



Theory Meets Practice

Interdisciplinary Approaches
to Master a Smart Future



Conference at Dresden International University
Dresden, Germany, 2015
Proceedings

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Preface

The whole world is connected more than ever and especially scientific fields have moved closer together, not only among each other, but with the practice as well. It is a necessity to acknowledge these connections and draw information and innovation from them. Every human on Earth faces the globalized challenges of science and practice and should be prepared for the upcoming “smart future.”

Our conference had the aim of explaining certain issues of our modern world and suggesting possibilities to overcome them. We would like to thank DIU for opening their doors for our purposes and express our gratitude to all attendees of the conference.

Everybody uses and thinks to know it, but most of the time, its potential gets overlooked: Wood. Wood has been used as a resource by humans for a very long time, however its usage has steadily decreased since the industrialization started in the 19th century and better materials became widely available. However, wood could make a comeback as modern technology offers opportunities to enhance the structure of the material, which could possibly put it on par with other materials. This would change everybody’s daily life drastically, as it would mean that many products and whole cities could be completely redesigned. If you are interested in sustainable wood farming “forestry 4.0” and the technological advancement in the usage of wood, you should take a look at *The Misconception of Wood – Why the dated is more up-to-date than ever* by Nils Knüppel.

Nils Knüppel is a sixth-semester student of forest sciences and a fourth-semester student of process engineering, who takes great interest in the development of wood as a modern resource.

As wood seems to get a technological boost, the production of other materials is also experiencing great steps forward: “Selective laser melting” as a relatively new process that

allows the production of highly sophisticated metal parts by using 3D CAD data and a high-power laser beam to fuse metal powders together. This process is already used in aerospace, medical orthopedics and automobile production, but is still in its infancy, which means that its impact on all fields of production will most likely become even greater. You should take a look at *The Future of Materials Science and Engineering* by Omar Oday Salman to gain knowledge on this innovative topic.

Omar Oday Salman is an Iraqi Ministry of Higher Education and Scientific Research–scholarship holder as a PhD student at Dresden University of Technology (TU Dresden). He currently works on his PhD thesis, which focuses on the selective laser melting technology.

While lasers use extremely high temperatures to form materials, cryogenics does something on the other end of the spectrum and uses very low temperatures that go beneath 120 K (−153 °C) to e.g. liquefy permanent gases. This technology makes way for new processes in the recycling industry as well as in the magnet technology industry. This field of study is more than likely to have an even greater impact than it already has had, as even lung disorders are starting to become more easily treatable thanks to cryogenics. If you would like to know more about this scientific field and its potential benefits or dangers, you should take a look at *Cryogenics – The science of the super-cold* by Marc Fuchs.

Marc Fuchs is a student of mechanical engineering in his tenth semester at TU Dresden and focuses on cryo-engineering.

To round the work about STEM fields off, what could be a better topic than the fifth generation (5G) of wireless communication? The progress of the wireless communication technologies has gained momentum ever since their introduction to the world and has led to many advantages, such as the installation of WLAN in every household and the possibility of watching videos in high quality with your smartphone. The next step is 5G, which will mainly focus on enhancing the connections between machines in order to achieve a higher rate of support by machines during the normal day of a person. This opens the door for a truly “smart future.” If you are interested in the technology of 5G, you should have a look at *The fifth generation (5G) of wireless communication makes the future more than smart!* By Mohamed Ahmed.

Mohamed Ahmed is a DAAD scholarship holder as PhD student at TU Dresden. He focuses on antennas and propagations and takes great interest in electromagnetics, communications, electronics, and antennas.

Onwards to the humanities and a topic that has become more important to many people all over the world in the last fifty years: Coaching. The complicated world of today's work environment requires experts as a supportive aid that ensures a successful corporation. The rate of success of coaching programs done by professionals is extraordinarily high and most over-performing corporations use it to ensure success and happiness of their employees. You can read up on why that is in *Coaching: An effective way to promote and develop performance* by Ulrike Röthig.

Ulrike has studied psychology and been self-employed as a coach for a couple of years. She returned to university to study business sciences and is currently in her fourth semester.

Last, but not least, every scientific field is somewhat connected to business, as the globalized markets demand of technologies to not only be able to solve problems, but also to be able to sell well. The greatest innovations of the last forty years were developed and introduced to the market by "start-ups." However, Germany, despite being one of the most innovation-driven countries of the world, has shown to be unable to establish a healthy and successful start-up culture, which led to the country staying behind in international comparison. The issues of German start-up founders regarding corporate financing, management and marketing as well as some psychological aspects will be explained in *Start-up Companies – How German business culture needs to change* by myself, Johannes Goldhan.

I am a student of business sciences in the fourth term at TU Dresden and take great interest in accounting, financing and managerial processes.

I wish you a beneficial reading!

Dresden, July 2015

Johannes Goldhan

Organization

Theory Meets Practice was organized by Dresden University of Technology with affiliations of Teaching Centre for Languages and Area Studies and Dresden International University. The conference was part of a project course during summer term 2015.

Course Instructor

Dr. Silvia Scheinert

Chair of the Conference

Ms. Ulrike Röthig

Finance and Sponsoring

Mr. Marc Fuchs

Mr. Johannes Goldhan

Technical Realization

Mr. Mohamed Ahmed

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Mr. Omar Oday Salman

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Presenters

Mr. Mohamed Ahmed

Mr. Marc Fuchs

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The Misconception of Wood – Why the dated is more up-to-date than ever

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Abstract. While wood as a commodity has accompanied mankind for some time, it is seldom accounted for as being high-tech. Modern forestry dates back to the 18th century, when the principle of sustainability was first introduced to the industrial society to counter wood shortage. Nowadays, *sustainability* is oft-cited, though with little consequence. The uniqueness of a biological production prevents its adoption to the conventional industry. Renewable base materials that are otherwise inaccessible are transformed into usable biomass.

