The workshop on Innovations in Technology Services hosted by the Srini Raju Centre for Information Technology and the Networked Economy (SRITNE) was held on October 31 and November 1, 2015 at the Indian School of Business (ISB). The theme of this year’s workshop was ‘Smart Cities’. It attracted a plethora of participants from across the industry as well as students who were interested in learning and understanding the technological imperatives of smart cities.

The workshop discussed technology solutions, engagement models, impact assessment and technology innovation around the subject. The workshop was a confluence of knowledge from academia and experience from the industry to look at the novel subject from various perspectives and develop a better understanding for leaders to usher in the change required. It was also a great forum for collaboration and networking, and the two day workshop resulted in several worthwhile take-aways for all.

Urbanization in India is a rapidly growing trend that is fuelled by the government’s emphasis on the manufacturing and services sectors as engines of growth. According to the 2011 census report, more than 600 million Indians will be living in urban areas by 2031, and the contribution of urban India to the national GDP is expected to rise from 52% in 2011 to 75% in 2031. However, the current state of infrastructure, human capital, and services in Indian cities is a large constraint in accommodating the pace of urbanization. A plan for rapid development of 100 smart cities by the Government of India intends to address this challenge. A smart city is commonly defined as the one that leverages technology to integrate and optimize its limited resources towards better habitability, sustainability, and citizen empowerment; however there is a limited understanding of how technology-enabled solutions can help cities evolve into safe, secure, and efficient habitats. Several presentations at this year’s workshop bridged this understanding by outlining specific contributions of technology service providers to urban transformation.

Technology service providers are increasingly emerging as strategic partners who impact their clients’ competitiveness and profitability. Fuelled by rapid technological advances and globalization, the scope of technology services has evolved from peripheral activities with a focus on cost reduction to include a diverse set of critical functions such as innovation, new product development, and supply chain management that impact firm performance and society. This evolution of technology services is especially pronounced and relevant in an era of rapid automation, large data, and social networks all of which play a major role in transforming cities into smart cities.

The morning sessions were dedicated to look at technology’s role and contribution in its many ways towards building a smart city. It started with Prof. Deepa Mani’s talk on Smart City Maturity Index and included Mr. Subrahmanyam Yadavalli’s presentation on Hyderabad Traffic Integrated Management System (HTRIMS), Prof. Kiran Kuchi’s talk on the internet and broadband services in the country, and a discussion panel of industry leaders and practitioners.
Smart City Maturity Index (SCMI) by Prof. Deepa Mani, Assistant Professor, Information Systems and Joint Executive Director, Srinivasa Raju Centre for IT and Networked Economy, Indian School of Business

Prof. Deepa Mani initiated the workshop with a talk on her research done at SRITNE to develop a smart city maturity index (SCMI). The journey to develop 100 smart cities is a challenging one and given the diversity of our states and cities, one standard solution is clearly not plausible.

The Smart city maturity index is a robust benchmarking and urban planning tool for a region. Developed with the idea of helping the government in the smart city initiative, it helps assess the maturity of a city towards its readiness to being transformed into a smart city.

The key to SCMI is the smart city maturity model (SCMM) framework, which holds the ingredients necessary for a good recipe. The framework is developed using prior research in economics and information systems and examining leading case studies of smart city implementations to identify a common template for smart city planning and development, while also noting differences in their implementations and complementary practices across cities.

It comprises of a detailed Assessment and Solution framework.

The Assessment framework takes into account the physical infrastructure, social infrastructure and technological aspects of the city and measures them under certain parameters. The physical infrastructure has been assessed with respect to the city’s infrastructure capacity. The social infrastructure is assessed with respect to education as well as access to amenities like electricity, drinking water and TV. The technology savvy-ness of the city is a measure of the citizens’ access to computers, internet, and mobile phones.

The framework first assesses the cities against social and physical parameters and places them into four groups- development laggards, low moderate development, high moderate development, and development leaders. These groups are further classified into either technology leaders or technology laggards depending on the technology savvy-ness of the city. This analysis is able to
define the maturity of the city against these parameters. It also gives a fair idea of the city’s readiness towards the change.

An initial assessment done using the 2011 Census data generated the following result for some of the Indian cities. It depicts the city’s maturity with respect to its physical and social infrastructure as well as its technology readiness.

One of the key observations as part of the research study was the stand out positive impact of technology on the performance across clusters of development. This impact was particularly high for clusters at the extreme ends of the development trajectory – laggards and the leaders. As the analysis reveals- “The percentage difference in per capita GDP between technology leaders and laggards, for laggard, low moderate, high moderate and leader clusters is 173%, 29.4%, 20.75% and 64.1%, respectively. The equivalent difference in innovation for the four clusters are significantly greater at 132%, 771%, 12.4% and 1082%, respectively, and that for life expectancy for the four clusters is 10.3%, 0.86%, 4.7% and 3.2%, respectively.”
This insight forms the base to further chalk out the customised solution for the city depending on its current maturity. This is done using the Solution framework. The Solution framework develops the right operating model, identifies the technology and process design and the degree of stakeholder involvement as part of the customised solution for the city’s planning and development.

