

NOKIA

Teollinen 5G Tänään ja huomenna

Jarkko Pellikka

Digitaaliset yhteydet - 5G:n uusia käyttötapauksia -
webinaari 13.12.2023



In 2020, we started Nokia's Veturi Program ('Unlock Industrial 5G')

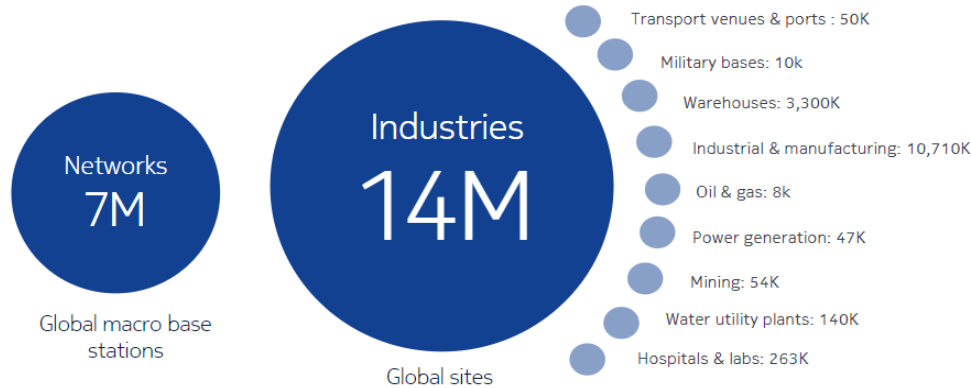


Networks are
unlocking
productivity
like never
before

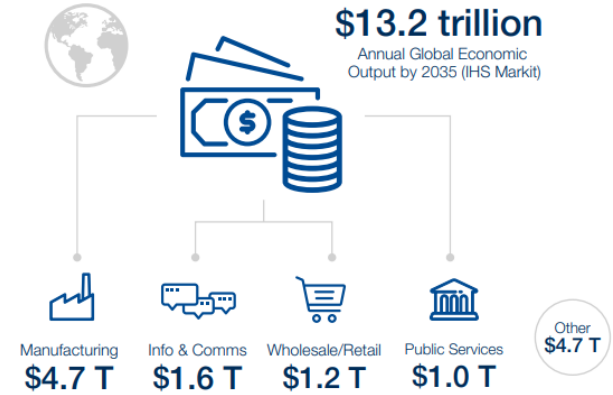
Industrial 5G is
unlocking efficiency in
every industry

Improved
productivity,
sustainability and
global
competitiveness

Intelligent Connectivity by 5G, will enable growth



Source: Harbor Research



Source: Based on IHS Markit, The 5G Economy: How 5G will contribute to the global economy, 2019.

Technology Disruption:
5G for speed, quality and latency needed for innovative applications

Market Disruption:
New customers and markets

Business Model Disruption:
New value chain partners enabling collaborative innovation

Industrial 5G results – Nokia Veturi examples

8-15 %

Productivity increase

15-30 %

Energy Efficiency

10-13 %

Energy efficiency on data
transport

15-20 %

Reduced emissions

Mining industry trends and challenges

“Purpose, long-term value and sustainability are no longer add-ons to business as usual — they are business as usual.”

– EY, Top 10 business risks and opportunities for mining and metals in 2022.

1

Market volatility

COVID-19 has significantly disrupted supply chains created ongoing around demand (EY)

The Russian invasion of Ukraine leading to higher prices; inflation boosting safe-haven demand for gold.

2

Regulation & environment

The industry is required to fulfil its formal regulatory conditions (its license to mine) as well as taking into consideration these community concerns (its social license to operate) (CSIRO)

3

Lack of innovation

The mining sector only spends ~1% of its revenue on innovation.

The leading obstacle to the future mine is the conservatism of decision makers (Mining Journal)

4

Operations transformation

Mining companies need to increase revenues, lower costs, and delight customers; doing that requires reinventing the operating model (McKinsey)

