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SENIORPRENEURSHIP AS AN OPPORTUNITY FOR SUPPORTING SCIENCE AND TECHNOLOGY TRANSFER AT UNIVERSITIES

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Keywords: seniorpreneurship, knowledge transfer, intrapreneurship, technology based start-ups

1. Demographic change and entrepreneurship

Societies in Europe are aging rapidly. This change creates challenges for a fair coexistence of generations as well as new perspectives regarding the professional careers of young and old people. Little discussed, though, is the question of how an aging society may remain innovative and successful in creating demanding and competitive jobs. Since the driving forces behind these processes are the qualified and forward-thinking entrepreneurs of a technology based society, one may well worry whether, in the future, we will witness a lack of company founders?

Over the next forty years the working population will decline by 16 % according to estimates by the European Commission. At the same time it is expected that the population group of pensioners will grow by 77 %. *Theil* predicts for the U.S. a "golden age of innovation" [Theil 2010], where the average age of entrepreneurs will increase from 37 to 39 years in 2030 (in the EU over the same period from 40 to 45 years). Inevitably, we will have to overcome the cliché that only a smart and young entrepreneur will be successful because of his contemporary education. Especially when it comes to start-ups in high technology, the average founder is a 40-year-old engineer or manager who is married, has children, and claims his professional independence from the scene, no longer wanting to work for others. This is one of the major results of a study from Duke University, in which 549 successful technology entrepreneurs had been interviewed with regard to their motives to start a new business [Wadhwa et al. 2009].

How serious do we finally have to take *Schirrmacher's* prediction of a "Methuselah Conspiracy" [Schirrmacher 2004] as a threat to societies, in general, and Germany, in particular? He fears that the retiring "baby boomers" as a generation are confronted with offensive stereotypes accusing them to be forgetful, sick, weak, selfish, unimaginative, boring, ugly, tired, lazy, exhausted, hard-hearted and evil. On the other hand, *Theil* speaks of the "good news" that more and more "baby boomers" are actually becoming successful as entrepreneurs and, thus, play an increasingly important role as employers for new generations. Indeed, this behavioural scenario is statistically confirmed in the U.S., where entrepreneurs at the age of over 55 years are comparativly twice as likely to prevail in the market as their younger rivals between the age of 20 and 35. Moreover, *Stangler* [Stangler 2009] predicts for the U.S. both an increase in the average age of the entrepreneur and a general decrease in the number of entrepreneurs younger than 35 years.

Similar investigations are currently being conducted for Europe and especially for Germany, the country with one of the oldest populations (Figure 1). Accordingly, one can identify initial trends that illustrate and underline the growing social as well as economic importance of seniorpreneurs. Already one third of the newly formed companies is currently built on the initiative of 50+ entrepreneurs, i.e.,

founders who are 50 years and older. The tendency of the increasing life age of start-up entrepreneurs continues to be progressive and, therefore, can be regarded as a continuing trend [Meyer et al. 2009].

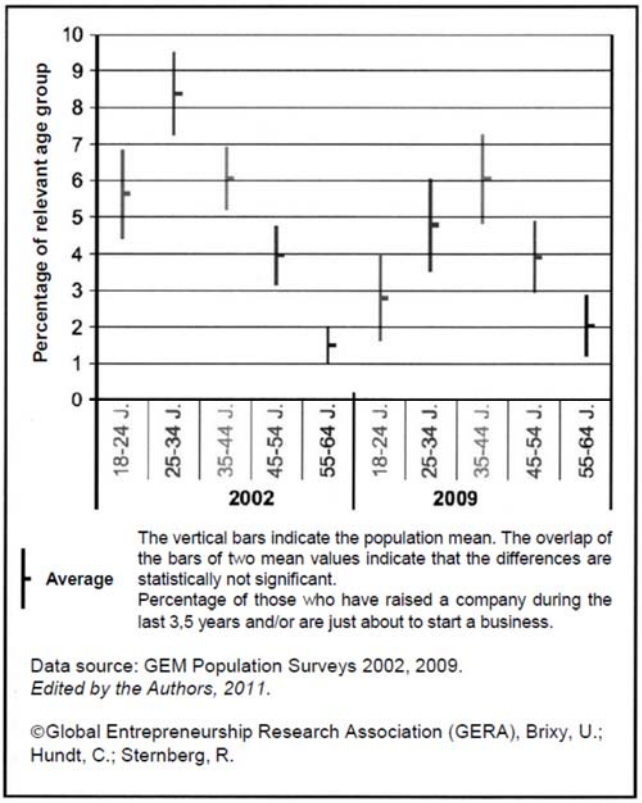

Figure 1. Total early-stage entrepreneurial activity (TEA)

