Digitalization is the Future

Key Challenges and Opportunities

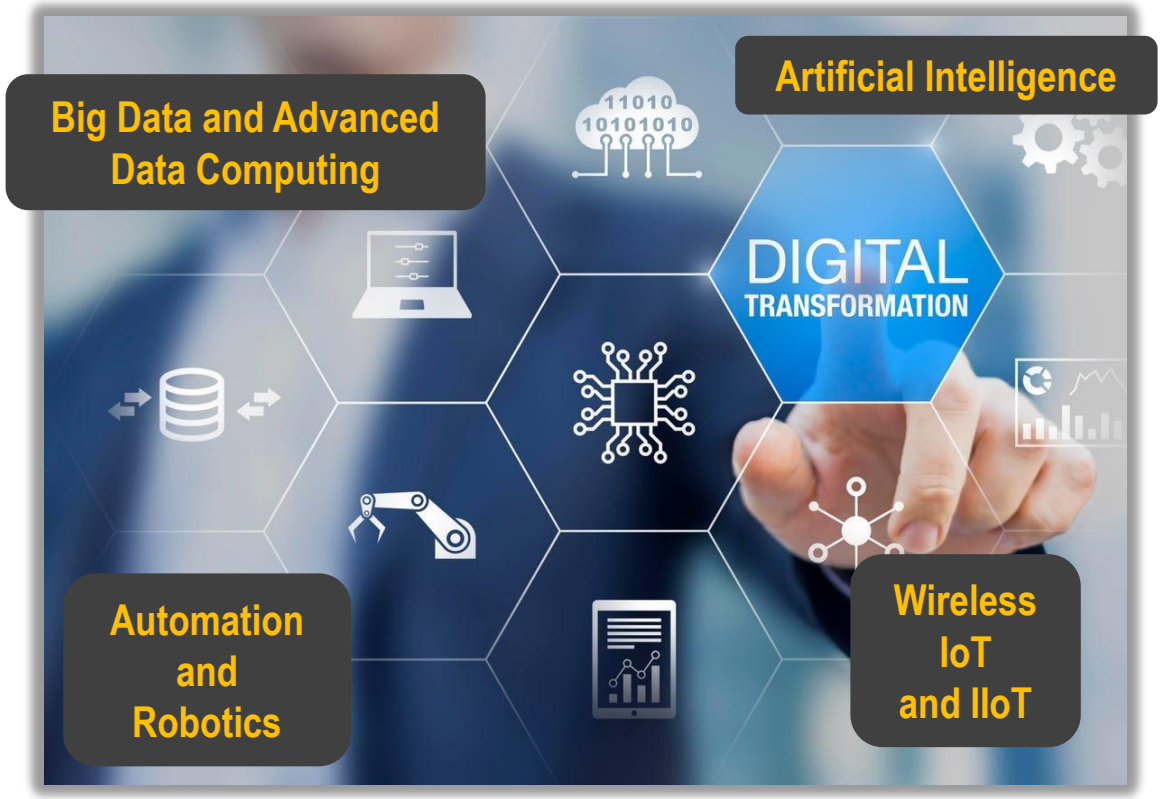
Hussam Kloub, Dr. Eng.

Agenda:

- Key Business **Drivers** (**45** min)
- Significance of **SMEs** (**45** min)
- Implications on **Project Management Practice** (**30** min)

Key Business Drivers

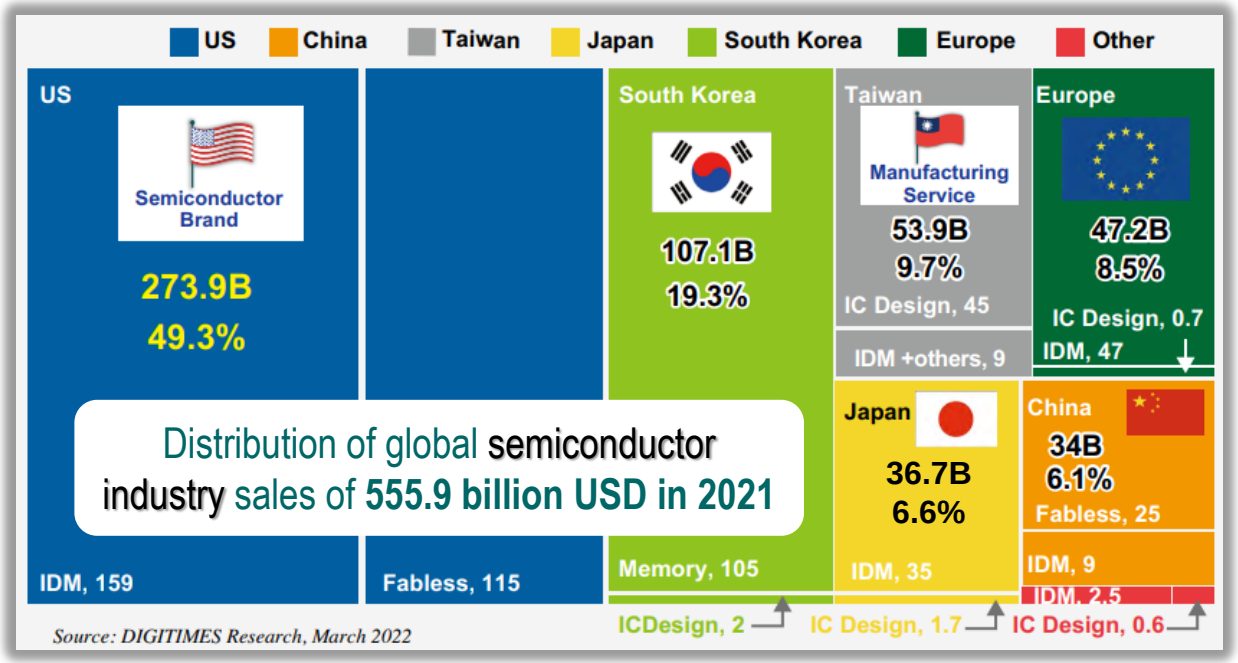
Key Business Drivers: Interconnection of Everything

