Erasmus+
Strategic Partnership Project
FMgoesDigi

IFMA Switzerland Chapter meets FMgoesDIGI

9 February 2023

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NA | DAAD
Nationale Agentur für EU-Hochschulzusammenarbeit | Deutscher Akademischer Austauschdienst German Academic Exchange Service

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FMgoesDIGI – Three Key Questions

How can FM professionals of tomorrow be educated to meet the upcoming demands of digitalization?

Quelle: Pixabay

What technologies will drive the future of FM, and how to identify them?
What skill sets will be needed to provide a good professional service?

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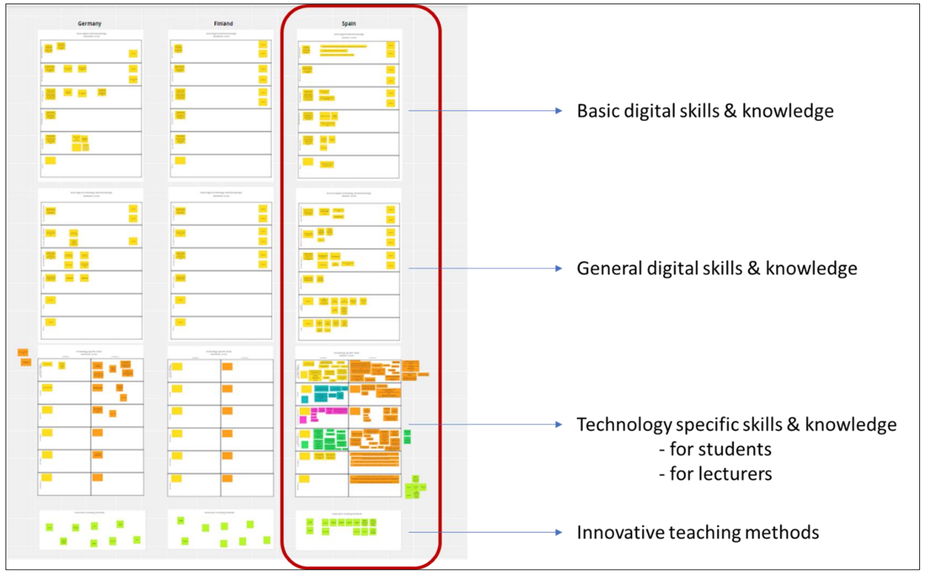
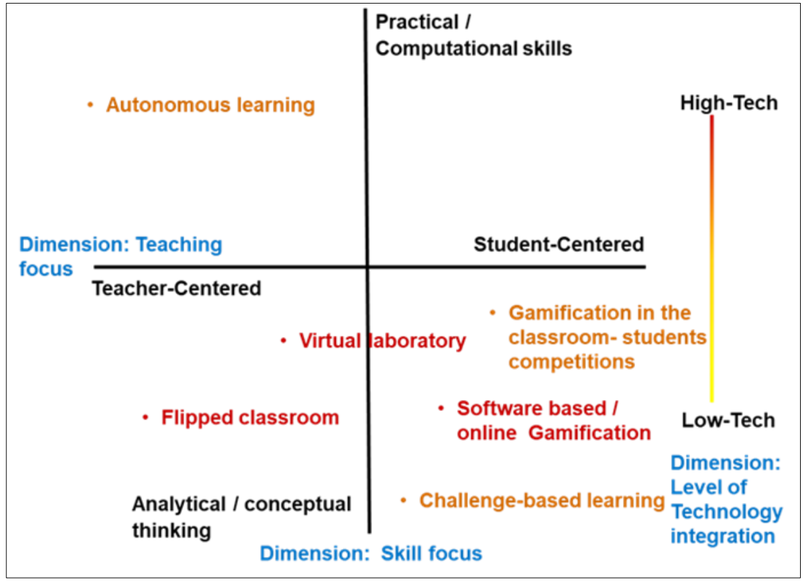
FMgoesDIGI – Outputs

- *FMgoesDIGI - Global Technology Study*
- *FMgoesDIGI - Teachers´and Learners´Skill Sets*
- *FMgoesDIGI - Three Dimensional Teaching Model*
- *FMgoesDIGI - Digital Facility Management Teaching Formats*





FMgoesDIGI – Quick Survey

Bitte nennen Sie die aus Ihrer Sicht Drei wichtigsten digitalen Trends!

Go to www.menti.com and use the code 3856 2839

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FMgoesDIGI – 14 European Reports

https://www.fm-house.com/en/facility-management-technology-tools/

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International Facility Management Association

FMgoesDIGI - 14 Non-European Reports

https://www.fm-house.com/en/facility-management-technology-tools/

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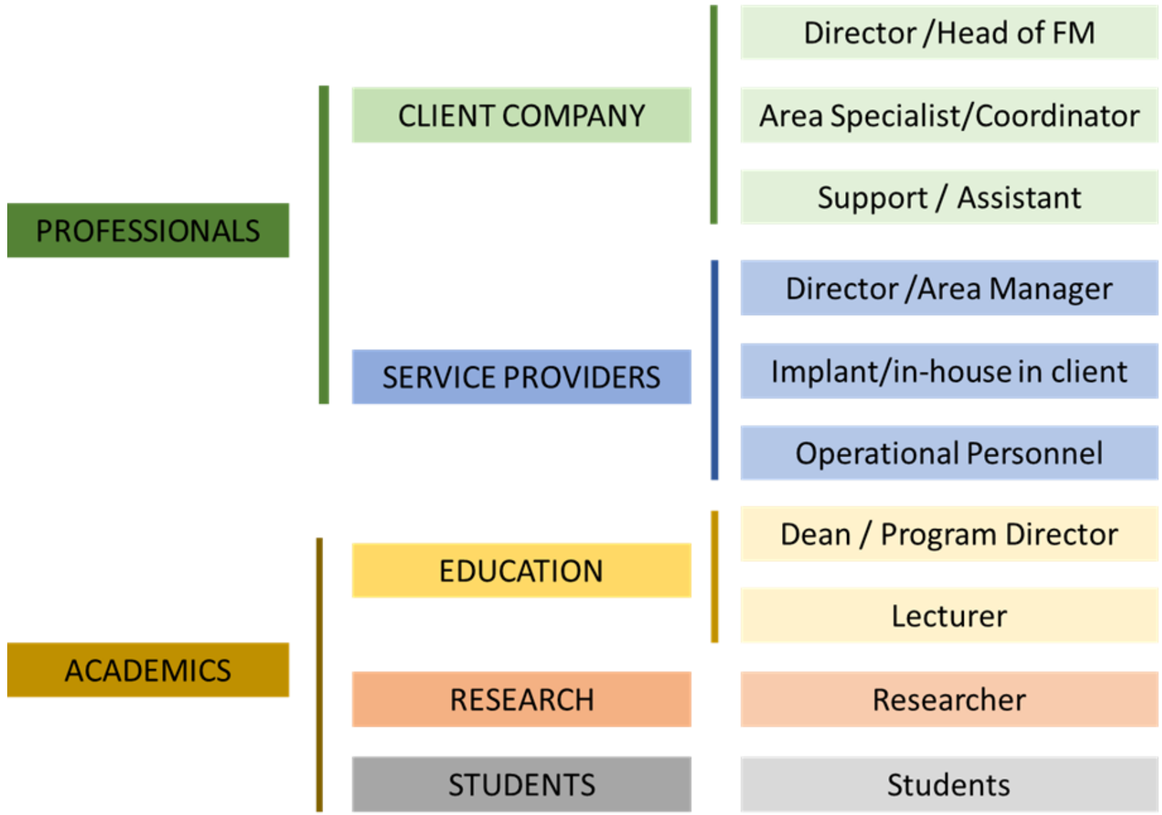
FMgoesDIGI - 25 technologies – 10 profiles

Technology	Comments
3D Scanning	Interior, spaces, buildings, etc.
3D Printing	Parts, consumables, etc.
5G Network	Smart Cities, etc.
Advance Metering Infrastructure	Real-time data acquisition
Artificial Reality	Augmented, virtual and mixed reality
Building Information modelling	Networking 3D-software
Biometrics Systems	Security, access, location, etc.
Blockchain based tools	Contracts, helpdesk, etc.
Building Automatization Systems	IoT, sensors, actuators, etc.
Building Management Systems	Monitoring, performance, etc.
Business Intelligence tools	To process large/different data
Computer Aided tools	IWMS, CAM, EMIS, etc.
Digital Twins models	Replicating physical assets
Drones & microdrones	For exterior and interior use
Generative Design	Iterative exploration process
Geographic Information systems	Geo localization
Holograms	Virtual display or assistance
Human Augmentation	Exo Skeletons, wearables, etc.
Indoor Navigation Systems	Beacons for GPS inside buildings, etc.
Laser Imaging Detection and Ranging	Mapping, measuring, etc.
Applications for Mobile Devices	Support, reporting, etc.
Remote Maintenance Services	Tele maintenance, etc.
Radio Frequency Identification	Tags or control systems
Robots	Cleaning, transport, security, etc.
Virtual Assistants	Reception, guidance, etc.



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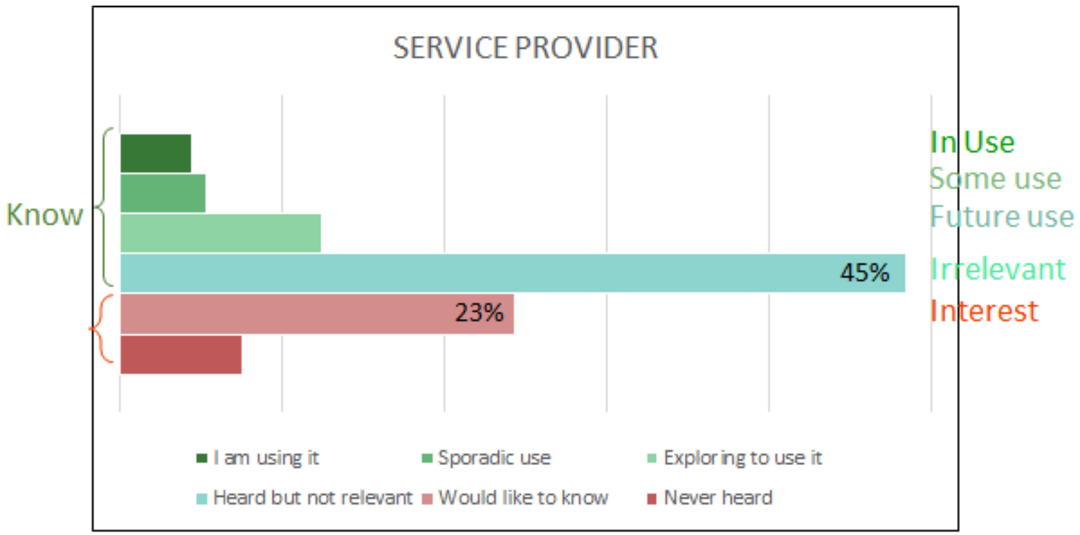
FMgoesDIGI - 25 technologies – 10 profiles



25 technologies – 10 profiles
3 profiles Service Providers
3 profiles End Users/Client companies
4 profiles Academia

MARKET	ACADEMIA	RESEARCHER	STUDENT
I am using it	It is included	We are working on it	It is included
Sporadic use	Exploring to include it	Exploring to work on it	It Will be included
Exploring to use it	Might include in the future	Could be interesting	It should be included
Heard but not relevant	It is not relevant	Not valid for FM	
Would like to know more			Would like to know more
Never Heard	Never Heard	Never Heard	Never Heard

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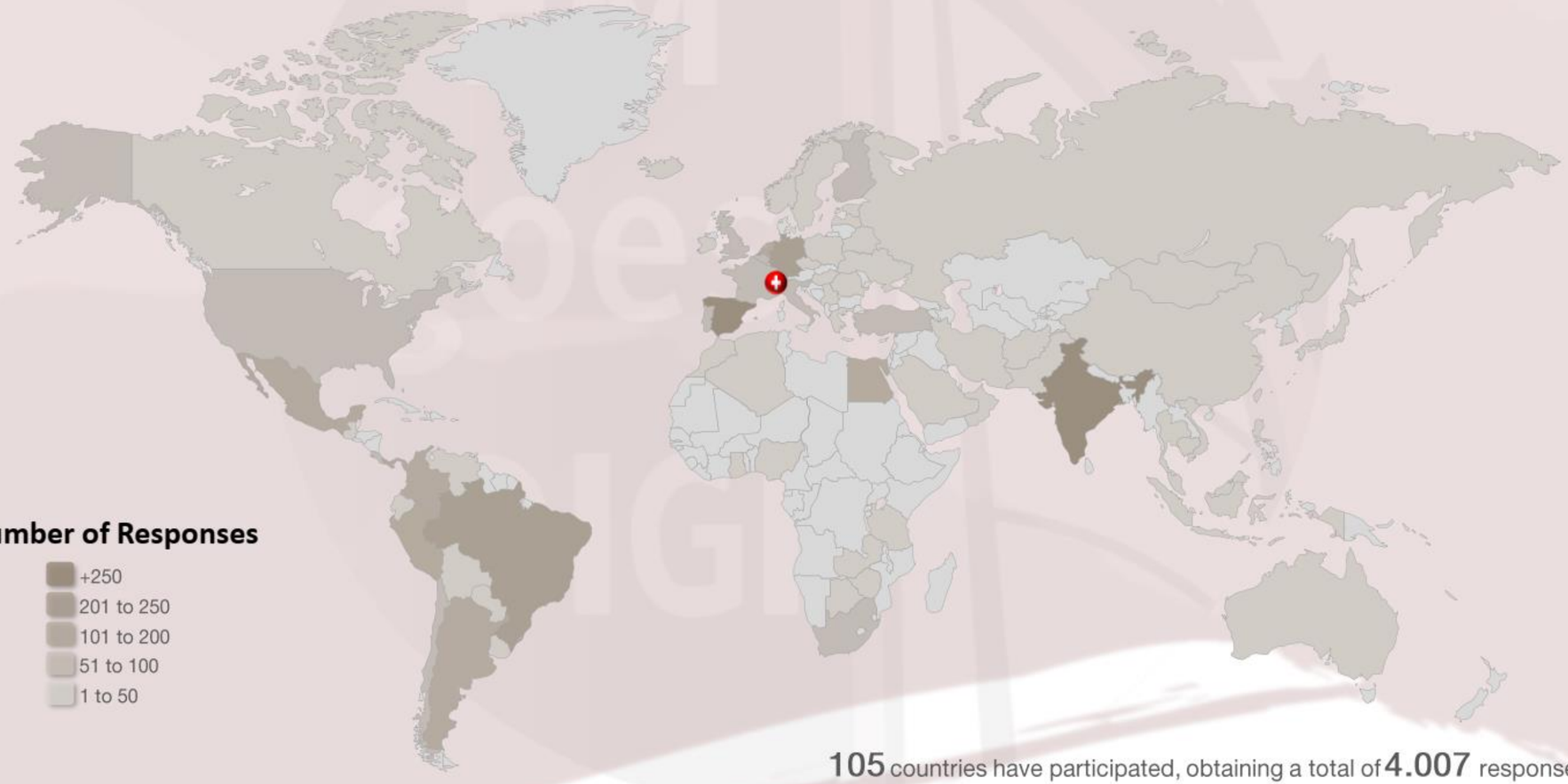
FMgoesDIGI - Global Survey DIGITALIZATION in FM

Responses by country

The questionnaire was distributed openly, online, through social networks and contacts of the partners.