As the average start-up entrepreneur tends to get older, it seems likely that he differs in his interests, traits, and competencies from the typical profile of the young start-up founder. With regard to the industries targeted by the newly formed companies, it is noticeable that young entrepreneurs often favor software and IT start-ups, while older entrepreneurs in their late 40s to early 50s belong to the growing age group which is engaged in the research-intensive knowledge industry [Metzger et al. 2010]. These different profiles of start-up-entrepreneurs are confirmed by *Gottschalk* and *Theuer* in their study on "The Impact of Demographic Change on the Start-up activity in Germany" [Gottschalk et al. 2008].

If one tries to weight the start-up-relevant profile characteristics that have high relevance for successful entrepreneurial acting, it becomes evident that the level of individual education and training plays a crucial role. As a consequence, one can expect future academics to be not only of great importance for research and development, but that they will also play a crucial role later on in their career as high-expectation entrepreneurs. Indeed, the group of seniorpreneurs could probably participate much more in the start-up scene, if only their doubts concerning their own abilities could be eliminated [Werner et al. 2008]. The previous findings suggest that a determining factor of success in entrepreneurship is whether future seniorpreneurs have access to training and advisory services. These povide both general entrepreneurial know-how as well as specific methods and tools to determine the prospective success of a strategically planned entrepreneurial start-up. This aspect is crucial, as older entrepreneurs often tend to cancel the creation process, if the performance targets are in question [Werner et al. 2008]. Moreover, they will wish to make this decision as early as possible before starting a business.

This desideratum is also highlighted by the World Demographic & Ageing Forum. On the World Ageing & Generations Congress at the University of St. Gallen in 2009 the conditions of a high professional competence, a success-oriented entrepreneurial approach, and the ability of a critical self-assessment in one's own abilities as a seniorpreneur stood in the foreground. An active and systematic

promotion of entrepreneurs aged 50+ is considered to be a useful and valuable investment in the maintenance of the European welfare states, given that the number of approximately 12 million self-employed people in this age group all over Europe has to increase significantly over the next 20 years because the welfare states will depend on the entrepreneurial achievements more than ever. In Germany, the number of seniorpreneurs is about 1.6 million with a strong growth potential [Cannon et al. 2010].

This paper examines how, on the one hand, the generation of entrepreneurs 50+ should be addressed, in order to raise their interest for training services to improve their skills, but also, on the other hand, how young entrepreneurs and students can profit from the seniorpreneurs' expertise in production processes and market knowledge as well as from their networks.

To promote the promising synergies arising from the collaboration of young and elderly entrepreneurs, the University of Magdeburg in Germany initiated the project titled „Senior- & Juniorpreneurship" (SeJu), which is funded by the Ministry of Science and Economics of the State of Saxony-Anhalt. By accessing an educational platform for inter-generational interaction, seniorpreneurs have the opportuninty not only to engage in lively interactions concerning their entrepreneurial ideas, but also to benefit from personal standpoints, current academic knowledge in technology and business, and, last but not least, from the enthusiasm of future entrepreneurs.

