

## **Towards Digitalization in Academic Start-ups**

### **An Attempt to Classify Start-up Projects of the Gruendungsgarage**

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**Abstract**—Founded in 2013 as a playground for implementation-oriented start-up ideas, the Gruendungsgarage is now an established academic start-up accelerator and an integral part of the regional start-up scene. Starting with a brief introduction to the program of the Gruendungsgarage as a best practice example with five years of experience in academic entrepreneurial education, a model with a practical-oriented focus for classifying the degree of digitalization in start-up projects is presented. Successful start-ups and promising start-up projects from the Gruendungsgarage are classified according to their degree of digitalization and illustrated by examples. Finally, implications for the practice in engineering education on entrepreneurship are derived and suggestions for future research are identified.

**Keywords**—Entrepreneurship education, digitalization, start-up accelerator

## **1 Introduction**

As a cooperation between Graz University of Technology and University of Graz, the Gruendungsgarage is inter-university organized, interdisciplinary oriented and provides a convergence of scientific theory and entrepreneurial practice in the format of a course. Every semester students and employees of all universities apply for one of the ten coveted places to further develop their innovative start-up ideas within one semester at the Gruendungsgarage and, at best, to subsequently found a start-up. The participating start-up teams are professionally accompanied and supervised by the scientific staff of both universities as well as by qualified mentors who are professional experts in their field. Within the structured course of one semester at the Gruendungsgarage, basic knowledge about starting a business is acquired, the participants work on their own business plans and get coaching on the further improvement of their business ideas. Workshops on business model development, design thinking, online marketing, intellectual property rights, legal and tax consulting complete the preparation for the everyday business life of company founders. After the first pitch of the start-up ideas, each team defines development goals together with their mentor. The improved start-up projects as well as the goals' achievement are presented at the interim and final presentation in front of sponsors, investors, faculty members and

personalities from the regional start-up scene. Figure 1 shows the course of the Gründungsgarage within one volume, corresponding to one semester.

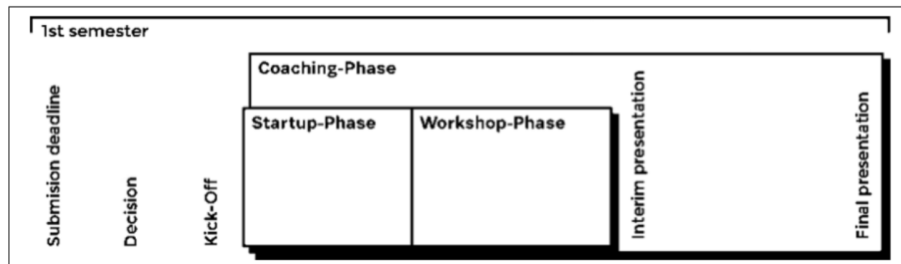


Fig. 1. Structure of the Gründungsgarage [1]

Digitalization is progressing and is undoubtedly a megatrend with far-reaching implications. Investigating business models of the industry 4.0 Kaufmann [2] states, that products no longer consist only of hardware, especially the relevance of software is rising sharply and many products are being expanded by controls and communication modules in order to communicate. The technical possibilities and developments offer opportunities for business model innovations and new market participants arise [2]. Setting the focus on manufacturing, digitalization enables faster processes in product development, a more flexible production and increased efficiency regarding the use of resources. Therefore, costs can be significantly reduced while reliability, quality and process sustainability increase [3].

Digitalization also offers plenty of chances for start-ups and future entrepreneurs developing new business ideas. It is therefore of interest in this paper to examine the start-up projects of the Gründungsgarage and to answer the questions as to whether the start-up projects are affected by digitalization and how the start-up projects can be classified accordingly. With regard to the aspects of digitalization, the start-up projects participating in the volumes I to X (ten semesters) of the Gründungsgarage are examined in more detail in the present paper. Based on an initial, practice-oriented assessment, an attempt to classify the start-up projects is made. After analyzing the successful start-up projects of the Gründungsgarage, implications for the entrepreneurship education, especially in the field of engineering education, are derived.

## 2 Classification Concept and Allocation of the Sample Start-ups

In the context of the digital transformation in society, economy and science, the start-ups (already founded or in the founding process) of the Gründungsgarage are analyzed for the first time. A practice-oriented classification of the digitalization of start-up projects with a focus on the product, the process and the business model is carried out, adapting the concept of Matzler et al. [4].

