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QUANTITATIVE ANALYSIS OF COMMUNITY DEVELOPMENT AND USAGE PATTERNS IN A NEWLY - ESTABLISHED ACADEMIC MAKERSPACE

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Abstract: At a regional level, makerspaces can foster co-innovation. For this purpose, the development of a community with different stakeholders has to be promoted. Knowing the community and its usage patterns is an important factor for developing the makerspace and its offerings, thus providing regional stakeholders with a suitable environment for co-innovation. In this paper, we present the results of our activities aimed at analyzing community development and usage patterns in our newly-established makerspace. After conceptualizing and developing necessary architecture components, data were analyzed with a quantitative approach using descriptive statistics. Results show i.a. that most users were private at the beginning, while student registrations significantly increased in the second year. Wood and metal processing are prevalently used by private users, enterprises being more active in laser cutting and students in 3D printing. These insights can play an important contribution to assessing the launch phase of the makerspace as well as to promote collaborative projects in the future.

Keywords: makerspace, data analysis, community, usage, co-innovation

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1 INTRODUCTION

In order to develop innovation capability at a regional level, a network of stakeholders with academic, entrepreneurial as well as governmental background and interests is needed [1]. A multiple case-study of the European University Association (EUA) shows that innovation models in universities and companies are shifting from classical linear approaches towards more co-creative and systemic ones, which require the involvement of different external partners [2]. According to studies about product innovation, however, co-innovation often gets inhibited due to technical and organizational barriers and insufficient supporting processes [3]. At this point, makerspaces can be seen as a valuable resource to support co-innovation. Makerspaces are not only physical workspaces that are opened to the community and offer machine equipment [4], but they also have a strong collaborative character, i.a. promoting networking and knowledge sharing ([5], [6]) and enabling interaction between stakeholders [7]. Different stakeholders, however, have different goals and limiting factors and see different opportunities and risks when involving in co-innovation (e.g. [8]). This underlines the importance of gaining insights into the community to adapt makerspace offerings accordingly. In this paper, we present the results of exploring community development and usage patterns in the newly-established makerspace at the University of Applied Sciences Wiener Neustadt (UAS WN) after two years of operation.

2 BACKGROUND

The makerspace was opened up in Sept. 2021 and is located in a former factory building close to the university campus (see Fig. 1). With 7 distinct sub-labs, each specializing in a particular technical domain, it includes: (1) Metal Lab (2) Wood Lab (3) 3D Printing Lab, (4) Electronics Lab, (5) Textile Lab, (6) Laser Lab, and (7) Robotics Lab.

Figure 1. Newly-established makerspace of the UAS WN in a former factory building (Sept. 2021)

The makerspace is regularly utilized by many different user groups. Previous research work has been done in order to identify their needs and goals ([8], [9]). Accordingly, a wide

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range of service offerings has been implemented, from free trainings to workshops and community meetings [10], as well as a digital tool architecture for supporting co-innovation [11].

3 METHODS

For our research, two main steps were performed, being (a) the development of a data analytics architecture, and (b) data analysis with descriptive statistics to quantitatively assess community development and discover usage patterns.

3.1 CONCEPTUALIZATION AND DEVELOPMENT OF ARCHITECTURE

In this step, a database and necessary interfaces were developed to conduct a similar analysis in the future, thus monitoring developments. Fig. 2 shows the data pipeline architecture used.

