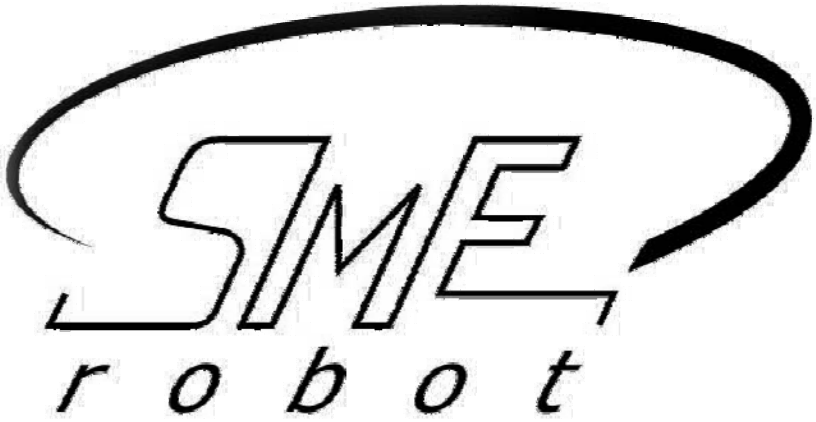

The European Robot Initiative for
Strengthening the Competitiveness of
SMEs in Manufacturing

Summary and outlook of technologies & components of the SMErobot™ initiative

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Barriers for SME automation

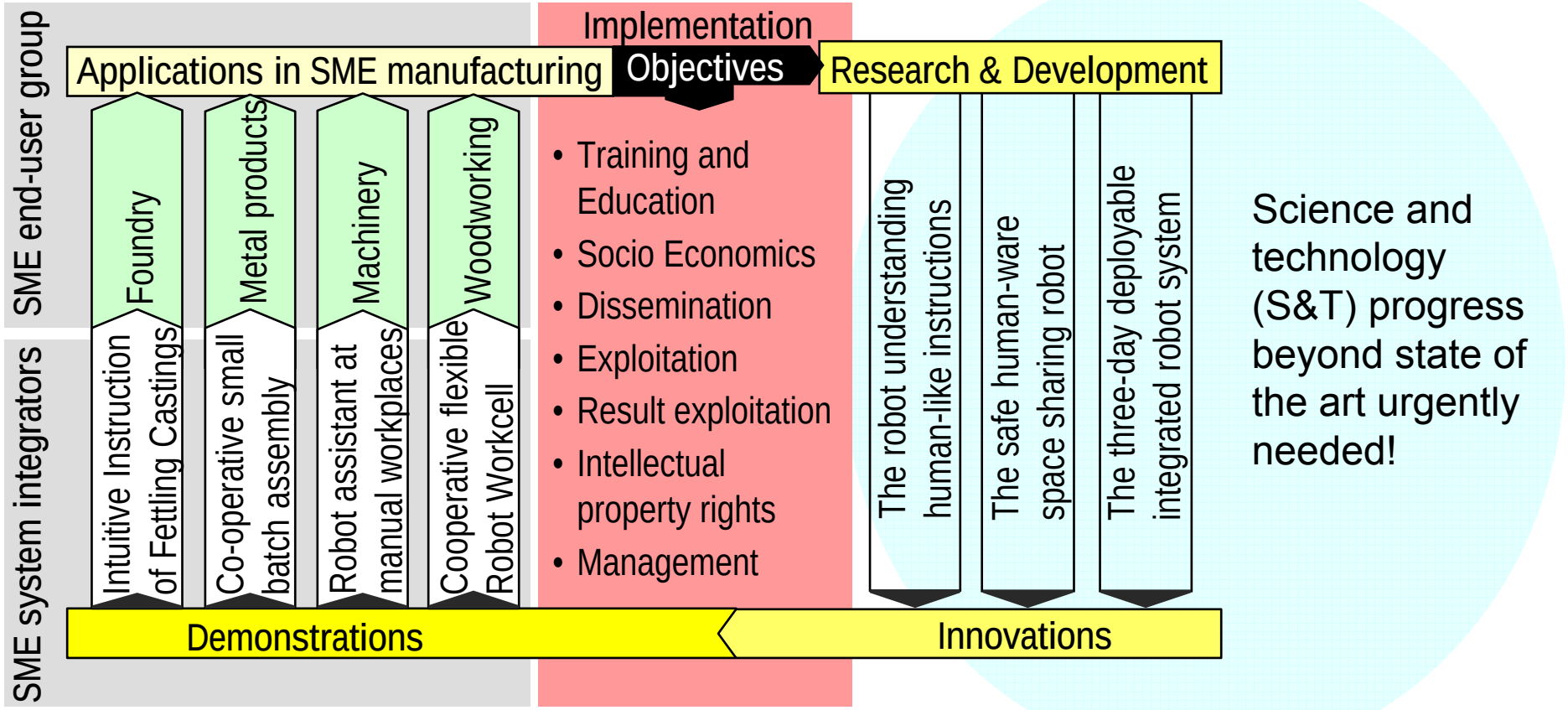
Barriers preventing profitable use of robots in SMEs:

1. Task operations not expressed in **end-user terms**
2. Teaching a robot requires programming competence
3. Expensive mechanics and drive trains
4. CAD data not suitable for SME usage
5. motion control & workspace sensing not dependable/affordable
6. Workcell components not easy to integrate
7. Knowledge-based system hard to maintain/manage

The SMErobot Initiative

Innovations:

1. The robot capable of understanding human-like instructions
2. The safe and productive human-aware space-sharing robot
3. The three-day-deployable integrated robot system