5

Digital transformation

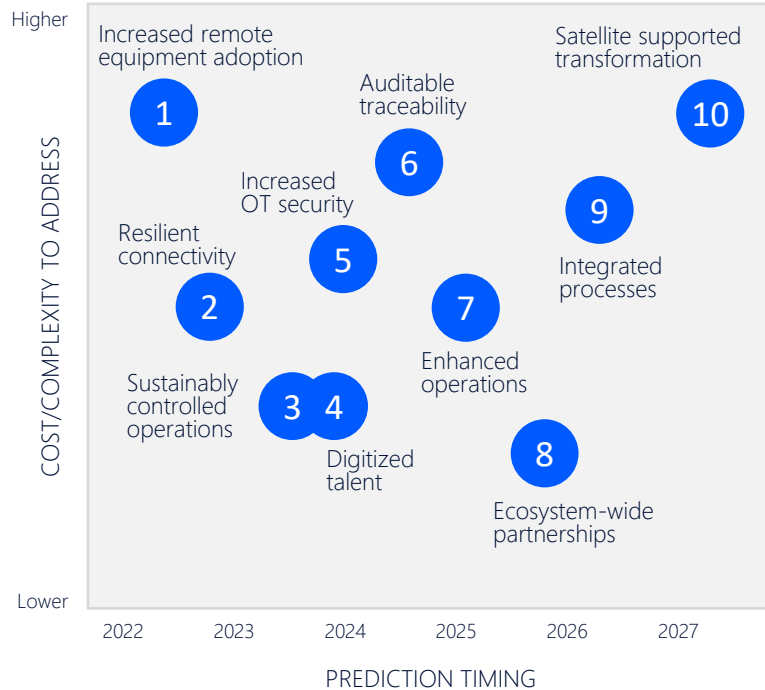
Leveraging technology to improve processes aligned to value has become a business imperative (Accenture)

6

Workforce transformation

The mining industry is facing a changing talent landscape, with digitization necessitating new skillsets (Deloitte)

Mining industry trends and challenges



- 1 Accelerated as a result of the pandemic, by 2022, 75% of the top 100 miners will operate remote and autonomous drill rigs throughout their operations, improving equipment efficiencies.
- 2 By 2022, 5% of global mining operations will be early adopters of 5G to utilize reliable, low latent connectivity reliant technologies, improving safety, sustainability, and operational performances.
- 4 By 2023, 25% of the top 100 mining organizations will utilize augmented reality to perform operational maintenance reducing on-site labor requirements by 20%.
- 7 By 2024, 50% of the top mining organizations will utilize cloud based operational planning and simulation tools, providing decision support, greater analytics and improved optimization capabilities.
- 9 By 2025, the top 5 mining organizations will deploy cloud-based platforms to deliver insights across their value chain, supporting self-service for workers and a single source of truth.

Source: IDC FutureScape, "Worldwide Mining 2022 Predictions"

Impact of digital automation on mining productivity (open pit case)



Case example – Next Generation Mining project

VTT, Nokia and Sandvik take steps together towards safe autonomous underground mining supported by 5G and edge intelligence

News, Press release  04.10.2023 09:05 EEST



The Next Generation Mining (NGMining) project started in May 2021 and ended in September 2023. It also included **University of Oulu** and **VTT** as a research partners, as well as **Epec**, **SATEL**, **Huld**, **Terrasolid**, **Etteplan**, **Noptel**, **Unikie**, **Iiwari**, **Millisecond**, **Wizense** and **Indagon** as company partners. The project advisory board included representatives from **Outokumpu** and **Agnico Eagle Finland**, **Telia 5G Business**, **Kalmar** and **Ponsse**.

The project was funded by Business Finland in connection with **Nokia** and **Sandvik Veturi** programs.

Case example – AI Situational Awareness

AISA PROJECT STRENGTHENS THE COMPETITIVENESS OF INDUSTRIAL AUTOMATION BY DEVELOPING 5G AND AI APPLICATIONS

JUNE 8, 2022

Nokia-led Veturi project AISA presented results in easier positioning and controlling of Valmet's field equipment

The competitiveness of industrial automation is enhanced through artificial intelligence and high-speed wireless communications. Development work is currently underway on the AISA (AI-assisted Situational Awareness) project, led by Nokia. One of the participants is Valmet Automation Oy, a globally leading supplier of industrial automation.

Webcam button: Continuous object detection



AISA is a three-year Nokia-led Veturi project with Valmet Automation, Mirka, Insta, Top Data Science and Tampere University. The project facilitator is DIMECC.

The total budget of the project is 12 M € and it is financed by Business Finland and the participating companies.

