Importance of Private 5G Spectrum for Industrial Development of India

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Abstract -- **Manufacturing industries today, generate and consume enormous data in real time, which is moved and consumed within these manufacturing Industries. For this, the smart factories of today must send this gigantic amount of data up and down within the factory and to their own offices and subsidiaries with minimum delay and superfast speeds and utmost security. Such data cannot be shared on public networks.**

The time is ripe for many industries to leverage private and captive 5G to increase efficiencies and automation. Connectivity needs of a range of industries, such as those in the mining, port, energy and utilities, automotive and transport, public safety, media and entertainment, healthcare, and education industries, among others require private 5G spectrum.

5G is available in configurations perfectly suited to building industrial-strength private wireless networks to support Industry 4.0. High band private 5G captive networks could generate an additional multi-trillion dollar of positive impact to India's GDP.

Keywords: Smart factories, Industry 4.0, Automated guided vehicles, 5G technology, Private wireless, High bandwidth video support

I. INTRODUCTION

INDUSTRIAL competitive advantage for India for the post covid-19 era depends on the integration of information technology (IT) to build an automated, agile and intelligence driven manufacturing industry. Today's manufacturing industries generate and consume a huge amount of data in real time, which is moved and consumed within these manufacturing Industries so as to harness the advantages of digital technologies. For this, the smart factories of today must send this gigantic amount of data up and down within the factory and to their own offices and subsidiaries with minimum delay and superfast speeds and utmost security. Such data cannot be shared on public networks.

II. LIMITATIONS OF WIFI

Until now, connectivity has remained a critical barrier to realizing the full potential of what is collectively known as Industry 4.0. Even the most advanced factories of today still largely depend on inexpensive Wi-Fi networks that have several drawbacks, such as interference in dense settings and complex fixed connections that are difficult to manage in large industrial settings. While spectrum for Wi-Fi is freely available, it is severally limited in quality of service (QoS) and support for mobility. In smart manufacturing, Wi-Fi cannot support the mobile requirements of automated guided vehicles (AGVs) or the even some of the faster moving arms of robots. It also does not support low power requirements of sensors and other IoT devices. And, it cannot support the high density of sensors, devices, robots, workers and vehicles that are operating in a typical manufacturing plant.

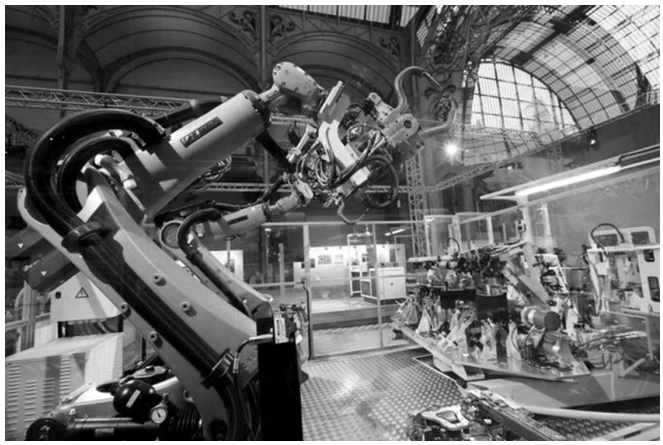

Figure 1. Smart factories move huge amount of data within the premises and subsidiary offices.

Today's industrial automation is powered by information technology and this trend will increase manifold with advent of 5G technology leading to increased business efficiencies, improved safety and enhanced market agility. Industry 4.0 enables industries to fuse physical with digital processes by connecting all sensors, machines and workers in the most flexible way available. Tethering them to a wired network infrastructure is expensive and, ultimately, it will limit the possible applications of Industry 4.0.

Industrial grade private wireless will unleash its real potential by providing the most flexible and cost-effective way to implement a wide range of Industry 4.0 applications. Current IT based automation solutions are well adapted for day-to-day business communications but are limited in reliability, security, predictable performance, multiuser capacity and mobility, all

features which are required for operational applications that are business or mission-critical.

If we look at mines, port terminals or airports, for example, Wi-Fi has been tried, but the areas requiring coverage are too vast and the environments too challenging. In both mining and port terminals, they are using remotely operated, autonomous vehicles, such as trucks, cranes and straddle carriers, which require mobile communications and high bandwidth video support.

The emergence of ultrafast 5G technology in higher frequency bands provides manufacturers with this much needed reliable connectivity solutions, enabling critical communications for wireless control of machines and manufacturing robots, and this will unlock the full potential of Industry 4.0.

Taking manufacturing, with thousands of factories with more than 100 employees, as an example, typical business cases revolve around controlling the production process, improving material management, improving safety, and introducing new tools.

