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Summary Report:

WP 5 - Valorization

Institute for Entrepreneurship and Innovation
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Work package overview

Work package number:

- WP5

Work package title:

- Valorization

Lead beneficiary:

- WU Vienna
- WP leader: Peter Keinz
- Deputy: Johannes Gutleber
- ESR 5: Linn Kretzschmar

Description of work:

- Develop a catalogue of feasible and viable market opportunities for EASITrain technologies, detail market entry strategies in close cooperation with industrial partners and with IP management support of CERN.
- To cover the demand for training of high-qualified young engineers in the field CERN, TUW, UGENOA, WUW and other participants will develop a curriculum for an interdisciplinary doctoral program on applied superconductivity that in addition to strong technical training will contain courses on project management, IP systems, entrepreneurship and innovation management.

Deliverables:

D5.1: Impact potentials of EASITrain research on society and industry

D5.2: Reference curriculum for PhD program on applied superconductivity

D5.3: Technological Competence Leveraging roadmap for superconductivity applications

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Project overview

Best practice analysis: Entrepreneurship and innovation programs for scientists

Market analysis: Communication equipment, glass manufacturing & automotive industry

Market analysis: Skiing industry

TCL: High Power Impulse Magnetron Sputtering

Market analysis: Scrap metal recycling & fruit sorting/grading

TCL: Manufacturing value chain of magnets

EASISchool 1: KT and PM

"Bursts of collaboration: How collective idea development unfolds in crowdsourcing"

Hackathon | Employment period ESR 5, Linn Kretzschmar | Extension of contract

2017 | 2018 | 2019 | 2020 | 2021

Oct. 1 (M1)
Project start

Sept. 30 (M24)
D5.1 due

June 30 (M45)
D5.2 due

Aug. 31 (47)
D5.3 due

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Methodological approach

A user community-based approach to technological competence leveraging

Identification of the technology's benefits → Search for application fields → Analysis of application fields → Design of a commercialization strategy

- use experience
- no functional fixedness

- market intelligence
- no need for disclosure

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Project structure

Semester-long projects with BSc and MSc student teams, led by Linn Kretzschmar (ESR 5)

Kick-off meeting

- Transfer object
- negative list of interviewees
- strategic fit criteria

Steering board meeting

- Presentations of top applications
- Analysis of top applications

Final meeting

- Presentation market and competitor analysis
- Description of business model

2 weeks:
Identification of benefits

6 weeks:
Application discovery

3 weeks:
Market and competitor analysis

3 weeks:
Business modeling

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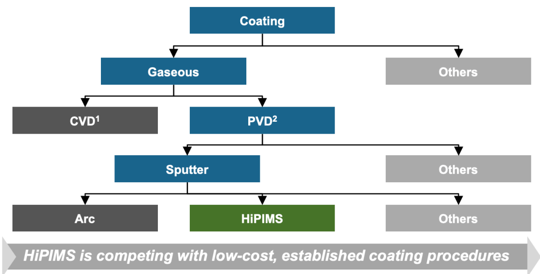
Example: Outcome HiPIMS analysis

The benefits of "high power impulse magnetron sputtering"

Classification of Coating Procedures



Comparison of Coating Procedures

	Arc	CVD[1]	HiPIMS
Surface	Droplets	Rough	Smooth
Coating Temperature C°	500	1000	500
Max Layer Thickness	4 um	10-15 um	12 um
Residual coating stress	High compress	Tensile	Low compress
Ductility of layer	High	Low	Very high
Ease of Production	Yes	No	Yes
Flexibility	Low	None	High

Advantages

- Possibility to coat complex 3D-structures
- Thinner, more precise coatings
- Longer lasting coatings

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Example: Outcome HiPIMS analysis

Potential application fields

Automotive Industry
- Engine components
- Gears
- Plain bearings
- Ball bearings

Aerospace Industry
- Drones
- Satellites
- Spacecrafts

Medical Industry
- Implants
- Prostheses & Stents
- Catheters

Electronic Devices
- Touchscreens
- Electronics (e.g. chips)

Clothing Industry
- Shoes
- Gloves
- Active wear

Glass Industry
- Windowpanes
- Solar panels
- Optical glass

Other Industries
- Rails
- Drill heads (oil & tunnel drilling)
- Food manufacturing machines

