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Sriram Rajagopalan
Great Lakes Institute of Management, sriram.raj@greatlakes.edu.in

Sriram Ravi
Great Lakes Institute of Management, sriram.r@greatlakes.edu.in

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A Critical Appraisal of Digitalization in City Administration

Completed Research

Dr. Sriram Rajagopalan
Assistant Professor – Great Lakes Institute of Management, Chennai
sriram.raj@greatlakes.edu.in

Mr. Sriram R.
Lecturer, Great Lakes Institute of Management, Chennai
sriram.r@greatlakes.edu.in

Abstract

The improvement in technology infrastructure has paved way for creating web-portals, social media portals and space for suggestions within. This facility is well utilized by public to provide observations on development activities. For city administration, where development activities can take the help of technology to resolve social issues, it has given options in expressing opinions on different hash tags created by stakeholders for making structural decisions. The opinions posted are often random and at times critical to the issues in discussion. This paper brings out those observations posted in social media portals like twitter on urban development activities, analyzing statements to capture topics in discussion, the degree of relationship within the topics, and human emotions expressed as sentiments in the observations made for resolving social issues and innovative measures undertaken. The results indicate utmost positive sentiments expressed by public for measures and resolutions undertaken to deploy technology infrastructure in cities.

Keywords

Technology Infrastructure, Digital Cities, Digital Urbanism, Social organs, Sentiment Analysis

Introduction

International cities which use technology for accomplishing social needs in its administration are categorized as "Smart Cities". These cities have made a series of innovative measures in their administration to use information and communication technologies (ICT) for improving efficiency and optimization of resources (Khatoun et al. 2017, Kennedy et al. 2018). Working definitions from literature quote "smart cities" as an integration of physical, social and technology infrastructure (Hollands, 2008; Washburn et al. 2009; Toppeta, 2010). Digital urbanism in the form of ICT mediates the interplay between city's social organs and technology infrastructure (Chatterji, 2017). However, in India, a similar approach in urbanizing cities with modern infrastructure has prospered with development plans such as "Smart Cities Mission 2020" which precisely measures the cities based on select factors (MoHUA, GoI, 2018). A common and a long persistent observation from the academia on this vision plan is the modern infrastructure has missed out on ubiquitous utilization of latest technologies (Aijaz and Hoelscher, 2015; Orlikowski and Iacono, 2001). Today, technology is slowly getting mapped to the social organs in India, re-emphasizing the cognizance of digitalization in cities. The digitalization was earlier preceded with measures on e-governance as a first step in cities (Alderete, 2020). This article brings out the sentiments on using technology in cities and its profound benefits to the society at large making way for a digitally sound urban development in India.

Background of the study

City administration in East Asia, Europe and America have long been successful from use of digital technology. The case of Singapore city, the first one to transform into an intelligent economy describes this digital progress with advantages at the local, regional and national levels (Mazihnan, 1999). In later years, the cities of Barcelona and Vienna benefitted from such technologies setting twin goals. The first is addressing concerns to social problems in social organs, and second, in promoting clean and safe livelihood for protecting environmental depletion (Harrisons et al. 2010; Aggarwal et al. 2014; Trivellato, 2016; Talari et al. 2017; Zhuhadar et al. 2017). Development reforms in India took structural shapes between 1979 and 2005. The first one was the Integrated Development of Small and Medium Towns (IDSMT) in 1979, followed by Mega Cities Scheme (MCS) in 1993 and the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) in 2005. The objective of these schemes are improving India's economic and physical infrastructure by creating urban settlements proportionally to population sizes, developing infrastructure through approved projects, and delivering services to common man at large. Additionally an important feature prospecting digital technology was in understanding trivial needs on input requirements by city administration (Beranek et al. 2014). With the emergence of digital technology across the world, the necessity to adopt such measures to address social concerns has arisen for India. This desperate need has set the premises for a new urban agenda described in the Digital India program (Aijaz and Hoelscher, 2015; Wu, 2016). Multiple challenges exists in addressing concerns to build this new urban agenda for an urban development to Indian cities. Research studies have revealed higher concentration of 75 percent ICT users are in various urban clusters with 18 percent of them attracted to the internet boom (Chatterji, 2017). Investments worth Rs. 2.73 Lakh crore (spread for the next decade) has been sanctioned as outlay for smart city plans. Issues in the city administration also exists at the micro and macro-economic level. These challenges have led to unsafe living environment in cities apart from existing human incursions on protected zones(Aijaz and Hoelscher, 2015; Chatterji, 2017). The challenges mentioned here appear beyond the significant hikes made in budgetary outlay for development plans. An extensive promotion of ICT in urbanization is streamlining the focus of creating future cities that are digitally connected as smart cities (Kennedy et al. 2018). The word cloud developed from topics in social media discussions and presented in figure 5 on technology infrastructure reveal similar views on digital technology.

