Case-let

Cisco: Technology and Partnerships for Impact

Abstract

This case-let highlights the work undertaken by Cisco in using technology to enable partnerships for social impact. The case-let engages with the efforts involved by a multinational technology company like Cisco to develop effective partnerships in the social sector and maximise the potential of technology in this space. The case-let explores Cisco's partnerships with individual non-profit entities as well as its larger missions operating at the scale of nations. It also provides learners the opportunity to reflect on the role of technology in civil society.

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Origins

Cisco Systems, Inc. is a multinational organisation that specialises in the development, production and sales of information technology (IT) products and services. The organisation is headquartered in Silicon Valley, San Jose, San Francisco, California. The company was founded in 1984 by a young couple, Leonard Bosack and Sandy Lerner, who were working as computer support staff at the University of Stanford. At the time of its launch, the company's major product was the Cisco router, the first commercially available multiprotocol router. This technology allowed the router to connect together computers of different makes and connect them all to the early internet, which was at the time just starting to enter its phase of rapid growth and large-scale global adoption.

At the time, Cisco was the only company that was manufacturing the physical hardware necessary to connect computers to the internet, giving it huge competitive advantage in the commercial space at the time of its initial public offering (IPO) in 1990, making it the most valuable company in the world with a market capitalisation of USD 500 billion by 2000. Exhibit 1 covers the detailed story of Cisco's origins. According to Don Valentine, the founder of venture capital firm Sequoia Capital, who helped take Cisco

public: “Cisco in 1987 filled a desperate need. Customers were tearing the doors off hinges to get the products. I never met a company that entered the market in such a timely way and with no competition.”

Cisco’s products and solutions

Cisco has a wide range of networking hardware and software products, as well as packaged solutions for a large range of applications domestically, commercially and industrially. For example: Cisco’s technology can be deployed for use in analytics, automation, artificial intelligence, cloud computing, collaboration, critical network infrastructure, data centres, the Internet of Things, wireless mobility and digital network architecture.

Cisco’s traditional areas of expertise have been in switching (connecting devices to each other to create networks, within a campus or a building), routing (connecting multiple switches together to create even larger networks, for instance, connecting networks of computers and devices to the internet), security (defending against network intrusions and threats) and collaboration (conferencing, internet telephony and integrating various communication tools into unified solutions). Cisco also offers products related to data analytics and data centres (servers for storing and managing data generated by an organisation) (“Products, Solutions and Services”, 2020). Cisco’s network connectivity, switching, security and collaboration products are widely recognised as high-end, cutting-edge technology.

Technology-enabled partnerships for social impact

The problems that social purpose organisations (SPOs) look to solve are often orders of magnitude greater than the capacities of the individual organisations seeking to address those issues. On the journey to solving these problems, SPOs often find themselves competing for funds or attention from donors and society at large. They may fall short of the skills or resources required to meaningfully pursue their social mission. Technology is increasingly considered an effective solution for SPOs in this regard. Technology is able to increase operational efficiency, remove bottlenecks in the backend processes of SPOs, significantly reduce resource requirements, boost innovation and increase the efficiency of communications.

The strategic use of technology can also enable SPOs to scale their operations with a lower level of resource input. For effective impact at scale in today’s world, the ability to collect, process and make decisions based on data across all levels of an organisation’s operations is essential. However, when it comes to introducing technology into SPO programs or internal processes, some common pressure points have been reported (Pasala, 2018).

For SPOs working with funding constraints, the cost of in-house development of technical capabilities that could enable them to scale impact can be a significant barrier. Further, since SPOs are focussed on their social mission, investment in technology is low on the list of priorities, despite the potential benefits of these investments. Additionally, this lack of required technical expertise within SPOs also means that the true potential and capability of technical solutions is not optimally explored. Although many SPOs do have full-time technical staff, fewer have the bespoke technical development teams required to develop contextually appropriate, mission-aligned technologies that could enable an organisation to scale and increase their social impact (Sun, 2016).

It is in these instances where effective technical partnerships can help SPOs ease these pressure points. Cisco's scope for its non-profit partnerships lies specifically in helping SPOs to use technology to increase scale, efficiency, innovation and impact. Its chief strengths as a technology company lies in its ability to connect multiple working sites on a single secure network; collect and process vast quantities of data; provide collaborative platforms; set up highly secure means of storing and transferring data; develop innovative technical equipment that can transform the way an SPO manages its programs; and provide technical expertise and experienced development teams that are able to fully maximise the potential of a technology solution within a partner organisation.

As a technical partner, Cisco is able to help SPOs scale impact through increasing operational efficiency, making better and faster data-based decisions, increasing reach of programs in remote areas through connectivity solutions and improving an organisation's ability to collaborate with multiple stakeholders through the use of collaboration software and platforms. It is also able to provide advisory support in the areas of governance, operations, financial sustainability, impact evaluation and strategy. Cisco's core technical expertise is the foundation of its commitment to the use of technology for social equity and environmental benefit (CSR report, 2019).

Cisco and its non-profit arm the Cisco Foundation focus on the following areas for potential partnerships with SPOs:

Technology for social good

Developing partnerships and programs that use technology to increase access to opportunities. Primary areas of investment in this area include education, economic empowerment and critical human needs. Within this portfolio, Cisco's strategy is to enable non-profits to maximise their use of technology for scale and social impact.

Once identified, support is provided in the form of funding, expertise and donation of technology. For non-profits working in the area of economic empowerment, Cisco focuses on identifying technology-based programs that connect underserved populations to employment, skilling and entrepreneurial opportunities and financial services. In the education sector, the focus is on supporting innovative technology-based programs with an emphasis on STEM subjects to improve access to quality education in underserved communities. In the area of critical human needs, support is provided to non-profits working to increase access to basic human needs such as food, water and shelter. Within the area of critical human needs, Cisco places special focus on disaster response and supporting scalable technology solutions that help disaster teams provide critical services when disasters strike (Faucett, 2019).

Environmental impact and sustainability

Here, Cisco focuses on partnerships for innovation in energy efficiency and initiatives in the use of technology for water resource and waste management.

On a much larger scale, Cisco (the parent company) develops long-term partnerships with national governments to help countries accelerate their national digital agenda, as well as implement nationwide projects for digital inclusion, innovation, education and public services.

Partnerships for digital acceleration and inclusion

Cisco's product lines and areas of expertise lend themselves particularly well to the application for digital acceleration[1] and inclusion on a large scale. The company pursues a wide variety of partnerships to enable social transformations through the use of technology. These partnerships are formed at the levels of SPOs, enterprises and corporations, as well as with state and national governments to accelerate digital agenda at these levels.

One of the company's partnership strategies involves forming long-term partnerships with national leaders, industries, and academic institutions to enable and catalyse their national digitisation agenda. This program is known as Country Digital Acceleration (CDA). The CDA program is designed with four objectives ("Country Digital Acceleration," 2020):

- advancing digital education in the country to build a workforce capable of supporting the country's digital vision.
- enabling technological innovation in the country through the establishment of start-up incubators and innovation centres.
- increasing economic growth, efficiency and reducing costs through the application of technology and intelligent networks across economic sectors like healthcare, education and providing the technology for "Smart City" services.
- applying technology to increase the reach and impact of public services, increase digital inclusion and citizen access and increase public safety and security.

With a large-scale, long-term partnership like CDA, Cisco has to consider several factors that may not be relevant to their work with individual CSR projects or in their partnerships with specific SPOs. The first and most important thing Cisco emphasises as the key to the success of CDA partnerships is building trust and a real bond with the governments it works with. Programs that Cisco undertakes within a country as part of a CDA partnership often involve the development and maintenance of the underlying infrastructure to support and manage digital systems of the entire nation. This infrastructure would require critical support of the government, state and private systems, as well as handle the flow of highly sensitive data. The relationship between both parties is therefore critical to the success of the partnership.

In developing CDA partnerships, Cisco's leadership takes the time to develop trusting relationships with world leaders based on "shared vulnerability"—frank and open discussions about their personal lives, experiences, and context, as well as those of the world leader. It takes several meetings before technical project details or any sales take place. Initially, Cisco leadership works towards forming deep personal relationships with world leaders, understanding the detailed context of the country and earning trust through empathy, competency and action.

