Advanced manufacturing
Technology Integration in Industry: Barrier and success levers
Introduction

EU-KNIGHTS results.

Key levers for a better KETs integration

Industrial examples.

Conclusion
To decrease the time to market and the valley of death
EU KNIGHTS strategy is fully in line with the EU H2020 strategy.
Innovative **advanced materials** for functional elements.

- **UV lamp systems** for curing and tool for **nanoimprinting**.
- **Advanced manufacturing** and monitoring control systems.
EU-KNIGHTS analysis focused on 4 industrial sectors
9 European partners:
- CEA
- TNO
- KIT
- Tecnalia
- Fraunhofer ISI
- VDMA
- UNOTT
- FESTO
- NANOfutures

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Three parts questionnaire

1) ID of the company
2) Case study description
3) Dedicated questions through five domains
THE FIVE DOMAINS AND THEIR CRITERIA

Technological Domain
1. Fundamental understanding
2. Maturity
3. Reproducibility/
4. Reliability / Durability
5. Quality & risk assessment

Manufacturing Domain
1. Manufacturing implementation
2. Scalability (pilot line) reproducibility, throughput, quality
3. Cost
4. Integral process and design capability and control
5. Standards

Organisation & Investment Domain
1. Access to human resources/talent/experts
2. Company vision / strategy
3. Value chain management/control
4. Access to technical infrastructure
5. Entrepreneurial spirit and capabilities

Economy & Market Domain
1. Access to market s
2. Appropriate business models
3. Access to and protection of intellectual property
4. Access to talent / human resources
5. Access to capital (privates & public)

Societal & Cultural Domain
1. User acceptance
2. Education and training system
3. Addressing grand challenges
4. Institutional framework conditions / impediments
5. Innovation culture in/of society at large
52% of interviewees have heard of KETs

69% of interviewees have heard of KETs
How was the prototype made?

Printing

- In the existing home production line/site: 35%
- Prototype in a new dedicated production line: 22%
- Prototype in a platform/shared facility: 29%
- Outsourcing: 0%

Plastic and rubber

- In the existing home production line/site: 28%
- Prototype in a new dedicated production line: 22%
- Prototype in a customer/supplier/manufacturer pilot line: 22%
- Outsourcing: 6%

Non metallic

- In the existing home production line/site: 44%
- Prototype in a new dedicated production line: 23%
- Prototype in a platform/shared facility: 25%
- Outsourcing: 3%

Equipment manufacturing

- In the existing home production line/site: 57%
- Prototype in a new dedicated production line: 16%
- Prototype in a customer/supplier/manufacturer pilot line: 17%
- Outsourcing: 0%
Q 21: What was the driver behind your company developing the case study?

For all OHIO plastic companies (29)

- Specific customer demand / (industry, end user) 34%
- Breakthrough or discovery 12%
- Societal challenge 11%
- Market pull 16%
- Technology push 22%

For all Europe plastic companies (46)

- Specific customer demand / (Industry, end user) 26%
- Specific customer demand (Govermental influenced) 4%
- Societal challenge 8%
- Market pull 17%
- Breakthrough or discovery 16%

Technology Push 34% vs. Market pull 66%  
Technology Push 45% vs. Market pull 55%

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Europe is working less with the value chain partners: only 15% compare to OHIO 30%
Europe is working more with University and RTO compare to OHIO: 40% compare to 25%

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Q 25: most significant DIFFICULTIES that you encountered for integrating KETs in the TECHNOLOGICAL domain?

For 193 EU companies

For all 59 institutional projects

Reproducibility is a critical barrier

Reproducibility and Reliability are critical barriers

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Technology domain

Advice for better success factor

For 193 EU companies

For all 59 institutional projects

The fundamental understanding is one of the main advice for a better success

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### Main barriers

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<th>Barrier</th>
<th>Industry</th>
<th>Institutional projects</th>
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<tr>
<td>Technology</td>
<td>Reproducibility</td>
<td>Reproducibility, Reliability</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>Manufacturing implementation, scalability and pilot line, cost</td>
<td>Manufacturing implementation, scalability and pilot line</td>
</tr>
<tr>
<td>Organization/Investment</td>
<td>Access to human resources</td>
<td>Access to human resources, company vision, value chain control</td>
</tr>
<tr>
<td>Economy and Market</td>
<td>Access to markets</td>
<td>Appropriate business model</td>
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<td>Society and Culture</td>
<td>User acceptance</td>
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- EU-KNIGHTS first results.
- Key levers for a better KETs integration.
- Industrial examples.
- Conclusion

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Industrial workshops have been organised to get a better understanding of the key levers.
6 Workshops across Europe

More than 100 industries have been involved in these 6 workshops

- Smart plastics Lyon
- Manufacturing equipment Bilbao
- Non metallic Limoges
- Manufacturing equipment Charleville
- Plastic and Rubber Alessandria
- Printing, Munich
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Technological domain: reliability (Workshops results, n=291)

- Workshop average result of reliability (n=291)
  - Process Knowledge: 35%
  - Understanding of the relationship between material and process: 31%

Bar chart:
- Standard, reference: 12%
- Change of technology (parameters): 13%
- Supply chain control: 14%
- Understanding of the relationship between material and process: 30%
- Process Knowledge: 31%
1) **Technological lever:** Understanding of relationship between material and process, material properties through the quality of material supplier, process knowledge and process qualification, validation.

2) **Manufacturing lever:** The knowledge of critical process parameters, bridging R&D and manufacturing together to minimize the difference between lab scale and production scale, process control (ensure constant process environment, in-situ measurement/inspection), and anticipate as soon as possible the fixed cost.

