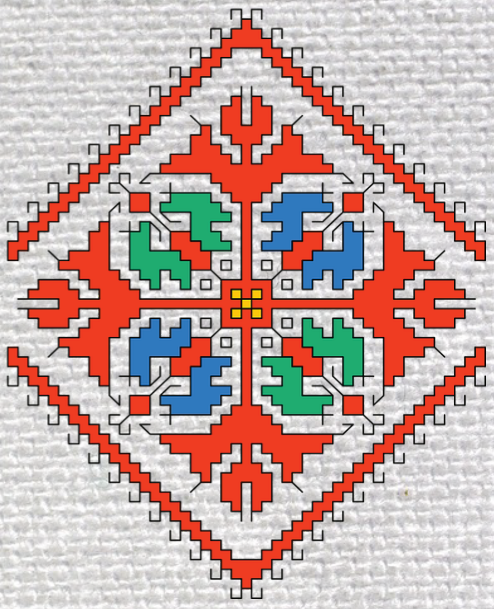
Образование, научни изследвания и иновации



Education, scientific research and innovation

ЗА БУКВИТЕ
О ПИСМЕНЕХЪ

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Съдържание

Contents

ИСТОРИЯ И АРХЕОЛОГИЯ
HISTORY AN ARCHAEOLOGY

МОДЕЛ НА БРАДВА ОТ СЕЛИЩЕТО СТРАШИМИРОВО I

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Резюме: *Праисторическият обект Страшимирово I е част от системата от праисторически селища около Варненските езера. Поради драгиране обектът е бил нарушен и археологическите материали са били изхвърлени на брега. Находките от обекта са без контекст и част от тях не могат да бъдат точно датирани. Това се отнася за повечето оръдия от обекта. От обекта е известен един каменен предмет, оформен като каменна брадва. Той е с трапецовидно тяло, правоъгълно сечение и с оформено симетрично, затъпено острие. Предметът е направен от силно изветрял вулкански туф, със силно обрушена оригинална повърхност. Изглежда оригиналната му повърхност е била излъскана. При сравнение с други подобни находки, но от археологически контекст, може да се предполага, че брадвата от Страшимирово I произхожда от енеолитния пласт на селището. От същата суровина са направени още няколко подобни предмета от други обекти. Рядко се срещат в гробове, а повечето произхождат от селищен контекст. Предназначението на предмета с форма на каменна брадва от Страшимирово I е неясно, но може да се предполага, че не е ползван за дърводобив и дървообработка. Въз основа на характеристиките му може да се предложи хипотеза за символичната му функция, вероятно като елемент от култовите практики, амулет или друга не стриктно утилитарна функция.*
Ключови думи: *праистория, енеолит, каменни оръдия, каменна брадва, Страшимирово I, модели на оръдия*

ВЪВЕДЕНИЕ

Праисторическото селище Страшимирово I е едно от множеството такива, разположени в зоната около Варненските езера (Ivanov 1993). В историческо време то се намира под нивото на водите на езерото. За пръв път селището е регистрирано още през 1921 г. във връзка с прокопаване на канал (Шкорпил, Шкорпил 1921, 79). През 1957 г. (Маргос 1961, 3) и за няколко месеца между 1969 г. и 1970г. селището е засегнато от дейности по драгиране на езерното дъно с цел увеличаване на дълбочината му (Маргос 1973, 267). При това на брега на езерото са били изхвърлени археологически материали от обекта. Събраните по брега предмети са предадени и се съхраняват в Регионален исторически музей – Варна.

При драгирането автентичната стратиграфска позиция на археологическите материали е нарушена и те са извадени от контекст. Не може да се реконструират археологически комплекси. Поради това при извършената обработка материалите са разграничени типологически, чрез сравнения, с други обекти с изяснена стратиграфия и въз основа на тях са направени заключения за периодизацията на Страшимирово I. Такъв подход е приложим най-вече за керамичните съдове и малък брой други категории, характерни за даден период, предмети – например антропоморфна пластика. По този начин са разграничени два пласта в селището: от късния енеолит и от ранната бронзова епоха (Маргос 1974, 279).

Поради специфичното си утилитарно предназначение предмети като оръдията от камък,

кремък и кост обикновено не са добър хронологически индикатор. Поради това и в статията, посветена на материалите от селището Страшимирово I, всички оръдия са разгледани сумарно и не е направен опит за тяхното отнасяне към разграничените два периода на обитаване (Маргос 1973, 269).

Сред материалите от селището, които се съхраняват в Регионален исторически музей – Варна, има каменен предмет с инв. № I. 1234, който е обект на настоящото изследване (фиг. 1). Предметът е с форма, близка до тази на каменна брадва. Формата му е издължено призматична. Той е симетричен, с точка на максимална дебелина близо до средата на предмета. Сечението му в най-изпъкналата част на тялото е правоъгълно със заоблени ъгли. Широката му страна е с форма на трапец, но със заоблени ъгли. От едната страна, подобно на другите каменни брадви, е оформено острие чрез двустранно симетрично скосяване на тялото. Острието е извито и при него се намира най-широката част на предмета. Ръбът на острието не е добре заострен, а е заоблен. На страната, противоположна на острието, е оформена заоблена пета чрез постепенно скосяване, без да се оформя друго острие или равна тилна площадка. Тилната част е най-тясната част на предмета. Максималните размери на предмета са: дължина 8,1 см, ширина 4,1 см, дебелина 2,7 см. Теглото му е 42 г. Изделието е направено от бяла скала, с множество тъмни, неравномерно разпределени включения с размер под 1 мм. Скалата е много мека и ронлива. Може да се определи като хидротермално изменена скала – силно изветрял вулкански туф. Поради качествата на суровината повърхността на предмета е силно обрушена, на места с до 2 мм дълбочина. Оригиналната повърхност е запазена само на отделни малки участъци. По тях може да се заключи, че целият предмет е бил излъскан.

Фиг. 1. Каменен предмет с форма на брадва от обект Страшимирово I

В публикациите, посветени на материалите от селището, не е изказано мнение за датировката и интерпретацията на предмета.

МЕТОДОЛОГИЯ НА ИЗСЛЕДВАНЕТО

При ограничената информация за контекста на каменния предмет от Страшимирово I и невъзможността той пряко да се свърже с датирани материали от обекта, единственият подход за добиване на повече информация за хронологическата му принадлежност остава сравнителният анализ с негови паралели. Информация за предназначението на предмета би дало трасологично изследване. Тъй като оригиналната му повърхност е запазена само на отделни места, по него няма следи от употреба, въз основа на които да се предположи функцията му. Поради това формата

и материалът, от който е направен, трябва да се приемат за водещи при идентификацията на функцията му. Наред с това за допълнителна информация при интерпретацията му могат да се приведат паралели с други сходни находки.

РЕЗУЛТАТИ

От селищна могила Сава е известна каменна брадва от същата бяла ронлива скала – инв. № I 904 в Регионален исторически музей – Варна. Брадви от същия материал и със сходни характеристики са известни от III пласт на селищна могила Поляница – инв. № 3474 в Регионален исторически музей – Търговище, и V–VI пласт на селищна могила Радинград – инв. № 4883 в Регионален исторически музей – Разград (фиг. 2).

Фиг. 2. Каменни брадви от бяла, ронлива каменна суровина от: a) с.м. Сава; b) с.м. Поляница; c) с.м. Радинград

Въз основа на тези паралели може да се предполага, че предметът с форма на брадва от Страшимирово I произхожда от енеолитния пласт на селището. Въз основа на керамичния материал той е отнесен към късната фаза на периода (Маргос 1973, 274). За сходна датировка подсказват и посочените паралели на предмета – от селищни могили с пластове от късния енеолит (Мирчев, Златарски 1960, 24; Тодорова 1986, 73; Иванов 1987, 5) от втората половина на V хил. пр. Хр.

Формата на предмета от Страшимирово I е близка до тази на посочените три каменни брадви от селищните могили при Сава, Поляница и Радинград. При всички тях е оформено тяло с призматична форма и трапецовидна широка страна. Чрез симетрично заточаване са оформени остриета, които са и най-широките части на предметите. Остриетата са силно обрушени поради характеристиките на суровината, от която са направени изделията. Пак тя е причината за силно нарушената им автентична повърхност. Само при брадвата от селищна могила Поляница автентичната повърхност е по-запазена. Може да се предполага, че и при четирите предмета тя първоначално е била излъскана. Сеченията на предметите са с различни пропорции, но са четириъгълни, със заоблени ъгли. Освен суровината, от която те са направени, сходства се откриват и в размерите им (таб. 1).

Таблица 1. Характеристики на каменните предмети

Инв. № и произход	**Максимални размери**	**Тегло**	**Материал**
I 1234 от Страшимирово I	Дължина: 8,1 см; Ширина: 4,1 см; Дебелина: 2,7 см;	42 г	Бяла, ронлива скала с малки тъмни включения (изветрял туф)
I 904 от с.м. Сава	Дължина: 6,6 см; Ширина: 4,6 см; Дебелина:1,3 см;	56 г	Бяла, ронлива скала с малки тъмни включения (изветрял туф)

3474 от с.м. Поляница	Дължина:4,7 см; Ширина: 3,8 см; Дебелина: 2,5 см;	32 г	Бяла, ронлива скала с малки тъмни включения (изветрял туф)
4883 от с.м. Радинград	Дължина: 6,3 см; Ширина: 3,5 см; Дебелина: 2,3 см;	55 г	Бяла, ронлива скала с малки тъмни включения (изветрял туф)

Брадви със сходна форма са открити при проучванията на енеолитни селища в Североизточна България, като селищна могила Голямо Делчево и селищна могила Овчарово (Тодорова и др. 1975, 70; Тодорова и др. 1983, 60). Същевременно брадвата от Страшимирово I се различава от повечето праисторически брадви, открити в селища, със своите по-малки размери, по-малко тегло и със суровината, от която е произведена.

Каменните брадви от селища от късния енеолит, включително и другите каменни брадви, произхождащи от Страшимирово I, са с по-големи размери, с тегло над 100 г и са произведени от твърди скали с вулкански произход. Тези характеристики на каменните брадви се налагат поради естеството на работата, за която се използват, а именно дърводобив и дървообработка. Особено важна е здравината на оръдието. То трябва да може да отстоява на многократни удари с минимални щети. Суровината, от която е произведена каменната брадва от Страшимирово I, не предполага то да е използвано по такъв начин. Бялата хидротермално изменена скала е много крехка и ронлива. Оформеното от нея острие много лесно би се затъпило и счупило. Наистина повърхността на брадвата от Страшимирово I е силно обрушена, а оформеното острие е силно наранено и заоблено, но няма сигурни следи, че това е вследствие на използване. Повърхността на целия предмет е нарушена, не само работните му части.

Има данни за използването на оръдия за дърводобив и дървообработка от светли скали с по-ниска твърдост в Централните Балкани (Antonović 1997, 37). Обърнато е внимание, че това може да е свързано с използване на местна суровина за производство на оръдия в късните фази на култура Винча (пак там). Същевременно в селища в Североизточна България оръдия от суровина като брадвата от Страшимирово I се откриват много рядко. Те винаги са в пъти по-малко от оръдията, изработени от по-твърди вулкански скали, независимо че в целия район не се срещат удобни находища на такива. Явно за общностите, обитавали Североизточна България през късния енеолит, не е било проблем да се снабдяват с голямо количество качествена каменна суровина за производство на оръдия.

Описаните характеристики на брадвата от Страшимирово I, разгледани на фона на особеностите на местната каменна индустрия, предполагат, че предметът не е бил използван за дърводобив и дървообработка. Същевременно няма основания да се предполага, че предметът е имал друга утилитарна функция. По размери, форма и материал се различава от другите каменни оръдия в инвентара на енеолитните общности, като чукалки, гладилки и други. Ниската затъпеност на подобни предмети в селищните контексти също пречи да се предполага ежедневна утилитарна функция.

ДИСКУСИЯ

За предметите като брадвата от Страшимирово I може да се изкаже хипотеза за неутилитарна функция – като символи или обреден инвентар. Те могат да се явяват модел на брадви, натоварени с определено значение. В полза на това предположение могат да се приведат по-малките размери и тегло на предметите. Ако не е предвиждано те да бъдат използвани за дърводобив, то и изборът на суровина намира своето обяснение. Тя е много лесна за обработка, съответно много бързо и с минимални усилия може такъв предметът да бъде произведен. От сходен материал са направени и някои от т.нар. „скиптри“ от некропола Варна I (Костов, Пелевина 2006, 28). В тази връзка е интересно да се отбележи, че при погребалните практики от енеолита е констатирано високо ниво на символизъм (Тодорова 1986, 194). Например в некропола при Девня в гробовете са поставяни миниатюрни, зле изпечени съдчета, които са модели на реално използваните в ежедневието

(Тодорова-Симеонова 1971, 21). За некропола при селищна могила Търговище е отбелязано, че положените в гробовете каменни оръдия са направени от „бял, лесно трошлив камък“ (Ангелова 1986, 62). Те също могат да се приемат за модели, в случая направени специално за погребението. Такава информация има и за няколко гроба от некропола Варна I (Костов, Пелевина 2006, 27).

Трябва да се обърне внимание, че не всички предмети, които могат да бъдат идентифицирани като модели на каменни брадви, са свързани с гробен контекст. Повечето ни известни такива произхождат от селища. Това се отнася и за брадвата от Страшимирово I. Изглежда тя е играла някаква роля в ежедневния живот на енеолитната общност. Хипотетично тя може да е играла роля на вотив, амулет, което може да се предполага и за други малки каменни оръдия (Avramova 2005, 123), или да е имала някаква роля в обредни практики.

ЗАКЛЮЧЕНИЕ

Каменният предмет от Страшимирово I, както и другите подобни предмети, които са известни от селищен контекст, са оформени като каменни оръдия за дърводобив и дървообработка, но се различават от тях по своите размери, тегло и суровина за производство. Характеристиките, които отличават брадвата от Страшимирово I и сходните ѝ предмети от останалите оръдия, всъщност ги правят неефективни за работа.

За съжаление, няма достатъчно информация, за да се предложи по-конкретна интерпретация на функцията на предмета с форма на брадва от селището Страшимирово I. Сведения за контекста на намиране на подобни предмети могат да допринесат за изясняването на ролята им в живота на енеолитните общности. За съжаление, към момента те са много ограничени.

Все пак с голяма доза сигурност може да се предполага изказаната хипотеза за функцията на каменния предмет с форма на брадва от Страшимирово I като символ – означение за брадва, което е натоварено с определен смисъл от общността. В качеството си на такива знаци или символи подобни предмети може да са играли роля в разнообразни дейности, израз на вярванията на общностите.

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MODEL OF AN AXE FROM THE SETTLEMENT STRASHIMIROVO I

Abstract: *The prehistoric site Strashimirovo I is a part of the system of prehistoric settlements around Varna lake. Because of dredging in the lake, the site was disturbed and the archaeological materials were deposited on the shore. As a resault the finds are without context and some of them could not be precisely dated. That is the case with most of the tools from the site. One stone object form the site is shaped like a stone axe. It has a symmetrical, dull blade and a trapezoid body with a rectangular cross section. The object is made from degraded tuff, making it very brittle and with a crumbling surface. It appears that the object was polished all over, but the authentic surface has eroded. By comparing the object with similar finds from archaeological context, it could be dated in the 5th millennium BC. There are few objects made from the same material, from other sites. They were rarely placed in graves and most of them were found in a settlement context. The function of the stone axe from Strashimirovo I is unclear, but it was not used as a tool for woodcutting and woodworking. It could be hypothesized that it had as a symbolic function, probably part of the cult practices, an amulet, or other not strictly utilitarian use.*
Keywords: *Prehystory, Eneolithic, stone tools, stone axe, Strashimorovo I, models of tools*

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ОБЩЕСТВЕНИ КОМУНИКАЦИИ И ИНФОРМАЦИОННИ НАУКИ
PUBLIC COMMUNICATIONS AND INFORMATION SCIENCES

THE CHALLENGES OF TRANSFORMING THE CONSTRUCTION SECTOR FROM A LINEAR TO A CIRCULAR ECONOMY

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Abstract: *One of the EU's priorities under the Green Deal to combat climate change is to transform the EU economy into a circular economy, as the extraction and processing of raw materials generates large amounts of greenhouse gas emissions. Unlike the linear economy, which essentially consists of the production, use and subsequent disposal of goods, the circular economy is a holistic approach aimed at conserving resources. The construction sector is known to consume many resources and produce large amounts of waste. The much-needed implementation of the circular economy in the construction sector requires a lot of effort, long-term planning, and a holistic approach. In essence, it is about designing a modern building that is both sustainable and circular. The measures needed to implement the circular economy concept are waste, resource efficiency, reuse of soil, circular design principles, non-destructive dismantling, a renovation wave and so on. We have long known that business as usual, i.e. economic activity in a linear pattern, is no longer possible in the face of climate change, resource scarcity and increasingly critical geopolitical dependencies. The fact is that the sooner the construction industry recognises the challenges, the more successful it will be in managing change.*
Keywords: *Circular economy, urban mining, secondary raw materials, material flows, resource consumption*

INTRODUCTION

Climate change and the loss of biodiversity and the ecosystem services associated with it are the most complex challenges humanity has ever faced. It can only be overcome through collective action. Linked to this is the problem of increasing global competition for scarce resources such as fresh water, land, and raw materials, and the closely related worldwide environmental problems of species extinction, deforestation, soil degradation, and the availability of landfill space. With resource extraction and processing accounting for 50% of total greenhouse gas emissions and more than 90% of biodiversity loss, the European Green Deal has launched a concerted strategy for a climate-neutral, resource-efficient, and competitive economy. (European Commission, 2020). It includes a series of measures to combat climate change and promote sustainable development, with a focus on the circular economy. The conservation of natural resources through a comprehensive circular economy – CE has become a key issue. As part of the Green Deal, the EU published a new Circular Economy Action Plan in March 2020. This plan outlines measures to transform the EU economy into a circular economy, focusing on sectors with high circular potential such as electronics, batteries and vehicles, packaging, plastics, textiles, and construction and demolition materials. The development of a circular economy should make a decisive contribution to achieving climate neutrality by 2050, decoupling economic growth from resource use while ensuring the EU's long-term competitiveness and leaving no one behind. To achieve this ambitious goal, the EU must accelerate the transition to a regenerative model that gives back more to Mother Earth than it takes and ensure that its consumption of resources remains within the limits of our shared planet.

RESEARCH METHODOLOGY

The research methodology aims firstly to demonstrate the urgent need to transform the current linear economic system into a circular one. It analyses the negative environmental impacts of the construction sector. It then identifies and explains a wide range of measures that can be taken to transform the linear economic system in the construction sector into a circular economy.

RESULTS

1. Linear economic system versus circular economy

The concept of the circular economy is first and foremost a critique of the dominant linear production system of 19th century industrialization. The problems associated with our linear economic system will become even more acute in the coming years unless radical changes are made as the world's population and economies continue to grow and prosper. A fundamental rethink is therefore urgently needed. The circular economy offers a way forward. Unlike the linear economy, which essentially consists of the production, use and disposal of goods, the circular economy is a holistic approach to conserving resources. It safeguards the livelihoods of future generations, reduces greenhouse gases and pollutants, and minimizes anthropogenic pressure on intact habitats. Waste is a recent invention. Until well into the 19th century, there was little waste. At that time, raw materials were highly valued. In this respect, there was a functioning circular economy in pre-industrial times. This changed with industrialization. Factories produced mass goods and people accumulated possessions. Waste became fuel for incineration and an integral part of the thriving economy. The growth of markets for new products depended on the continued short-term disposal of used goods. As the saying goes, "You can only grow if you throw away". In other words. Waste is the price of prosperity. Switching to a functioning recycling economy is the order of the day. (Strasser, 2000).