Digital cities

International cities like Odense, Genglou, and Vienna have made conscious efforts in digitalizing city administration for resolving social issues. A structured process is in place for controlling energy consumption in houses utilizing the innovation in technology within these cities (Aijaz Hoelscher, 2015; Talari et al. 2017; Zhuhadar et al. 2017). The use of Information and Communication Technologies (ICT) to create digital cities in India has enabled the government to frame necessary policy guidelines for having clean and safe livelihood as the agenda of urbanization plan (Kennedy et al. 2018). A lag in conceptualizing the idea has pecked more than 60 percent of the current development projects to "paper work" status with rest of them indicating "implemented" (Hindu Business Line, dt: December 16, 2018). This lacuna, policy guidelines and the urge to create digital cities have given a motivation to researchers for pursuing empirical studies in this area mainly to kindle the interests of different stakeholders involved in these development plans. A broad historiography of ICT enablement draws the distinction between mental state that carries voices of urbanization to a state of digital transformation prospecting cities to have its defined stages of urbanism outlining progresses made during various timelines (Bhattarcharya et al. 2015). Sustainability among international cities has set the goals of growth in technology infrastructure, layer models, informatics, networks for monitoring urban activity, issues of climate change, carbon emission, and excessive consumption of power and energy resources. The integrative development framework would measure city administration for its performance using different constructs. These constructs include organization, technology, governance, policy context, people, economy, built infrastructure and natural environment (Chourabi et al. 2012). A similar approach to create digital cities in India has encouraged us

to identify organs of city administration which includes technology infrastructure. This approach at first requires administration and stakeholders to understand social situations prevalent in cities. One such method would be in observing sentiments of public and community groups upon applying technology infrastructure to the dimensions of city administration. This paper provides an opportunity to bring out such sentiments observed from social media platforms where public and community groups often post their comments on social situations. Conducting such experiments to assess ground realities have been done in the past as quoted in literatures (Agarwal et al. 2011; Arun et al. 2017).

This literature experiment has created a deep interest in utilizing this approach for our study in understanding observations of public and community groups in using digital technology for urban administration with dimensions in focus. For this purpose, interest words created as hashtags on this topic in twitter pages are taken for the study. These words listed below in figure 1 are taken for discussion in this paper with further literature drawn from other empirical studies.

Agglomeration	AMRUT	Artificial Intelligence	Big Data	Brownfield	Community Groups
Cloud	Disruption	Electronic waste	Energy	Environment	Environmental Risk
Fiber optic	Future City	Global Positioning	Greenfield	Healthcare	Hriday
Housing	ICT	Human Capital Interaction	Infrastructure	Intruder Detection	IoE
Mark-Up	NFC	Machine Learning	Measurement	Network Effects	Pattern Recognition
Population	Power	Recycling	Redevelop	RFID	Retrofit
Road Network	SCADA	Scalability	Security	Sensors	Sensor-Owner Layer
Sustainability	Swatchch	Service Encounter	Traffic	Space time mapping	Transport
Urbanism	Water	Unemployment	Sensors	Wireless networks	

Figure 1 – List of words (hash tags) identified for the study

The observations made in these pages are for a brief period of three years (from 2017 to till date). The data obtained from these pages are converted into workable files using text mining methods from machine language programming. Due to capacity constraints in processing the data within a complete file, the data file has been split into multiple distinctive files. These distinctive files have been run with the machine language program for mining the data to identify topics being discussed by public and community groups. In addition, a frequency graph for topics, word association statistic for mapping content, and sentiment graphs for identify human emotions are prepared for each of the data file. These are presented under respective dimensions below.