The operating model for the city’s development is designed with an eye for using the right amount of process standardization across the different agencies in the city as well as the right amount of data integration across the various agencies keeping in mind the maturity level of the city. The second aspect is the magnitude and type of core technologies and ICT involvement. The third crucial aspect is the degree of stakeholder involvement like that of having dedicated government bodies, citywide guidelines as well as citizens’ involvement. All together, the three carve out the best suited solution for the city.

The maturity curve for Smart City Solutions, depicted below, indicates information dissemination and service optimization to best suit cities with lower development indices whereas replication, integration, and connected services to work well for cities on a higher developmental trajectory where the cities are more mature in terms of their readiness towards the change.
While the model provides some great insights around the maturity of the city and brings out areas where efforts need to be made, Prof. Mani also elaborated on the need for more enriched data and information for best results. To this she welcomed collaboration and contribution from all the various stakeholders. It is clear that efforts based on good information would have positive and definitive results in the cities of the future.

Smart Cities – Solution and Learnings from HTRIMS by Subrahmanyam Yadavalli, Managing Director and Group CEO, NextWave

HTRIMS is being used in the city of Hyderabad for automating 221 traffic signals. It leverages technology for managing the rapidly growing city’s traffic.

The state of Hyderabad city in terms of vehicular traffic- increasing number of vehicles every day- 20 year old standalone signals and lack of adequate infrastructure like footpaths etc. is a condition known to all the citizens. Mr. Subrahmanyam was driven by the motivation to devise a smart technology solution to ease the city’s traffic. He studied the many models and solutions being used abroad and used the knowledge from the west and moulded it to be used in Hyderabad. He emphasized the need for social and technology infrastructure mapping for a city while designing a solution that best fits and caters to the needs of the city.

Building a model like that of HTRIMS requires uninterrupted power supply and support of other physical infrastructure at many fronts. Inadequate power supply and inadequate infrastructure is a common scenario in most of the Indian cities. While trying to execute a project like this, the many departments that come into play for executing a number of requirements is not small either. Multi-departmental interaction with no single ownership of systems and processes makes it difficult to
execute the project in a streamlined manner. Managing contracts and SLAs were some of the other bottlenecks that Mr. Subrahmanyan identified in the process.

With this set of ground challenges, HTRIMS is being executed with 221 automated and centrally controlled signals. It uses Vehicle Actuated Technology to execute Area Traffic Control (ATC) with synchronized signals. It does corridor management and has cameras to monitor the traffic congestion along with fall back power connectivity. HTRIMS has set an example among major cities. It stands as an icon that has leveraged technology and integrated the limited resources into taking a step towards a smarter city.

Can India Offer Affordable Mobile Internet and Broadband Services for Billion+ Users? By Prof. Kiran Kuchi, IIT Hyderabad

Prof. Kiran Kuchi’s talked about a key infrastructural element- Internet connectivity- without which smart cities cannot function. He spoke about how despite auctions and conversations about 2G, 3G and now 4G some fundamental gaps remain as far as Internet connectivity is concerned. He alluded to the fact that the definition of broadband itself has evolved and it is only now that there is a general consensus that sustained speeds of over 2Mbps can be considered to be broadband.

The professor also spoke at length about how these speeds were not available to retain customers in India even with 3G. In the western world, telecom service providers often have sufficient bandwidth in the spectrum allocated to them and therefore are able to provide sustained speeds. In India, however, with high competition for spectrum during auctions and high cost of the spectrum, the providers often have insufficient bandwidth allocation to provide end customers the kind of internet speeds comparable to the west.

In India we need to bring Internet to the masses at relatively low cost to expand reach beyond urban areas into the rural hinterland. The NOFN (National Optical Fibre Network) project, aims to implement optical fibre network for the country taking Internet to the farthest corners of the country. There are challenges despite high penetration of optical fibre network at the last mile that is still covered through installations of cellular base stations. This contrasts with the western world, where optical network would terminate at homes.

Prof. Kiran Kuchi, who is also an active member of the TDSI, spoke about the expectations of 5G especially in terms of cost and the impact it might have on the internet through the volume generated by Indian retail customers if we were to make an assumption of 2.5GB consumption per month. With the advent of IoT and allied solutions it is imperative that these computing resources are provided with appropriate telecommunication resources.

Looking at the future, Prof. Kuchi mentioned the initiatives that they were taking under the aegis of TDSI to embrace indigenous innovations. With numerous Indian start-ups taking the dive to develop solutions for challenges such as those of Smart cities and the eco system warming up to the needs of India, it is extremely important that the new products and solutions are able to handle high volume data, a spectrum of frequencies, and are able to deliver all of these at a competitive cost to the Indian consumer.
Panel Discussion: Smart Cities Technology Solutions

The panel to discuss technology solutions for a smart city consisted of Mr. Jayesh Ranjan-Secretary Information Technology, Electronics and Communications Department, Telangana, Mr. Amer Azeemi- Managing Director, Cisco Consulting Services & head Internet of Everything Practice for APJC emerging markets, and Mr. Laxmi Narayan Rao, country leader-HP Future Cities and CTO-Technology Services at HP India Sales Pvt. Ltd.

Technology is considered the epicentre for the development of a smart city. Technological solutions in all walks of life like that of HTRIMS for managing vehicular traffic, efficient means of energy consumption, making services easily available for citizens, safety etc. are already being used worldwide.