The Ellen MacArthur Foundation has conceptualised the circular economy as a system based on the idea of dividing material flows into two cycles: the technical resource cycle and the biological resource cycle. In the circular economy, products and industrial processes are designed so that materials are left behind to be used in either the biological or the technical cycle. The traditional linear economy, which dominates most sectors, including the construction industry, is based on the 'extract – produce – dispose' model. In this model, resources are extracted, processed into products, and often disposed of very quickly after use. The construction sector is known for its high consumption of resources and large quantities of waste. In addition, many building materials are suspected of containing harmful substances that can endanger the environment. These challenges to the linear economic model have far-reaching environmental and economic consequences. Given the planet's limited resources and the need to minimise environmental impact, a new approach is required. Contrary to what the name suggests, the concept of the circular economy is not limited to simply returning waste to the production cycle through recycling. It is about optimising the use of resources throughout the value chain.

2. THE MAIN CHARACTERISTICS OF THE LINEAR OR CIRCULAR ECONOMIC SYS TEMS ARE:

- **Resource consumption:**

In a linear economic system, resources are often used only once before they become waste. This take-make-waste model leads to high consumption of raw materials and energy. In contrast, the circular economy aims to preserve the value of resources for as long as possible by reusing, repairing, upgrading and recycling products and materials.

- **Waste production:**

A linear economic system generates large amounts of waste because products are often disposed of after use. In the circular economy, waste is seen as a resource. The aim is to minimise waste and return it to the production process wherever possible.

- **Life cycle of products:**

In a linear economy, the life cycle of a product is often short – It is made, used and then disposed of. The circular economy tries to extend the life cycle of products, for example through durable design, repair options and upcycling.

- **Sustainability:**

A linear economic system cannot be sustainable in the long term because it is based on the consumption of limited natural resources. The circular economy aims to create a sustainable economy that works within the ecological limits of our planet.

- **Business model:**

In a linear system, economic success often depends on constant growth and increasing consumption. In contrast, the circular economy promotes business models based on services and sharing resources rather than selling more and more products. The circular economy decouples economic growth from resource consumption.

These differences make it clear that the transition from a linear to a circular economy requires fundamental changes in the way we make, use, and dispose of products.

3. TOWARDS A CIRCULAR ECONOMY IN THE BUILDING SECTOR

The built environment has a significant impact on many sectors of the economy, local employment and quality of life. The construction sector is one of the most resource intensive in the world. It accounts for around 50% of total raw material extraction and more than 35% of total waste generation in the EU. Greenhouse gas emissions from the extraction of raw materials, the manufacture of construction products and the construction and renovation of buildings are estimated to account for 5-12% of total national greenhouse gas emissions. Improving materials efficiency could save 80% of these emissions. (European Commission, 2020).

Since the 1980s, the term 'circular economy' has been used to describe models that extend the useful life of products, minimise waste and conserve resources. The idea is to organise construction in cycles. Building projects that use recycled materials such as old tyres, cork, newspapers or seaweed to insulate climate-friendly social housing show how this can work. These are valuable resources that would otherwise be landfilled or incinerated. By recycling or reusing them, they are put back into the economic cycle. Implementing the circular economy in the construction sector has some unique features. Buildings and built infrastructure often have a long lifespan of decades or even centuries. This requires long-term planning and a holistic view of materials and resources to ensure sustainable use throughout the life cycle.

In recent years, the EU has made considerable efforts to promote the circular economy in various sectors, including construction. Essentially, it is a matter of designing a modern building which is both sustainable and circular. The measures needed to implement the circular economy concept are listed below:

-**Waste reduction:**

One of the main areas in which the EU expresses its ambitions for a circular economy in construction is through waste reduction. The construction sector is one of the largest producers of waste in the EU, and much of this waste ends up in landfills. The EU therefore aims to reduce construction waste while promoting its reuse and recycling.

- **Resource efficiency:**

Another important aspect of the EU's circular economy objectives for construction is to improve resource efficiency. This means using fewer resources to construct buildings and infrastructure and using materials for as long as possible. This can be achieved through a number of measures, such as the use of sustainable construction materials, innovative construction methods or designing buildings to last longer and to be easily dismantled and reused at the end of their useful life.

- **Reusing soil**

Until now, urban mining has been understood as a strategy related to anthropogenic materials and deposits. In addition to construction waste, soils can also be used and reused as part of the circular economy. A large proportion of construction-related waste streams are generated during the excavation of building pits. While excavated soil is usually transported away and disposed of, gravel and sand from construction pits can be processed into concrete on site using mobile plants. A mobile batching plant on site reduces transport distances by 40%, protects quarries and landfills and saves money by eliminating disposal. Not all excavated soil is suitable for construction purposes such as concrete production. But even soil that is not suitable for construction can be incorporated into the design in the form of mass levelling.

Natural soil is a non-renewable resource. All terrestrial production processes, such as food production, are directly dependent on healthy, intact soil. It is therefore necessary to use soil as a resource not only sparingly but also in a circular way: To integrate soil protection into the construction process, strategies for reusing soil are summarised in the concept of "circular soil". Soil from the excavation phase is stored and can be used as an organic component in the mixing and preparation of vegetation substrates and for construction purposes.

- **Circular design principles**

Circular design must become an integral part of planning in architecture and engineering. The principles of circularity must be taken into account in the design phase and the objectives and criteria for achieving them must be defined. The definition of measurement and performance indicators is particularly important in order to be able to check the implementation of circular objectives in the subsequent project steps. The transition from a linear to a circular economy does not necessarily mean a return to pre-industrial production methods. If sustainability can be successfully integrated into the design process, products can be used for much longer.

- **Non-destructive dismantling:**

Deconstruction plays an important role in the circular economy. It is understood as "reverse construction", i.e. the possibility of dismantling a building piece by piece in a non-destructive way and preserving its value by reusing it in different contexts. It is the alternative to traditional demolition, which tends to be a haphazard and destructive process. Compared to conventional demolition, deconstruction allows for a much higher degree of reuse and recycling of materials. After demolition, building components can be reused in a new context and life cycle. Before being reused, they must reach a qualified and certified level of quality to ensure construction and use safety.

- **Renovation wave:**

The circular economy in the construction sector is often associated with new buildings. However, there are many buildings that need to be renovated as part of a 'renovation wave'. This means that we will need to focus even more on renovation in the future in order to meet ambitious climate targets.

- **Energy efficiency:**

The EU also aims to improve the energy efficiency of buildings, which is an important aspect of the circular economy as buildings account for a large proportion of total energy consumption in the EU. Improving the energy efficiency of buildings can reduce energy consumption while reducing dependence on fossil fuels.

- **Renewable and local raw materials:**

An important lever for improving the environmental performance of buildings is the substitution of materials such as steel and concrete, i.e. the replacement of materials with poor environmental performance with climate-friendly building materials, preferably made from regional and renewable resources. Great progress is being made in materials science. However, the use of such materials must not lead to competition or land conflicts with food production. Transport routes should be kept short, and energy consumption during production and recyclability at the end of use should be taken into account. In the future, buildings will be constructed mainly from renewable or locally available raw materials. Architects are rediscovering clay and wood as sustainable building materials. Wood is renewable, generally requires less energy to manufacture building products and can be easily reused or recycled if treated without chemicals or pesticides and the structure can be dismantled. The wood used should be native species from certified sustainable forests with less than 60 per cent deforestation. Native hardwoods should be preferred to softwoods.

- **Collaboration between stakeholders:**

There are a variety of building materials such as concrete, steel, glass, wood and plastic. Each material has its own recycling and reuse characteristics, making it difficult to implement circular approaches. Construction projects are often very complex and involve many actors from architecture, engineering, construction and supply industries. A successful transition to a circular economy therefore requires close cooperation and coordination between all parties involved.

- **Life cycle assessment:**

A circular economy in construction must consider the entire life cycle of a building, from design and construction to use and eventual disposal or reuse. This means identifying opportunities to maximise resource efficiency throughout a building's life cycle.

- **Innovative business models and services:**

Another important lever for conserving resources in a circular economy is the intensification of use through innovative business models. These include rental and service models such as car sharing, but also the development of new business areas through the use of previously unused waste streams (e.g. innovative materials made from feathers from the poultry industry). So-called operator models (also known as XaaS models) are increasingly finding their way into the building sector, from the building envelope to building services and interiors.

- **Digitalization:**

Developments in the construction industry and the circular economy are very dynamic. New regulations and organisations are constantly emerging to address the issue. In addition, the rapid development of Building Information Modelling (BIM) and building simulation (digital twin) is rapidly changing project management. The same applies to the field of building automation (BA), with a focus on artificial intelligence (AI) in buildings and cybersecurity. Transparency in construction projects is an important basis for the circular economy in buildings. If you know what has been used where and how, you can plan for conservation and reuse. Digitalization already makes this possible. Information transparency is happening on several levels. Building Information Modelling (BIM), for example, stores a digital twin or passport of the building. The technology enables more efficient planning and networking of data throughout the entire lifecycle of buildings, right up to demolition. This information can be stored in digital cadasters and would then form the basis for long-term urban mining in the EU. At the product level, material and product passports can be used to compile information on the material composition, origin, manufacturing method, service life, repairability and recycling options of building materials. This would provide designers and clients with an overview of the overall impact of building products at an early stage of the project, enabling them to make informed decisions. Transparency at product and building level can also make the grey energy and grey emissions of buildings visible.

- **Urban Mining:**

Urban mining refers to the concept that buildings are “mines” containing valuable secondary resources. The aim is to avoid the extraction of primary resources and to optimise the use of secondary resources. The materials should be able to be recovered, reused, or recycled in at least the same quality, e.g. during renovation or demolition, instead of being disposed of or landfilled. The concept is that they can be dismantled and reused at the end of the building's life. The building becomes part of the urban mine. At the end of its life, instead of becoming rubble for landfill, it becomes a valuable source of raw materials or a supplier of raw materials for new construction projects. Maximising value retention is a prerequisite. Waste generation, landfill, air and water pollution should be avoided and fossil fuel consumption reduced. Urban mining offers the opportunity not only to reduce CO2 emissions in the construction sector through recycling in the sense of a circular economy, but also to make the construction industry somewhat less dependent on raw material shortages. It should be noted that urban mining is not limited to cities or buildings, but also fundamentally affects durable goods such as electrical appliances or cars.

- **Material Building Passport:**

A Material Building Passport (MBP) is a documentation of the material composition of a building. It provides quantitative and qualitative information on the relevant raw materials in a building. The MBP serves as a planning and optimisation tool for the efficient use of materials and subsequent demolition. It documents the material information required for the recycling of buildings at the end of their life cycle and serves as the basis for an urban resource register at the city level. New planning tools such as Building Information Modelling (BIM) offer great potential for the creation of a MGP. The basic concept is similar to that of the Energy Performance Certificate. It aims to show the resource consumption, climate impact and recyclability of each individual building. The first step is to collect general information about the building, such as its location, year of construction and construction method. The total mass of the building is also recorded. The main focus is on the materials used and which recyclable materials were used. In the case of construction and demolition waste, the proportion of renewable raw materials and reused or recycled materials is also recorded. This creates transparency and opens up new possibilities for assessing the recyclability of a building. In practice, the Building Resource Passport creates an information base for

all phases of a building's life cycle and thus makes an important contribution to transparency regarding the materials used, the greenhouse gas emissions of buildings and their recyclability. All information about the building will be made available in order to promote the refurbishment and new construction of buildings in a circular manner. In the long term, the digital building passport will enable a consistent circular economy in the construction sector by linking all life cycle phases from planning to recycling

- **Commercial viability:**

In addition to the environmental urgency, there are also economic reasons for change in the construction sector. Circular and recyclable buildings make economic sense. In addition to the environmental benefits of protecting the climate, resources and biodiversity, they also offer advantages for building owners and the construction industry as a whole. It is true that recyclable buildings are currently more expensive to buy. This is because recyclable, durable materials are generally of higher quality and are more expensive due to lower volumes and availability. The scarcity of resources will tend to lead to rising raw material prices, i.e. the material value of the materials used will increase (rising residual values). The economic benefits will be realised in the renovation and maintenance of buildings that can be recycled and dismantled. Connections are easily removable, making it easier to replace parts. In addition, recyclable building materials are of higher quality and therefore tend to last longer. Replacements and repairs are less frequent. Cost savings during demolition are particularly high. Instead of costly disposal, recycled building materials can be more easily reused, recycled and even resold. Cost-saving processes such as prefabrication, modular construction, serial construction, etc. have a significant cost-reducing effect. When costs are considered from this life-cycle perspective, recyclable buildings are quite competitive in terms of price.

CONCLUSION

The recent EU Climate Change Adaptation Strategy sets out how the EU can adapt to the unavoidable impacts of climate change and become climate neutral and resilient by 2050. This strategy has implications for the buildings sector and requires a transformation. The transformation of the buildings sector towards a circular economy is inevitable from both a climate and resource perspective. The first regulatory frameworks that take into account the need to transform the sector are now in place. The decarbonisation of the buildings sector is one of the major challenges that policymakers, businesses and society need to address urgently in the coming years. At the European level, the European Green Deal is also ensuring that policymakers take a closer look at measures in the construction and building sector. The Circular Economy Action Plan foresees a wave of renovation and a revised Construction Products Regulation, with increased use of recycled materials, digital building logbooks, life cycle analysis, recycling targets for construction and demolition waste, and less soil sealing. The concept of the circular economy is a promising one. By valorising, reusing, and recycling resources, it aims to ensure their availability and quality for future generations. The circular economy is therefore a fundamental building block of sustainability and applies this to the economic system and its individual sectors. We have long known that “business as usual”, i.e. economic activity in a linear pattern, is no longer possible in the face of climate change, resource scarcity and increasingly critical geopolitical dependencies. Change and the abandonment of established and traditional ways of doing things automatically trigger resistance. A lack of life cycle thinking leads to a focus on supposedly 'low-cost building'. There is currently a strong sense of optimism among stakeholders. EU projects such as the New European Bauhaus are proving fruitful. The fact is that the sooner the construction industry recognises the challenges, the more successful it will be in managing chang.

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ПРЕДИЗВИКАТЕЛСТВАТА ПРЕД ТРАНСФОРМИРАНЕТО НА СТРОИТЕЛНИЯ СЕКТОР ОТ ЛИНЕЙНА КЪМ КРЪГОВА ИКОНОМИКА

Резюме: *Един от приоритетите на ЕС в рамките на „Зелената сделка“ за борба с изменението на климата е превръщането на икономиката на ЕС в кръгова икономика, тъй като добивът и преработката на суровини генерират големи количества емисии на парникови газове. За разлика от линейната икономика, която по същество се състои от производство, използване и* последващо *изхвърляне на стоки, кръговата икономика е цялостен подход, насочен към опазване на ресурсите. Известно е, че строителният сектор консумира много ресурси и произвежда големи количества отпадъци. Така необходимото прилагане на кръговата икономика в строителния сектор изисква много усилия, дългосрочно планиране и цялостен подход. По същество става въпрос за проектиране на съвременна сграда, която е едновременно устойчива и кръгова. Необходимите мерки за прилагане на концепцията за кръгова икономика са отпадъците, ефективното използване на ресурсите, повторното използване на почвата, принципите на кръговото проектиране, неразрушителното разглобяване, вълната на обновяване и т.н. Отдавна знаем, че обичайната стопанска дейност, т.е. икономическа дейност в линеен модел, вече не е възможна в условията на изменение на климата, недостиг на ресурси и все по-критични геополитически зависимости. Факт е, че колкото по-рано строителният бранш признае предизвикателствата, толкова по-успешно ще се справи с промяната.*

Ключови думи: *кръгова икономика, градски добив, вторични суровини, материални потоци, потребление на ресурси*

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ОБЩЕСТВЕНИ КОМУНИКАЦИИ И ИНФОРМАЦИОННИ НАУКИ
PUBLIC COMMUNICATIONS AND INFORMATION SCIENCES

ARTIFICIAL INTELLIGENCE IN MUSIC EDUCATION

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Abstract: *Artificial Intelligence (AI) is gradually becoming a significant component in music education due to the increasing demand for new technologies and their constant supply. While AI is an important tool, it remains a device, which makes sense only if it is contextualized. The efficiency of music education with AI depends very much on music theory and systemic circulation to research conversion methods between music media, identifying music videos, audio and emotion. AI could collect big music education data, model the teaching process, perform analytical and systemic research, and make quality suggestions on resource allocation. At the same time AI poses challenges related to the authorship and ownership of its products, liability and infringement of copyright protected content, attribution and regulations. Nevertheless, AI needs to be incorporated in any efficient music education model. While AI is gradually entering the creative space, it needs to be applied in a responsible manner, so as not to replace the human expression and reflect context.*

The article provides an overview of key concepts and research related to AI application in music education and analyzes the different uses of AI in teaching and learning. Against the background of existing research, it outlines the structural elements in music education and identifies the pros and cons of AI application in this field, its potential and limitations. Efficient music education and AI are closely related to the use of intellectual property hence the article pays specific attention to the challenges related to intellectual property rights evoked in the process of AI application in music education.

Keywords: *artificial intelligence, intellectual property, education, efficiency*

INTRODUCTION

Artificial intelligence (AI) is quickly becoming an inseparable part in virtually every field of our lives. From dealing with everyday tasks and managing our personal lives to performing tasks related to our professional activities AI becomes a necessity and influences our choices in conscious and unconscious manner. Music education is not an exception and AI is increasingly making its way into this field, which has traditionally been reserved for humans.

Technology has been closely associated with music and has revolutionized the music industry over time. The gramophone, radio transmissions, recording equipment, tape recorders, cassette recorders and CDs are just a few examples of the milestones in technology development, which made music one of the most popular and successful creative industries. In relation to music education probably the first examples of using rudimentary AI are linked to the 60ies of the XX century and the functions of the keyboard (Howie and Rosenblatt 2023). By introducing various contextual musical inputs technology opened up possibilities for emulating environments where education could be more effective.

The topic of AI in music education is an interdisciplinary one and it involves contributions from the fields of music, education, AI, cognitive psychology, the psychology of music, social psychology, anthropology, philosophy, linguistics, human computer interaction, mathematics, computer science and many other fields. AI in Education as a subject has its origins in the 70ies when the first works of Carbonell appeared (Carbonell 1970). It has its own developed methodologies, techniques and traditions. AI in music education is a subset of issues in AI education with an even more recent history.

Music education comprises two parts. One is the process of teaching and the second, inseparable part is learning. In both parts AI has made considerable progress and has become a useful tool for achieving

learning objectives and improving efficiencies. Its main contribution is in improving the engagement and communication between **the educator and the student while using the power of technology.**

The Evolution of AI and Technology in Teaching

With the advancement of technology music teachers have acquired new knowledge on how to build connections with their students, adapt their curriculum and the pedagogy. Teachers tried various individual approaches but results suggest more efficiency in streamlining teaching approach and adopting a single learning management system. Using curated technology resources provides more opportunities for collaboration both with other teachers and with students, while freeing more time and space for focusing on the development of content of the individual courses.