Sports Equipment
- Helmets
- Sport balls
- Climbing equipment
- Skiing equipment

Engineering
- Gripper
- Stamping tools
- Cable car drive pulleys

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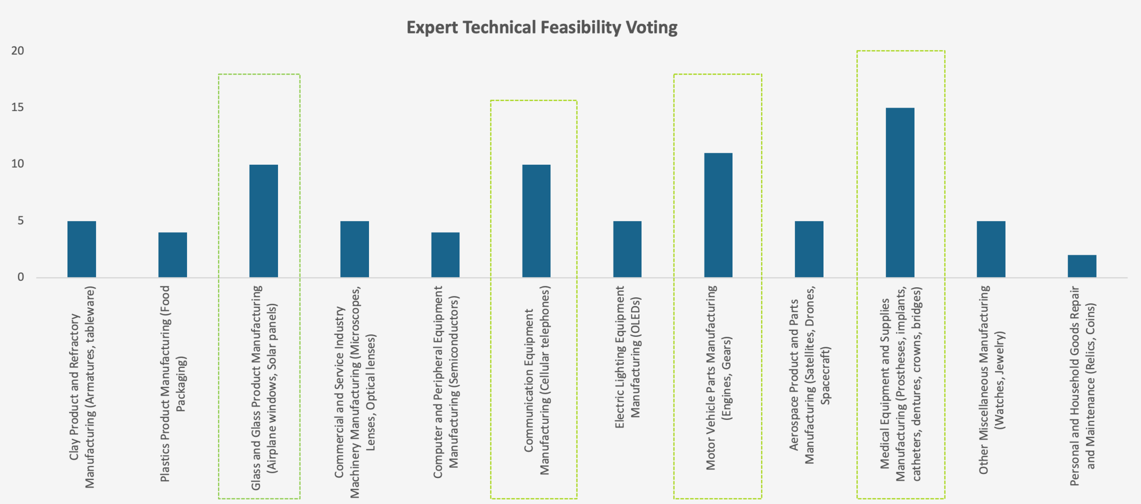
Example: Outcome HiPIMS analysis

Evaluation of potential application fields



Glass products, Comm. Equipment, Motor parts & Medical Supplies are confirmed as high-potential use-cases for HiPIMS coating by experts

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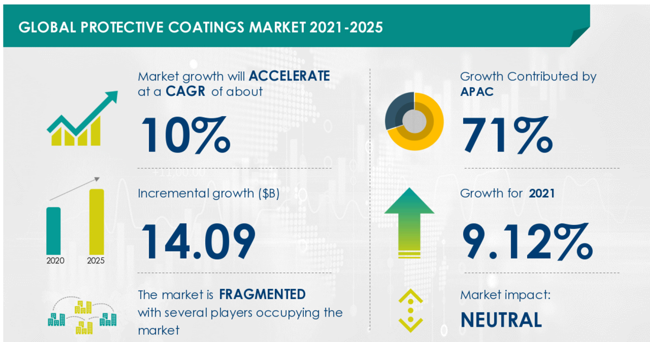
Example: Outcome HiPIMS analysis

Evaluation of potential application fields

- Coating of frames of **smart devices** is emerging application field of HiPIMS
- offers outstanding advantages compared to conventional PVD coating methods (**against corrosion, sticking and wear**)
- Major mobile electronic production firms (e.g. Apple, Samsung) increased their R&D efforts
- Potential to expand to further use-cases (e.g. luxury products)



Apple's IPhone 12 Pro Gold is less prone to fingerprints & more durable due to HiPIMS coating

Source: Technavio (2021)

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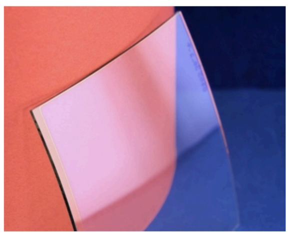
Example: Outcome HiPIMS analysis

Evaluation of potential application fields

- Currently: HiPIMS Coating of architectural glass due to thermal insulation properties
- Especially **solar panels** and **windows** are promising application fields
  - Limits stress from environmental influences
- Fastest-growing glass products:
  - solar control glass (low-emissivity glass, reflective glass and "smart" glass)
  - heads-up display windscreens; self-cleaning glass & ultraclear glass
- HiPIMS coating allows glass to be curved for consumer electronics (smartphones, tablets, …)



Curved ITO coating on glass following a tempering and bending process at 650 °C (Fraunhofer IST)

Benefits of curved displays

More visible in ambient light | **Produces less reflection and glare** | **Improves battery life**

USD 115.8 billion*

*Global flat glass market 2019

Sources: First Research Industry Profiles (2019): Glass & Glass Product Manufacturing; Fraunhofer IST (2017)