105 countries have participated, obtaining a total of **4.007** responses.

112 responses have been collected from Switzerland

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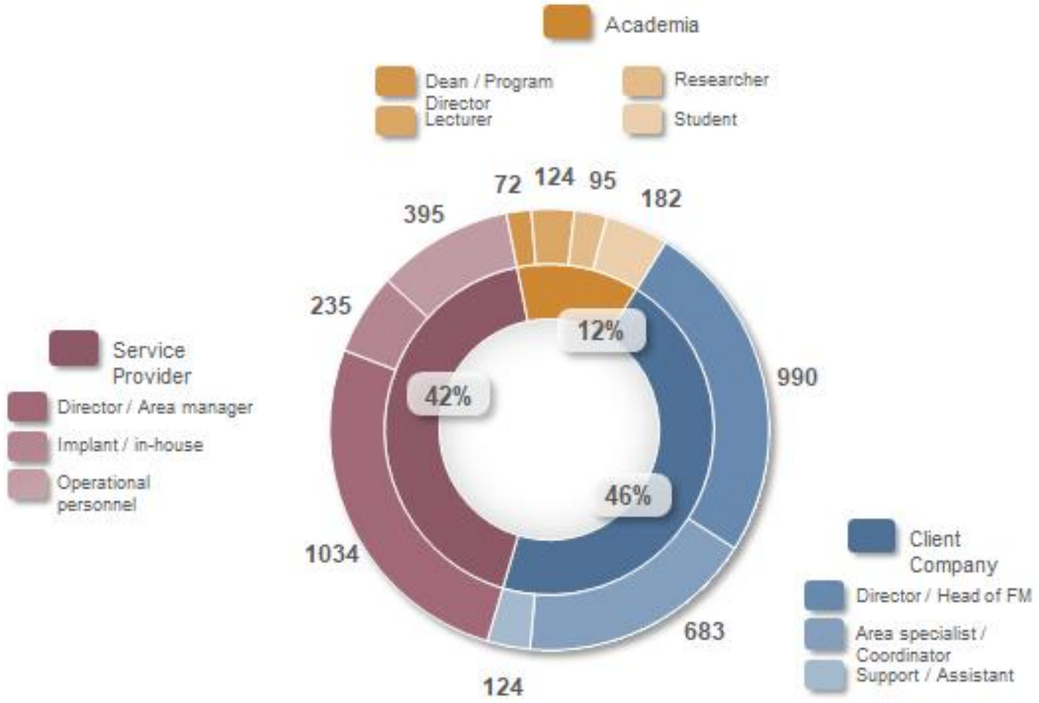
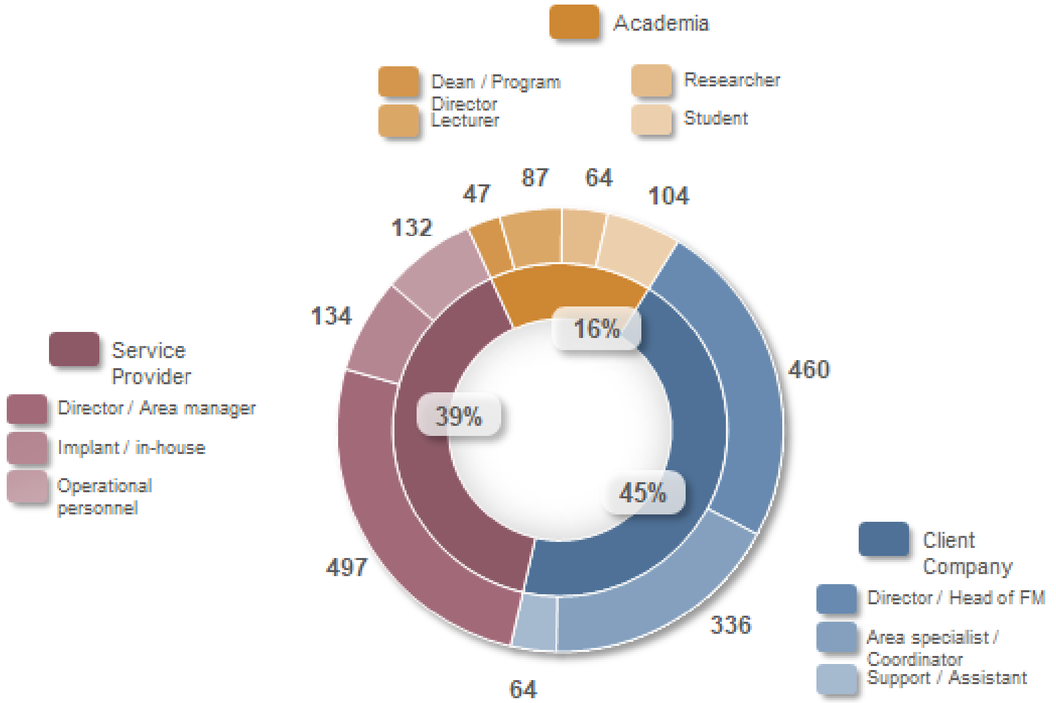
FMgoesDIGI - Global Survey DIGITALIZATION in FM



Global
3934
responses



Europe
1925
responses

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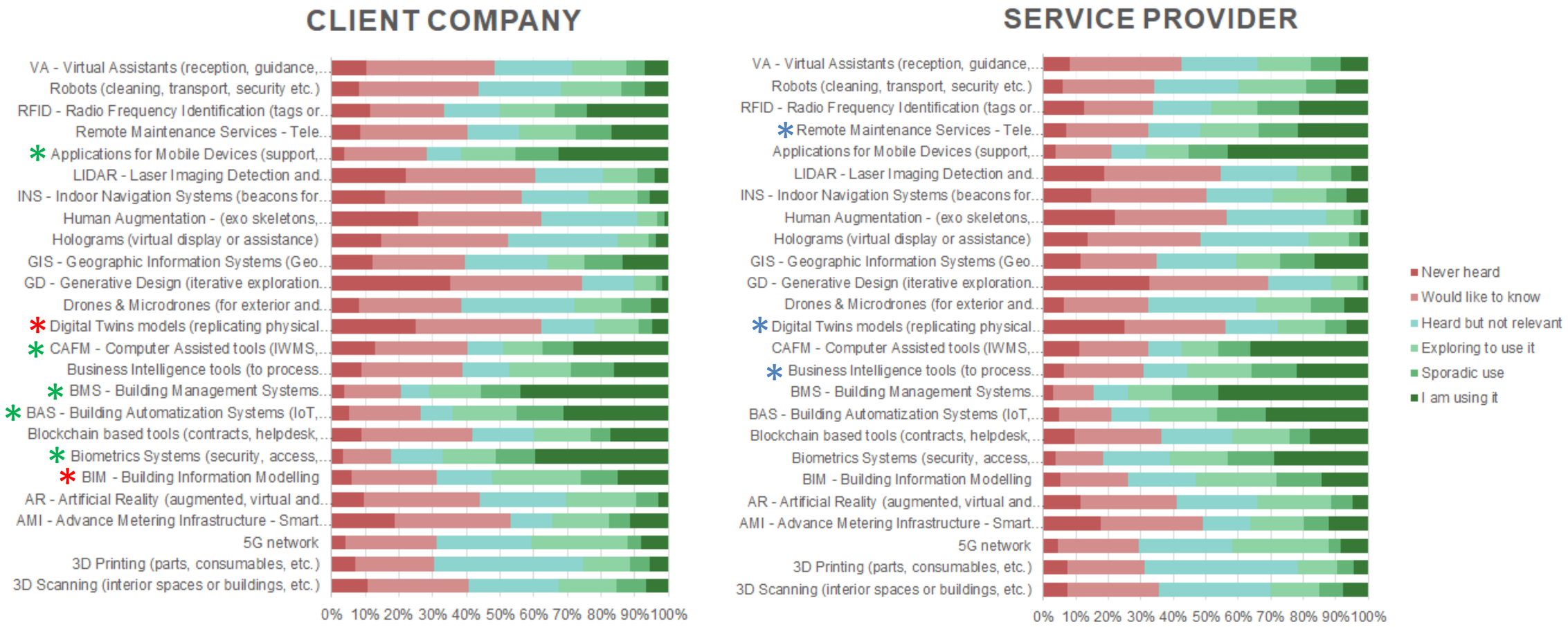
FMgoesDIGI Global Survey – Raw Data Analysis



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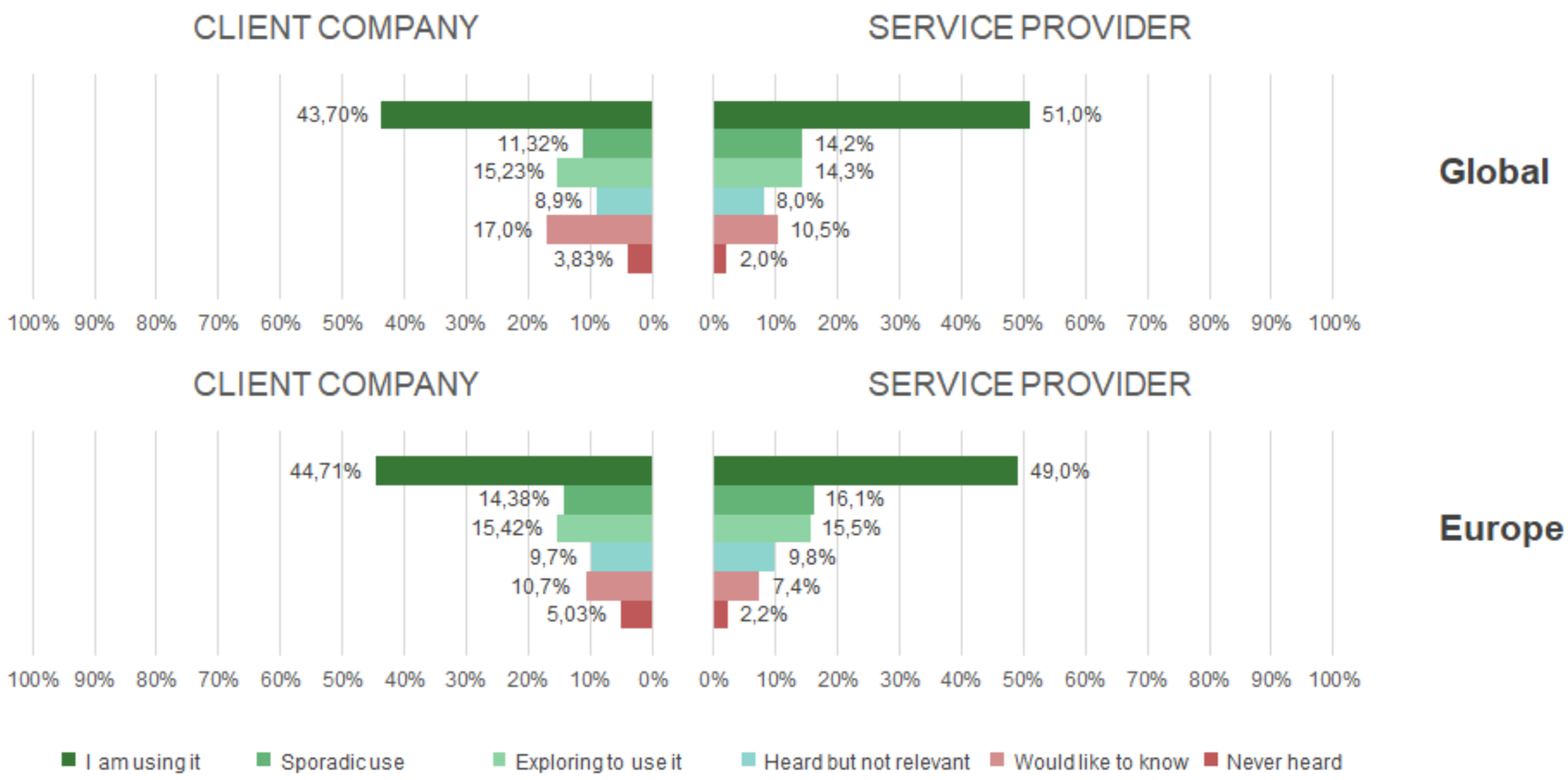
FMgoesDIGI Global Survey – Raw Data Analysis – Awareness Gaps

BMS - Building Management Systems



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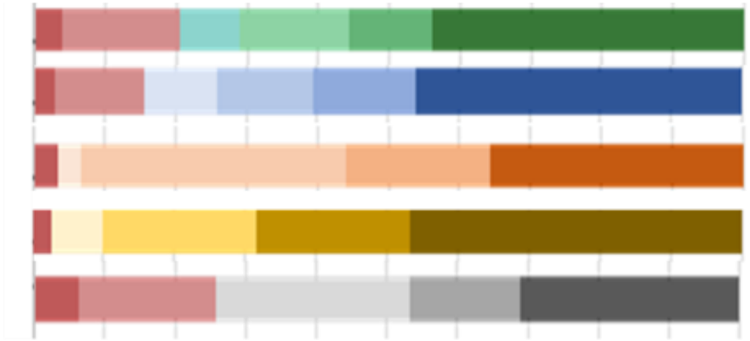
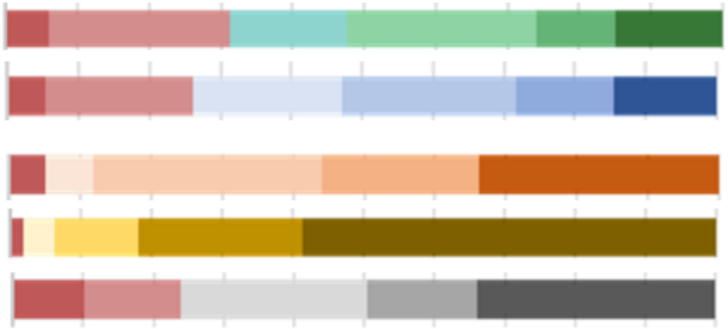
FMgoesDIGI Global Survey – Raw Data Analysis