Digital urbanism

Digital urbanism, as explained earlier, is an emergent understanding of pervasive use of ICT in city administration. The adoption of technology is completely based on the belief of people who use them as motivating factors to gain advantages of process automation in society. The readiness to adopt technology is measured in assessing this digital urbanism. The behavioral intentions of society measured precisely in technology adoption has a positive outlook on different users of technology products and acts as a moderator in assessing its readiness in use (Davis et al. 1989; Dabholkar, 1994; Dabholkar, 1996). The different interactive models of adoption in later stages measures the outcome of attitudes and belief of people who shop for products, the increase in use of computers and cellular phones for administration, the disillusionment in society for computers reveal inverse relationships on use rates of adoption among new adopters and early adopters. These new adopters are not to be perceptive as the early adopters ((Eastlick, 1996; Asop, 1999; Mosberg, 1999). It is important for people in society to embrace new technologies for accomplishing goals in social life. Technology adoption was only profound to e-commerce platforms in the society (Hoffman et al. 1999). The initiatives of developing a future technology plan later linked technology to the existing features of the service triangle model for creating a social need in reinvigorating service offerings and delivery, a feature more relevant to the administration of cities (Parasuraman, 2000). This addition has further improved the categories of services, its customer interfaces, delivery, measuring quality

in continuum of services and recoveries from failures. The augmented model of the readiness indices with enablers and inhibitors tests the effect of changes in state of mind for people, determining the future embracement of new technologies (Parasuraman and Colby, 2015). The brief sentiments on such technology adoption by society towards city administration is discussed in this paper.

Digital transformation in Indian context, with the mission of creating smart cities aspires to build core infrastructure, clean sustainable and safe environment, creating employment which enhances income for poor and disadvantaged (Aijaz and Hoelscher, 2015). The state government of Indian states have made significant progress in its attempt to transform various state departments. However, the gaps revealed in infrastructure, traffic and transport services, land acquisition, housing development, increased agglomeration has plagued such progresses (Vinoth Kumar, 2015). This research paper attempts to address concerns of transformation in city administration adopting digital technology under select dimensions where sentiments and expectations of community groups are expressed from the social media platforms upon hash tags created to share observations. The dimensions of the study are the absorbed outcome from past empirical research studies conducted on International cities where discussions of using technology in urban administration reveals the solutions.

Conceptual

Urbanization of a city is carefully constructed with the foundation of characteristics a city possesses (Goist, 1971). The theoretical framework in creating cities and its post-modernistic perspectives of administration has brought-in technology infrastructure to serve social needs like in international cities (Batty et al. 2012). A greater emphasis to apply technology in city administration has become the outcome of this social change (Zanella et al. 2014; Aijaz and Hoelscher, 2015). Indian city administration which has created different projects to redevelop city administration is continuously reminiscing community groups in social media posting their observations on the development projects. The snapshot of the discussion in social media platforms are presented as a word cloud with topics in discussion and frequency of words used by community groups sharing their expressions through human emotions. The snapshots of topics in discussion and the frequency graph of topics are given in the below Figure 2 and Figure 3.