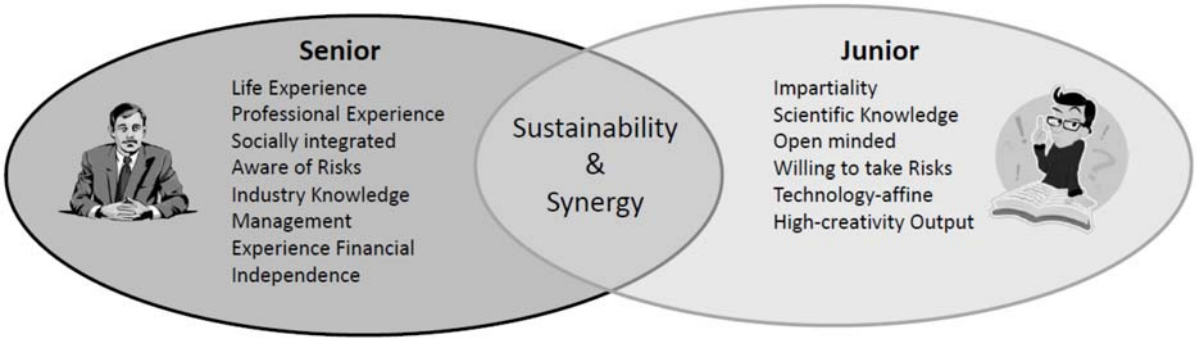

Figure 2. Combining senior- and juniorpreneurship [own illustration]

During the past six years of actively supporting university start-up projects by the chairs of entrepreneurship and engineering computer science (explained in more detail in chapter 2) it became noticeable that the target groups of 'Seniors & Juniors' have clearly differentiable and equally complementary properties (Figure 2). It is important to know these characteristics and behavioural manners to be able to fully exploit the synergy potential. Based on the long-term cooperative project work within the university it has been shown that the experience as well as knowledge advantages of both age segments must be considered to mitigate the potential risks during the process of founding a company. This, as an example, can be demonstrated by revisiting the founding history of the company 'InerSens', which develops specific sensors in the field of medical technology. The start-up entrepreneurs consist of a team of experienced IT-System developers (Seniors) in coalition with young graduates from engineering and business administration [Kauert 2011].

2. Integrated product development and business plan design

SeJu is a university-based project that facilitates technically oriented start-ups of founders with a professional, yet non-entrepreneurial background. Specifically, SeJu offers the possibility to develop product ideas technically while, at the same time, constructing a business plan for a firm to successfully implement a mature product on the market (Figure 3). The project extends the intensive collaboration since the year 2005 at the University of Magdeburg in Germany between the chair of Information Technologies in Mechanical Engineering (Sándor Vajna) of the Faculty of Mechanical Engineering and the chair of Entrepreneurship (Matthias Raith) of the Faculty of Economics and Management. Taking advantage of the synergies already mentioned, participants obtain the opportunity of learning how to create high-growth start-ups.

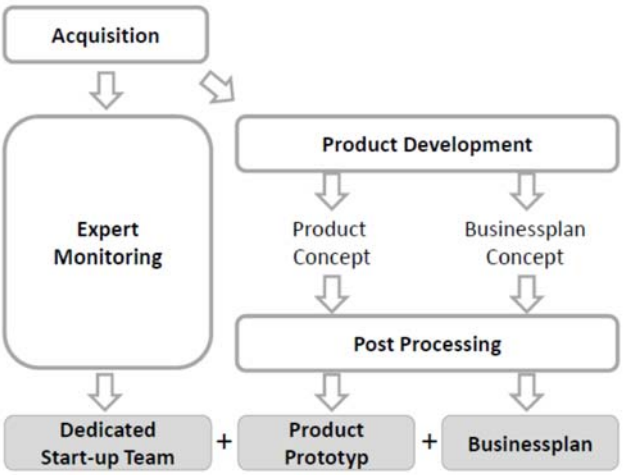

Figure 3. Output of the SeJu project

The design of the 'SeJu' project is inspired by the so called 'Clinic Program', developed by Harvey Mudd College in the U.S. It's considered to be an "extraordinary program of collaboration between industry and Harvey Mudd College that has been a hallmark of this institution for close to 50 years, engages juniors and seniors in the solution of real-world, technical problems for industrial clients." Even the organizational teaching and learning process as well as research and transfer are designed quite similar although both initiatives were raised independently from each other [HMC 2012].

A prerequisite for being able to capture the high-growth potential of promising start-ups was a prior, completed R&D project with the title "High-Expectation Entrepreneurship" (funded by the German Ministry for Education and Research from 2008-2010). The exploration and simultaneous implementation in cooperation with actual start-up projects and early-stage companies was aimed at bringing the latter into a high-growth phase right from the outset. One of the most important results of this project was to trim start-up enterprises already in the phase of business planning to consstently exploit all analyzable entrepreneurial opportunities [Raith 2011]. The high-expectation approach neatly complemented the principles of Integrated Product Development (IPD), operated at the University of Magdeburg [Vajna 2001]. IPD requires a consistent vision of the entire product life cycle, meaning that the interaction between product and process is paramount. As a consequence, the product developer is faced with the task of synchronizing the creation of a product with the production process all in one. The derived goal is to create a consistent product, while ensuring a demand-oriented production, use, and disposal.