Teaching with AI techniques has now become more complete as contemporary scientific achievements and technology tools are enhancing the process and results of music education. AI was initially used in electronic music, where software applications considerably enhanced the process of music education. This was initially adopted predominantly in private educational institutions. According to the Chinese scholar Jing Wei, AI can provide an optimized environment for professional music education, which yields best results in a network teaching model. His research indicated that the AI enabled scores students' learning outcome rate was 95.2%, the efficiency ratio was 98.1%, the mean square error rate 17.9%, accuracy ratio 95.3% and the teaching performance analysis ratio was 90.7%. This impressive empirical data, obtained though Wei's case study, suggests unequivocally that AI technologies improve music education results (Wei 2019).

The concept of music and AI builds on a combination between music theory using platforms as a subject and AI analysis for studying transfers of the music media, including the identification of music records and audio identification. Research is focusing on such fields as perception, music collection, automated composition, automated recording, and music extraction (Farivar 2020). The results of research on teaching and education of music with AI is used for understanding and analyzing the creative process and improving technologies used for information analysis. AI enabled teaching patterns effectively increase teaching efficiency and performance and spare both teachers and students certain educational and learning functions and responsibilities such as correction of tests, collecting references, updating curriculum and many more. One of the most important outcomes is the increase of interactivity in music education. Students are more engaged and interested when teaching is based on innovation theory methods and AI applications as compared to conventional teaching modes (Billah 2021, Baratè 2020). This is a field of constant research – developing new student involvement strategies through technology.

Another important area with constant improvements is the reinforcement of a personalized approach with AI enabled teaching methods. When using teaching assistant format, personalized music teaching helps students learn faster and each individual student can receive special attention (May 2020). Teachers can identify the excellence and weaker points and stimulate the student innovative performance. Moreover, interactive education and teaching can be applied at every stage of the educational process – from introducing basic concepts, through practice and performance.

For AI-enabled education, music is not an easy area. The problem is that, in general, music demands creative and problem-solving approach both by students and teachers. Music is not a predictable outcome of the creative process. Looking at the advantages, AI-based educational method can offer students additional resources that enhance the passion in education and teaching activity and provide a platform to develop innovative ideas (Asaaf 2019). This is done with the use complex information technologies which are integrated with the educational process. Students can use advanced AI guidance to understand and improve training outcomes and performance abilities. When the educational process takes place in a network teachers can enhance musical abilities through the network teaching resources and platforms, which adds additional benefits in the process.

Interaction is a two-way street. It involves exchanges and discussions to analyze performance, the results of learning and the evaluation of progress. These actions can be carried out in an appealing environment which makes the process even more interesting. Evaluating the learning and teaching impact is a key element in education and teaching. Music teachers can assess more efficiently following different

methods and evaluating students. Some experiments show that instead of using a statistical modeling or other machine learning approaches, a rules-based AI system can give better results. The evaluation is not only based on the embedded theory, but also on the feedback, which adds an interactive feature and enhances the outcomes.

Overview of research

The research on the use of AI in music education has expanded only recently. On the one hand, this is explained by the increased supply and abundance of AI technologies. AI can do things which were unthinkable years ago. On the other hand, there is a notable increase in demand for AI technologies in all fields, incl. the music field. This match between increasing demand and constant supply creates a favourable environment for future dynamic developments in this field. Moreover, since the creative outcomes are unpredictable, they constantly generate demand for new technologies and new teaching and educational products.

Existing research is based on case studies and largely focuses on improving the environment, the performance, the perception and studying the effects produced on the students.

With regards to the environment scholars analyze the effects of instrument arrangements and recordings on music creativity outputs such as, for example, resulting compositions. Some scholars are studying the importance of music classification for music education. Ashraf, M. (Ashraf 2020) experimented with music files that could recover the original music properties and reduce functional categories. The model showed the integrated progress of the neural network against the extraction of functionality and time aggregation. Different information enhancement methods with audio signals were used to use fundamental approaches in extensive applications to improve education. The analysis included other music classification activities, linked datasets, including the condition classification, artist, and instrument recognition. Other studies focused on the use of mobile virtual reality in music education. The results indicated that using VR technology with conventional teaching methodologies could increase musical learning experience in active listening, concentration, and time. AI-enabled applications may evolve significantly and offer improved functionalities for music education (Degli Innocenti 2019).

As far as AI impact on performance is concerned, research has looked into the effects of the simulation of actual music performances. An example is the Google DeepMind project which produced the WaveNet algorithm. The program generates raw audio waveforms that sound highly natural and realistic and are manifested as speech, musical instruments, or a particular sound used to train the AI algorithm (Oord 2023). The WaveNet program trained the algorithm on samples of classical piano pieces and then produced new audio files from scratch in attempts to emulate live instrumentation. This research project compared samples of human-performed piano compositions to samples of piano compositions generated using WaveNet. The results indicated that 73% of participants were able to correctly distinguish the WaveNet sample from the human-performed sample. This shows that there are still improvements that must be made to AI before computer programs can entirely replace human performance (Hawthorne 2018).

Another important research dimension focused on composition. AIVA is one of the first music generating technologies, which can be used by musicians to compose music almost instantly and can easily be customized. Amn interesting element of this product is that is linked to a copyright collecting society, which means that the product received copyright attributes and can be easily monetized through the system of copyright. Since AIVA many more AI products have appeared, offering assistance in music composition. This is analysed from a music education perspective (see Zulic 2019). With regards to music performance AI can preempt possible reactions, reinforce the link between the instrument and the emotional state of the performer, introduce elements of control over the instrument played, enhance, and amplify the performance. All these aspects are embraced in music education methodologies.

Regarding perception research has studied the process of how audiences experience concert music. For example, Elkoshi explored the experience of college music students when listening to several performance contributions of different forms. The course included interaction with the description of the music forms, components, and musical style. Students developed the ability to listen to various musical

talents representing all types of compositions. Teachers received immediate feedback automatically and were able to adjust the teaching process for improved structured music performance (Elkoshi 2020).

With regards to the effects on students, researchers have studied the impact of music education in terms of social, cultural, age and language specifics and its impact on social interactions. Zhaoran experimented with machine learning and wireless processing and examined the difference in participating in the music activity and the potential implications of culture, college, age, and language. The results showed that listening and enjoying at home develops positive social interactions, inspiration, and effective education in a certain field, content, and college music (Zhaoran 2021). Another scholar –Tu B. focused on the efficiency of online education. He analyzed distance music education course based on field-programmable gate arrays and wireless sensors. The wireless sensor indicated that students participated in online music education differently. In this experiment, wireless sensors interacted with the students, such as easy access and payment, from a functional perspective. The interactive composition technology drives artificial intelligence, while a computer uses music for a live performance. Several additional A.I. applications cover the way music is marketed and consumed depending on music composition, production, and performance (Tu 2020).

Wang studied the effect of comprehensive teaching platforms using field programmable gate arrays and neural networks to study the educational effects for students in advanced music systems courses. This research analyzed the means of increasing involvement of students in the learning process. The music education was analyzed using the neural network focusing on the intensity of the connections within these teaching networks. This process is referred to as network developing teaching. The application encouraged students to play music and achieved higher involvement, created an interesting atmosphere, bridging to some extent the lack of emotional depth which AI can produce. The experimental results obtained indicated high-efficiency ratio, student learning outcome rate, accuracy, mean square error rate, teaching performance to analyze ratio, false-positive rule, true positive rule and flexibility ratio (Wang 2022). A number of researchers have used Fuzzy Analytical Hierarchy Process (Fuzzy AHP). This method is based on intelligent assessment of qualitative and quantitative information on the basis of designed criteria. It has potential for improving decision-making processes. With regards to music education it has been applied to analyze the effects of instruction provided by the educator on the student/performer (Hong Yun, Alshehri).

One of the conclusions from the various research streams is that AI needs to be constantly improved to fit the context of the educational process. Technology is simply a tool, and a device is not useful if you cannot understand how a given outcome can be achieved in a particular context. Integrating technology in the teaching in an efficient manner puts a strong demand on music teachers to master technology and use it in the specific context of the educational process.

Key AI uses and tools in music education

Having discussed the main areas of research let's review some of the key practical AI uses and tools in music education:

- A more personalized approach to learning and practice

Just like mobile apps can be customized and personalized, AI tools can enhance a more personal approach to music education and practice. A number of platforms, such as Yousician or Melodics can offer interactive tutorials, monitor and evaluate progress and provide feedback. AI algorithms can identify strong and weak points and suggest practice sessions, which focus on the individual specifics of the student. This creates an engaging environment and results in more efficient training. The feedback provided instantly by the platform can reveal information on the music intonation, technique or accuracy in the performance which can improve the overall efficiency of the education in an improved personalized environment.

Chordify is an e-learning platform which can easily transform melodies and songs into chords. Its speed and user-friendliness are appealing to every beginner and it works well with different music genres. Moreover, it is not expensive and anyone can afford it. The technology used is based on deep neural networks. As with any other AI, it is trained on music works, their spectrograms, chord structures and

rhythm patterns. As a result of the training the AI can detect a pattern and apply it to new information – the music performed by the student, and generate the respective chord. Chordify has also a beginners guitar teaching app, which has become immensely popular and can also be used in guitar teaching. The company has also developed an AI-enabled guitar teaching app, aimed at guiding absolute beginners while learning their first chords. It recognizes what you play, then gives feedback to aid your performance. This is indicative of the additional learning avenues AI can open and the presence it could have in the future of music teaching.

- Virtual Music Mentors

The essence of the virtual mentor with AI is to offer the students the possibility to learn the styles of famous musicians and guide the students into mastering these styles without any physical presence. Examples of such applications are Zenph or the Music Room. (https://store.steampowered.com/app/431030/The_Music_Room/). The power of technology enables students to improve their composition skills, while learning from the great masters.

- Music Composition and Arrangement

While music composition remains a highly creative activity with human inputs, AI algorithms can play an important facilitating role. AI technologies analyse huge data bases, according to a set of defined criteria which can include theory, style, performance specifics, mood, etc. On this basis applications as Amper Music or Jukedeck are capable of producing new music ideas and add on features as harmonies, rhythm, effects, etc. This can be a great opportunity to test ideas for music composition and check their musical value with the help of AI. (https://ampermusic.zendesk.com/hc/en-us).

- Practice Tools

Any musician needs constant practice to perfection style, technique, understanding and knowledge of the musical work to be performed. With the help of AI the process of music practice, which is the cornerstone of music education can become much more interesting, engaging and efficient. Music practice can be progressive, adding on new features, levels of complexity, new instruments and effects. An example of such tools is The MusicMind Games app. (https://www.musicmindgames.com/).

AI lowers the barriers to entry for music creators by enabling high-quality production without the need for professional equipment (Gantchev 2023). There are multiple AI-powered programs capable of generating instrumental soundtracks based on text prompts. While these tools can indeed produce high quality recordings they will not replace the skills and professional touch typical for the professionals in the field.

The efficiency of music education with AI depends very much on music theory and systemic circulation to research conversion methods between music media, including identifying music videos, audio identification, and emotion. It also involves fields of study like perception, music extraction, and automatic design. In general, this is a cross sectoral analysis for music and technology. The AI information interaction, cloud computing, music-big data relationships, and the music-cloud interaction ensure that students understand music and AI. Music extraction is used for accessing music using limited music information. Limited music information such as words, ideas, components, or instances provides several musical knowledge equal to the music information; conventional music recovery involves message keyword deployment, collection of emotional music, software-based music implementation, and various reasons for music training and development. The findings are in the form of language, song, audio, or sequence. The automatic identification of music results performance is a technology for processing and identifying photographs of digital music results. It uses an advanced system to upload pictures of paper music into the application. The music's processing and recognition are performing features converted to a standard music format. It uses AI, image processing, model identification, computer vision theory, theory of music, and other aspects in detail. Media platforms such as virtual reality (VR) and increased reality (AR) have the potential to enhance learning in and outside of the classroom through the enhancement of collaboration or immersive approaches to visual learners. Although there is currently only limited use of music education, major advances in these areas can encourage innovation in teachers' use of media as a tool for learners.

AI could collect big music education data, model the teaching process, perform analytical and

systemic research, and make scientific decision-making regarding music education and the exact allocation of resources. The range of music education data is constantly increased and the processing time is constantly optimized. Aural examinations, such as recognizing and dictating rhythm patterns, musical intervals, melodic patterns, chord characteristics, and harmonic progressions, have been the primary focus of most music education programs in existence.

Intellectual property aspects

The issues related to intellectual property rights are becoming very pertinent in the discussion on AI. The main problem is that laws were made for humas and not for machines. We are trying to apply conventional concepts to a new phenomenon which did not exist at the time of drafting modern and prevailing copyright legislations around the world. The main issues on AI application in music education from the point of view of copyright compliance are:

- Is the underlying content cleared from copyright infringement?
- What is the status of the AI generated product from the point of view of authorship and ownership?
- What rights are exploited or generated in the process of creation of the database from which the AI is trained?
- What attribution is given to protected content?
- What rights are generated and owned in the interaction between the human author and the AI?
- Who is liable in the case of copyright infringement?

The main economic characteristics of AI is that as an input it represents a tool, which can be privately, corporately or publicly owned and can benefit from copyright or other form of IP protection. As an output AI results in a product, which generally does not qualify for copyright protection (Gantchev 2024).

The lack of common standards and regulations are not helping in finding answers to the legal questions on authorship and ownership. Considering the serious damages that may arise in case a new successful music education tool is created one should apply due diligence in selecting the training inputs for the AI and making sure all relevant rights are cleared.

It has to be noted that to the extent to which in music education some of the products of the AI, depending on the jurisdiction, may fall under the educational exception in copyright law, and would therefore not represent an infringement of copyright, as long as they are used only for educational purposes. However, exceptions in domestic law cannot allow unlimited use and reuse of copyrighted content for machine learning (ML). As Gervais points out the demand for material for ML purposes will almost certainly exceed the bounds of exception (Gervais 2020).

Elements of a model for music education

It is challenging to develop one single educational model for music. On the one hand, intelligent tutoring solutions are generally insufficient to teach an open-ended subject as music. On, the other hand, an educational model is to be applied with nuances, depending on the context and the established objectives for the particular educational group.

Nevertheless, it appears that the following assumptions are indispensable for each model:

- The purpose of using AI is to increase student engagement in the learning process and the applied effort, which is needed for improving performance and information absorption.
- Teaching and learning need to be translated into an intelligent educational process in music education. Students need to absorb the knowledge of music optimally, consciously, and actively.
- AI applications are only a tool that music student can use to process and edit everything to improve music information processing and expand the selection of music information.
- Students in the classroom can be transformed from an inactive to an active position, not only listening to the teachers' explanations, but learning and understanding the music into an artificial intelligence system, appreciating the music, and experiencing the music that the teacher cannot experience.

What could be the structural elements in an AI supported educational course model?

The design of an online music education module will generally involve the following steps:

1. Creating the curriculum and defining the learning objectives – skills to be acquired, steps in the learning process, criteria for establishing achievements and teaching requirements for the module.

2. Designing the application for the online teaching platform. This involves choosing the general teaching technology for the system, incl. developing and designing the software for music performance teaching, using creative models, cognitive support frameworks, highly interactive interfaces and AI-based music tools. Ensuring connections between different operations through the AI module. Clearing intellectual property rights.

3. Developing the actual online teaching course tutorial, classification of inputs and developing an evaluation system, assessing student attributes of behavior, information, and additional achievements under the corresponding educational purpose. Organizing all styles of musical work in a network teaching system for music playback, the students can perform simulation teaching at a certain time that teachers are teaching playback material, and the student can teach each playback document. Video display and on-site guidance to teachers are exercised for presentations. Registering and clearing intellectual property rights.

4. Integrating teaching and development materials into the online course, technical adaptation for learning and sharing, incl. elements as stage presence emulation, onsite guidance and alike. Connecting the course library, the music library, and the tag library to the AI system for synchronization.

5. Monitoring the educational effect based on the students' understanding and ability to learn music through the module, tracking and reflection systems.

Pros and cons of AI uses in music education

To summarize, here are some of the key dimensions in which AI can assist music education:

- AI makes it more interesting and engaging for both students and teachers.
- AI tools transform abstract things into reality;
- AI tools shorten teaching time and free time allocation of other creative activities;
- AI broadens the scope of music information through software improvements of the processing ability for music data;
- AI provides an efficient platform for communication and interaction;
- AI promotes network education – through online learning and improved communication, music teaching is no longer in the classroom;
- AI tools facilitate the distribution of music works;
- AI can enhance practice, understanding and evaluating individual performance;
- AI enabled tools can improve the understanding of the structure and use of the musical elements, their functions and the building of a new musical structure;
- AI endorses teaching music basics as rhythm and note recognition, pitch training – play in tune with music composition, music recording and links to music content standards;
- AI tools can help overcome such factors that negatively affect music education as funding (some music courses can be unaffordable for talented but disadvantaged students), timing (if students have to work dayshifts to support their families or fund education), space (best music schools maybe in far-away locations for many students).

Limitations

- AI plays a supporting role in music teaching, but cannot replace the emotional aspects of music teaching, such as music emotion and music content expression.
- Artificial intelligence in music education still needs to be widely recognized and accepted by the industry, it can function best when a certain scale is achieved.
- AI is not yet able to reflect context and its impact in the musical teaching. Only a teacher can understand why the student is in a particular emotional state which may affect the potential for efficient teaching and learning. Teachers can be supported by AI but will always have a leading role in at least three aspects. First, they keep a human connection and emotional bond with the students providing empathy, insights, and inspiration. Second, teachers can adapt in real time to the individual needs of the student,

observe their progress in real-time, take into consideration the context, which impacts on the student ability to learn and adapt. Thirdly, teaching is not just about passing knowledge and acquiring skills. The teacher has always been a fundamental institution in society which contributes to educating students how to be responsible and appreciate social values. In the context of generative AI, teachers can help students identify bias, they can teach them how to respect other people's rights and avoid copyright infringement. Students need to be aware of the possibilities of AI hallucinations, the vulnerability of the technology and unethical uses of AI technologies. Therefore, it is extremely important to invest in teacher development and provide support to teachers to become educators. Artificial intelligence can be an important tool for music educators, but the intellect of the teacher is much more important than the artificial intellect and is the decisive factor for quality education.

CONCLUSIONS

It is certain that the development and use of AI is going to be much faster than the adoption of previous disruptive technologies. The consequence of this is that music educators and students have to understand and master the AI technology if they want to make use of it in the music education process.

The use of AI in music education is indeed revolutionary. It adds on efficiency in the process of learning, practicing, and developing skills. A key advantage of AI is the possibility to separate physically the student and the teacher, create a personalized context, quick feedback, monitoring of progress and new practice environments. The students can thus advance at their own tempo, making use of a completely different environment with virtually endless possibilities. While AI can support teachers in the process of music education it cannot replace the teachers, who add the human interaction, adapt to the emotional state of the students, promote and develop their critical thinking and responsible behavior.

Meanwhile, AI can help students to absorb knowledge more efficiently. It optimizes such processes as grading, instructions and management of time and resources, enabling teachers to focus on more content intensive tasks. Teachers can use AI to support and improve student learning. AI-enabled platforms can help introduce and adapt to individual learning needs, develop creative thinking and improve musical skills.

While AI is gradually entering the creative space, it needs to be applied in a responsible manner, so as not to replace the human expression. This is a matter of concern of creators from different domains. Recently more than 150 organizations representing creative industries launched the "Human Artistry Campaign" (https://www.humanartistrycampaign.com/). The campaign developed "Core Principles for AI Applications in Support of Human Creativity and Accomplishment" which reflect serious concerns and are very relevant for the domain of AI enabled music education. While recognizing the empowering function of AI, the principles underscore the central role of human-created works and the need to secure copyright permission for the use of protected content. Ultimately, AI-enabled tools in music education should be built on the basis of respect for the principles, endorsed by the campaign.

