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TRANSFERRING V4 EXPERTISE IN KNOWLEDGE/TECHNOLOGY TRANSFER

Transferring V4 expertise in knowledge/technology transfer

Workshop on Knowledge and Technology Transfer

4 March 2021: Tbilisi 11 March 2021: Yerevan

Speaker:

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ASUE ARMENIAN STATE UNIVERSITY OF ECONOMICS

TUKE

Silesian University of Technology

CANDLE

MASARYK UNIVERSITY

Model of technology transfer from university to business

Commercialization of the R&D research results:

- transformation of knowledge into new products, services, technologies and organizational solutions
- making the intellectual property or rights owned by the Research Institutions (RIs) University available to other entities (e.g. SMEs) in order to obtain financial benefits by the RIs.

Technology Transfer:

Practical implementation of advanced technical knowledge developed by RIs in order to meet requirements of modern market and needs of business, industry and services.

Technology Implementation:

Adapting particular technology and/or product developed by the RIs to the users' needs and requirements.

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GENERAL IDEA, BASIC TASKS, RULES & PROCEDURES

COMMERCIALISATION TASKS:

- assessment of intellectual property in terms of economic application and commercialization opportunities
- searching for market applications of research results
- offering the intellectual goods and rights in order to make them available to third parties
- market analysis, advertising and marketing of intellectual goods
- mediation and negotiation in step-by-step commercialization process implementation and its further development

COMMERCIALISATION MODELS:

- Direct commercialization
- Indirect commercialization
- Commissioned research
- R&D projects, consortia
- Spin-off/spin-out companies

Technology Transfer Centers

GENERAL IDEA, BASIC TASKS, RULES & PROCEDURES

KNOW-HOW:

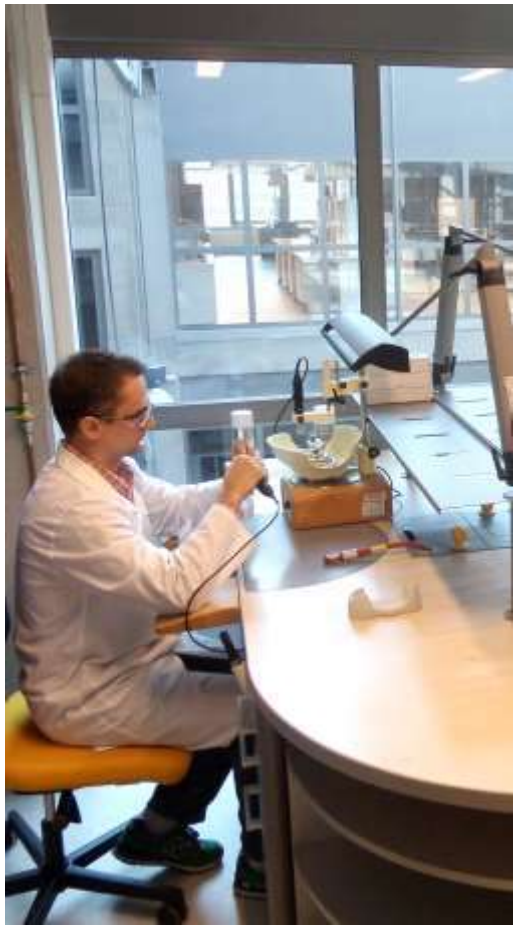
Information of an economic value of a technical, technical and organizational, technological, scientific nature (including research results) or of any other nature, for which the University/ Research Institute has taken the necessary steps to maintain confidentiality.

DIRECT COMMERCIALIZATION:

Sale of the results of scientific research, development works or know-how related to these results or giving them use, in particular on the basis of a license, rental and lease agreement.

INDIRECT COMMERCIALIZATION:

Taking up shares or stocks in companies in order to implement or prepare for implementation the results of scientific research, development works or know-how related to these results.