Nevertheless, even if a start-up company succeeds in bringing an innovative product to the market, there still remains the question regarding its profitability. On the one hand, "under modern conditions of competition, it is becoming increasingly hazardous not to innovate. The firm that does not maintain a program of managed innovation can quickly find itself behind competition" [Yoon 1985]. On the other hand, the same authors point out that "a survey of 148 companies... indicates that only half of the companies have achieved successful performance in two thirds or more of their new industrial products. In a study of 122 industrial product innovations... of every 100 products that are fully developed, only 60 become a commercial success." This describes a fundamental dilemma that "New Product Development speed is critical, because product life cycles are shrinking and because obsolescence is occuring more quickly than in the past, while competition also has intensified, although all in all one must take into account that…" the valence of the link between development speed and new-product profitability is unclear at this time [Langerak et al. 2006].

However, turning a concept into a profitable product is a challenging issue for all involved "and requires people from multiple disciplines to work together. New Product Development is a complex, collaborative process that requires coordinating the innovation efforts of many to meet a common goal" [Brown et al. 2005]. In order to find a reliable approach to implementation in practice, Aberdeen's Product Innovation Agenda stands out as particularly important by emphasizing that

"companies that are best-in-class at new product development and introduction tend to have (...) a senior manager (who) is directly responsible for overseeing the full process of identifying innovation, opportunities, engineering them, developing them into products, and bringing them to market." As a head of team this "senior" is a necessary "coxswain," who steers a project through the technical as well as the entrepreneurial process, while realizing the strategic and tactical success criteria that have been earlier developed in the business plan with the participation of the entire team.
This is where business-plan design comes into play. The finding that both an innovative product as well as the targeted market must perfectly fit together is insufficient. A third and mission-critical component is the strategic positioning of the company itself. For a start-up company, this implies that market, competiton, customer, price and product distribution concepts already have to be worked out before communication on the product begins between the company and the market. This is essential, because strategic errors that are made at this stage of development cannot be reversed without large losses. On the other hand, in the strategic development of the relationship between company, product and market there lies a business opportunity to transform a product innovation into a high yield value. To achieve this, business planning has to be taken seriously: it is always in reference to a future reality. Just as the creation of a new and innovative product design benefits from a view what future demands will be, entrepreneurs also should anticipate the needs of tomorrow's consumers. These are crucial aspects for the design of the company. A central question is, therefore, if the economic success of a company that comes with a new product can be achieved by business planning and whether this success is scalable. As the practical and theoretical support for start-up companies in the previously mentioned project "High-Expectation Entrepreneurship" revealed, entrepreneurial success can be designed and does not necessarily occur accidentally.
After the issue of predictable business growth of start-ups had been discussed since the early 1990s, especially in the US, by the end of the millennium the interest shifted from "if" to "how" growth can be achieved. A noticeable break in this discussion finally was the transfer of what was previously thought into a application-based strategy. When in 2005 *Kim* and *Mauborgne* first published their book on "Blue Ocean Strategy" [Kim et al. 2005] it was an unusual idea, even for economists, that in addition to a "Red Ocean" of competition, a "Blue Ocean" should exist. This idea arises from the assumption that high growth and, as a consequence, profits can be generated by creating new demand in untapped market segments. This is significantly different from a concept that just aims at being faster, better, or cheaper than competing market participants. Therefore, instead of providing a daily head-to-head race, companies are invited to seek non-competitive or weakly-competitive market niches that arise from their innovations. Accordingly, they bypass the competition and also obtain the opportunity to present their demanded prices at the value of the customer's need, which increases the unit value of their offered goods. Properly understood, this strategy concept may also address the problem of unlimited speed of New Product Development – with the early employment of appropriate analytical tools for business planning, sound product innovations can be established to be more valuable and sustainable on the market.

