CONSEQUENCES OF VOCATIONAL TRAINING FROM GROWN MARKET DYNAMICS
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Abstract
If the quality of your company is lower than that of its competitors, market pressure arises. This pressure must be reduced by appropriate measures before it threatens the existence of the company. As the criteria for the competitive strength of a company have changed significantly over the last 50 years, the effective measures are not the same as they used to be. Typical markets today are global and therefore narrow and dynamic. More than ever, companies are forced to keep innovating in order to counter the superiority of their competitors. The authors call the quantity of these innovative events that cannot be ignored “dynamic”. With low dynamics, knowledge, good methods and optimal processes are the criteria for the competitive strength of a company. This has been supported by what is known as “dual training” in Germany. Today, at high dynamics, the quantity and quality of problem-solving ideas is crucial. The source of ideas come solely from employees who are well-suited to solving a particular problem. The authors call this talent. Talent becomes visible only when a company faces an actual problem.

During vocational training, the talent only for problem-solving in vocational training can reveal itself and develop. This means that the talent needed today for the dynamic day-to-day running of a company is only visible after training. Only then can they be identified, promoted and developed.

This article attempts to shed light on hidden connections and describe them as problems by interpreting the authors’ own observations from an almost systems theory perspective. Based on an application example, some consequences for vocational training resulting from the growing dynamics of the economy are described. By drawing attention to the upheaval in vocational education and training for dynamic environments can alternative courses of action be derived.

Keywords: technical training, professional education, vocational training, dual education and training, talent development, market dynamic, boundaries of vocational training, post-Taylorism

1. INTRODUCTION, DEFINITION OF TERMS AND RESEARCH DESIGN
“If I asked people what they want they would have said: faster horses” (Henry Ford)

At the end of the 19th century, the powerful nations began to open up new economic markets in non-developed parts of the world. Declining transport costs facilitated the creation of new, large, but still empty mass markets. During this period, the manufactory represented the typical form of industrial value creation. It was best suited for the small, local and thus narrow markets at that time. Its strength was the production of customer-oriented, small series for small and territorially narrow markets. However, this wide artisanal competency was no longer required for new mass markets. The decisive competitive feature was no longer the ability to produce to customer specification, but the usability and price of products. The new markets generated demand for simple and low-cost mass products. Manufactories could not meet this demand.

In response to this new problem, the industrial value creation developed, which has been predominant to this day. Expensive artisanal competency was replaced by a scientifically designed, uniform workflow, i.e. the controlled process. Nothing more but superficially trained assemblers were enough to carry out such processes. Pioneer behind this new theory of work organization was the US American
Frederick Winslow Taylor (1856 – 1915). Up until this day, the control of work with low skill requirements through highly qualified mental labor is called ‘Taylorism’, and his theories were first published in his 1911 monograph “The principles of scientific management” (Taylor 1911). It was Henry Ford who achieved the first practical application of this theory. The conveyor belt, which was first used in his factories, is still used in today’s industrial production.

This new structure of work organization was very inflexible and cumbersome compared to the manufactory. In contrast, products became 100 times cheaper while maintaining the same, consistently high quality. It had exactly the features required for the new markets at that time.

Around the year 1980, an MIT study (Womack 1991) emphasized that the world markets had changed anew. The formerly empty market has filled. It has become impossible for companies to avoid each other. Once more, it is getting narrow. Price and quality are no longer sufficient, competitive characteristics. Between this new narrowness, innovation and flexibility have become an advantage again. Unfortunately, these qualities are not simply generated at the push of a button. Thus, fierce competition develops. Companies are now forced to mutually observe each other with destructive intelligence, and if possible, to disrupt each other by means of innovative events. We call the amount of such innovative events, which have to be processed, ‘dynamics’.

Companies successful in the context of high dynamics constantly surprise their competition with such innovative events, and parry their competition’s innovative events with ease. In contrast, the controlled processes of Taylorism do not tolerate innovative events. They are dynamic-sensitive.

New companies do not suffer from the growth in dynamics; they rather thrive through it. They utilize post-Tayloristic, dynamic-robust organizational structures. Conservative companies, as they are used to, rely on science to develop new work methods before they introduce them. Over the course of time, this method has received many modern-sounding names. However, success has never been achieved.

Having said that, due to the pressure of the dynamic market environment, companies officially conceived as conservative have developed adapted work organizations in the form of an intra-company knowledge generator. Yet, those can only operate in secrecy, as they have to break official, internal rules. Therefore, they are officially kept unknown. Wohland and Wiemeyer (2012) call these innovative areas “isles of dynamic-robust top performance”, meaning areas, factories or whole companies working according to dynamic-robust structures. So far, such isles of dynamic-robust top performance did not remain adaptable because of, but despite all principles of structural control in work processes. Their fields of activity could include, e.g. R&D towards product innovation, or a sales department Task Force for opening up new markets. Such isles of dynamic-robust top performance must first be identified within the conventional company to be supported by all employees. Modern organizational development tries to protect and foster these isles, so they can be used as role models.