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ИЗКУСТВЕНИЯТ ИНТЕЛЕКТ В МУЗИКАЛНОТО ОБУЧЕНИЕ

Резюме: *Изкуственият интелект (ИИ) постепенно се превръща в значим компонент в музикалното обучение поради нарастващото търсене на нови технологии и тяхното постоянно предлагане. Въпреки че ИИ е важен инструмент, той си остава средство, което има смисъл само ако е контекстуализирано. Ефективността на музикалното обучение с ИИ зависи в много голяма степен от музикалната теория и системната връзка между изследването на методите за преобразуване между музикалните медии, идентифициране на музикални видеоклипове, аудио материал и емоции. ИИ може да формира големи бази данни за музикалното обучение, да моделира процеса на преподаване, да извършва аналитични и системни изследвания и да прави качествени предложения за разпределение на ресурсите. В същото време ИИ поставя предизвикателства, свързани с авторството и собствеността върху създаваните продукти, отговорностите и нарушаването на защитено с авторски права съдържание, кредитирането на авторите и регулациите. Въпреки това ИИ следва да бъде включен във всеки ефективен модел на музикално*

образование. Макар че ИИ постепенно навлиза в творческото пространство, той трябва да се прилага отговорно, за да не замества човешкото творчество и да отразява коректно контекста.
Ключови думи: *изкуствен интелект, интелектуална собственост, образование, ефективност*

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ОБЩЕСТВЕНИ КОМУНИКАЦИИ И ИНФОРМАЦИОННИ НАУКИ
PUBLIC COMMUNICATIONS AND INFORMATION SCIENCES

ARTIFICIAL INTELLIGENCE: HISTORY, TYPES AND BOUNDARIES

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Abstract: *This article deals with the question of what is artificial intelligence. Inspired by the great success of Chat GPT by the organization open AI and the media discussions about the challenges and risks of artificial intelligence, this paper provides an overview of the emergence, types and limits of artificial intelligence. To develop the study, sources from the academic environment and sources from the IT industry were used based on literature research. After an overview of the chronology of the origins of artificial intelligence, where the reader will get an overview of the history of Artificial Intelligence and that science has it's root decades back. The article explains the most important technological trends and their effects. The different development streams will be explained, as well as the different types, like natural language processing or neuronal networks. Finally, the article provides an assessment of the opportunities and risks of the new technology. The reader will get an overview of the history of Artificial Intelligence and that science has its root decades back.*
Keywords: *Gen AI, Natural Language Processing (NLP), Neural Networks – Deep Learning, strong AI hypothesis, weak AI hypothesis*

INTRODUCTION

Since November 30, 2022, (generative) Artificial Intelligence is the new hype topic in media, economy and politics. On that Wednesday in November 2022, the company Open AI released the ChatBot Chat GPT, which can communicate with users on a text basis based on artificial intelligence.

The adoption rate for this service on the Internet broke all known records up to that point. Five days after its release, one million users were already counted (Lindner 2023).

By comparison, the two most successful platforms on the Internet at the time, Instagram and Spotify, took two and a half and five months, respectively, to reach this number of users. The rapid dissemination has made the possibilities and potential of artificial intelligence accessible to a broad mass of people in a very simple way. At the same time, the first experts have started warning about the dangers of AI. "Reducing the risk of annihilation by AI should be a global priority alongside other risks of societal magnitude, such as pandemics or nuclear war" (Kelly 2023). The call was issued by the San Francisco-based U.S. nongovernmental organization Center of AI Safety. Co-signer Sam Altman founder of OPEN AI.

Why should AI pose a threat?

Artificial intelligence (AI) has become one of the most disruptive technologies of modern times, revolutionizing industries and changing our daily lives. At its core, AI is about developing intelligent systems that can replicate the cognitive processes of human learning, thinking and problem-solving.

In the following pages, I will explore these questions and illuminate how AI has evolved over time, what types exist, and what the basic mode of action is. And whether the "capabilities" of AI have such a great influence on the economy and society as is prophesied in the media.

As already mentioned above, the topic is currently on everyone's lips, but the beginnings of this

discipline and the fundamental considerations that are still valid date back several decades.

In this paper the path of evolution of AI will be shown and a brief explanation what AI is will be given. Based on that we will see how risky the technology might be.

RESEARCH METHODOLOGY

For this paper, a comprehensive research methodology incorporating both qualitative and quantitative approaches was adopted. The methodology primarily revolves around a systematic literature review to provide a holistic understanding of AI's applications, challenges, and societal implications.

A systematic literature review was conducted to identify and analyze (ideally) peer-reviewed studies, scholarly articles, and commercial web sources related to AI. This involved defining specific research questions, establishing inclusion and exclusion criteria, and systematically searching electronic databases such as Google Scholar.

The selection criteria for studies and data sources encompassed several key considerations:

Relevance: Studies and sources were selected based on their relevance to the research objectives and questions.

Credibility: Emphasis was placed on peer-reviewed articles, reputable reports, and scholarly publications from recognized institutions and experts in the field of AI.

Currentness: When it came to Technology newer publications were preferred.

RESULTS

The history of AI is not a new phenomenon. It began decades ago. A brief overview of the most important milestones in AI development:

The year 1943 is cited as the "birth year" of artificial intelligence. In that year, McCulloch and Pitts presented the first mathematical model of an artificial neuron, which served as the basis for the development of neural networks (Kaplan 2017).

1950: Alan Turing, in his article "Computing Machinery and Intelligence", proposes the idea that machines might be able to imitate human thought (Kaplan 2017).

1956: The Dartmouth Conference is held, at which the term "artificial intelligence" is used for the first time; the term was coined by Professor John McCarthy. Researchers present their ideas and developments in the field of AI at this conference (Kaplan 2017).

1960s: Expert systems based on knowledge representation and inference are developed and used in various application areas (Kaplan 2017).

1970s: Research in AI is slowed by a lack of progress in development and limited computing power (Kaplan 2017).

1972 French scientist Alain Colmerauer invents the logic programming language PROLOG (Ertel, 2009)

1980s: Advances in computer hardware and algorithm development lead to further development of expert systems and neural networks (Kaplan 2017).

1990s: Machine learning becomes an important area in AI research. Data-driven algorithms are developed to detect patterns in large amounts of data. Pearl, Cheeseman, Whittaker, and Spiegelhalter bring probability theory into AI with Bayesian networks (Kaplan 2017) .

2000s: Deep Learning, a special machine learning method, is developed. Deep Learning is used to solve complex problems, such as speech recognition (Kaplan 2017).

2010s: AI systems are used in various application areas, such as robotics, medicine, and autonomous driving. Discussions about the ethical and societal implications of AI are also increasing (Stecking 2000).

The development of AI is characterized by ups and downs and is driven by advances in computer hardware and algorithm development.

If we look at Ertel's graphical representation of the chronological development of artificial intelligence, we realize that there were already at the beginning different approaches under the common term artificial intelligence.

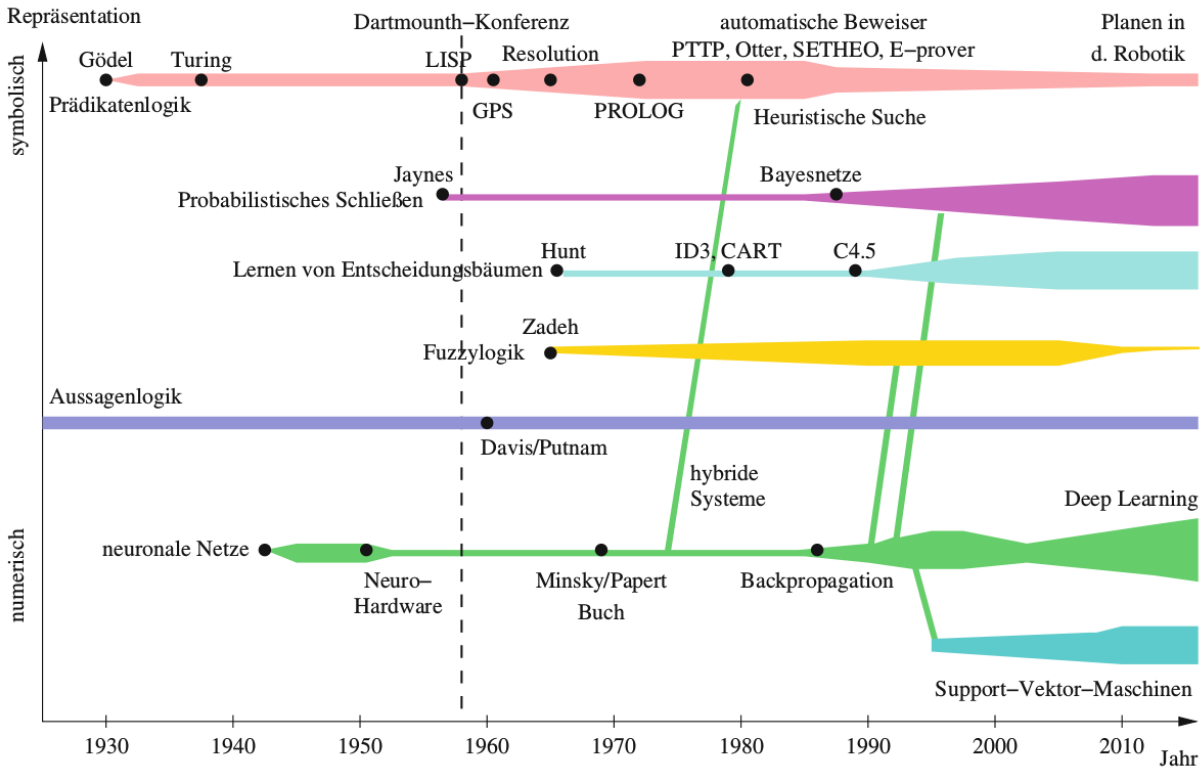

Fig. 1. Overview of development stream (Ertel, 2009)

Types of Artificial Intelligence

Figure 1 shows the different types of technologies and methods associated with Artificial Intelligence, as well as their evolutionary history. From top to bottom, the different AI approaches can be broadly categorized as follows:

– Natural Language Processing (NLP) – pink. cf (Bosse 2020)
– Dialogue robots & expert systems (bots, chatbots...) – purple and turquoise cf (Bosse 2020)
– Knowledge based systems (fuzzy logic) – yellow cf (Bosse 2020)
– Neural Networks – Deep Learning – green cf (Bosse 2020)
– Latest development Generative AI (Chat GPT) – not in the picture

What is Natural Language Processing NLP?

"Natural Language Processing is a theoretically motivated range of computational techniques for analyzing and representing naturally occurring texts at one or more levels of linguistic analysis for the purpose of achieving human-like language processing for a range of tasks or applications" (Liddy 2001).

IBM is giving a quite pragmatic explanation and makes the topic a bit more tangible: Natural Language Processing (NLP) refers to the branch of computer science – and artificial intelligence (AI) in particular – that is concerned with giving computers the ability to understand text and spoken language in the same way that humans do. NLP combines computational linguistics – rule-based modeling of natural language – with statistical machine learning and deep learning models.

These technologies enable computers to process human speech in the form of text or voice data and "understand" its full meaning, including interpreting the speaker's or author's intentions and feelings.

NLP drives computer programs that translate text from one language to another in real time, respond to spoken commands, and quickly summarize large amounts of text. Anyone who uses digital assistants such as Amazon's Alexa or Apple's Siri, voice-to-text dictation software, customer service chatbots, and other consumer features has very likely encountered Natural Language Processing. But NLP is also increasingly playing a role in enterprise solutions that help streamline business operations, increase employee productivity, and simplify business processes. cf from German (IBM 2024).

What are Dialog robots or expert systems (bots, chatbots)

An expert system is a computer system that uses artificial intelligence (AI) algorithms to simulate the decision-making capabilities of a human expert. The four main components of an expert system are the knowledge base, search or inference engine, knowledge acquisition system, and user interface or communication system. The basic goal of an expert is to duplicate human experts and replace them with problem-solving. There are five main types of expert systems: rule-based systems, frame-based systems, fuzzy systems, neural systems, and neuro-fuzzy systems (Lourdusamy & Gnanaprakasam 2023).

Nowadays, expert systems are no longer considered an active area of AI research... There are several reasons for this: The most important is the drastic increase in computing power, storage space, and networks, which means that vast amounts of data are available in easily accessible electronic formats (Kaplan 2017).

That's why from here on we continue with the system called ChatBot, which represents a further development of the expert systems. A chatbot is a computer program that can mimic human conversation by using voice commands, text dialogues, or both. Chatbots can be integrated into any messaging service and are useful for providing easy and quick communication for users. Good chatbot development is dependent on the chatbot algorithm and the implementation approach employed by the chatbot developer. Today's chatbot landscape is wide (Lourdusamy & Gnanaprakasam 2023).

Also for the ChatBots IBM is offering a hands-on explanation: A chatbot is an application that uses artificial intelligence to converse with humans in natural language. Users can ask questions, to which the system responds in natural language. It can support text input, audio input, or both (IBM 2024).

The terms chatbot, virtual assistant, and conversational agent are sometimes used as synonyms. Chatbots tend to support simpler conversations and more customized tasks. For example, it can tell you whether or not it will rain tomorrow. A conversational agent, on the other hand, might determine that what you really want to know is what to wear tomorrow.

Definition Fuzzy Logic

Is defined as vague logic, fuzzy logic; a domain of logic that allows semantic interpretation of statements that cannot be classified as unambiguously true or false (e.g. "Peter is tall."). Discrete truth values (true and false or 1 and 0) are replaced by a continuous range (usually interval from 0 to 1). For values from this range propositional logic operations are defined. Fuzzy Logic is used for example in the examination of address data (Gillenkirch 2018).

As an example, the correct name of a street can be "Bahnhof Straße". The use of Bahnhofstrasse, Bahnhofstr. or Bahnhof Str. semantically conveys approximately the same information and would be filtered out in an automated 0 or 1 decision – when using an appropriately "calibrated" fuzzy logic, this fuzziness would be accepted and a still sufficiently accurate result would be delivered.

Definition of Neural Networks – Deep Learning

Neural networks, also known as artificial neural networks (ANN) or simulated neural networks (SNN), are a subfield of the machine learning (ML) discipline and are at the heart of deep learning algorithms. Their name and structure are modeled after the human brain, and they mimic the way biological neurons send signals to each other. Artificial neural networks (ANNs) consist of a node layer that contains an input layer, one or more hidden layers, and an output layer. Each node or artificial neuron is connected to another and has an associated weight and threshold. If the output of any individual node is above the threshold set for it, that node is activated and sends data to the next layer in the network. Otherwise, no data is passed to the next layer in the network.

Neural networks use training data to learn and improve their accuracy over time. However, once these learning algorithms are tuned for accuracy, they are powerful tools in computer science and artificial intelligence that can be used to classify and cluster data at high speed. Tasks in speech or image recognition often take minutes instead of hours compared to manual recognition by human experts (IBM 2024).

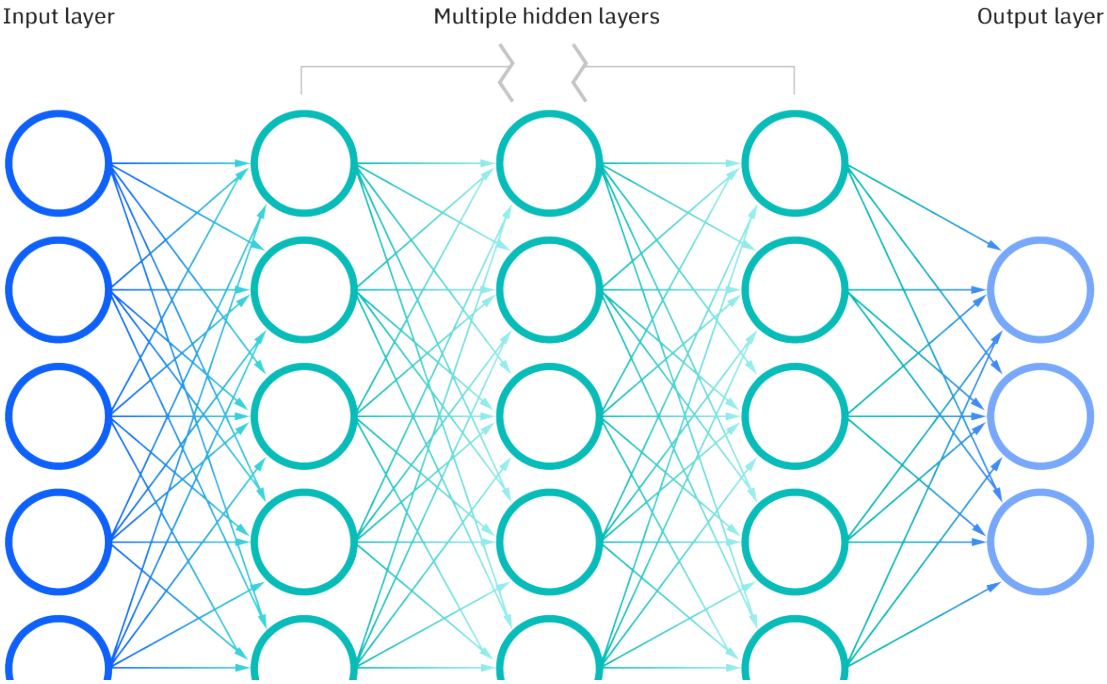

Fig. 2. Schematic representation of the structure of a neural network

Deep Learning and neural networks are often used interchangeably in conversation, which can cause confusion. Therefore, it is worth noting that the "deep" in Deep Learning refers only to the depth of layers in a neural network. A neural network that consists of more than three layers-including both the input and output layers can be considered a Deep Learning algorithm. A neural network that consists of only two or three layers is just a simple neural network.

What is generative AI?

At its core, it is the combined application of NLP with neural networks and deep learning. These models were fed with extremely large amounts of data. According to a McKinsey publication, the data input and thus the use of computing power is exorbitantly high:

"When you're asking a model to train using nearly the entire internet, it's going to cost you. OpenAI hasn't released exact costs, but estimates indicate that GPT-3 was trained on around 45 terabytes of text data – that's about one million feet of bookshelf space, or a quarter of the entire Library of Congress – at an estimated cost of several million dollars. These aren't resources your garden-variety start-up can access" (McKinsey 2024).

As we can see above, an "artificial intelligence" has to be trained based on training data. I.e. with a simple image recognition, the program is trained to distinguish for example the image of a cat from the image of a dog. If the image of a horse is presented to this image recognition, the image recognition will initially fail in the task or make a false statement. This, admittedly very simple example, shows the dependency of artificial intelligence on data and its quality and quantity as well as the training of the algorithms. This leads us to the question of security.

The outputs generative AI models produce may often sound extremely convincing. This is by design. But sometimes the information they generate is just plain wrong. This is called a hallucination and even worse, sometimes it's biased (because it's built on the gender, racial, and myriad other biases of the internet and society more generally) and can be manipulated to enable unethical or criminal activity.

To avoid these negative effects the provider of Gen AI services need to invest heavily in training and data quality (McKinsey 2024).