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RESEARCH and RESULTS IMPLEMENTATION

COMMISSIONED RESEARCH:

- Performed for or jointly with external entities and strengthens cooperation between science and business.
- In case of large or risky investments, is run in the form of the **Scientific & Industrial Consortia** (for joint implementation actions of a specific economic undertaking, which due to the financial potential exceeds the capabilities of single entity), that consist of research units and entrepreneurs joining forces in order to:
  - ✓ run joint ventures (e.g. for specific scientific research or development works for subsequent use in the economy development),
  - ✓ provide possibility of financing works on the development of modern scientific solutions, which can then be used in business transactions
  - ✓ give the entrepreneurs and SMEs the access to the latest scientific achievements.

Implementation of commissioned research:

- contributes to the prestige and brings the worlds of science and business close together,
- brings an additional income for:
  - *employees* involved in the provision of services
  - *units* involved in the provision of services (in the form of indirect costs).

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SUT's Gliwice (PL) organisational model for technology transfer, incubation and innovations

Activities:

- ✓ coordinated by the Centre for Incubation and Technology Transfer (CITT, created in 2009) and its Business Processing Office (BPO)
- ✓ enhancement of the implementations of research potential of SUT's faculties
- ✓ establishing and maintaining relationships between SUT'S researchers and enterprises
- ✓ helping researchers to
  - seek industrial and SMEs partnerships
  - apply for external funds, grants, projects (national and international)
  - commercialize technologies and incubate new companies (developing academic entrepreneurship
- ✓ management and protection of SUT's intellectual property
- ✓ leading own project (with and without external suport) and promotional activities
- ✓ supporting companies in common applications for projects with SUT's participation (e.g. National Centre of R&D, Ministry of Science and Higher Education)
- ✓ mediation and negotiation of commercialization proces within its whole life(from the „technology request" to implementation and further development)
- ✓ administrative support for entire proces (from the order to the invoice)

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Management of the Intellectual Property (IP) rights at the SUT's Gliwice (PL)

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Activities:

based on the:

- SUT's own „Rules of Procedure for the Management of Intellectual Property"
- rules of the Polish Industrial Property Law

(copies of English translation of both documents will be made available to participants)

✓ managed by the Centre for Incubation and Technology (CITT), responsible for the:

- assessment of the IP commercial value
- maintaining patent protection for the most valuable IP items
- looking for licensing opportunities
- representing the SUT at the Polish Patent Office (by the CITT's Patent Attorney)
- cooperating with the Patent Attorney in approving the IP applications from the SUT's community,
- processing draft test, license, sale, confidentiality, consortium agreements, etc.
- advising on the entire intellectual property process (from application to commercialization)

The CITT database contains 900 IP items (mainly patents, utility models and know-how).
An average of 100 IP applications are filled in annually at the SUT (e.g. in year 2020: 108 applications).

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Intellectual Property Management Regulations at the SUT

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Define aspects of:

- ✓ subject, objective scope, confidentiality
- ✓ moral and property rights to intellectual property, business secrets and know-how
- ✓ principles of notifying intellectual property and procedures for their nation-wide and international level protection
- ✓ principles for concluding contracts
- ✓ commercialization modelsR&D wo
- ✓ distribution of funds for commercialization and principles of remuneration.

In the case of consortium projects:

- the issue of division of **rights to the results of R&D works** between the members of the consortium must be settled before starting any project
- *usually*, the scope of such property rights is granted in proportion to actual financial involvement of members in the implemented project
- clear division of the rights to the R&D works results has a significant impact on the cooperation among partners during the project, as well as in the subsequent commercialization and distribution of profits.

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INNOVATIONS

"innovation" is derived from the Latin verb *innovare* meaning *to renew*

Innovation means improvement or replacement of something: process, product, or service.