Competency and action are demonstrated by undertaking detailed research into the country across various dimensions and providing recommendations to advance education, enable innovation, increase GDP and improve the quality of life. It is only if this stage goes well between all parties that the partnership grows to the stage of discussing contracts for social transformation (Moorhead, 2020).

> This is a partnership with country leaders, it is a bond that we are creating with countries and country leaders, all of us are working together to obtain

[1] A strategy of continuously investing in and evolving new digital capabilities to suit the needs of the organisation.

> specific benefits for that country…It is very personal, as you are talking about equality amongst the citizens of a country, and CDA is going to be a demonstrator of how digitisation and use of technology is going to make communities that are underserved, become important in the country, as well as enabling that country to compete with other regions. (Maria-Jose Sobrini, Strategic Consulting Director at Cisco EMEAR; Cisco, 2018)

The next crucial aspect of building an effective partnership at scale is laying a foundation of the required intellectual capital within a country.

> One of the fundamental requirements of being successful in the digital age is having the intellectual infrastructure, the intellectual capital to be able to take advantage of the digital trends and changes that are taking place. So, when Cisco comes in to do a Country Digital Acceleration program, we don't just sell equipment and say, "Ok, good luck." So, one of the most important things that we do is that we commit to helping that country educate the next generation of digitisation professionals. We do that in a number of ways, for instance our Networking Academy program. When a student goes through a Networking Academy that Cisco puts on, they are trained as network professionals. (Guy Diedrich, Cisco VP Sales Strategy and Planning; Cisco, 2018)

Following this, Cisco looks to provide spaces within a city where an innovation ecosystem can come together to collaborate and take forward the CDA agenda in that city and country.

> The innovation centres that we create all around the world are really at the heart of a CDA. They are places where the innovation and technology community can come together to hear the greatest ideas from Cisco, for Cisco to gear the greatest ideas from them, and to create the next generation of opportunities and technologies within that city. (Guy Diedrich, VP Sales Strategy and Planning, Cisco; Cisco, 2018)

Cisco's CDA program in India operates a "6 x 6" framework: six focus areas across six states. In India, CDA invests in the design of proof-of-concept programs that are aligned with the national digital agenda under the Digital India initiative. The six focus areas are national broadband, smart cities, central government, cybersecurity, skills & education, and digital & financial Inclusion. The six states of operation are Andhra Pradesh, Telangana, Gujarat, Maharashtra, Rajasthan, and Madhya Pradesh. The first round of the CDA partnership with the Government of India ran 60 individual programs. For CDA 2.0, 27 new projects have thus far been identified (Mahalakshmi, 2020). In India, Cisco's CDA program operates under the Government of India's Digital India Initiative.

> Digitisation is the catalyst for economic growth. The government is actively promoting a start-up ecosystem and recognises the need for providing a conducive environment through the right investments and alliances. Our

> collaboration with Cisco is aimed at creating a sustainable innovation ecosystem in India to better compete in the global digital economy and improve digital inclusion for our people and businesses. (Rajiv Kumar, Vice Chairman, NITI Aayog; CRN Team, 2018).

CDA partnerships in India: Smart Cities and the Internet of Things

A salient feature of global society today is the widespread availability of devices that have the ability to connect and share information on the internet. In the latter half of the previous decade, this expansion in connected devices grew even further, leading to the development of the term Internet of Things (IoT).

> In a nutshell, the Internet of Things is the concept of connecting any device (so long as it has an on/off switch) to the Internet and to other connected devices. IoT refers to a huge network of connected things and people—all of which collect and share data about the way they are used and about the environment around them. IoT includes an extraordinary number of objects of all shapes and sizes: from smart microwaves, which automatically cook your food for the right length of time, to self-driving cars, whose complex sensors detect objects in their path, to wearable fitness devices that measure your heart rate and the number of steps you've taken that day, then use that information to suggest exercise plans tailored to you. (Clark, 2016)

IoT is the foundation of the concept of "smart cities" that are underway in India and around the world. Smart cities are cities that have been designed to use large amounts of digital technology and collected data to enhance the standard of living and quality of life in urban areas. In such cities, several aspects of public life and public services can be centrally managed for greater efficiency and sustainability. The concept holds significant implications for the entire discipline of urban planning, policy making and the future of human habitation. Research and development in this domain is often linked to the goals of UN Sustainable Development Goal 11: sustainable cities and communities.

A smart city would be able to use networks of connected sensors and devices around the city to regulate traffic flow; suggest optimum routes; monitor pollution levels throughout a city; manage street lighting, energy, and water consumption in buildings; schedule and optimise trash collection; manage parking services and improve surveillance and crime prevention, amongst others (Clark, 2016).

For Cisco, IoT is a key area of active research and partnership. With their strength in providing the underlying network infrastructure for vast networks of internet-connected devices, they are able to provide technical partnerships to cities, for-profit enterprises and social enterprises looking to develop smart city infrastructure for sustainable futures. Cisco provides the digital and physical platforms (e.g., dashboards, software and data centres) to allow for centralised data management and usage protocols, as well as the physical infrastructure through which a wide variety of smart applications, sensors and devices can connect, communicate and transfer data.

Cisco currently operates several smart city initiatives around the world as part of the CDA programs. One of the objectives of Prime Minister Narendra Modi's Digital India Initiative is to create 100 smart cities in India by 2022, with an available funding of around Rs. 7,060 crore for their development.

> When you think about the 100 smart cities in India, it is most important for us to understand what Prime Minister Modi's priorities are and as the technology partner, how we line up and help him go and execute against those. These smart cities are all about creating jobs, more efficient government, easing traffic and creating more effective citizen services. (Chuck Robbins, CEO, Cisco; CNN Business, 2016)

Towards this end, Cisco has established the sprawling, two-million square feet "Cisco Smart City" in its campus in Bengaluru. The campus will function as a blueprint for the development of smart cities around the country, to specifically demonstrate how networked technology and IoT can be applied to transform city and community design as well as urban planning practices.

The blueprint will showcase how intelligent digital infrastructure for education, transport, healthcare and parking services can be integrated within the macro environment of a city or community to ensure long-term economic, social and environmental sustainability (PTI, 2014).

Within the showcase smart city in Bengaluru, sensors and devices collect data from a city-wide infrastructure network with centralised management. Software then uses this data in conjunction with urban design principles and government policy to optimise and manage the services and environment across various parameters of the Smart City. This management occurs at multiple levels through the city environment. The technology at the core of the Cisco Smart City is discussed in Exhibit 3. The fully functioning Jaipur Smart City and the partnership between Cisco and the Jaipur Development Authority is presented in Exhibit 4.

Gram Marg Project: a new model of partnership for the rural context

The Gram Marg Rural Broadband project is one of the proof-of-concept projects undertaken as part of Cisco's CDA partnership with India. In collaboration with Indian Institute of Technology (IIT) Bombay, the project aimed to generate data on the optimal wireless technology architecture for the rural Indian context and showcase how wireless technology can be effectively deployed in rural areas. Insights on cost, ease of deployment, workable commercial models and behavioural changes in the population after the adoption of broadband in rural areas were generated (Cisco, 2020). Further, the project aimed to develop and validate a new model of partnership that directly involved the local community in the ownership, maintenance, and security of the broadband services. This model was termed the Public-Private-Panchayat Partnership Model (4-P model). In its pilot phase, the project aimed to connect 25 villages in Palghar district, Maharashtra with wireless broadband.

Sustainable rural connectivity requires an understanding of supply-side and demand-side factors which are very different compared to urban deployment. On the supply-side, low profitability of investment due to smaller scales and lack of existing digital infrastructure services play major roles in hampering efforts to introduce connectivity.