CONCLUSION

The strong and the weak AI hypothesis

In the context of Artificial Intelligence, philosophy distinguishes the weak AI hypothesis and the strong AI hypothesis. The weak AI hypothesis is the assumption that machines can act as if they were intelligent. In contrast, the strong AI hypothesis assumes that machines can really think, i.e., they do not just simulate thinking. Or as Searle says originally:

What psychological and philosophical significance should we attach to recent efforts at computer simulations of human cognitive capacities? In answering this question, I find it useful to distinguish what I will call "strong" AI from "weak" or "cautious" AI (Artificial Intelligence). According to weak AI, the principal value of the computer in the study of the mind is that it gives us a very powerful tool. For example, it enables us to formulate and test hypotheses in a more rigorous and precise fashion. However according to strong AI, the computer is not merely a tool in the study of the mind; rather, the appropriately programmed computer is a mind, in the sense that computers given the right programs can be said to understand and have other cognitive states. In strong AI, because the programmed computer has cognitive states, the programs are not mere tools that enable us to test psychological explanations; rather, the programs are themselves the explanations (Searle 1980).

The weak AI hypothesis is taken for granted by most. and the example of image recognition and its possible problems presented above supports this thesis. The strong AI hypothesis is not generally at the forefront of AI research, but rather the pragmatic view that it is irrelevant whether the "thinking" is merely demonstrative or actually happens – the main thing is that the system works.

It is to this first the Strong AI hypothesis that the warnings against AI mentioned at the beginning, have referred to, presumably under the impression of the performance of Chat GPT.

Do we now have to be afraid that in a not-too-distant future mankind will be wiped out by AI-controlled robots, like in the Hollywood movies Terminator with Arnold Schwarzenegger? This question can be answered quite quickly with NO.

However, damage can still occur if the existing tools are used for unethical and criminal purposes.

The simplest are so-called deep fakes, i.e. the artificial generation of (moving) images including the sound (voice) of celebrities, e.g. politicians, who spread fake messages. In addition to these applications, which are created by criminal energy, the danger also lurks in the unclean/unprofessional use of artificial intelligence. As we have seen above, the system's function depends on data and training.

Let's imagine a system for automated cancer detection is poorly trained or works with qualitatively and/or quantitatively insufficient data. A false negative diagnosis that ends in a non-treatment of cancer would be an extremely dangerous and harmful result.

The conclusion therefore is to use the possibilities of artificial intelligence BUT always with the premise that a human expert can check the results again and correct them where necessary. This implies, that the user of the artificial intelligence service will need an understanding of how the system came to its conclusion.

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ИЗКУСТВЕН ИНТЕЛЕКТ: ИСТОРИЯ, ВИДОВЕ И ГРАНИЦИ

Резюме: *В тази статия се разглежда въпросът какво е изкуствен интелект. Вдъхновена от големия успех на Chat GPT на организацията Open AI и медийните дискусии за предизвикателствата и рисковете на изкуствения интелект, тази статия прави преглед на появата, видовете и границите на изкуствения интелект. За разработването на изследването са използвани източници от академичната среда и източници от ИТ индустрията въз основа на литературно проучване. След преглед на хронологията на възникването на изкуствения интелект читателят ще получи обща представа за историята на изкуствения интелект, която датира десетилетия назад. В статията са обяснени най-важните технологични тенденции и тяхното въздействие. Ще бъдат обяснени различните потоци на развитие, както и различните видове, като обработка на естествен език или невронни мрежи. Накрая статията дава оценка на възможностите и рисковете на новата технология. Читателят ще получи обща представа за историята на изкуствения интелект и за това, че всъщност историята му датира десетилетия назад.*
Ключови думи: *генеративен ИИ, обработка на естествен език (NLP), невронни мрежи – дълбоко обучение, хипотеза за силен и слаб AI*

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ОБЩЕСТВЕНИ КОМУНИКАЦИИ И ИНФОРМАЦИОННИ НАУКИ
PUBLIC COMMUNICATIONS AND INFORMATION SCIENCES

INTERNAL CONTROLS: ADDED VALUES, LIMITATIONS, COSTS AND BENEFITS

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Abstract: *Companies operate in a dynamic and constantly changing environment with increasing risks and growing complexity. Effective internal controls and internal control systems can help to reduce these risks and make them more manageable. The purpose of this article is to illustrate and discuss the added values, limitations, costs and benefits of internal control based on scientific publications. Studies indicate, for example, that internal control provides significant added values and benefits for companies in various forms, such as a positive effect on the market value, on internal business processes and on investors' financing decisions. Nevertheless, it is often viewed as merely fulfilling regulatory requirements. But it is important to note that internal control weaknesses have led to the collapse of well-known large companies in the past. Therefore, effective internal controls and internal control systems are integral elements of an adequate and proper management system. Internal control systems and their effectiveness should be analysed in future research work, considering the changes brought about by increasing digitalisation (such as artificial intelligence), agile working methods and the challenges of New Work.*
Keywords: *Internal controls, internal control system, risk management, adds values, limits, costs, benefits*

INTRODUCTION

The global economy is becoming increasingly dynamic, which means that companies are operating in a highly complex environment. As a result, the competitive pressure on companies is increasing and the associated risks, such as the increasing market risk due to this highly competitive situation, are growing (cf. Liu and Wang 2019, 1; Siepermann 2008, 81). Companies should therefore reduce their (individual) risk factors so that they can build up a certain level of resilience, keep up with the competition and generate profits at the same time. One solution is to design and implement customised internal controls that are effectively managed and operated. Focussing internal controls solely on the company's market situation is not expedient. Internal controls or rather an internal control system should align with the overarching corporate strategy, internal control processes and control objectives (cf. Länsiluoto et al. 2016, 6, 24ff). Many companies, especially small and medium-sized enterprises, associate the establishment and operation of internal controls or rather an internal control system with the fulfilment of legal requirements (cf. Ruud et al. 2018, 18). In addition, several financial scandals in the international financial and business world attracted attention in the early 2000s. These were caused by errors in the internal control systems of companies (cf. Kratz 2008, 5). The US energy company *Enron* collapsed in 2001 due to accounting fraud and artificially inflated profits (cf. Kratz 2008, 5). *WorldCom*, the third largest telecommunications company in the world at the time (cf. Fox 2008, 409), also suffered from accounting fraud in 2002. *WorldCom* engaged in fraudulent activities such as backdating contracts, understating costs and concealing debts through accounting tricks. These are just three examples of the many (fraudulent) irregularities that occurred at *WorldCom* (cf. Gamage et al. 2014, 26). In addition to other US companies, such as *Bernie Madoff* (former financial and stockbroker) and the *American International Group* (AIG), companies worldwide were involved in accounting scandals (cf. Umar and Umar Dikko 2018, 13; Gamage et al. 2014, 26): The South Korean conglomerate *Daewoo Group*, the Indian software and consulting company *Satyam Computer Services*, the British investment company

Barlow Clowes and the German conglomerates *Daimler* and *Siemens* as well as others (cf. Ewelt-Knauer et al. 2015, 1012; Gamage et al. 2014, 26). The German financial services provider *wirecard* is a more recent example of balance sheet fraud (cf. Bender et al. 2022, no page). This article will explore the added values and benefits that internal controls and an internal control system can provide to a company beyond regulatory compliance. It will also examine the limitations and attempt to evaluate their costs and benefits. The conclusion will summarise the key findings and provide suggestions for future research.

RESEARCH METHODOLOGY

This article is primarily based on a literature analysis. The aim is to present the current state of research on the added values and limitations of internal controls or rather internal control systems and to demonstrate a theoretical construct for the costs and benefits. Relevant published research results on the three subject areas are intended to give readers a deeper understanding and provide managers in companies with a compact overview and impulses on the topics.

RESULTS

The added values of internal controls or rather internal control systems can be categorised into two perspectives: an overarching perspective focussing on the company as a whole and an internal perspective focussing on internal processes and structures.

In performance research on internal control, there is evidence that effective internal control systems promote the profitability, growth and continued existence of the company and safeguard its assets (cf. Arad and Jamshedy-Navid 2010, 1). Gal and Akisik (2020, 1228) concluded that effective internal controls regarding financial reporting not only have a significant positive impact on the company's market value, but also increase it. Ibrahim et al. (2017, 693) suggest that companies can achieve better financial results by implementing an effective internal control system, conducting internal risk assessments, actively monitoring and having an appropriate IT infrastructure. Furthermore, companies that invest in an effective internal control system have a higher financial performance than those with weak internal control systems (cf. Origa 2015, 31). In addition, external stakeholders, such as lenders, consider the published information on a company's internal control system to be important for their investment and financing decisions (cf. Deumes and Knechel 2008, 56f, 59ff). The design and effectiveness of the internal control system in particular are the main focus of external lenders, as both factors impact the valuation and lending decisions of investors (cf. Schneider and Church 2008, 1, 11f). If the company has a formalised, documented and effective internal control system, it generally has a positive influence on the investors' risk classification. This, in turn, makes it easier to raise capital (cf. Bungartz 2020, 45f). Weaknesses in the internal control system could therefore reduce the financing volume (cf. Schneider and Church 2008, 1, 11f).

Regarding the internal perspective, the company's business processes are the main focus. The internal control system can identify operational weaknesses in the business processes, allowing for process optimizations to be initiated. Additionally, the introduction of an internal control system can lead to greater stability in business processes by documenting key processes. Process documentation can also have a positive effect, particularly when training new employees or dealing with staff turnover. Familiarisation period can be shortened. Process documentation provides external stakeholders with insight into key business processes, which in turn corresponds to the advantages of the overarching perspective described above. As the company deals with risks and internal controls in detail, this subsequently strengthens the employees' risk awareness, which can have a positive effect on the detection and avoidance of errors (cf. Bungartz 2020, 45). Internal management reports on the internal control system provide management with additional information – for example, to make decisions on the extent to which the internal control system can be optimised and the reports contain indicators for the future existence of the company (cf. Hermanson 2000, 340). Furthermore, internal controls assist management in efficiently allocating resources to achieve corporate goals (cf. Arad and Jamshedy-Navid 2010, 1). The literature and practice extensively discuss whether internal control generates shareholder value (cf. Ross et al. 2021, no page; Qi et al. 2017, 1101f; Pfister 2009, 28). Internal control already has an inherent

indirect link to the company's performance, as it is a component of the company's internal business processes and therefore part of the corporate organism. Assuming that top management focusses strongly on the design and performance of internal controls, the effectiveness and efficiency of business processes will generally increase. As a result, costs are reduced and the company's results are positively influenced. An adequate internal control system increases the reliability of financial results and ensures compliance with internal and legal regulations. Therefore, the possibility of the company being accused in cost-intensive legal proceedings decreases, which particularly impacts its reputation and can ultimately result in reduced earnings. However, if effective internal control is seen as internal control with a high degree of formalisation, a possible positive effect on the company's performance becomes questionable. This may even lead to increased costs. This example illustrates that the relationship between internal control and company performance is not always clear (cf. Pfister 2009, 28). Lastly, it is important to note that top management's focus on internal control alone may positively influence the objectives of an internal control system: Effectiveness and efficiency of operational business processes, reliability of reporting and compliance with laws, regulations and internal policies (cf. Pfister 2009, 28; Rittenberg and Miller 2005, 14, 22). To summarise, the aforementioned focus of management on greater effectiveness means that there is a high probability that internal control will contribute to improving results – but it is not a driver of performance itself (cf. Pfister 2009, 28, cf. also Simons 2005).

However, even well-designed internal control systems that have been in place for years have inherent limitations that can compromise their effectiveness and functionality and ultimately hinder the achievement of corporate objectives. The limitations of internal control are twofold: the "human factor" in the form of errors, omissions, fraudulent actions and the trade-off between cost and benefit aspects (cf. Pfister 2009, 30). These two inherent limitations of internal control make it clear that, despite well-designed internal controls, there is always a residual risk of the unexpected due to the behaviour of employees and the resulting consequences, which cannot be foreseen (cf. Pfaff and Ruud 2007, 23). Bungartz notes that human errors can result from negligence, distractions, errors of judgement and misinterpretation of work instructions. Omissions occur when employees responsible for certain controls misuse or neglect their responsibilities (cf. Bungartz 2020, 45). Additionally, employees are often required to make decisions under time pressure with incomplete information. It is possible that these decisions were made incorrectly and may need to be changed or corrected later (cf. COSO 1992, 76). For instance, if the assessment of risks is made incorrectly and inaccurately, risks that have a negative impact on the achievement of corporate goals can be misjudged or, in the worst case, ignored (cf. Pfister 2009, 30). Subsequently, fraud is defined as the circumvention or deliberate overriding of the internal control system by company management or employees. This can occur between employees within the company or through fraudulent collaboration between internal employees and external parties, such as customers or suppliers (cf. Bungartz 2020, 45). In summary, it can be stated that the integrity of management and the individual attitude and behaviour of each employee are particularly important factors for the effectiveness of the internal control system (cf. Pfister 2009, 31).

In many cases, regulations require the establishment and operation of internal controls or rather an internal control system. However, companies may require varying financial and time resources depending on their financial situation (cf. Krishnan 2005, 655). Companies in a weak financial position may focus on cost-saving to avoid insolvency and invest fewer resources in an effective internal control system (cf. Pfister 2009, 31). On the other hand, it is not guaranteed that high investments and strong internal control structures will result in high-quality internal controls (cf. Pfister 2009, 32). As a result, company management may choose not to implement certain internal control measures if they assume that the costs outweigh the benefits (cf. Bungartz 2020, 45). In most cases, internal controls or rather internal control systems are required by regulation. Their benefits and added values may not always be immediately apparent due to the inherent complexity of an internal control system (cf. Kinney 2000a, 88). Non-routine business processes, for example, are difficult or even impossible to capture by an internal control system, as they only run very irregularly. Additionally, internal or external factors may temporarily override the internal control system's functionality for a short period of time (cf. Bungartz 2020, 45). Nevertheless, it is important for a company's top management to evaluate the cost-benefit potential when implementing

and operating an internal control system (cf. COSO 1992, 75f, 77f, cf. also 4, 11, 116).

The issue of top management can be discussed using the model-theoretical approach presented in the following figure (figure adapted from Pfister 2009, 32 and Kinney 2000b, 91):

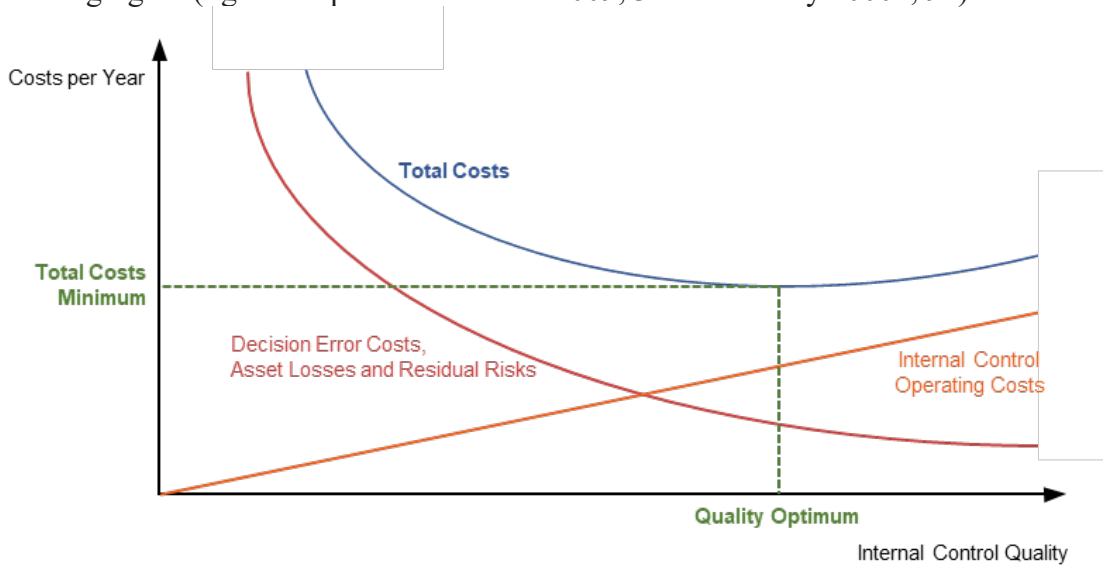

Fig. 1. Costs and benefits of internal control from a model-theoretical perspective

The figure illustrates the correlation between the total costs (blue line) and the internal control quality. The total costs are made up of the decision error costs, the asset losses, the residual risks (red line) and the internal control operating costs (orange line). According to the model theory, the 'optimum' of the total costs is attained when the sum of the decision error costs, the asset loss and the residual risks are balanced with the internal control operating costs. When designing and implementing the company-specific internal control system, top management should aim for this 'quality optimum' in terms of model theory. This is marked in the figure by the highlighted intersection of the graphs (cf. Pfister 2009, 31; CICA 1995, 3). The figure also shows that despite high investments in internal controls and the associated high degree of formalisation of internal control, certain residual risks remain. Even if the internal control system is comprehensively designed with sufficient functionality, not all influences and factors that affect the internal control system can be predicted and taken into account (cf. Pfister 2009, 31f). Furthermore, many decisions on the cost-benefit balance cannot be made entirely independently by the company. In many cases, there are regulatory requirements and minimum standards. For instance, the Sarbanes-Oxley Act in the USA establishes minimum standards for the level of formalisation of internal control that companies must comply with. These minimum standards subsequently affect the balance between the costs and benefits of internal control (cf. Pfister 2009, 32).

CONCLUSION

An effective and well-designed internal control system provides a company with protection against errors, omissions, failures and fraudulent behaviour. It is important to note that this protection is not absolute. The examples cited, from *Enron* and *WorldCom* to *Siemens* and *wirecard,* demonstrate the importance of an internal control system, as well as its vulnerability to deliberate or unconscious offences. Furthermore, when designing and operating an internal control system, top management must consider regulatory requirements, costs and benefits. Nevertheless, the aforementioned research results of the literature analysis suggets that an internal control system is an integral element of management systems (cf. Suárez 2017, 10). The primary purpose of internal control is to safeguard and enhance the efficiency and effectiveness of business operations, as well as both internal and external financial and non-financial reporting, while also ensuring compliance with relevant laws and regulations (cf. COSO 2013, 3). Therefore, it should always be more than compliance with and fulfilment of regulatory requirements and thus also be understood and lived by the company's management and employees. Future research should look more closely at the model-theoretical question of the 'optimal' balance between the cost and benefit

aspects of internal control with a focus on quantification. In addition, it is important to analyse current influencing factors, such as agile working methods, artificial intelligence in the course of the increased digitalisation of companies and the challenges of New Work, which affect the overall construct of an internal control system and its effectiveness.