Mature technologies

BMS
Building Management Systems



BIM
Building Information Modelling



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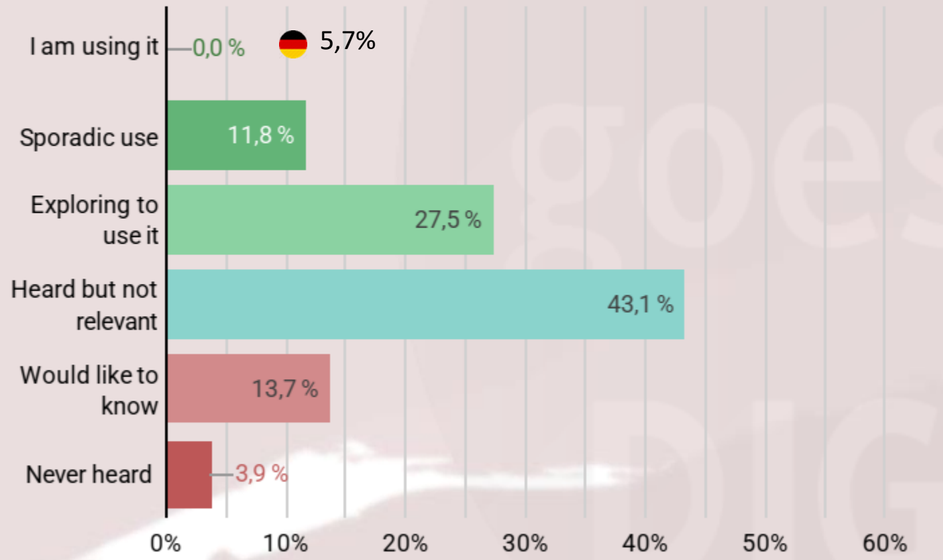
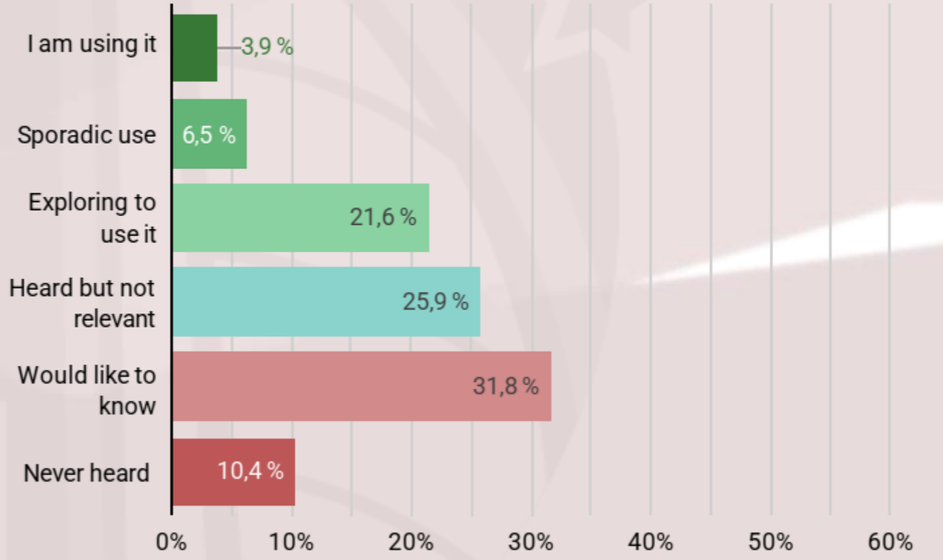
FMgoesDIGI Global Survey – Raw Data Analysis

5 AR - Artificial Reality (augmented, virtual and mixed reality)

It consists of creating interactive immersive environments, based on video recognition technologies, that put the user in total contact and without limitations with the digital world. With these technologies, errors can be detected in the construction process or remote guided maintenance tasks can be carried out, among many other things.



Switzerland
(n=112)



Global
(n=4.007)

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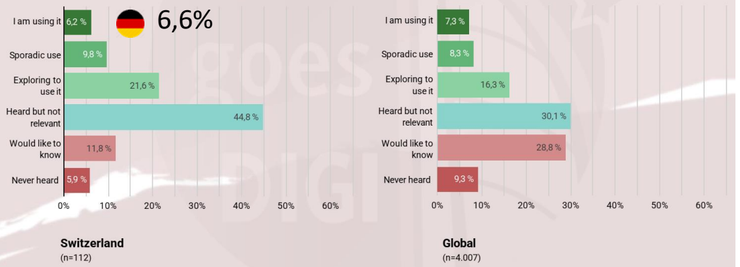
IFMA Switzerland Chapter
International Facility Management Association

FMgoesDIGI Switzerland Report – less used technologies – emerging?

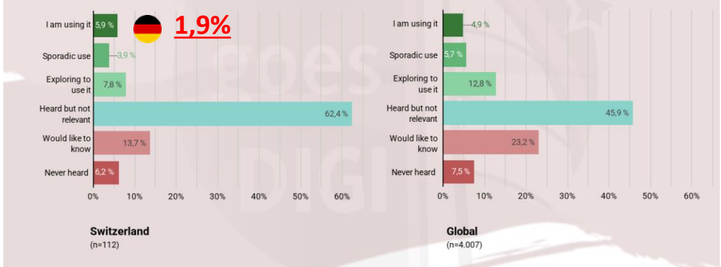
1 3D Scanning

It is the process of analyzing a real object to recreate its shape and appearance digitally in a three-dimensional model. In FM it is used to improve building security processes and maintain accurate records for maintenance and renovations.



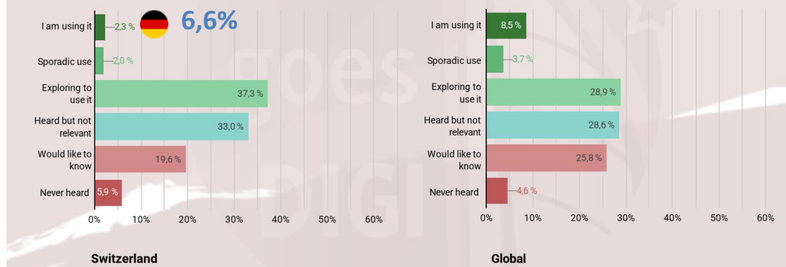
2 3D Printing

Creation of three-dimensional solid objects from a digital file. It is mainly used in the manufacture of spare parts or customized parts, increasing efficiency and improving the maintenance and useful life of equipment.



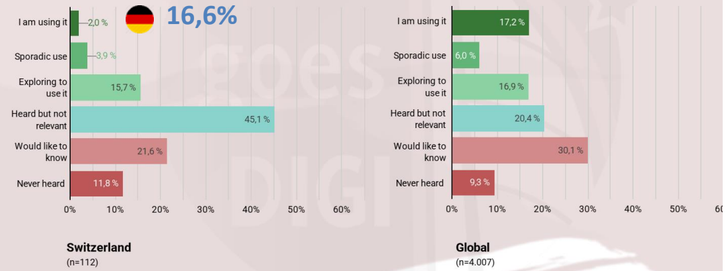
3 5G network

It is the fifth generation of mobile networks. It is a new global wireless standard, with which maximum data speeds of several Gbps can be achieved. With the improvement in connectivity, remote maintenance processes and more effective connections between systems are enabled.



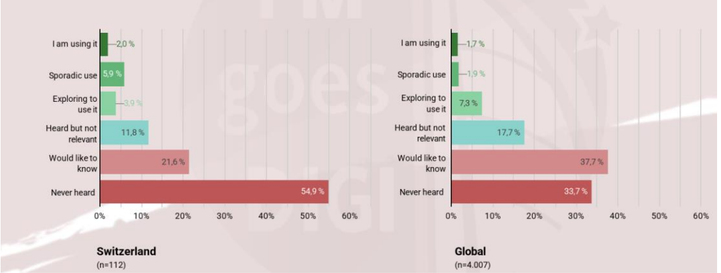
8 Blockchain based tools

Decentralized database that maintains an ever-growing list of ordered records, called cryptographically protected blocks. With this, you can have a simplified way of storing and securing data and documents, creating unique traceability and coding.



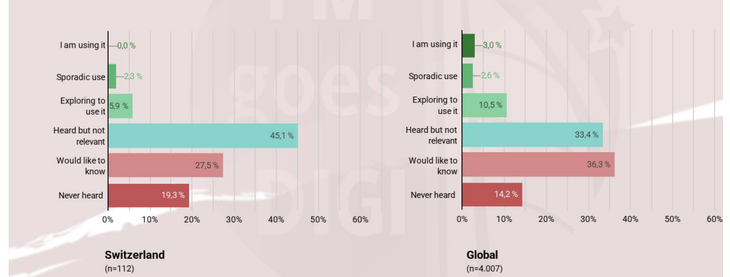
15 GD - Generative Design

It is an exploration process, where all possible permutations of a solution are contemplated, quickly generating design alternatives. With this technology, project decisions can be anticipated, improving the proposed models and quickly determining what works best.



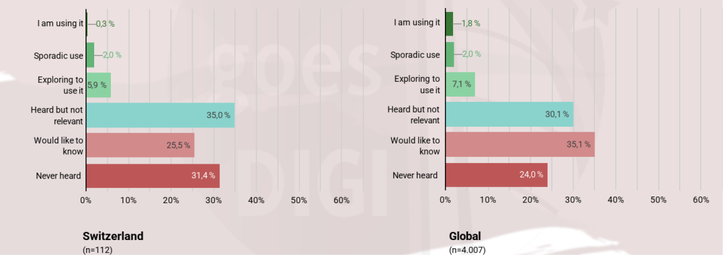
17 Holograms

It is an advanced photography technique that consists of creating three-dimensional images based on the use of light. They are connected to artificial intelligence programs that simulate people or scenes with volume and depth.



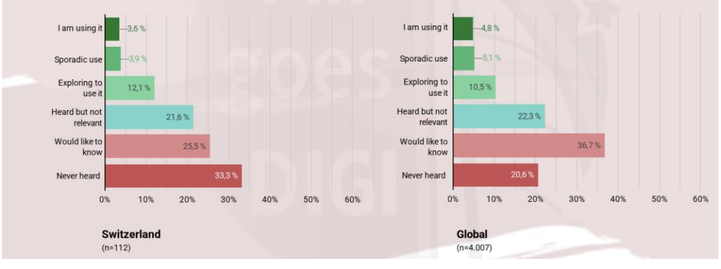
18 Human Augmentation

It is cognitive and physical enhancement by adding or expanding (bodily) functions with the help of technological means. It is mainly used to increase physical capacities in the development of routine activities such as maintenance and construction.



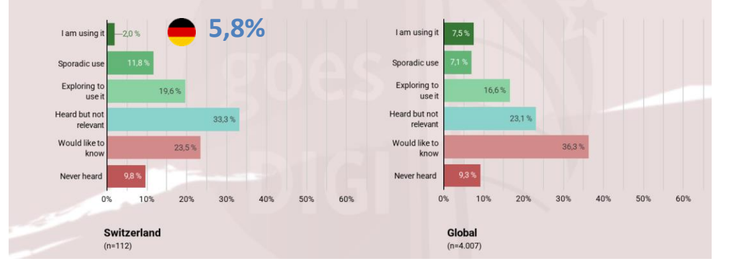
20 LIDAR - Laser Imaging Detection and Ranging

It is a remote sensing method that uses light in the form of a pulsed laser to measure ranges (varying distances) to Earth. This technology allows inspections of spaces and generation of plans automatically with high precision.



25 VA - Virtual Assistants

It is a software agent that can perform tasks or services for a person based on commands or questions. The term "chatbot" is sometimes used to refer to virtual assistants that are accessed generally or specifically through online chat.



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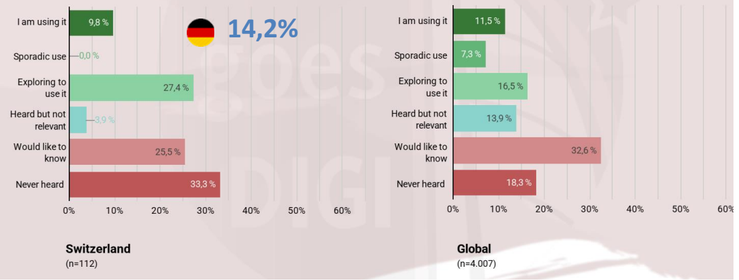
FM goes DIGI

FMgoesDIGI Switzerland Report – medium use – emerging?

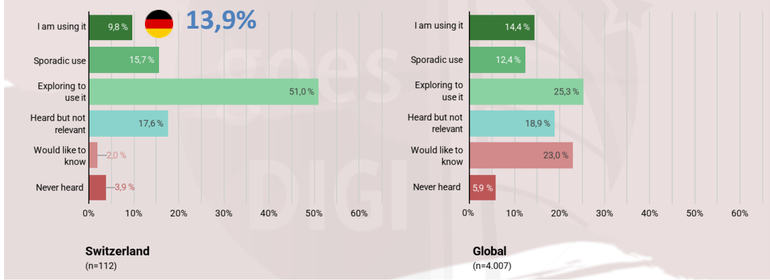
4 AMI - Advance Metering Infrastructure

It is an integrated system of smart meters, communication networks and data management elements, which allows bidirectional communication between services and users. The integration allows the generation of automated and highly accurate information, which translates into operational savings.



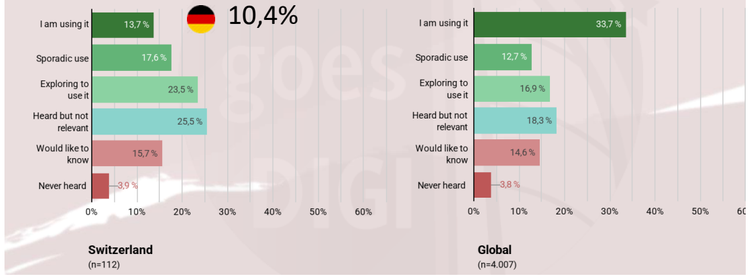
6 BIM - Building Information Modelling

Comprehensive process of creating and managing information related to a physical asset, where its digital representation is produced throughout its life cycle. With this you can improve decision making in real time, and streamline processes such as construction, documentation and maintenance.



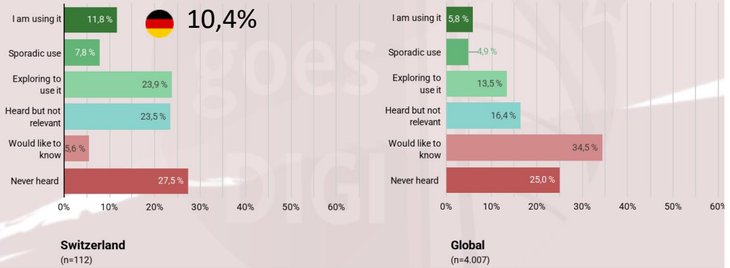
7 Biometrics Systems

It is the use of specific data about unique biological traits of an individual, to generate information by which that individual can be effectively identified. With this technology it is possible to facilitate access control, the granting of permissions or the identification of features to analyze sensations or behaviors.