Disruptive technological innovations, digitised business models, local and reverse innovations are some rapidly growing trends being observed in many industries now. Internet of Things with cutting edge sensors are now capable of collecting a wide variety of data that can be accumulated and visualized for better insights to address the challenge at hand. The near real time data collected from the sensors can be turned into valued information and used for better understanding of the problem as well as the solution to be designed.

With an understanding of the vast potential that technology holds, the leaders from the IT industry defined a smart city as one that is liveable with all the basic amenities like health and safety being taken care of first. Smart cities should be based out of innovation and should be enterprising places catering to the needs of all, including the urban poor.

With this clear blueprinting of a smart city and no dearth of technology innovations and solutions, be it from being adopted and adapted to the west or locally developed solutions, the Indian cities now look for concrete formalized solutions for them.

The suite of technologies like that of Internet of Things with sensor devices to collect real time data and cloud for designing solutions were proposed to cater to core necessities like water and

![Image of Smart Cities Need to Deliver to Citizens]

Figure: Smart Cities Need to Deliver to Citizens
electricity, essential services like health and education, and city specific services like Innovation Hub. The panellists also spoke of the potential use of mobile apps and web portals in this process to enable the key aspect of establishing G2C (government to citizen) and C2G (citizen to government) connect, which is critical in driving the change.

This conversation was well complemented by inputs provided by Mr. Jayesh Ranjan, who shared the view from the governance side and gave a holistic picture to the participants.

Mr. Ranjan stated the government’s vision of a smart city was that it should be catering to the needs of citizens at all levels and not being limited to that of one. The setup of T-hub in the city to encourage and scale innovative ideas from start ups is a great initiative being executed under the joint efforts by the government and key stakeholders. The appointment of the city CIO is a first of its kind initiative that is being taken for looking into the standardization and integration aspects of technology across various departments as well as providing a single point of contact for the technology savvy community. These initiatives point towards a forward looking government.

T-Hub is expected to collect many start-up ideas from entrepreneurial minds. Mr. Ranjan stated the five criteria against which the government plans to evaluate the start-up projects- the ability to solve the stated problem, cost effectiveness, ease of use, interoperability, and the potential to cater to the citizens at all levels. These he said, were formulated keeping in mind the general interests of the citizens to be primary.

As a critical point, Mr. Ranjan spoke of technology as a key enabler in the process. However, he cautioned against treating it as the panacea for all the problems. He highlighted some of the major challenges like that of lack of trust in the citizens towards the government which hampers their acceptance of these smart solutions. Also, the fragmented and complicated administrative structures and multitude of agencies working in silos with no coordination between them did not help the cause. With these challenges at hand, he spoke about the change management required to work on some of these issues and set the expectations of the audience towards a balanced approach between technology-led smart city solutions and ground level realities.

Further, as we understand the need for multiple technical solutions that will be required for a smart city, it becomes mandatory to look into some of the best practices that can be leveraged for sustainable outcomes. The need for a standard platform and a basic architecture for building the many innovative solutions can be one such critical point. The standardised architecture, once identified, may be made available to the general public for being used to further build the many technical applications. This will bring in the ease of interoperability and future maintenance as well
as coordination among the various applications. Further, identifying certain services that can be
coordinated nation-wide so as to avoid reinventing the wheel at various levels, can be one other
best practice that should be adopted.

The second half of the day dealt with discussions and knowledge sharing on the various engagement
models to drive the huge initiative of developing 100 smart cities. Public-private partnership (PPP)
was the major topic of the discussion and brought out the many bottlenecks that still exist in the
systems and processes that govern PPPs since a decade now.

**Panel Discussion: Smart Cities Engagement Models**

The Union Finance Minister has spoken about our infrastructure not matching our growth ambitions
and therefore has indicated the pressing need to increase public investments. The Union budget
2015 shows an increase of INR 70,000 Crores towards investments in infrastructure creation,
considering it central to its road map for economic growth. While the government is consciously
working in this direction, the kind of infrastructure growth across many sectors like transportation,
education, power, and urban services that is needed in setting up 100 smart cities is understandably
substantial. Public funds as well as quantity and quality of manpower with central, state, and local
government alone cannot meet it.

The government’s efforts in the development of PPP to exploit the private sector efficiencies in
implementing projects was seen to start around the mid-1990s and has been a growing trend with
both parties to benefit from each other. While India is only second to China in the number of on-
go ing PPPs and second only to Brazil in PPP investments, there are bottlenecks seen and felt in the
partnership.

The panel on smart city engagement model had Mr. V.B. Gadgil, chairman L&T metro rail Hyderabad
and Mr. N.S.N. Murty, Smart Cities Leader for PwC, India. The discussion saw Mr. Gadgil speak
vociferously about some of the related issues from his personal experience.

Some of the issues that he stated included the need for restructuring the government-industry
partnerships with the primary concern being the contracts and the SLAs. The risk sharing between
the two parties working for the project should be equal. Although the risks are identified and shared
with equal obligations from both the parties in the contract, the structure of the contract and SLAs
are often not foolproof and capable to handle situations as they occur during execution. He related
an instance where the promoter of the project goes through the SPV (Special Purpose Vehicle) route
for specific reasons, and a certain amount of funding for the project is made available by SPVs from
banks and financial institutions. The banks and the SPVs look at raising funds from the future
revenues of the projects. In the scenario of the project not performing up to the mark, the
promoters may want to withdraw midway, which is risky for both the parties. This, however, is not
well accounted for in the contracts and SLAs.

