

# Enforcing Innovation across Maker, Industry and Research Using Capabilities of Academic Makerspaces

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## I. BACKGROUND – THE PROJECT

The cooperation between industry and research is an essential and established innovation driver. In recent times industry is faced with shorter and accelerated product innovation cycles. In addition, new trends with huge growth rates like the Internet of Things are posing new challenges for established businesses.

International studies [1] show the increasing influence of Maker. Maker are creative minds who use digital production infrastructures to create ideas, prototypes and marketable products. Their motivation is the joy of developing and using their own product. What sounds like tinkering at first, offers tremendous potential for innovation in practice - spurred on in particular by today's lower entry barriers to simulation and design software, production infrastructure at industry standards and the use of open source licenses.

Futurologists describe the Maker Movement as a physical version of Web 2.0. The Maker Movement intends to revolutionize the industry with a new ecosystem of crowdsourcing and crowdfunding. The innovation potential of Maker needs to be examined, increased, made utilizable and integrated to established cooperations between industry and research.

Therefore, the Institute of Innovation and Industrial Management (IIM) started the Research Project “Enforcing Innovation across Maker, Industry & Research” (MI&R) in 2017. MI&R is a three-year project involving 15 industrial partners and is partly funded by the Austrian Ministry of Digital and Economic Affairs. The IIM is running the first academic Makerspace (currently 200m<sup>2</sup>) in Austria since 2014 and is member of the FabLab community. The existing facilities is expanded to a new Innovation Laboratory (800m<sup>2</sup>) within MI&R.

## II. OBJECTIVE AND PURPOSE

The objective of the project is the design, ramp-up and operation of a new Makerspace as a laboratory environment to research the targeted and coordinated exchange across Maker, industry and research.

The project goals can be summarized as follows:

- Development and construction of a laboratory environment to investigate interfaces between Maker, industry and research in product creation
- Development of a holistic approach to support a transdisciplinary cooperation in product creation across Maker, industry and research

- Derivation of teaching concepts to integrate gained knowledge in education and training programs for Maker, industry and research

## III. PARTNER

Industrial partners, a diverse group of 15 national and international companies in number of employees (150 up to 163.000), turnover (50 million up to 36,4 billion Euros) and industry sectors (automotive industry, electric power supply, electronic industry, plant engineering, logistics, petroleum industry, semiconductor industry, steel industry) are supporting MI&R. Industrial partners provide a financial contribution to the project.

Graz University of Technology provides facilities, energy, telecommunication and human resources. Several faculties (e.g. Electrical Engineering, Computer Science, Architecture, Mechanical Engineering) and institutes are supporting the project.

Maker, Start-Ups and several student driven teams like Formula SAE Racing Team, Shell Eco Marathon Racing Team, or RoboCup Team use the facilities to design and built their prototypes.

## IV. METHODOLOGY

The methodology is based on the action research approach to identify needs, testing strategies, gathering data and to determine if and how specific cooperation models between Maker, industry and research work. Within MI&R, different cooperation models (see chapter V. for detailed descriptions) are identified, developed further, executed, evaluated, improved and re-executed for several times. Involved parties exchange their experiences about completed, planned and yet to be developed cooperation models in semi-annual partner-meetings. Within the framework of these meetings, implemented cooperation models are presented, discussed and adapted for later implementations by all partners. The meetings contribute significantly to the further development of already developed models of cooperation as well as to the concerted and targeted development of new forms of cooperation.

This procedure leads to a continuous development and optimization of the cooperation models and gives insights into the role of Makerspaces as a core Maker Movement Element [2] to enforce innovation capabilities in the cooperation between Maker, established companies and research at university.

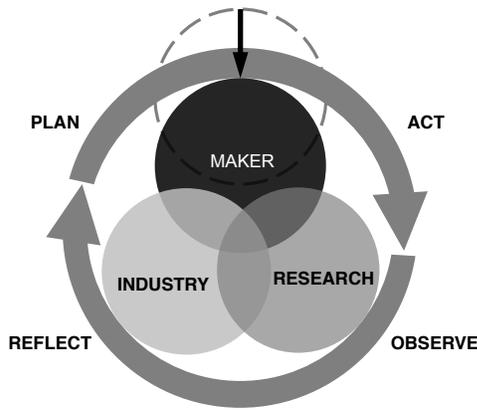


Fig. 1 Integrating Maker to the established cooperation between industry and research by action research

## V. COOPERATION MODELS

The *Product Innovation Project* is a course offered by the IIM since the year 2006. Within this course groups of Maker are working on tasks, given by industry, for one academic year. Each team is given a budget to design and prototype their product ideas.