Despite all diversity, the new forms of work have one thing in common: They rely on talents and the ideas they have to solve the problems arising through dynamics. This means that they seldomly ask “how?” a problem is solved and rather “who?” can solve it.

In case of low dynamics, knowledge, proven methods, and optimized processes are mandatory for the company to remain competitive. In case of high dynamics, however, the quality of problem-solving ideas is key. The source of ideas is solely the workforce that is fit to solve a problem. We call employees who are able to react to certain problems ‘talents’. However, they only become evident when this communicative reaction takes place, and unlike experts, they cannot be trained ‘on stock’.

Thus, it becomes evident that growing dynamics has an impact on vocational training. So far, discipline and acquired knowledge were sufficient as training result. Both could be transferred and confirmed by an official certificate. The ability to later develop an idea for solving a problem within a company can neither be trained nor certified within the framework of vocational training.

The fostering of talents for professional practice therefore cannot be part of vocational training. But what can be part of it?
This article is our contribution to this topic of research. For the purpose of this article, the concept of “problem” is defined in relation to the grown market dynamics. In this case, the problem is understood as a condition or situation which cannot be left unchanged without risking harm. This represents a great risk. Thus, the problems described in this article (cf. Section 2.1.) always relate to the same risk, i.e. that current professional education in Germany, without significant changes, is unable to adjust adequately to increased market dynamics.

Through an explorative case study in accordance with Yin (2018), the practical handling of the three defined problems is emphasized by an example from an almost systems theoretical point of view. This example is represented by the concept of the training center for industrial professions InfraServ GmbH & Co. Wiesbaden KG (BizKA, cf. Sections 2.2. and 2.3.). A critical statement on the explorative case study (cf. Section 3.), followed by the conclusion (cf. Section 4.) tops off the authors’ thoughts. Further interpretations, consequences to be drawn and the necessary alternatives for action are left to the readers.

2. PROBLEMS AND PRACTICAL HANDLING WITHIN A CASE STUDY

2.1. The three main problems

2.1.1. Technology-related changes to job requirements

Since the point has been reached from which productivity of human work was so high that the results of work became tradeable, markets and prices have emerged, leading to an economy. When the output of work is exchanged, everyone can do what s/he can do best. This makes the basic needs of life more easily satisfiable. However, this is also exactly what generates new needs. So the need for purchasable performances necessarily remains higher than the possibility to satisfy it. Therefore, there is a permanent incentive to increase work productivity. This is achieved by overcoming the limitations of the human bodies of the producing workforce (on the producer’s side) again and again. The means to this is technology. For the development of this technology and the engineering behind it to be applied, knowledge and skills are required. On one hand, a marked-based economy generates an insatiable requirement for, e.g., technological innovation. On the other hand, the practical application of this innovation demands new competencies from the producing workforce. In order to ensure that this requirement for competencies is met appropriately, the governmental institution of education has been created. Although it is not part of the economy, it is still indirectly subject to the same conditions: Today’s high market dynamics.

However, to make use of a new technology, work needs to be carried out in a different way than before. The application of new technologies demands a re-organization of work. Traditional specializations of lively competence, meaning professions, change regarding to contents and focus. Known professions slowly disappear, new ones are on the rise, which nowadays often occurs faster than finding a name to describe them.

One example for the relationship between technological innovation and the change of profession contents was the so-called Industrial Revolution. It was also the decline of transport costs which heralded the domination of industrialization in world economy around the year 1900. Individual, honed skills of craftsmen and -women working in a manufactory and of agricultural farmers were replaced by the competence of science. This was more suited to the needs of new, but sluggish global markets. Due to these developments, a variety of specialist industrial professions was formed. Focal points regarding quality in new professional education shifted from being a talent-based, skilled worker to becoming a knowledge-based expert, i.e. from a wandering journeyman with recommendations given by several master craftsmen to a student receiving a diploma.

Currently, the character of world economy is subject to a new change, and so are the requirements to quality and contents of professions and vocational education In the meantime, the sluggish mass markets have transformed into narrow and dynamic markets. It is no longer sufficient to just be competent in the use of current technology to compete successfully. It has become necessary to apply new, yet unknown technology faster and more profit-oriented than competitors. Gaining and applying knowledge alone is
also no longer sufficient: The constant generation of new knowledge is now more important than ever. The generation of new knowledge through ideas will become the distinguishing feature between modern enterprises.