Wood, albeit it has been utilized for thousands of years, now reinvents itself with new processing technologies in combination with other disciplines. The variety of the material makes it on the one side applicable to many technological questions, but also difficult to handle on the other side. For example, thirty-story wooden constructions are possible as of today. Yet a restrictive legislation and inexperience forestall the sight of such buildings. Raw timber is merely the starting point and it is up to interdisciplinary teams to exploit its versatility.

The management of forests is subject to change as well. Timber harvest was mechanized with the advent of harvester machines. Microcontrollers and real-time mensuration capabilities have automated the on-site processing. Nonetheless, wood production conflicts with other demands on forests, e.g. the preservation of biodiversity and ecosystem services, or recreational functions.

This talk leads the audience from the merits of forestal production to the old and the new management of forests and concludes with a discussion about the next generation of forestry, *forestry 4.0*.

Keywords: Forestry 4.0, Multi-functionality, Processing technologies, Resources, Sustainability, Wood

Introduction

Wood as a material has mixed connotations. Some enjoy the sight of it, the touch of wooden surfaces, or the ambiance it creates; the major mindset I however encountered in the course of my studies was that wood is (a) an insignificant, featureless material, (b) burns and perishes quickly, and (c) utterly expensive for the little gain. The foremost misperception of it was the sense of obsolescence and low-tech.

This talk aimed to clear up the misconceptions of wood and provide insight into recent developments in the utilization of wood as such. It also was to background on the supply of wood, to complete the whole value chain of wood, as it plays an important role for its image. The talk finished with a prospect of future forest management, which is introduced as *forestry 4.0*.

1 Sustainability

The value chain of forest products is indivisible from the principle of sustainability. It is recorded that sustainable forest concepts have been developed several times throughout the latter half of the second millennium. (Marsch, 2013a) Early examples are the Sachsen-spiegel in 1215, Erfurt municipal forestry in 1359, or Saxonian Forest Regulations in 1560. (Marsch, 2013b; Sachsen, 1560) Be that as it may, the situation escalated with the advent of industrialization in the 18th century and an unprecedented demand for charcoal. In turn, forests were exploited and a wood shortage, known as “Holznot” announced itself. (Marsch, 2013b)

In 1713, Freiburg, Hans Carl von Carlowitz postulated in his renowned work *Sylvicultura oeconomica* the principle of sustainability: “Timber is to be grown in such a way that it ensures continual, steady, and sustainable use.”¹ (Carlowitz, 1713, pp. 105–106) Modern forestry is based on this principle and the production of wood is ecologically compatible.

2 Wood Utilization

Wood as a resource is not only abundant, but also versatile in its utilizations and in many cases preferable to other, more recently discovered materials. Some of those uses were presented in the talk, knowing that such brief outlines cannot claim completeness.

Timber is a term for raw logs that are debarked and cut to assortments, but not machined any further. The use of timber is ubiquitous, as furniture, beams and frames in construction, and decks and covers are widely made out of wood. Advanced machining of wood can result in veneer or particle- and fiberboards as pre-products.

The merits of wood are its strength by maintaining a comparably low density. The tensile elastic modulus can reach from 5 to 20 GPa, as compared to 210 GPa (Steel),

¹ “Anbau des Holtzes anzustellen daß es eine continuierliche beständige und nachhaltige Nutzung gebe.“ Carlowitz, H.C. von, 1713. *Sylvicultura Oeconomica*, Oder Haußwirthliche Nachricht und Naturmäßige Anweisung Zur Wilden Baum-Zucht. Braun, Leipzig.

105 GPa (Titanium), 45 GPa (Magnesium). (Leyens, 2014; Wagenführ, 2015) Engineered wood and wood composites reach more than 300 GPa tensile elasticity. (Wagenführ, 2015) At the same time, density is lower by one to two magnitudes: 0.1 g/cm^3 to 1.1 g/cm^3 for wood and up to 3 g/cm^3 for wood composites compared to 2 g/cm^3 to 30 g/cm^3 for metals. (Bues, 2012; Wagenführ, 2015)

3 Forest Management

3.1 Generational Classification

Forest management is closely linked to harvesting methods and technology. Hereby, one can distinguish three radical changes, or generations, in forestry:

The first and by far longest stage was cutting and delivering trees manually with different tools like axes or saws. Smaller trees were carried or pulled by hand, larger segments by logging horses, and whole woodpiles by drifting on waterways. These methods are still in use today, albeit in regions with no access to conventional, modern equipment or in private uses.

With the advent of gas-operated, manageable chain saws in the '20s and '30s, harvest operations became fully mechanized. The chain saws were used to fell trees, de-limb and cut the logs; whilst tractors and stationary machines pulled the logs to a forest road or the next terminal. (Erler, 2013)

The current generation of forest management is the ongoing automation of forest labor. Stationary processing machines of the early '70s de-limbed, debarked, and cut to lengths in one pass. Modern logging machines are highly mobile and move alongside logging trails to reach into the forest with a harvester aggregate that fells the tree, pulls it to the trail, automatically measures diameter and quality of the stem, de-limbs and cuts to lengths.