3) **Organisation lever:** Transversal and multidisciplinary skills are necessary for a better KETs integration and beyond the technical aspect it is beneficial to involve value chain partners – in particular customers/end-users - Ensure that all competences are involved in public funded projects (R&D, manufacturing, sales, marketing). IP support for SMEs.

4) **Market and societal levers:** Ensure that marketing and sales competences are involved, continuous update of market analysis, the business plan must be part of the project content in order to prepare the manufacturing and market implementation. Involving a user in the process development is important: test in my house. Social aspects should be take into account: culture dimension, ageing population, etc...
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Nanoparticle enabled coatings provided finished tile with a smooth, transparent and anti-slip surface, keeping the whole design and colour development, whilst smoothness was assured by the nanostructure of the surface.

**Technical success levers:**
To succeed the dispersion and inclusion of nanoparticles into the coating TORRECID mastered the process knowledge and the understanding of the relationship (nano)-materials and process.

**Fundamental understanding:** TORRECID succeeded in joining chemistry with design. **Reproducibility and Maturity.**

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<tr>
<th>TRL 1-3</th>
<th>TRL 3-5</th>
<th>TRL 5-6</th>
<th>TRL 6-7</th>
<th>TRL &gt; 7</th>
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<tbody>
<tr>
<td>Basic technology research</td>
<td>Technology development</td>
<td>Demonstration (Prototype or Pilot Line)</td>
<td>Qualification and testing</td>
<td>Pre-production</td>
</tr>
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</table>

**Expertise acquisition Prepare 2nd generation**

**Incremental R&D, Define 2nd generation**

**Disruptive or incremental innovation (or exit)**

Al$_2$O$_3$ SiO$_2$ nanopowder, ZnO, CoO and other nano oxides used in coatings.
**INDUSTRIAL SUCCESS STORY**

Manufacturing success levers:
Torrecid succeeded in **scaling up the production** and supply of anti-slip coating. **Early involvement of manufacturing/production planning** in the development process is an important reason for the product’s success.

**Manufacturing success levers:**
- MRL 1-3: Identification of manufacturing concepts
- MRL 4-7: Capability to produce or duplicate a prototype
- MRL 8: Pilot line/intermediate line
- MRL 9: Low rate production
- MRL 10: Full rate production
- Ramp-up management
- Optimisation of supply chain
- Monitoring yield management
- Increase production efficiency
- Production line termination
- Recycle or dismantle

**Manufacturing benefits:**
- Scalability (pilot line) (reproducibility, throughput, quality), cost
- Improvement of efficiency

**Time to market**

<table>
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<tr>
<th>MRL 2-3</th>
<th>MRL 4-7</th>
<th>MRL 8</th>
<th>MRL 9</th>
<th>MRL 10</th>
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February 25th, 2015
**INDUSTRIAL SUCCESS STORY**

**Organisation and investment success levers:**
TORRECID has a strong partnership with its customers, being involved along the whole product value chain, from product design to technical assistance. The company tries to anticipate customers’ needs creating future trends. Value chain management is granted thanks to appropriate: Company vision/strategy. IP protection of its innovative solutions. Entrepreneurial spirit and capabilities. Access to human resources / talents /experts, thanks to external acquisition and internal training.

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**Market introduction**

<table>
<thead>
<tr>
<th>Organisation &amp; Investment</th>
<th>Pilot line and scale up investment, CAPEX, resource increase, find and involve key competencies (industrial operation, sales, supply chain, quality)</th>
<th>Identify production strategy and funding, risk analysis, Training people: production, marketing, sales</th>
<th>Implement production strategy, Sales and technical support force</th>
<th>Fine optimisation of the organisation, Led by sales and marketing</th>
<th>Stable organisation, ROI</th>
<th>Return on experience, Investment to improve the production throughput, ROI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company vision / strategy</td>
<td>Access to HR</td>
<td>Entrepreneurial spirit and capabilities</td>
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INDUSTRIAL SUCCESS STORY

Economy and societal success levers:
TORRECID innovations to generate new solutions and future trends aim to provide the best competitive advantages and the maximum added value. **Appropriate business model.** The proximity with its customers provides an optimum position to **Access to markets** and a strong commitment to the global marketplace.

User acceptance: Customers were satisfied with stability of application parameters, performance of nano solution in terms of transparency and anti-slip.

**Addressing grand challenges:** Customers were able to supply materials with added value to new markets.

**Institutional framework conditions:** The new legislation regarding anti-slip coatings was an advantage.
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Introduction

EU-KNIGHTS first results.

Key indicators for a better KETs integration through collaborative projects.

Fine Tuning the final stage of EU-KNIGHTS project.

Conclusion
## Micro analysis: “Chess” model

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<th>Technological domain</th>
<th>Fundamental understanding</th>
<th>Reproducibility</th>
<th>Reliability / Durability</th>
<th>Maturity</th>
<th>Quality &amp; Risk assessment</th>
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<tbody>
<tr>
<td>Manufacturing domain</td>
<td>Manufacturing implement.</td>
<td>Scalability (pilote line)</td>
<td>Cost</td>
<td>Integral process Design capability Control</td>
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<tr>
<td>Organisation &amp; Investment domain</td>
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<td>Access to technical infrastructur e</td>
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<td>Entrepreneur . spirit Capabilities</td>
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<td>Institutional frame conditions</td>
<td>Education and training system</td>
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THANKS YOU