Correspondingly, the requirements businesses demand from their employees also change. A certificate as proof of competence may look nice at first glance. What is needed, however, are ideas to solve problems arising not during professional training, but in real-world professional settings. A name for these problem-solvers already exists: Talents (cf. Section 1.). There is no lack of talents, but because they would have disturbed the development of processes, they were simply excluded from value-added chains during early industrialization. On the other hand, this means that problems have to be made evident and/or communicated. Thus, the concept of “honesty” should be incorporated in the culture of the organization.

In the past, the requirements of traditional economy towards professional education already used to be high. However, these requirements changed so slowly that the development of new, adjusted training contents could keep up with the pace.

High market dynamics, which has been established in the meantime, has two effects on the structuring of adequate training: First, the adaption of education can hardly keep up with the speed in which changes occur (cf. Chap. 2.1.2.). Second, talents only gain opportunity to stand out and be promoted when faced with problems arising within businesses (cf. Chap. 2.1.3.). Supplying the economy with talents cannot be the topic of reputable, professional education. All that can be done by educational institutions is to inform both students and businesses about this new problem.

The requirements towards vocational education in Germany are regulated by the Vocational Training Act (BBiG 2019). The basis for any in-company training are the vocational training regulations for the corresponding profession. Key elements of the training in accordance with Sections 1 and 14 of the BBiG are:

- The transfer of technical knowledge, skills, and abilities, as well as the so-called “vocational competency” as stipulated in the vocational training regulations for the corresponding profession;
- Enabling to gain first professional experience;
- Personal development;
- Protection from physical or moral danger.

Especially the requirement of personal development as part of a vocational training shows an outdated way of thinking. It remains concealed that personal development is only possible through teaching staff are exemplary characters, and who are accepted as role-models by their students. Having obtained one or several degrees does not certify this requirement towards character, an aspect that should be considered in the selection of teaching staff. But also: Even the ones selecting require a certain quality of character. It has become undisputed that this personal competence exists. As an essential criterion for contemporary education, there is certainly still not enough awareness of it within society.

The dual training system used in Germany takes this interaction of, among others, learnable knowledge and skills that can only be acquired through personal practice into account. It is a very modern and widely praised approach. However, it can already be recognized that it reaches its boundaries for the currently high market dynamics.

Thus, the dilemma between the changing requirements of modern work organization on one hand, and the adaptability of training on the other, will probably lead to problems for professional training through the technology-related change in job requirements for modern times. The ability of professional education and training to adapt to the legal, economical and technical structure of vocational training in industrial practice, in the context of an increased market dynamic, has to be reconsidered.

2.1.2. Frugality of vocational training

Frugal innovation means the reduction of the characteristics of a performance to the essential. Applied to a tool, this could mean: Functional design and easy handling, but high safety and reliability at the
same time. Impressive, but for every-day work unnecessary add-ons, are subject to cuts. For professional market segments, this price-conscious pragmatism is an important pre-requisite.

In our view, frugal services are not what known as “cheap products”. They are performances for which the material and financial resources spent over the full product life-cycle, from development and production to use and disposal, can be reduced (adapted from Tiwari & Herstatt 2014), because they do not feature the unnecessary.

For frugal innovation, the exact identification of the customer’s problem is mandatory. Only if the dispensable and the indispensable are distinguished clearly, this type of optimization is helpful. Otherwise, this specialization will hinder more than it helps, as it is too distant from practicality. The general purpose of (further) training is to transfer knowledge. For learners to benefit best, the selection and representation of this knowledge must meet the demands of their future profession. Due to the currently high dynamics, it is no longer sufficient to just apply the knowledge that has been acquired. It has become a necessity to constantly generate new knowledge. So a frugal vocational training for this new and dynamic work would have to reduce the amount of transferred knowledge intelligently to leave more time for learners to experience how and when to apply their knowledge, to further improve it and, as a result, generate new knowledge.

Following the modelling principle known from systems engineering, the contents to be taught should be simplified in a frugal manner by depicting a situation in a problem-oriented way. The “model” is understood as frugal depiction. In accordance with Stachowiak (1973), a model is one possible representation of a natural or artificial original, which could be a model itself. A model captures only the original’s characteristics required for processing. As already mentioned, such a frugal model demands certain distinguishing between important and unimportant. This, in turn, requires exact knowledge of the problem to be solved. If a model is useful is only determinable relative to the problem. When the problem changes, the model must be adjusted as well. Furthermore, not all parts of the model can be assigned one-by-one to the corresponding originals. Nevertheless, in its foundations, the model remains related to reality, and as already described, it requires a specific adjustment towards an existing problem. Here, special attention must be paid to “whom”, within “which time intervals” and under “which limitations” the model should apply.