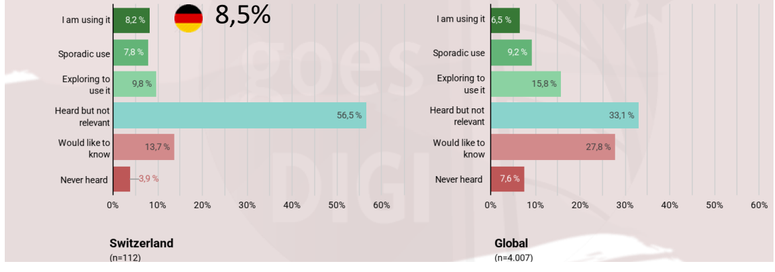
13 Digital twins models

It is the creation of a detailed digital replica of a physical asset, including systems, processes and devices. It allows monitoring and simulating behavior, identifying trends and errors, allowing action even before construction.



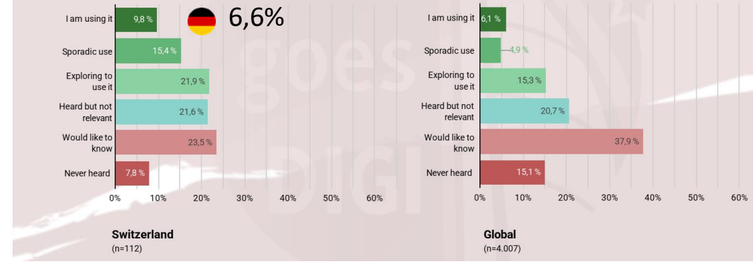
14 Drones & Microdrones

Unmanned aerial portable vehicles capable of flying over any element and carrying out visual inspections. They can transmit images of buildings, machinery, or equipment in inaccessible locations, to a remote-control point, or on land far from danger.



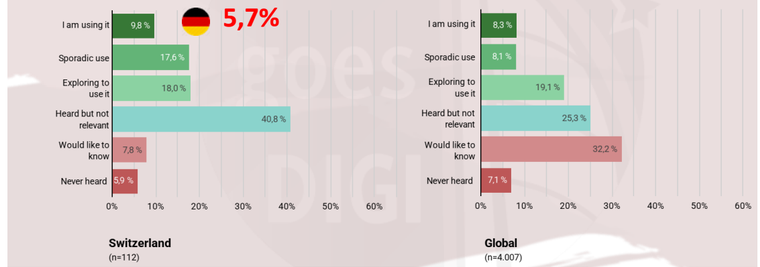
19 INS - Indoor Navigation Systems

It consists of creating a map of the interior of a building, which is displayed in an application or in a browser window and allows you to search for places and be guided to a specific point with interactive instructions.



24 Robots

Autonomous machines capable of sensing their environment, performing calculations to make decisions, and take action in the real world. Commonly used in cleaning tasks, receiving users or in high-risk activities.



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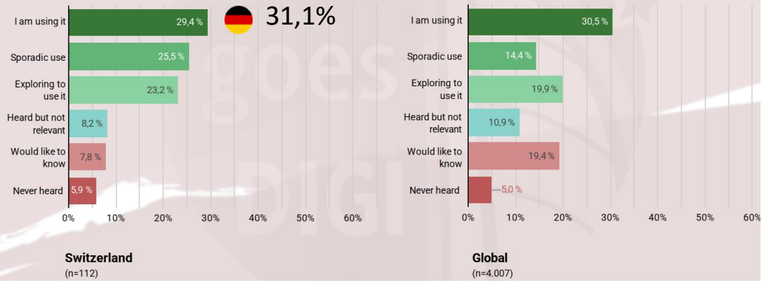
FMgoesDIGI Switzerland Report – high use – mature?

9 BAS - Building Automatization Systems

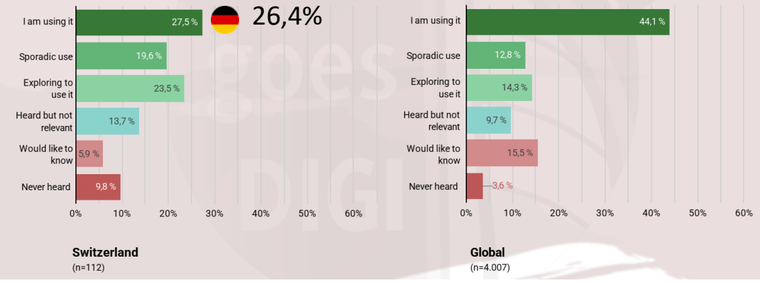
Systems that provide automatic control and monitoring, but also allow equipment to be activated or deactivated remotely. Being centralized, actions can be viewed from a central point, which helps decision-making and speeds up response.



Switzerland (n=112) **Global** (n=4.007)

10 BMS - Building Management Systems

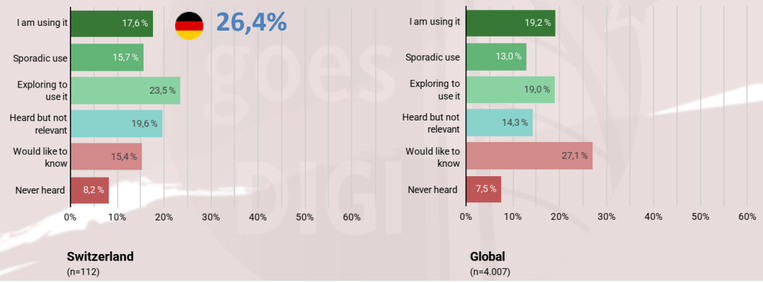
Software specialized in controlling and monitoring the equipment of a building in a centralized way, providing effective supervision and reports. With this technology it is possible, for example, to reduce the costs associated with energy and water consumption in a building.



Switzerland (n=112) **Global** (n=4.007)

11 BI - Business Intelligence tools

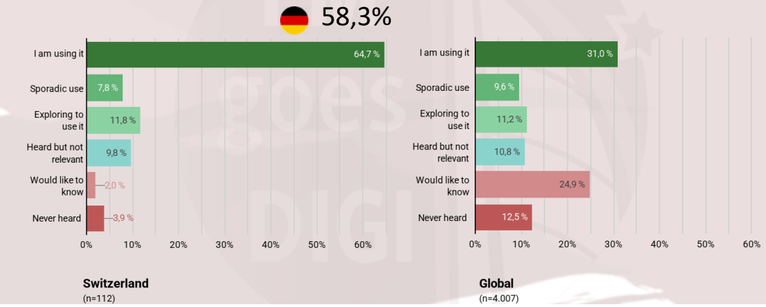
Software that aids in the collection, transformation, and presentation of large amounts of both structured and unstructured data. With this software it is possible to have reports, dashboards and visualizations that allow strategic decision making based on complex information.



Switzerland (n=112) **Global** (n=4.007)

12 CAFM - Computer Assisted tools

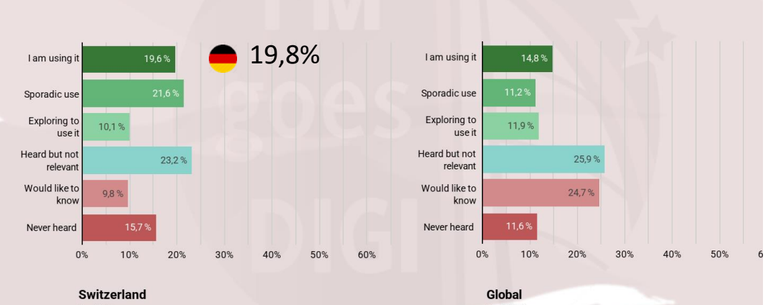
Specialized software to coordinate activities in the physical workplace and relate it to the organization's facilities, people, and operations. With this type of tools, the management capacity and the response to requests or indecency are increased.



Switzerland (n=112) **Global** (n=4.007)

16 GIS - Geographic Information Systems

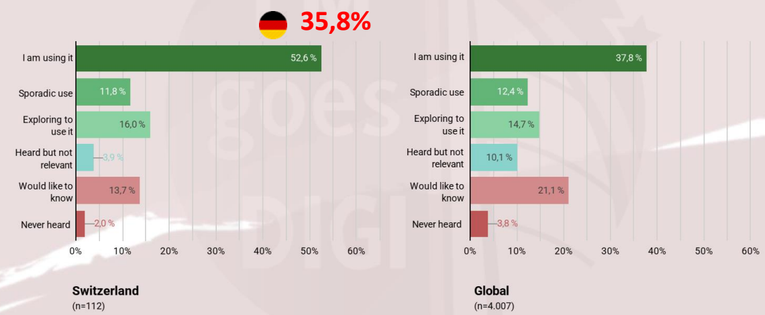
Complex methods that allow the use of spatial location and associate layers of information using maps and 3D scenes, helping to collect, manage and analyze geographic data.



Switzerland (n=112) **Global** (n=4.007)

21 Applications for Mobile Devices

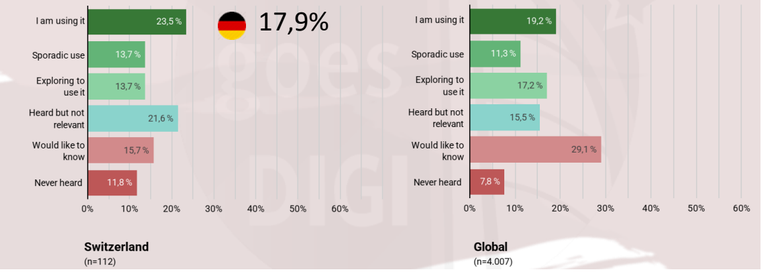
It is a type of software designed to run on a mobile device, such as a smartphone or tablet. This technology has been widely applied for all kinds of needs, especially for the improvement of user experience, effective control of facilities and service management.



Switzerland (n=112) **Global** (n=4.007)

22 Remote Maintenance Services

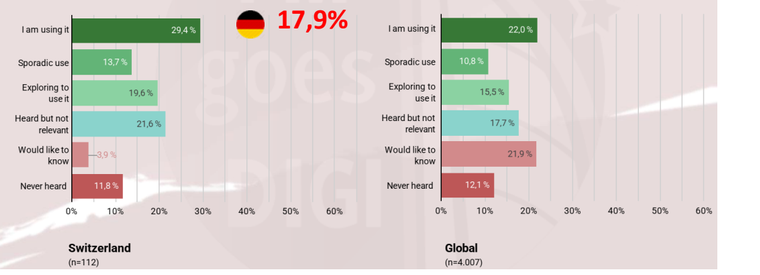
Application of specific software on local systems, which can be accessed from another location, creating the appropriate means to monitor and control maintenance activities remotely.



Switzerland (n=112) **Global** (n=4.007)

23 RFID - Radio Frequency Identification

They are remote data storage and retrieval systems that use devices called RFID tags, cards, or transponders. The fundamental purpose of RFID technology is to transmit the identity of an object (similar to a unique serial number) through radio waves, improving access, inventory and logistics control systems.



Switzerland (n=112) **Global** (n=4.007)

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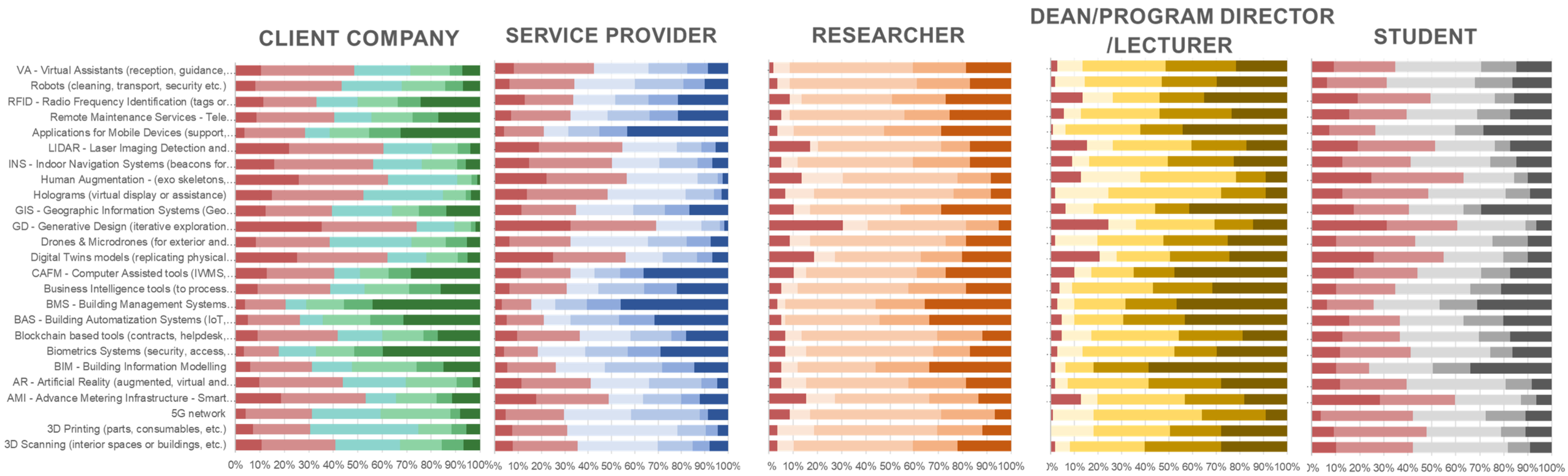
FMgoesDIGI Global Survey – Raw Data Analysis

25 technologies at a glance



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FMgoesDIGI Global Survey – Cross Analysis

	CODE	Indicator /Index	Objective & Description	Feasibility	Concept Formula	Arithmetic weighted average
per stakeholder Profile	RDU	Rate of FM digital unawareness per stakeholder	To measure the percentage of responders that do not know the technology in each stakeholder	All profiles	% Never heard(+% would like to know?)	∑ (80% * sample Never heard +20% *sample would like to know/it's not relevant/Not valid for FM)/(25*sample)
	RDA	Rate of FM digital awareness per stakeholder	To measure the percentage of responders that do know the technology in each stakeholder	All profiles	Complementary % of RDUS	100%-RDU = 100% - (∑ (80% * sample Never heard +20% *sample would like to know/it's not relevant/Not valid for FM)/(25*sample))
	IDI	FM Industry Digital Interest	To measure the interest/potential that is attributed to the technology within the industry representatives	companies&providers	% (Using+sporadic+exploring)	∑ (50% using + 30% sporadic + 20% exploring) /25*sample
	DU	FM-Digital Usage	To measure the technologies that are already in use	All profiles	% (Using / working on /included) + % (sporadic use)	∑ % (100% using + 20% sporadic) or ∑ % working on or ∑ % included /25*sample
		FM-Digital Usage per family of technologies	To measure the technologies that are already in use grouped by families	All profiles	% (Using / working on /included)	∑ % (100% using + 20% sporadic) or ∑ % working on or ∑ % included /(technology sample)
	IDE	Index of digital FM excepticism	To measure the level of excepticism in FM digitalization	All except students	% (not relevant / not valid for FM)	(∑ % not relevant or ∑ % not valid)/25*sample
	ECI	FM Educational Coverage Index	To show the digital educational coverage in FM	Academics & students	% included technologies/ % (included+exploring or it will+might or should be in future)	∑ % included technologies/ (∑ % included + ∑ % exploring or it will + ∑ % might or should be incluided in future)