The PPP infrastructural projects are usually long tenured. The funding models for the projects are
such that these long projects receive funds only towards the end. This adds to some amount of
unrest as the private partner often does not look at it as a fair deal. Mr. Gadgil compared a PPP to a
vehicle being driven by a horse and a bull. This design for pulling a cart brings in the tenacity of the
bull and the speed of the horse in accomplishing the task. PPP is a design that runs with the same
idea but needs rectification on some fronts like that of contracts. It demands a fair mindset from
both the parties while designing the contract to make it a potential partnership as that of a horse and bull to work in coordination.

Mr. Murthy from PwC shared his experience around structuring contracts and SLAs that play a critical role in the success of the partnership. He stated that even though there are best practices listed in the General Financial Rules (GFR) which are international standards, the departments involved in the PPP choose to go back to their own guidelines for the contracts as they want to stick to how it has been done in the past. To this, he stated the need for training people in the administrative structure for contract development, which at the moment is inclined more towards closing the contract rather than ensuring its success. The private partner, on the other side, has been observed many a times to be using risky bidding by not being judicious in stating the time and material required for the project. This is driven by the idea to clinch the deal, which eventually leads to lapses and problems like not being able to meet the timelines while executing the project.

Under the smart city initiative, Mr. Murthy spoke about the government’s pan-city initiative and area-based development of the cities. The pan-city initiative is towards building at least one smart solution to be applied city-wide, whereas the area-based development is a step by step model to look into small areas like a minimum of 15 acres for a redevelopment, 250 acres for a greenfield, and 500 acres for a retrofit. Mr. Murthy stated that the SPV for area-based development will not be for the entire city and will have limited scope and power to those areas only. The SPVs and PPPs are not formalised under these initiatives as of now, which is also an opportunity for the city and state to decide on the guidelines for them.

Mr. Gadgil expressed his views towards shifting the focus of the smart city efforts from technology to other critical aspects that hamper the execution of the smart solutions. He stated that the fragmented government departments and lack of single ownership in the departments pose a major bottleneck in addressing a problem completely. Our country needs a change in the mindset of people and smart leaders to drive the smart city initiative before talking about anything like smart technology solutions.

Delivering the Promise of Smart Cities: Vizag, Ajmer and Allahabad by Prof. Shamika Ravi, Fellow, Development Economics, Fellow, Governance Studies at Brookings

Prof. Shamika Ravi opened the talk by stating that her motivation behind the subject of smart city was the Modi-Obama joint declaration in November 2014. The declaration spoke about preparing three blueprints for smart cities: Ajmer, Allahabad, and Vizag. Given the current state of the Indian cities, the amount of transformation that will be required is understandably phenomenal. The ideal scenario of a smart city is one which essentially leverages technology to manage and use the city’s limited resources like that of water and energy to create intelligent ways of making the city more liveable. Prof. Ravi stated that “the nature of the smart city project is not one intervention but multiple interventions”. It raises many challenges like that of environmental concerns as well as fiscal stress on the government. The need for newer and innovative ways to achieve the goal is necessary to take these challenges head-on.

Efforts are being made both by governments and global firms to meet the challenges to provide smart city services. Prof. Ravi said that despite the efforts, there is still a long way to go and the smart cities movement is still a work in progress. She gave a reality check on how some of the random efforts put in for a smart city turn out to be a dampener. Vested interests and varied perspectives often hinder the development of a unified plan for the city. This eventually results in non-productive outcomes that do not sustain in the long run.
Prof. Shamika Ravi’s presentation was a cue towards observing the development of a smart city from an economic perspective of the city. She stated five key points as principles to formalise the smart city framework which would provide direction to the efforts being put in and usher the city into being an economically driven smart city--

1. A city cannot maximize growth and investment without an economic plan. A strategic economic plan should be formalised for meeting goals like that of job growth, productivity, economic inclusion, leveraging industry specialization, innovation and education, to name a few, for the economic prosperity of the city. Off the shelf technology solutions are not viable everywhere and there is a need for a comprehensive economic vision to understand the products and solutions to use and policies to adopt under the smart city economic plan.

2. A chief innovation officer in the city to guide and coordinate the investments being made is needed. This will provide a single point of contact on behalf of the government to ensure that multiple smart city projects and investments are aligned with the city’s economic plan.

3. The provisioning for trainings and education in the smart city should naturally gravitate towards technology-based jobs such that smart cities develop a natural inclination towards their contribution in India’s indigenous innovation and technology community.

4. Frameworks should be developed to scale innovation and foreign investment in the city. For instance, new specifications from the International Standards Organization (ISO) can establish a new set of city performance indicators for smart cities with a universal approach to measure them. Acquiring these new ISO standards can help cities grow their marketplace.

5. Any smart city’s partnerships should be a paragon of transparency and citizen engagement. The smart city technology being rooted in systems and processes of government and citizen engagements will have the capacity to promote and foster transparency and as a result of which, inculcate trust within the citizens. This may even help ameliorate India’s reputation with respect to corruption and inequality.