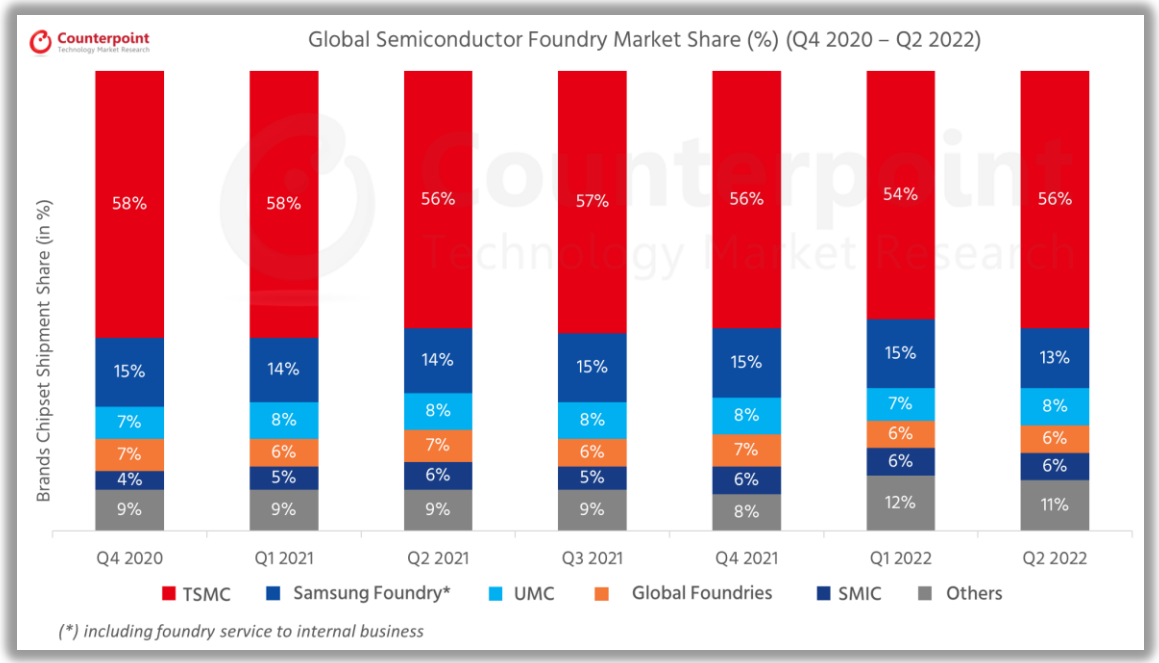


Technology and Solutions

Applications

Key Business Drivers: Semiconductors Industry





United States dominates **50%** of global semiconductor industry

Taiwan supplies **65%** of global needs of microchips

Key Business Drivers Complex Supply Chains

Semiconductor Manufacturing Equipment
10%

Design (Fabless)
65%

Fabrication (Foundries)
20%

tsmc

SAMSUNG

Packaging and Assembly
5%

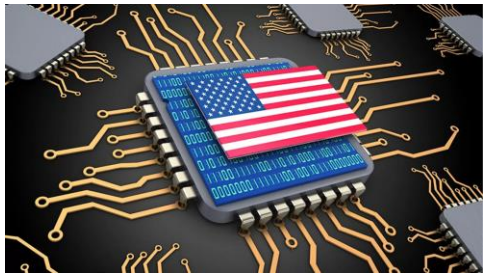
Key Business Drivers: Leadership and Competition Pressure

Signed on **August 9, 2022**

Creating Helpful Incentives to Produce Semiconductors (**CHIPS**) Act

280 billion USD funding over **10 years**

To boost the domestic research and manufacturing of semiconductors **in the United State**

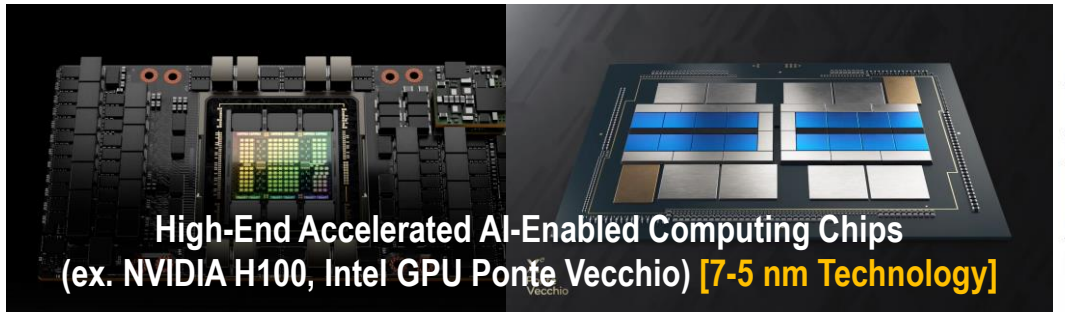


To keep leadership in **advanced chip technology** for AI, biotechnology and quantum computing

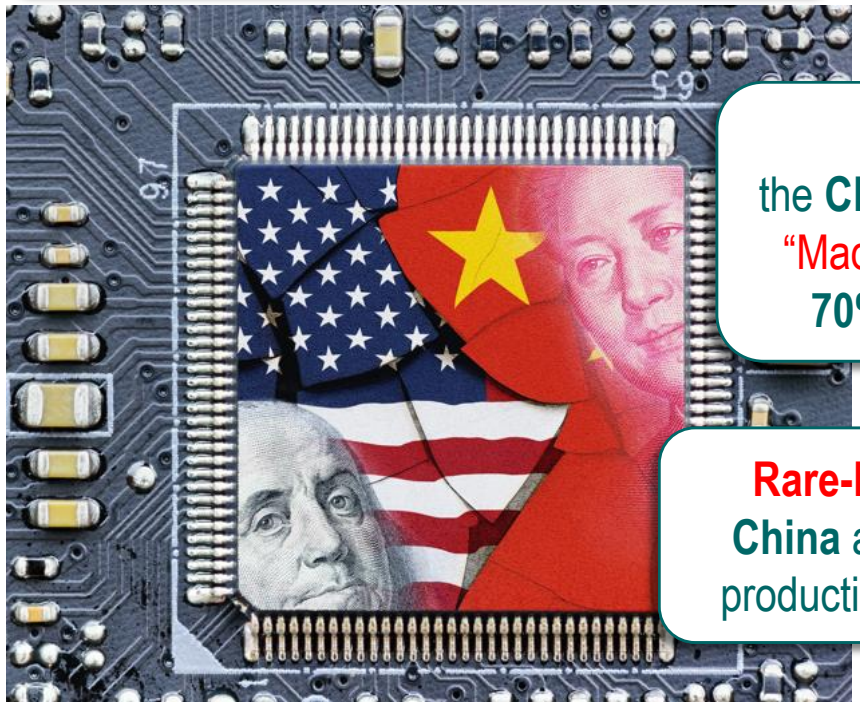
Key Business Drivers: Geopolitical Tensions

CHIPS **BATTEL** on **October 7, 2022**

Biden administration banned Chinese companies from buying advanced chips and chip-making equipment without a license!



[EUV from ASML Holding]



Threatening
the **China's technological ambition**
"Made in China 2025" for reaching **70% autonomy** in chip-making

China's High-Tech Companies are 4-5 years behind the overseas counterparts

At least **1 trillion USD** for a fully "self-sufficient" local chip supply chains [Boston Consulting Group]

Rare-Earth-Metals CONTROL
China accounts for **70%** of global production, **37%** of global reserves

Singapore's prime minister warned that greater decoupling between the US and China would create a **"less stable world"!**

Key Business Drivers: Strategic Investment in High-Tech

Taiwan News, October 31, 2022

TSMC **continues investing** in advanced chip manufacturing **in Taiwan** and reportedly building **1nm chip fab** in northern Taiwan

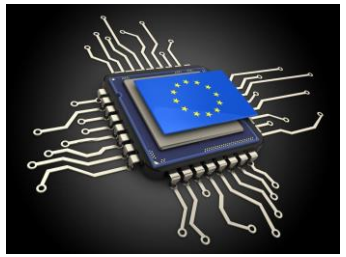
TSMC's **2nm chips** mass production is anticipated **by 2025**

TSMC's **3nm chips** commercial production will start in the **second half of 2023**

Transforming **from 3nm to 2nm technology** will enable **10% - 15% more speed**, and **25% - 30% less power-consumption**

Key Business Drivers: Global Technological Race

European Commission



EU CHIPS Act

Proposed on **February 8, 2022**

160 billion USD funding over **10 years**

To boost domestic research and manufacturing of cutting-edge semiconductors **in the European Union** aiming to achieve **20%** of global production **by 2030 (EU's 2030 Digital Decade)**

High Cost of Manufacturing (Key Challenge)