3.2 Next Generation Forestry

The next generation of forest management is in an area of conflicting interests. On the one hand, city dwellers demand naturalistic forests with little to no intrusion of forest operations; on the other hand, the demand for raw wood rises steadily, as new wood-based products are developed and more biomass is used for energy. As of today, short rotation plantations with willows and poplars have a reasonable output of biomass-for-energy, but lack recreational value.

I foresee further separation of these areas of interest in that areas in the proximity of cities are abstained from forestal production, but on other, remote areas high yielding plantations are established that overcompensate the discontinued conventional forest management in some areas.

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The Future of Materials Science and Engineering

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Abstract. From the dawn of human existence, materials have been fundamental to the development of civilization. Anthropologists' definition of the historical eras is given by the materials used by various civilizations such as the Stone, Copper, Bronze, and Iron Age. The different rates of development towards more complex materials between the cultural groups are associated with different levels of innovation and the local availability of these materials, and led to different standards of living.

Materials science and technology take an interdisciplinary approach to science that includes the design and select and use three main classes of materials—metals, ceramics, and polymers. Materials science combines several areas of science (chemistry, physics, and engineering) to get better, more useful, and more economical and efficient “stuff.”

Selective laser melting (SLM) is one of the newly developed additive manufacturing (AM) – a process by which a product is made by melting selected areas of powder layers under a protective atmosphere, using a computer-controlled laser beam. A high-intensity laser beam selectively scans a powder bed, melting the particles which solidify to form a solid layer. A new layer of powder is deposited on top of the previously made solid layer and the process continues until the part is complete.

Key words: CNC, SLM, Powder Metallurgy

Introduction

Additive manufacturing, such as selective laser melting (SLM), is one of the options. Selective laser melting is able to produce parts with complex geometry and superior proper-

ties (1, 2). Moreover, it has been reported that additive production through SLM can help to achieve a significant reduction of energy and materials use (3, 4). Furthermore, application-oriented research such as the production of SLM of complex parts for biomedical and other industrial applications has also attracted considerable attention (5, 6, and 7).

Selective Laser Melting

The SLM process starts with a totally defined CAD model. Divided into cross sections through a special software, the model is then directly involved in the process. The important operation is the laser scanning over the surface of a thin powder layer previously deposited on a substrate. The molding process is going along the scan direction of the laser beam. Each cross-section (layer) of the part is successively filled with elongated lines (vectors) of molten powder. The quality of a part manufactured by this technology is highly dependent on the quality of each single vector and each single layer. Identification of the optimal parameters of the laser power and scan speed is a crucial task because these parameters are the most influential on the part's characteristics (porosity, hardness and mechanical properties).

Powder binding mechanisms, such as melting point and solid-state or liquid-phase sintering, depend on the temperature thus local temperature fields are important for the process stability and quality of the manufactured objects

The following index of process variables for SLM technology can be established:

- (1) *Powder*: composition, size distribution, shape, optical and heat transfer properties, thickness of deposited layer for each cycle of fabrication.
- (2) *Laser*: power, spot size, beam spatial distribution, scanning velocity and application of protective gas atmosphere.
- (3) *Strategy of manufacturing*: decomposition of each plane to be sintered on a number of elementary elements (vectors), definition of orientation and distance between them, definition of relative positions of elementary elements in two consecutive planes.

Conclusions

The obvious trend for miniaturization of devices and components in different applications makes it important to develop defined, repeatable, predictable processes of the production of objects with less than 1mm-sized inner structures. Using SLM technology in this purpose shows considerable promise and therefore requires research effort to maximize process stability and accuracy in respect of the desired dimensions of the final product (8, 9, and 10).

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Cryogenics – The science of the super-cold!

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Abstract. Cryogenics is the study of concepts and technologies with the aim of producing and applying very low temperatures. We are referring here to a temperature range below 120 K ($-153\text{ }^{\circ}\text{C}$), a range in which permanent gases such as hydrogen, nitrogen, oxygen and helium begin to liquefy.

Why do we need such low temperatures after all? After liquefaction, the mentioned permanent gases are called cryogenic liquids and mostly find their application in industrial and medical areas. Those are, for instance, in the technical gas industry, the transport, storage and separation of gases. Liquid hydrogen for example is used as rocket fuel. A further application of cryogenics is material treatment, since mechanical and electrical properties of many materials change extremely when cooled down. The recycling industry is making use of this effect as the recycling of a number of materials becomes much easier after their exposure to such low temperatures.

In magnet technology, the material property of superconductivity plays an important role thus establishing another application field of cryogenics. Here the exposure of material to very low temperatures leads to superconductivity. This phenomenon is utilized also for high-energy physics accelerators as used at CERN, but also for energy storage and, in the medical field, for magnetic resonance imaging (MRI). Further examples like cryosurgery and cryotherapy in the medical field, as well as storing, modification or destruction of cellular structures in biology point out other important applications of cryogenics. Not to forget the common procedure of food freezing in food factories.