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ВЪТРЕШЕН КОНТРОЛ: ДОБАВЕНА СТОЙНОСТ, ОГРАНИЧЕНИЯ, РАЗХОДИ И ПОЛЗИ

Резюме: *Компаниите работят в динамична и постоянно променяща се среда с нарастващи рискове и сложност. Ефективният вътрешен контрол и системите за вътрешен контрол могат да помогнат за намаляване на тези рискове и да ги направят по-управляеми. Целта на тази статия е да илюстрира и обсъди добавената стойност, ограниченията, разходите и ползите от вътрешния контрол въз основа на научни публикации. Проучванията показват например, че вътрешният контрол осигурява значителни добавени стойности и ползи за дружествата под различни форми, като например положителен ефект върху пазарната стойност, върху вътрешните бизнес процеси и върху решенията на инвеститорите за финансиране. Въпреки това той често се разглежда като просто изпълнение на регулаторните изисквания. Важно е обаче да се отбележи, че слабостите на вътрешния контрол са довели до фалита на известни големи компании в миналото. Ето защо ефективният вътрешен контрол и системите за вътрешен контрол са неразделни елементи на една адекватна и правилна система за управление. Системите за вътрешен контрол и тяхната ефективност следва да бъдат анализирани в бъдеща изследователска работа, като се вземат предвид промените, предизвикани от нарастващата цифровизация (като изкуствения интелект), гъвкавите методи на работа и предизвикателствата на новата работа.*

Ключови думи: *вътрешен контрол, система за вътрешен контрол, управление на риска, добавени стойности, ограничения, ползи, разходи*

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ОБЩЕСТВЕНИ КОМУНИКАЦИИ И ИНФОРМАЦИОННИ НАУКИ
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DIGITAL SALES CHANGING THE ROLES OF ONLINE CAR CONFIGURATORS

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Abstract: *Customers requiring more digital interactions with OEMs change the role of dealers. Wheras in the past, dealers were pivotal in the sales process they are expected to be reduced to test-drive and hand-over retail outlets, with the customers doing essentially the purchase process in self-administration online. As a result, the question arises if the mass customization of OEMs, which creates complexity and a wide variety of choices, is still valid or over-complexifies the process of purchasing a new car. The literature reviewed on mass customization indicates that if the role of the dealer accompanying the customer is taken away, there might be a need to reduce complexity. The reviewed available data set only shows anecdotal evidence, given that Tesla is the only OEM that runs a direct sales model and Mercedes-Benz the only agency. Changing the configuration process is also impossible overnight, as the development cycle and the linked production are multi-year efforts. With OEMs currently being in a shift of sales channels, there is likely a change required going forward, where the introduction of new models can be perceived as the opportunity window.*
Keywords: *Car Configurator, Personalization, OEMs, New Car, Purchase*

INTRODUCTION

Historically, customers had no choice in configuring vehicles; manufacturers like Henry Ford made the trade-off in cost and individualization. As such, Ford introduced 1914 black as the only color option, given it was the cheapest paint: "Any color the customer wants, as long as it's black." This policy remained until 1926 when customers could choose from further options (Sullivan 2023). As of today, customers can generally choose between two sales process options: choosing a vehicle that is readily available at the retail outlet, already configured to a particular spec, or configuring their vehicle towards their specific needs, which then gets produced afterward and shipped within an average of 55 days in Europe for volume OEMs (Holweg and Jones 2001, p. 364), under average market conditions, not considering supply crisis. In such situations, dealers assist the customer in configuring the car and ordering the vehicle from the OEM. Customers can pre-inform themselves via the OEM car configurators offered on the OEM website (Herrmann et al. 2007, p. 391). This leads to a situation in which customers select from one of multiple hundred vehicle configurations (MeinAuto 2013). With a shift in sales models, where dealers are traded for agents who act on behalf of the OEM, and the introduction of more online sales, the sales process becomes more customer-driven (pull) and less pushed by dealers (push). This paper shall, therefore, assess to what extent the requirements for vehicle configuration change and if there is a need to reduce the complexity of car configurators. Reviewing the literature on mass customization and its role in increasing sales, as well as new car sales processes, requirements for a configuration complexity shall be deviated, which then will be applied to an enriched data set of vehicle configuration options for 13 sold vehicles in Germany.

RESEARCH METHODOLOGY

The research of this publication is based on a literature review and a systematic review of the car configurators offered for the ten most sold vehicles, where a specific focus is set on understanding the role

of the sales model of these OEMs within Germany, allowing to conclude when a higher complexity is beneficial a when less is more. The literature review includes published books, journals, research papers, online articles, and websites, which are used to consider more recent evolvements. In the first step, the benefits of a wide variety are explored, such as why a complex car configurator can increase OEM sales and how variety in car configuration can decrease. Secondly, literature linked to the sales process of OEMs is reviewed, allowing us to ultimately conclude which circumstances customers prefer a complex or a simple car configurator. For the systematic review of the car configurators, this paper draws on a dataset conducted to examine a different research topic. The data set, as a result of this, systematically screens the OEM configurators of ten of the eleven most sold vehicles in Germany in 2023 and allows to conclude on the number of options offered in the process, as well as allows to differentiate between battery electric vehicles and traditional internal combustions engines, resulting in a total data set for 13 vehicles. This paper will enrich the dataset with relevant categories based on the literature review, allowing us to ultimately test if the conclusions from the literature apply to the German OEM industry and its sales processes.

MASS CUSTOMIZATION IN SALES PROCESSES

To avoid losing customers to a competitor, manufacturers have adapted mass customization, allowing them to target various customers. Literature has shown that this allows for an increase in sales, as an increase in variety enables customers to create the variation they value the most, increasing the sales probability (Kahn 1998, p. 45). With customers who are more explorative and likely to change products use by use, the variety can increase brand loyalty, as it enables the customers to switch within the same product and explore a different variation time by time (Kahn 1995, p. 141). The criticality is to maintain complexity, which customers no longer value. Examples include the advertisement for a sofa shop that markets 500 styles, 3000 fabrics, and 350 leather combinations (Huffman and Kahn 1998, p. 492). In such cases, the increase of customization might lead to a sales process abortion, and the customer might shop with a different provider, which offers a more selective set of options. Research has shown that customers do not value the variations if they are similar attractive, hence the customers cannot prioritize one variation over another. (Dhar 1997, p. 215). With customers needing to evaluate the different options, the level of mass customization becomes a question of sales process structuring (Chernev 2006, p. 171). As a result, the customers must be sufficiently capable of managing the variety in a sales process. Retailers play a critical role as sales consultants, which help customers evaluate the different options (Huffman and Kahn 1998, p. 492). In particular, the relevance of having navigable complexity in mass customization becomes critical in online sales, where complexity and usability are vital drivers when converting traffic into sales. It should be reduced (Meurs 2013, p. 25). As a result, there is no specific value for mass customization. However, it is rather driven by the sales process and the relative customers' capabilities and motivation to purchase a unique variation, which is likely to be driven by the individual relevance of the decision and, hence, the linked effort the customers are willing to make in evaluating different customization options.

NEW CAR SALES PROCESS IN GERMANY – OEM RETAIL MODELS

OEMs retail vehicles via three key distinctive sales channels. The traditional dealer model enables authorized dealers to retail vehicles for their authorized brands. Dealers then order the configuration once they have agreed on a sales price and vehicle specifications with the end customers. OEMs sell the cars to the dealers and then re-sell them to the end customer. If OEMs have remaining production capacity, they encourage the dealers to go into risk and pre-configure vehicles, which will then be sold as stock vehicles to end customers. This is also in the interest of dealers, as they need to show vehicles to present the configuration options. In an agent model, dealers become agents, which changes the control by OEMs, as they become the contracting party with the end customers and can define the prices. Agents no longer have a trade margin but are remunerated by a commission. As a result, they carry less risk and handle the sales process on behalf of the OEM (Creutzig 2005, pp. 156–157). If OEMs want to take maximum control, they use a direct sales approach using proprietary channels. OEMs tend to steer the sales from

the central organization, similar to the traditional fleet sales team or the digital online sales channel. To interact with customers via a retail environment, OEMs run their own stores, where they sell to end customers. As a result, the staff running the stores, often called "own retail", is typically employed by the OEM (Diez and Reindl 2005, pp. 100–101). From a customer's perspective, all three retail outlets are not necessarily distinguishable (optically), as they all fulfill the same corporate branding. In some instances, OEMs might have all three sales models; in such cases, the retail is managed the same way as dealers and agents to not discriminate against dealers from a competitive law perspective (Fritz and Graf 2006, p. 5). The chart below illustrates the different sales channels in Germany where customers can purchase a new car with an OEM (Bacher 2020, p. 19).

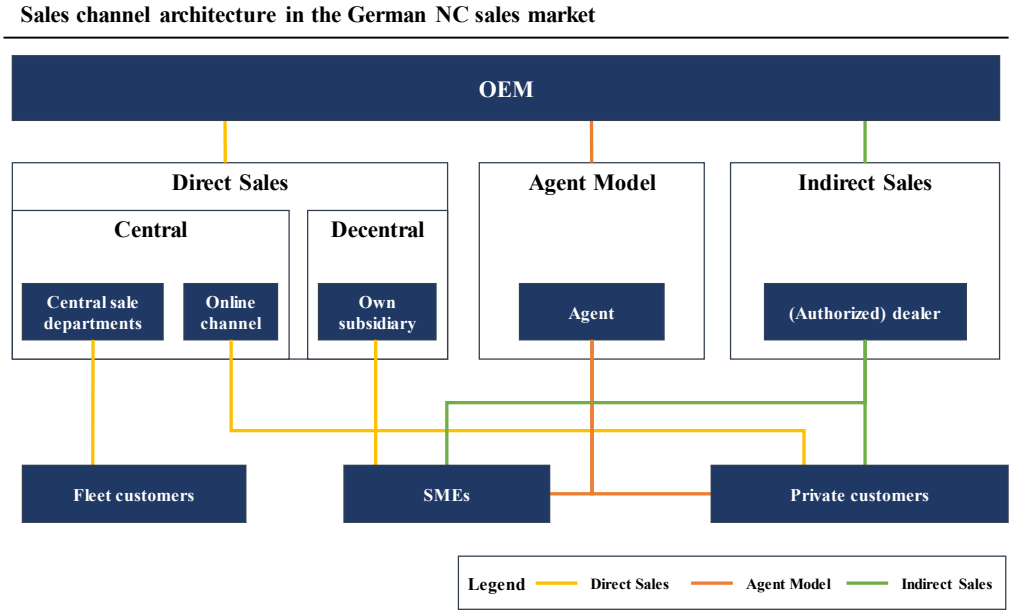

Fig. 1. Illustration of sales channel architecture

CAR CONFIGURATORS IN DIFFERENT RETAIL FORMATS

Car configurators play a crucial role in increasing OEM sales in the sales process. Via customization of vehicles, they allow customers to access a greater variety and increase brand loyalty. If the car configurator is well structured, with an adequate market adaption, it has shown that it can be a competitive advantage in the respective markets (Fettermann, Echeveste and ten Caten 2012, p. 2340). Retailers must assist customers in overcoming challenges arising from the complexity and variety. Research has shown that if dissatisfaction with the sales process arises, this is attributed to the retailer (Huffman and Kahn 1998, p. 492). To overcome the variety of sales, salespersons accompany the customer in the process of doing the car configuration by answering complex questions that might not have been obvious to the customer initially (Peraković, Behúnová and Knapčíková 2020, p. 196). Customers appreciate the help of dealers if they consider them a trusted source of information. Further social interactions allow to reduce the uncertainty in the configuration process. Customers expect to discuss their vehicle option choices during the process of configuring and once they are done, to increase confidence in their decision (Grosso, Forza and Trentin 2016 p. 34). With increased information technology systems' availability, car configurators have moved online, making them available for customers in self-administration. This step decreased the costs for dealers, as less time has been involved in configuring vehicles, with customers coming prepared to the dealerships (Peraković, Behúnová and Knapčíková 2020, p. 195). On the other hand, customers are now more left by themselves in the sales process, which increases the need for a car configurator that is easy to use. In addition to that, the general use of customers for the retail outlet is changing. In the past, customers also visited retail outlets at the beginning of the sales process to inform themselves about different options, but this step has mainly moved online. It is expected that in the future, retail outlets will remain critical for the test drive and vehicle hand-over once purchased. Customers

prefer to purchase more in self-administration in digital channels. As a result, they become the initiator of the sales process and expect communication in real-time once they request it. This fundamentally changes the requirements of retail outlets: from dealers that have converted walk-in customers offline into a vehicle purchase to dealers that need to respond to customers online/offline, ideally in real-time (Bacher 2020, pp. 21–22). OEMs have reacted to that change, which allows them to take over more of the retail channels via agent or direct models, given that they can deploy customer service centers at scale more efficiently than multiple small dealers (Coase 1937) and manage the brand reputation, as well as determining prices and avoiding intra-brand competition. This shift is underway: Mercedes-Benz and VW (EVs only) have already shifted to Agent Models as of November 2023 (Backovic 2023; Hubik 2023). Further OEMs have announced their change (Meunzel 2022).

Review of top ten most sold vehicles in Germany and their sales model

The analysis is based on an available data set, assessing the extra options customers can choose when configuring a specific model on an OEM website. The data set has collected 13 car models, which are part of Germany's eleven most sold vehicles in 2023. The data set differentiates between electric and combustion engine vehicles and excludes one model, which created challenges in retrieving configuration data. The standardized categories of variants, engines, colors, and rim sizes are not considered as they are similar across OEMs, and the focus of this data set has been set on the extra options. The data set has been retrieved via a simulated configuration experience, in which, systematically, every active choice the customer needs to make has been recorded; if the option is free of charge or attached to a premium is not relevant, the active click is considered for the count. The data set has been enriched in this context with information on the OEM's current sales model, which is presented in Figure 2 below.

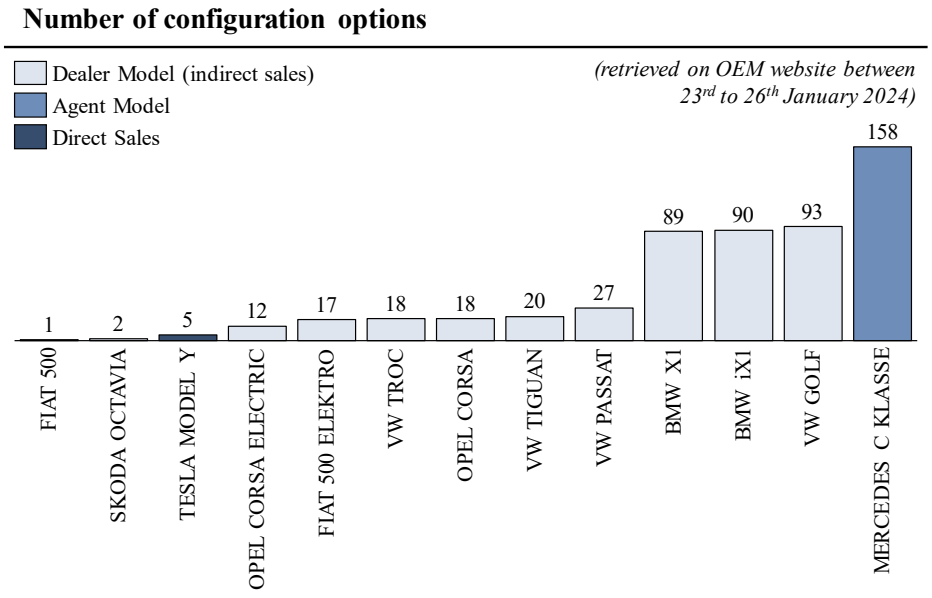

Fig. 2. Sales models of OEMs and the number of configuration options

Of the sample, only Mercedes runs an agent model, Tesla direct sales and Stellantis (Opel, Fiat), VW Group (VW, Skoda), and BMW run a traditional dealer model. Notable Tesla is the only OEM that has emerged towards its size in recent years. In contrast, the others can be considered as traditional established OEMs, which becomes critical when assessing their configuration choices, as they haven't started designing this from scratch for a more digital retail model. In the data set, it becomes visible that Tesla has a limited set of options, which might be linked to their capabilities in designing customer journeys specifically for their direct sales model. Based on the theoretical research, the number of configuration options for the Mercedes-Benz C series is on the higher end of the sample, which could be linked to the historical evolution from a dealer model in 2022 and the development cycle of a new car is

longer, resulting in a theoretical mismatch of complexity and sales channel. In summary, the data sample and the movement of the sales model in the market make it difficult to determine the complexity of each model required. In addition to that, customers might differ across segments, which could explain why BMW and Mercedes, as premium OEMs, offer more configuration options than volume brands like FIAT or OPEL. Still, OEMs are required to provide a simple customer journey, illustrated by the simplicity of TESLA, which does not necessarily have to be via the number of options but also other journey elements, like real-time customer support, simple explanations and high useability of the configurator.

CONCLUSION

The paper reflects on the automotive industry's mass customization via car configurators. Car configurators have emerged historically in a competitive environment for sales volumes for OEMS by offering a larger variety of the same product and increasing customer loyalty as customers can vary within the same product over time. In the past, dealers had a decisive sales process role, in which most configuration was done offline at the dealer site. Customers value the knowledge and expertise of dealers in supporting them through the large set of configuration possibilities. With information technology, the car configurator has moved online onto the OEM websites, where customers can configure vehicles in a self-administered manner. While dealers remained the main transaction point, this made the transaction faster and more cost-efficient, as customers came pre-informed and discussed the options with the dealers before placing an order. With the increase in digital sales, customers reassessed the value of a dealership: industry forecasts see the role of retail outlets in the future, mainly in the process of test drives and vehicle handovers. As a result, customers now need to self-navigate through the configuration process, which requires a simple customer journey with an appropriate user interface and experience, not exclusively but also driven by less variety in vehicle configurations, as customers only value the variety to the extent where options are differentiable. To overcome the heterogeneous landscape of individual dealers today, OEMs are shifting towards more direct sales models, such as the agency, where they control the sales process and agents acting on behalf of the OEM. This allows them to unify the digital complexity and provide a single trusted customer journey. In reality, OEMs still need to adapt to the new requirements fully. The data set analyzed shows that TESLA is the only OEM running a direct sales model with a low variety of configuration possibilities. Only Mercedes Benz has so far transitioned to the agency model, but it still offers the same complexity as vehicle development cycles are long, and the variety cannot be reduced overnight. Managing complexity in the car configurator will be a key challenge going forward, which likely needs to find its new equilibrium; also, considering the positioning of each OEM (premium vs. volume), customers might have different requirements towards the brand. While premium customers might prefer the customization, volume customers could be rather price-sensitive.