Therefore, a model is a static structure, and without relation to time, it only depicts the important aspects of a problem. Applying this structure with a relation to time within a dynamic environment leads to a temporal change of the structure, i.e. in the chronological sequence of processes within the considered structure. We call such a temporal change of the structure ‘simulation’. The problem has to be known for both the model, as well as for the simulation.

For vocational training, both modelling and the simulation are of very high importance. Let us take manned spaceflights as an example (Apollo program in the 1960s). For years, every possible situation was modelled in a structure on earth. Then, this model was simulated to detect errors that could occur during the real flight immediately and to handle them in an almost automatized manner (because the training was repeated a thousand times). Without doubt, a simulator is the best learning environment. For example, practical vocational training is also organized according to this principle.

As mentioned before, a distinction between important and unimportant aspects of a problem is made already during the modelling process. A further distinction is made between the model, which describes a process structure statically, and a simulation, which applies the model dynamically. Thus, the term ‘distinction’ is essential for describing the frugality of vocational training. Making a distinction is a process of thought in which certain differences are determined in the comparison of two existing objects and/or relations. This allows to describe a certain contrast and thus, existing relations in a certain context, in a clear and understandable way. The distinction is a pre-requisite for classification and for knowledge. Here, the following premises are defined by Wohland and Wiemeyer (2012):

- Where no distinction is recognized, no relation can be determined.
- Distinctions cannot be made objectively. They are selected by the observer and, depending on the selection, visualize certain relations.
If new relations shall be made visible, new distinctions must be defined. Here, the desired relations are always regarded as relationships of the objects and/or relations to be distinguished, and one would never relate solely or entirely to one or the other side of the distinction.

Wohland and Wiemeyer (2012) could determine one further distinction between the culture of behavior and the culture of values on the respective front and back stage of a company organization. Without having to mention any significant limitations, this approach is also applicable to a training organization (Figure 1). Following this approach, the culture of a vocational training organization is generally constituted of a visible front stage and an invisible back stage. The visible front stage is built of the behavior of the organization’s members and is named ‘culture of behavior’. The back stage has an effect through invisible values. Such values are feelings, which let a certain behavior appear as pleasant or unpleasant. However, from the visible behavior, it is hardly possible to draw any conclusions to the invisible values.

As shown in Figure 1, the culture of behavior consists of actions (DOs), triggered from within the mind. Such qualities include, among others, discipline, punctuality, politeness, and obedience. In contrast, the culture of values is comprised of feelings evoking in one’s own body subconsciously. Such feelings evoked by the body may include trust/distrust, regard/disregard, and love/hate. Behavioral culture is controllable based on power. Corresponding instruments include arguments, instructions, rewards, punishment etc. In contrast to that, the culture of values is coined by persons of high esteem. Such persons, highly regarded within their organization, shaping the value culture of the organization as a whole, are called “command heights” (German: Kommandohöhe) by Wohland. This was verbally confirmed by Mr. Wohland (G. Wohland 2020, pers. comm., 20 February). Here, he refers to the effect these persons have, often unconsciously, and not to their conscious actions as members of the organization. Corresponding instruments include experience, knowledge, and good example. Thus, the causality existing on the front stage is not found on the back stage. It is not to be expected that with a certain command height, a certain culture within the organization can be provoked.

In the current debate on the quality of vocational education and training, the authors believe that the distinction between front and backstage with regard to the frugality of vocational education and training...
is not sufficiently referred to. This represents a big problem for professional education in a dynamic environment.

2.1.3. Boundaries of vocational training

When an experienced employee changes to a different job, s/he cannot simply be replaced by a novice. Not even if s/he has received the best training imaginable. The new employee must gather own work experiences before it becomes evident if s/he can replace her/his experienced colleague or not. It must therefore be clarified which part of the necessary competence of the employee can be provided via vocational training, and which part is formed during work. Successful companies know that the second part of job training is their achievement. It cannot be acquired externally. Here, so-called master/student interactions have proven their worth. Experienced employees (masters) are instructed to find students whom they can encourage to gain their own experiences. By following this practice, not only a master’s knowledge is passed on, but also her/his skills will serve as an example. The reason for this shift in the role of vocational training is the growth in dynamics within the economy. A modern vocational training must take this connection into account and make use of it. This applies to all parties involved: teachers, companies, and, above all, students. It does not make sense to expect something from a vocational training that can only be taught during every-day work within a company.