Cryogenics has various applications in different fields and consequently invites, even demands, interdisciplinary work, and scientific cooperation. This talk will provide a general overview about this field of study and discuss some advantages and disadvantages

Keywords: Cryo-engineering, Cryogenic fluids, Hydrogen, Helium

1 What is Cryogenics

We could call cryogenics an extreme part of refrigeration. Therefore, we should first of all shortly clarify what does refrigeration mean. Refrigeration, in general, is the art of keeping an item below ambient temperature by transporting heat from one side, which shall be cooled, to the other, where we can release the heat e.g. to the surrounding. Cryogenics is the study of concepts and technologies with the aim of producing and applying very low temperatures. In this scientific field we are here now referring to temperatures below 120 K ($-153\text{ }^{\circ}\text{C}$), an area where permanent gases like oxygen, hydrogen, nitrogen and helium begin to liquefy. Permanent gases are gases which were once believed impossible to liquefy and therefore only exist in the gaseous state. Just as a quick reminder, the conversion from Kelvin into degrees Celsius is 273.15 , which means $0\text{ }^{\circ}\text{C}$ equals 273.15 K and 0 K equals $-273.15\text{ }^{\circ}\text{C}$. The lowest temperature ever recorded on earth is $-89.2\text{ }^{\circ}\text{C}$, 1983 in Russia (“Coldest Temperature Ever Recorded – Current Results,” n.d.). The lowest temperature in the universe is 2.7 K (“Absolute zero,” 2015). Boiling points of the most important permanent gases are 4 K for helium, 20 K for hydrogen, 77 K for nitrogen and around 90 K for oxygen. However, with cryogenics it is even possible to cool down to 280 pK which means 0.00000000280 K and, therefore, has cryogenics even surpassed nature by several orders of magnitude. The biggest issue of producing such low temperatures is the enormously high demand for energy

2 Chosen applications

There are many applications for cryogenics where I just want to pick out some of the most valuable. First of all we can start with the already mentioned liquefaction of permanent gases. This technique is used for example in air separation plants where air is separated into its components helium, neon, argon, krypton, and xenon. These elements can then be used for further applications wherever they are needed. A grand advantage of the liquid state of these permanent gases is their enormously reduced volume in comparison to their gaseous state. This important advantage is used to transport and store such gases or now called cryogenic liquids. Since many places where permanent gases can be liquefied do not yet exist, their transport by trucks or over pipelines is another important issue that needs to be addressed.

Reduction of thermal noise and excitation is another application for undisturbed measurements in the solid state, physics, and nuclear physics as well as for all superconductive applications. The largest application of superconductivity lies in magnet technology where it plays a very important role for high energy accelerators, for example the

Large Hydrogen Collider at CERN, but also for energy storage and magnetic levitation, used, for example, in the superconducting MagLev train in Japan (550 km/h). Not to forget the high importance of superconductivity for magnetic resonance imaging (MRI) scanners or other specialized research magnets (“EBL Reader - Helium Cryogenics,” n.d.). Since we already referred to MRI, which is extensively used in the medical area, we can go on with cryosurgery as another medical application. Here they are freezing portions of the body to destroy unwanted malfunctioning tissue. It is used to treat cancer and abnormalities of the skin, cervix, uterus, prostate gland, and liver. (“Cryogenics - Chemistry Encyclopedia - water, uses, metal, gas, symbol,” n.d.). Cryotherapy shall just be mentioned as another medical application. We can also find cryogenic application in the biological field where it is used for example for storing, modification or destruction of cellular structures.

Cryogenic temperatures can change material properties significantly. This is resulting in further applications like cryogenic shrinking and hardening in the engineering field. Another interesting application for material property variation can be found in the recycling industry where it is used to separate material because of its different thermal contraction and the increased brittle nature of materials. (“EBL Reader - Helium Cryogenics,” n.d.). Food freezing is – not to forget – another important application of very low temperatures.

As a new application hydrogen is considered as a second energy carrier. The idea here is to use surplus energy (e.g. on a very windy day) and transform gaseous hydrogen into liquefied hydrogen. The energy which it contains can now be used when there is suddenly a high demand for energy by transforming the liquid hydrogen back into the gaseous state. This releases some of the energy put in before and, transformed, can be used again as electricity. Unfortunately, a not-too-little percentage of the energy gets lost as well.

Conclusions

Cryogenics has various important and also necessary applications in different fields of study and consequently invites, yet even demands interdisciplinary work and scientific cooperation. There are many unexploited advantages left in this field of study and a lot of improvement in some areas is necessary to use it more efficiently and sustainably in our smart future.

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The fifth generation (5G) wireless communication makes the future more than smart!

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Abstract. What is the fifth generation (5G) wireless communication?

The demand for higher data rates in wireless communications due to extensive use of multimedia applications and video streaming is always on the rise. 5G is the fifth generation of wireless technology, which is completely wireless with almost no limitations, also can be called REAL wireless world. There are many features that 5G can offer: high resolution for crazy cell phone users, enhanced and available connectivity around the world. The 5G technology is providing up to 25 Mbps connectivity speed. The new 5G technology will make all delivery service obsolete in the future. 5G systems will not be a single technology but rather a combination of integrated RATs [radio access technologies]. Right now, there are no 5G phones and devices to use the new technology, although manufacturers like Samsung, LG, and HTC are experimenting with new designs. While the specifics are unclear, the 5G concept is mind-boggling and complex.

This talk will highlight the features of 5G technology, mark its challenges, will give an overview on recent research, as well as on the evolution from the first generation to the fifth generation.

Keywords: 5g, wireless, communication, technology.

Introduction

In a few years, you may be able to download a full-length HD movie to your phone in only a few seconds not minutes. Also, video conversations will be so compelling that it will feel like you can reach out and touch the other person right through the screen.

At least, that is what the wireless companies envision for the future of mobile devices. While now the world is still awaiting the rollout of 4G networks, the telecommunication industry is already looking ahead to the next generation of cellular technology, called 5G [1].

1 Wireless communication and the evolution from 1G to 5G

Wireless technologies are going to take new dimensions in our lives. The wireless broadband will soon become readily available to everybody while being at home, driving a car, or sitting in the park, and even on a pleasure boat in the middle of a lake. Because of this, our need to have information at any time and to be connected at all places, all the time, will be satisfied. The world of universal, uninterrupted access to information, entertainment, and communication will open new dimension to our lives and change our life style significantly.