Mr. Naveen Gattu is the co-founder of Gramener which is a data visualization and analytics firm. Mr. Naveen gave a peek into the many ways data can be visualized to make better sense of the analysis results. His presentation showcased how visualizations based on the results of the analysis done using data can bring out clarity on the issues involved. This holds particular relevance to the current subject when the industry and the government are looking to draw upon the outcomes from the data analysis to prepare definitive and concrete solutions for a smart city. He brought out the challenge of data scarcity. The need for data, which is the core and essential necessity to leverage the potential that data analysis and visualizations offer, was emphasised and the need to build on data in all fields was established.

Complexities of Land Acquisition by Prof. Ashwini Chattre, Associate Professor, University of Illinois

Prof. Ashwini Chattre from the University of Illinois is an Associate Professor of geography and Geographic Information Science. He spoke on the topic of complexities of land acquisition practices in the country. Though it seems like a straight forward process to acquire land, the way it is executed in our country is not so simple. Prof. Ashwini attributed the unfair and complicated land acquisition deals to two problems. The first problem is the system of land valuation which is being used to value a parcel of land. It is now also enshrined in the 2013 Land Acquisition Act and it continues to use the
old 1894 model of valuation. The model holds no sane reasoning to be used and applying more than a century old rules to present day land deals. The second problem is that the land valuation system completely neglects and does not account for the public land at all. Looking at the 120 year old history of land acquisition in India, public land has been used as sweeteners for deals where the land is given almost for free. The value assigned to the public land is calculated as some multiple of the land revenue that was assigned to it in the land revenue settlement conducted by a colonial officer 100 years ago. This severely under values the contribution of this public land towards the livelihood of the poor and the landless and has severe adverse impacts on the incomes of those people who are affected by this land acquisition.

These issues, although known to all, are not addressed and cause severe damage to the livelihood of many. They often result in delays in acquiring the land, lead to inevitable cost escalations of the land, and loss of efficacy in the process. The leaders and the bureaucrats themselves have no idea on how to deal with the valuation of land either as there are no available tools, techniques, and data for the same. The investors, who are looking to buy the land, on the other hand have no experience or interest in contributing in this issue as their main concern is limited to acquiring and transforming the land for infrastructural facilities and urbanization.

Prof. Chattre’s work along with other colleagues is to use technology to turn the act of land acquisition into a science. He plans to harness technology and data sources and combine them in innovative ways using state of the art techniques and technologies, both analytical and physical, to estimate the value of specific piece of land anywhere in India. Smart cities development and acquisition of land for various developmental requirements go hand in hand. The process of land valuation becomes extremely valuable in this scenario to reduce the challenges that occur while acquiring the land and to provide a fair deal to those affected by it.

He stated some of the current approaches that are used by economists to estimate the value of land like that of Revealed Preference Model and Atomic Decomposition Model. These can be used to understand for instance, the distribution of the money paid as a cost towards buying the house, under various parameters like cost of the construction, land, interiors, plumbing, including aesthetic things like the view from the house. There are contingent valuation methods as well, that allow one to estimate how much value can be attributed to aesthetic attributes to which it is otherwise difficult to assign a monetary value. There are Rational Optimization Models which have a net present value approach and help estimate, for instance, the net expected returns of the land bought today. The problem with all these estimation models is that they require a lot of data and will thus require a lot of land transactions to be able to collect the kind of data to actually generate results out of these models.

To overcome the challenges of operating in data scarce environments and being able to deal with the extremely diverse data, Prof. Ashwini proposed a suite of models to bring together analytic advances to deal with these challenges. These models have the capability to draw the power of data available at the national level and bring it down to the local level where the data is pretty scarce. There are three kinds of solutions already being used in disparate fields that can be used and applied for land valuation as well.

The first one being ensemble predictions for uncertainty estimates. This is where a number of different models are built with different attributes and different functional forms that predict the same output. This ensemble is a check to see whether estimates using different modelling assumptions tend to converge to the same value or not. These kinds of models are used for weather prediction. For instance, the path of the hurricane is a mean of the estimates of different models
working under different modelling assumptions. This model draws upon the power of all the models involved and is not dependent on the errors of any one model.

The second one is called coupled models and these are popular in the public health domain and public land management. These models use techniques to bring different kinds of data to bear on a particular outcome using the process model, such as to predict the value of land in our case. A major implementation of coupled models is in disease transmission.

The third set of models includes integrative models that link local and micro level processes to macro level outcomes and vice versa. This is particularly interesting in the land valuation scenario as both the macro and micro levels are equally important and interact in real time to produce the value of land. Many decisions taken at the macro level influence the way in which owners and users value land in a particular point in time and in specific localities. It is important to know the decision making that takes place at the macro level to identify the priorities for land acquisition at local levels and vice versa. The integrative models have been used for hugely diverse purposes such as poverty mapping for small areas using nationally representative surveys. These models draw the power of nationally available data and pull it to draw inferences locally where the data is insufficient.

Using the above models and the two step approach as mentioned further, the value of the land can be derived. The first step involves scrapping, acquiring, cleaning, and integrating primary and secondary data. The aim is to put all the data together in a spatially explicit cyber infrastructure that has identifiers across scale, both temporal and spatial. This is being done as a collaborative project between the Indian School of Business, National Council of Applied Economic Research, and Department of Land Resources, which is in the ministry of rural development and responsible for the implementation of the Land Acquisition Act. This is a time consuming work in progress.