South Korea planned an investing of **450 billion USD** to boost domestic research and manufacturing of semiconductors **by 2030**

JAPAN planned an investing of **8 billion USD** to boost domestic research and manufacturing of semiconductors

The Digital Europe Programme

Horizon Europe

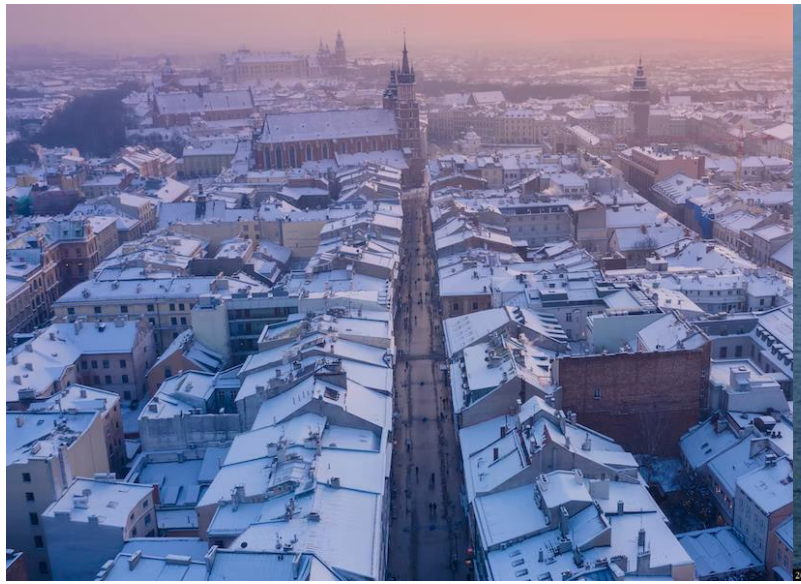
Key Business Drivers: Global Energy Crisis

International Energy Agency

"Never too early to prepare for next winter: Europe's gas balance for 2023-2024"

Europe needs to take immediate action to avoid risk of natural gas shortage next year
03 November 2022

New IEA analysis identifies a challenging 30 bcm supply-demand gap next summer at key time for refilling EU storage if Russia halts all pipeline deliveries and China's LNG imports rebound



Key Business Drivers: The Bright Side

Recognized by WEF as "Manufacturing Lighthouses" for their large-scale use of **Fourth-Industrial-Revolution solutions** (AI, IoT sensors, smart drones, robots)

Monitoring and Inspection times **cut by 40% - 90%**

Power consumption **reduction by 18%**

Maintenance cost **reduction by 30%**

Aramco and IBM aim to establish an Innovation Hub in Saudi Arabia

DHAHRAN, October 31, 2022

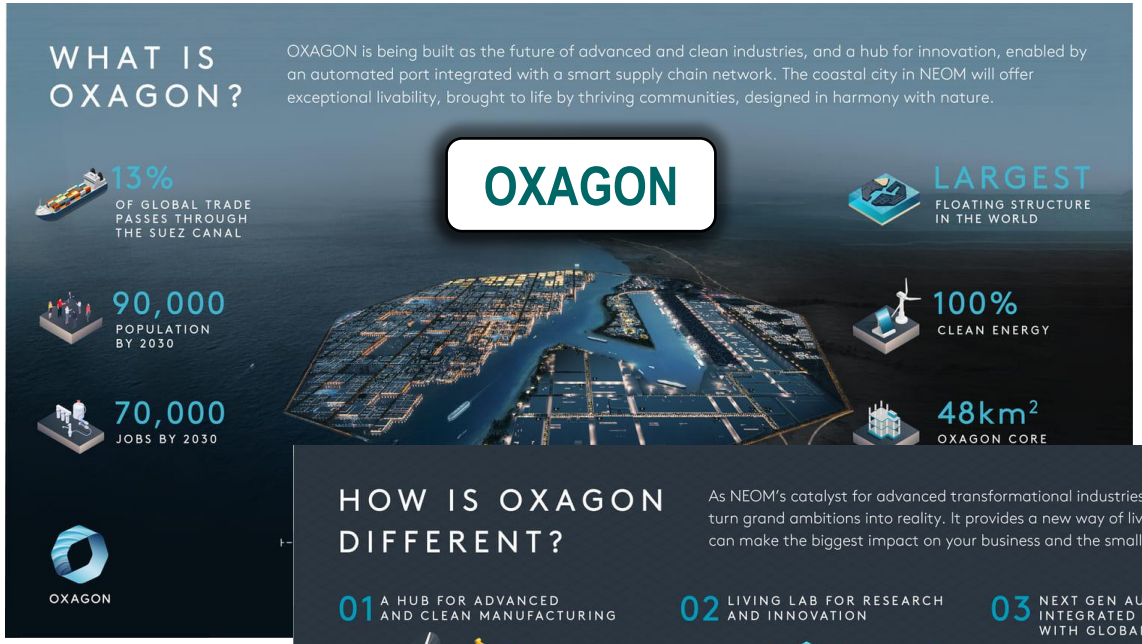
"Aramco and IBM (NYSE: IBM) today announced preliminary plans for a **strategic collaboration** to establish an Innovation Hub in Riyadh, Saudi Arabia. The collaboration aims **to support high-tech driven** economic growth in the Kingdom of Saudi Arabia leveraging emerging technologies in **hybrid cloud**, **AI**, and **quantum computing** to address objectives including circular economy, materials science, supply chain, sustainability, security, and digitization."