Nokia Veturi 'Unlock Industrial 5G'

Nokian johtama 120 kumppanin veturihanke kasvatti yli 200 miljoonalla eurolla tutkimus- ja kehitysinvestointeja Suomessa

19.9.2023 08:14:00 EEST | [Business Finland](#)

Jaa [f](#) [in](#) [t](#) [p](#) [e](#) [w](#)

Business Finland vauhdittaa globaalisti toimivien yritysten tutkimus-, kehitys- ja innovaatiotoiminnan (TKI) lisäyksiä Suomeen veturihankkeella. Nokia-veturin ekosysteemikumppanit investoivat Business Finlandin osaroittamissa projekteissa TKI-työhön yhteensä yli 200 miljoonaa euroa vuosien 2020-23 aikana. Veturihankkeissaan yritykset ratkovat merkittäviä tulevaisuuteen liittyviä haasteita. Tavoitteena on Suomen kilpailukyynn kasvattaminen.



Real-time Extended Reality Multimedia - for next generation mining

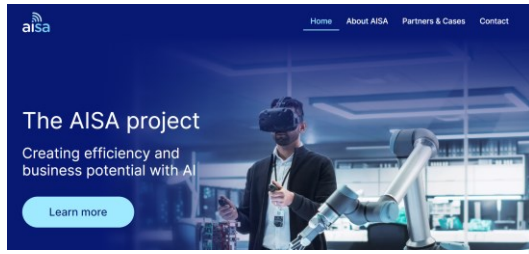


Nokia 1,332,016 followers
Our first Nokia Ecosystem Partnerships Summit continues today in Espoo, Finland. We are sharing insights with customers and partners who have gathered together to discuss how openness is key to unlocking more value in our industry.
The attendees also had a chance to see the latest technology demos at our Executive Experience Center.
#NokiaPartners #OpenToCollaborate <https://nokia.ly/3rTMtWv>



RF SAMPO project strengthens Finland's competitiveness in radio technologies

A consortium of major industrial and academic stakeholders led by Nokia and coordinated by the University of Oulu will start a massive project aiming to speed up the development of RF and antenna technologies and accelerate the transition from 5G to 6G. Through technological development, the project contributes to the creation of new jobs and new business opportunities.



Driving Business Growth via Nokia Veturi Program - Strategic Approach on Edge Ecosystem Building
Ecosystems allow firms to create value that no single firm could do alone. From the perspective of an organizational ecology, innovation ecosystem participants co-evolve capabilities around a shared set of technologies. At the same time, the dynamic...
Pellikka, Jarkko (Nokia - FI/Espoo)



<https://www.nokia.com/innovation/veturi-program/>

Industry Transformation Boosted by 5G Innovations -research results will be published in December '23

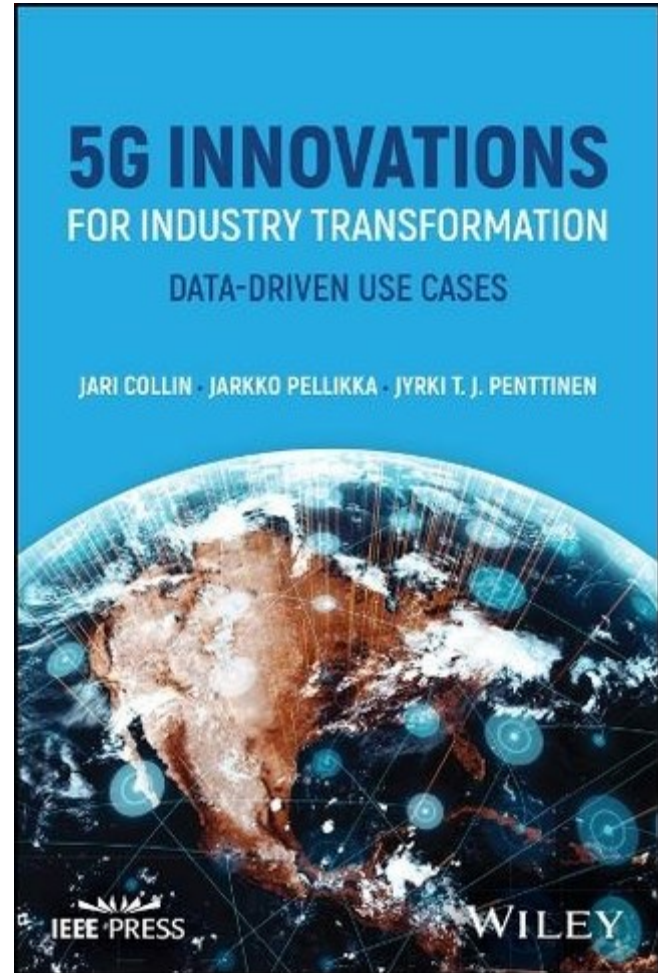
Part of Nokia Veturi: Unlocking industrial 5G