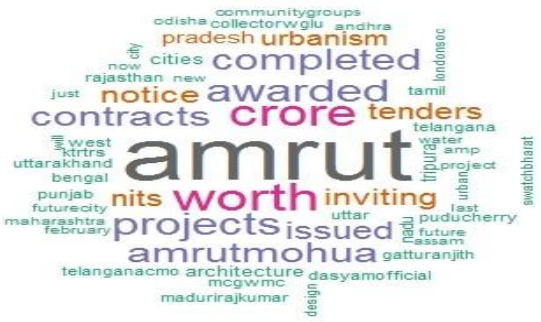


Figure 2: Word cloud - Conceptual Dimension

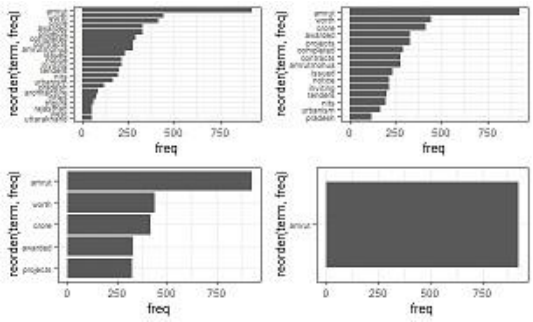
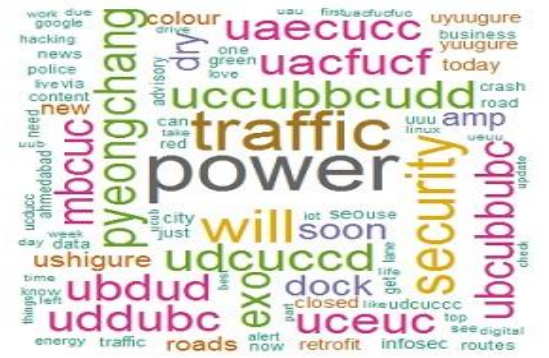


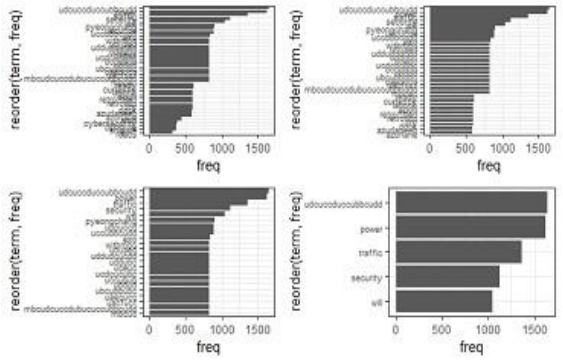
Figure 3: Graph representing frequency of terms

City Administration

A greater demand for using modern infrastructure for upgrading city administration with advanced systems has prospected the use of digital technology (Gann et al. 2011). The real time experiences of having digital technology in developed countries has motivated small and medium towns to have transformation plans in urbanizing country side localities (Aijaz and Hoelscher, 2015; MoHUA, GoI, 2015; MoHUD, GoI, 2018). The recent vision plan documents of city administration in India has its focus on progress of small and medium towns through the policy objectives of area-based and part-based development plans for

constructing green and brownfield projects. The required budgetary allocations have also been made to include overhauls in social organs of city administration (Bhattacharya et al. 2015). With involvement of technology found more in the vicinity of giving purposive attention to social organs, public and community groups who are active in social media, share and exchange their observations on progress of city administration in their respective user accounts. The topics in discussion are briefly presented in figure 4 and 5 as word clouds and frequency graphs.





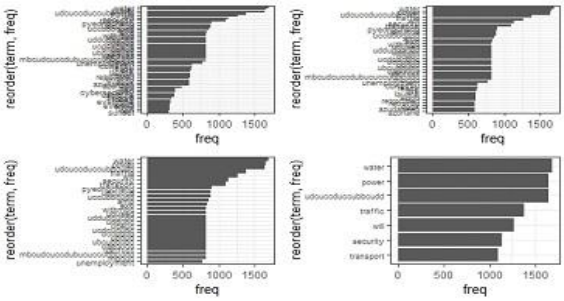


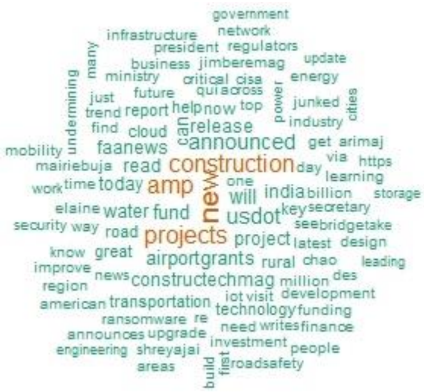
Figure 4: World cloud on City Administration