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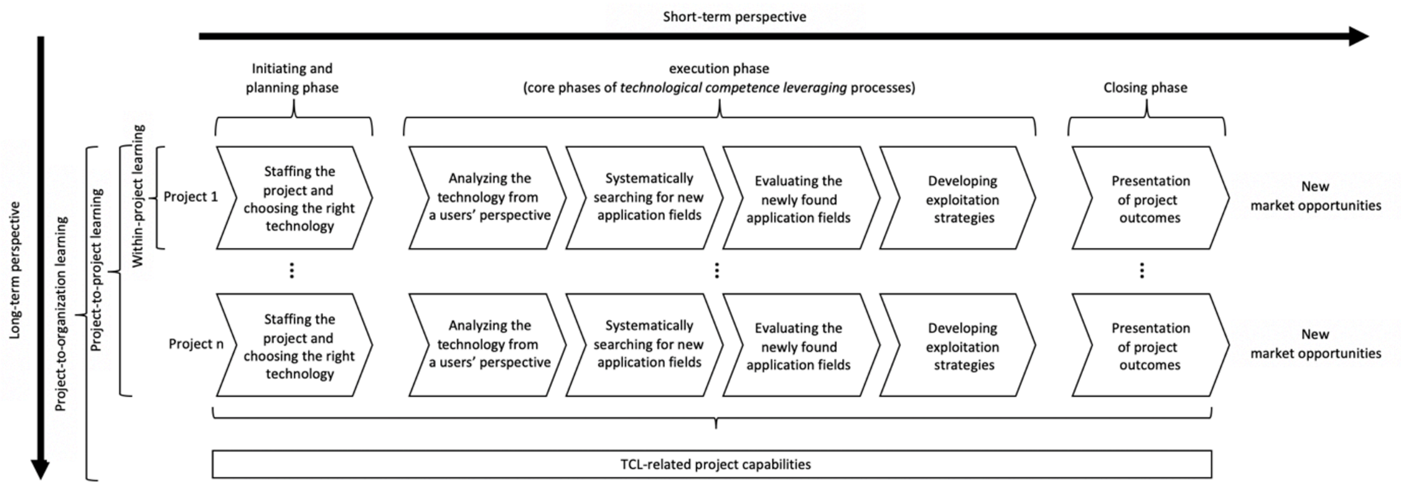
Scientifically relevant insights

Research question(s): What are the short-term and long-term outcomes of TCL projects conducted by innovation intermediaries? What barriers to the success of TCL projects do exist?



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Scientifically relevant insights

Based on 10 projects from 3 different Marie Curie ITNs, short- and long-term outcomes were analyzed in the course of a comparative, multiple case study.

	Short-term	Long-term
Outcomes	‣ average of 25 application fields identified ‣ technology roadmaps used to attract R&D partners from industry and to apply for future funding	‣ development of TCL-related methodological competences ‣ increased motivation and capability to engage in boundary-spanning, inter-disciplinary projects
Challenges	‣ unclear project goals and a lack of insight into the method ‣ Lack of company-internal perspective (e.g., specific KT policies, etc.)	‣ Project owners without management responsibilities

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List of publications (I)

Peer-reviewed journal articles:

- Keinz, P., & Marhold, K. (2021). Technological competence leveraging projects via intermediaries: Viable means to outbound open innovation and mediated capability building?. *International Journal of Project Management*, 39(2), 196-208.

Book chapters:

- Kretzschmar, L. (2020). Leveraging the Economic Potential of FCC's Technologies and Processes. In: The Economics of Big Science. Essays by Leading Scientists and Policymakers; Beck, H.P., Charitos, P. (Eds.), 85-91. Switzerland: Springer, Cham.
- Keinz, P., Marhold, K., & Fell, J. (2021). Applying a Systematic Technology Competence Leveraging Approach in Knowledge Transfer of Big Science. In: Economic & Societal Impact of Big Science, Li-Ying, J., Charitos, P. (Eds.), forthcoming.

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List of publications (II)

Project reports:

- Kretzschmar, L., Mehner, B., Hausberger, M., Ledermüller, F., Mayrhofer, F., Schreiber, D., & Gutleber, J. (2019). Manufacturing process of superconducting magnets: Analysis of manufacturing chain technologies for market-oriented industries (1.0). Zenodo. https://doi.org/10.5281/zenodo.2579834
- Brzobohaty, L., Habernig, S., Moravec, P., Pably, M., Schürz, T., Kretzschmar, L., & Quach Tuong-Vi, S. (2019). Analysis of potential markets for using technologies in the superconducting magnet value chain (1.0). Zenodo. https://doi.org/10.5281/zenodo.3362855
- Keinz, P., Kretzschmar, L., & Quach, Tuong-Vi S.. (2020). High-Power Impulse Magnetron Sputtering (HiPIMS): Assessing the innovation potential using the Technological Competence Leveraging (TCL) method (1.0). Zenodo. https://doi.org/10.5281/zenodo.3744821
- Quach S., Fabian C., Kretzschmar L., Hütteneder M., Schmidle T., Tanson J., Schmidt M., & Deutschbauer S. (2021). Evaluation of the market potential of HiPIMS and advanced coating technologies (1.0). Zenodo. https://doi.org/10.5281/zenodo.4551291

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List of publications (III)

Talks:

- Kretzschmar, L. (2019). Leveraging the economic potential of FCC's technologies and processes. Future Circular Collider Week (FCC), Brussels, Belgien, 24.06.-28.06.
- Kretzschmar, L. (2021). Bridging research & industry: Creating value from FCC‘s technologies for the general public. Future Circular Collider Week, Genf, Schweiz, 28.06.-02.07.

Posters:

- Kretzschmar, L. (2019). Economic Analysis of superconducting magnet production. Future Circular Collider Week (FCC), Brussels, Belgien, 24.06.-28.06.

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Thank you very much for your attention

and

this interesting collaboration!

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