PART I: New Data-Driven Business Opportunities with Industrial 5G

PART II: Industry Case Studies

- Mining industry – Sandvik
- Forest Industry – Metsä Group
- Elevator Industry – Kone
- Telecom Industry – Telia
- Oil and Gas – Neste

PART III: Transforming for Digital Business



Foreword by Allison Kirkby & Pekka Lundmark

'The potential industrial innovations enabled by 5G are limited only by our imagination. In this book, Jari Collin, Jarkko Pellikka and Jyrki TJ Penttinen have done a fantastic job of providing a comprehensive overview of the impact that the latest 5G technologies are having on a variety of industries. We trust that it will inspire the next generation of big thinkers in telecom and beyond to stretch the limits of 5G, and future cellular technologies, even further.'



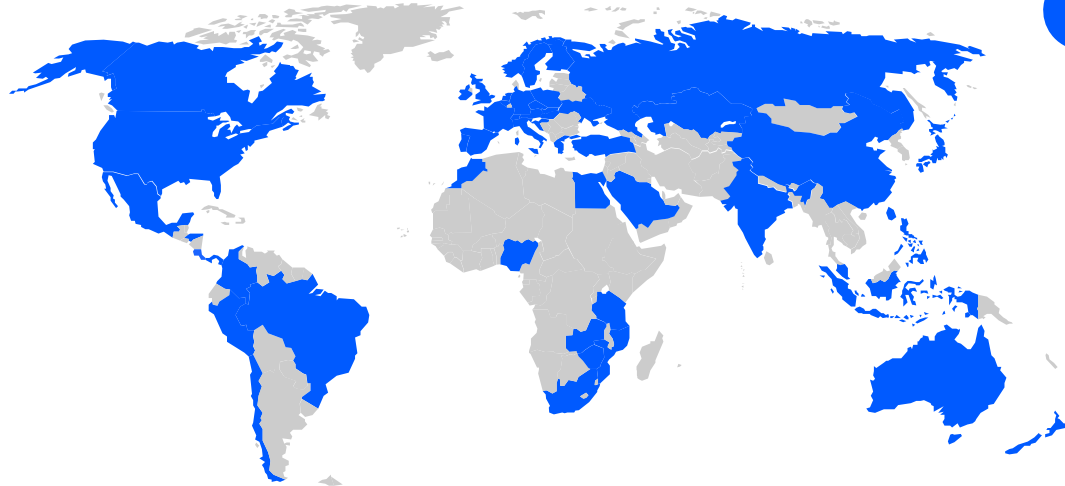
Allison Kirkby
President and CEO
Telia Company



Pekka Lundmark
President and CEO
Nokia

675+ private wireless customers

Uncontested market leader in private wireless*



Public references

Recent new logos



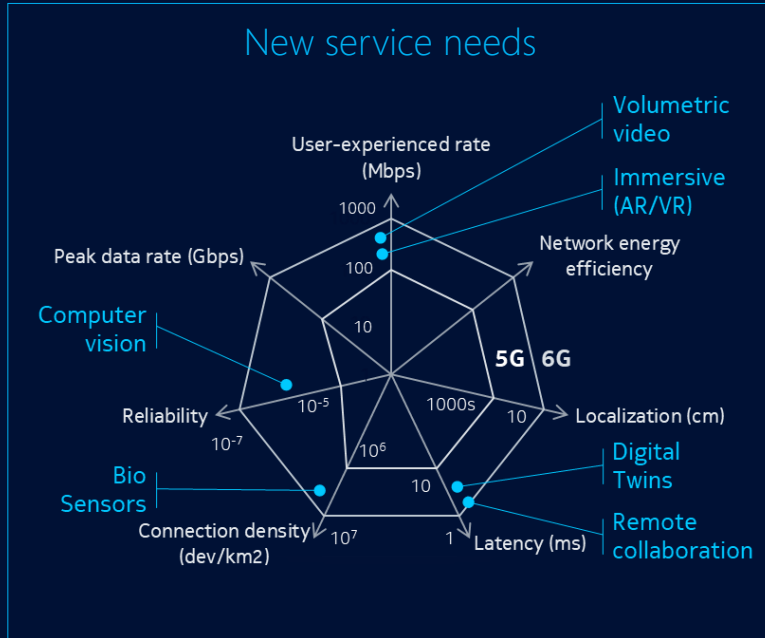
*Supported by latest publicly released data from key analysts firms



What's next?