In the context of companies:
activities aimed at implementing changes leading to the increase of the company's modernity and competitiveness, and thus ultimately to the increase in its value. For example:

- introduction of new products
- implementation of new technologies
- changes in production and distribution infrastructure
- activities aimed at better use of employees' knowledge and skills
- development of information networks

Components of Innovation Strategy:

- analysis of current position of organisation
- choosing an innovation strategy
- implementation of the innovation strategy

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TECHNOLOGICAL INNOVATIONS

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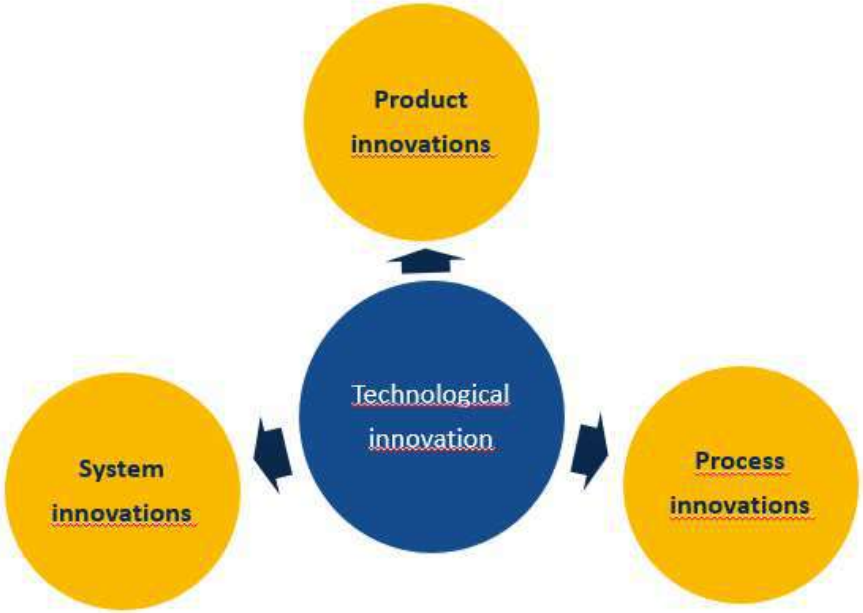
Technological Innovations:
cover new products and processes, as well as significant technological changes in products and processes.

Purpose *of product innovation:* to design and produce a new product with features that distinguish it from other products offered to the recipient.

Process innovation: a change in technology that includes the content (parameters) and sequence of operations that make up a given technological process.

System innovation: creation of a new technological and organizational solution (system), primarily in the field of the so-called information and communication technologies, leading to changes in information flows in logistics and management processes and in traditional processing.



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INNOVATION STRATEGY

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Components of Innovation Strategy:

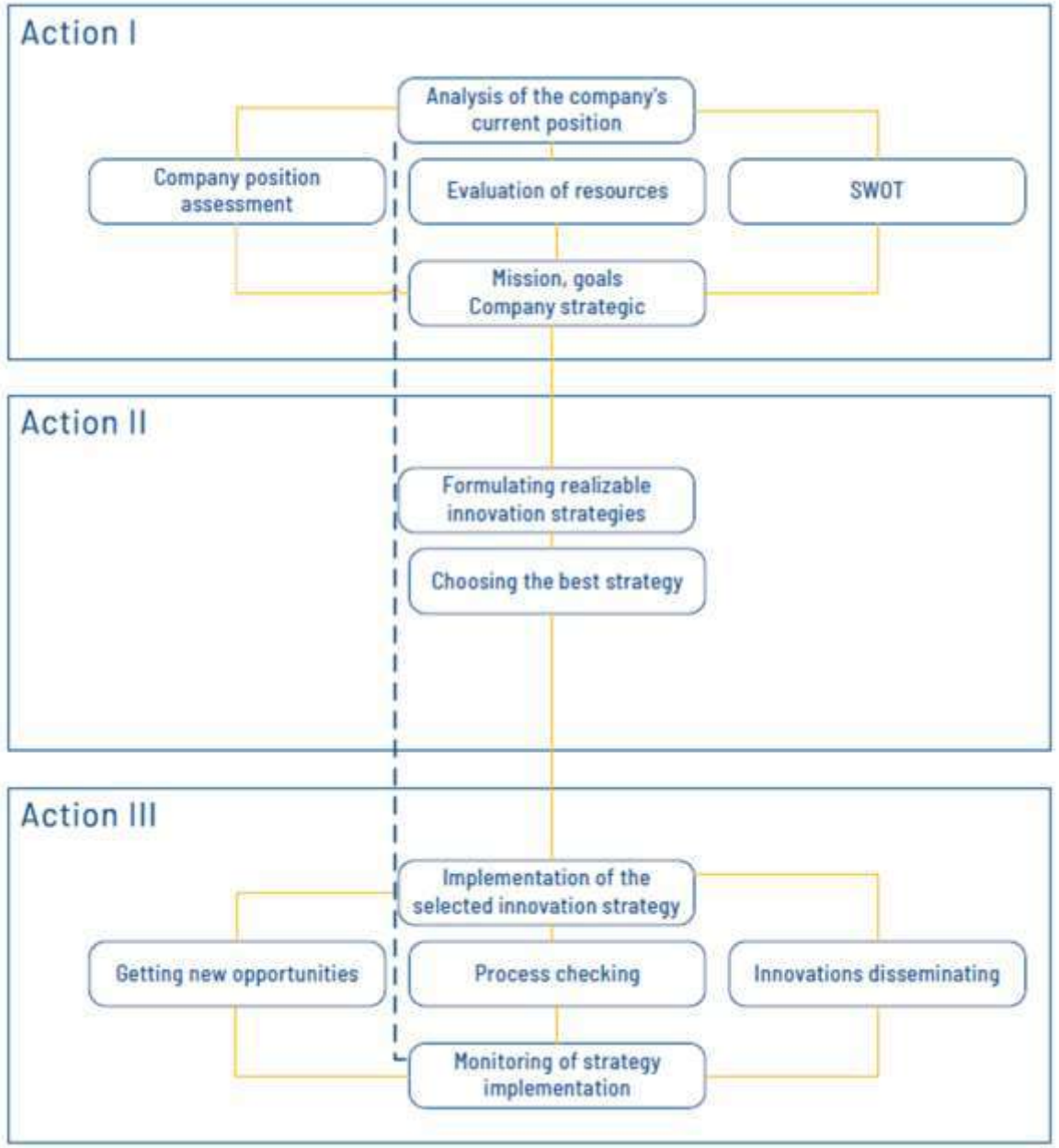
- analysis of current position of o
- choosing an innovation strategy
- implementation of the innovation s

Internal resources:

- customers, CRM, discussion forums
- own research
- employees

External resources:

- databases,
- TT Centers
- business competition
- Research Institutions, Universities
- innovations fairs, conferences and s



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Steps of implementation:

Step 1	Market analysis Assessment of the current and future needs of the client along with the competition analysis
Step 2	Assessment of the state of technical knowledge Determining potential sources of own innovation
Step 3	Design task Defining the subject of innovative activities
Step 4	Design Team Structure Composition-Structure-Project leader
Step 5	Concept of project implementation - Designing an innovation path Cost assessment / project effects / market analyzes
Step 6	Project realization Technical project with main tasks
Step 7	Implementation of the project Technical project with the division of tasks to be performed
Step 8	Implementation-Technical tests-Promotion
Step 9	Project completion - production realization
Step 10	Evaluation of the results - Conclusions for subsequent projects

Innovative directions

Product innovations	Technological innovations
Product development to reduce production costs by simplifying the design, reducing material costs, etc.	Using the learning effect to reduce material consumption or labor intensity, change the process for increasing economies of scale.
Product development for increased quality.	Process changes for higher production quality and flexibility as well as better production flow control
Product development to meet the quality requirements of a given market segment at a minimum cost.	Process changes to meet the requirements of a given segment while minimizing the costs of servicing this segment.
Product development to better meet the quality requirements of a given segment	Process changes to better meet the requirements of a given segment by

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SUCCESS of INNOVATION

Depends on integration of mental models and activities carried out in relation to business models
and technology management.