After an investigation of several studies Rachinger et al [5] state, that digitalization affects and triggers changes in businesses and business models threefoldly – when

refining established business models, transforming established business models and developing novel business models [5]. Matzler et al. [4] also describe the impact of digitalization on three levels: At the level of products and services with customer value, the more efficiency-driven processes leading to more profound changes and at the level of the business model, combining data and data-driven services, creating new customer value and a new business logic.

Classifying a start-up's business model predominantly into analogue, hybrid (a combination of digital and analogue) or digital is a new approach and therefore, only a first attempt is made in the present paper referring to the following definition of a digital business model by Veit et al. [9]: "*A business model is digital if changes in digital technologies trigger fundamental changes in the way business is carried out and revenues are generated*" [9, p.48].

In the present paper, the data generation and assessment of the digitalization on product, process and business model level was conducted on the basis of the projects documentation of the Gruendungsgarage and compared with the information available at the start-ups' websites as well as personal response from the founded start-ups and start-up projects. Based on the current state of information on the founding projects, these are classified as predominantly digital, hybrid or analogue at each of the three levels and evaluated in a tabular form.

## 2.1 Classification of digitalization by examples

To classify the product into digital, hybrid and analogue at product and process level, the product was defined as a physical result or service for the customer and the process of service provision in terms of production and sales. An assessment of the business model was made with reference to the dimensions "Who, What, How and Why" of the business model by Gassmann [6] and the definition of Teece [7], according to which a business model describes the design and mechanisms for the creation, delivery and capture of value. Stated by Vendrell-Herrero et al. [8] digital technologies are drivers for change in the competitive market as companies develop new ways of generating, delivering and capturing value.




Using nine examples of founded projects, the classification into the levels of digitalization is demonstrated in Table 1. The clustering into predominantly digital, hybrid or analogue answers the questions in which form value is offered (product), how value is provided and distributed (process) and how revenue is generated (business model).

In Table 2 three examples of successfully founded and established start-ups of the Gruendungsgarage Graz are investigated in more detail. Studo, the app from the start-up project Moshbit is classified as digital on all levels of focus: digital product, digital processes and digital business model. Drone Rescue Systems is evaluated hybrid, as the product, the processes for delivering value, and the business model consist of both, analogue and digital components. Mehlspeisenfräulein with individually hand-made confectionery and pastries is considered an analogue example, whereby the use of digital media for communication, social media and operating a website are left aside in this classification.

**Table 1.** Classification of nine examples of start-up projects into the levels of digitalization

	Product	Process	Business Model
Digital	Crosscloud Crosscloud's digital product enables companies to control and secure the use of various cloud storage services such as Dropbox or OneDrive in an enterprise.	TeLLers A digital feedback tool developed for the gastronomy industry. Trends and improvement potentials are derived directly from the opinions. Simple, anonymous and fast, the feedback is made easier for customers and operators.	Moshbit (Studo) Moshbit's Studo is an app for the digitalization of universities. It is used for organizing the individual everyday life of students, for work-load surveys of studies and evaluation of courses as well as a job portal for students.
Hybrid	Timeular (Zei) Timeular's physical "Zei" octahedron simplifies and optimizes time recording in companies by assigning each page to a task or project and automatically recording the time via software as the octahedron is rotated.	Accessio (Arivo) Arivo facilitates people with the access to parking lots and the management of parking areas. The smart software combined with an automated licence plate recognition system is used for offices and residential properties.	Drone Rescue Systems The innovative system automatically detects a fall and ejects a rescue parachute. The drone is safely brought to the ground, damage is minimized and the data relevant to the user is processed through digital networking.
Analogue	Kobatani Flip-flops (shoes) made from recycled car tires.	Mehlspeisenfräulein Confectionery with pastries on an order basis only.	Doro-Turbine Small and economical hydropower turbine.