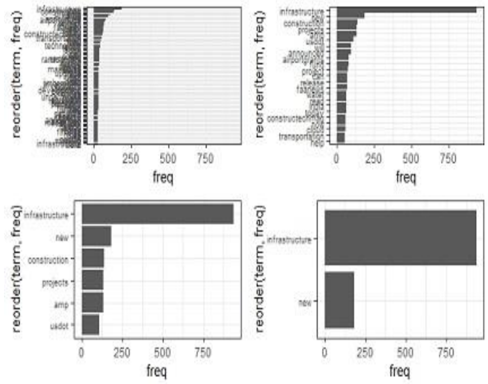
Figure 5: Graph representing frequency of terms

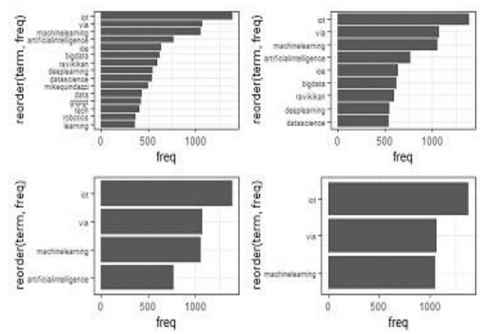
Infrastructure

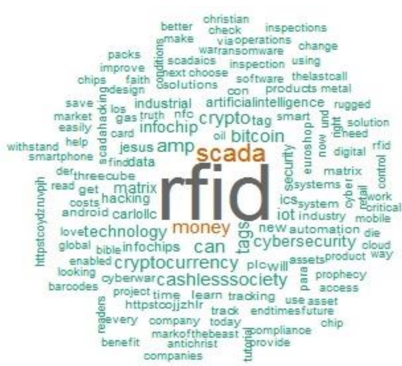
Technology infrastructure has its options of using different peripherals from low to high for tracing information in society. Normally, the lower-end uses common-where peripherals whereas the high-end systems use advanced technology requiring human deployment of technical skills (Ruta et al. 2010). Scale of usage and capacity for handling large sets of data and information categorizes different applications. Moreover, the communication between users and the computing techniques of far advanced systems such as Internet of things (IoT) has differentiated modern technology infrastructure from other low end products. It is here that methods such pervasive computing has gathered its significance (Mitton et al. 2012; Kitchin, 2014). Using low-end (RFIDs, Sensors, Wireless Sensor Nodes, and Wifi) and advanced technologies (SCADA, Pervasive, Space Time Mapping, Layering, and Machine Learning) along with application technology products like 3E and ZigBee have helped administration to improve infrastructure for making quick decisions on city administration (Gubbi et al. 2013). The digital technology is predicted to grow in larger context for India in resolving social problems (Aggarwal et al. 2015; Vinoth Kumar, 2015; Talari et al. 2017). Frequent observations and suggestions are shared by public and community groups in social media on latest technology infrastructure used by advanced economies. These observations are

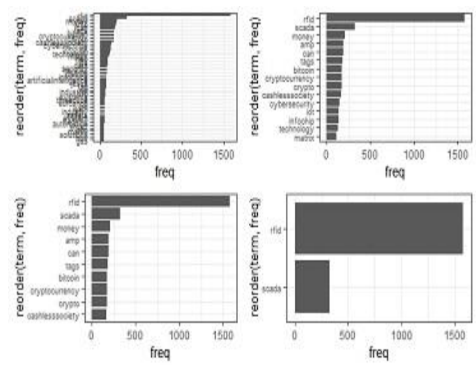
presented as topics of discussion in the word cloud along with frequency of words in figure 6 and 7. The number of charts and frequency graphs are more for this dimension as the data file used was split into multiple smaller files understanding the technical issues in processing a full length file for output.