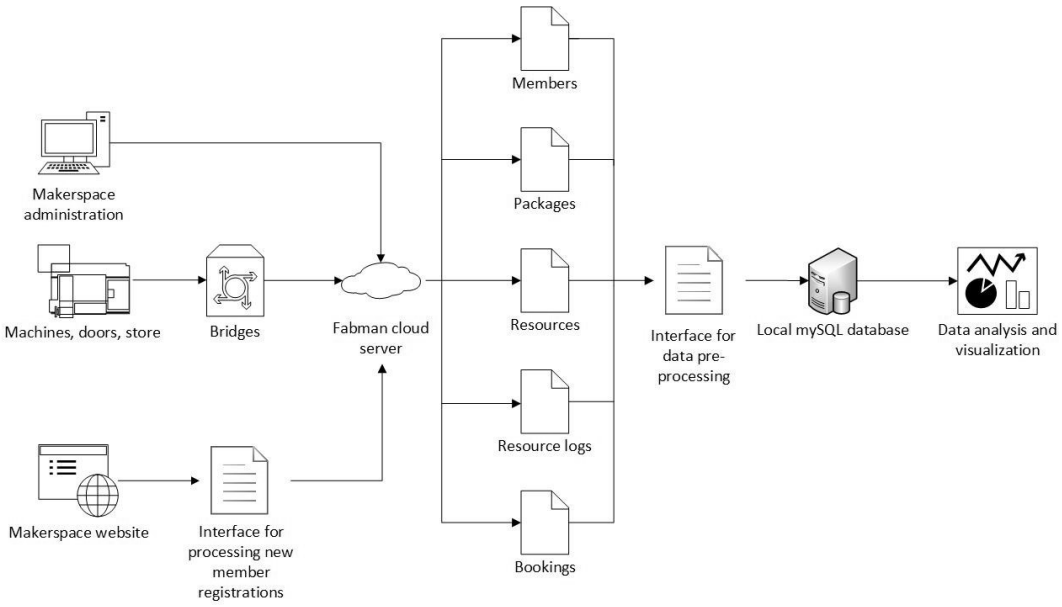

Figure 2. Architecture for data collection, storage and visualization

Data are collected in the makerspace through the software Fabman and sent to its cloud server. From there, data are retrieved via REST-API protocol, pre-processed and fed into a mySQL local database. In our work, interfaces for periodical data collection, pre-processing and database update were developed. Necessary datasets collected were (a) member-related, (b) package-related data, (c) resource-related data, resources being e.g. machines or access doors, (d) log-data, and (e) booking data of machines. In the last step, Microsoft PowerBI was used as a tool for visualization and analysis with respective DAX scripts for data processing.

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3.2 DATA ANALYSIS WITH DESCRIPTIVE STATISTICS

In this paper, we focus on presenting following topics:

(1) Community development in terms of size and composition, as two main characteristics of a local network affecting innovativeness [12]
   a. Actual status of the community (members with active package by Sept 30th, 2023)
   b. Development of new membership subscriptions by user groups (Opening – Sept 30th, 2023).

(2) Usage patterns
   a. Utilization of makerspace equipment according to the number of utilizations by lab (Jan 1st – Sept 30th, 2023).
   b. Utilization of the labs by user groups according to the number of utilizations (Jan 1st – Sept 30th, 2023).

4 RESULTS AND DISCUSSION

In the following, evaluation results of community development and usage patterns are presented in two subchapters.

4.1 COMMUNITY DEVELOPMENT

Fig. 3 shows the actual status of the makerspace community divided by user groups. Members that are both sponsors and enterprise users were considered twice.

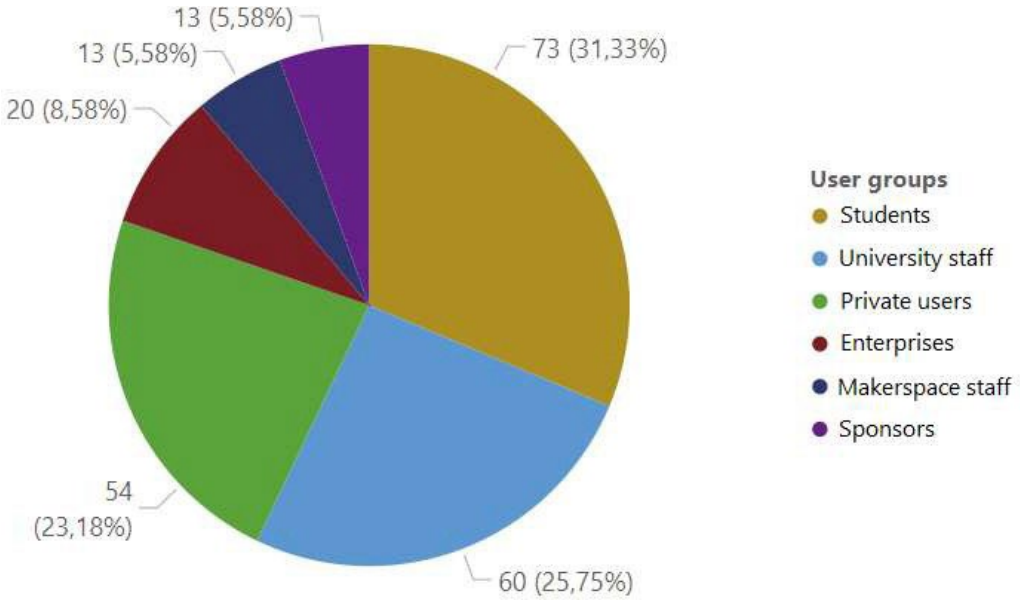

Figure 3. Actual status of the active community, N = 233 (Sept 2023)

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In Fig. 4, the development of new subscriptions since makerspace opening is visualized. The diagram shows the cumulative number of new subscriptions over time divided by user groups (both active and non-active users).