**Table 2.** Classification demonstrated in detail using three examples

	Product	Process	Business Model
	Studo App for the digitalization of universities, organization of everyday studies and job portal.	Course Management, search Function, data collection, processing and networking.	Digitalization, Solution Provider, Two-sided Market.
	Drone Rescue System with a physical parachute, digital web portal and app.	Fall protection by a physical parachute, data collection, processing and networking.	Cross-Selling, Subscription, Leverage Customer Data.
	Physical confectionery and pastries made by <b>Mehlspeisenfräulein</b> .	Individually handmade production in a bakery and physical delivery.	Ultimate Luxury, Solution Provider.

Taking a closer look at the start-up projects, in Table 2 the business model patterns according to Gassmann, Frankenberger and Csik [6] are used to sketch the business models. Not every single business model pattern that is identified has compulsory digital aspects. The patterns are adjusted and combined by the start-up projects and attributed to the classification in this first analysis based on the information available.

## 2.2 Analysis of the digitalization over ten semesters

After ten semesters of the Gründungsgarage a positive summary can be given: Over the past five years, 91 teams have participated in the academic start-up accelerator program Gründungsgarage, of which 25 start-up project ideas have resulted in founded start-ups with more than 130 jobs created. A further 16 projects are currently in the start-up founding phase and are about to enter the market.

The analysis and classification of the total of 41 projects of the Gründungsgarage (25 founded start-ups plus 16 promising start-up projects) in terms of digitalization was carried out as these have already gained a foothold in the market or have the best prospects of establishing themselves.

The overview of the number of analogue, hybrid and digital products, processes and business models shown in Figure 2 provides information about the degree of digitalization of the start-ups and start-up-ready projects of the Gründungsgarage.

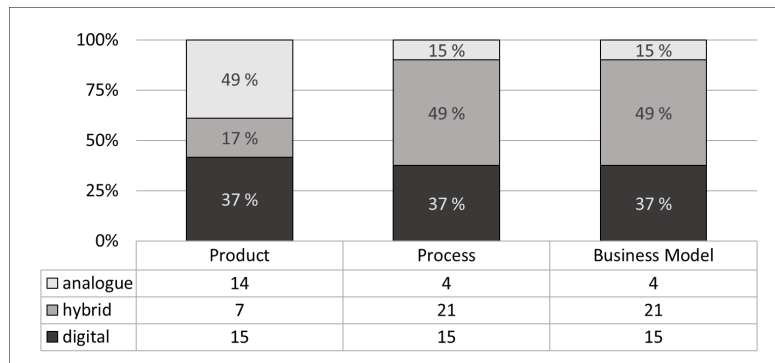


Fig. 2. Levels of digitalization of start-ups and start-up projects of the Gründungsgarage

The 41 analyzed projects of the Gründungsgarage clearly show a focus towards digitalization. While at product level 19 of the start-up projects are classified as analogue, 7 as hybrid and 15 as digital, this ratio changes dramatically at process level. About the half of the teams (49 %, 19 teams) already founded or currently in the founding process rely on analogue products or services, but integrate the aspect of digitalization at the process level. Only 12 % implement a largely analogue business model. All of the start-ups use digital technologies for communication and web presence, but this fact is not considered as a digitalizing element of the business model. A total of 88 % of the projects of the Gründungsgarage (37 % digital and 51 % hybrid) are characterized by digitalization in their business model.

In the case of the start-up projects with digital products (37 %), the dominant focus on digitalization is asserting itself to the same extent at the process level (37 %) and is also reflected in the business model (37 %). This phenomenon corresponds to the result considering the start-ups that have already been founded only, where 36 % have digital products, digital processes and digital business models.

Figure 3 shows the classification of the start-up projects' business models over the course of all ten volumes (semesters) of the Gründungsgarage. Six out of the ten

volumes are characterized by start-up projects with digital and hybrid business models only. Although no clear trend can be derived from the graph, it is shown that aspects of digitization have played a role across all volumes.