Key Business Drivers: 1000 Billion USD Investments

Trojena

The Line

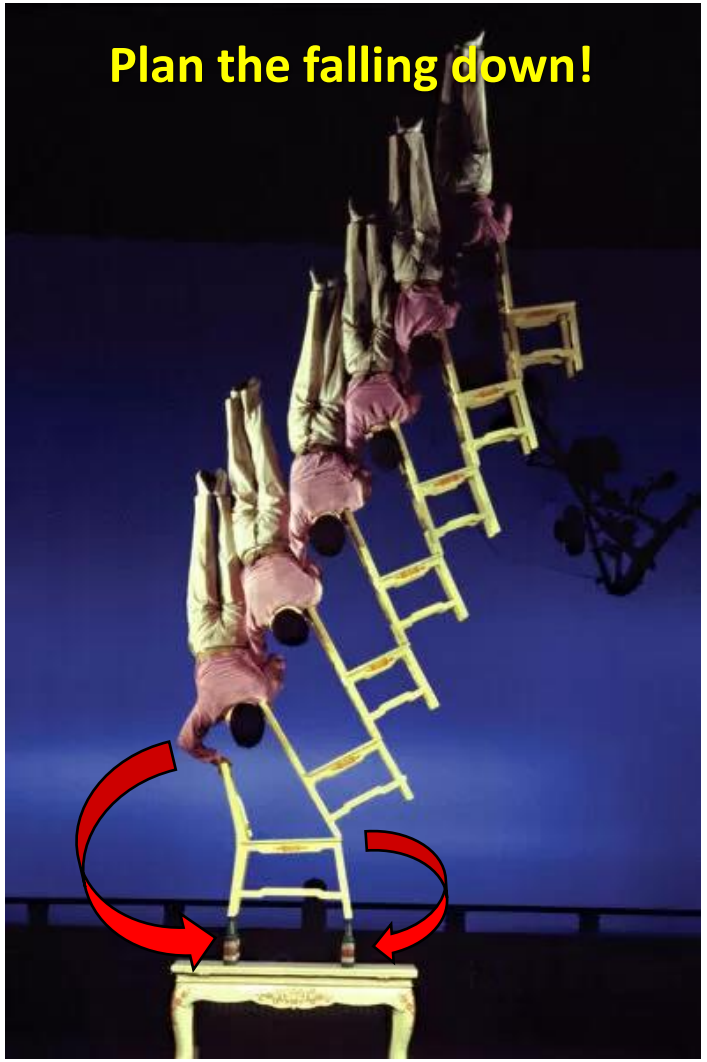
Cutting-Edge Smart City in KSA



Key Business Drivers: High-Tech RND in KSA

Lessons Learned – Key Business Drivers

- Digitalization is a **global technological race** with **billions USD strategic investments**
- Digitalization as well as semiconductors industry are incorporated within a **volatile environment**:
  - **Complex supply chains** of highly interconnected actors across the globe and **numerous chock points** which impact the production
  - Highly impacted by **geopolitical "games"** and **energy crisis**
- Digitalization is definitely the **global revolution and culture** of the presently decade (**2030 Digital Decade**)
- Digitalization business is a **great excited opportunity** but closely engaged with **high threats** and **rapid changes**



Significance of SMEs

Significance of SMEs: Backbone of Economy Growth

Middle East Investment Initiative
An Innovative Approach to Development Finance.

50 YEARS OF SUPPORT

JEDCO
المؤسسة الأردنية لتطوير المشاريع الاقتصادية
Jordan Enterprise Development Corporation

غرفة صناعة الأردن
Jordan Chamber of Industry

SME's in Jordan:

- Represents **99.5%** of all companies
- Making up to **30%** of the country's GDP
- Employing **60%** of the Jordanian Workforce
- Accounting for **10%** of exports

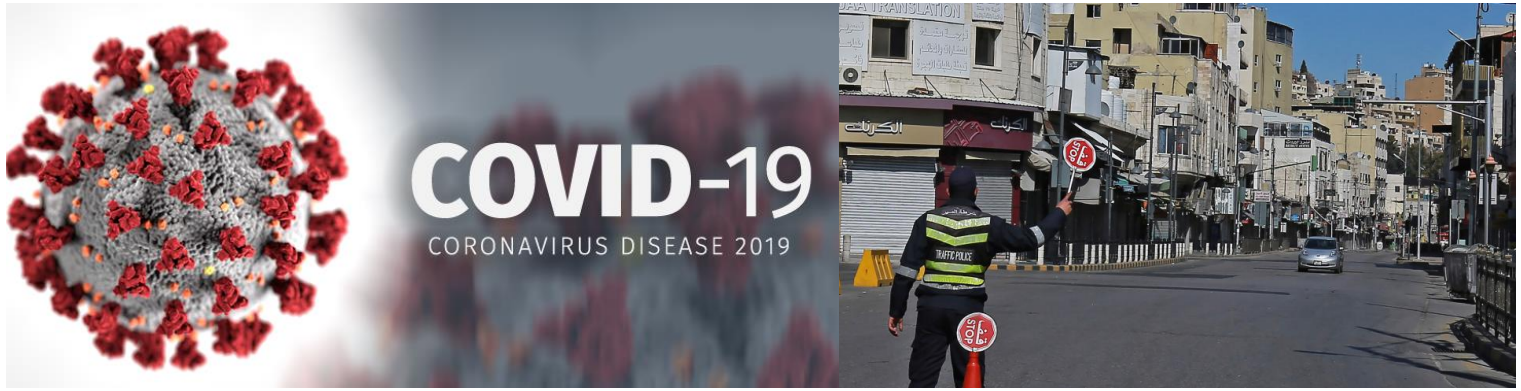
Industrial

Trade

Service

	Micro	Small	Medium
Number of Employees	< 5	< 20	< 100
Annual Revenue (JD)	< 100 k	< 1 M	< 3 M

Significance of SMEs: Expanding Opportunities

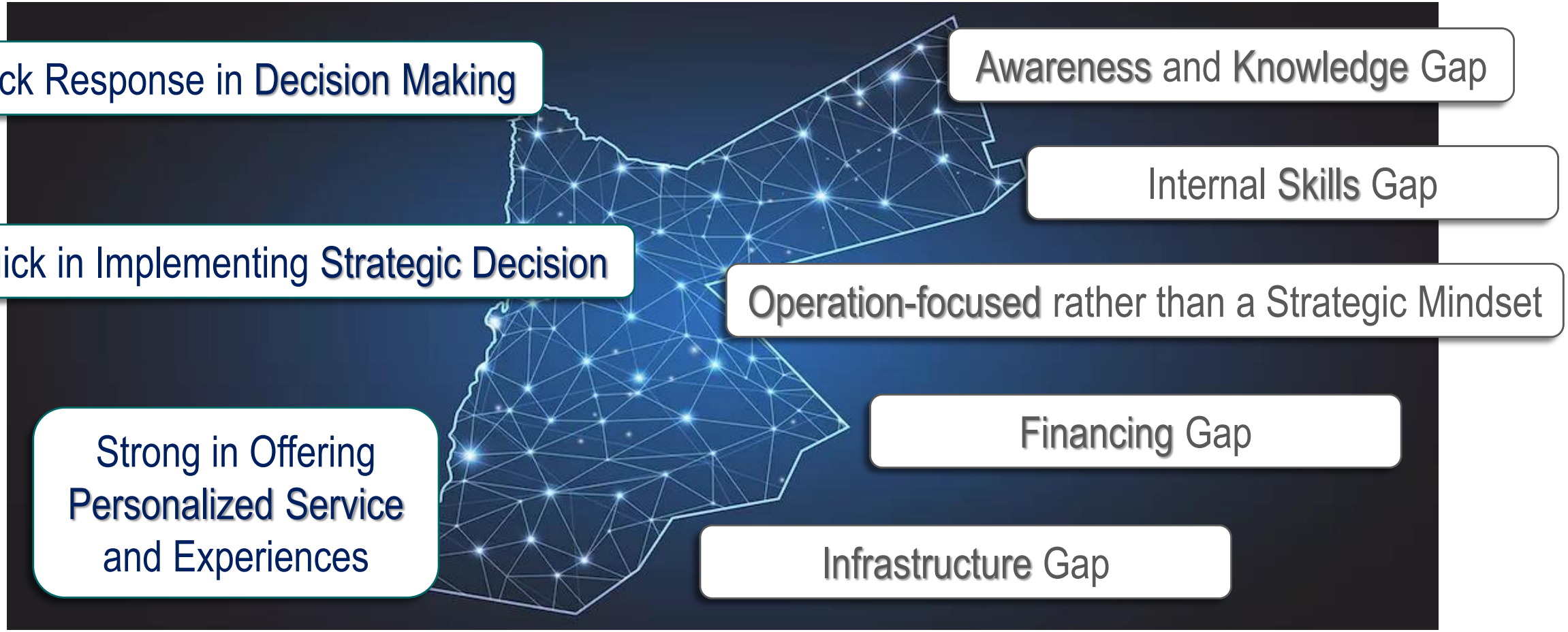


- **Lockdowns**
- **Social Distancing**
- **Disruptive Supply Chains**

"Digital" Connectivity and Communication as Keys to Access the Market

- Improving **Customer Acquisition**
- Lowering Operational **Costs**
- **Automating** Redundant Tasks
- Improving **Customer Relationship**
- Optimizing **Service** Provision
- Improving **Decision Making**
- Improving **Process Agility**
- Increasing **Productivity**
- Enhancing **Competitiveness**