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ДИГИТАЛНИТЕ ПРОДАЖБИ ПРОМЕНЯТ РОЛЯТА НА ОНЛАЙН КОНФИГУРАТОРИТЕ НА АВТОМОБИЛИ

Резюме: *Клиентите, които изискват повече дигитални взаимоотношения с производителите на оригинално оборудване, променят ролята на търговците. Докато в миналото търговците бяха ключови в процеса на продажба, сега се очаква те да бъдат сведени до търговски пунктове за тестово шофиране и предаване, а клиентите да извършват основно процеса на покупка чрез самостоятелно администриране онлайн. В резултат на това възниква въпросът дали масовата персонализация на производителите на оригинално оборудване, която създава сложност и голямо разнообразие от възможности за избор, все още е актуална или прекомерно усложнява процеса на закупуване на нов автомобил. Разгледаната литература за серийното персонализиране показва, че ако се отнеме ролята на търговеца, съпровождащ клиента, може да се появи необходимост от намаляване на степента на сложност. Разгледаният наличен набор от данни показва само непотвърдени данни, като се има предвид, че Tesla е единственият производител на оригинално оборудване, който прилага модел на директни продажби, а Mercedes-Benz – единствената агенция. Промяната на процеса на конфигуриране също така е невъзможна да се постигне изведнъж, тъй като цикълът на разработване и свързаното с него производство са дългогодишни начинания. Тъй като понастоящем производителите на оригинално оборудване са в процес на смяна на начините на продажба, в бъдеще по всяка вероятност ще е необходима промяна, при която въвеждането на нови модели да се разглежда като благоприятна перспектива.*

Ключови думи: *автомобилен конфигуратор, персонализация, производители на оригинално оборудване, нов автомобил, покупка*

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ОБЩЕСТВЕНИ КОМУНИКАЦИИ И ИНФОРМАЦИОННИ НАУКИ
PUBLIC COMMUNICATIONS AND INFORMATION SCIENCES

HOW TO CONDUCT DATA PROTECTION-COMPLIANT DATA EXCHANGE WITH INDIA

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Abstract: *This study investigates the compliance of data protection frameworks in India with the European Union's General Data Protection Regulation (GDPR). With India's evolving digital economy and the absence of an EU adequacy decision for the country, this research assesses the legal robustness and operational feasibility of transferring personal data to India under GDPR stipulations. Employing a qualitative methodology, the research analyzes current Indian data protection legislation, proposed reforms, and comparative standards set by the GDPR. The analysis is grounded in a review of legal documents, draft legislations, judicial decisions, and expert commentaries. Key findings indicate that while recent draft reforms aim to enhance compliance with international standards, substantial gaps remain concerning adequacy, enforcement, and rights assurance compared to GDPR requirements. The study highlights the potential of Standard Contractual Clauses (SCCs) and Binding Corporate Rules (BCRs) as interim mechanisms to facilitate data transfer, pending significant legal reforms in India's data protection landscape.*
Keywords: *GDPR, Data Protection, India, Data Transfer, Compliance*

INTRODUCTION

The protection of personal data is of paramount importance in democratically organized state entities. How a society, private companies or the state handle the personal data of its citizens, how much information is stored, used or passed on, why and for what purposes, can be seen as a kind of "litmus test" in terms of the rule of law. It shows how much freedom the state and private companies grant citizens and consumers. This puts a large number of fundamental rights on the agenda that can be encroached upon, e.g. telecommunications secrecy (Art. 10 GG), the fundamental right to informational self-determination (Art. 1 para. 1, Art. 2 para. 1 GG) and a large number of other fundamental rights Art. 5 GG (freedom of opinion, information and broadcasting, Art. 12 GG, Art. 13 GG, Art. 3 GG). While data protection in its beginnings was primarily directed against interference by states, which were dubbed "Leviathan" (di Martino 2005, p. 17 with reference to Thomas Hobbes "Leviathan or the Matter, Form and Power of a Commonwealth Ecclesiastical and Civil") of 1651 and Job 41, 15ff.), today it is primarily private companies that have succumbed to an al-most limitless "hunger for data". This, digitalization (Bendel 2021; Lehmann 2014, p. 4; Kusch & Malik 2017, p. 6; Wolf & Strohschen 2018) and the rapid rise of modern information and communication systems ("ICT"; Szczutkowski 2017) prompted the European standard setter to create the General Data Protection Regulation (GDPR). In doing so, it has set high standards for data exchange not only across the EU, but also on a global scale. However, an appropriate level of data protection is to be ensured not only in the European Union (EU), but also when transferring data to third countries, such as the USA (Weichert 2017, p. 10). The GDPR contains corresponding detailed provisions in its Art. 46 to 49. A level of data protection corresponding to the GDPR must be guaranteed in each case. This will be analyzed below for the ex-ample of India: Firstly, Indian law delege lata and any reform efforts are presented and then how a legally secure and GDPR-compliant data exchange can take place under current law.

Data protection in India

India is an emerging nation, one of the so-called BRIC(S) countries (acronym for Brazil, Russia, India, China and South Africa as emerging economies; Magnus 2010), i.e. one of the economically emerging countries that will play a decisive role in the globalized world economy in the future. It is assumed that the enormous poverty problems of the Indian subcontinent can be tackled with the help of ICT (Rajadhyaksha n.d., p. 29). The Indian IT sector in particular has experienced a huge boom in recent years (Messner 2008, p. 64). Accordingly, and due to the increasing exchange of goods and information with the West, data protection issues have increasingly become the focus of public interest.

Reform efforts

A comprehensive discussion and reform process is currently taking place. Recently, the draft of India's first-ever Personal Data Protection Bill (PDPB) was withdrawn by the Indian lower house of parliament (Lok Sabha) (Merle 2022). The bill was heavily criticized in many ways. It goes back to a very first draft from 2019, which was followed by a revised version in 2021. In the following, the development is traced in the necessary brevity.

The 2019 draft

The 2019 draft was preceded by extensive consultations at various levels (Prasad & Menon 2020, p. 1). Of particular importance was not only the adoption of the GDPR, but also the fact that the Supreme Court of India in Justice K.S. Puttaswamy v Union of India had previously recognized the fundamental right to data protection or informational self-determination, which was first developed and recognized worldwide by the Federal Constitutional Court (BVerfG) (BVerfGE 65.1), as a fundamental right within the meaning of Articles 14, 19 and 21 of the Constitution in 2017 (Supreme Court of India 2017). India thus followed a global trend of using the adoption of the GDPR as an opportunity and starting point for far-reaching reforms. In addition, the previous regulation from 2011 had been recognized as inadequate (Prasad & Menon 2020, p. 2 fn. p. 24). Of central importance in the draft was the introduction of data protection principles that correspond to the GDPR standard (PDPB 2018, Section 3 Clause 14), in particular the principle of prior consent to data processing. It also provided for the establishment of a data protection authority (Art. 41 of the draft) and the abolition of Sec. 43A of the IT Act (Merle, Herzner & Schmitz-Bauerdick 2022). The draft was submitted to the House of Commons on 11 December 2019 (Merle, Herzner & Schmitz-Bauerdick 2022). The Information Technology Act, 2000 (IT Act), which was amended by the Information Technology (Amendment) Act, 2008, and the Information Technology (Reasonable Security Practices and Procedures and Sensitive Personal Data or Information) Rules, 2011, have been authoritative to date. Sec. 43A and 72A of the IT Act, which were added with the revision, provide for claims for damages and sanctions in the event of a data protection breach (Merle, Herzner & Schmitz-Bauerdick 2022).

Criticism of the 2019 draft and new rules of the 2021 draft

On 16 December 2021, the Joint Parliamentary Committee (JPC) submitted a report and a draft "Data Protection Bill, 2021" to the Indian Parliament, which included provisions on data localization and non-personal data (Merle, Herzner & Schmitz-Bauerdick 2022). The new draft of 2021 (PDPB 2021) (Tripathy & Sehgal 2021), takes up the suggestions of the JPC and now contains provisions on personal and non-personal data (Tripathy & Sehgal 2021). Extensive amendments were proposed. In particular, the regulations for company founders were considered too complex (Barik 2022). The JPC submitted 81 supplementary proposals and 112 recommendations. The scope of the new provisions should also cover non-personal data. Furthermore, provisions on the regulation of social networks and data security when using smartphones etc. are also proposed. Social media companies should also be able to be held liable for the content of their users (Barik 2022). Provisions on data localization are also proposed, as are regulations on data transfer only to countries with a comparable level of data protection (Barik 2022).

RESEARCH METHODOLOGY

This research aims to analyze the legal and procedural frameworks for GDPR-compliant data exchange between the European Union and India, focusing on the current laws and reforms within India related to data protection. This study employs a qualitative research design, utilizing documentary analysis as the primary method. This approach allows for a comprehensive review of existing legal texts, reform drafts, expert commentaries, and judicial decisions relevant to data protection in India and the European Union.

Data for this research was collected from multiple sources to ensure a robust analysis:

- **Legal Documents:** Examination of the GDPR, specifically Articles 44 to 49, and relevant Indian legislation such as the Information Technology Act 2000 and its amendments.
- **Draft Legislation:** Analysis of the evolving drafts of India's Personal Data Protection Bill, including the withdrawn 2019 draft and the proposed 2021 amendments.
- **Judicial Decisions:** Review of significant court rulings such as the Supreme Court of India's judgment in Justice K.S. Puttaswamy v Union of India, which recognized privacy as a fundamental right.
- **Scholarly Articles and Reports:** Consultation of academic publications and expert analyses on data protection and privacy laws in both the EU and India.

The study uses a thematic analysis framework to identify key themes related to data protection standards, compliance challenges, and the alignment of Indian laws with GDPR requirements. The analysis focuses on:

- **Comparative Legal Analysis:** Comparing GDPR standards with Indian data protection measures to evaluate compliance levels.
- **Regulatory Evolution:** Tracking the progress and changes in Indian data protection laws through various draft stages.
- **Impact Assessment:** Assessing the implications of legal frameworks on data transfers between the EU and India, considering both compliance and operational impacts.

Evaluation Criteria:

- **Adequacy of Protection:** Assessing whether Indian data protection laws provide adequate safeguards as required by GDPR.
- **Legal Robustness:** Evaluating the legal mechanisms in place to enforce data protection rights and resolve disputes.
- **Operational Feasibility:** Examining the practical aspects of implementing GDPR-compliant data transfer mechanisms like Standard Contractual Clauses (SCCs) and Binding Corporate Rules (BCRs).

The study acknowledges potential limitations due to the rapidly changing landscape of data protection legislation in India and the interpretation of GDPR compliance, which can vary significantly based on legal and technological developments.

The research adheres to ethical standards concerning the use of published data and reports, ensuring that all sources are cited properly and that the analysis is conducted objectively and respectfully, considering the legal and cultural contexts of the countries involved.

RESULTS

Data transfer to India is analyzed in detail below. Firstly, the basics of data transfer to a third country are presented. In a second step, we will examine whether suitable safeguards pursuant to Art. 46 GDPR exist in the case of India. Finally, exemptions pursuant to Art. 49 GDPR are discussed.

Principles of data transfer to a third country

The GDPR has not only improved data exchange within the EU, but also with countries that do not have an adequate level of data protection. If this is the case, such as in the USA, binding and legally secure instruments for third country data transfers must be observed. Before data is transferred to third countries, a risk assessment must be carried out and protective measures must be taken; both must also be documented (Art. 49 para. 6 GDPR; Weichert 2017, p. 10).

According to Art. 44 GDPR, the provisions of the subsequent articles and other GDPR provisions

must be observed when transferring personal data that is already being processed or is to be processed after its transfer to a third country or an international organization. In principle, the transfer of data pursuant to Art. 45 para. 1 GDPR does not require any special authorization if an adequacy decision has been made. This presupposes that the level of data protection in the third country fulfils the requirements of the GDPR. This is not the case in India.

Such decisions have so far been made for 14 third countries, including Argentina, Uruguay, Canada, New Zealand, Japan, South Korea, Switzerland and the UK (Roßnagel 2022, p. 546). Data may be exchanged with these countries in the same way as within the EEA (Roßnagel 2022, p. 546). No separate steps are therefore required in these cases. However, India is not one of the countries with a comparable level of data protection.

Standard contractual clauses

According to Art. 46 para. 1 GDPR, a controller or processor may only transfer personal data to a third country or an international organization in the absence of a decision pursuant to Art. 45 GDPR if the controller or processor provides appropriate safeguards and if enforceable rights and effective legal remedies are available to the data subjects. Accordingly, in its Schrems II decision, the ECJ found that a level of data protection compliant with the GDPR does not exist in the USA (ECJ, judgement of 16 July 2020, C-311/18, Data Protection Commissioner/Maximillian Schrems and Facebook Ireland).

It must therefore be checked in each individual case whether such guarantees exist.

It is questionable how this will affect data transfer to India (Das 2020).

In its decision, the ECJ emphasized three aspects: 1. the level of data protection in the US, 2. the importance of efficient protection provisions for private individuals in the event of data protection violations and 3. the possibility of asserting these in a legal remedy procedure that meets the requirements of the rule of law (Das 2020; ECJ, judgment of 16 July 2020, C-311/18, Data Protection Commissioner/ Maximilian Schrems and Facebook Ireland).

The IT Act 2000 contains the relevant standards for state data monitoring. Art. 69 stipulates that data transmission can be interrupted, objected to and decrypted. The provision has a broad scope of application, applies to personal data of EU citizens and also contains sanctions for data protection offences. It also provides for certain restrictions, such as the sovereignty of the Indian state, defense aspects, national security, good relations with other states, public policy, etc. Although these provisions are vague in terms of their wording, they do provide a minimum level of protection. This is because they restrict interference with data transfer by only allowing it in these exceptional situations. US law, on the other hand, does not provide for such restrictions (Das 2020). In addition, government orders issued by Indian authorities must always be in writing (Das 2020).

As far as the second aspect of Schrems II is concerned, the Indian High Court has already recognized the importance of the right to data protection or informational self-determination in the Puttaswamy decision and thus elevated it to the rank of a constitutional guarantee. This fundamental right applies to both Indian and foreign nationals (NASSCOM 2021 p. 28).

In the Puttaswamy case, the Indian Supreme Court developed a three-stage test for reviewing state interference in data protection law:

1.The intervention may only be carried out on the basis of the law and in compliance with the regulations stipulated therein.

2.Specific purpose: The interference must be justified by a legitimate legal purpose.

3.Proportionality: The objectives and implementation of the intervention must be in reasonable proportion to each other. Accordingly, any state intervention must not only be based on the applicable law. It must also fulfil the requirements of this three-step test (NASSCOM 2021, pp. 28–29).

The application of these principles subsequently led to the Bombay High Court declaring the action to be unlawful in a case dealing with telephone surveillance by the intelligence agency due to non-compliance with the aforementioned criteria (NASSCOM 2021, p. 29). Overall, with regard to the second aspect of Schrems II, it can therefore be stated that data protection law in India is on the right track, as re-strictions on executive intervention are now being developed.

With regard to the third aspect, it should be noted that India, like the USA, has no independent data protection authorities. In the USA, compliance with data protection regulations is only monitored by the courts.

The European Data Protection Board (EDPB) objected to the (now withdrawn) 2021 draft, criticizing in particular the fact that the draft contains a wide range of exemptions for interventions by the executive or government. These are very far-reaching and unclear. The implementation of the draft would make it possible to access all data stored in India and thus also leave personal data of EU citizens unprotected (EDPB 2021, p. 55). Certain conditions would also have to be met for such access. However, the entire procedure is not transparent. Based on the Schrems II criteria, the protection of data is very limited and there are only a few constellations in which data subjects can claim compensation with regard to any legal remedies. In most cases, the government cannot be prosecuted for data protection violations (EDPB 2021, p. 55). All of this means that an adequacy decision for India is ruled out de lege lata and in accordance with the 2021 draft.

Accordingly, an adequacy decision by the EU Commission pursuant to Art. 45 GDPR is currently out of the question.

Thus, in the case of India, only appropriate safeguards under Art. 46 GDPR can serve as a transfer mechanism. These are the standard contractual clauses of the European Commission (SCC; Art. 46 para. 2 lit. c GDPR) and the so-called Binding Corporate Rules (BCR, Art. 46 para. 2 lit. B; Art. 47 GDPR; Schmidt & Klingen 2020, p. 331). The latter is discussed in more detail in Chapter 3.3.

The standard contractual clauses contain a general section that regulates their purpose and scope (clause 1), the effect and inalterability of the clauses (clause 2), the third-party beneficiary of the data subject (clause 3) and the interpretation (clause 4). Of particular importance is the principle that the standard contractual clauses take precedence over all other agreements (clause 5). The data transfer pro-cess is also described (clause 6). Finally, additional parties can also join the contract and submit to the clause (clause 7). Clause 8 establishes an obligation for the data exporter to check in advance, as far as can reasonably be expected, whether the recipient of the data transfer is able to fulfil the obligations arising from the clause by implementing technical and organizational measures. Module 1 then contains pro-visions on the trans fer of data between two or more controllers. The purpose limitation of the transfer of personal data, transparency (informing the data subject about the transfer) and the principle that data must be accurate and up-to-date and only transferred if it is required and that it is deleted after use are decisive.

A working paper by the globally active Finnish IT company Basware (Basware 2021) explains in detail how to proceed when using standard contractual clauses. A total of six steps are described there:

1. identification of the intended data transfer;
2. ensuring proper transmission mechanisms;
3. review of the legal situation in the third country;
4. identification and implementation of supplementary measures (i.e.: SCC or BCR);
5. examination of any disadvantages for private individuals resulting from the transfer;
6. decision on the transfer and enforcement measures (Basware 2021).

Binding company and group rules

A third option for data transfer to India is the agreement of binding corporate rules (BCR; Art. 46 para. 2 lit. B; Art. 47 GDPR). This instrument can only be considered without further ado for groups of companies and multinational corporations (Stutz & Seiter, 2022, para. 174). Such regulations can be used to work particularly efficiently in terms of data protection law. On the other hand, the effort involved in developing internal company standards is enormous. Instruments must be developed with which rights and obligations can be enforced both internally and externally. It must also be possible to defend and, if necessary, justify these to supervisory authorities. Finally, internal enforcement in large companies can also encounter difficulties (Stutz & Seiter 2022, para. 174). BCRs have the advantage that they are in line with the data protection requirements of the GDPR (compliance), data processing is standardized across the group, risks in third country transfers are avoided and a sep-

arate contract does not have to be concluded for each individual data transfer. In addition, the special data protection standards can also be used effectively in the context of corporate marketing. Finally, the BCR provide internal company guide-lines for employees (Stutz & Seiter, 2022, para. 175).

Art. 47 GDPR contains detailed provisions on the requirements and scope of what BCRs must contain. The Art. 29 Working Party of the EU Data Protection Supervisors has developed various working papers on detailed issues. Working Paper 256, for example, contains a checklist of which provisions must be included in the BCR. Working Paper 244 also states which authority is the lead authority (Stutz & Seiter 2022, para. 175).

For global players who also have branches or subsidiaries in India, BCRs are a suitable way to transfer data to India.

Exceptional provisions (Art. 49 GDPR)

If the data transfer cannot be based on an adequacy decision or a suitable guarantee, it is only permitted if one of the exceptions standardized in Art. 49 GDPR ap-plies. However, the European Data Protection Board (EDPB) interprets the provisions very narrowly. Accordingly, this standard only has a very limited scope of ap-plication in practice (EDPB 2018; Schmidt & Klingen 2020, p. 331).

CONCLUSION

In light of the above, data transfers to India must still overcome certain rule of law hurdles in order to be GDPR-compliant. In individual cases, the recommendations for action issued by the EDPB (EDPB 2020a; EDPB, 2020b) should always be observed. In this context, the EDPB once again mentioned that when data is transferred and personal data is exchanged with third countries, the high level of data protection in the EU and the European Economic Area means that data protection "travels with you" (Schmidt & Klingen 2020, p. 332). Accordingly, the strict criteria of the GDPR must always be observed without any restrictions.

It is to be hoped that the necessary adaptation measures to the EU level of data protection will be implemented quickly. Although the level of data protection in India is higher than in the USA, it does not justify an adequacy decision, at least not at present. The current reform efforts are an indication that India is doing everything it can to enable secure data exchange due to the great economic importance of Indian-European trade.