III. RETURNS ON INVESTMENT

Research has shown that manufacturers can expect to see a tenfold increase in their returns on investment (ROIs) with 5G, while warehouse owners can expect a staggering fourteen fold increase in ROI. Fortunately, 5G is available in configurations perfectly suited to building industrial-strength private wireless networks to support Industry 4.0. They bring the best features of wireless and cable connectivity and have proven their capabilities both in large consumer mobile networks area as well as in many industrial segments. The time is ripe for many industries to leverage private and captive 5G to increase efficiencies and automation.

IV. EXAMPLES OF PRIVATE SPECTRUM DEPLOYMENT

An example of 5G in industrial automation can be seen at the new Mercedes-Benz Cars–the new "Factory 56" in Sindelfingen, Germany where the world's first captive 5G mobile network has been installed for automobile production as part of an innovation project that extends over an area of more than 2 million square feet. Here, one can see 5G mobile communications standard being implemented in a running car factory of future. The experience gained here will be actively incorporated into plans for future implementation in other car plants. By putting this milestone in place, the 5G standard of the future has become a reality for Germany as an industrial base.

Apart from manufacturing, many other industries are also looking at 5G as the backbone for their equivalent of the Fourth Industrial Revolution. This is opportunity to address industrial connectivity needs of a range of industries, including diverse

Figure 2. World's first captive 5G mobile network has been installed for automobile production over an area of more than 2 million square feet.

segments with diverse needs, such as those in the mining, port, energy and utilities, automotive and transport, public safety, media and entertainment, healthcare, and education industries, among others.

An example of use of 5G can be seen at a seaport in Germany. In July 2019, the Hamburg Port Authority in Germany completed a 5G field trial at the Port of Hamburg, Germany's largest container port. The trial demonstrated use cases that require 5G capabilities such as ultra-reliable low-latency communication (URLLC), enhanced mobile broadband (eMBB) and network slicing. This study explains the use of 5G to support traffic light control, AR/VR headsets and IoT sensors mounted on mobile barges and provides countless possibilities to improve efficiency and sustainability in seaports and other complex and changing industrial environments.

As an example, for mining exploration sites, the drilling productivity could be increased by 40 percent through automation of its drills alone. Additional savings from increased usage of equipment could also lead to lower capital expenditures for mines (CapEx) as well as a better safety and working environments for their personnel.

Figure 3. 5G capabilities such as ultra-reliable low-latency communication (URLLC) and enhanced mobile broadband at transport hubs enhance efficiency.

It is estimated that availability of high band private 5G captive networks could generate an additional multi-trillion dollar of positive impact to India's GDP. A key factor influencing the uptake of wireless solutions is the question of how to handle spectrum for industrial purposes. Many countries have already provided spectrum dedicated for industrial use. Unfortunately, these Industries are not so well organised as to lobby for their needs of radio frequency spectrum as this is not their main raw material (as it is for the mobile operators). Thus, these wireless users are not so well organised to project their spectrum needs. This is the case not just in India but in most countries.

However, many governments, particularly in developed countries around the world have realised the importance of captive 5G communications by their industries and enterprises and have been proactively working towards making the necessary spectrum resources available for their captive needs, keeping in view the importance of these users in nation building and economic growth. Some examples of the governments that have earmarked necessary spectrum for Industry 4.0 are:

FCC in USA – https://www.fcc.gov/wireless/bureau-divisions/mobility-division/35-ghz-band/35-ghz-band-overview

OFCOM in UK: https://www.ofcom.org.uk/consultations-and-statements/category-1/enabling-opportunities-for-innovation

BNetZ in Germany -https://enterpriseiotinsights.com/20200827/channels/news/67-local-licences-in-10-months-5g-in-the-home-of-industry-40

Bharat Bhatia, FIETE is President, ITU-APT Foundation of India and Vice Chairman, World Wireless Research Forum (WWRF). He possesses over 41 years of experience in PPDR, Spectrum management and ICT policies and regulations. Earlier, he served as President of Telecom Equipment Manufacturers Association of India (TEMA) and Vice President of Association of Telecom Industries of Singapore (ATIS).

He was a senior regulator with government of India for 22 years as a spectrum regulator and Telecom policy specialist and was actively involved in opening of the Indian telecom to the private sector, including the first ever GSM metro licensing in India. He was also a key architect of India's first ever National Frequency Allocation Plan (NFAP) in 1981 and the first ever published NFAP in 2000.

Mr Bhatia holds a BE degree from University of Delhi in Electronics and Telecommunications and completed a number of management courses from various institutes and universities including National University of Singapore and George Washington University.