Chances of success of innovation in companies are **increased by**:

- focus on clearly defined strategic goals
- long-term contacts supporting technological development
- project management skills
- management supporting innovation
- creating a climate conducive to innovation

TECHNOLOGY PORTFOLIO is determined by the attractiveness of the enterprise

- Organizes products according to related or the same technologies
- Determines the technology level attractiveness according to the established criteria
- Influences the prognosis of technological changes

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EXAMPLES OF INNOVATIONS' IMPLEMENTATION AT THE SUT

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Management cooperation with industry and business (indirect commercialisation):
„INNOVATIONS of the SUT LLC." *(INNOWACJE POLITECHNIKI ŚLĄSKIEJ SPÓŁKA CELOWA):*
Special Purpose Company of the SUT

- A special type of commercial capital company, with the main element of business mission in the indirect commercialization of intellectual property developed at the SUT.
- Established in 2016, in accordance with the Higher Education Act, with the SUT as the sole owner.
- Activities:
  - leasing of intellectual property and similar products, excluding works protected by copyright,
  - other technical research and analysis,
  - research and development on other natural sciences and engineering,
  - engineering activities and related technical consultancy, as well as specialised design activities,
  - other non-educational forms of education not elsewhere classified,
  - other business and management consultancy activities,
  - market research and public opinion polling,
  - other professional, scientific and technical activities not elsewhere classified,
  - renting and leasing of other machinery, equipment and tangible goods n.e.c,
  - commercialisation of intellectual property created at the SUT

EXAMPLES OF INNOVATIONS' IMPLEMENTATION AT THE SUT

SPIN-OFF activities happen when a company creates a new independent company by selling or distributing new shares of its existing business.

Spin-out / spin-off activites at the SUT are regulated by the internal Order of Rector about a pro-quality programme focused on creation of this kind of business *(English translation will be shared among workshop participants).*

SUT's spin-out / spin-off companies:

1. MIDOSE SOLUTIONS
2. CORRTEST M&T JAŚNIOK
3. INNOMAT S&D Lab
4. QSYSTEMS PRO
5. PRO-LAB Małgorzata Dobrowolska
6. JSSystems
7. Fly-Gen
8. Elfabric

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Examples of good practice in product commercialization: a spin-off company

Prof. Małgorzata Dobrowolska, SUT Gliwice (PL)

Why is it worth to be a scientist in business and how to combine scientific interests with profit-making activities?

Inspiration for spin off activities : Organic and inorganic compounds

The human-robot system is characterised by :

- working together to achieve a specific objective* and
- acting in a shared space **

The above is an example of a new form of ensemble of 3 types of creatures: human - animal - robot

Pew Research Center (2017) states:

- 80% of Americans believe that by year 2050 robots will take over most of the work currently done by humans
- 75% are convinced that it will increase social inequalities
- twice as many respondents believe that automation is socially harmful
- the stereotype of artificial creatures becoming part of everyday life, a consequence of demography, relieving man of difficult, dangerous and monotonous work(David Berrreby, 2020)

*) Green, Billinghurst, Chen, Chase, 2008; Hoffman i Breazeal, 2004; Bradshaw et al., 2008