Demand is characterised by unstable customer bases (predominantly agricultural workers, often with no fixed income) and lower levels of digital awareness. Large-scale government-led, or private-sector initiatives do not work well in these settings due to the significant costs involved with little return. Instead, partnerships have been identified as the most suitable way to enable digital connectivity. Observations suggest that in some of the models that have operated in rural areas in the past, such as "Build Operate Transfer" models (BOT) or public-private partnerships, a major challenge is the lack of longevity of these services on the ground. The lack of involvement of the community for which the connectivity services have been deployed has been identified as a possible reason.

The 4-P model is conceptualised as a partnership between a public-sector partner, private-sector partner and the *gram panchayat* of the village in which the connectivity services are being deployed. In the model, the private-sector partner (for instance, Cisco) provides bandwidth and in the case of Grame Mark, the wireless infrastructure to connect together and centrally manage connectivity for 25 villages. The public partner in the model deploys the networks on the ground as well as the capital expenditure funding (CAPEX) for installing the infrastructure in the villages. The *gram panchayat* owns the network at the village level and forms the basis of the revenue model of the rural network. Exhibit 6 provides data on the design and validation of the 4-P model on the ground.

Partnerships for humanitarian assistance and disaster relief: the Hastily Formed Network

The Hastily Formed Network (HFN) is a term that was first coined in the aftermath of Hurricane Katrina, which struck New Orleans, USA in 2005. The term was used to describe the ad-hoc networks set up for crisis communications following the hurricane. It has since grown to become a formal term. HFN is a term used today to describe a portable network deployed in the immediate aftermath of a humanitarian or natural disaster, where normal communications equipment may have been degraded or destroyed. They are designed to provide basic communications capabilities for on-scene responders, support agencies or refugees. These networks further provide situational awareness and enable the co-ordination of relief efforts. From a connectivity perspective, disaster zones are characterised by minimal to no power availability, degraded or overwhelmed telephone services, limited internet access, limited satellite telephony services, limited signal reception and inhospitable terrain (Nelson, Stamberger and Steckler, 2011).

Cisco's strength in providing secure networks and connectivity around the world has led to the development of a unique niche in the area of disaster management. Cisco Tactical Operations (TacOps) is a team that is able to deploy anywhere in the world within 72 hours of an emergency, setting up and operating HFNs to support relief agencies, provide emergency connectivity to responders in the field and support critical infrastructure such as hospitals, utilities and essential services in times of disaster. Deployment of TacOps include providing government agencies and non-governmental organisations (NGOs) with real-time data and telecommunications ability in disaster zones, setting up secure communications networks in refugee camps, allowing families to access aid, complete asylum applications and access employment and educational services (Cisco Tactical Operations, 2020). To this end, Cisco TacOps develops bespoke equipment and vehicles that are designed to be taken into and used to provide connectivity in disaster zones. These are designed based on the characteristics of communicating in disaster zones. Overarching design principles include portability, non-military grade, commercially available equipment, flexibility (ability to run on multiple services such as 3G, 4G, Wi-Fi) and energy independence (Nelson, Stamberger and Steckler, 2011).

When setting up an HFN, important considerations include the physical geography of the disaster zone, availability of power and human needs, the most suitable form of network hardware, the required communications services and applications for the situation and an understanding of the socio-political and cultural dynamics of the human elements of the disaster. Exhibit 9 gives a detailed model for the deployment of an HFN. Cisco uses this model to determine the most suitable form and configuration of the HFN when deploying their TacOps team to crisis situations.

In 2015, tens of thousands of Syrian refugees began arriving on the shores of Greece, fleeing the brutal civil war in their country. In 2015, over 9,00,000 people made the journey to Greece, mostly by sea on unreliable and overcrowded craft (Clayton, 2016). On arrival in Greece, the vast numbers made it quickly apparent that purpose-built refugee camps would be required. A global relief response ensued. The TacOps team arrived in Greece in 2015 to set up connectivity services for the refugee camps. The project was overseen by NetHope, a consortium of 50 NGOs that specialise in improving IT capability and capacity of humanitarian organisations in developing countries as well as in disaster-prone regions. Cisco is one of the key partners of NetHope, contributing expertise, equipment, and ground response from its TacOps teams (Tompson, 2017). Past efforts in refugee camps focussed on ensuring connectivity and communication services for relief workers. This was the first instance where connectivity had to be set up on a huge scale for the thousands of refugees spread across a vast geographic area. Rakesh Bharania, the point-man for TacOps on the ground recalls that, “Internet access was not an optional luxury for these people, it was actually essential to their safety and wellbeing.”

At the time, asylum applications in Greece could only be submitted through Skype, rendering internet access a critical element of survival for a refugee. Cisco TacOps assessed the situation in Greece and designed a network based on the contextual requirements: a standardised network to allow replication across multiple refugee camps for rapid deployment; small, lightweight and highly portable elements, streamlined to require as few resources to run as possible; in-built scalability to account for the fact that the refugee camp would grow over time; and a configuration that maximised equity of access. This meant that the network supported the highest number of people while also preventing users from consuming an unfair share of bandwidth that would affect network speeds for the rest. Bandwidth tailored to delivering voice and video content was prioritised to ensure that refugees could reliably complete asylum applications and keep in touch with their family. Cisco’s wireless solution used for the project in Syria was centrally managed from the cloud, which meant that IT professionals from their headquarters and offices around the world were able to manage and maintain all systems on the network without the need to send staff to the ground, which would take time. The network was deployed across nine separate sites and supported a total of 4,00,000 users.

Security was another critical consideration in the design and deployment of this network. As noted by Bharania:

> A humanitarian crisis can create a justification for waiving concerns about how information is collected and used…refugees are especially vulnerable to lax cybersecurity in humanitarian crisis zones because there is an expectation that security will be lax due to limited resources and a focus on immediate survival.

The approach to designing networks for the refugee camp prioritised a strict adherence to advanced cybersecurity to prevent the network being crippled or infiltrated by parties from the ongoing

conflict in Syria as an act of cyberwarfare. It also emerged that around the camps, people would tend to congregate where the signal strength was strongest. This had the potential to develop into conflict as some members of the many ethnic groups and religions present had actually been in conflict with each other before becoming refugees in the same camp. Similarly, refugee camps could also become divided on gender lines, with some of the ethnic groups involved being averse to mixing across genders. The team, therefore, had to consider the location of signal routers to ensure gender equity within camps, so that cultural gender divides didn't also result in a divide in digital access. Thus, an in-depth understanding of the social dynamics of the refugee population was required to inform design and deployment decisions, to ensure that no single group was prioritised, and that consistent inclusivity was maintained. Overall, the project resulted in the largest and most secure wireless network for a humanitarian crisis ever deployed (Otto, 2017).

Using technology for social good: the next chapter for Cisco

It is no exaggeration to say that Cisco was a fundamental part of the technological revolution that built the modern world, its routing technology being directly responsible for bringing the internet into widespread commercial and personal use in homes and offices around the world. Cisco's context has changed significantly from that of the late 1990s through to the mid-2000s. Today, it is a highly established multinational in its field and is able to initiate and sustain a large number of programs towards its vision of a digitally inclusive future.

According to the organisation, in this current chapter of its existence, the question is how best to go about building the bridges that will set the company on a sustainable course to preserve the planet for future generations (CSR Report, 2018). The company has made significant effort to understand the potential of its technology for social and environmental benefit. Its activities within its profit-generating, corporate social responsibility (CSR) and non-profit partnerships are being consciously reoriented to leverage this potential to connect people and ideas across distances and at scale. Cisco sees this ability to build connections and networks as its greatest opportunity to contribute to a sustainable future. From partnerships and CSR initiatives at the level of individual NGOs, Cisco has over time transformed its capability and the scope of its vision as a technology partner. The CDA program seeks to leverage the power of trust-based partnerships and its expertise in the field of secure, intelligent digital infrastructure at the level of entire nations over long periods of time. The lens through which it approaches its business presence and its responsibility as a corporate citizen has progressively evolved over the last decade, with sustainable practices, circular economy, businesses modelled after the earth's natural cycles and consciously decoupling its consumption of finite resources from its planetary footprint right at the top of its agenda (CSR Report, 2018).