In Figure 2, the phases of competence development are shown, as they are typical under dynamic circumstances (from top to bottom):

- **Phase 1**: During the training phase, knowledge is transferred by a teacher who is giving exercises to her/his students and who assesses their performances. Upon success, the students will receive a certificate. Here, skills, and thus competency, is created as well. However, this skillset is only related to problems occurring during training. Therefore, it cannot be used actively within companies.

- **Phase 2**: During a transition phase, e.g. during an internship, there may be first opportunities to gain professional competency.

- **Phase 3**: It will take until this phase for the “novice” to be confronted with actual problems arising within the company. Only now, her/his professional competency can become evident (or not).

![Fig. 2. Creation of qualification for high dynamics](image-url)
In the cultivation of competencies for dynamic environments, one must distinguish between basic training (Phase 1), a transition phase of professional education (Phase 2) and pure, professional practice (Phase 3).

To prevent misconceptions, we want to point out that during vocational training, both knowledge and skills are acquired. Both only occurs coupled together tightly, and is called ‘competency’. The knowledge portion is universally valid and can be applied wherever suitable. Knowledge is acquirable through learning, e.g. from a teacher. It is also acquirable although it is not needed yet (to broaden the pool of knowledge). The skills portion, however, is always related directly to an actual problem. Skills are developed when trying to solve problems (practice). During training, only problems arising during the training phase itself are accessible (exercises).

Only when its limitations are recognized and accepted, vocational training can unlock its full potential. It is also a part of this to be informed as well as possible about problems beyond vocational training, letting companies and students alike take responsibility in this area.

These aspects to the boundaries of professional training and further training should be discussed and worked on as problems of vocational training for dynamic environments.

In the next section, the practical handling of the problems described above and first approaches to possible solutions are introduced. An explorative case study will serve as background.

2.2. Case Study for InfraServ GmbH & Co. Wiesbaden KG

2.2.1. Initial situation

Since 1997, InfraServ GmbH & Co. Wiesbaden KG has been managing the business and logistics of the 96-hectare-sized industrial park Kalle-Albert in Wiesbaden, Germany (InfraServ 2020). With approximately 900 employees and an annual turnover of 170 m € (as of 2019), InfraServ offers a wide range of infrastructure services for the production companies on site. This includes its own vocational education and training center (Bildungszentrum/BizKA) for apprenticeships to develop the future skilled workforce for these companies. Training for over twenty different professions in technical industrial jobs (i.e. metal-working or electrical occupations), in chemistry (productions, laboratories), in office and IT jobs as well as in special services such as plant firefighting and plant security is offered. In addition to the compulsory German dual vocational training program (‘Duale Ausbildung’; theoretical classroom instruction at professional schools plus practical on-the-job training), the BizKA offers a third basic component of in-depth professional training before and during specialization in the company and attending the professional school. In this company, the apprentice interacts not only with her/his future ‘actual’ team members and colleagues, but also familiarizes herself/himself with the systems and machinery he will later be working with to fulfill a professional position. By doing so, s/he will gain first, real work experience. During their basic training of practical skills i.e. milling, turning, drilling, CNC metalworking, both mechanically and manually, 300 apprentices are supervised by approximately 25 trainers. The goal of basic training is to simulate practical real-world problems arising at work (cf. Chapter 2.1.2.) and thus will enable the apprentices to cope with ‘everyday’ problems and tasks systematically as they methodically search and implement possible solutions. They also learn how to assess their results, taking into consideration security, stability and sustainability. It is the simulation of real-world problems which plays a critical role in the context of professional training. The trainer simulates a certain situation and guides the apprentices through the problem-solving process. Since problems in every professional context are manifold and rapidly changing in dynamic environments, the simulation of problems is itself a problem (cf. Chapter 2.1.3.). To address this, the trainer adapts the simulation to a process by which a certain pattern of typical situations is shown and by doing so, the trainee can detect the symptoms and systematically treat the problem. Adding a tight timescale brings the simulation closer to reality. In this way the trained professional gains her/his own set of tools which later will assist her/him in coping effectively and quickly with real problems. One problem still remains in terms of examining and evaluating training results. Not only are cognitive abilities tested but also practical skills. It is also about the apprentice’s ability to transfer her/his gained knowledge into a real job within the company in a processual manner.
In the last twenty years during basic training, knowledge was still widely transferred in a classical lecture format (‘ex cathedra’). Today, the focus has shifted to activating the basic skills and inherent abilities which were acquired during professional school through the transfer of basic knowledge. In today’s complex work environments with highly specialized areas of production, it is extremely difficult to attribute an effect to a cause. In order to match the challenges of future market dynamics, the organization of professional training itself should be reformed thoroughly. Similar to well-known examples in industrial history (e.g. Apple’s Newton PDA), innovative learning platforms are achieved by re-organizing the professional training environment. In so doing this, two aspects become relevant: On one hand, the traditional Taylorist division of labor is still relevant, due to its unrivaled effects on productivity: it still remains in the center of all professional education (e.g. through regulations). On the other hand, the training organization has to be more flexible in order to anticipate as many different scenarios as possible of future challenges for companies and their workforce. This also has to be simulated in training. This will be a new foundation to creating innovative forms of learning. This is how new educational content should be generated, to address unpredictable risks and to derive alternative courses of action to minimize these risks.