The second step is to crowd-source user input into a web interface that pulls together all the data of particular processes in particular locations through the models mentioned above by using some useful techniques like special disaggregation or geographically weighted regression. This would enable the users to go to a website and fill in whatever information they have at hand. The data engine at the back end can then pull out all the related data through these modelling procedures to provide an estimate of the value of the land and a confidence interval around that estimate.

This is a step being taken towards making the process of land acquisition as fair and transparent as possible so that the debate around the subject, while not avoidable, will at least be based on evidence. This effort is a fine example of how technology can be put to practice for particular outcomes desired by the society.

The entire day showcased the presentations, talks and ideas towards solutions for a smart city. It seemed like the right time to discuss and assess the impact of these solutions on its social, environmental and economic front.

**Panel Discussion: Impact Assessment of Smart City Solution**

The panel on Impact Assessment of Smart City Solution consisted of Prof. Sanjukta Bhaduri, HOD of Urban Planning and Architecture, Mr. Srinath Chakravarthy, Vice President at National Institute for Smart Governance, and Mr. Navin Mittal, Special Commissionaire of Greater Hyderabad Municipal Corporation, Telangana.
Prof. Sanjukta Bhaduri opened the talk with her submission on sustained and continuous growth of a smart city as the primary goal in laying out the development model for a smart city. An overall development plan of the city that is designed by taking into account the physical, social and environmental aspects of the city can ensure and account for sustained and continuous growth of the city. The cultural richness, physical integrity, resource efficiency, biological diversity, environmental purity, and local prosperity are some of the aspects that need attention to create social, environmental, and economic balance. The city’s development plan should be inclusive and account for these aspects to build smart cities that are deep rooted to not just cater to its citizens but also fend for the peripheral and neighbouring regions as well.

Taking scenarios to support the above, for instance, a big social impact on the citizens of the city would be that of many jobs being rendered obsolete by the introduction of Information and Communications Technologies. The development of skilled labour via various means to cater to the needs of such people will be critical. The impact on the environment considering the ecological footprint, waste disposal, hazard proneness of the city and even implications of climate changes due to introduction of the huge physical and technological transformation of the city cannot be ignored as well. While having systems for regular monitoring of these parameters is important, the city’s development plan should have these as inherent check points or guidelines in building the right development model for a smart city. Besides, the development plan should account for and ensure that a smart city should not be a smart island catering to the needs of its citizens only; it should also not become a burden on the surrounding and peripheral regions for things like waste disposal and carbon footprint.

Prof. Bhaduri emphasised the need for a development strategy to be in place. Dense population, low proportion of open spaces, high proportion of informal settlements and low income communities, poor quality of housing as well as the varied landscapes and history of the city are some of the characteristics that define our Indian cities. With such challenges at hand, there is a need to have a different development strategy as per the characteristics that define the city. Besides, different developmental strategies for regions that are greenfields (new cities still coming up and available for fresh development), brownfields (which are existing cities with already fair amount of work been done) or whitefields (with both existing greenfield and brownfield areas) are required for an overall ecological balance. A plan, which carves out the best fit model for a smart city which is just right in balancing the environmental, social, and physical needs of the city and is not limited to the boundaries of the city alone in terms of meeting the ecological needs, is the mantra.
Further, under the lens of impact assessment, having an all round plan for the development at the physical, social, economic, and institutional front of the city will result in the improved quality of life with the cumulative effect to attract investments and generate better employment for citizens. This kind of overall uplift of the city provides a competitive edge to it and a base for sustained future growth.

Figure: Sustainability Concerns of a City

CONCEPT NOTE ON SMART CITIES- MINISTRY OF URBAN DEVELOPMENT, GOI

VISION FOR A SMART CITY

SMART CITIES will provide for Sustainable Economic Development and High Quality of Life through

- Improve Quality of life with:
  - Physical Infrastructure
  - Social Infrastructure
  - Economic Infrastructure
  - Institutional Infrastructure

This Quality will then provide for
- Ability to attract investments.
- Generate Employment

Figure: Vision for a Smart City
Mr. Navin Mittal shared his perspective on the development of a smart city. He mentioned the change in the maturity of the art of urban development over the past decade. There is a realization that cities can be huge generators of wealth and managing them well, they can serve as great drivers for growth. He viewed the smart city development broadly under governance, infrastructure, environment, and technology. He stated the importance of formalising processes for better governance and developing infrastructure support on models that suit and apply well to Indian cities. Talking about the environment, he spoke that smart cities should be built on a foundation to be able to give back to Mother Nature in the same way as we use its many resources for a sustainable model of the city. Mr. Mittal elucidated that ICT is already being used and applied by Hyderabad Municipal Corporation for the ease of business. Data analytic techniques are being leveraged to draw knowledge from the available data sources for insights. He stated the role of government in this entire process as an enabler and emphasised the need for innovation and change management in the current government structure to help in this process of change.