Every 10th year a new mobile generation appeared since the first generation 1G wireless communication system, Nordic Mobile Telephone, was introduced in 1981 and completed in 1990. The data transfer speed was 2.4 Kbps and was using analog signals. The only application available during the 1G was transferring voice calls within a city [2]. The second generation 2G system was commercially launched in Finland in 1991. The 2G was the start of using digital signals. The 2G was also called Global System for Mobile (GSM), which had a data rate of 64 Kbps. The service of text messages and Multi Media Messages (MMS) were introduced firstly by the 2G. The first 3G system appeared in 2001. Packet switching technology was used to send the data and the voice call interpreted through circuit switching. The operation of 3G was at a range of 2100 MHZ with a bandwidth of 15–20 MHZ used for high speed internet services and video. The fourth generation 4G offers a higher download speed of 100 Mbps and provides the same features as 3G and additional services like Multimedia services and more clarity in watching videos and send data much faster than the previous generations. LTE (Long Term Evolution) is the 4G technology.

2 The fifth generation (5G) wireless communication

2.1 2.1 What is 5G?

5G is the short term for the fifth generation wireless communication, which is a mobile broadband technology. It is supposed to be available on the market in the next six to seven years from now. The 5G network will be able to handle 10,000 times more calls and data traffic than the currently available technologies. The data downloading speeds will be several hundred times more than with the 4G [3].

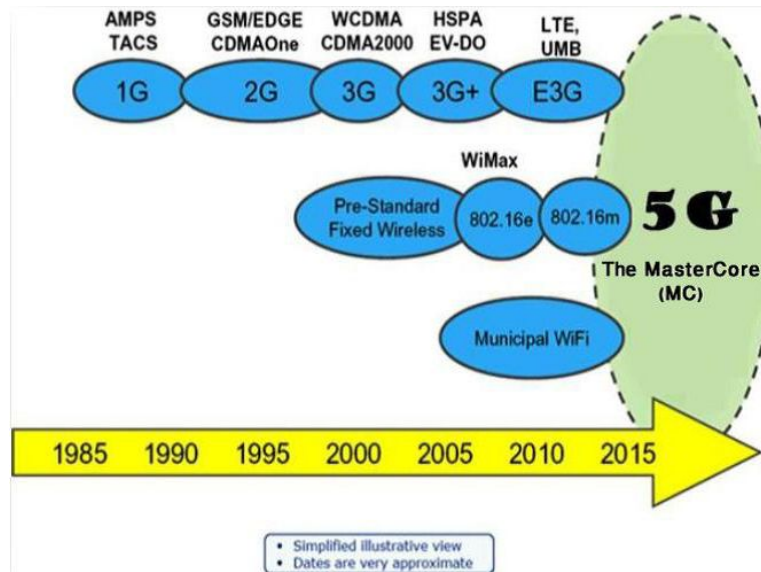


Figure 1: Evolution of Mobile Technologies [4]

2.2 Why is there a need for 5G?

5G as a new technology will provide all the possible and smart applications, and only by using one universal device. Interconnecting most of the already existing communication infrastructures to the 5G network will be a great challenge for the 5G. The 5G mobile networks will focus on the development of the user terminals where the terminals will have access to different wireless technologies at the same time and will consolidate various flows from various technologies [4].

From a user's point of view, the major difference between current generations and 5G techniques must be something else than increased maximum throughput; other requirements, for example :

- To make 5G practical for all sorts of radio access technologies there should be a common platform unique for all the technologies.
- Lower battery consumption
- Lower outage probability
- Better coverage and high data rates available at cell edge
- Possible to 1Gbps and higher data rate in mobility
- More secure; better cognitive radio/SDR Security
- Higher system level spectral efficiency
- World Wide Wireless Web (WWW), wireless-based web applications that include full multimedia capability beyond 4G speeds

- More applications combined with Artificial Intelligence (AI) as human life will be surrounded by artificial sensors which could be communicating with mobile phones
- Not harmful to human health
- Cheaper traffic fees due to low infrastructure deployment costs
- Smart beam antenna systems

2.3 Advantages of 5G

For the 5G will also be a new technology, designed for the boundless wireless service and called The MasterCore. So the computer, entertainment devices and mobile phone may all share the same wireless network and can be connected to the internet anytime, anywhere. The common features for 5G are as follows [5]:

- Files can be downloaded (even movies) within seconds
- Pages will upload almost instantly
- Can easily play online games
- 5G devices are comparatively less expensive than 3G and 4G devices
- Using 5G the battery runs out very fast
- Finest Quality of Service (QoS)
- Easily support previous generations
- No limitation, as user demands
- Ability to support the new services
- The MasterCore's hardware and software are upgradeable
- Able to meet users demand up to next century
- Subscribers can store data in central storage
- Remote PCs can be controlled by handsets
- Subscriber can use application software without installation in own devices that are provided by the MasterCore
- Security is distributed over several layers
- The MasterCore can manage all securities of PSTNs, MSC, and BTS etc.
- The high quality services of 5G technology based on Policy to avoid error

Conclusions

I conclude that 5G will be the next step in the development of mobile communication and will be a key component of the Networked Society. To enable connectivity for a wide

range of applications and use cases, the functionality of 5G wireless access should extend far beyond those of previous generations. These features include very high achievable data rates, very low latency, and super-high reliability. Furthermore, 5G wireless access needs to support a huge increase in traffic in an affordable and sustainable way, implying a need for a drastic reduction in the cost and power consumption per delivered bit.