3. Facing the problem of start-ups without entrepreneurs

If one views the combination of Integrated Product Development (IPD) and growth-oriented business planning as a "recipe" for the success of start-up companies, the question arises why start-ups are not continuously being initiated through this approach. By taking a look back at the cooperation between IPD and business planning at the University of Magdeburg, one recognizes that the successful implementation of the concept requires a crucial "ingredient," which all to often is missing at universities: The entrepreneur. The reason for this is known and, therefore, not surprising. Universities are excellent breeding grounds for new product ideas and their transformation into innovative products as well as their profitable commercialization through start-ups. Yet, to deliver products to the market, one must also have entrepreneurs.
The people at universities mainly involved in innovation through research are students, graduates, and professors. Students generally have the primary interest to successfully finish their studies. They also argue that they lack the professional experience to establish a firm. "Not yet" is an often-heard response to the question whether they can imagine starting a business with a promising product idea.

Academic staff, which includes graduates and professors, often have the preference to do research on other or further going innovations, rather than bring them to the market by establishing a company. Overall, the result is that there is a significant lack of suitable entrepreneurs at universities.
Against this background, one of the fundamental motivations for the development of the SeJu project was to find individuals who would actually implement an entrepreneurial idea and who also had the appropriate skills. Over the years, sophisticated design and business plans had been accumulated in the archives of the cooperating academic chairs at the University of Magdeburg, waiting for their implementation. Once the idea was born to look for entrepreneurs outside the university, it developed into an agenda to implement already developed products and create further business plans.
After this intellectual step was taken, one could not only imagine a business founder outside the university, but the idea of addressing existing businesses also evolved. Specifically, this meant that existing companies could integrate a new project in collaboration with the SeJu project in the form of a profit center, in order to take it further – as in an incubator – to market. Given this interaction between research & development on the university's side and profitable product selling on the business side, there remains the question of who should receive the return on investment at the end? How could the yield be divided fairly among the interacting partners? And how would the university handle its share internally?

4. Research & development changes to science & technology transfer

These questions lead directly to the center of the debate on science and technology transfer from universities to society. With the beginning of the last decade, the universities in Europe face a strong challenge to develop structures that are suitable to transform scientific innovations into economic value. This economic postulate stems from the realization that the innovativeness of an economy strongly depends on the efficiency and transfer power of research institutions. For private research institutions, the incentive for their transfer activities is given, because it usually involves contract research from industry. Actors in public research institutions, however, are committed to their research and teaching and do not have the task to exploit their work economically, neither for themselves nor for their academic institution. However, the situation in the increasingly knowledge-based society has changed: because new knowledge has become an asset and must be used as a resource in the value-creation process of economies. It is, therefore, not surprising that politicians and business leaders are recently speaking of the "entrepreneurial university". This term primarily means that, in particular, universities and research institutions are asked to find efficient ways to make research results available for economic use. Since public science in Germany is publicly funded, additional benefits should make such a transfer attractive for appropriate scientific institutions.
In practice, universities and, specifically, faculties and scientists, must be able to draw their own benefit from scientific transfer. Moreover, they must be allowed to use the gained benefits (e. g., money) according to their own preferences. To initialize this function, two important requirements must be met: It is a necessary condition for any research transfer of public scientific research institutions to examine and to assess the value of innovation. The resulting knowledge concerning the extent and quality of the determined transfer potential can be made available for different utilizations in a next step. Possible transfer partners can be start-ups from universities and research institutions, start-up managers from the outside of universities and already existing companies interested in intrapreneurial opportunities, or third parties engaged in buying and selling research with high economic value on the world-wide market. If one accepts such a comprehensive concept of Science & Technology Transfer, one must logically understand the process itself as a topic in research and development as it is done e.g. in the research project "Universities as Enterprises" (Uni:prise), which is tied to the Chair of Entrepreneurship at the University of Magdeburg. As far as currently predicted, an institutionally supported knowledge transfer requires two additional conditions. They relate to the recognition of the importance of value innovation and negotiating skills.