	CODE	Indicator /Index	Objective & Description	Feasibility	Concept Formula	Arithmetic weighted average
per Technology	RDUT	Rate of FM digital unawareness per technology	To measure the percentage of responders that do not know the technology in each one of the 25 Technologies	All profiles except students (skipped)	% Never heard(+% would like to know?)	For every technology ∑ (80% * sample Never heard +20% *sample would like to know/it's not relevant/Not valid for FM)/(technology sample)
	RDAT	Rate of FM digital awareness per technology	To measure the percentage of responders that do know the technology in each one of the 25 Technologies	All profiles except students (skipped)	% Never heard(+% would like to know?)	For every technology 100%-RDUT = 100% - (∑ (80% * sample Never heard +20% *sample would like to know/it's not relevant/Not valid for FM)/(technology sample))
	IDIT	FM Industry Digital Interest per technology	To measure the interest/potential that is attributed to every technology within the industry representatives	companies&providers	% (Using+sporadic+exploring)	∑ (50% using + 30% sporadic + 20% exploring) /(technology sample)
	DUT	FM-Digital Usage per technology	To measure the technologies that are already in use	All profiles	% (Using / working on /included)	∑ % (100% using + 20% sporadic) or ∑ % working on or ∑ % included /(technology sample)
	IDET	Index of digital FM excepticism per technology	To measure the level of excepticism in FM digitalization	All except students	% (not relevant / not valid for FM)	(∑ % not relevant or ∑ % not valid)/(technology sample)
	ECIT	FM Educational Coverage Index per technology	To show the digital educational coverage in FM	Academics & students	% included technologies/ % (included+exploring or it will+might or should be in future)	∑ % included technologies/ (∑ % included + ∑ % exploring or it will + ∑ % might or should be incluided in future)/(technology sample)
	TMI = IDIT	Technology maturity for Industry	To measure the maturity of the technology in FM Industry	companies&providers	% (working on+exploring or could be interesting in future)	50% using it + 30% sporadic use + 20% exploring to use)/(technology sample)
	TMR	Technology maturity for Researchers	To measure the maturity of the technology in FM Research	Researchers	% (working on+exploring or could be interesting in future)	50% working on + 30% exploring to work + 20% it could be interesting in future)/(technology sample)
	TMA	Technology maturity for Academia	To measure the maturity of the technology in FM teaching and training	Academics & students	% (included+exploring or it will+might or should be in future)	50% included + 30% exploring or it will + 20% might or should be in future (technology sample)
	TRI	Technology Readiness Index	To measure the readiness of the technology for the market	the market	Weighted average of TMI+TMR+TMA	Weighted average of 70% TMI+10% TMR+ 20% TMA
	TRL	Technology Readiness Level	To measure the readiness of the technology for the market		TO BE DEFINED	

Set of indicators for a Cross-Analysis of survey results

Digital awareness/unawareness

Digital interest/excepticism - Digital usage

FM Academia digital proactivity

Technology readiness index (industry-researchers-training)

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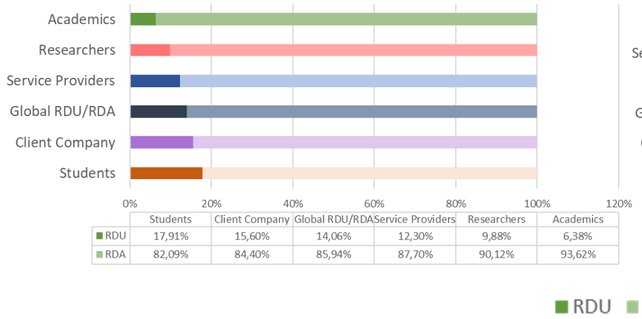
FMgoesDIGI Global Survey – Cross Analysis

Knowledge and unawareness

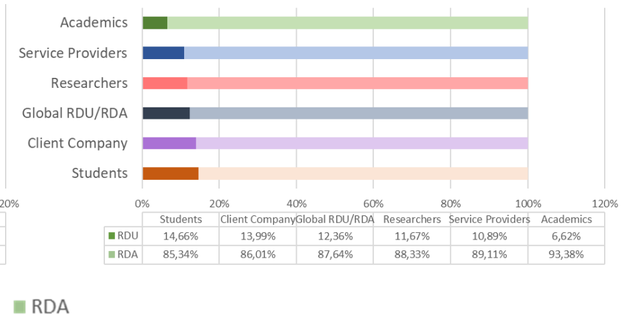
Rate of digital unawareness/awareness (RDU/RDA) per stakeholders

RDU/RDA - GLOBAL



	Students	Client Company	Global RDU/RDA	Service Providers	Researchers	Academics
RDU	17,91%	15,60%	14,06%	12,30%	9,88%	6,38%
RDA	82,09%	84,40%	85,94%	87,70%	90,12%	93,62%

RDU/RDA - EUROPE



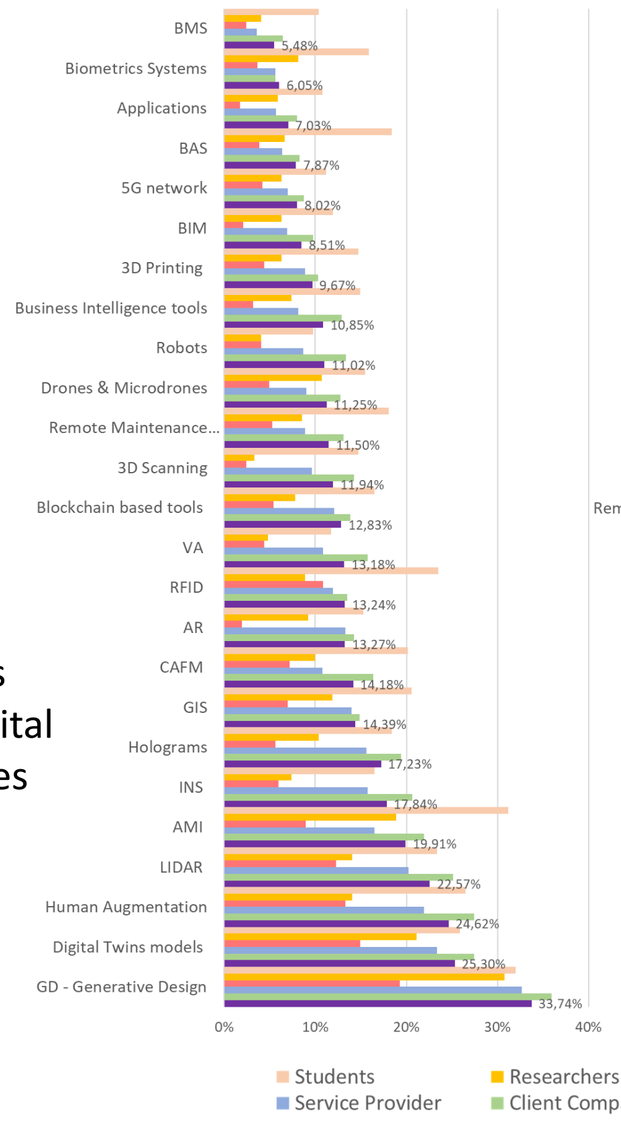
	Students	Client Company	Global RDU/RDA	Researchers	Service Providers	Academics
RDU	14,66%	13,99%	12,36%	11,67%	10,89%	6,62%
RDA	85,34%	86,01%	87,64%	88,33%	89,11%	93,38%

RDU RDA

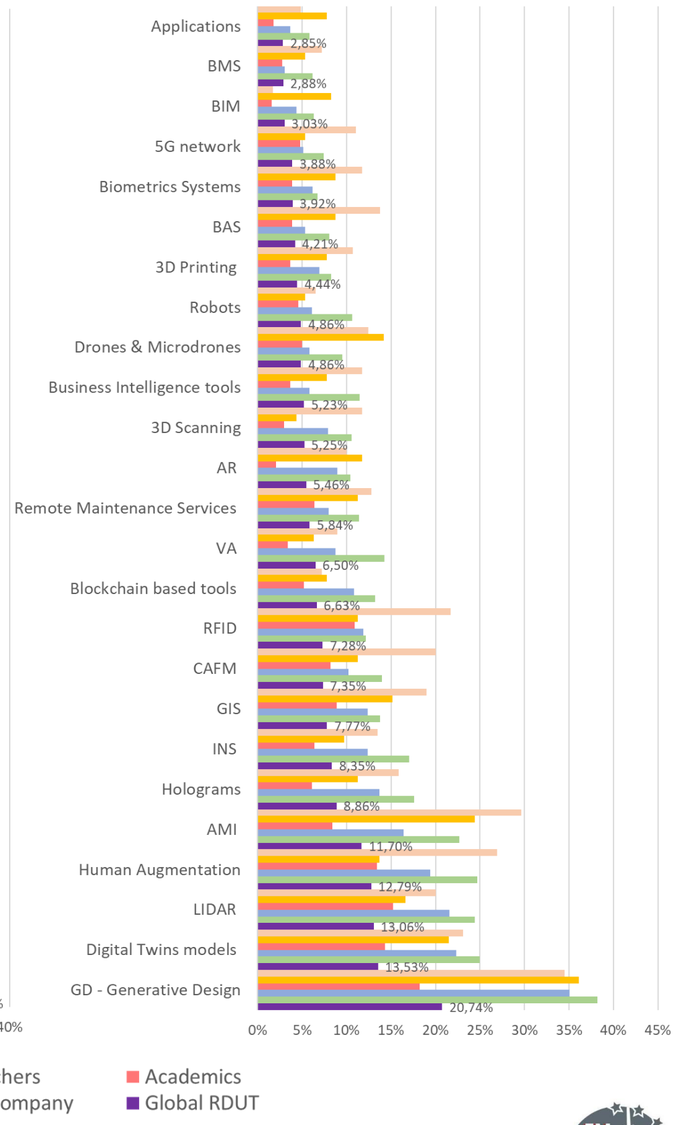
- The European results show a slightly higher awareness of directors to intermediate managers and assistants, and a higher average digital recognition for service providers (89,11%) than for client companies (86,01%).
- The lowest digital awareness ratio is for students with an RDA of 85.34%, and the highest is for Academics with 93.38%.

RDUT - Rate of digital unawareness per stakeholder & technologies

RDUT - GLOBAL



RDUT - EUROPE



Students Researchers Academics
Service Provider Client Company Global RDUT

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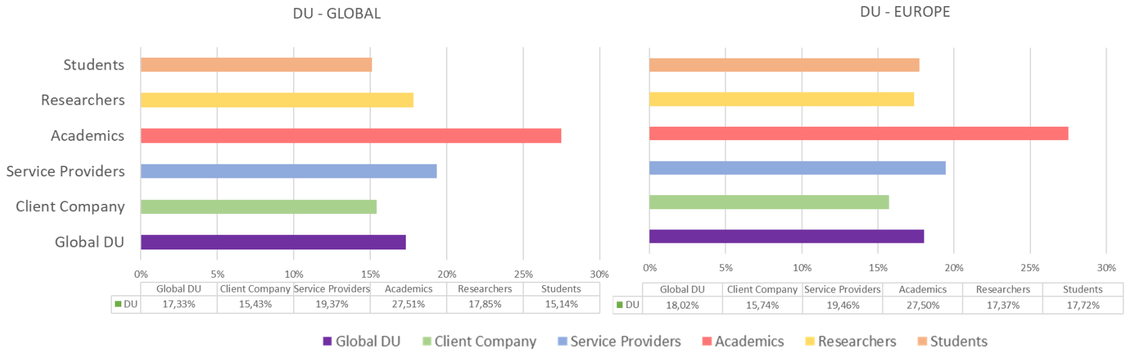
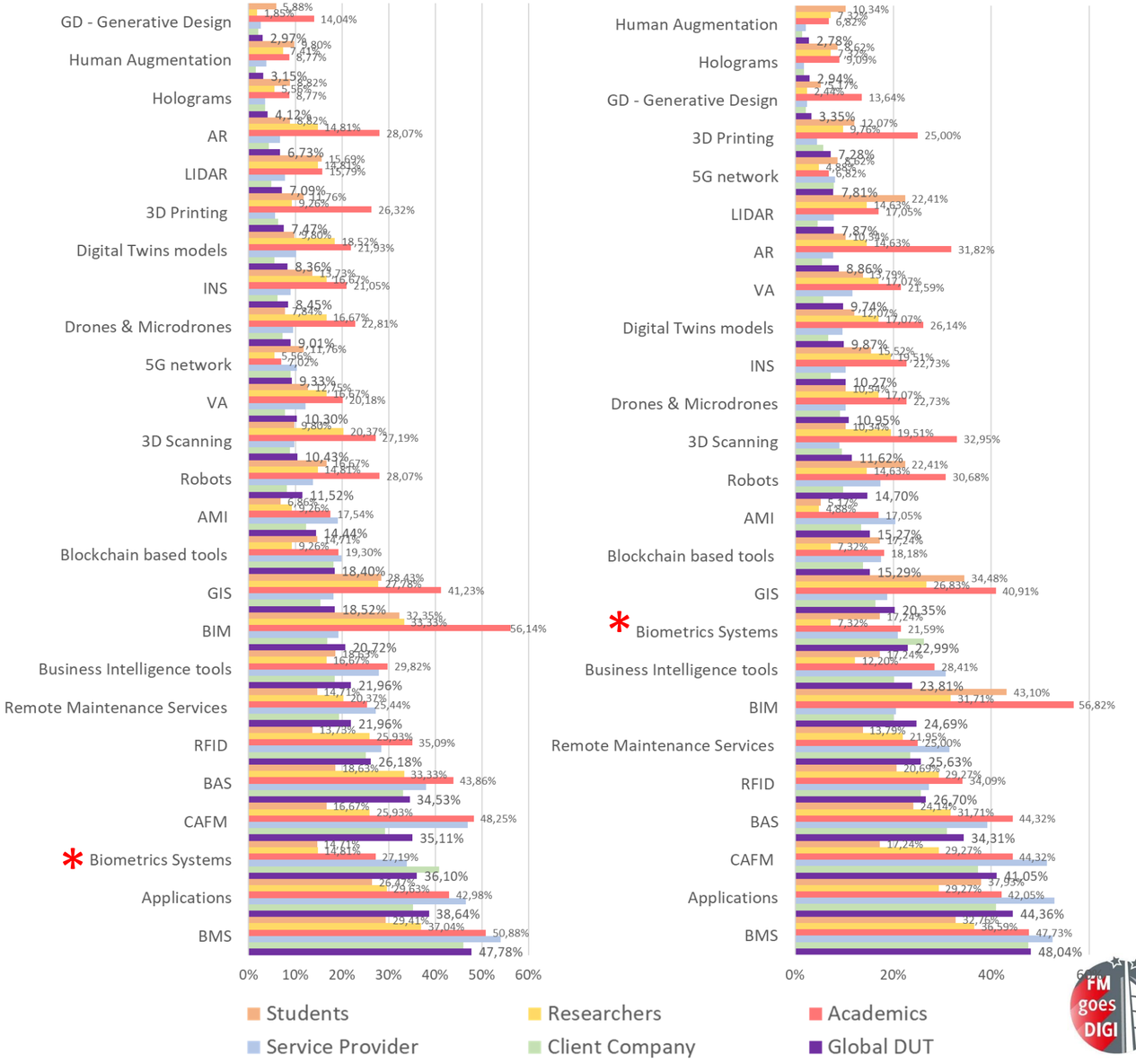
FMgoesDIGI Global Survey – Cross Analysis