2.2.2. Realized changes

One important claim that the BizKA has made for a year now states: “Training means preparing”. This may sound ambiguous, as in one instance ‘Training’ refers to the apprentices, and in the other, to BizKA itself. For the latter it means that the BizKA has to steadily and continually create innovative ways of teaching and preparing new forms of vocational challenges. The former typical hierarchical organization with its top-down management has already been supported by a more or less hierarchical way of collaboration (with center and periphery). The organization did this by eliminating the hierarchy of positions and reorganizing the whole work structure through team roles and functions, which are less strictly connected with individuals as it had been before (and documented in so-called job descriptions). They are working with roles and functions tables of each individual team member, which are dealt with cyclically and periodically. According to Große’s approach (Heinz-Walter Große 2018), all member roles must first be identified. Then, the related functions are, in the end, assigned to individuals (according to their skill sets). In order to address internal organizational dynamics, roles, functions and individual assignments, the teams discuss and assess them once a year. Similar to a system of ‘checks and balances’, in an open communication culture, the evaluations are signed by every team member. Leadership functions are mainly represented by tandems (dual leadership), capitalizing on the advantage of splitting decision-making competencies between more individuals, each with a clear set of expertise. So individual leadership roles turned into leadership tandems with an internal differentiation: For the organization of education, this means combining and mixing different departments to arrive at the best solution (e.g. Business Administration with Costs/Prices etc., and Mechanics with Feasibility/Safety etc.). Since a perfect overlapping of different areas of leadership is not possible, it remains quite tricky to maximize and to describe the cross-sections within a leading team. The main objective is to increase the possibility of getting talents involved in the solution of problems in an experimental setting. This should also lead to cell-based growth for new business activities.

Moreover, vocational training itself depends on the progress of methodological didactics. BizKA is trying to proceed not only in terms of vertical enhancement of didactics (i.e. digital learning tools, or ever improving the skill range of single learners only), but also “horizontal”, i.e. across educational frontiers by bringing together academic and vocational learners. As described in Chapter 2.1.3., simulations increase the probability that certain problems are introduced to corresponding addressees who are able to solve them, which unveils their talent. The vertical development of the methodology of knowledge transfer means a vertical integration of the problem situation into the vocational training. At the example of training for a metalworking profession (e.g. welding techniques), this means the integration of modern processes and installations for welding simulations (e.g. via computer-based welding simulators). They enable to train an apprentice’s welding skills without having a trainer guide the hand of the apprentice. In addition, using a welding simulator does not involve any form of danger, no material is wasted, and apprentices may repeat the training session as often as they like. The continuous development of horizontal education formats means the in-depth revision of training content within the framework of educational regulations prescribed by law (“Ausbildungsverordnung”). In
Germany, this is enacted by the Chambers of Commerce & Industry, which use their authority to update these regulations every 5 to 8 years. This is meant to reduce risks of dynamic development of the different professions and from that alternatives for some teaching subjects will emerge. At BizKA, an innovative concept called “PioneersPort” was developed. This concept serves as an inter-disciplinary format for innovation and entrepreneurship to overcome limitations of any class-ridden education system. Simultaneously, vocational training for industrial environments will be fostered and upgraded. This was verbally confirmed by Mr. Wünsch (B. Wünsch 2020, pers. comm., 6 February).

2.3. Result of the realized changes

The changes in the BiZKA had been initiated in 2019 and put into effect in January 2020. Although it is too early at this time to receive verifiable results, after one year of preparation we can expect to see the first effects and tendencies towards an anti-Taylorist reintroduction of the ‘human factor’ into the organization and its development.