**) Hoffman i Breazeal, 2004; Ma, Fong, Micire, Kim, Feigh, 2018

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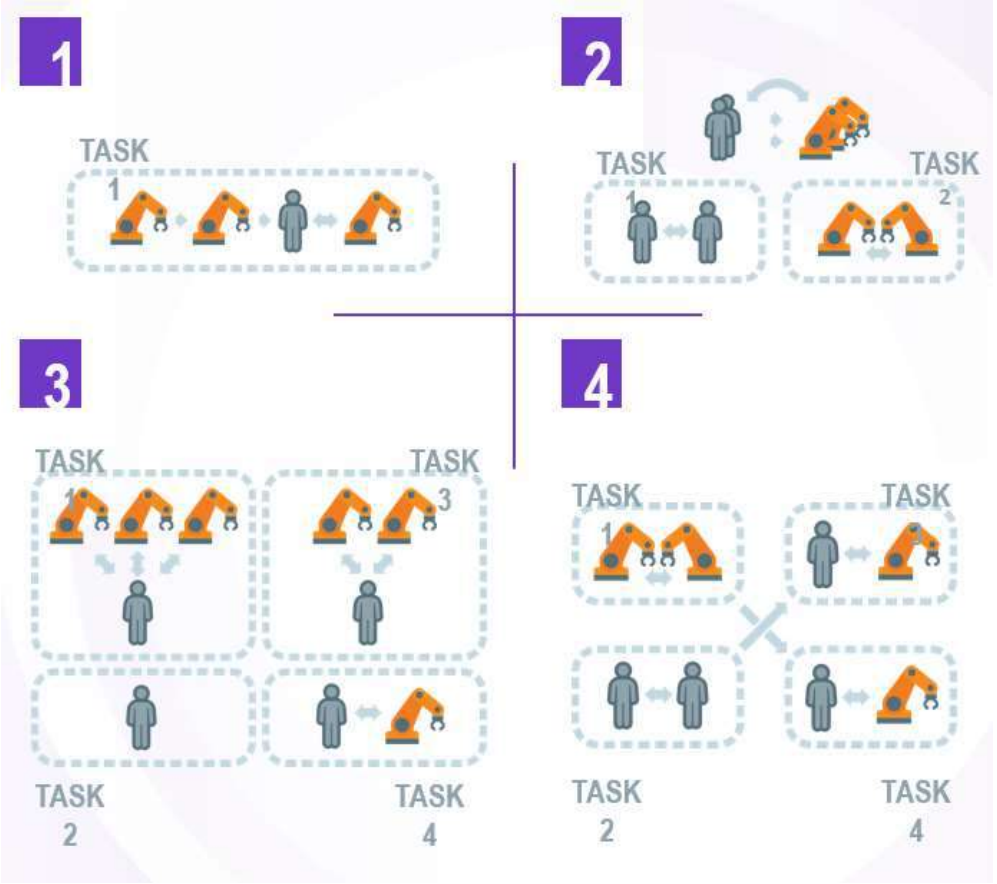
Evolution of a robot:

Initially, the robot was treated as a specific tool (*active or extension tool*), then it was seen as an assistant, until finally he was given the role of a full member of the team (*peer like teammate, trustworthy team member*)*

What happens when:

- the human-robot ratio changes?
- the working environment changes?
- the mode of operation changes?
- the appearance changes?

*) *Ma et al. 2018; Shah, Wiken, Williams, Breazeal, 2011*



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How a spin off company works? Example of the PRO-Lab spin-off company (www.pro-lab.edu.pl)

THE DETERMINANTS OF HUMAN-ROBOT COOPERATION:

The resources of a team consist of:

- knowledge and competences possessed by the human
- software and functionalities of the robot (Ma at al., 2018; Muller, Vette, Mailahn, 2016)

Mutually complementary competences lead to synergy effects, resulting in higher productivity (Green i in., 2008; Gombolay, Bair, Huang, Shah, 2017)

New diagnostic tools:

- ✓ mental levels for implementing Industry 4.0 solutions.
- ✓ technological readiness
- ✓ 4.0. no frustration