5G wireless access will be achieved by the development of LTE for existing spectra in combination with new technologies primarily targeting a new spectrum. Key technical components of 5G wireless access include extension to higher frequency bands, advanced multi-antenna transmission, lean design, user/control separation, flexible spectrum usage, device-to-device communication, and backhaul/access integration.

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Coaching: an effective way to promote and develop performance

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Abstract. Employment relationships nowadays have become rather unsteady as formerly stable professional structures alter with rapid innovations in knowledge, changing work methods and new technologies. Mere technical knowledge of any profession is no longer sufficient to master the fast occurring social changes accompanied by new complexities of issues. Here, coaching serves to identify these issues on a personal and/or structural basis. Coaches assist in a very individual manner in promoting skills to handle work relationships and thus they ultimately also aid to reach corporate goals in a better, more effective as well as faster way. They have their clients work on their own solutions and thus serve as a catalyst. At the end of a professional coaching process the client will also have gained better self-reflection and self-awareness which aids to master future challenges of the working environment. Any good Coach should therefore have a profound background in psychology as well as an understanding of managerial concepts.

The focus will be on possible scopes of coaching as well as its implications for teamwork and leadership. Next, the effectiveness of coaching will be examined. In conclusion, some of the main criteria for professional coaching are outlined.

Keywords: coaching, communication, effective cooperation, leadership, skills, teamwork

Introduction

The world has changed dramatically and rapidly within the past twenty years. We have immediate access to knowledge via the worldwide web. Furthermore, the internet and

social networks facilitate instant communication. Computers and electronic data processing are applied in almost every household as well as in organizations. Therefore, major changes occurred in conducting business in this globalized world. Attitudes and our responsibility towards nature and the way we interact as humans have become more responsible with the focus on harmonious and more efficient work relationship.

A new form of individual counseling has entered the world of business. Coaching, or, more explicitly, executive coaching, aids and guides leadership and management to meet these challenges. For instance, people-oriented skills are individually trained, which results in higher motivated and more focused employees. (HBR Research Report, 2009))

Nevertheless, coaching is not yet established as an autonomous profession. The term “Coach” is not protected. Almost anyone can claim to be an executive coach, independent of background, education, experience and skills. Giving that great variance and rather short lasting relationships, qualified studies about the effectiveness of coaching are still in their infancy. (de Haan, Duckworth, Birch & Jones, 2013)

There is general agreement, however, that the coaching process is perceived as beneficial both, for the client and the organization. Existing data suggest that the main ingredient to a successful outcome is a respectful and positive work alliance between coach and client. Range of techniques and education are mediating. (de Haan et.al., 20013; Wampold, 2001)

1 The diverse landscape of coaching occasions

Coaching has become an integral part in leadership development over the past years. Parsloe and Rolph (2004), for example, conducted a survey of learning and development practices in organizations. Findings therein indicate that the use of coaching has increased by 51% over the past years. Additionally, a general acceptance among leadership and employees was found, that individually given advice is needed if one is to take on more responsibility.

The challenges in this globalized world require multi-professional solutions. Problems become more complex and interdisciplinary cooperation is a must for success. Ultimately a good work performance is of utmost importance. As such, leadership must be equipped with new techniques and skills to motivate their employees, avoid or solve conflicts and nourish a positive morale.

Individual challenges could include taking on new responsibilities, dealing with job-cuts and lay-offs, or the general social interaction between colleagues and staff members. This would be further occasions to initiate a coaching process. (Dehner, 2009)

1.1 The Coaching Process

Every coaching process will therefore start with a mutual agreement in form of a contract. Then, the issue to be worked on will be analyzed by the Coach. Thereby structural and organizational influences are also being taken into consideration. Only after defining the issue to be worked on, the actual process of accompanying, guiding and motivating the client will start. Basically the client has to try out new ways, change perspective and hope-

fully gain new and successful experiences and insights. With mutual agreement the work alliance can then be closed in a formal manner.

1.2 Levels of coachability

Naturally not every coach-client relationship can be successful because of differences in personality, individual motivation and sympathy. Bacon and Spears (2003) distinguished seven levels of coachability, i.e. how well a client will respond to coaching.

Essentially a coach can encounter a client who is not coachable at present, who lacks motivation to change or only complies with the request of their management. On the other side, the client not only readily accepts coaching, but also shows gratitude and an inherent lifelong drive for personal improvement.

In any case, a professional coach needs to bear in mind that not every relationship will turn out to be successful. With this awareness, a coach has to be able to end the relationship formally and with adequate feedback given.

2 Effectiveness of coaching

The question therefore arises, whether coaching is effective and beneficial not only to the client, but also to the company. In other words, is it worth the time and money?

Given the wide variety of occasions and different industries and branches that self-employed coaches operate in, it is rather hard to conduct qualitative research. Surveys mostly ask for subjective opinions about the effectiveness of coaching. (HBR Research Report, 2009). Jarvis (2004), for example, found that 92% of participants in a coaching judge this process to be effective.

Because of the general agreement that coaching is a special and trustworthy relationship, some parallels can be drawn to the clinical setting of psychotherapy. It is widely acknowledged that therapy is beneficial and improves the wellbeing up to 80%, regardless of the method. (Greif, 2008; Wampold, 2001) Moreover, the quality of the relationship has a major influence (Cooper, 2008).