The first effects of the organizational changes within vocational education and training not only has opened the mind for change, but has considerably stimulated more engagement and satisfaction for all parties involved. The internal differentiation of the organization serves as a role model (s. Figure 1 in Chapter 2.1.2) for the apprentices. They are made aware of a transparent, comprehensible, and quick way of decision-making, as well as more sustainable problem-solving in the context of a dynamic-robust organization. This is reflected in “safe spaces” or “shelter rooms” in which dynamic-robust top performance is becoming more likely (cf. Chapter 1). As a result, trainers and leaders manage more conflicts (of course rarely personal, mostly related to technical issues) which lead to substantially better results in terms of quality – instead of relying on “one boss” at a top-down (Taylorist) organization. This renders the decision-making process more effective and more sustainable. One question remains: Can these types of conflicts be kept on a ‘constructive’ or (non-personal) ‘technical’ level? At this point, before escalating any conflict to a personal level, the traditional hierarchical decision-making comes into play; it relies on the talents of the leading person who finally decides. He or she must know how long conflicts could be kept on a technical level and when “the boss” must take a decision. Another level of prevention is mediation or a decisive order from the management board. Part of the structural reorganization is the application of a common digital Kanban-Board (“Trello”, Atlassian 2020) for each team member, using it on equal terms. Anyone can call for a (virtual) meeting or put topics on the commonly used agenda. This evokes a kind of positive form of ‘give and take’ of all others towards the organization and its way of collaboration. Moreover, recruiting new team members is easier than ever by using a 1-sheet functional role table instead of multilateral job descriptions. Additionally, the process for choosing new apprentices is smarter, because at the end of aptitude testing, the teams choose amongst themselves the candidates best suited for their team. The last effect of the restructuring is the new capacity for developing new business models for more market impact in the professional education sector. This was also verbally confirmed by Mr. Wünsch (B. Wünsch 2020, pers. comm., 6 February).

The last result of the restructuring of the professional training center is the development of new business models. In this connection, it is now possible to discuss new, unprecedented marketing and sales concepts. Employees are asked to contact potential clients and to familiarize them with the programs they offer. The employees are often accompanied by members of the management board and thus always have the support of their team leaders. This makes employees identify more with their own company and the education they provide, promoting the whole business of the BizKA. They gain additional motivation, become more committed, which contributes to the success of the training center. In the near future, InfraServ Wiesbaden is going to invest in a new facility (campus) for a new vocational training center, which will be more innovation-oriented and open to every customers’ (both industry clients and learners) demands, existing or potential. Leadership by tandem teams allows one person to concentrate on daily business while the other one focuses on creating and enhancing innovative formats. This allows for more flexibility for organic growth, which in turn will foster systemic segmentation in the future.
3. DISCUSSION

It is the goal of this article to give an understanding for the grown market dynamics and the consequences thereof for professional education.

Citing the head of BizKA, the case study considered in this article, together with the change of the organization, represents an experiment with high risks. Through the organizational restructuring of the training center, a large gap between the organization of the training institution and the apprentices opened up. This was verbally confirmed by Mr. Wuensch (B. Wünsch 2020, pers. comm., 6 February). Apprentices are usually not interested in how the training center is organized. They submit their applications, having in mind the prestige and quality of the professional education offered, and the increased chances for success to be gained for their future professional development. At first, the way the training institution is organized did not show any correlation with the training.

The case study shows that InfraServ Wiesbaden has a significantly advanced organization regarding the training center (BizKA), which represents an exception. As InfraServ Wiesbaden is situated in the Rhine/Main area, a German industrial metropolitan region near Frankfurt, it is under high competitive pressure, which forces it to defend its position through innovative training concepts, despite the growing market pressure. The changes introduced recently to the organization of work mark the beginning of a test phase to open professional education as a reaction to grown market dynamics. What is tested is the innovation of education to react to dynamic problems within companies. For the institution, this means that apprentices who complete the educational training (by means of adequate personnel, material, and organization) receive a higher-value qualification, which is an advantage in their future professional lives.

Currently, there is a lack of robust results concerning the organizational changes. As described in Section 2.3., the reason for this is that the training center’s leadership structure was just changed recently (01/01/2020). Thus, the tendencies and perspectives described in this article are primarily subjective experiences of possible, future developments in education, which are based on the re-introduction of the human factor into work organization. To gain more reliable results, further and, above all, long-term studies are imperative.

In this article, three problems (cf. Section 2.1.) received special attention. They certainly do not depict the overall structure of the threat situation professional education is facing due to grown market dynamics. Rather, they point out the tips of three icebergs. Significantly more information and analysis are required to derive specific consequences and alternatives for action.

Ultimately, every kind of education is unique, and strongly depends on the intrinsic motivation of all parties involved in the training organization. Each training institution should provide the organizational and structural basis that activates and motivates trainers to further develop and improve themselves. Following the principle of an isle of dynamic-robust top performance (cf. Section 1), they should be supported and protected by the institution. Trainers with the right motivation will be able to coach trainees in a better way. This enables and motivates them to acquire new knowledge and to gain experience regarding new knowledge and topics.