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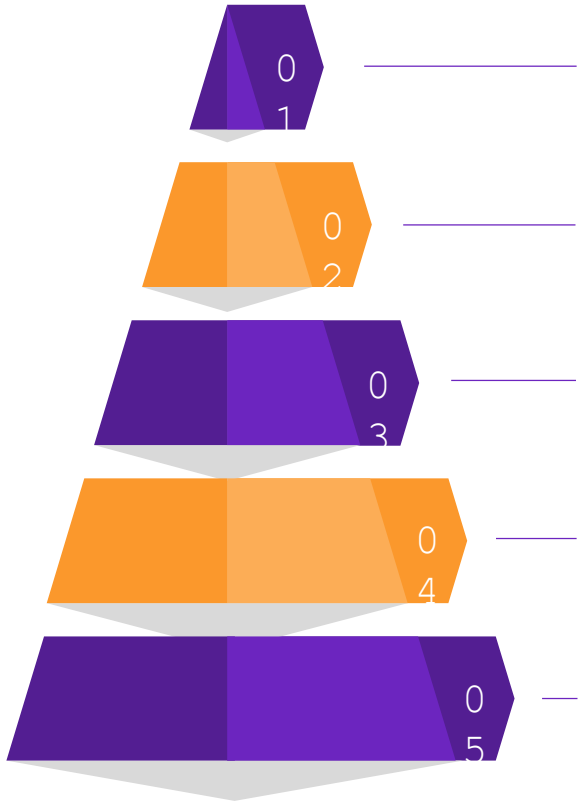
DETERMINANTS OF COOPERATION



SECURITY

Individuals behave in a different way than usual, even if the robot moves according to the human movement pattern (Reed and Peshkin, 2008); they usually behave in an uncertain manner (Harriot et al. 2012)

When the robot's speed matches the person's movement pattern, the person feels safe (Maurice et al. 2017)

Delays and errors occur when the robot runs faster than normal and the person must follow the robot (Lasota and Shah 2014; Maurice et al. 2017)

The training contributes to mastering work at higher speed, this is also helped by visualisation of the course of action (Maurice i in. 2017)

Subjective assessment of own strength and speed does not match objective measurements (Schmidtler, Bengler, 2015)

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DETERMINANTS OF COOPERATION

COLLABORATION AND BURDEN

Full synchronisation (team fluency) as an indicator of the level of cooperation and productivity (Hoffman, Breazeal, 2007)

Subjective evaluation of liquidity used to assess cooperation (Hoffman, 2013)

A person's adequate response to the robot's movements as a measure of engagement: person is engaged if compliance exceeds 79% (Sidner, Lee, Lesh, 2003)

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DETERMINANTS OF COOPERATION

EFFICIENCY

The level of situational awareness can be expressed through the number of actions taken, number of errors, reaction time, lead time, perceived burden (NASA-TLX scores). (Prewett, 2009)

It depends on :

- ✓ organisation of work on the job (methods, working time),
- ✓ material resources (organisation of the work space in physical terms),
- ✓ type of task (complexity, repetitiveness),
- ✓ personal competences and resources (training, motivation, stress),
- ✓ external environmental factors (lighting, visibility) (Steinfeld et al. 2006)

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Examples of good practice in product commercialization: a spin-off company

Prof. Małgorzata Dobrowolska, SUT Gliwice (PL)

DETERMINANTS OF COOPERATION

BURDEN

It is a consequence of *no longer physical* but cognitive and psychological demands. (Prewett, 2009)

Place of operation (environmental complexity), the type of task, the speed of the robot and its capabilities are all related to the perceived burden. (Schipani, 2003)

Remarks:

- Satisfaction with the robot depends on the burden perceived. (Prewett, 2010)
- Too little or too much stress affects situational awareness. (Gombolay et al. 2017)
- Working with a robot can be a source of stress. (Arai, 2010; Itoh et al. 2006)
- The IDLE TIME is not conducive to maintaining productivity and creates a sense of burden. (Crandall et al. 2005; Gombolay et al. 2017)
- Persons without the opportunity of decision to work with a robot, mentally withdraw from the work (their relationship with a robot becomes less important). (Gombolay, Shah, 2014)