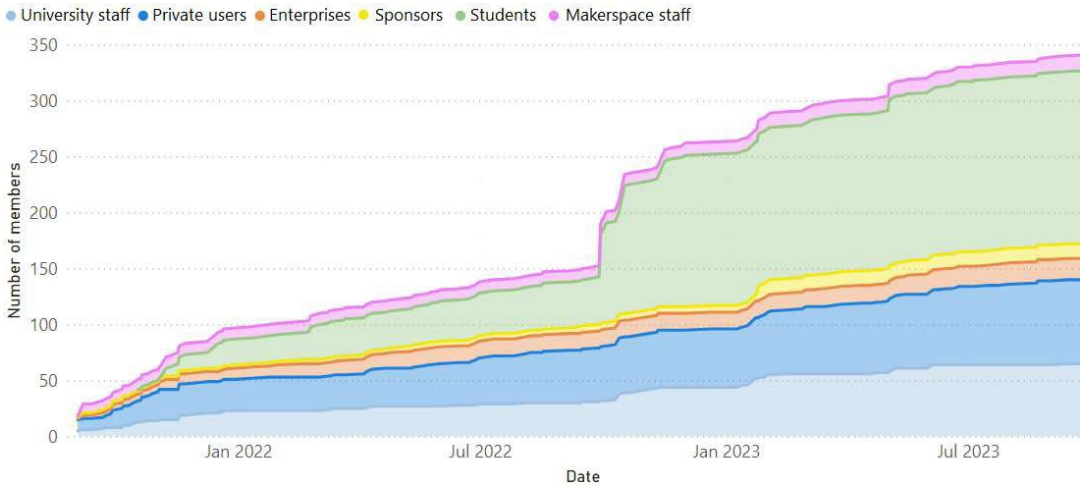

Figure 4. Development of new subscriptions by user groups since opening (Sept 2021 – Sept 2023)

Shares of user groups at six-month intervals are summarized in Table 1.

Table 1. Shares of user groups at six-month intervals (both active and non-active users)

User group	Jan 31st, 2022	Jul 31st, 2022	Jan 31st, 2023	Jul 31st, 2023
Enterprises	10,89%	10,64%	5,30%	5,69%
Makersp. staff	9,90%	7,09%	3,53%	3,89%
Private users	29,70%	30,50%	19,79%	21,56%
Sponsors	2,97%	3,55%	4,59%	3,89%
Students	23,76%	27,66%	48,06%	45,81%
Univ. staff	22,77%	20,57%	18,73%	19,16%

4.2 USAGE PATTERNS

For analysing user patterns, overall usage of each lab was assessed first. Fig. 5 shows the share of utilization of each lab.

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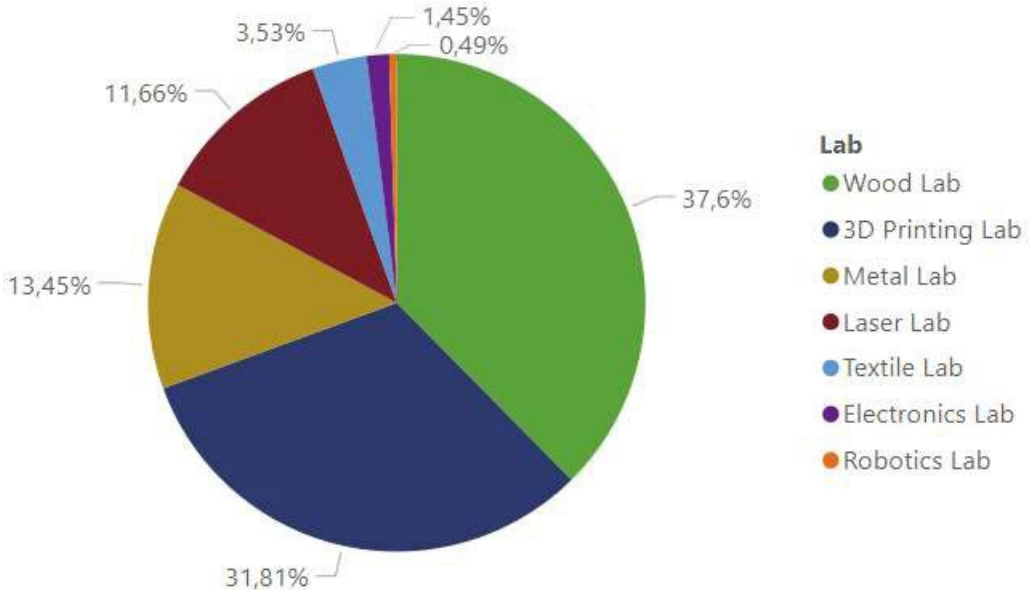

Figure 5. Usage of the labs according to the number of machine utilizations (Jan 1st - Sept 30th, 2023)

Utilization of the labs was then divided by user groups (see Fig. 6). Here, the four most used labs are presented.