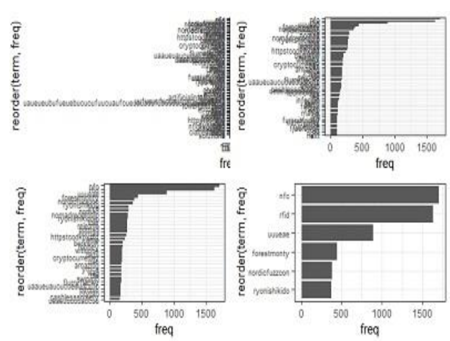


Figure 6: Word cloud on Infrastructure dimension

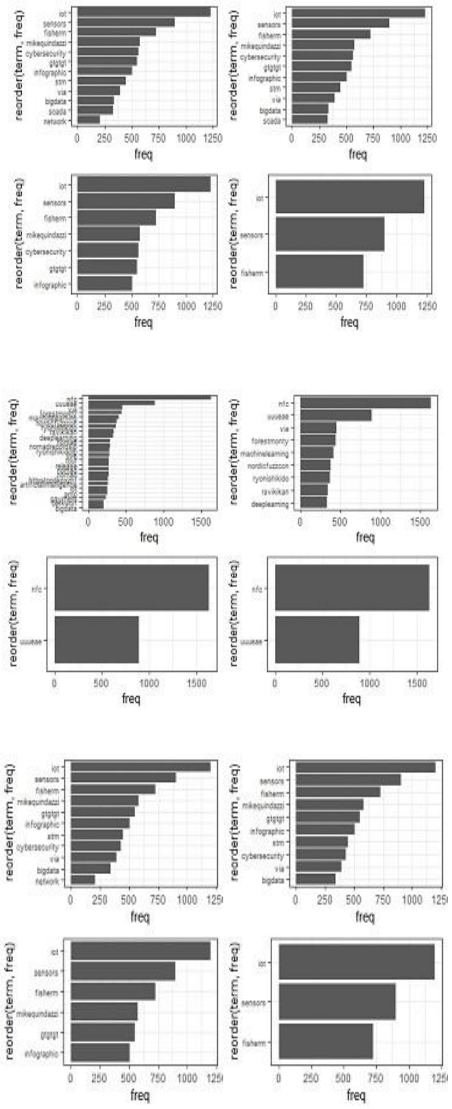


Figure 7: Graph representing frequency of terms

Service Encounter

Services for city administration is offered in categories and on different platforms with technology oriented solutions to society. These include solutions given to Infrastructure through Infrastructure as a Service (IaaS), Software as a Service (SaaS), and Platform as a Service (PaaS) (Vinoth Kumar, 2015). The ideation plans by government in creating web-portals, measuring delivery of critical services with quality, strategies for timely recovery from service failures are aspects where existing customer interface models are available to encounter services (Bitner et al. 2000; Parasuraman, 2000; Batty et al. 2012; Zaslavsky et al. 2013; Ministry of Urban Development, GoI, 2015; Ministry of Urban Development, GoI, 2018). It becomes customary for public to provide observations on services rendered for any transaction. The presence of information technology has made options to share observations on any transaction in social media platforms. These observations on using technology is processed using machine language. The topics in discussion is presented as a word cloud and frequency graph in figures 8.

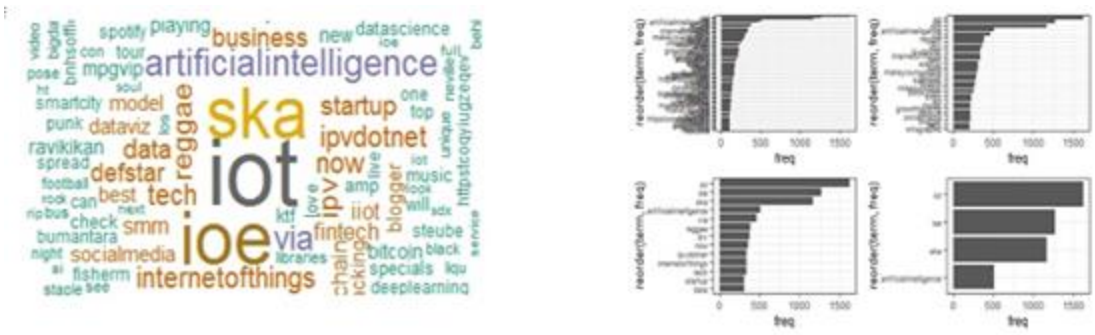


Figure 8 – World Cloud and Frequency Graph representing words on Service Dimension