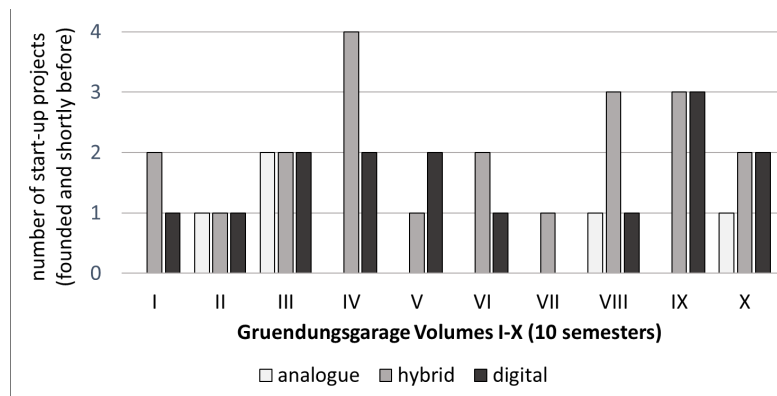


Fig. 3. Digitalization of the start-up projects business models over time

### 3 Conclusion and Implications

The focus towards digitalization is revealed by analyzing the start-ups and current projects of the Gruendungsgarage. The analysis shows that analogue products are increasingly extended by services in order to achieve unique selling points. These services are usually provided in digital form, for example by storing and evaluating data or networking devices. Therefore, nowadays an early consideration of the topic of digitalization seems indispensable in the founding process of a business.

Digital enterprises are empowered by new information and communication technology systems that integrate the following three technological keys according to Loonam et al. [10]: virtualization (for example cloud technology), mobility (such as social media, internet of things or mobile devices), and embedded analytics (like big data). These technologies coupled with embedded enterprise solutions enable the digital enterprise [10] and can also be seen as a point of origin to be promoted for developing new start-up ideas in the academic field.

Müller et al. [11] show that the lead of American companies regarding the degree of digitalization compared to German companies is also reflected in the implications of their digitalization activities. For example, performance goals can be achieved, sales can be increased and costs reduced. For start-ups, it is interesting to note that digitalization enables to open up new markets and enhance the company's image [11], a fact that could also be taken into account when promoting the Gruendungsgarage.

Another tendency is that many business ideas require programming knowledge or digital skills, which the idea providers are often lacking themselves. Therefore, in addition to basic user knowledge, other topics of digital education (raising awareness on the relevance of digitalization as well as basic knowledge in programming) should be integrated into curricula and cross-study training formats. The masterplan of the

Austrian Federal Ministry of Education, Science and Research for the digitalization of the Austrian educational system aims to provide orientation for three fields of action: software, hardware and teaching [12]. Starting with the school year of 2018/2019, curricula of all secondary level I schools in Austria cover basic education in digital competencies based on successful projects on "Digital Basic Education" [13]. Nevertheless, a continuation of the digital education on an academic level seems reasonable.

Lindner [14] provides starting points for the entrepreneurship education of seven different target groups. The start-up teams participating in the Gründungsgarage can be assigned to the target group four of entrepreneurship education programs as the attempt to implement, the behavioral intention and the business idea are present. Hence, the Gründungsgarage should continue to focus on the further specification of the business idea and competence development for founders.

Sedelmaier and Landes [15] investigated the skills needed by requirements engineers at present and propose a set of competencies as a basis for the development of learning situations, which could also be of interest in the entrepreneurship education at the Gründungsgarage. With entrepreneurship education as a cornerstone in engineering education, Holzmann et al. [16] provide insights from the Entrepreneurial Campus Villach, which could be considered as a case to elaborate on similarities and differences comparing it to the programs already offered in Graz.

In engineering education on entrepreneurship, especially in the Gründungsgarage, it is worth considering how to better support teams with digital business ideas or start-up ideas that require digital components. For example, the range of workshops can be extended and the pool of mentors broadened to include more people with expertise in digitalization. A further initiative could be launched to match people willing to set up a business with programmers. In addition to making entrepreneurship education even more attractive, the inter-university and interdisciplinary cooperation contributes significantly to the success of the Gründungsgarage and will therefore be continued.