Significance of SMEs: Competitiveness and Challenges



Significance of SMEs: Innovation Culture

Create **NEW** idea, Conceptualize **NEW** solution, Realize **NEW** approach, Achieve **NEW** added-value

Productivity | Costs | Profitability

Recognition | Competitiveness | Networking

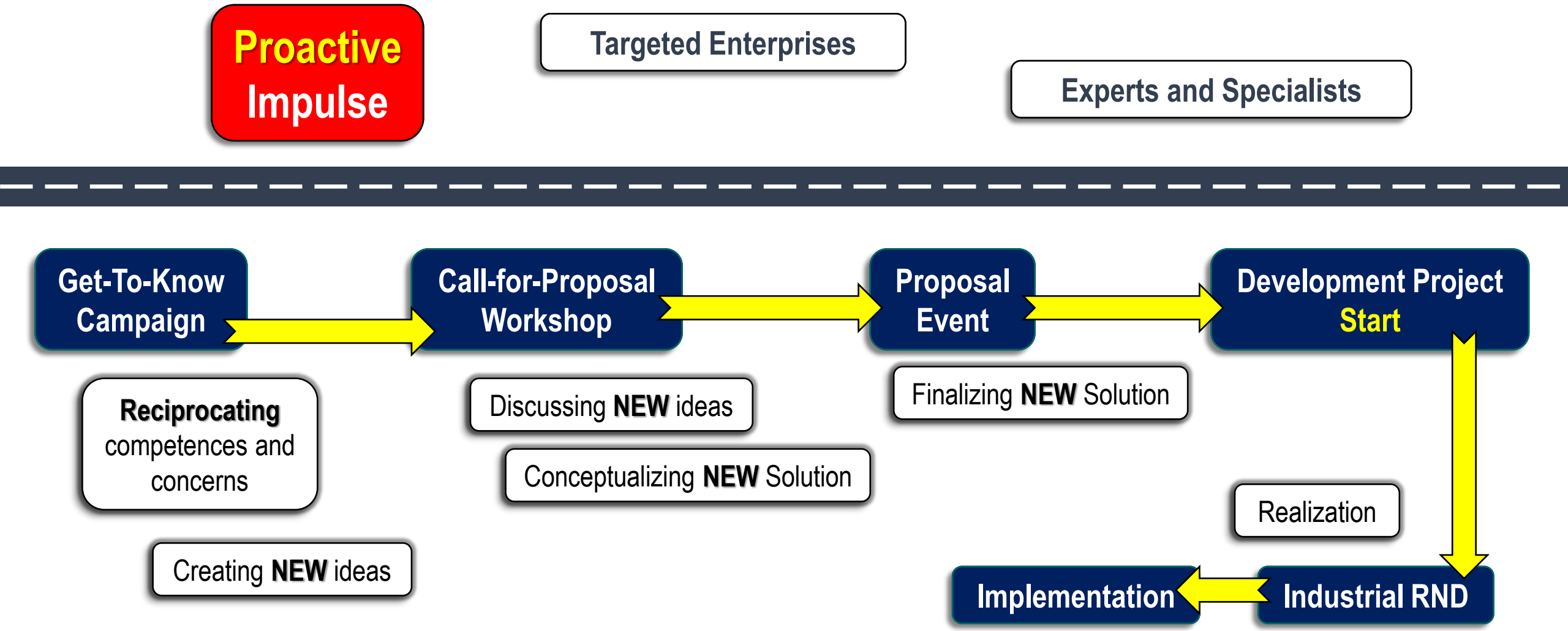
Each Enterprise has **unique** business model and needs

Tailored Roadmap

Willingness of the company:
lack of time, reluctance to change, trust

HOW to engage with the SME?

Significance of SMEs: Innovation Focused Campaign



Significance of SMEs: Focused Campaign in Practice

Proactive Step

Federal Ministry of Education and Research

HOCHSCHULE FURTWANGEN UNIVERSITY HFU

Academic Research Institute specialized in High-Tech RND

Engaged SMEs

KLS martin GROUP
STORZ KARL STORZ—ENDOSKOPE
ATMOS MedizinTechnik
3D LABS BLCK FRST
econsteel cutting performance in steel
Orthobion PERFORMANCE IN ORTHOPEDICS
B BRAUN SHARING EXPERTISE
ZEISS Vision Care
JENOPTIK
smart MEMBRANES
BECHEM LUBRICATION TECHNOLOGY
KERN
GÜHRING
bredent group
emos technology
Tesch

Selected Domestic SMEs in Healthcare Industry

Customized NOVEL Solutions

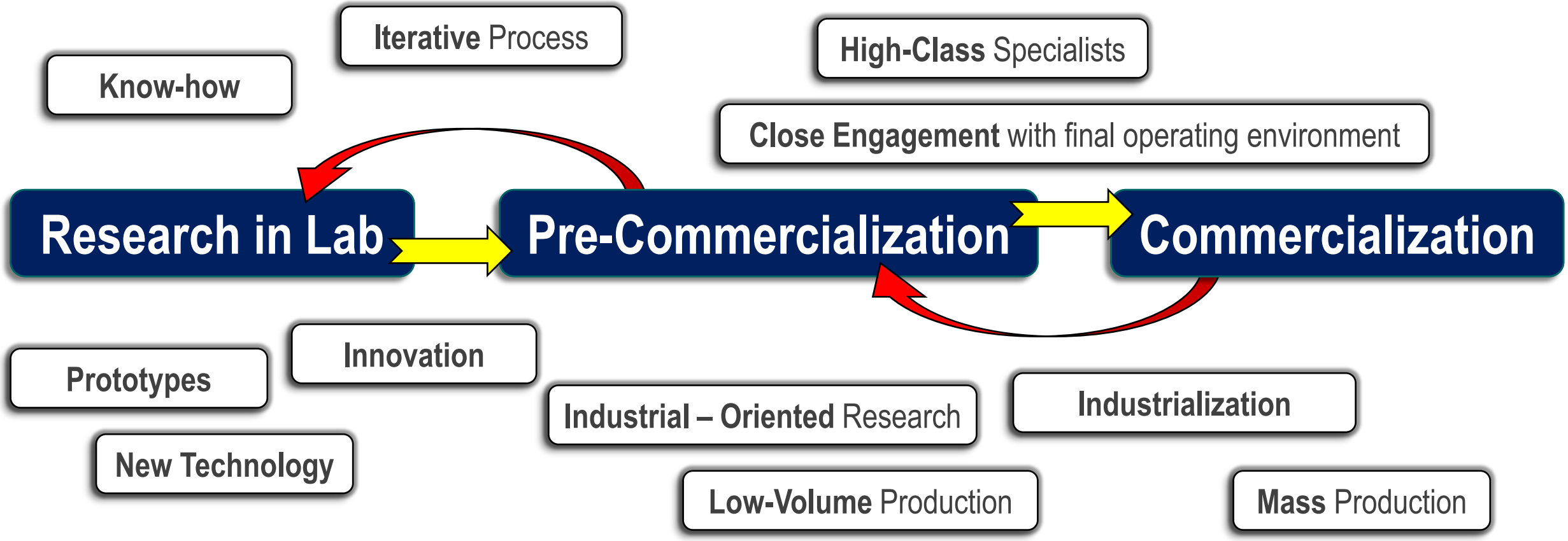
CHMed
CONNECTED HEALTH IN MEDICAL MOUNTAINS