FM Digital usage

DU - FM-Digital Usage per stakeholders



DUT - FM-Digital Usage per technology



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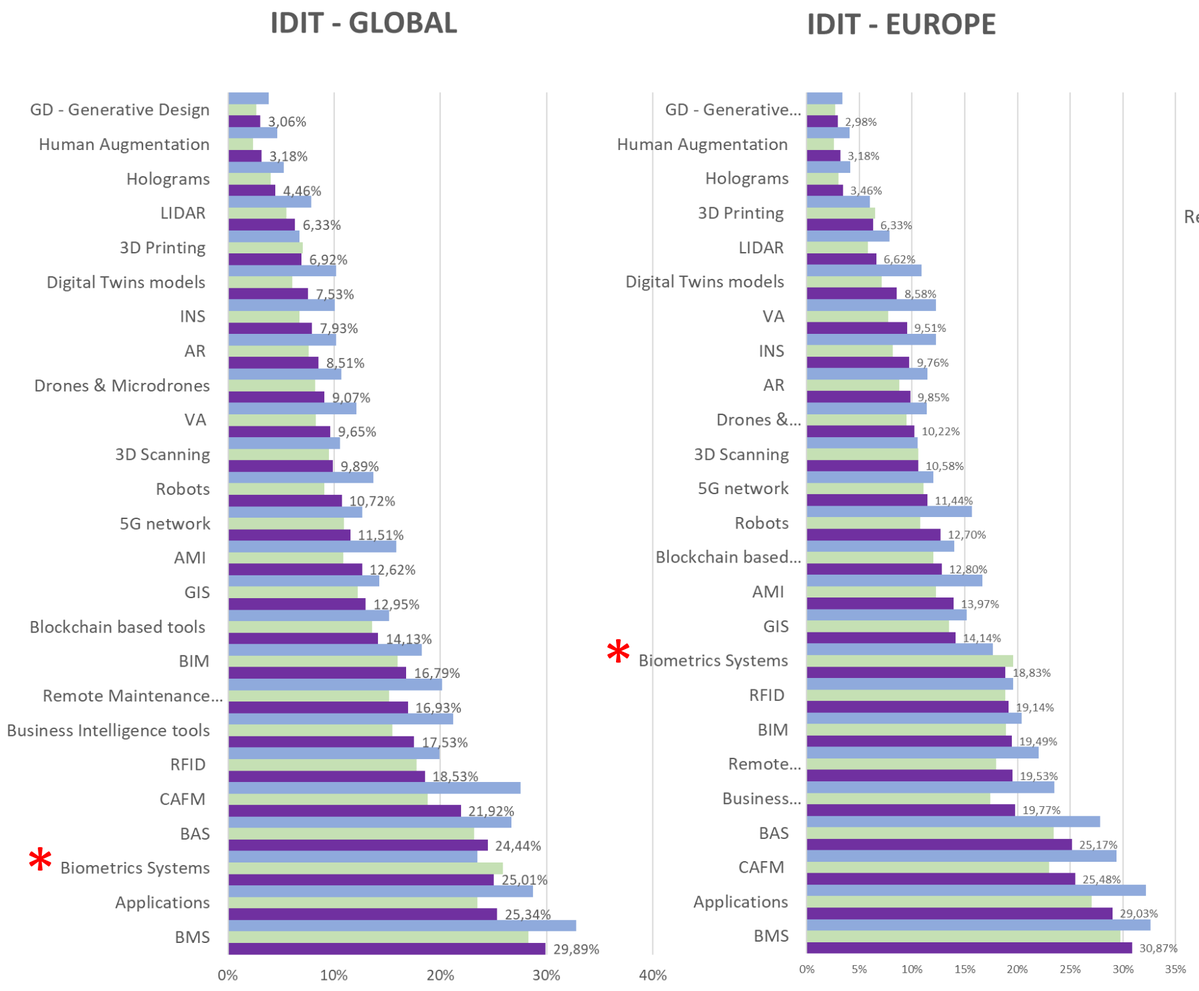
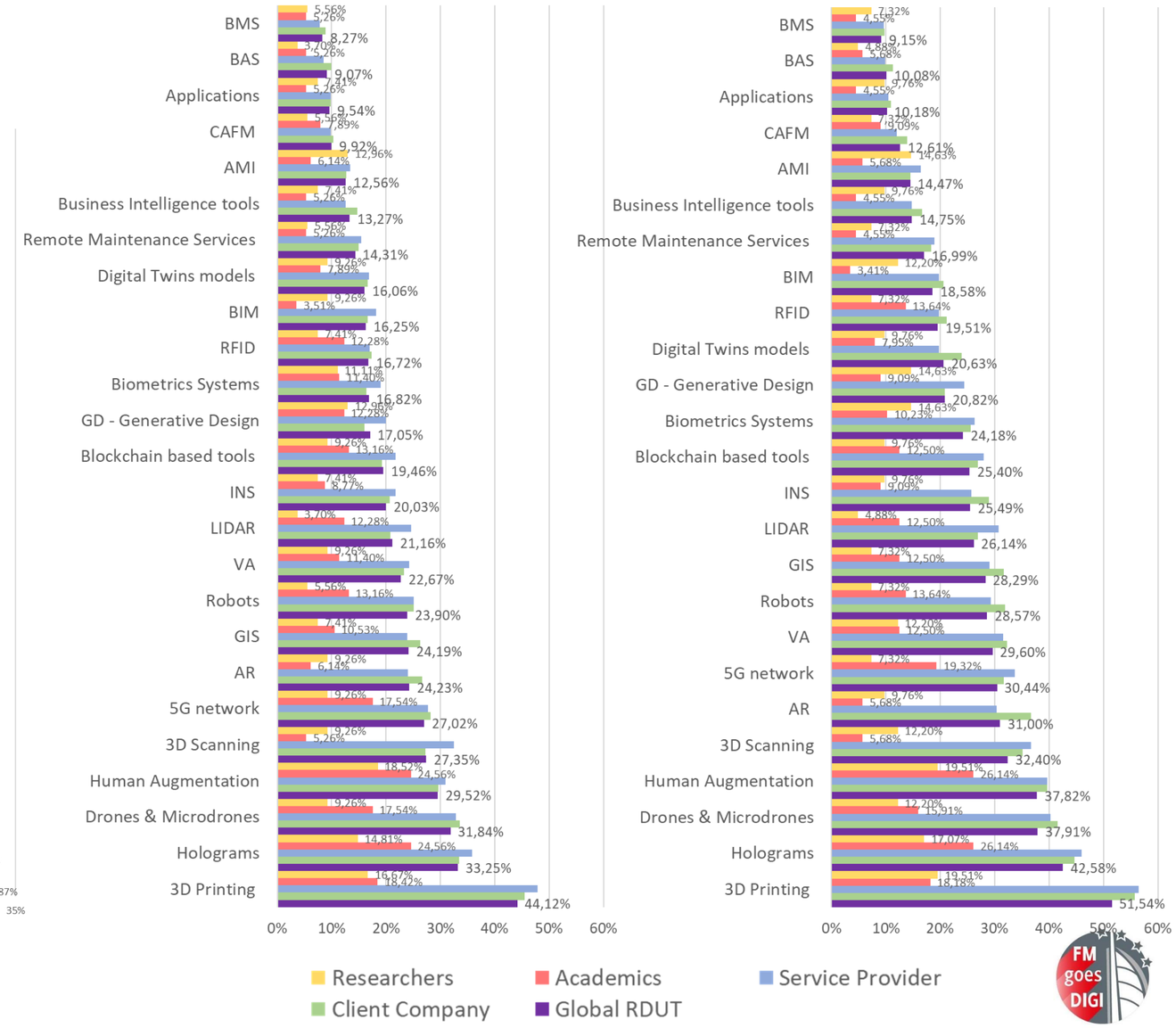
FMgoesDIGI Global Survey – Cross Analysis

FM Digital interest & excepticism

IDIT - FM Industry Digital Interest per stakeholder & technologies



IDET - Index of digital FM excepticism per stakeholder & technologies



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Service Provider | Client Company | Global IDIT

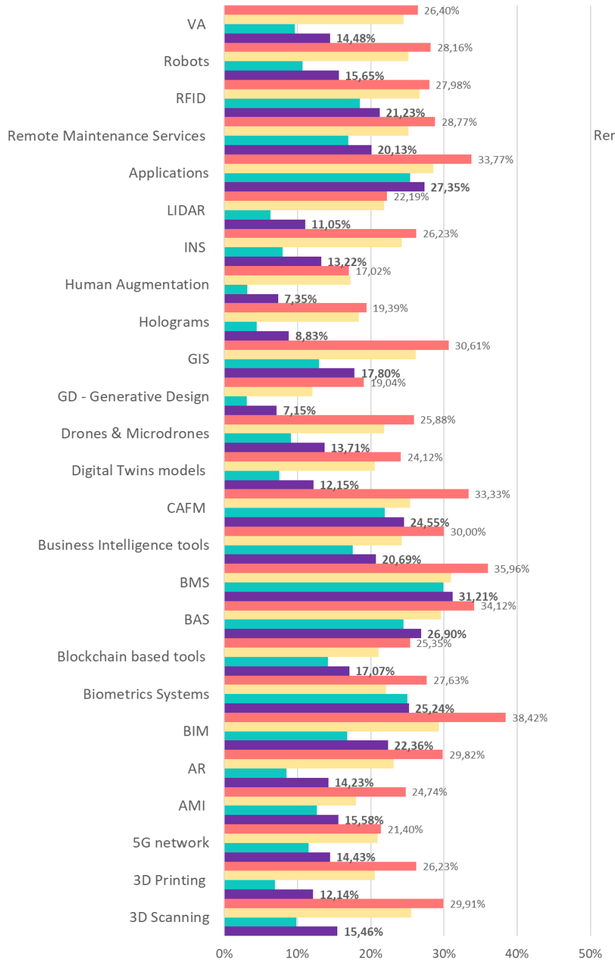
Researchers | Academics | Service Provider | Client Company | Global RDUT