Mr. Srinath looked at the development of a smart city under the four pillars of smart governance—physical, social, institutional, and economic infrastructure. To assess the impact of the development done and to understand how it has converted to make citizens’ lives better, the answer can be best obtained from the citizens themselves, he said. Mr. Srinath took scenarios from healthcare and education. He cited the difficulties people from the rural areas face when they have to come all the way to cities for treatments big or small and spend days outside the hospitals. Making use of technology, if they can be provided the first consultation and a diagnosis for their problem at their place, will make a big difference to their lives. Meeting basic amenities like that of education, creating green spaces and affordable housing can be some of the many parameters that can make big differences in the lives of the citizens. Besides provisioning of the amenities under the four pillars, it is equally important to have a set of formalised KPIs against each to measure the extent to which each of them is being executed and delivered.

Assessing the impact of these many smart solutions on the lives of the citizens is important and should be obtained from the citizens for best results. Given the way our electoral democracy functions, we can expect the feedback to be brought in from the citizens. At the same time, it is very difficult to actually measure some of these parameters like ‘liveability’ or ‘quality of life’ keeping in mind the varied aspects under which it will have to be assessed. Given this complexity and the urge to generate the best assessments of impact around these many parameters, it is essential to capture, collect, and monitor data from different sectors. A city level MIS incorporating this kind of data for doing an impact analysis is a vital investment that was proposed.

The second day was dedicated to look at the innovation landscape of the country from various perspectives. Prof. Anand looked at innovation through patents being registered in the country and laid out some of the trends and questions to ruminate about. Mr. Patro from Cyient showcased how innovation is being encouraged and fostered at Cyient Ltd. Prof. Sisir used the Mid-day Meal programme to showcase how innovative ideas along with the use of simple technology can help maintain sanctity in systems and processes and Mr. Manoj Nuthakki from 42 Hertz drew out a comparison between the product IT firms and innovative customized services firms.

Innovation Landscape of India: Some trends and puzzles

Innovation Landscape of India: Some trends and puzzles by Prof. Anand Nandkumar, Assistant Professor, Strategy at Indian School of Business
The quantum of innovations in the country indicates technological and scientific growth in the country. They contribute towards economic growth and can be directly linked to the GDP of the country. Considering the number of patents being filed as a fair representation of the number of innovations happening, the figure below depicts a positive association between the number of patents and the GDP.

Figure: Number of Patents and GDP per Capita in the Country

Although the GDP of the country has more than tripled between 2000 and 2013 and is second only to China in this period, India’s scientific output has been quite low. India pales in comparison to the USA and China with per million patents being 3.27 for India, 1861 for China, and 459.31 in the USA.
The grim picture of the Indian patent scenario can be attributed to controversial IPR laws in our country. The dearth of patenting by government entities and almost no university patenting being available also adds to the reasons. China on the contrary is leaps ahead even with its relatively new patent systems. Democratization of innovation across China with patenting being done domestically by local establishments as well as mainly by private enterprises and individuals seem to be the main drivers.
A further study of these patents in the country showed that the science and technology patents alone registered 8% year on year growth as against a 7% overall growth, revealing that most of the patenting was done in this area. An industry-wise study of these patents gives a good sense of the nature of industrial development over decades in the country. It shows most of these patents to be coming from industries like chemicals and pharmaceuticals, mechanical engineering, medical devices, electronics, and computers, while a few of them from textiles and rubber.

Figure: Science and Technology Patents

The next point of observation is the domination of patenting by entities not resident in India. The trend shows that although there has been an increase in the total number of patents by Indian entities, the proportion of Indian patents to the foreign patents has marginally decreased. Patent filing being cheaper in India, around 78% of the patents filed in India were invented outside while only a handful of 7% were invented in India. Adding to this information, between 1974 and 2000, 45% of all granted patents that were held by foreign entities belonged to those entities that also operated in India and the proportion was higher in the top 12 science and technology classes as against other classes. To support this, a region wise study of the patenting pattern in the country also revealed that patents came mainly from regions in which the foreign firms were located.

Figure: Who Patents?
Another controversial point to be noticed is the trend in the trademark patterns. Assuming trademarks to be a crude proxy for the products being introduced, the trademark pattern (as against the patents) shows large increases in Indian filing.

![Trademark Patterns](image)

**Figure: Trademark Patterns**

To summarize these gatherings, there has been a good GDP growth for the country and a large increase in the trademark numbers, whereas there have been low numbers of patent filing in the country with a good amount of them being held by foreign entities. Prof. Anand left the audience to ponder over some of the puzzling questions like that to consider indigenous innovation as against foreign innovation as the sources of growing GDP of the country and to explain the growing trend of trademarks with no supportive figures from patenting. He left the question open for people to think of ideas on how the government can revamp some of its policies to promote indigenous innovation in the country.

**The Differentiators in Technology Services by Mr. Rajendra Kumar Patro, VP Engineering, Cyient Hyderabad**

Mr. Rajendra Kumar Patro, Vice President Engineering at Cyient Hyderabad took the talk on innovation forward. He spoke about Cyient’s expanse into providing engineering services into many industries like rail transportation, energy, semiconductor, heavy equipment, aerospace, and defence. Their goal is to achieve the $1 Billion mark. This he said cannot be achieved by just providing services and manpower. The firm looks to provide integrated services and solutions in solving problems for its customers as a strategy to achieve this goal. He stated that a firm’s capacity should not be limited by only services and manpower, an inclination towards new solutions and innovative ideas is the need. Innovation and value lies when the firm solves the problem for the customer and not just provides standard services. Having said this, there is no one standard way that can be laid out for integrating and solving problems. Innovative new ideas form the basis for these
solutions. He stated that innovation should no more stand as a differentiator but should become a norm that can be used and applied in all walks of life.