Initiative Program with multiple application-oriented projects

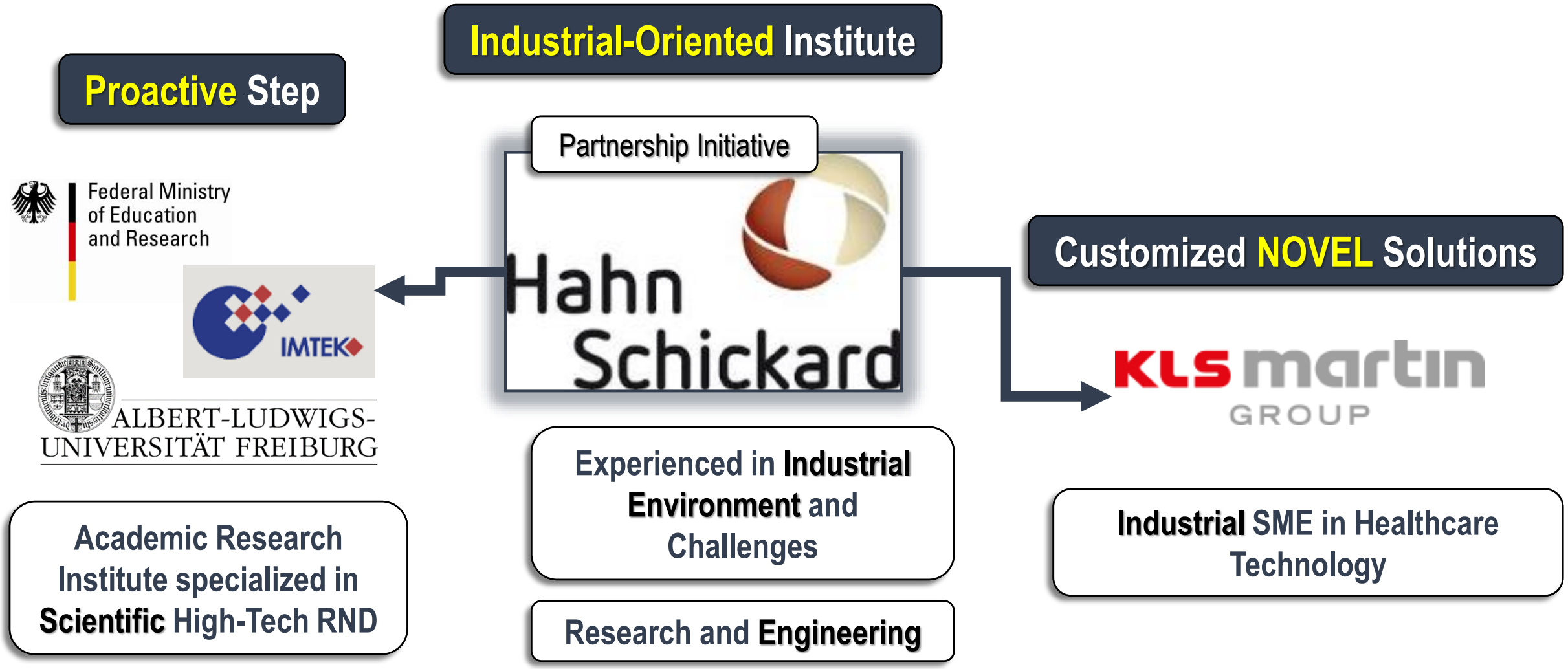
Successful Experience resulted in NEW follow-up projects

Significance of SMEs: The Pilot Line

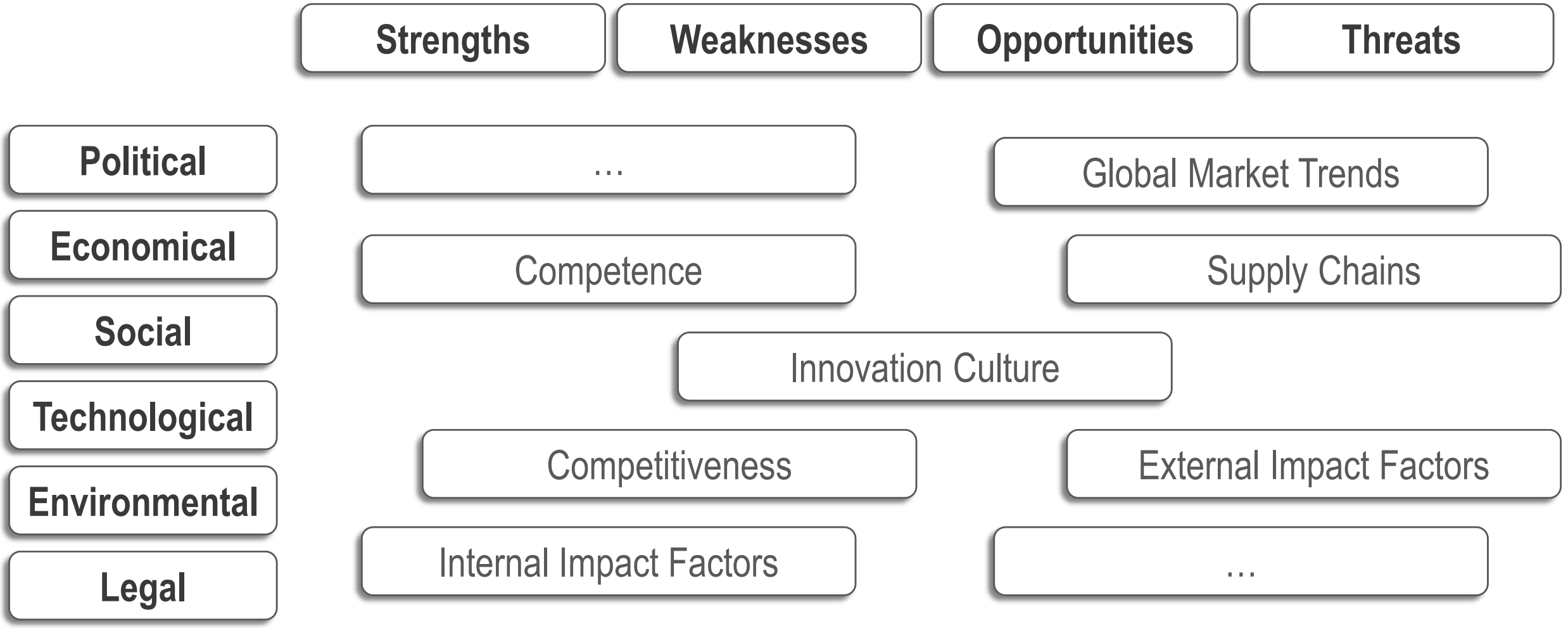
From **Idea Creation** through **Solution Conceptualization** to **Full-Scale Production**