4. CONCLUSION

Today’s economy is global. Lateral growth has become impossible. In this new narrowness, pressure on the market can no longer be generated through cheap mass products, but through innovation. This has created a new dynamic, in which only companies that go beyond proven competencies are successful. Above all, they succeed because they have the competence to apply the latest technologies, even under dynamic circumstances. It would be too slow and imprecise to impart scientifically generated knowledge through education, which could then be applied later. Under dynamic circumstances, the demand for new knowledge is only generated directly during value-added processes. New ideas are required, and work conditions under which the corresponding talents may unfold.

This should be the new goal of professional training for dynamic environments.
Surely, vocational training has always been eager to adjust its contents to changing requirements. In recent years, many, and also fundamental adjustments took place. However, the dynamics of value-added processes during that time remained at a low level. No adjustment to high dynamics was necessary. Therefore, this adjustment is even harder to make today.

One further reason for current deficits in vocational training is the following: The handling of dynamics is only possible in a concrete manner. It can only be trained with problems that exist currently. Problems occurring at a later point in value creation can only be trained once they arise. Consequently, a relevant part of the competency required for practical work is acquired only after the training has been completed. On one hand, students need to learn that they will acquire a major portion of their professional competencies through practical work during their professional lives. The acquired knowledge then serves as the foundation for the acquisition of new knowledge. On the other hand, companies must learn that only themselves can find and support the talented persons required. It cannot be the task of an educational institution.

Knowledge is only found in environments where failures and errors are reckoned with and, eventually, are overcome or at least endured. The latter is easier when talents are trained to distribute problems among several talents, and to form teams. Teaching staff can definitely be a role-model regarding this competence, but only when they themselves are gifted with this competency (or talent) which cannot be learned. Consequently, the problem of sufficient and adequate competencies in modern education is not only a topic of interest for apprentices, but especially for teachers as well.

For example, in companies with a strong Tayloristic approach to work, the creation of “safe spaces” is typical. Here, it is possible to work on the solution of problems unhindered by the company’s rules. The motto is “Who is going to try it?” instead of “How it has to be done?”. They are similar to isles of dynamic-robust top performance, which were introduced in Section 1. Within the framework of vocational training, the function of such a safe space can be provided for trainers, but only simulated for trainees. However, during their training, it could help students to gain a glimpse of what they will encounter during their professional lives.

It is important to always keep the focus on competencies. This means the constructive coupling of knowledge and skills, or in other words: The ability of an individual to use their knowledge to solve problems.

The topics: “Where does new knowledge come from”, “How are ideas being created”, “How to find solutions to new problems” are currently not part of vocational training. Shifting from the question: “How are problems solved?” to the question: “Who can solve problems” corresponds to the shift from knowledge to talent as a source for the solution of problems. It is possible to cultivate knowledge through education. Talents are only discovered, not made. Especially not through hard work and discipline. The extension of knowledge through skills is the single possible way to adjust to dynamics.

Knowledge and skills are interdependent. They cannot be developed or used separately. But still, they are two different qualities. The transfer of knowledge is a topic of vocational training. Developing talent for professional practice can only be a topic of professional practice.

Traditionally, the hierarchic position of an employee is oriented around the efforts invested into her/his vocational training. Within the hierarchy, an academically-educated engineer is placed higher than a craftsperson who has received vocational training. As long as the dynamics remain low, the necessary cooperation between hierarchy levels can be organized while maintaining sufficient quality. Formalized processes are being created, along with the corresponding cultures.

With an increase in dynamics, more innovative solutions to unexpected problems must be found. Again and again, new structures are required that fit to current problems. We call such structures “team-based projects”. The hierarchy within these projects is only temporary, and is oriented towards the respective topic and the talents of team members. The formal hierarchy of the periphery would disturb the project and must be neutralized through safe spaces (see above). During training, as described above, it is only nearly possible to reconstruct this form of working, since dynamic problem situations only occur in a staged context.
As a case study, a German, medium-sized vocational training institution of the chemical industry is mentioned in this article. It exemplifies how a corresponding organization and educational structure was re-designed and built up in an innovative way. However, as the BizKA is legally obliged to adhere to the status quo of vocational training, according to which this innovative form of education represents a problem, the structure of its organization and education design is still in an experimental phase.

This article has shown that system-theoretical approaches open new possibilities to tackle the current deficiencies in vocational training. However, the dynamics-related portion of competencies of future employees cannot be acquired through training, but through real-world experiences in the every-day business of companies. It is of utmost importance for training providers to become aware of this new limitation of their possibilities. Furthermore, both trainers and trainees must adjust to this situation. Henry Ford was quoted at the beginning of this article, and suitable to the findings above, I would like to cite him again for my conclusion:

“If you always do what you’ve always done, you’ll always get what you’ve always got.” (Henry Ford)

REFERENCES