It does, however, remain a large, listed entity that is answerable to shareholders. Its market performance against competition that is much more developed and capable (relative to its early days when it had a near-total monopoly on the market) is crucial to sustaining its portfolio of activities through its non-profit foundation and its wider partnerships for social impact. Cisco has already grown past the practice of CSR as a simple budgetary and compliance requirement and is seeking to become an involved and transformative partner for the social space, carving out a niche as a technological enabler for the social sector as a whole. As the use of technology, collaborative platforms, and technical partnerships in the social space increases, both in India and around the world, Cisco's importance as a partner to the space looks set to grow.

Exhibits

Exhibit 1: The Origins of Cisco

The story of Cisco begins at the University of Stanford (California) in December 1984, when it was incorporated as a company by a young couple, Leonard Bosack and Sandy Lerner, who worked as computer support staff at the university. However, its origins lie a few years earlier in 1980, when Xerox, the company, gave Stanford some Alto workstations (an early form of the personal computer [PC] and precursor to the first Apple Macintosh) as well as an ethernet networking board. The ethernet technology inspired computer scientists at the University to develop a way to connect all the workstations around the campus so that they could all communicate with each other as well as access the early internet, which was widely used in academia at the time but had not found the commercial and casual use it knows today. Staff and graduate members at Stanford developed the "Blue Box," the first multiprotocol router. This router was capable of connecting together computers of different makes that ran different protocols and connect them all to the internet. Leonard Bosack was one of the team members who developed networking hardware components for the Blue Box. The software for the box was written by research engineer William Yeager, whose program enabled the Blue Box to exchange data between printers, terminals, servers as well as run the Internet Protocol.

Around the same time, Bosack and Lerner incorporated the company Cisco Systems (Cisco is short for San Francisco, where they were based) and started modifying and assembling Blue Box routers in the living room of their home. Along with another staff member, Kirk Lougheed, they improved the original Blue Box program's Internet Protocol ability and removed some of its non-Internet Protocol. Largely, however, this first "Cisco router" was identical to the original Blue Box. In 1986, Leonard Bosack's supervisor was informed that Bosack, Lerner and Lougheed had been developing routers for commercial use using Stanford time, resources and possibly their intellectual property. An investigation found that Bosack had sold some of this early technology to Xerox, under the brand name Cisco, but had not informed or compensated Stanford. Gathering enough evidence of misconduct, Bosack's supervisor went to the Dean's office. Bosack and Lougheed were forced to resign from Stanford, with the University considering whether to press criminal charges for the theft of intellectual property. Ultimately, however, the decision was made by Stanford to license the routers to Cisco, receiving USD19,300 in cash and USD150,000 in royalties from the fledgling company. Cisco also agreed to allow Stanford to use many of the improvements the company had made to the original program as well as to maintain Stanford University's internet for three years (Carey, 2001).

Rapid growth and the dotcom bubble

Following Bosack's departure from Stanford, the fledgling company took on investment from venture capitalist investor Sequoia Capital to grow the company and make their versatile routing technology commercially available. Multiprotocol routing that allowed the connection of disparate and geographically remote devices of different makes and models was a revolutionary technology in the commercial space. The venture capitalist investors of the firm, once contracts were signed, had the right to craft the management team. While Bosack and Lerner were given senior leadership positions, other members of their founding team were replaced by the investors. John Morgridge was also appointed by Sequoia Capital as a Chief Executive Officer (CEO) without consulting the Cisco founding team. The new executive did not get along well with the founders of Cisco who continuously clashed with the corporate

direction the start-up was taking (Bunnel & Brate, 2000). In 1990, the company was taken public through an IPO on the NASDAQ stock exchange in 1990 for a valuation of USD224 million. The same year, Lerner was fired by the Cisco board. Leonard Bosack resigned in solidarity shortly after. Leonard Bosack and Sandy Lerner are still known as the pioneers of commercial Local Area Network (LAN)—creating a network of locally connected devices across a company or campus boundary, which is today a staple of any large institution—corporate, governmental or academic (Vashishtha, 2018). This was, again, a technology that was unheard of at the time.

The timing of Cisco's public offering in particular was significant. The internet, in the first half of the 1990s, was going through a rapid expansion worldwide. The financial markets were caught by what is now called the "dotcom bubble" as investors flocked to capitalise on the potential of internet enterprise and commerce. Internet-related websites and companies were floated on the stock markets with multi-billion-dollar valuations, often far-inflated from their real value. Between 1995-2000, the NASDAQ Composite Index rose 582%, with 199 internet-related stocks worth USD450 billion ("What is the Dotcom Bubble?", 2018). This was a hugely significant period for Cisco. The market for large-scale internet service providers was only just emerging. Cisco was the only company in a position to provide the physical routing infrastructure required to sustain the rise of widespread Internet usage as well as support the bandwidth requirements of major internet service providers. Further, all its core products were integrated through their Internetwork Operating System, a flexible operating system that allowed its products to maintain pace with technology evolution through frequent software updates. Thus, by providing the entire suite of networking equipment and integrating them all together with a single versatile operating system, they were able to secure a near-total monopoly on the market. By 1997, between 70% to 80% of the large-scale routers that powered the internet were Cisco routers (Flower, 1997). By the height of the dotcom bubble in March 2000, its stock, worth USD224 million at launch, had soared to USD500 billion, making it the most valuable company in the world ("8 Things," 2017).

However, the extreme valuations that had been based on predicted future earning potentials of internet-based companies fell drastically when those predictions failed to materialise as real profits. Between 2000 to 2002, the highly inflated bubble "burst" leading to a widespread collapse in stock prices and several highly valued companies going bankrupt. Cisco's own value collapsed down to about USD51 billion after the bubble burst. However, the adoption of the internet for a wide variety of uses had arrived and Cisco managed to turn itself around by becoming a widely known high-tech brand, although never reaching the same dizzying heights as during the bubble. As of December 2020, it was the 51st most valuable company in the world ("Market Capitalization," 2020).

Exhibit 2: Digital India Initiative

The Digital India Initiative is the Government of India's program that attempts to bring together digital visions of the future across multiple government ministries and departments. The initiative has a threefold vision:

Digital infrastructure as a core utility to every citizen

- Availability of high speed internet as a core utility for delivery of services to citizens.
- Cradle to grave digital identity that is unique, lifelong, online and authenticable to every citizen.
- Mobile phone and bank account enabling citizen participation in digital and financial space.
- Easy access to a Common Service Centre.
- Shareable private space on a public cloud.
- Safe and secure cyberspace.

Governance and services on demand

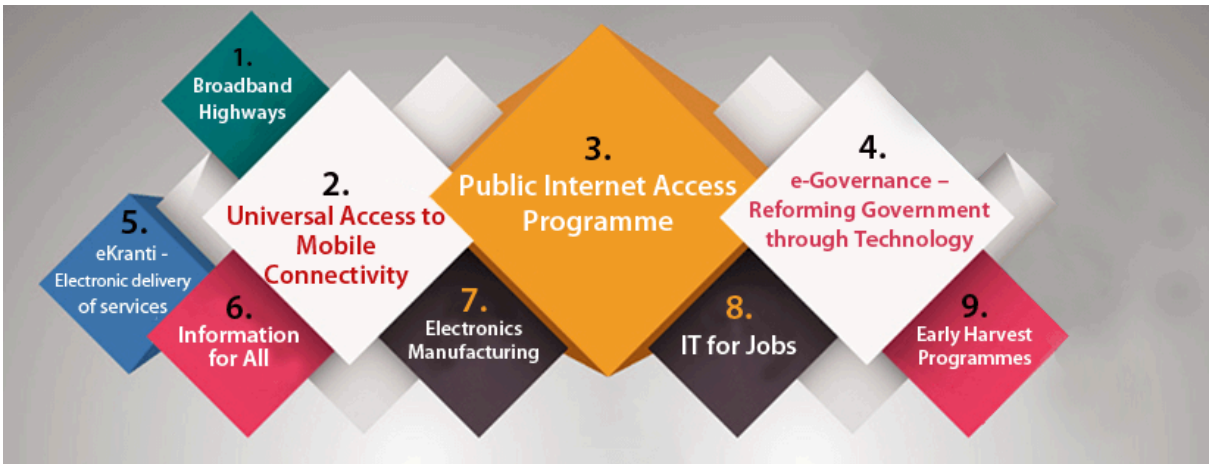
- Seamlessly integrated services across departments or jurisdictions.
- Availability of services in real time from online and mobile platforms.
- All citizen entitlements to be portable and available on the cloud.
- Digitally transformed services for improving ease of doing business.
- Making financial transactions electronic and cashless.
- Leveraging Geospatial Information Systems for decision support systems and development.