Disruption

Different products in society has evolved as the outcome of disruptive innovation which has made strides in advancement of technology. International cities have implemented such technology driven products in their urbanization (Bitner et al. 2000). Stakeholders have identified emerging technologies which have stable and value chain models that are ready to be tested for its preparedness in use. These tests measure effectiveness of products to customers, community and environment at large (Parasuraman, 2000). Disruptive innovation has continuously made its efforts in sensing a readiness in society to identify products, tools and advanced systems to retrofit urban development optimizing resources for effective utilization in city administration (Bibri S E, 2018). Observations are made by public and community groups on such disruptive technologies in city administration. These observations are presented as topics in discussion in figure 9 and 10 below as word cloud and frequency graphs of topics discussed.

Figure 9: Word cloud on Disruption dimension

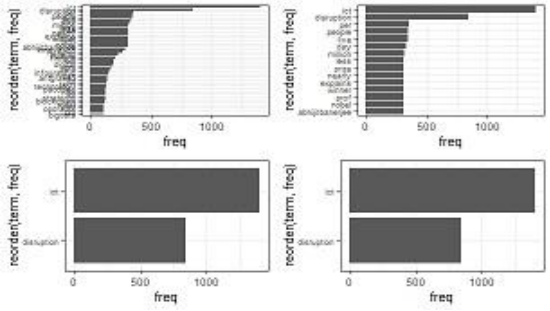


Figure 10: Graph representing frequency of terms

Physis (Environment)

The progress in urbanization has led to risks of changes in nature with excessive use of organic resources. Additionally, the hurricanes, blackouts, pollution, use of hazardous chemicals, flooding and inundation of solid or liquid wastes have also brought in challenges to society. Models such as virtual cities which visualizes landscapes and telecommunication networks in urban planning has augmented better administration of cities (Kitchin et al. 2007). A technological augmentation has paved way for measuring land availability and its physical use in society (Carli et al. 2013). These augmentations have also faced issues of obsolescence to its products. The excessive use of natural resources is offset by using alternate material resources for improving product manufacturing and de-risking society through digital technology. Active social interactions among community groups can help educate people on social problems (Nohara et al. 2008; Cucchiara et al. 2011; Morton et al. 2012; Perera et al. 2014; Mora Mora et al. 2015). The digital

technology has paved way for utilizing data and information on society by limiting the cap of using hazardous chemicals as a control measure on excessive use. It has also been useful in observing the amount of emission of fluorocarbons for social utility. In total, these mechanisms protect the environment (Rathore et al. 2016). Digital technology is influenced by green ICT and thematic approaches for conserving environmental sustainability in social life. The big data, pervasive computing, and deep learning has ensured sustainability of information, optimizing resources through this digital technology taking necessary decisions and actions on society (Bibri S E, 2018). The ICT has now made social media platforms available for sharing environmental information allowing public and community groups to provide their suggestions and comments. These suggestions, comments and other statement made by public have become topics of discussion and is carefully analyzed using machine languages. The topics of discussion relevant for environment as a dimension of analysis is presented in below figure 11 and 12 as a word cloud and frequency graph of topics discussed.