A *Makerthon* (Maker+Marathon) is an event, where teams of Maker meet to face a real life challenge by searching for new ideas, solutions, products and services within 48 hours. The tasks are given by industrial partners. The teams are supported by experts from industry and researchers. Participants use the Makerspace to prototype their physical products.

An *Experthon* (Expert+Marathon) is a project setting, where a team of selected researchers, industry experts and suitable Maker analyze problems to finally design and develop a solution within 24 hours.

An *Innovation Week* is a project where teams from industry use the Makerspace for one week to design, develop and prototype. They are supported by selected researchers and Maker if required.

*Training Programs* regarding topics like design thinking, ideation or creativity techniques are held for employees of industrial partners. Employees of the company are coming to university and get in touch with current research and Maker at the Makerspace.

*Memberships* offer the possibility to get access to the makerspace for employees of industry side by side with Maker. By utilizing the facilities face-to-face contacts occur between Maker, industry and research to enforce possible cooperations.

The *Makerspace* can be used as *Event Location* by Maker, industry and research and acts as a communication platform and crystallization point for possible future cooperations.

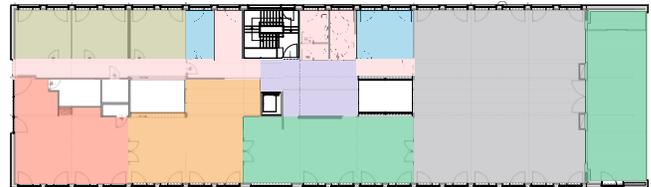
## VI. THE INNOVATION LABORATORY

The Innovation Laboratory (IL) is an academic Makerspace at Graz University of Technology led by the Institute of Innovation and Industrial Management and deals as the melting pot to reduce inhibition thresholds of its users.

The layout and design of the space is initially based on own experiences at the already existing FabLab facilities at the IIM

and results of field trips and visits at Makerspaces in Europe, USA and China. The fact, that a Makerspace is a dynamic, changeable environment can be stated as the key result of the investigations. [3]

The IL is basically divided into 5 areas: FabLab, research, open communication, meeting rooms and multifunctional space. The multifunctional area is equipped with high tech display, sound, light and videoconferencing equipment as well as moveable and adjustable furniture. Additionally, it is equipped with the same basic supply of energy and necessary resources to be used as extension of the FabLab if needed.



|                         |                   |                         |                    |
|-------------------------|-------------------|-------------------------|--------------------|
| FabLab - Dustroom       | 73 m <sup>2</sup> | General area            | 66 m <sup>2</sup>  |
| FabLab - Cleanroom      | 77 m <sup>2</sup> | Reception area          | 38 m <sup>2</sup>  |
| Research area           | 63 m <sup>2</sup> | Open communication area | 134 m <sup>2</sup> |
| Dedicated meeting rooms | 31 m <sup>2</sup> | Multifunctional area    | 222 m <sup>2</sup> |

Fig. 2 Layout of the Innovation Laboratory

## VII. STATUS

Since the start of MI&R, 37 cooperation models were successfully executed and allowed deep contacts to roughly 160 employees of industrial partners, 150 Maker and 20 researchers as representatives of various faculties and institutes. Another 10 executions of cooperation models are fixed and another 90 are planned until the end of the project. Actual research deals with the “Impact of Makerspaces on the innovative capability of established companies” and “The role of Maker Movement Elements in startups’ product development”. The Innovation Laboratory is currently under construction and will be at full work in November 2018.

## VIII. CONCLUSION AND OUTLOOK

The strong interest and the active participation of all parties attests the necessity of integrating the creativity and innovation potentials of Maker to the established cooperation between industry and research. Several obstacles such as legal and organisational issues, personal impediments of involved people as well as the necessary adaptability of the Makerspace appeared during the execution of different cooperation models and need to be addressed in further research. Further research will be based on available data gained by the development, execution, evaluation and improvement of cooperation models for Maker, industry and research to overcome identified obstacles.

## IX. REFERENCES

- [1] J. Hagel, “A movement in the making,” *Deloitte University Press*, 2014
- [2] M. Friessnig., T. Böhm, C. Ramsauer, “The role of academic Makerspaces in product creation – Matching the hardware entrepreneur’s request

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[3] M. Friessnig., H. Karre, H.P. Schnöll, C. Ramsauer, "Development of an Educational Program Using Capabilities of (academic) Makerspaces," in *Proceedings of the 1<sup>st</sup> International Symposium on Academic Makerspaces*", 2016, Paper No. 13