Digital empowerment of citizens

- Universal digital literacy.
- Universally accessible digital resources.
- Availability of digital resources/services in Indian languages.
- Collaborative digital platforms for participative governance.
- Citizens not required to physically submit government documents/certificates.

Program Pillars

Figure 1: The pillars of the Digital India Program



Source: “About Digital India”, 2020

Digital India is an umbrella program that covers multiple government ministries and departments. It weaves together a large number of ideas and thoughts into a single, comprehensive vision so that each of them can be implemented as part of a larger goal. Each individual element stands on its own, but is also part of the larger picture. Digital India is to be implemented by all the government departments with overall coordination by the Department of Electronics and Information Technology (DeitY). Digital India aims to provide the needed thrust to the nine pillars of growth areas shown in Figure 1 (“About Digital India,” 2020).

For 2021, the Digital India program has a total program outlay of INR 3,958 Crore, a 23% increase from the previous fiscal year (PTI, 2020).

At its launch in 2015, several prominent leading players from the private sector in India as well as multinationals with a presence in India announced plans for partnerships and investments in Digital India program areas (IANS, 2015) including:

- Reliance Group
- Reliance Industries
- Aditya Vikram Birla Group
- Bharti Group
- Vedanta
- Microsoft
- Google
- Cisco Systems
- Dassault Systemes
- Delta Electronics
- Nidec Corporation

Table 4: Key initiatives under the Digital India Program

Initiative	Description	Current Status
BharatNet	Aims to provide broadband access to 250,000 Gram Panchayats (GPs) through a network of Optical Fiber Cable	• 1,44,430 km of optic fiber laid; OFC connectivity to 62,943 GPs. • Initial target: Broadband to 150,000 GPs by Dec 2015. • Revised Target: Broadband to 100,000 GPs by March 2017.[2] • Non-involvement of states in the initial phases has led to hurdles, especially Right-of-Way issues, in laying of OFC.[3]
Smart Cities	Creation of 109 smart cities (target revised from 100) by 2022. INR 5 billion allocated to every city over 5 years for this purpose	• 60 cities have been chosen to be covered under the Smart Cities mission. • Allocation of INR 32 billion in union budget 2016-17.[4] • Budget allocation of INR 70 billion done at the time of launch, but revised to INR 1.4 billion in the 2015-16 union budget due to non-deployment of funds.[5]
Common Service Centers (CSCs)	CSCs are centers through which e-governance and related services will be made available to villages	• Over 1,70,000 CSCs are operational across India. • 2,50,000 GPs to have one CSC each (at least). • Village Level Entrepreneur (VLE) model being followed to empower locals; nearly 240,000 VLEs have been appointed.[6]
Digitization of Post Offices	Digitization of post offices including setting up centralized data centres, networking of all post offices and enabling digital payments	• All 25,297 departmental post offices have been computerized. • 238 million postal bank accounts have been digitized. • 155,000 post offices (130,000 in rural areas) to be digitized by March 2017.[7]
Universal Access to Mobile	Aims to provide mobile access to more than 55,600 villages that do not have mobile coverage	• 55,669 villages to be covered by March 2019. • 8,621 villages in the North East to be connected by September 2017.[8] • Accessibility of villages and sparse population make it commercially unviable.
Public Wi-Fi Hotspots	Creation of public Wi-Fi hotspots in India to enable citizens to access content without depending on mobile data	• India currently has over 31,000 Wi-Fi hotspots. • Over 100 hotspots to be made operational at various railway stations by March 2017. • India should have 8 million Wi-Fi hotspots to meet the global average of one hotspot for every 150 people.
India Stack	It is a set of open APIs that enables development of payment-enabled applications, using Aadhaar as the base for authentication	• Rapid adoption of the JAM (Jandhan-Aadhaar-Mobile) trinity has enabled customer identification and access, based on which several other digital transactions can be carried out. • The open API ecosystem combined with the digital literacy mission can go a long way in creating apps that are customized to suit local needs.
National Cyber Coordination Center (NCCC)	The Ministry for electronics and IT has planned to set up a center to safeguard India's cyberspace against potential threats	• Process has been fast tracked; RFP expected to be finalized by December 2016 – January 2017. • NCCC expected to entail an investment of INR 9 billion.[10]

Source: Deloitte (2016)

Exhibit 3: Cisco Smart City Blueprint, Bengaluru

Cisco Smart City is a blueprint for smart city architecture and functionality, set within its campus in Bengaluru. Designed as a 'campus-as-a-city' for Cisco employees to live, work, play and learn, it is intended to showcase how a city-wide physical infrastructure can connect to a network of devices with high security, to deliver enhanced quality of life.

Within the buildings of the Smart City, energy consumption, water usage, lighting and ambient environment and carbon emissions are monitored and managed in accordance with the central network's protocols that can be programmed to align with various sustainability priorities or with the goals of the city's energy and emissions policies. Energy usage can be precisely aligned with demand cycles. For instance, lighting can be remotely turned off across streetlights, offices or parking spaces when not in use. Cisco has estimated a 35% saving in overall energy costs for buildings using its energy management solution as well as a 40% reduction in overall energy usage. Within workspaces, Cisco uses technology to optimise workflow and office management for overall efficiency as well as leveraging its strength in providing collaboration software to facilitate group work and creativity. Cisco's collaboration technology is also applied in the Smart City to showcase the latest advancement in collaborative learning techniques and remote healthcare and clinical examination for use in connected learning campuses and healthcare environments. The Smart City also incorporates the Remote Expert solution, designed as a blueprint for enhancing digital inclusion and delivering governance and government services digitally. The solution connects the citizen to a selection of local, regional and central government services, as well as enabling face-to-face sessions with government representatives from remote locations (Cisco, 2015).

> One of the fundamental tenets of economic development is that as a country grows, prospers and becomes more developed, it becomes more of a polluter. It is impossible, some believe, to grow an economy and be a good environmental steward. But through country digitisation and the Internet of Things, we can actually break that cycle. An example is, inside a Smart City, where you have smart parking. As I'm driving to my destination guided by my Google Maps, as I get within a few hundred metres, all of the available parking spaces automatically light up on the map. I pull into a parking space, and it starts charging me automatically through my smartphone, and stops charging me when I leave the space. It is a simple improvement, it is simple technology that has reduced congestion in the city of Paris by as much as 30%. At the same time, it's going to keep all those cars from driving around for 20 or 25 minutes looking for parking and polluting the air all the while. (Guy Diedrich, Cisco VP Sales Strategy and Planning; Cisco, 2018)

Cisco is also in partnership with the Delhi-Mumbai Industrial Corridor Development Corporation to establish four financial and industrial hubs with sustainable habitats, optimised energy supply, waste management and pollution control and efficient public transport. The project also involves engineering companies as partners who will develop the required physical infrastructure for the regions. Cisco will be developing the Master System Integration Plan for the entire project. The partnership will therefore attempt to integrate the city management and urban planning layer (the foundation of a city's services such as public safety, traffic management, municipal services) into an intelligent digital infrastructure

developed by Cisco. Exhibits 4 and 5 provide more examples of Cisco's IoT-based partnerships in India (Cisco, 2019).