With the assumption that coaching and psychotherapy belong to a general class of personal interventions, based on helping relationships, de Haan, Duckworth, Birch and Jones (2013) conducted a qualitative study on the effectiveness of coaching.

One important hypothesis was, that the working alliance has a major influence on a positive coaching outcome. They also included coaching techniques, self-efficacy of the clients and personality difference as independent variables for a positive coaching outcome.

Examining altogether 156 coaching relationships, their findings confirmed the main assumption: the work alliance is of utmost importance for a positive coaching outcome. The amount of techniques of the coach or self-efficacy influence the outcome indirectly as mediators. Personality differences, however, had no effect at all.

Conclusions

Further research is needed to distill the ingredients of effectiveness in a coaching process. Nonetheless, quality needs to be ensured by maintaining a good relationship. A coach must have a certain amount of techniques, background knowledge and the ability of self-reflection.

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Start-up Companies – How German business culture needs to change

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Abstract. When it comes to taking economic advantage of innovative technologies, Germany is lagging behind in international comparisons. In spite of the fact that many promising technological concepts stem from the country well-known for its engineers, many inventors have been unable to come even remotely close to the success of e.g. the US-American corporations from “Silicon Valley”. This circumstance has already led to a handicap for the German IT industry.

Google, Microsoft, Apple, Intel and many more corporations currently dominate their respective business fields and if there shall ever be a comparable German corporation, the German industry needs to adopt the successful business practices of those firms.

Entrepreneurship research suggests that especially the process of financing is more difficult in Germany, as private “Business angels” and venture capital funds are not as common in the German financial culture as they are in the Anglosphere. Company founders also oftentimes do not have applicable knowledge of management, accounting and organizational strategies, which leads to ill-advised decisions. Last but not least, a phenomenon referred to as “German Angst” is seen as an obstacle. This concept implies that the common German attitude perceives failure as something that should be avoided at all costs. The possibility of failure though is an inherent part of the risks of founding a company.

This talk will focus on what potential business founders should know beforehand about financial structures, management processes and their own mind-set.

Keywords: EXIST, Gründerszene, IT, Silicon Saxony, Start-Up companies, Venture Capital

Introduction

Innovation has become an ever more important process, as globalization has united markets worldwide, which led to a situation in which business locations that failed to bring forth competitive technologies were severely punished.

Germany, despite having a reputation as the centerpiece of Europe's economy, is among the countries that have to tackle the issues that are a product of missing out on a worldwide trend: Establishing a start-up-friendly culture. The Business Insider magazine compiled a list of the 100 most valuable digital start-ups of 2011 and not one German start-up made it onto that list [1].

German founders face many issues that are harder to solve than in other countries and this text focuses on merely three of those issues: Corporate financing, marketing, and psychological misconceptions.

1 Corporate Financing

The financing of a young company is one of the major challenges entrepreneurs face, as it is mandatory to choose the right monetary sources at the right time. Figure 1 below shows the different segments of a start-up financing lifecycle.

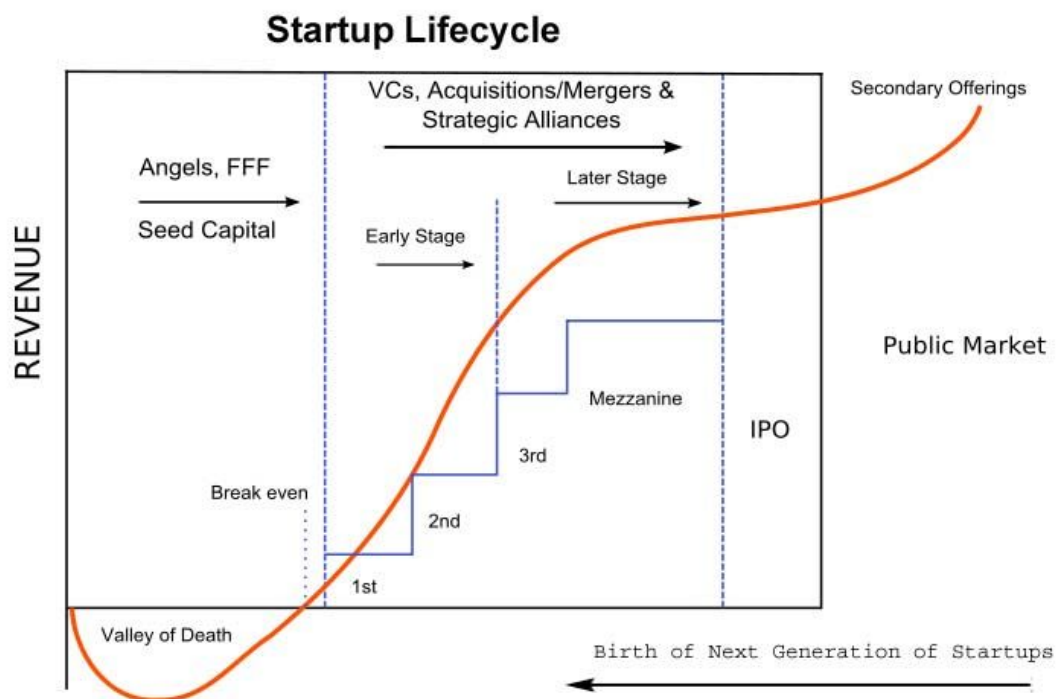


Figure 1: Start-up financing cycle [2]

1.1 Seed capital stage

German founders face most of their problems in the first stage, the so-called “Seed capital” stage. At this point, companies rely heavily on business angels and FFF (friends, fami-

lies and fools), as bigger companies / investment banks are unlikely to invest any monetary funds into a company that has not made positive profit and could fail at any moment. While in other countries – the USA is the best example for it – angel investors are a rather common source of equity, Germany's founders cannot count on their project catching the eye of rich private investors. This leads to financial bottlenecks for almost all highly innovative start-ups. However, investments in this early stage are on the rise, as more and more organizations, both of private and public nature, acknowledge the need for successful entrepreneurship. [3]

The most important thing to know is that, despite all planning, the “valley of death” is something that cannot be avoided. Initially, negative profits are simply a result of the non-recurring costs of setting up business. The disadvantage for German companies in this field is something that should not be overlooked, but can also simply not be avoided at the current date.