He laid out some of the creative initiatives his Company has adopted to encourage innovation among the employees. Idea Tree has been conceptualised by him and is being used at Cyient to cultivate an innovative mindset. It is one such effort in this direction which welcomes new ideas from one and all and scales them to desired levels.

Dial Mobile for Monitoring: Using Technology to Increase Transparency in Public Service Delivery by Prof Sisir Debnath, Assistant Professor, Economics and Public Policy, Indian School of Business

Prof. Sisir used the case of the delivery of mid-day meals (MDM) for school children to portray how a simple technology like that of Interactive Voice Response System (IVRS) can be used to rectify leakages and inefficiencies in systems.

MDM program was initiated in 1995 to combat malnutrition among the school going children and it entitled each school going child to a meal on the school premises. Based on the anecdotal evidence that the program had leakages and the suspicion that reports might have been inaccurate, the government introduced IVRS in the system to improve information flow. The conclusions drawn from the statistical data to study the quality and sufficiency of meals revealed improved efficacy of the delivery system post the introduction of IVRS.

Using simple and existing technology in innovative ways to accomplish big goals like these are great examples to be replicated and adopted by other regions as well.

Pitfalls of Customization in Enterprise Technology – Is productization the future? By Manoj Nuthakki, Founder and CEO, 42 Hertz

Mr. Nuthakki from 42 Hertz looked at innovation from the angle of customized IT services being offered by the IT firms. The IT services industry has been seen to evolve from offering product centric services to more and more customer centric services in order to improve customer satisfaction. Although customization can be better associated with innovation as against productization, the existing trends in the industry show a growing trend in revenue for IT product firms; this is not the trend for customized service firms. The customised service offerings by firms are deemed to cater more to the needs of the customers, yet it does not show in the revenues of the firms.
The high revenue trends for product firms can be attributed to the firms being able to capture bigger spectrum of the market requirements by segmenting their products better and by having low productization costs. The service firms on the other hand seem not to contribute much through innovation while delivering customized services.

Given the trends and the reasons to justify the trends, the need and relevance of both productization and customization is obvious and unquestionable. A customer may opt for an off the shelf product for reasons like the industry proven technology and processes that makes the product robust and reliable. The interoperability becomes better while they are also available at lower costs. Another customer with the need for building a competitive advantage or while driving a change management may opt for customized services as against the standard ones available in the market.

The service providers also may have different reasons to being product oriented and customized service oriented. The product services providers get an I/P which gives them a competitive advantage against the service providers that do not have I/P. Customized service firms may be driven by the idea to offer core business models customized to create competitive advantage for customers; other product oriented firms may choose to be product driven for simple reasons like reduced implementation risks, repeatability, and demand.

Having established needs and requirements for both, Mr. Nuthakki suggested ways to encourage productization in areas where there is no need to customize, and to customize and create value at the higher end of the market where the need exists. For instance, modularizing and standardizing solutions according to functions or industries can be one way to promote productization. Building a standardized core system and layered architecture too can promote productization and reduce redundancy to save time and resources. Specialized teams can then build customized innovative solutions on the top to create value.

Panel Discussion: Technology and Innovation
The panel for innovation consisted of Ms. Reena Dayal Yadav, Principal Engineering Manager in MSIT, India, Paul Meinshausen, Vice President of Data Science at Housing.com, and Mr. Srinivas Kollipara, COO at IIIT-H Foundation. The discussion opened on a very interesting note by Ms. Yadav stating that innovation has always been around and there is a need for continuous evolution.

India is witnessing many burgeoning start-ups with innovative ideas. Technology with its vast potential has opened the gates for creating new innovative solutions for almost all the challenges of life. It is not a surprise that a wish for a ‘magical device’ to overcome a certain problem by someone has already been thought of and devised somewhere. With firms and individuals opening up to the innovative mindset, there are ideas and solutions pouring in from everywhere. The revolution of being ‘smart’ has already created smart phones, televisions etc and the idea for a smart city has set the minds rolling and start-ups with bright innovative ideas are coming up in good numbers.

Given the fact that not all of the ideas from the start-ups are worth scaling to be able to cope with the challenge they hope to address, there is also the critical need to identify and promote those that are aligned with the broader scheme of action and have the potential to deliver. The setup of T-hub promotes these ideas from the start-ups. It has qualified people to gauge and pull out projects that have the potential to be scaled.

Having said that, some of the ground challenges that these start-ups face are unique to our country; these include trust among the citizens towards the government and also towards each other. Coordination and ownership issues between the multitude of agencies that come into play while executing such projects, inadequate infrastructural support, and the ‘jugad’ mentality make it difficult for the start-ups to establish themselves, which eventually dampens the spirit of innovation. Even as we realise and understand these existing bottlenecks, we hope that the spirit of innovative ideas and entrepreneurship of the country is not hampered by these idiosyncrasies and the continuously burgeoning new ideas will lead to an accelerated and compressed innovation cycle in the country.