Figure 11: Word cloud on Sustainability dimension

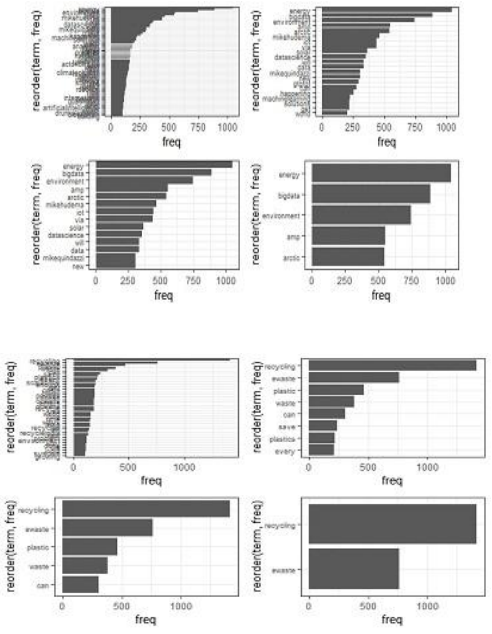


Figure 12: Graph representing frequency of terms

Analysis, Conclusion and Future scope of research

The results of frequency graphs of the dimensions indicate for conceptual frameworks, the contract projects undertaken like AMRUT has been the topic of discussion. In city administration, the focus is on making green governance, power, traffic, transport, water, unemployment and controlling population. The infrastructure has the topics internet of things (IOT), artificial intelligence, machine language, RFIDs, NFCs, and sensors. The service encounter has internet of energy (IoE) and square kilometer arrays (SKAs). Likewise, disruption has use of ICT, innovation, people and digital. Sustainability (Physis) has energy, big data and environment as topics. A descriptive statistic mapped with correlation scores between these topics identifying the degree of relationship between these topics is in Figure 13 below. To describe, the focus of green in city administration is on roads and traffic; the IOT in infrastructure on Internet of Energy; the IOT on service encounter is towards IoE, IoT, and Artificial Intelligence; the ICT in disruption is towards innovation; Energy in sustainability is towards renewable resources. The analysis infers a serious interest is on encouraging green efforts for energy resources along with emphasis given to use IOT in enabling

technology for service and infrastructure. The results of sentiment analysis given below in Figure 14 reveals human emotions made by public is found to be "Positive", "Joyous", "Anticipated" and "Trust Worthy" for all dimensions with "Fear" and "Negativity" found in dimensions – City Administration, Disruption, Service Encounter and Sustainability. This article is the outcome of qualitative research concludes with descriptive data on correlated topics. However, a detailed study on these dimensions is currently under progress with scope of upgrading the progress to a large empirical analysis on enabling technology for creating a sustainable urban development in which cities are digitally connected.

City Administration		Infrastructure		Service Encounter	
Green	Correlation	IOT	Correlation	IOT	Correlation
Advisory	0.93	ioe	0.53	ioe	0.67
Roads	0.92	industrial	0.24	internetofthings	0.44
City	0.84	bigdata	0.23	artificialintelligence	0.36
Traffic	0.25			tech	0.35
Disruption		**Sustainability**		cloud	0.25
ICT	Correlation	Energy	Correlation	importance	0.24
innovation	0.23	renewable	0.24	sensors	0.24
startups	0.21	solarpowered	0.23	government	0.23
		international	0.21	industrial	0.21

Figure 13 – Association (Correlation) of topics in discussion

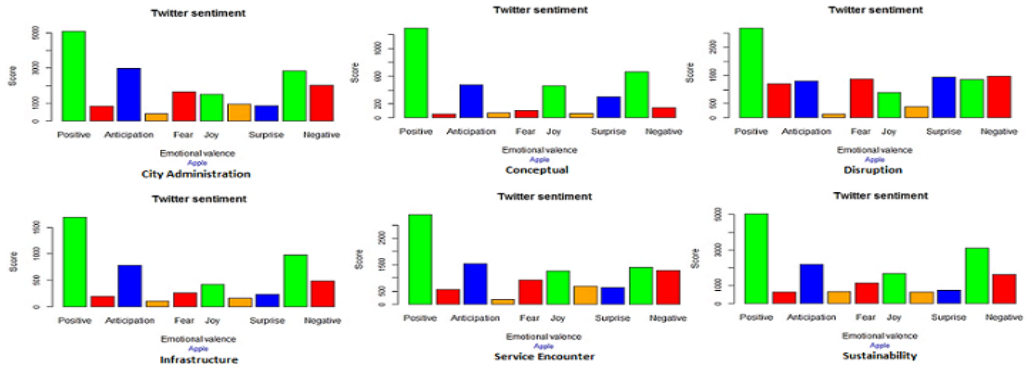


Figure 14 – Graph on Sentiment Analysis of Dimensions

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