1.2 Venture capital stage

As soon as the corporation has established itself in a new market, its revenues will rise and it will become more interesting to investment banks and bigger corporations that operate on the same / a similar market. This opens up a whole new world of monetary funds, as the big venture capital holders are very likely to invest into a corporation that shows signs of success in an analysis.

2 Management and Marketing

The marketing and management practices of inexperienced entrepreneurs are often suboptimal, even though optimization could easily be achieved by gathering the freely available information. As for the topic of marketing, Figure 2 below gives a comprehensive impression of the steps that should be followed through.

The process of marketing management starts with an analysis of the advantages and disadvantages of the product, which is followed by the selection of the target market and the target customers. This is extremely important, as many start-ups fail because their product was not demanded, which led to no market interest. Analyzing the market situation thoroughly will lead to a higher chance of avoiding just that.

The core of the marketing process is the choice of the marketing mix. This mix includes the “4Ps” (Product, Price, Promotion and Place). New theories suggest the use of other indicators, however are not yet fully developed. The first P is “Product” and can be characterized as “finding the necessary basic and the additional premium features of a product.” Determining the “Price” is also a very important part and, if done wrong, will either lead to the business making negative profits or the customers not buying the product, as it might be too expensive.

“Promotion” includes several activities: Determining the platform of promotion, the target group. The aspects that should be highlighted, the frequency of promotion, etc.

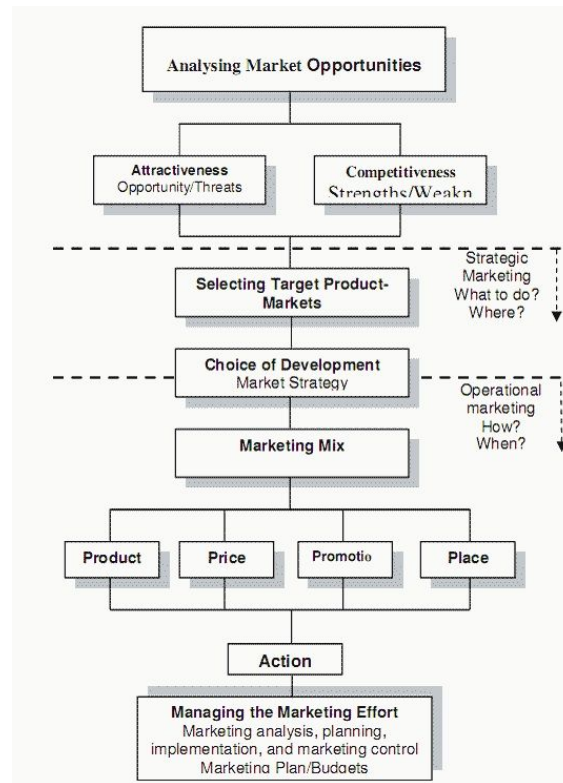


Figure 2: Process of Marketing [4]

Last, but not least, there is the determination of the “Place.” This part has become rather minor, as the place of transaction is not bound to a physical proximity, since the internet enables people from all over the world to buy services / products.

Altogether, going through these steps ensures the minimization of the chance for failure.

3 Psychological misconceptions

Germany has a relatively low rate of early stage entrepreneurs in percentage of all adults compared to more successful countries, such as the USA. In 2011, the USA had a rate of about 12%, German early stage entrepreneurs merely make 5% of the whole population. [5]

This circumstance is a result of a cultural background most Germans share that leads them to believe that security should be valued over everything else and clearly marks “risk of entrepreneurship” as something to be avoided. [6] Especially young enterprises do in fact face incalculable risks that could, without a doubt, lead to failure and bankruptcy. Statistics have shown that of all start-up companies founded in 2007 in Germany, only ca. 40% were still around just five years later in 2012. [7, 8] This indicates that the risk of failure is indeed real and rather high, but this simply needs to be accepted.

Entrepreneurs will always face risks, no matter how big their company, but the pay-off for success is even bigger. Still, even failure has its upsides: Failing a business operation implies that one learnt as to why the failure occurred. The failure can therefore be used to be successful in the future.

Germany, however, does not see eye to eye with the success of this concept: Christian Lindner had to hear a lot of criticism for his opinions on corporations, not necessarily because of the content of his opinions, but because of the simple fact that he once led a business and failed. [9] This is a rather twisted logic that needs to change in order to create more open-minded conversations and more possibilities for businesses.

Conclusions

This text merely focused on three of the many aspects that have to be considered if one would like to found a business, but those aspects are of utmost importance.

First of all, potential entrepreneurs need to learn about the potential sources for monetary funds and they need to know about the hardships (Valley of Death) that they will go through. Secondly, they need to have knowledge about marketing issues and the complex thought processes that are necessary in order to successfully campaign for a product / service. Thirdly, they, and with them all of Germany, need to change their mindset regarding failure, as failure should be viewed rather as an opportunity than as the point of defeat.

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