Exhibit 4: Jaipur Smart City

Jaipur, the "Pink City" in Rajasthan, has a rich cultural heritage dating back hundreds of years. Its architecture, culture and sights have made it a very popular tourist destination, both nationally and internationally. The city attracts 40 million tourists every year. A huge boost to the city's economy, the vast numbers of visitors in recent times have been putting city services under strain. As a result, the Jaipur Development Authority initiated the Smart City project to improve the lives of the city's 3.5 million residents as well as improve the tourists' experience in the city. The objective was threefold:

1. Uncompromised safety for all: Having in place security solutions throughout the city to monitor activity and movement in the city's most crowded areas as well as increase safety for vulnerable groups such as female solo travellers.
2. Simplified tourist experience: As a 300-year-old city, the maze of narrow lanes and modern elements built over generations of ancient public infrastructure makes it a complex place for tourists to understand and navigate. The city represents a significant challenge to digitise due to its nature being at crossroads between the modern and the ancient.
3. Digital empowerment of citizens: As per the key mandate of the Digital India Initiative, the Jaipur Development Authority wanted to provide its citizens with state-of-the-art digital public services to increase the quality of life for its citizens.

Hence, the need emerged for a partner with a strong pedigree in technology that can manage the huge task of digitising a city, reliably integrating complex technical solutions at various levels and packaging them for straightforward central management by the city's authorities.

> Digitisation will be key to how cities, communities and countries maintain global competitiveness, increase GDP growth, foster innovation, and create new jobs. "Digital Rajasthan" is a powerful platform to realise that vision. Today, citizens of Jaipur are digitally empowered, and this is just the beginning. We envision Jaipur as a role model for digital transformation for other cities to follow. The City of Jaipur and JDA recognises the effort of Cisco to help us lead in this transformation. (Vaibhav Galriya, Jaipur Development Authority Commissioner)

Hence, Cisco developed a framework for comprehensive digital infrastructure incorporating the following city development layers:

The street layer: Smart lighting, public WiFi networks, smart parking, citizen engagement (smart information kiosks and apps for tourists, resident access to digital government services), public safety solutions and a wide range of environmental sensors (detecting pollution sources and levels throughout the city). All urban services at the street layer are connected using a secure, scalable city-wide IoT network.

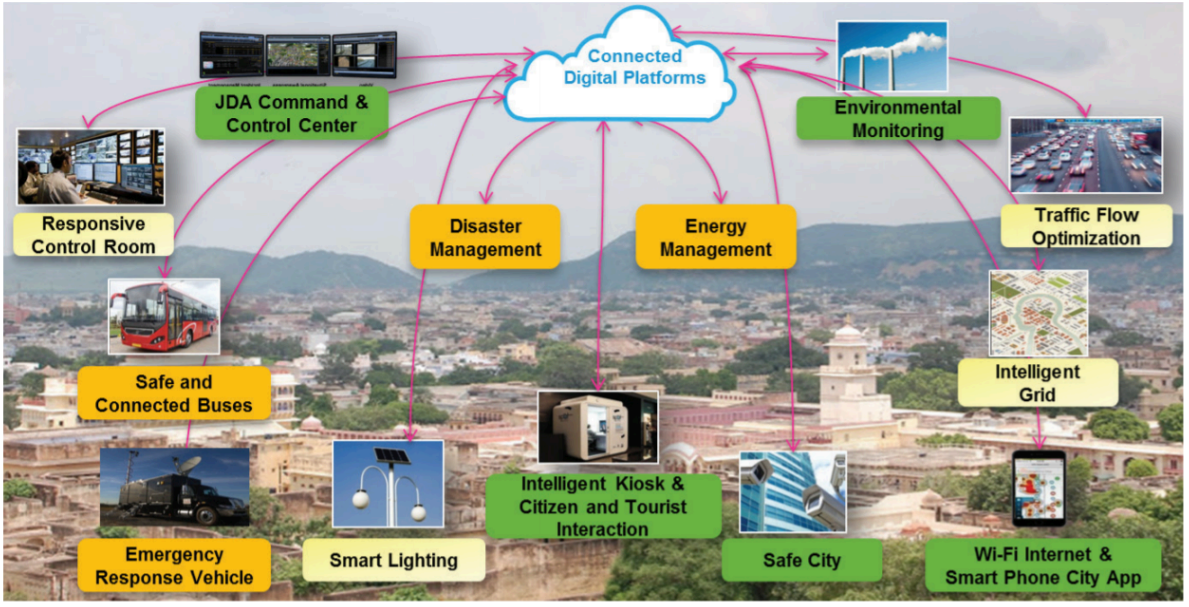
The city layer: Incoming data from the street level is aggregated through a city-wide fibre optic network for transfer to a bank of data centres.

The data centre layer: This layer accepts the huge amount of incoming data for processing into simplified, actionable parameters and recommendations and communicates these to the central command and control room staffed by the Jaipur Development Authority. The information aggregated by Cisco's digital platform is viewable through an interactive dashboard by both the Jaipur Development Authority and residents of Jaipur (Cisco helps turn Jaipur into a Smart and Safer city, 2017).

> Jaipur is a historical city that attracts tens of millions of tourists from all over the world annually. Jaipur is focusing on technology innovation as a Digital City to showcase greater connectivity and information access for our citizens and tourist visitors. Working with Cisco has made this vision a reality, and our city is benefitting in every aspect—from safety and security, to easy access to information, to overall improvement of our image and our stepping into the "Smart City" arena. (Shikhar Agrawal, Principal Secretary Water Resources, State Water Resource Planning, Government of Rajasthan)

On a particular stretch of roadway in Jaipur, prior to the partnership with Cisco, over 4,000 accidents were recorded every single year, and officials could not understand the reason. After installing IoT sensors and video cameras as part of Cisco's overall smart city solution for Jaipur, city officials learned that more than 70% of accidents were attributable to drivers going the wrong way down the road. The Jaipur police department used this information to significantly reduce the number of accidents on the road. Access to data, "completely changed the paradigm," stated Munish Khetrapal, Managing Director of Solutions, Cisco.

Figure 2: A vision for Jaipur Smart City



Source: Cisco helps turn Jaipur into a Smart and Safer city, 2017

A video is provided to be used alongside this exhibit titled: Cisco Exhibit 4: Jaipur Smart City

The video contains a clip from local news media on a tour of Jaipur Smart City's command room developed by Jaipur Development Authority and Cisco. In Figure 2, the room featured in the video corresponds to the tag "JDA Command and Control Centre." The tour explains the various aspects of Jaipur Smart City infrastructure and its control. A translated transcript of the video, originally narrated in Hindi, is shared below:

Reporter: Chief Minister Vasundhara Raje has inaugurated a networking centre under JDA and along with her lot of other people were also present. Now we are going to present to you the specialisation of this operating centre. If you look at the back, there are various cameras that are placed at various locations in Jaipur, and with the help of these cameras, monitoring will be done in the operating centre. Apart from these, there are various other things. We have with us Mr. Debesh Gupta who is in charge of this operating centre. We will have a conversation with him. What are you going to monitor?

Mr. Debesh Gupta: With the help of this operating centre, whichever smart solutions are there, have all been connected to a single digital platform. If we talk about cameras, they are located at 45 different locations, where 350 cameras are installed, and for which, monitoring is done here. These are not normal CCTV cameras, these are analytics-based cameras where we can capture the different situations as you can see on the laptop, right now, which means entire monitoring is done here. To ensure that accidents don't happen, we have 35 high-end cameras placed at Gaurav Tower. In addition, smart solutions like smart lights are integrated here, parking solutions are integrated, environmental sensors are displayed, and all this data through Citizen's App, which CM [Chief Minister] Madam has launched, will be visible to the general public. Please show parking data. From 9 different locations, including the mall, we can see parking data and a layman can also see this. Like this JDA building, there are 490 slots

out of which 245 are occupied and 245 are empty, so before a person comes he can figure out if the parking space is available or not available.

Reporter: What about pollution?

Mr. Debesh Gupta: Please open the pollution screen. This is pollution status, this is CO [carbon monoxide] level that is below 10 PPM. It is considered a safe zone, above that falls a bit under an unsafe zone, so for laymen, for example, if he is an asthma patient, or if he is going into GT [Gaurav Tower] area, what is the pollution level there? What is the CO level? So he can avoid going there.

Reporter: Can we see all those things in the App?

Mr. Debesh Gupta: It is also displayed on the app and we are also monitoring it here. This entire data is available on the App.

Reporter- As per the layman?

