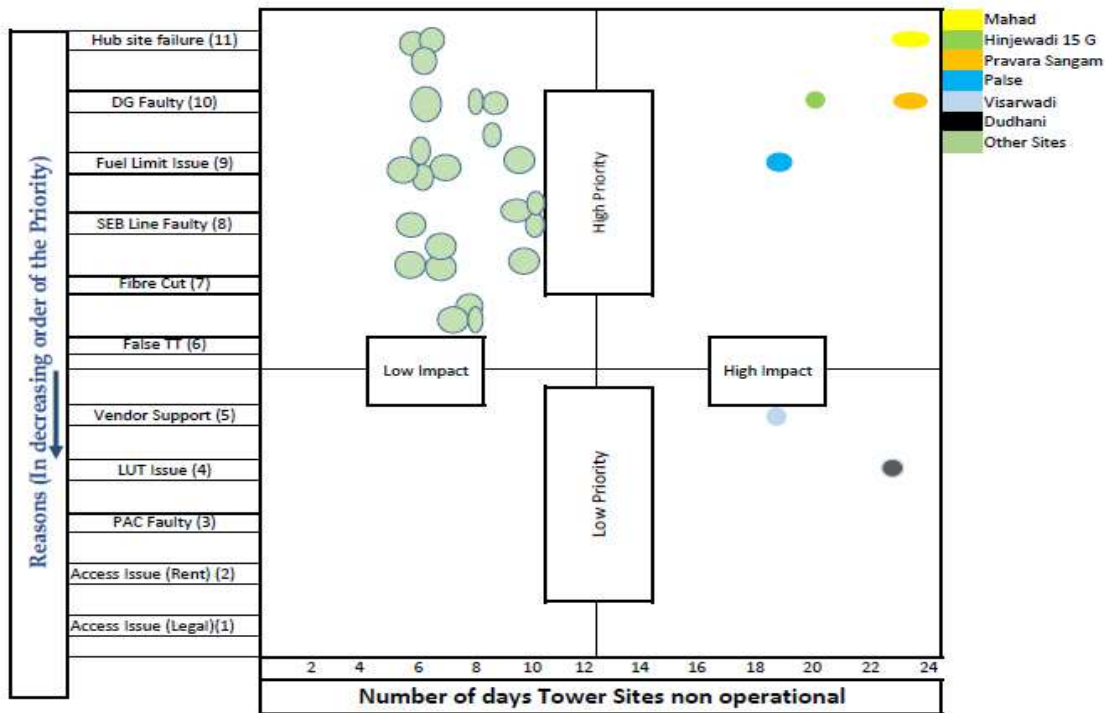
On reasonable identification and scrupulousness of the reasons for these tower sites being non-operational for all the 3 major categories, the main reasons fall under the following categories:

- **Equipment Failure Issue:** DG Faulty
- **Preventive Maintenance Team Errors:** False TT, Fuel Limit Issue for DG, SEB Line Faulty due to non-payment
- **Some external factors:** HUB Site Issue, Fibre Cut

After careful analysis of the outage data, the following tower sites (category wise) have been identified to be heavy loss incurring sites, which has been decided on the basis of number of days a particular tower site was non-operational.

For all the categories, the reasons have been plotted on Y axis in decreasing order of priority on the basis of ascertainment of number of days a tower site was non-operational. The number besides the reasons plotted on Y axis signifies that reason to be the major reason for outages for Category A Tower sites. For example, the Hub Site failure issue has been allotted number 11, which signifies that this issue is the most prominent reason behind the outages for Category A sites calculated on the basis of number of days a tower site has been non-operational. In the similar manner, the other reasons have been assigned number besides them.