Significance of SMEs: Pilot Line in Practice



Significance of SMEs: The Vision



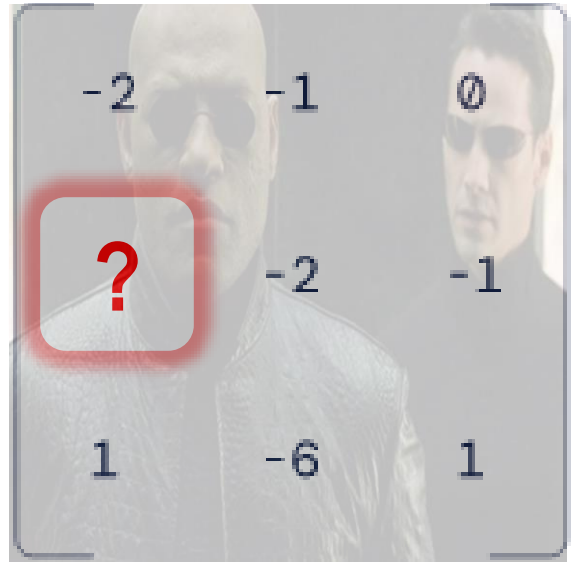
Lessons Learned – Significance of SMEs

- SMEs are the **core** of economy growth
- The **unique** business model and needs of each SMEs represents a **serious challenge** for realizing a **tailored** solution
- **Innovation mindset** is potential approach for the digitalization of SMEs
- **Approaching the SMEs** and gaining their interests and trust requires a **proactive impulse culture**
- **Innovation** solutions incorporated creation of **new ideas** and **pre-commercialization** competence that is applicable through **focused partnership and multidisciplinary collaboration**

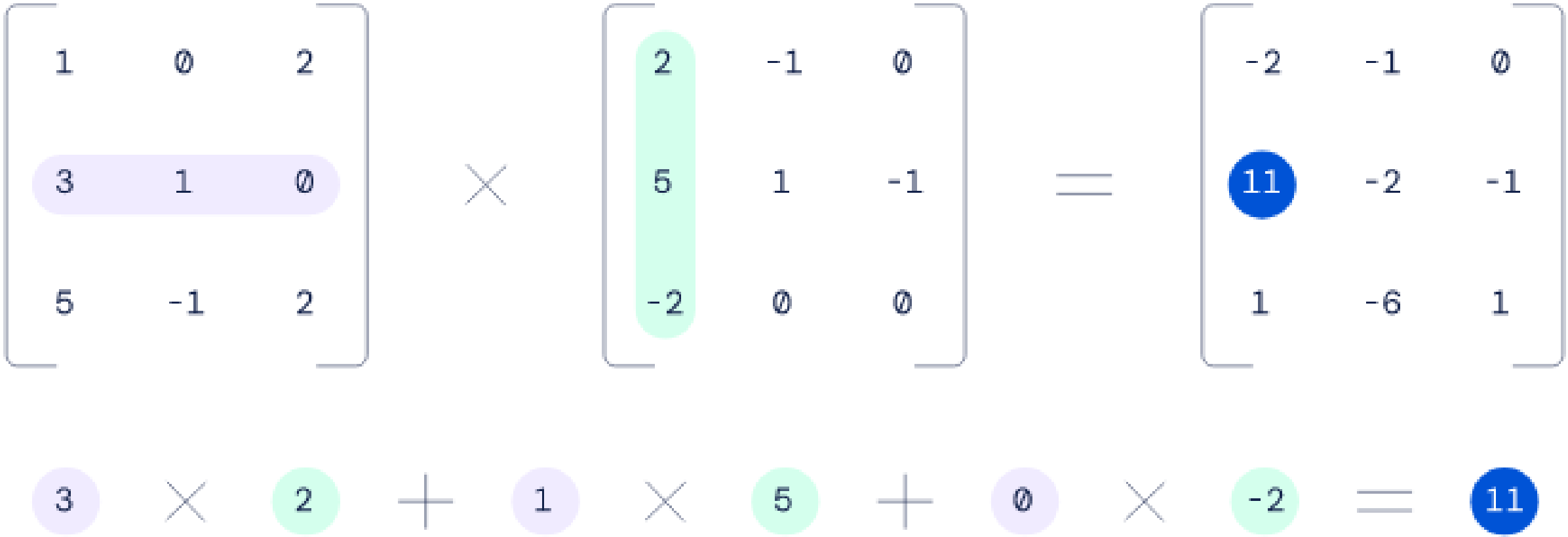
Implications on Project Management Practice

Quiz

$$\begin{bmatrix} 1 & 0 & 2 \\ 3 & 1 & 0 \\ 5 & -1 & 2 \end{bmatrix} \times \begin{bmatrix} 2 & -1 & 0 \\ 5 & 1 & -1 \\ -2 & 0 & 0 \end{bmatrix} =$$

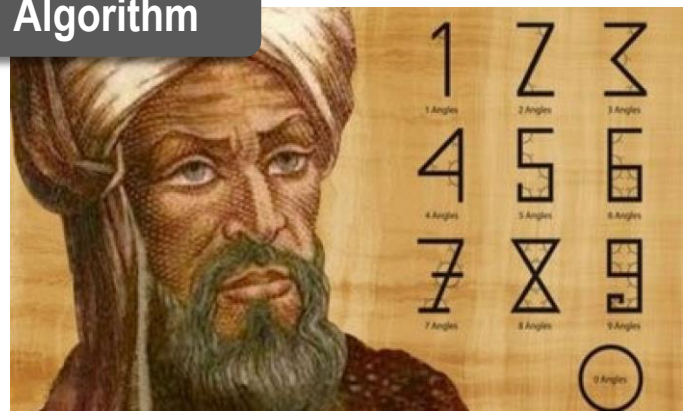


Solution



Implications on Project Management Practice: Ancient School

Algorithm



Muhammad ibn Musa al-Khawarizmi

Algorithms for Solving Matrix Multiplication

$$\begin{bmatrix} a_{1,1} & a_{1,2} \\ a_{2,1} & a_{2,2} \end{bmatrix} \times \begin{bmatrix} b_{1,1} & b_{1,2} \\ b_{2,1} & b_{2,2} \end{bmatrix} = \begin{bmatrix} c_{1,1} & c_{1,2} \\ c_{2,1} & c_{2,2} \end{bmatrix}$$

$$\begin{aligned} c_{1,1} &= a_{1,1} \times b_{1,1} + a_{1,2} \times b_{2,1} \\ c_{1,2} &= a_{1,1} \times b_{1,2} + a_{1,2} \times b_{2,2} \\ c_{2,1} &= a_{2,1} \times b_{1,1} + a_{2,2} \times b_{2,1} \\ c_{2,2} &= a_{2,1} \times b_{1,2} + a_{2,2} \times b_{2,2} \end{aligned}$$

Standard Algorithm — **8** Multiplications

Strassen's Algorithm — **7** Multiplications

Strassen's Algorithm:

- Invented in **1969**
- Applicable **only for 2x2** matrix
- Algorithm for **larger version** such as 3x3 have remained **unsolved!**

Fifty years ago!