5. From product innovation to value innovation

Any successful utilization depends on the communication with transfer partners. Innovative products or services are not taken up by companies without reason. Promising co-operations have to be

analyzed in advance, especially regarding the willingness and the ability of a product-to-market strategy. This is important because not only a product has to be innovative in order to be successful, but also the market. In other words, the customer wants to understand why a product innovation is a value innovation (is a buy worth the money?).
Indeed, it is necessary to evaluate the degree of innovation of a new or established product. This task has to be executed by the management of a company in order to assess technical risks. In terms of market success through differentiation of a product by its novelty, however, the customers' perception is relevant. As a consequence, the company-specific perception of the degree of innovation of a new product has to be separated strictly from the customers' perception. This makes sense particularly in such cases where entrepreneurial opportunities result from using familiar technology in new products, brought to selected markets where this technology is still unknown [Pahl and Beitz 2005]. This idea was a significantly important basis for the development of what was later considered to be an entrepreneurial "Blue Ocean Strategy."
If these conditions are fulfilled for the customer, a carefully selected transfer partner would be able to use his company's resources, e. g., production, sales and marketing, to realize a value-creation process in short time. Regardless of which form of transfer is chosen, an experienced entrepreneur or manager is always required to design and implement the described process of value-adding support (Figure 4).

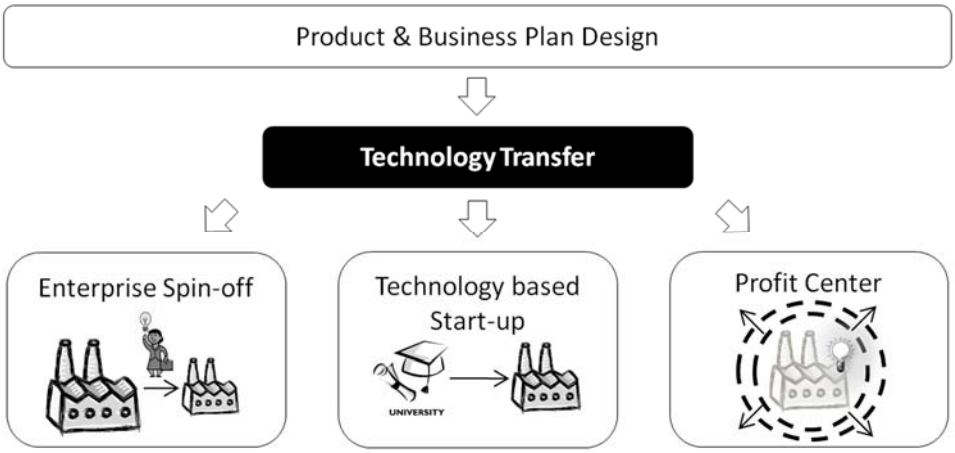

Figure 4. Variants of technology transfer

6. Negotiation and contracting

The value of an entrepreneurial product innovation promotes the growth of a company. This results in an assumed value, which is appreciated at the time of sale on the basis of a current and carefully developed business plan. A research goal is, on the one hand, to use evaluation models for value taxation, and, on the other hand, to develop cooperative negotiation models, which allow differentiated solutions and support. Methodological knowledge of this type pays off when it comes to negotiating and enforcing best value strategy. From case to case, it may be advisable to opt for different negotiation objectives. For instance, an exit strategy may be useful if a product innovation is to be sold for one-time payment under the assignment of all rights. But more important is the use of scalable business models that allow for investments in transfer companies by scientists or scientific institutions. Results of negotiations must be sustained and also legally fixed. In-depth knowledge of contract law is important so that corporate investments are completed safely.
The perspective that emerges from this representation is the possibility for "entrepreneurial universities" and research institutions to be permanently refinanced through business investments and private equity engagements. As a consequence, public research institutions may join in the long run the goal of establishing research priorities which are no longer dependent on public funding. In this way, science has the option to reach a hitherto unknown degree of freedom in the selection, design, and utilization of scientific knowledge. Of course, this requires the need for entrepreneurial thinking

by players on the institutional side of science. Questions like "what kind of progress does society need in the future?" act on the actual orientation of research. The performance of research in science, then is no longer "apolitical" in the sense of freedom of teaching and research, but "political" because it is placed on the basis of responsible and conscious decisions. This means that, on the one hand, the degree of freedom of a scientific actor increases when he is engaged in such a form of "entrepreneurial research." On the other hand, the degree of individual as well as institutional "entrepreneurial responsibility" increases. Suddenly, it becomes imaginable that students, scientists, entrepreneurs, companies, or even investors from the public area are probably willing to participate in a entrepreneurial research institution. This can be expressed by financial investments, but also by participation in utilization-related research projects. However, this ensures that recovery-related research in public research institutions is controlled by shareholders, investors, stakeholders and actively involved and rewarded scientists.