## 4 References

- [1] H. Höller and S. Vorbach, "Entrepreneurship in Engineering Education: The Example of Graz University of Technology," in *Interactive Collaborative Learning: Proceedings of the 19th ICL Conference - Volume 2*, M. E. Auer, D. Guralnick and J. Uhomobhi, Eds., Springer, pp. 486-499, 2017. <https://doi.org/10.1007/978-3-319-50340-0>
- [2] T. Kaufmann, *Geschäftsmodelle in Industrie 4.0 und dem Internet der Dinge: Der Weg vom Anspruch in die Wirklichkeit*. Wiesbaden: Springer Fachmedien, 2015.
- [3] D. A. Martin, "Shaping the Digital Future in Education – Together," *International Journal of Engineering Pedagogy (iJEP)*, vol. 8, (2), pp. 7-9, 2018. <https://doi.org/10.3991/ijep.v8i2.8228>
- [4] K. Matzler, F. Bailom, S. F. von den Eichen, and M. Anschober, *Digital Disruption: Wie Sie Ihr Unternehmen auf das digitale Zeitalter vorbereiten*. München: Vahlen, 2016. <https://doi.org/10.15358/9783800653799>
- [5] M. Rachinger, R. Rauter, C. Müller, W. Vorraber, and E. Schirgi, "Digitalization and its influence on business model innovation," *Journal of Manufacturing Technology Management*, 2018. <https://doi.org/10.1108/JMTM-01-2018-0020>

- [6] O. Gassmann, K. Frankenberger, and M. Csik, *Geschäftsmodelle entwickeln: 55 Innovative Konzepte mit dem St. Galler Business Model Navigator*. München: Hanser, 2013.
- [7] D. J. Teece, "Business Models, Business Strategy and Innovation," *Long Range Planning*, vol. 43, (2), pp. 172-194, 2010. <https://doi.org/10.1016/j.lrp.2009.07.003>
- [8] F. Vendrell-Herrero, G. Parry, O. F. Bustinza, and E. Gomes, "Digital business models: Taxonomy and future research avenues," *Strategic Change*, vol. 27, (2), pp. 87-90, 2018. <https://doi.org/10.1002/jsc.2183>
- [9] J. Loonam, S. Eaves, V. Kumar and G. Parry, "Towards digital transformation: Lessons learned from traditional organizations," *Strategic Change*, vol. 27, (2), pp. 101-109, 2018. <https://doi.org/10.1002/jsc.2185>
- [10] D. Veit, E. Clemons, A. Benlian, P. Buxmann, T. Hess, D. Kundisch, J. M. Leimeister, P. Loos, and M. Spann, "Business Models: An Information Systems Research Agenda," *Business & Information Systems Engineering*, vol. 6, (1), pp. 45-53, 2014. <https://doi.org/10.1007/s12599-013-0308-y>
- [11] S. C. Müller, M. Böhm, M. Schröer, A. Bahkirev, B. C. Baiasu, H. Krcmar, and I. M. Welpel, *Geschäftsmodelle in der digitalen Wirtschaft. Vollstudie, Studien zum deutschen Innovationssystem*, No. 13-2016, Expertenkommission Forschung und Innovation (EFI), Berlin, 2016. Available: <http://hdl.handle.net/10419/156641> [Accessed Nov. 15, 2018].
- [12] Bundesministerium für Bildung, Wissenschaft und Forschung, "Masterplan für die Digitalisierung im Bildungswesen," Available: <https://bildung.bmbwf.gv.at/schulen/schule40> [Accessed Nov. 15, 2018].
- [13] Bundesministerium für Bildung, Wissenschaft und Forschung, "Digitale Grundbildung," Available: <https://bildung.bmbwf.gv.at/schulen/schule40/dgb> [Accessed Nov. 15, 2018].
- [14] J. Lindner, "Entrepreneurship Education," in *Handbuch Entrepreneurship*, G. Faltn, Eds. Wiesbaden: Springer Reference Wirtschaft, Springer Gabler, pp. 407-423, 2018. [https://doi.org/10.1007/978-3-658-04994-2\\_35](https://doi.org/10.1007/978-3-658-04994-2_35)
- [15] Y. Sedelmaier and D. Landes, "How Can We Find Out What Makes a Good Requirements Engineer in the Age of Digitalization?" *International Journal of Engineering Pedagogy (iJEP)*, vol. 7, (3), pp. 147-164, 2017. <https://doi.org/10.3991/ijep.v7i3.7424>
- [16] P. Holzmann, E. Hartlieb and M. Roth, "From Engineer to Entrepreneur - Entrepreneurship Education for Engineering Students: The Case of the Entrepreneurial Campus Villach," *International Journal of Engineering Pedagogy (iJEP)*, vol. 8, (3), pp. 28-39, 2018. <https://doi.org/10.3991/ijep.v8i3.7942>

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