Triple Challenge - New service needs, security and cost of energy

... requiring interoperability and standardization



Cost of Energy

According to GSMA Intelligence, energy consumption accounted for between 15% and 40% of teleoperators' OPEX in 2021 and is expected to heavily increase in 2022 onwards.

The energy costs associated with running the world's mobile networks are expected to exceed 24 B€ annually due to the ongoing energy crisis and inflation. Estimated annual increase of energy cost will be 8-12 %

Source: GSMA Intelligence & Telecommunications, 2021

Security

Global cyberattacks increased by 38% in 2022, compared to 2021. Global cybercrime costs are estimated to grow by 15 percent per year over during the coming years, reaching 10 trillion euros annually by 2025

Source: Check Point Research (CPR) & Cybersecurity Ventures, 2021

Towards Industry 5.0 and industrial metaverse

Via 'Human Augmentation' and 'Digital-Physical Fusion'

Metaverse enablers



Human Augmentation

Handhelds
VR HMDs
Tethered AR glasses
Haptic-enabled remote control

Connected bio-medical implants
Industrial exoskeletons
Ergonomic, untethered XR glasses
XR interoperability



Digital-Physical Fusion

Basic, organization-level digital twins
Smart sensor networks
Persistent virtual worlds & objects

Complex, enterprise-wide digital twins
Ecosystem interoperability
Interactive 3D digital twins

Metaverse opportunities

Consumer Metaverse



Enterprise Metaverse
(IT-centric)



Industrial Metaverse
(OT-centric)



~ today



~ 2030

* Virtual Reality Head-Mounted Displays


** Augmented Reality

*** Extended Reality

Revenue opportunities will exhibit different growth dynamics


Industrial metaverse opportunities are already revealing traction

Industrial Metaverse (OT*-centric)




- XR-enabled workforces
- Digital twin enhanced production & condition monitoring

Enterprise Metaverse (IT*-centric)

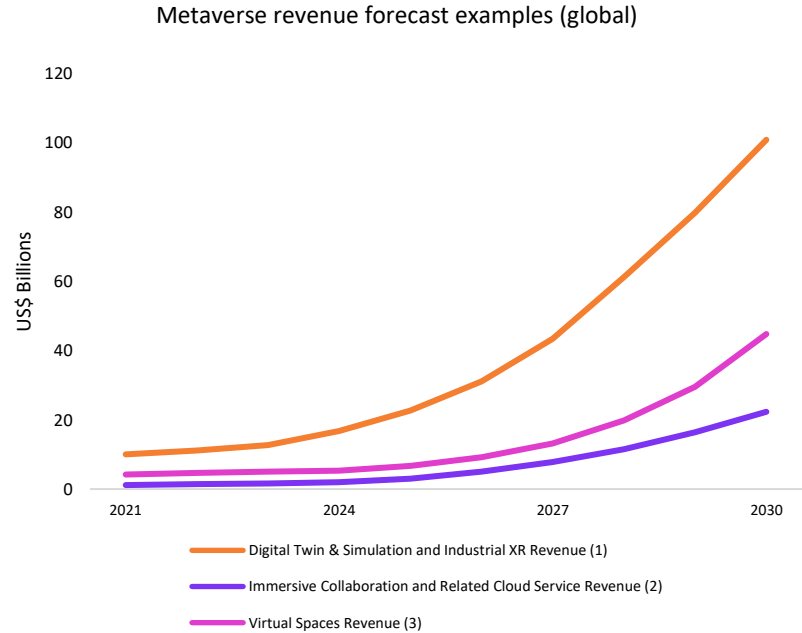


- Immersive team collaboration
- Digital co-design
- XR-based training & learning

Consumer Metaverse



- Immersive gaming
- XR-enhanced social & retail interaction
- Virtual tourism



1 ABI Research: The Future of Work, Augmented and Mixed Reality, Virtual Reality Market Data, November 2022

2 ABI Research: Enterprise Metaverse: Future of Work, March 2022

3 ABI Research: 2022 Consumer Metaverse Market Update, June 2022

* IT: Information Technology | OT: Operational Technology

Future of Industrial 5G – critical role of ecosystems

Strategic management

- Top management participation
- Ecosystem strategy
- Portfolio management & ecosystem offering

Ecosystem building & orchestration

- The set of deliberate and purposeful actions
- Active & global communication with partners
- Committed partners

Continuous learning

- Build internal competence on ecosystem management, R&D collaboration and enabling functions
- Use of digital tools: <https://open-ecosystem.org/>

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