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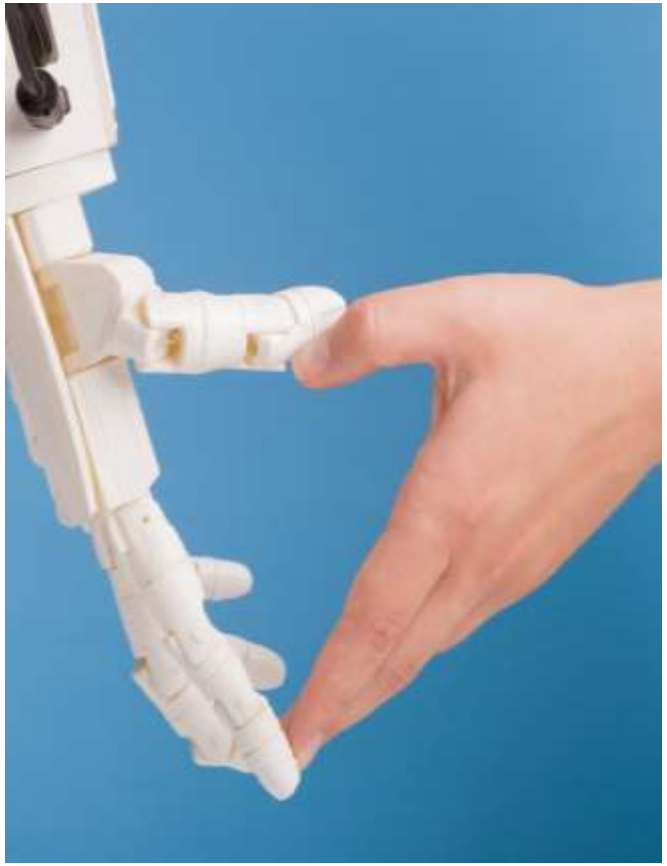
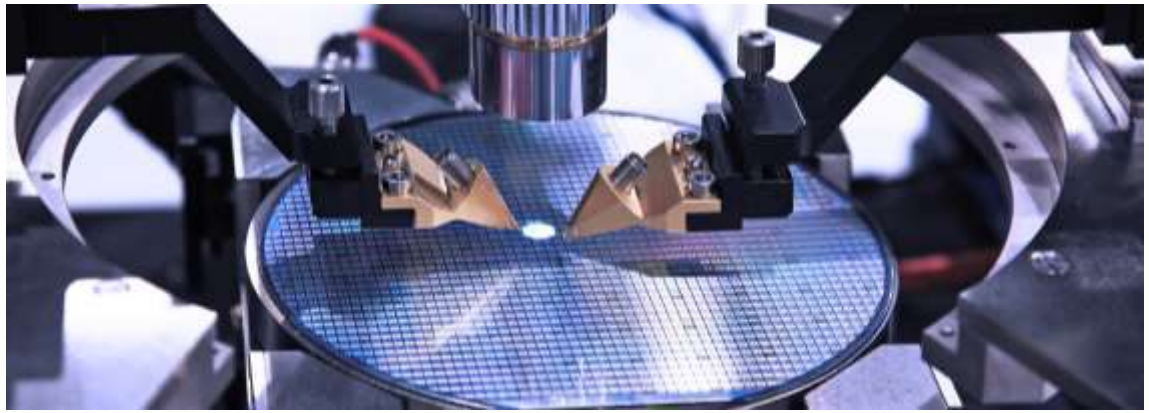
DETERMINANTS OF COOPERATION



TRUST

- Confidence in the robot is key when dealing with unexpected and risky situations.
  (Park, Jenkins, Jiang, 008)
- The higher the sense of reliability, the higher the confidence
  (Hancock et al. 2011)
- Inappropriate confidence levels (too high and/or too low) adversely affect the use of the robot for tasks.
  (Hancock et al. 2011)



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QUESTIONS?

You are welcome to cooperate with us!
Contact:

www.pro-lab.edu.pl

Malgorzata.Dobrowolska@polsl.pl

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Thank you!

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