Mr. Debesh Gupta: This entire data is there on the App.

Reporter: Can you also look at who's using Wi-Fi?
Mr. Debesh Gupta: Not just the people, but also which websites are being used, which mobiles are being used? How many people are connected at the moment? All this data comes into our City Digital platform.

Reporter: So, this is the step towards a smart city, whether it is about the cameras or the status of pollution…

Mr. Debesh Gupta: Yes…or sensors, parking, everything.

Reporter: So overall as you can see the way in which you can find out about parking, pollution status, and this entire thing is for a layman, if we talk about a layman they can download smart city App in their mobile phone and avail all this information.

Exhibit 5: Technology-Driven Agriculture: Village Knowledge Centres in Kannur, Kerala

The Kerala State IT Mission, in collaboration with Cisco, is developing a model for bridging information asymmetry in the rural economy of the state. The Village Knowledge Centre (VKC) is conceptualised as an institution similar to the *gram panchayat*. The VKC's focus will be tailored to the specific context of the village economy. The project is being piloted in 15 villages of Kannur district in Kerala, where the predominant rural economic activities are agriculture and aquaculture. Cisco is developing two separate platforms for the VKC project namely, the Agro-Digital Infrastructure (ADI) platform and the Smart Agricultural Platform. ADI platform will provide access to a data store containing farming data, land profiles and farmer databases. This platform will be connected to the separate Smart Agriculture Platform.

Paddy and shrimp fields across the pilot area will be equipped with IoT sensors that detect pH, humidity, temperature, rainfall *et cetera*, and transmit this information to the centralised platform at the VKC. These sensors are used alongside satellite imaging for real-time updates on field conditions, soil quality, harvest progression, harvest readiness, weather patterns and other parameters. Thereafter, ADI will run analytics software on this incoming data to generate insights that will be used alongside domain expert recommendations to provide farmers with actionable insights on crop yields, plant disease patterns, upcoming weather conditions, and other conditions. Farmers will also be able to access best practice videos, government policy updates, crop advisory services and government financing services through the VKCs.

The VKC is equipped with collaboration technology from Cisco to connect farmers to training sessions and conferences with domain experts, other VKCs and the Central Monitoring Centre. Further integration of the I Got Crops platform developed by Mindtree[2] into the VKC will connect farmers to market-making and business enabling opportunities (CRN team, 2019). All VKC capabilities can also be accessed through a mobile application as well as a web portal. The web portal and application include dashboards that summarise vast amounts of data into user-friendly displays at farm level, department level and individual incident level. It also enables farmers to rapidly upload incident reports and obtain help. The Government Engineering College in Kannur houses the main data centre for the whole project, also supplied by Cisco. It stores all of the incoming data across all sensors and satellites as well as server connections to individual VKCs ("Smart Agriculture and Aquaculture Project," 2019).

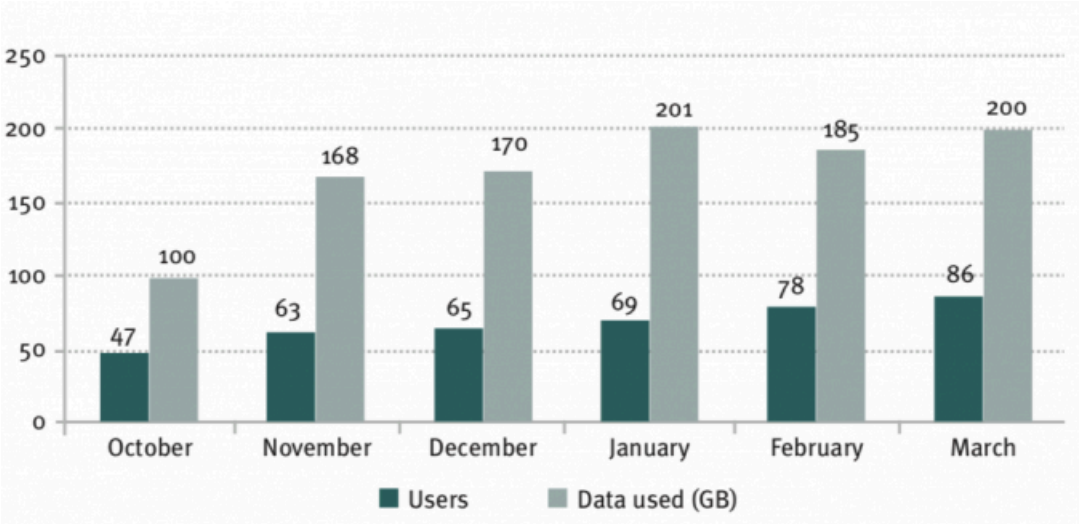
[2] A farmer empowerment platform that enables marginal and artisanal farmers to sell directly to consumers to increase their income. It provides information, opportunities and a formalised value chain for farmers' produce.

Exhibit 6: Gram Marg Project: 4-P Revenue Generation Model

In the 4-P model developed for the Gram Marg Project, two forms of revenue model were tested. In the first model, the *gram panchayat* purchased bandwidth from the local internet service providers. The *gram panchayat* then used this bandwidth for themselves as well as to sell it to villagers to generate revenue. They purchased the internet using Rs. 10 coupons at the *panchayat* office that provided one hour of connectivity. Alternatively, monthly usage coupons were also available for Rs. 100. This model was applied in 15 of the 25 villages. Once connected, the cost incurred by the *gram panchayat* per month to purchase the bandwidth was roughly Rs. 1000, including operational expenditure.

In the second revenue model, validated in 10 of the 25 villages, local youth from the village were designated as Village Level Entrepreneurs (VLEs) by the *gram panchayat*. Their capacities were built on skills including selling bandwidth to villagers, operating the network and conducting ongoing maintenance. In this model, the VLE invested a certain monetary amount essentially to purchase bandwidth from the local internet service provider. Fixed monthly plans were devised, enabling villagers to purchase connectivity coupons (Rs. 10 providing 500 MB for 10 days or Rs. 100 providing 12 GB for 28 days). It was noted that VLEs in villages running this model were able to generate between Rs. 3,000-6,000 in monthly revenue, varying as per village customer base size and internet usage. Based on the level of profit, the VLE was able to reinvest the earnings to buy more sellable bandwidth or to generate a larger user base. The initial results of the study as well as the steady growth in revenue generation in the villages represented a successful validation of the 4-P model on the ground. The 4-P model is a modular and scalable model. Although tested in 25 villages, it can be replicated for 50 or 100 villages with minimal changes to cost profiles or revenue generation. Longer-term trials are being planned for different village contexts and usage scenarios to further develop this partnership model (Belur, 2019).

Figure 3: The average number of users and data usage in the test villages between October 2017 – March 2018



Source: Belur, 2019

Exhibit 7: Other Initiatives by Cisco in India

Project	Overview	Year
Telangana Data Network	Establishing a data network between Hyderabad and Maheshwaram block, connecting *gram panchayats*, schools and primary health centres.	2017
Rural Common Services Centre (CSC) WiFi	Partnership between Digital India and CSC to provide WiFi at 2,50,000 *gram panchayats*. The Cisco Meraki technology was successfully demonstrated in Haryana and is now widely used by CSC.	2016
Andhra Pradesh Fibre	One-of-a-kind broadband project using a blend of aerial and underground fibre to provide digital services (TV, telephone and broadband) to every home, school, office and health centre in Andhra Pradesh.	2016
Connected Health Demonstrating Remote Diagnosis	Proof of concept connecting Jaipur Eternal Hospital to Pirawa village. The Remote Diagnosis Hub allowed patients to be diagnosed directly by the experts at Eternal Hospital as it provided the ability to share temperature, blood pressure and glucose probes with the hospital from the village.	
Connected Learning	Creating enhanced learning environments and seamless virtual classrooms (leveraging the potential of 'Bring Your Own Device'), setting up Digital Learning Campuses and solutions across 12 State Institute for Education Management and Training Institutes in Rajasthan.	2016
Digital Maharashtra	Nagpur Smart City, Fetri Digital Village, digital learning and	2016