CATEGORY A

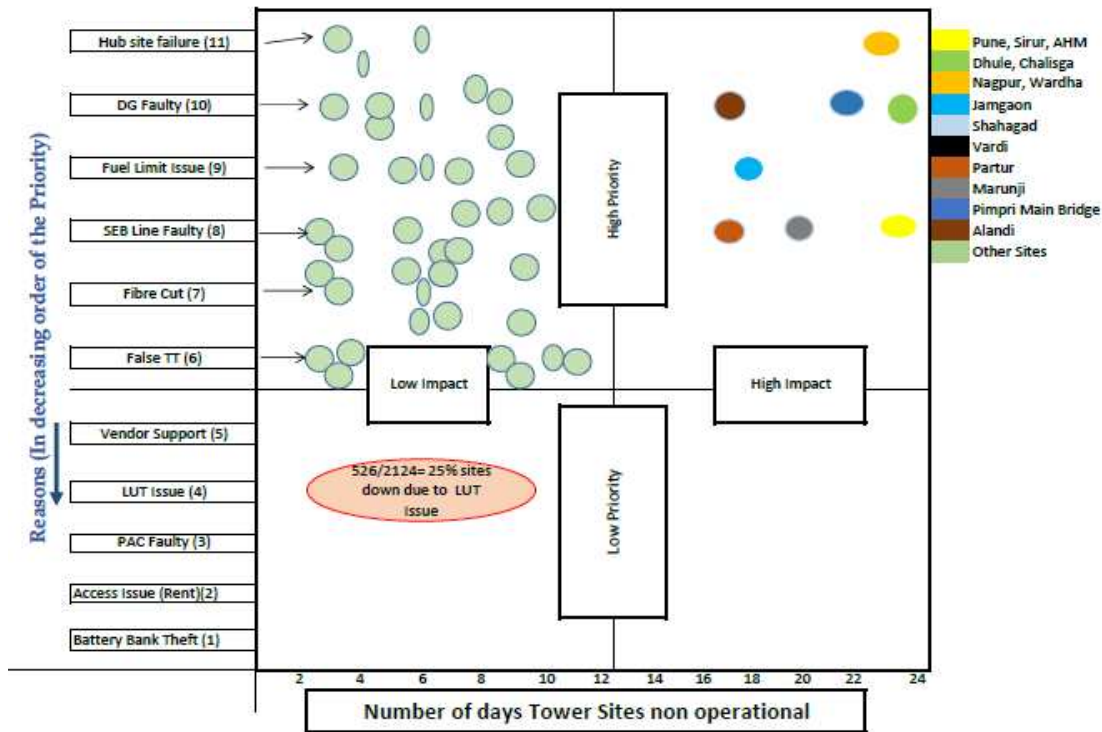


From the above diagram, the tower sites in 1st quadrant represent the number of days the sites were non-operational on account of outages and the reasons for the same have been plotted on X-axis. For example, Mahad tower site was non-operational for 23 days in the month of March 2016 because Hub Site to which Mahad is linked was down on account of outages. Therefore, it comes under the “High Impact-High Priority” category. The same could be interpreted for the other tower sites falling under the 1st Quadrant. For the tower sites falling under 2nd Quadrant, it can be concluded from above that majority of the tower sites were non-operational from 2-10 days reasons being HUB Site Issue, Fuel Limit Issue, Fibre Cut & SEB Line Faulty. These come under “High Priority-Low Impact” category as the tower sites falling under his category were non-operational for less number of days as compared to the tower sites in 1st Quadrant.

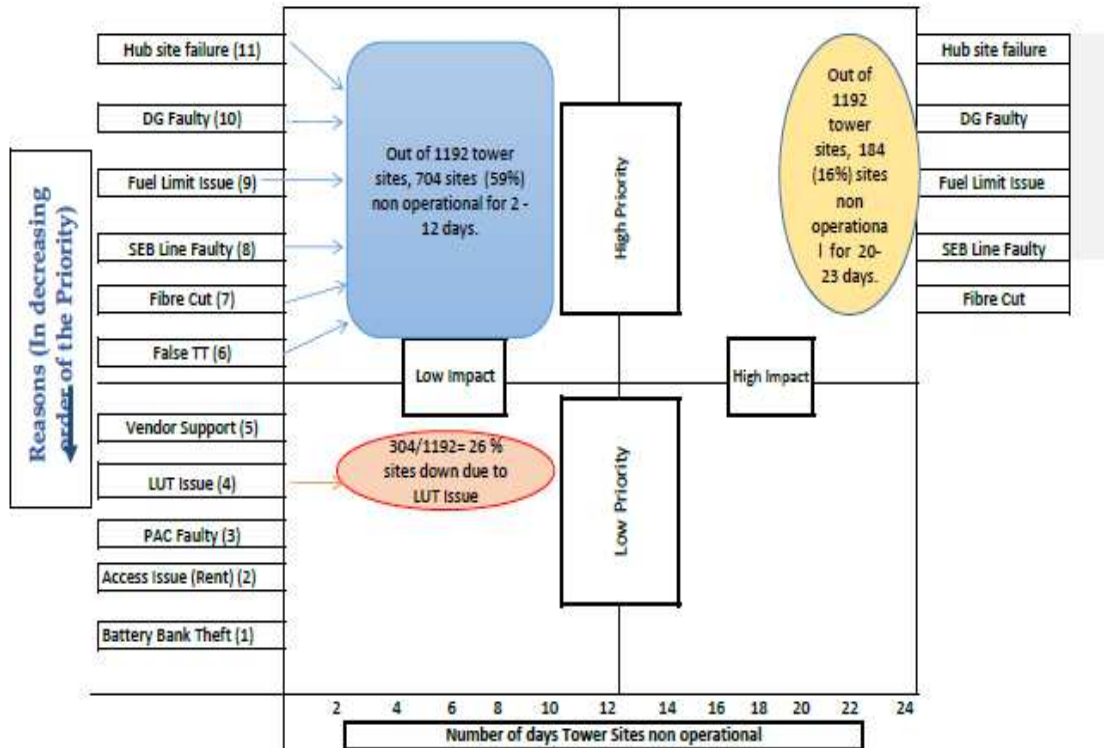
Some of the tower sites falling under 2nd Quadrant that remained non-operational for more than 5 -10 days, are mentioned below:

SwargateVega Centre, Rukadi, Arjun Building, Panvel Mahad C, SHEWALWADI JAKAT NAKA, Yogayog Karyalay, Viman Nagar 3, Ambegaon Pathar, Parvati Industrial Estate, Yeshwant Nagar, Rajegaon, Bavdhan gaon, Sasanenagar, Umri Pragane Balapur, Khardi Road Gaon, Panchwati Pashan, Gururwarpeth Karad, Mohmmad-wadi, Yawat, Waluj Bk, Musalgaon, DRDO, Kurulinanekarwadi, Dangechowk

CATEGORY B



From the above diagram, the tower sites in 1st quadrant represent the number of days the sites were non-operational on account of outages and the reasons for the same have been plotted on X-axis. For example, Pune, Sirur, AHM tower site was non-operational for 23 days in the month of March 2016 because SEB Line was found to be faulty being the reason for the outage. Therefore, it comes under the “High Impact-High Priority” category. The same could be interpreted for the other tower sites falling under the 1st Quadrant. For the tower sites falling under 2nd Quadrant, it can be concluded from above that majority of the tower sites were non-operational from 2-12 days reasons being DG Issue, Fuel Limit Issue, Fibre Cut, False TT & SEB Line Faulty. These come under “High Priority-Low Impact” category as the tower sites falling under his category were non-operational for less number of days as compared to the tower sites in 1st Quadrant. Some of the tower sites falling under 2nd Quadrant that remained non-operational for more than 5-12 days are mentioned below:
 Ner, Darda BLDG, Chatrpati Nagar, Wadgaon, Ahmadpur, Bhivapur, Dharam Peth Gamma, Dire, Ghulewadi, Shirdi, Kopargaon, Sinnar, Khanapur, Bibwewadi, Sharda Arcade, Roha, Lohagaon, Karad, Shanivarpeth, Wai, Alibagh, Jyotinagar, Shivaji Nagar, Curchorem, Panchawati Pashan, Pisoli, Wagholi, Vadeshwar, Sadavali Village, Mantha, Vaijapur, Deolali Pravara.



It is evident from the above diagram that out of 1192 tower sites falling under Category C, around 184 sites approximately 16% remained non-operational for 23 days in the month of March 2016 which falls under “High Impact-High Priority” category as the number of non-operational days were observed to be more than the tower sites falling under other quadrants. The tower sites under moderate revenue earning sites, mainly cater to areas - Dharni (Melghat), Kohane, Sayagaon, Ranigam, Chakarda, Dhokshet, Pimpalgaon Tarf Khe, Khirvire, Dahivali, Jij Mangal Karlya, Harisal, & Jalna-Deulgaon(WAGHRUL). The prominent reasons being Link site down due to any issue at HUB Site, False TT, SEB disconnection & DG faulty.

However, in the 2nd Quadrant, the reasons for the outages on the tower sites have been highlighted with the arrow signs. Category C tower sites also have tower sites which face the problem of LUT (Low Utilization Sites), which means that these tower sites earn very less revenue where the cost of operating the tower sites is more than the revenue earned. Few of the LUT sites are Raikot, Radhapur, Manmad, Aurangabad SIL, Sarve bk, Akola, Khangaon, Rajura - AP BO, Nagpur, Samudra, Panvel, Mahad, Mahad, Shiro, Talwara, Allipur, Angar, Borat.

8. CONCLUSION AND SUGGESTIONS

- Since the frequency of occurrence of equipment failure has been observed to be more for all the 3 categories, the company should maintain and check DG equipment on a daily basis so as to avoid the occurrence of outage due to fault in DG. Therefore, the frequency of evaluation of equipment at tower sites must be increased in order to ensure smooth service to the customers. Poorly maintained equipment at the tower sites are also the major source of outages. Therefore, the infrastructure condition at the tower sites must be closely monitored and updated on continuous basis in order to lower the outages due to equipment malfunction
- In case of False TT, the preventive maintenance team should emphasize more on accurately identifying, classifying and recording of the cause code, being the reason for the outage at a particular tower site. The site workforce team should be trained for the purpose of reducing outage because of the reason mentioned above and the training should focus more on human activities related to the operations of the tower site.
- In case of Fuel Limit Issue for DG, the problem identified was that in most of the instances, fuel for DG was available but it was not filled in DG on time because of which the site remained non-operational. Therefore, the preventive maintenance team can be more vigilant and cautious and can significantly reduce the outages happening because of fuel issue for DG.
- In case of SEB Line faulty due to non-payment of pending bills, the company should release the payment on time in order to avoid temporary suspension of electricity services of the tower sites so as to avoid outages.
- Implement periodic infrastructure checkouts on Category A & B tower sites which come under Very High Revenue & High Revenue earning sites, which have been non-operational for 16-23 days in the month of March 2016.
- The tower site maintenance engineers must have the requisite and accurate information to carry out the scheduled maintenance programs quickly & efficiently in order to respond accurately to the risk of occurrence of outages. It will further aid the company to reduce the revenue that is lost on account of tower sites being non-operational, which in turn will help the company to reduce the operating cost of tower sites.

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