Interplay between core sciences and SME needs, by integration project SMErobot…

Innovations

1. Robot capable of understanding human-like instructions

- ✓ **Industrial HRI**
- → **Declarative knowledge**

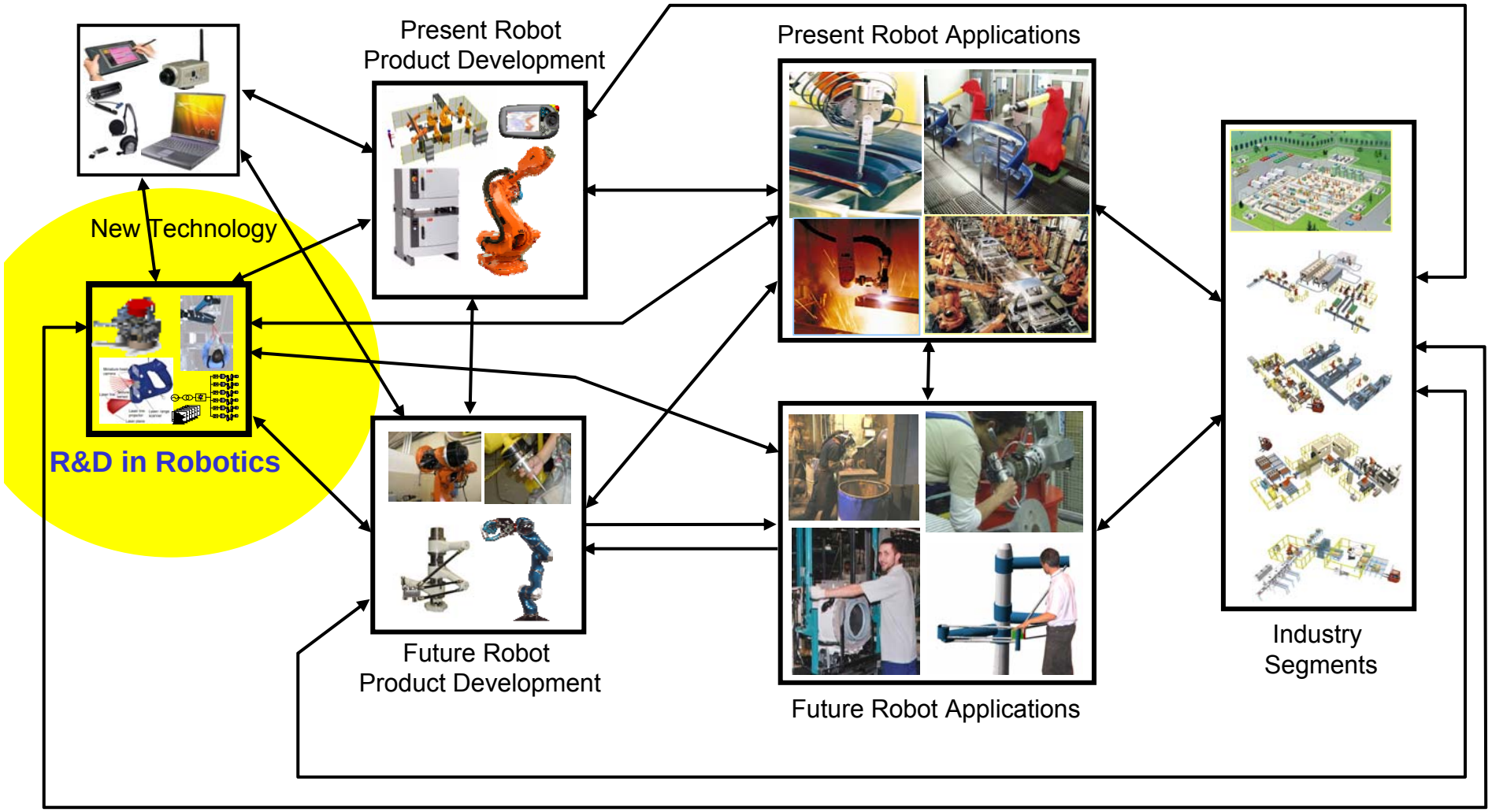
2. Safe and productive human-aware space-sharing robot

- ✓ **High-performance robotics**
- → **Human awareness**

3. Three-day-deployable integrated robot system

- ✓ **Modularity & Geometry**
- → **Agile technology upgrading**

Robotics research perspective



Some Technological Challenges

- Variable **access and transfer of knowledge** to generate robot programs: from CAD, databases, intuitive worker instructions, …, inclusion of learning
- **New low-cost components**: light-weight low-inertia actuation devices, new physical structures with embedded sensing and circuits (e.g. for safety)
- **Automation middleware** to seamlessly connect robots, peripheral devices and industrial IT systems (“plug-and-produce”)
- **Process-centric workcell services** for more shop-floor suitable configuration, interaction and operation (hiding software issues behind easy-to use tools).

Some Challenges

- Robots as **simple-to-use, low-cost solutions** for short series productions
- **Robotics is the science of integration**: Basic technologies, components, processes, industrial engineering and socio-economic factors
- Exemplary **demonstrations** and trial installations
- **Evaluation and assessment** with stakeholders for acceptance and establishing supply chain
- **Standardization and harmonization** for safety, component exchangeability, cost reduction, usability, and benchmarking

Conclusions

- Force control and lead-though programming established for usage in actual products:
  - Worked (for ideal cases) in labs 20 years ago,
  - was difficult to fit into industrial systems,
  - SMErobot enhancements and proof of concept in SMEs!
- Wide variety of competences needed for S&T progress; SME business models needed for impact!
- Very successful barrier breakthroughs (S&T results), but industrial impact not completed!
- SMErobot as a model and inspiration for extended Robotics and Automation research….