7. Seniorpreneurs: Mastering complexity in entrepreneurial decision making

Considering the conditions for a successful transfer of science and technology, the complexity of the issue becomes visible. One of the most significant barriers to change public research institutions into a concept of entrepreneurial science is the necessary inertia concerning decisions. In this context, it is perhaps easier to understand why even young, capable, and well qualified students and researchers can be overwhelmed by the role of the entrepreneur in a science-based start-up company.
Nevertheless, these concerns should be taken seriously, since they point to an interesting constellation. The experience in the SeJu project at the University of Magdeburg shows that product developers, economists, engineers, designers, or even psychologists, who are part of an interdisciplinary team (Figure 5) like to put their work under the guidance of an experienced seniorpreneur. Looking at the history of cooperation between the two involved university chairs, the balance can be described as outstanding and frustrating at the same time. From the standpoint of research and devolpment, the balance is excellent with over 16 product innovations and business plans for entrepreneurial implementation. From the perspective of science and technology transfer, the net result is an urgent request to implement the accumulated value creation potential into the market.

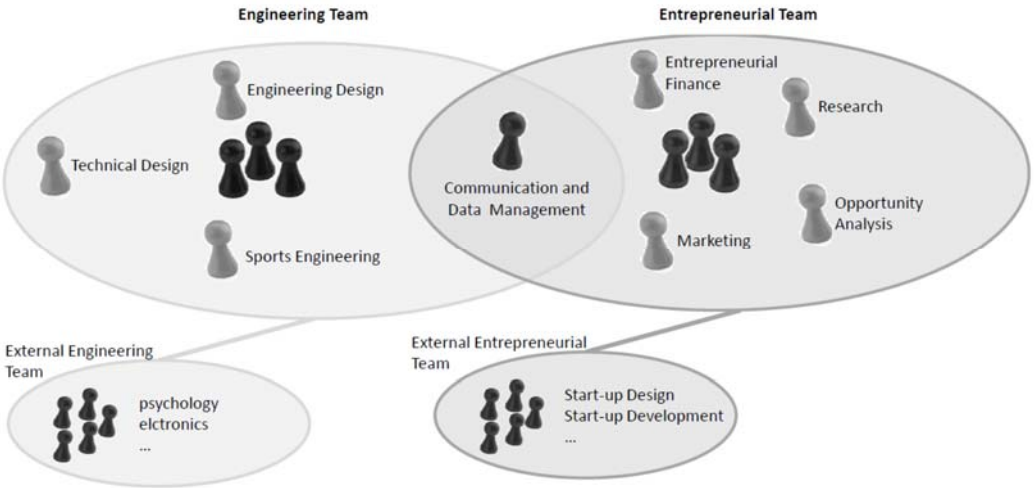

Figure 5. Organizatinal SeJu chart

Can this unsatisfactory state of a science and technology transfer be improved by the integration of experienced seniorpreneurs? Recent experience arising from the SeJu project supports this assumption. Having managed to inspire an active entrepreneur for a start-up idea, he integrated himself as the "Head of Team" and the "Decision Maker" into the process of product and start-up design. Right from the start of this project, it became evident that all people involved experienced a boost of motivation for their work. A major reason for this was that all parties realized that their development work went into an actual business establishment. A significant side effect is that students and staff learned about

entrepreneurial thinking and acting for practice. One must not underestimate this aspect, because these experiences trigger in all people involved an ongoing process of reflection about whether they themselves could be future entrepreneurs. A project such as SeJu invites young and intelligent people from nearly all scientific disciplines to study the stresses and rewards of entrepreneurs, to become familiar with risks and threats, but also with the strengths and opportunities of entrepreneurial ideas.

8. Conclusion

To become an entrepreneur or not equally depends on environmental influences and individual decisions. To make decisions is the high art that an entrepreneur needs to dominate and to exercise. The resulting experiences of good decisons in practise, together with the necessary knowledge of the theoretical foundations, characterize the type of entrepreneur that is able to establish a concept of an "entrepreneurial university."

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