FMgoesDIGI Global Survey – Cross Analysis

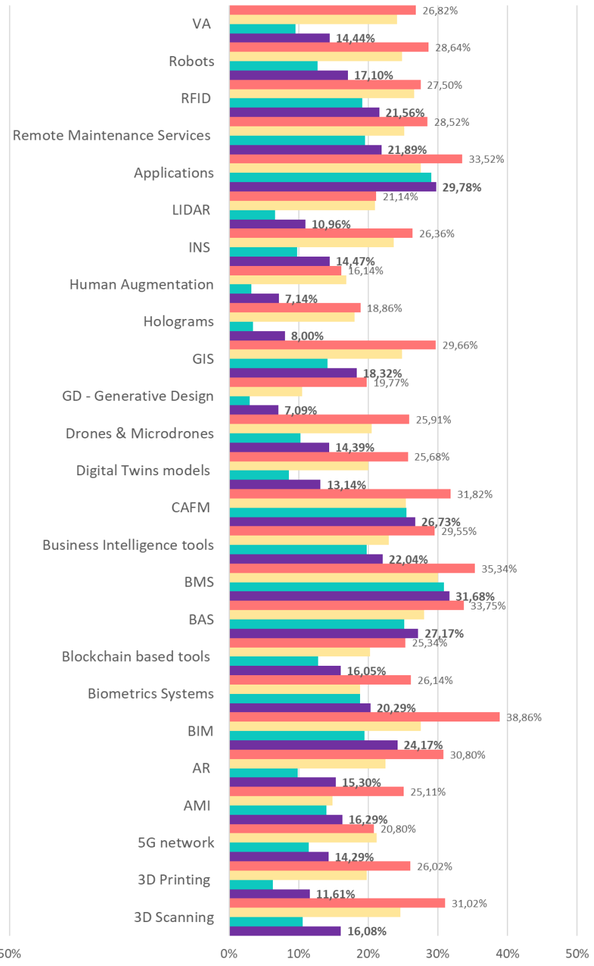
Maturity and Technology Readiness

TRI - Technology Readiness Index. TMI - TMA - TMR Comparation

TRI - TMI - TMA - TMR GLOBAL

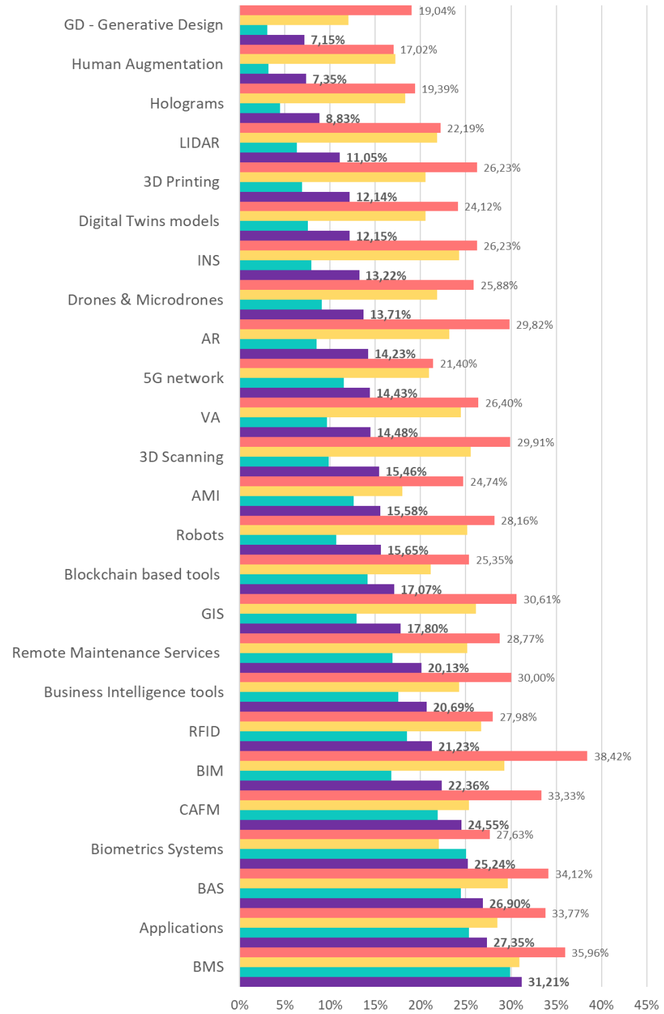


TRI - TMI - TMA - TMR EUROPE

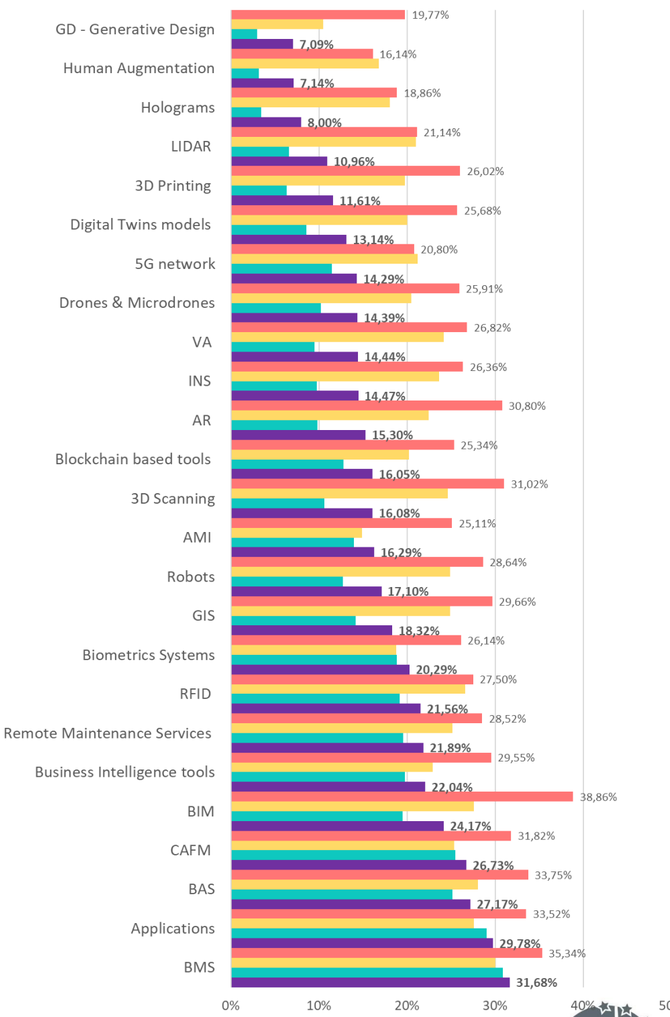


TRI - Technology Readiness Index. TMI - TMA - TMR Comparation

TRI - TMI - TMA - TMR GLOBAL



TRI - TMI - TMA - TMR EUROPE



TMA TMR TMI TRI

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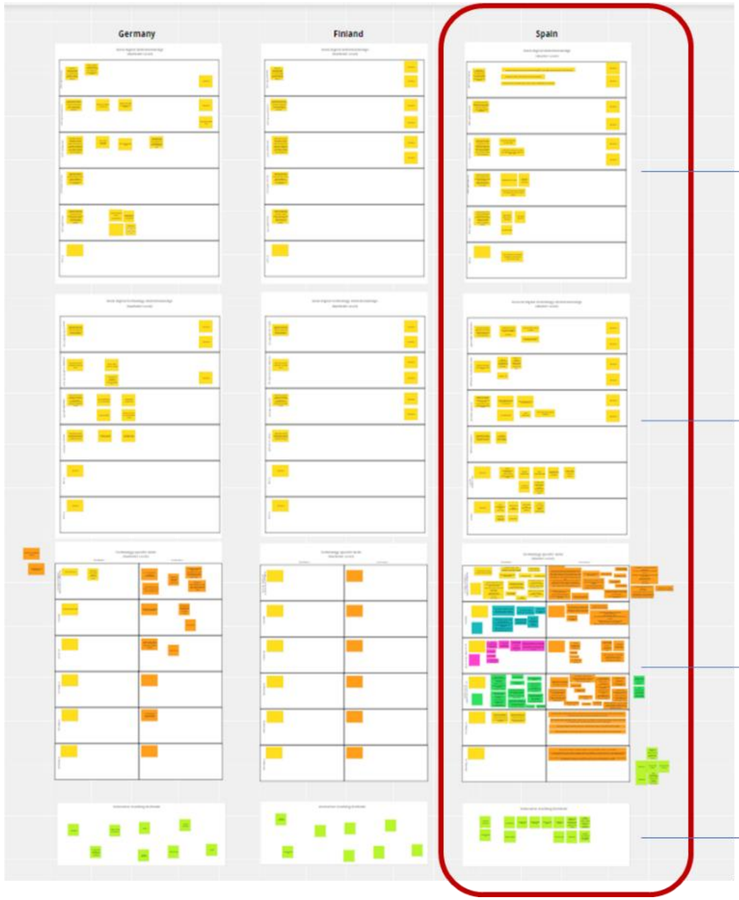
Digital Skills &Knowledge to be gained

FIGURE 2: DIGCOMPEDU AREAS AND SCOPE

[JRC Publications Repository - European Framework for the Digital Competence of Educators: DigCompEdu (europa.eu)]



- Basic digital skills & knowledge
- General digital skills & knowledge
- Technology specific skills & knowledge
  - for students
  - for lecturers
- Innovative teaching methods

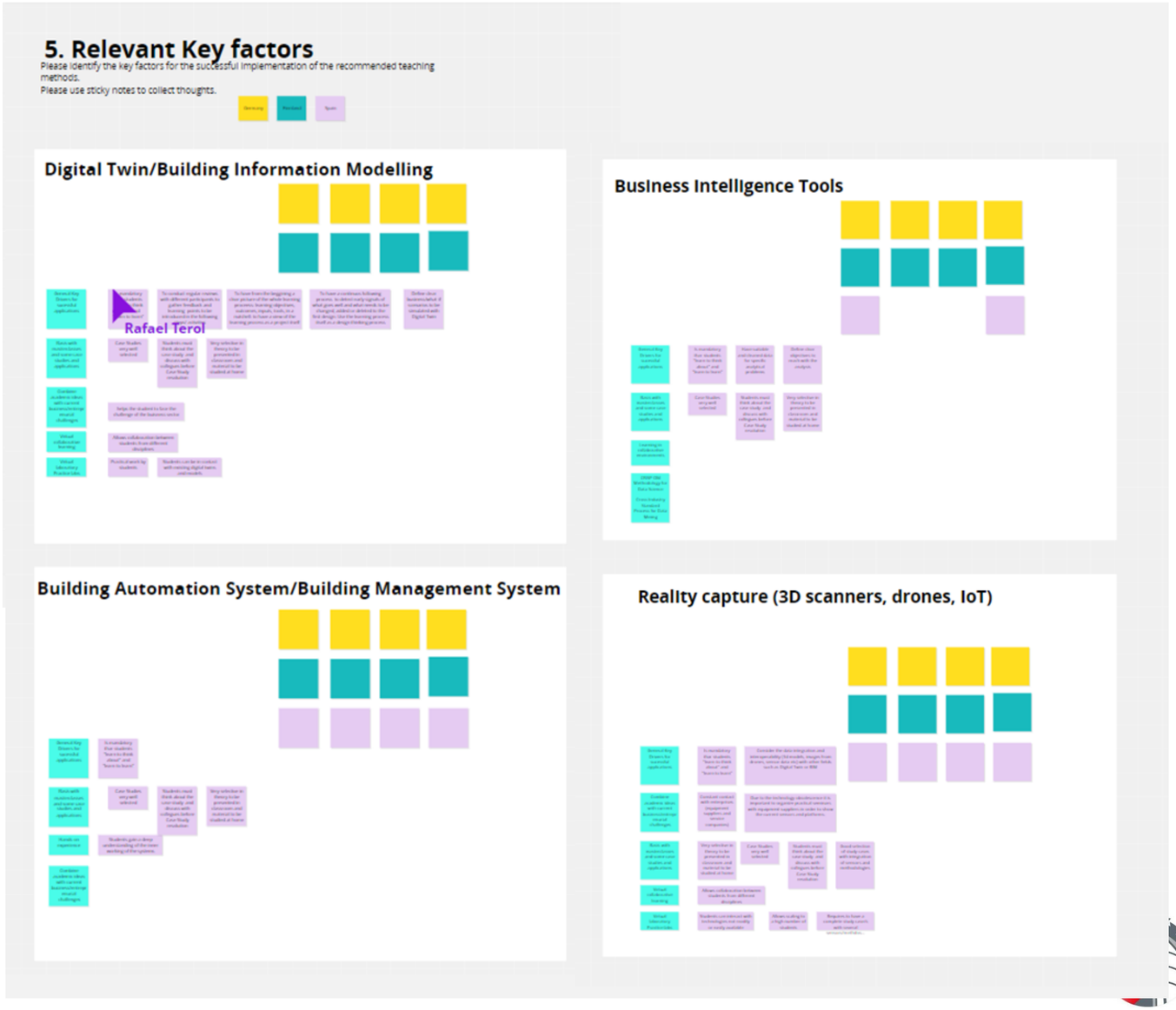
Teaching methods to “innovative Technologies”

TEACHING METHODS

- Traditional
- Innovative
- Digital - Innovative

KEY DRIVERS FOR SUCESSFUL TRAINING

INNOVATIVE DIGITAL FM TECHNOLOGIES



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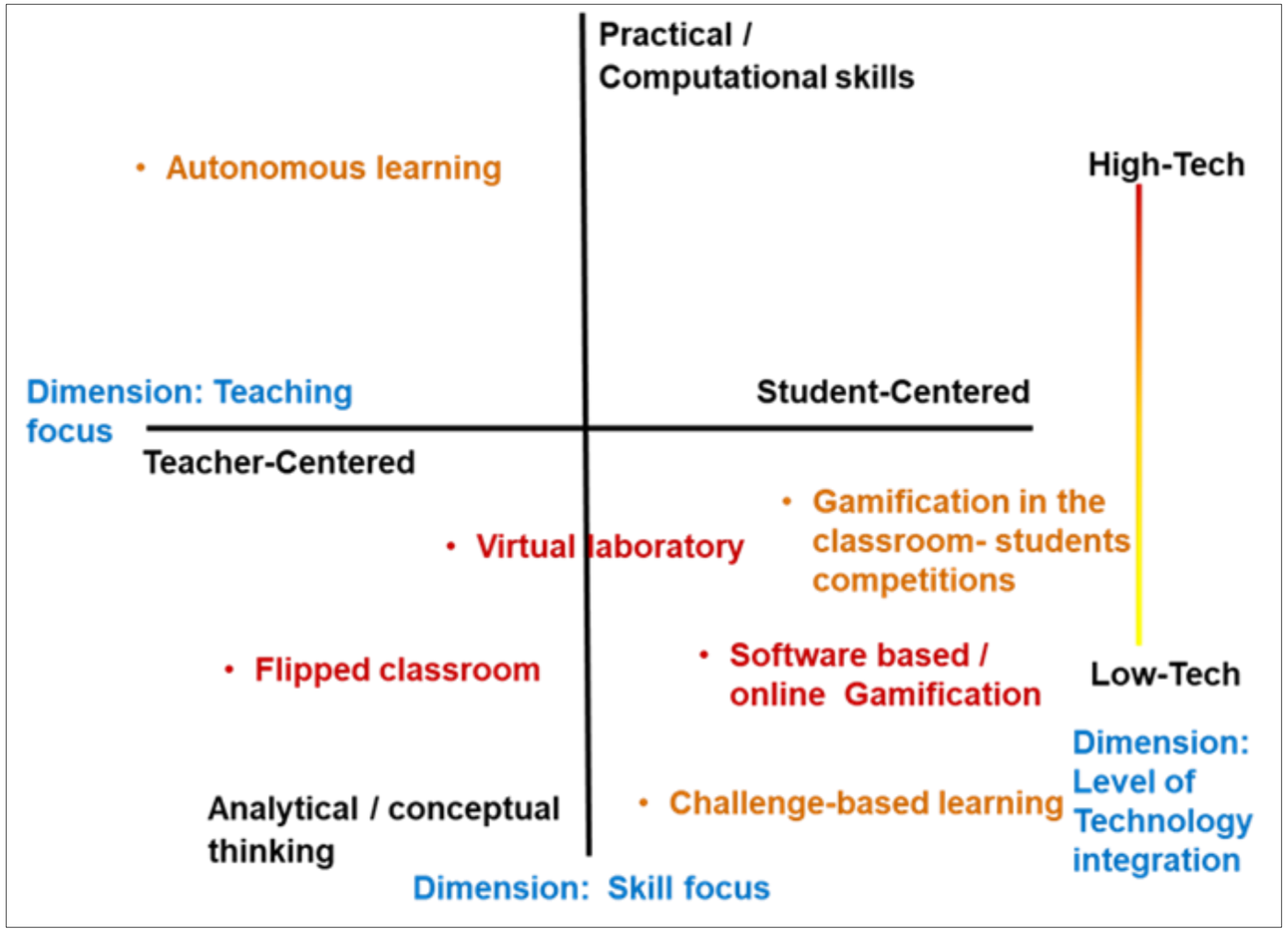
FMgoesDIGI – Three Dimensional Teaching Model