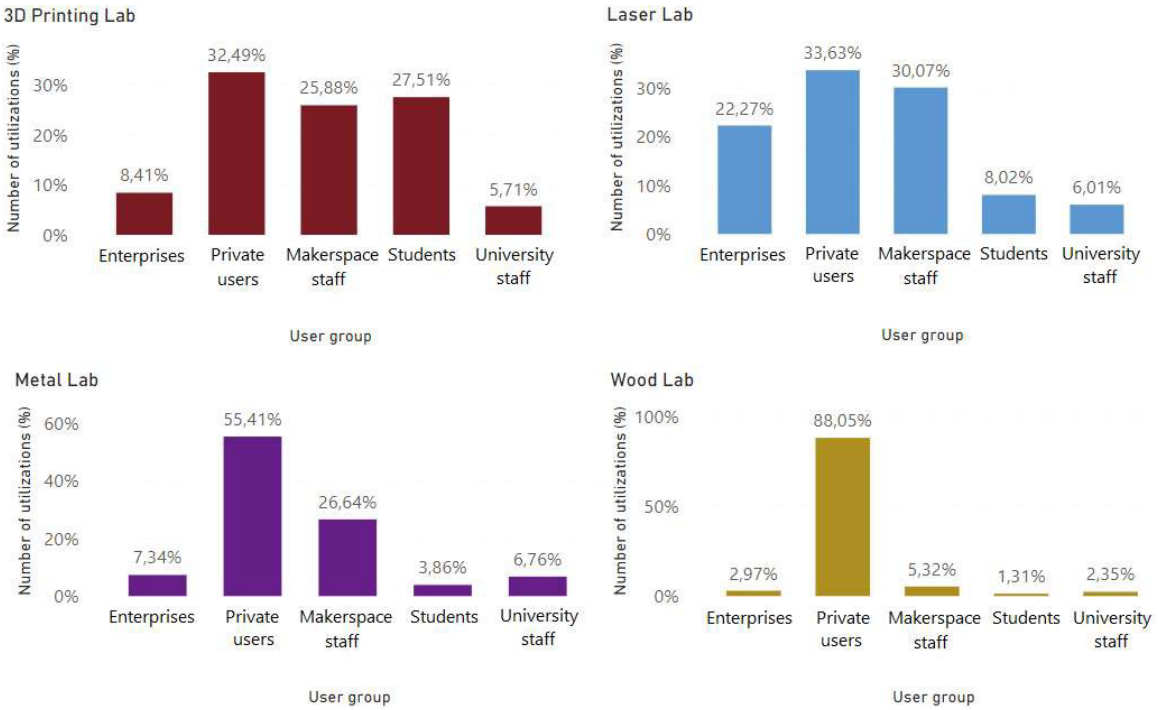

Figure 6. Usage of the labs by user groups (Jan 1st - Sept 30th, 2023)

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4.3 DISCUSSION

Evaluation shows that the largest active user groups are students, university staff and private users. Community development, however, shows that private users were the most represented group in the first year, while student subscriptions significantly increased afterwards. This is an indication that the makerspace was increasingly used for education in 2023. It is important to consider that the number of makerspace staff members corresponds to number of cards issued, not the number of people actually working for the makerspace. Analysis of usage shows that 3D printing, metal and wood processing and laser cutting are the most used technologies. While enterprises own a high usage share in the Laser Lab, metal and wood processing are particularly popular among private users and student projects mostly apply 3D printing. In our research, further analysis of timely usage patterns and relations with demographic data was conducted, but not presented due to limited space.

5 CONCLUSION

In this paper, makerspace community and usage at UAS WN were quantitatively assessed using descriptive statistics. Results provide first insights into the community and its development, as well as equipment utilization. Results contribute to assessing the outcome of the launch phase of the makerspace, but are also a foundation for planning future offerings in line with the actual target groups, thus promoting further collaborative projects. Apart from this analysis, we plan to conduct more in-depth analysis of interactions between user-groups, e.g. in social-media channels and communication tools.

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