Implications on Project Management Practice: Digital AI-based School

Artificial Intelligence is the **simulation of human intelligence** process by machines

nature 05 October 2022

Discovering faster matrix multiplication algorithms with reinforcement learning
Volume 610, pages 47–53 (2022)

$$\begin{bmatrix} a_{1,1} & \cdots & a_{1,5} \\ \vdots & \ddots & \vdots \\ a_{4,1} & \cdots & \boldsymbol{a_{4,5}} \end{bmatrix} \times \begin{bmatrix} b_{1,1} & \cdots & b_{1,5} \\ \vdots & \ddots & \vdots \\ b_{5,1} & \cdots & \boldsymbol{b_{5,5}} \end{bmatrix} = \begin{bmatrix} c_{1,1} & \cdots & c_{1,5} \\ \vdots & \ddots & \vdots \\ c_{4,1} & \cdots & \boldsymbol{c_{4,5}} \end{bmatrix}$$

Standard: 5x5x4 = **100**

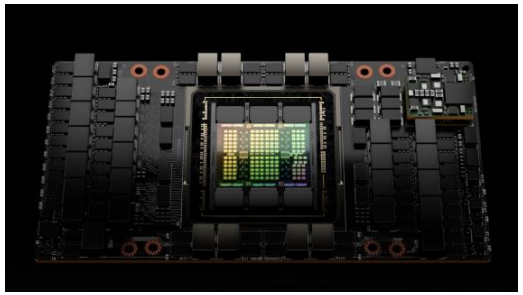
Advanced: 80

AI-based: 76

Artificial Intelligence (AI) techniques could advance the **automatic discovery of new** matrix multiplication **algorithms** that are **more efficient** than the state of the art for many matrix sizes

Unlocking New Possibilities

Matrix multiplication is essential for **computational tasks**:
image processing, speech recognition, computer games, weather simulations



Adapting the new algorithm on the **NVIDIA H100** High-End Accelerated AI-Enabled Computing Chips exhibited **10-20% faster** computing response compared to commonly used algorithm.

Implications on Project Management Practice: AI Powered Tools

Automating project communications and interactions with internal and external stakeholders

Cloud-based application offers resources for **collaboration and task management** with multiple users

ProofHub

Creating project documentation, allotting responsibilities and task allocation

ClickUp

Wrike

Visually tracking the project tasks and their statuses

Trello

asana

Project conceptualization and planning phase allowing **public access of tasks**

Quick way to track the project tasks and their statuses

Implications on Project Management Practice: AI Sets New Rules

- **Complex Analytics:** AI-powered data analysis enables the performing of complex analytics with high accuracy extremely beyond the human capability
- **Confident and Fast Decision Making:** AI-based data analysis provides deep insight in the project to help in decision making and project steering activities
- **Automated Data-Driven Tasks:** AI-powered tools assist in administrative tasks (meeting planning, reminders, day-to-day updates, cost forecasting) and fostering reduction if not removal of manual errors
- **People Management:** AI-powered tools preform routine administrative tasks allowing more focus on the higher-level and complex activities and planning tasks and thus increasing productivity and efficiency
- **Promoting Innovation:** AI-based project is not a typical IT one, it requires extensive experimentation (problem scoping, data acquisition, data exploration, modelling and evaluation)
- **Empowering Leadership:** AI-powered tools do not perform tasks with creativity, social skills and perceptiveness and this requires project managers to focus more on the development of leadership skills

Implications on Project Management Practice: Complementing with AI

Digital vs. Analog Project Management

Change Management Skills

- Continuous changes and uncertainties environment
- "Visionary" mindset rather than "get the job done"!
- Pro-activeness
- Creative problem-solving
- Life-long learning
- Collaboration

Awareness, **D**esire, **K**nowledge, **A**bility, **R**einforcement

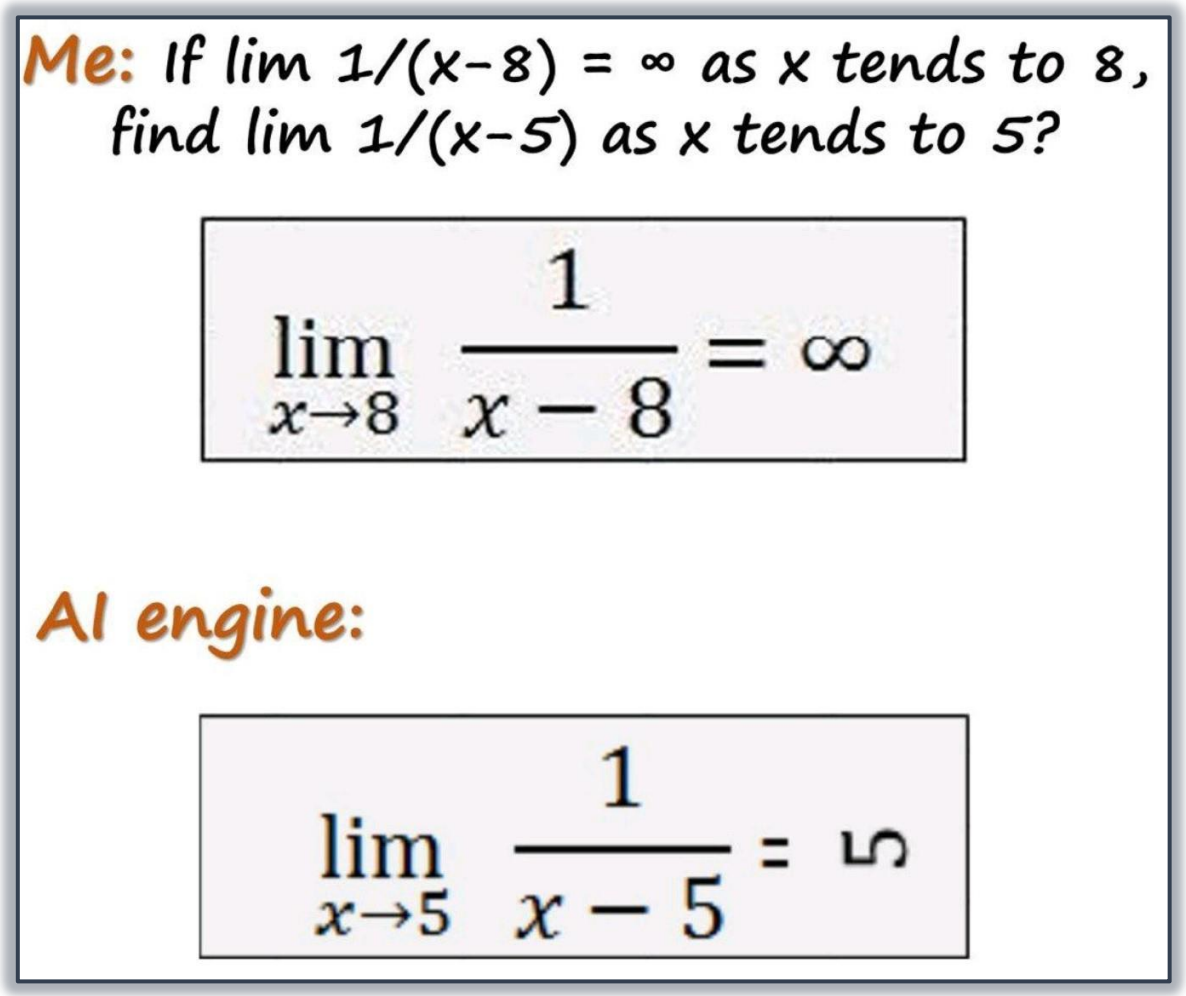
Artificial Intelligence Literacy

From **Reading and Writing** skills, to **Computer** skills, NOW **Artificial Intelligence** (AI) skills

Innovation Mindset

Lessons Learned – Implications on Project Management Practice

- AI-powered tools perform **complex data analytics** for assisting in **decision making** and **project steering** activities
- AI-powered tools save time for **focusing on high-level and complex activities** that require **creativity** and **social skills**
- **Developing the AI-based skills** is essential for project manager for effective adoption of AI culture in project management
- AI-based projects incorporate continuous changes and uncertainties thus practicing strong **change management skills** is essential for project success



Thank you for your attention!

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