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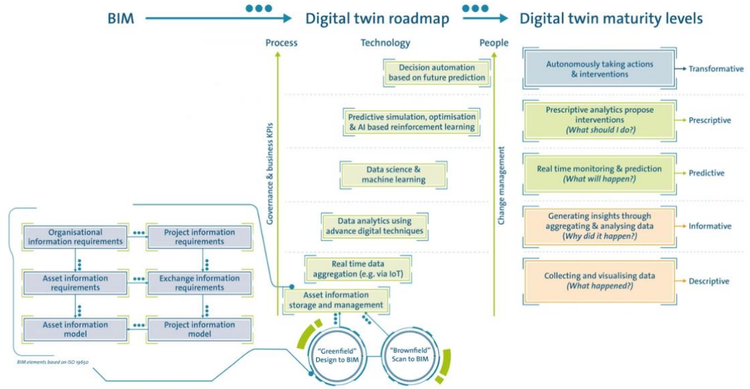
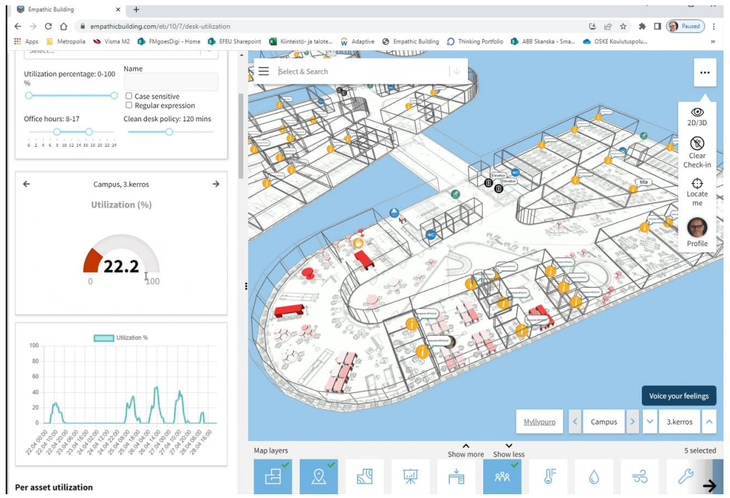
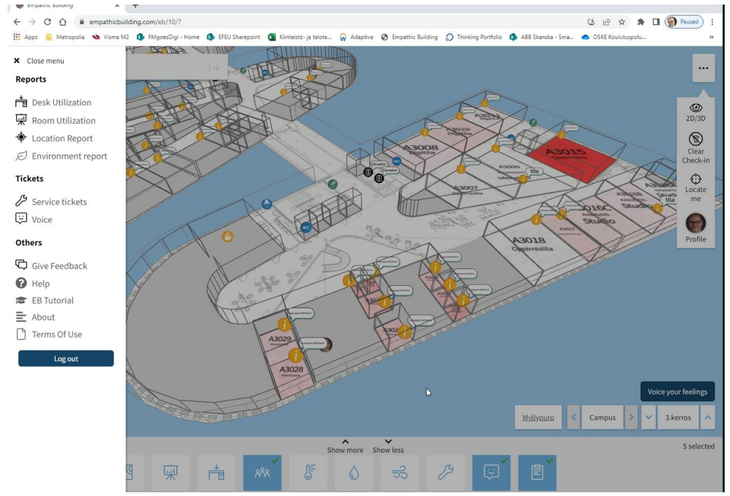
FMgoesDIGI - Teaching Digital Facility Management

IFMA Switzerland Chapter
International Facility Management Association

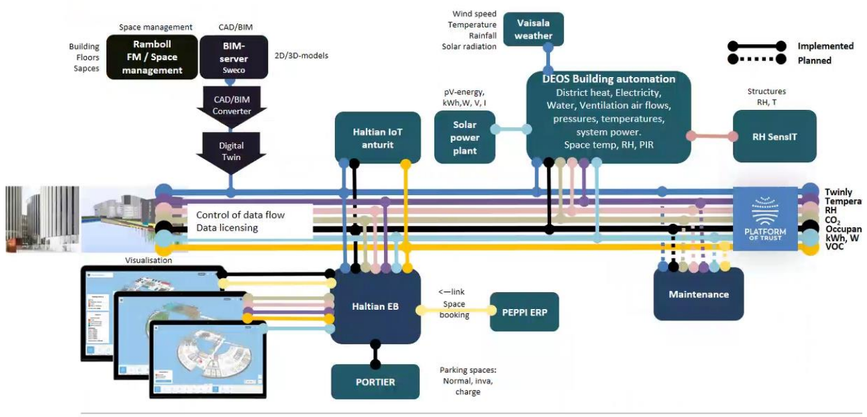
From BIM to digital twin

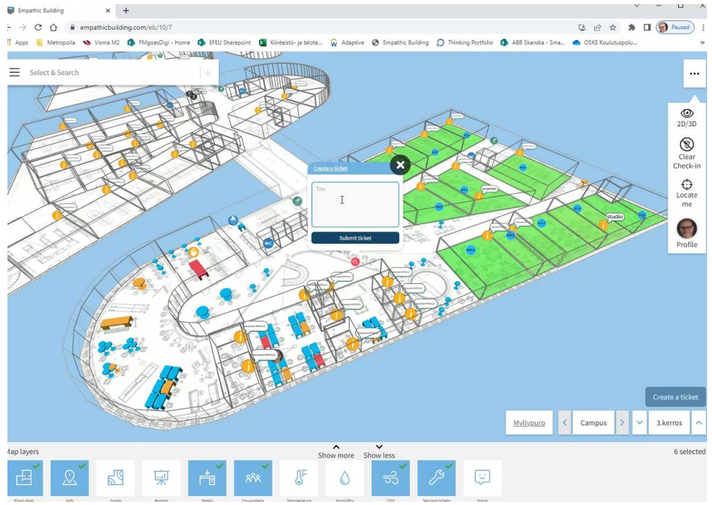


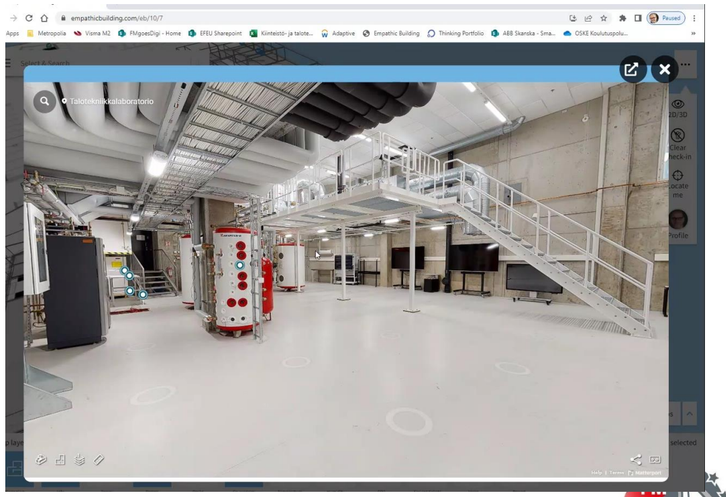




Myllypuro Campus Digital Twin – Visualisation of facility big data







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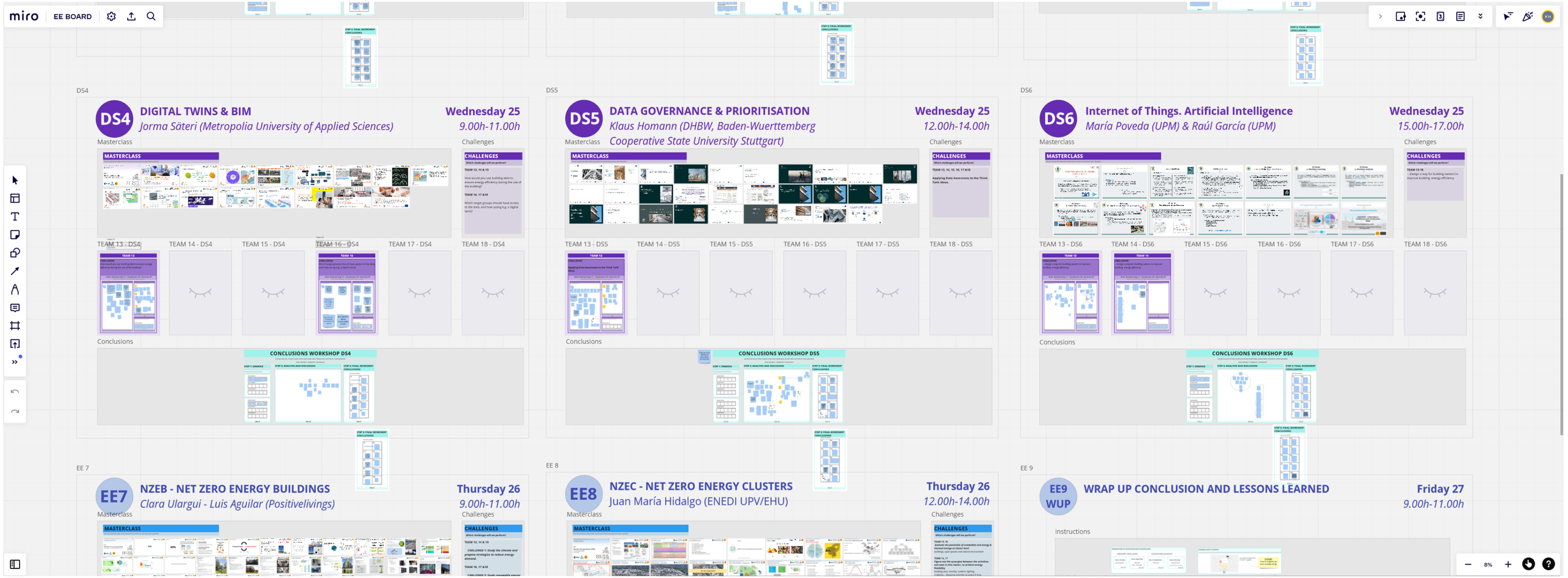
FMgoesDIGI - Teaching Digital Facility Management

Challenge based learning – THINK TANK SUSTAINABLE BUILDINGS EUROPEAN SPACE AGENCY/EUROPEAN SPACE ASTRONOMY CENTRE SUSTAINABLE BCC EELISA COMMUNITY, 23-27 January 2023



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FMgoesDIGI - Teaching Digital Facility Management

Shared Modul as Blended Intensive Program (BIP) or Collaborative Online International Learning (COIL)

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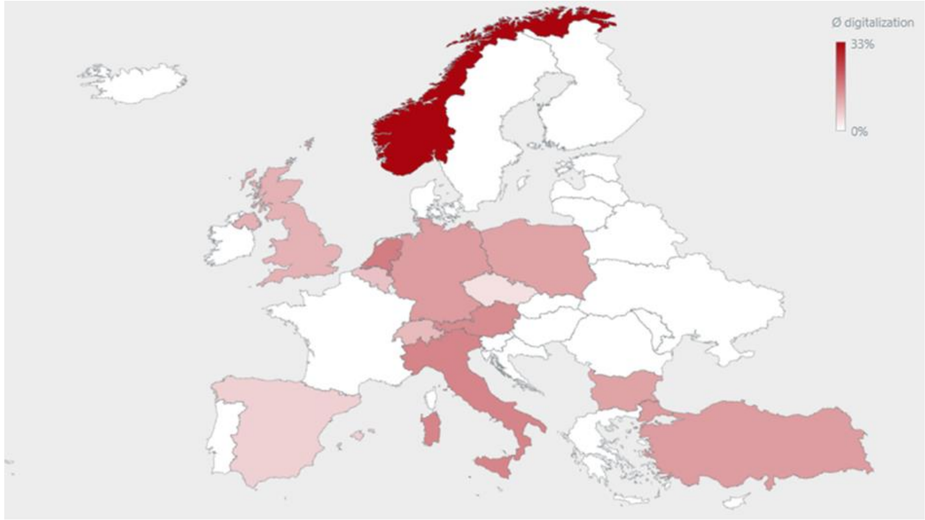
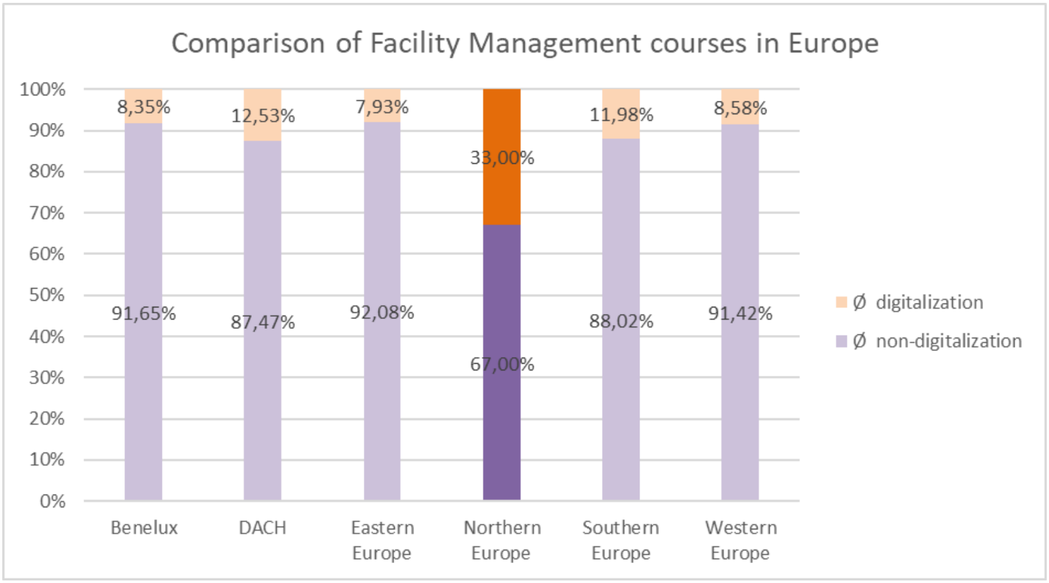
FMgoesDIGI – Educational Coverage of DFM in European Curricular

61 FM Programmes in Europe





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FMgoesDIGI – Educational Coverage of DFM in European Curricular

Some Conclusions

- Besides Norway as a notable exception, reviewed programs include only few digitalization related content (digitalisation coefficient: share of "digital content" related to total amount of credit points achievable, excluding thesis)
- The existing digitization content of the individual FM relevant degree programs focus on hyped topics such as BIM Building Information Modeling or IWMS Integrated Workplace Management Systems. Other topics, such as robotics/RPA, AI artificial intelligence, sensors or extended reality are only considered as marginal topics or are not addressed at all.
- Programs, awarding the academic degree of Engineering have a higher proportion of digitization than the other programs. It can be assumed that the bridge from technology to digitization is short.
- Master programs have a stronger focus on digitalization topics than bachelor programs.
- Most module descriptions of facility management courses lack the necessary transparency. It is not clear in which module which digitization content is taught and, above all, to what extent. In some cases, digitization is not explicitly mentioned as a separate teaching content in a module. This means that prospective students cannot accurately assess whether the degree program offered is the right one for them. But other external parties are also unable to clearly assess the maturity of a degree program in terms of digitization content. A high degree of transparency in the content of FM courses also makes it clear what potential can still be exploited in terms of digitization content.

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FMgoesDIGI – Some Conclusions

- There is a significant difference between academia vs. professionals, and within professionals, between service providers and client company.
- There are parallelism between global results and Europe, with higher awareness in EU
- Suggested technologies to incorporate into students' curricula are:
  - Digital Twins & BIM
  - Business intelligence tools
  - BAS & BMS
  - Reality capture tools (3D scanners, drones, IoT).

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Thank you for your attention!!!

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