	e-commerce hub in Dharavi, hardware manufacturing operations, 25 state-wide Networking Academies	
Cisco Kinetic for Cities	A centralised smart city management and monitoring platform that currently powers 75% of India's smart cities and moving towards the vision for 100 such cities in India under Digital India Initiative.	2019
Innovation Labs and centres of expertise for advanced digital technologies	Six innovation labs, three centres of expertise and USD40 million in funding opportunities for early stage startups, entrepreneurs, accelerators, developers and researchers that use technology for social impact	2016
Partnership with Atal Innovation Mission	Collaboration to equip 100 Atal Incubation Centres with high-end collaboration and conferencing tools to foster innovation.	2018
Project Leap: Cisco–Airtel partnership for fully automated 5G ready network in India	Developing an advanced automated network architecture in readiness for 5G data speeds and more connected devices than ever before	2019
Cisco N/Core partnership to identify tech-based Indian non-profits to incubate and fund, as part of Cisco CSR Initiative in India	The graduates of the program are supported and mentored to implement their ideas on the ground. These graduates have demonstrated the ability to deploy scalable technology solutions in the fields of critical human needs, education or environment sustainability. First Cohort: Involve Education, Alohomora Education, Pi Jam Foundation, Samagra Foundation, Lakeer Foundation, Intelehealth, Aquasafi Rural Development Foundation, and Change with One Foundation.	2018, 2019 ,2020

	Second Cohort: MIJINI, Anthills, Bridges of Sport Third Cohort: Energy Harvest Charitable Trust, Humsafer Driver Safety, Aroogya, Intellify, Level-Up, Makerghat, Charity Science Health, Civis Innovation, One Step Forward Foundation, Muskaan Dreams.	
Cisco Networking Academy	Aims to train one million students by 2025 in the areas of artificial intelligence, machine learning and IoT. Cisco provides a curriculum to schools, colleges and industrial training institutes for population upskilling. A Memorandum of Understanding has been signed with the Director General of Training for upskilling 1.5 million citizens through the Bharat Skills portal.	2020

Source: Cisco (2020), ETCIO (2016), Chakrabarti (2016), Balaji (2020), Cherian (2016), CRN Team (2018), Cicero (2019), Malli (2018), Rawat (2020)

Exhibit 8: Connected Conservation

Connected Conservation is a global foundation that aims to eradicate the practice of wildlife poaching through the use of technology. In wildlife reserves around the world, it was noticed that hundreds of people move through, enter and exit reserves—tourists, rangers, staff, suppliers and security personnel. These also include illegal incursions by poachers. In 2016, a pilot project was implemented in partnership with Cisco to deter poaching by comprehensively tracking the movement of people within the boundaries of a game reserve adjacent to Kruger National Park in South Africa. Cisco deployed an integrated solution, connecting multiple forms of technology and an array of smart sensors around the reserve to proactively monitor and stop illegal entry. The sensors would be able to detect and differentiate between legal and illegal incursion and trigger an alarm in the control centre. This in turn would be relayed to patrolling rangers and helicopters with the exact coordinates of the incursion.

The solution involved developing a "point-to-point reserve area network" (RAN). This functioned as a high-security virtual "net" that covered the geographic boundaries of the reserves. IoT seismic sensors and magnetic sensors around this periphery were able to detect incursions into the net. Further stages of biometric scanners and Closed Circuit Television (CCTV) cameras were able to detect incursion by unauthorised personnel. The entire reserve was also connected up with multiple Wi-Fi networks, the national poacher database and a cloud-based data centre to allow real-time data analysis. In the first year of implementation, poaching in the reserve dropped by 96%. In the following two years, no rhinoceros poaching incidents were recorded. It was a dramatic shift from the pre-pilot figure of one rhinoceros lost to poaching every week ("Connected Conservation," 2020).

Table 1: Data on rhinoceros poaching rates in Kruger National Park.

	2013	2014	2015	2016*	2017	2018
Incursions	51	52	76	25	20	27
Rhino carcasses	45	10	14	2	1	0
Possible number of rhinos lost	51	52	76	25	20	27
Poacher success rate	88%	19%	18%	8%	5%	0%
Ranger success rate	12%	81%	82%	92%	95%	100%

Source: CSR Report, 2018

*****Cisco technology was introduced in 2016.

A video is shared along with this exhibit entitled "Cisco Exhibit 8–Connected Conservation." The video is a short clip of Bruce "Doc" Watson, Group Executive of Cisco Global Alliance and a founder of one of Cisco's major partner organisations (Dimension Data) talking through the Connected Conservation project in South Africa. The transcript of the video is as follows:

Bruce: We are losing three a day, one every eight hours, which is a massive number. If we continue at the rate we are going, by 2025, rhinos will be extinct in South Africa, which is a desperate situation. It's a dream of mine. I'm a dreamer, but I do believe that I make dreams come true. The whole project arose, in terms of designing what we could do with next to nothing in terms of infrastructure. What we did was more looking at the proactive side in terms of conserving land and getting to the people before

they got to the animals. We networked a private reserve alongside the Kruger National Park. This morning, I got an update. There was an incursion along the fence line which we have sensors on and thermal cameras and they were able to intercept the people and get them on the run before they hit the animal. So it's a 24 x 7 x 365 day management centre of the reserve. It's one of the most exciting things I've ever done. If we can stop rhino poaching, hopefully we can stop all forms of poaching and that to me would then be how successful we have been in terms of implementing this little project in the greater scheme of things. I don't believe there's ever a wrong time. I think if you get an idea or dream that you want to perform or do or realise, I think there's no time like the present.

Exhibit 9: Hastily Formed Networks

Table 2 shows the model for a HFN for deployment in a humanitarian crisis or natural disaster. The table is to be read upwards from the bottom, with the first layer being the physical. This model can thus be used to obtain a configuration for the kind of response required for an emergency connectivity provider like Cisco. Individual configurations will vary widely depending on the specifics of the disaster situation that the Cisco team is heading to support.

Table 2: Model for a Hastily Formed Network

	Human/Cognitive Layer			
	Social/Cultural	Organisational	Political	Economic
Applications Layer	Text	Voice	Video/Imagery	Specialised
	Email, Chat, SMS	Cellular, Satellite Phone, Landline	Layer Maps, Geographic Information Systems e.g. Google Earth Pro	Software for collaboration, situational awareness, command and control
Networks Layer	Wired	Wireless Local	Wireless Long Haul	Satellite Broadband
	Cable, DSL	Wi-Fi	Microwave	VSAT
Physical Layer	Power	Human Needs	Physical Security	Network Operations Centre
	Fossil Fuel, Renewable	Shelter, water, fuel, food, medical care	Security of equipment and personnel, access and authorisation	Building, mobile unit, tent

Source: Adapted from Nelson, Stamberger and Steckler, 2011

Layer 1 - *Physical*: This layer takes into account the physical context of the disaster region. These comprise the base considerations of what is required to build an HFN. The layers above will not function unless the physical considerations at the site are met.

Layer 2 - *Networks*: This layer takes into account the specific type of network connectivity the situation at the disaster zone requires. When deployed, these will form the backbone of the connectivity services available onsite. Various technologies are available, and the configuration most suitable for the context is selected by the TacOps team.

Layer 3 - *Applications*: Once the layer 2 networks are deployed at the site, this layer determines the applications and communications services that will run on those networks, providing the relief teams with the ability to share information of various forms and co-ordinate the activities of multiple agencies and efforts.

Layer 4 - *Human and cognitive*: This is an overarching layer that wraps around the other three, and is often considered the most challenging aspect of HFN deployment, as the eventual effectiveness of the HFN depends on the human element at the disaster zone. This is especially the case when responding to situations in foreign countries. Relief efforts can be hampered by interference or lack of unity between competing relief agencies, government rules and regulations regarding the use of radio frequencies or satellite imagery or customs regulations regarding the network equipment, amongst others. Another sensitive area is the social and cultural impact of a disaster. Early responders can come into conflict with others on site due to biases and differences in culture, language, and different operating structures such as rigid top-down command (Nelson, Stamberger and Steckler, 2011).

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