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КАК ДА СЕ ИЗВЪРШИ ОБМЕН НА ДАННИ С ИНДИЯ, СЪОТВЕТСТВАЩ НА ЗАЩИТАТА НА ДАННИТЕ

Резюме: *В това проучване се оценява съвместимостта на индийските закони за защита на данните с изискванията на ОРЗД за международно предаване на данни. Чрез качествен анализ на развиващата се правна рамка на Индия, включително Закона за информационните технологии и неотдавнашните проектоизменения на Закона за защита на личните данни, в това изследване се оценяват правните механизми, с които Индия разполага, за да гарантира защитата на данните. Проучването установява пропуски в адекватността и прилагането, които възпрепятстват спазването на GDPR, като подчертава предизвикателствата пред стандартните договорни клаузи и задължителните фирмени правила като временни механизми за предаване на данни. Констатациите сочат, че са необходими значителни реформи, за да може Индия да отговори на стандартите на ЕС, като по този начин се засягат стратегиите на многонационалните компании за движение на данни.*
Ключови думи: *ОРЗД, защита на данните, Индия, съответствие, международен трансфер на данни, стандартни договорни клаузи, задължителни фирмени правила, правна реформа*

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ОБЩЕСТВЕНИ КОМУНИКАЦИИ И ИНФОРМАЦИОННИ НАУКИ
PUBLIC COMMUNICATIONS AND INFORMATION SCIENCES

DETERMINATION OF A SUSTAINABILITY CERTIFICATION SYSTEM AS A BASIS FOR THE DEVELOPMENT OF A SUSTAINABILITY CONCEPT FOR THE CONSTRUCTION OF PRODUCTION FACILITIES OF INTERNATIONAL AUTOMOTIVE SUPPLIER GROUPS

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Abstract: *A comparative presentation of the current sustainability strategy of automotive supplier groups from Germany with the criteria of the most common sustainability certificates for sustainable construction is carried out using the example of Continental AG. By assigning the evaluation priorities and the individual criteria of the different sustainability certificates to the desired Group goals in the area of sustainability, the sustainability certificate can be determined that has the most correspondence with the goals to be achieved in the sustainability strategy.*
By comparing the individual requirements, a recommendation for action is generated for companies in the automotive supplier industry for the selection of suitable sustainability certificates.
The aim of these recommendations for action is to sustainably optimize industrial buildings of automotive supplier groups on the basis of scientific findings and at the same time to reduce costs and contribute to the strategic objectives in the area of corporate sustainability by choosing a suitable sustainability certificate as the basis for the implementation of construction measures.
Keywords: *sustainability, industrial buildings, certficates, strategies*

INTRODUCTION

Leading industrial groups in the automotive supplier sector are aware of their responsibility towards the environment and society and are making both the company and the products manufactured sustainable. To this end, Continental AG, for example, has set itself the task of realizing certain sustainability goals and has committed itself to doing so in the Sustainability Report 2018 and in the Continental Environmental Strategy.

Consequently, the Group's construction and real estate department is also obliged to implement the sustainability principles and contribute to achieving the environmental goals it has set.

Numerous assessment and certification systems are available worldwide for assessing the sustainable quality of buildings. The most relevant and marketable certification systems for private buildings in the international market are LEED (U.S. Green Building Council), BREEAM (U.K. Green Building Council) and DGNB (German Sustainable Building Council) (cf. Statista 2004).

Various studies in Germany show that there is a different understanding of the term "sustainability". Of the three aspects of sustainability, ecology, economics and sociology, the ecological and economic aspects of sustainability are often preferred (cf. Ernst & Young 2013).

Derived from this, in addition to the different definitions of sustainability presented above, there are also divergent definitions of terms and concepts for buildings. The designations range from zero-energy, passive or low-energy houses to "green buildings" and "sustainable buildings". Behind each of these terms are different concepts that address and realize different sustainable qualities. The three terms zero-energy, passive or low-energy house focus on the energetic qualities of the buildings, i.e., the primary energy demand in the use phase, while "green buildings" encompass the ecological and social dimension

of sustainability throughout the entire life cycle.

In the case of "sustainable buildings", the third dimension, the economy, is added in the life cycle assessment.

Many national and international assessment and certification systems provide proof of compliance with these sustainability aspects and sustainability criteria in the building under consideration with the associated seals of approval and certificates. However, there is no national or international uniform standard in the evaluation system and its contents. For example, the results of certification by different institutions differ greatly.

Based on the assessment of the extent to which the existing sustainability certificates LEED, BREEAM and DGNB reflect the sustainability requirements of an automotive supplier group in industrial construction projects in a meaningful and economical way, a further recommendation for action is created.

RESEARCH METHODOLOGY

Every internationally active automotive supplier group has its own individual requirements for the implementation of sustainable concepts. One aspect of sustainable trade is the construction of new industrial facilities. To develop a goal-oriented concept, the corporate goals must be compared with those of the sustainability strategy and integrated at all levels of the company.

For the development of the sustainable concept for the Group's construction sector, three main stages must be examined.

The first step is to analyze the Group's sustainability strategy. Based on a survey of relevant stakeholders by means of a questionnaire, various aspects were divided into very relevant and relevant subject areas. These already defined topics must be analyzed regarding their relevance for the construction of new industrial buildings. To this end, the topics and the sustainability goals set are listed in an evaluation matrix. These criteria are then classified according to whether construction activities in the field of industrial buildings have an influence on the achievement of the target of the criterion.

At the same time, the main criteria with their sub-criteria of relevant international sustainability certificates must be examined. As a basis for the selection of the sustainability certificates for buildings to be considered, an internet search is carried out. An evaluation matrix with criteria is defined in order to be able to check which sustainability certificates can generally meet the requirements of the German, internationally active automotive supplier group.

In the next step, the results from the analysis of the sustainability strategy of the automotive supplier group will be evaluated with those of the selected sustainability certification systems in a weighted evaluation matrix.

The aim of this study is to determine an existing sustainability certification system with the greatest agreement with the sustainability requirements of the automotive supplier group to obtain this as a basis for the development of an individual sustainability concept for the automotive supplier group's construction sector that is tailored to the automotive supplier group.

RESULTS

Group Requirements

In order to be able to develop a suitable sustainability concept for new industrial buildings of a German international automotive supplier group, the first step is to determine the Group's existing requirements with regard to sustainability.

By 2050 at the latest, the Continental AG Group and its partners along the supply chain are aiming for the following four goals (cf. Continental AG 2023):

– 100% carbon neutrality,
– 100% emission-free mobility and industries,
– 100% closed resource and product cycles,
– 100% responsible sourcing and business partnerships.

In the first quarter of 2019, Continental AG conducted a comprehensive survey of various stakeholders on the topic of "Impact Evaluation".

Based on the results of this survey, a total of twelve topics were defined. These twelve thematic areas were further classified into strategic and relevant focus areas.

The four areas with a strategic focus are (cf. Continental AG 2023):

– Carbon Neutrality;
– Emission-free Mobility and Industries;
– Circular Economy;
– Responsible Value Chain.

The eight relevant topics are:

– Innovation and Digitalization;
– Green and Safe Factories;
– Long-term Value Creation;
– Good Working Conditions;
– Benchmark in Quality;
– Safe Mobility;
– Sustainable Management Practice;
– Corporate Citizenship.

Even though the topic of sustainable construction cannot be explicitly found as a strategic or relevant topic in this overview, it does have a non-negligible influence on the achievement of the Group's sustainability requirements. The new industrial building contributes to achieving the Group's goals in the following nine areas: Carbon Neutrality, Circular Economy, Responsible Value Chain, Innovation and Digitalization, Green and Safe Factories, Long-term Value Creation, Good Working Conditions and Sustainable Management Practice, Corporate Citizenship.

Selection of sustainability certificates to be examined

There are many national and international sustainability certification systems around the world that confirm the sustainability of a building. In order to be able to make a selection of a certification system, various criteria must be considered.

In addition to the project details, desired building qualities and costs, the subsequent use of the building plays a decisive role in the selection of a suitable certificate. Criteria are required for the selection of a certification system, which leads to the decision for one or more systems in the form of a recommendation with cost forecast. The criteria of marketing, building performance as well as construction and planning costs, and group requirements for sustainability goals determine an initial trend of the certification level with a limitation of the certification system, while the project information influences the usage profile. Three certification schemes were selected for further investigation. The focus in the selection was on the criteria:

– International applicability of the certification system;
– Awareness of the certification system;
– Consideration of the three sustainability aspects of ecological, economic, and social sustainability.

The American certification system LEED, the British certification system BREEAM and the German certification system DGNB were selected for further investigations due to their global awareness and dissemination as well as consideration of the three sustainability aspects.

Choosing a Sustainability Certificate

In order to be able to determine the relevance of the individual sustainability criteria to the Group's nine construction-related sustainability areas, they were assigned to the individual areas. In addition to the three sustainability aspects of ecological, economic, and social aspects, the following aspects of the certification systems technical quality, process quality and site quality were considered in the allocation.

The following sustainability criteria can be assigned to the Group's subject areas under the following sustainability aspects:

Carbon Neutrality

– Ecological quality: Life cycle assessment – emission-related environmental impacts, Risks to the

local environment und Life cycle assessment – Primary Energy;

– Social quality: Bicycle comfort;

– Location quality: Micro-location, Transport, Proximity to objects and facilities relevant to use.

Responsible Value Chain:

– Ecological quality: Environmentally friendly material extraction, Recyclability of the materials used.

Circular Economy

– Ecological quality: Environmentally friendly material extraction;

– Technical quality: Ease of dismantling and recycling;

Innovations & Digitalization

– Socio-cultural and functional quality: Methods for urban planning and design conception;

Long-term Value Creation

– Economic quality: Flexibility and repurposability;

– Process quality: Quality of construction and commissioning;

Green and Safe Factories

– Socio-cultural and functional quality: Thermal comfort, Indoor air quality, Acoustic comfort, Visual Comfort, User influence, Safety and Incident Risks, Accessibility and safety, public accessibility;

– Technical quality: Fire protection, sound insulation, Building, Durability of construction projects, Equipment quality and user-friendliness of the Utilities, Resistance to hail, storms and floods, Ease of dismantling and recycling;

– Process quality: Prerequisite for optimal use and management, Construction site / construction process, Quality of construction and commissioning;

– Location quality: Micro-location, Expandability/ Reserves;

Good Working Conditions

– Economic quality: Flexibility and repurposability;

– Socio-cultural and functional quality: Thermal comfort, Indoor air quality, Acoustic comfort, Visual Comfort. User influence, Outdoor space quality, Safety and Incident Risks, Accessibility and safety, public accessibility, design and art, floor plan quality;

– Technical quality: Planning integrals;

– Process quality: Prerequisite for optimal use and management;

Sustainable Management Practice

– Economic quality: Building-related costs in the life cycle, Marketability;

– Process quality: Prerequisite for optimal use and management;

Corporate Citizenship

– Process quality: Prerequisite for optimal use and management.

All criteria were assessed based on their relevance to the Group. 0 points were awarded for no requirement, 1 point for low requirement, 2 points for medium requirement and 3 points for high requirement. Subsequently, the points achieved were set in relation to the maximum total number of points achievable to determine the percentage coverage of the criteria of the sustainability certification systems with the Group's requirements for its sustainability topics.

Table 1. Compliance of certification criteria with the sustainability goals of the automotive supplier group

Area	**LEED**	**BREEAM**	**DGNB**
Carbon Neutrality	13	15	20
Responsible Value Chain	2	3	6
Circular Economy	2	3	6

Innovations & Digitalization	3	3	6
Long-term Value Creation	3	3	5
Green and Safe Factories	22	24	46
Good Working Conditions	11	10	37
Sustainable Management Practice	1	4	9
Corporate Citizenship	0	2	3
Total points out of 156 points	57	67	138
Coverage in % certification system vs. group requirement	**37%**	**43%**	**88%**

CONCLUSIONS/DISCUSSION

As can be seen in Table 1, none of the international certification systems fully meets the sustainability goals of the automotive supplier Continental AG. However, compared to LEED and BREEAM, the DGNB certification system most closely reflects the needs of the automotive supplier group in terms of achieving its own sustainability goals.

To develop an individual concept tailored to the Group, it makes sense to use the DGNB certification system as the basis for developing a sustainability concept that meets the requirements of the automotive supplier group and to further develop it accordingly.

The advantage is that an internationally known system is used as the initial evaluation system, which already has a large coverage of the Group's sustainability goals and will contribute to the achievement of the Group's sustainability goals worldwide through sensible adjustments.

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ОПРЕДЕЛЯНЕ НА СИСТЕМА ЗА СЕРТИФИЦИРАНЕ НА УСТОЙЧИВОСТ КАТО ОСНОВА ЗА РАЗРАБОТВАНЕТО НА КОНЦЕПЦИЯ ЗА УСТОЙЧИВОСТ ПРИ ИЗГРАЖДАНЕТО НА ПРОИЗВОДСТВЕНИ СЪОРЪЖЕНИЯ НА МЕЖДУНАРОДНИ ДОСТАВЧИЦИ ЗА АВТОМОБИЛНАТА ИНДУСТРИЯ

Резюме: *Сравнително представяне на текущата стратегия за устойчивост на групи доставчици за автомобилната индустрия от Германия с критериите на най-често срещаните сертификати за устойчиво строителство се извършва с помощта на примера на Continental AG. Чрез присвояване на приоритетите за оценка и индивидуалните критерии на различните сертификати за устойчивост към желаните групови цели в областта на устойчивостта може да се определи сертификатът за устойчивост, който най-много съответства на целите за постигане в стратегията за устойчивост.*

Чрез сравняване на отделните изисквания се генерира препоръка за действие за компаниите в индустрията на доставчиците за автомобилната индустрия за избора на подходящи сертификати за устойчивост. Целта на тези препоръки за действие е да се оптимизират устойчиво индустриалните сгради на групите доставчици за автомобилната индустрия на основата на научни открития и същевременно да се намалят разходите и да се допринесе за стратегическите цели в областта на корпоративната устойчивост чрез избора на подходящ сертификат за устойчивост като основа за прилагане на строителни мерки.

Ключови думи: *устойчивост, индустриални съоръжения, сертификати, стратегии*

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ОБЩЕСТВЕНИ КОМУНИКАЦИИ И ИНФОРМАЦИОННИ НАУКИ
PUBLIC COMMUNICATIONS AND INFORMATION SCIENCES

CONCEPTION OF A MODEL FOR SENSITIVE COMMUNICATION WITH PTSD PATIENTS

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Abstract: *Communication with patients suffering from posttraumatic stress disorder (PTSD) requires particularly sensitive and careful interaction on the part of the treating doctors and psychologists. This article develops a model for trauma-sensitive communication based on the models of Schellong and Epple as well as Schulz von Thun and Rogers. The aim is to ensure safe and supportive conversation that avoids re-traumatization and strengthens the therapeutic relationship. The article first describes the basics of PTSD, its symptoms and the importance of adapted communication. The theoretical models that serve as the basis for the communication model are then presented: the trauma-informed conversation model and the client-centered conversation model. The communication framework developed includes an empathic attitude, the planning of the conversation setting and the structured course of the conversation, which is divided into two main phases: the narrative phase and the processing and securing phase. In the narrative phase, active listening and anamnesis are the main focus, while in the second phase, further treatment and affect-regulating measures are discussed. The model emphasizes the importance of freedom of choice and control for patients and highlights the need for continuous adaptation and expansion of the model through empirical research. Finally, the limitations of the model and the need for further research are discussed.*
Keywords: *Posttraumatic stress disorder, communication, affect regulation, trauma-sensitive communication, resource orientation*

INTRODUCTION

Patients with posttraumatic stress disorder (PTSD) are particularly characterized by the fact that they react in a chronic manner to an exceptionally stressful event (Michael et al. 2018, 106–107). This includes, for example, reliving certain situations over and over again, and there is excessive stimulation of the autonomic nervous system. Anxiety disorders and depressive states are also closely related to this. In addition, dulling on an emotional level is also possible. For example, a person may no longer be able to feel joy (Layne et al. 2018, 235–236).

In this context, a particular significance arises when it comes to communication with people with PTSD. This applies from at least two perspectives. On the one hand, unreflective communication can have negative consequences for patients. In extreme cases, a thoughtless statement can even encourage re-traumatization (Grossmann et al. 2021, S. 1–3). On the other hand, there are various potentials for targeted communication with a view to improving symptoms and the risks of re-traumatization (Maercker 2021, 1–3).

Against the background of this challenging initial situation, the present work deals with the conception of a communication framework for the design of conversations with patients suffering from PTSD. It is primarily aimed at people who interact with them professionally, primarily doctors and psychologists. However, it should also give caregivers and relatives impulses for communication with PTSD patients. The core of this is raising awareness of the special initial situation and the needs of the burdened people and the conscious communication that builds on this. The communication framework is based in particular on three communication models: trauma-informed conversation according to Schellong and Epple (2018), combined with the four messages of a communicative message according to Schulz von Thun and the resource-based approach of client-centered conversation according to Rogers. Both approaches focus on the recipient of a message and the sensitive, trusting and at the same time goal-oriented interaction with them (Schellung/Epple 43–45).

The structure of the article is derived from these considerations. First, there is a brief introduction to the topics of PTSD and the two communication models mentioned. Both aspects are then brought together by designing the communication framework and describing it transparently using a concrete example. The results are then briefly

discussed. Further research needs are then addressed, particularly with regard to the existing limitations.

BASICS

Now we will first give a brief presentation of the basics of PTSD, the basics of trauma-informed conversation and the two communication models by Schulz von Thun and Rogers, especially with regard to the current state of research.

Posttraumatic stress disorder (PTSD)

In the DSM-5 and ICD-10, PTSD is characterized in particular by the following criteria, which occur more than one month after the traumatic experience:

– intrusions and reliving the traumatic situation;
– avoidance symptoms;
– chronic hyperarousal and
– negative developments in cognition and emotions. (Michael et al. 2018, 6–8).

Rogers' model

Rogers' model is particularly used in therapeutic contexts. It starts with the basic attitudes of the people. Congruence refers to the authenticity with which the person treating the patient conducts the conversation, and an empathetic and appreciative attitude also counts (Weinberger 2013, 19–22). It is a resource-centered approach: It is assumed that the solution to existing problems is already anchored in the person themselves. The client has a disproportionate share of the conversation (Weinberger 2013, 19–22). The therapist focuses on active listening. When answers are given, targeted impulses are given to support the person in finding a constructive solution. Paraphrases and mirroring are also used (Weinberger 2013, 19–22).

Model of trauma-informed conversation

Schellong and Epple (2018) have created a model for trauma-informed conversation. It is structured into a total of four areas. The first level addresses the requirements for basic knowledge on the subject of trauma and the basic attitude. Then, after three W questions, the basic areas are addressed: what (the content elements of the conversation), how (the principles on which the design of the communication is based) and what (i.e. how the feeling is controlled) (Schellong/Epple 2018, S. 43–47).

The model initially starts with the content basics. A person who conducts a conversation needs relevant and current specialist knowledge about the origin, the symptoms (physical and psychological) and the treatment of the patient. The content of the conversation is then based on this. This includes first of all the anamnesis of the previous symptoms. The security status and the quality of the previous social network with a view to support potential are also recorded. The conversation typically has a narrative character: the person is the focus. Elements of psychoeducation can be integrated at this point in acute cases. Interventions in the event of crises are also important, also with regard to the patient‘s skills in regulating their emotions. After the content level has been completed, professional advice on further treatment is given, whereby the patient should be made aware that he or she has freedom of choice. This is followed by referral to an expanded treatment network (Schellong/Epple 2018, S. 43–47).

The basic attitudes of the treating person also play a central role. The conversation should take place in a safe atmosphere and be free of disruptions. The expert‘s approach to the patient is congruent, appreciative and attentive, but at the same time objective. The patient‘s own resources are put into focus and understandable explanations are given if necessary (Schellong/Epple 2018, S. 43–47). Finally, based on the aspects presented so far, the question is what should be communicated. Three aspects in particular are in focus here: The patient's sense of security and control should be strengthened. In addition, the patient should be aware that he has freedom of choice regarding the further course of treatment, but also regarding his own behavior. Overall, the conversation should contribute in particular to normalizing the patient's own feelings (Schellong/Epple 2018, S. 43–47).

CONCEPT OF THE COMMUNICATION FRAMEWORK

On the basis of the previous representations, a communication framework can now be specified that supports sensitive and goal-oriented communication for patients with a PTSD diagnosis and is sensitive to the consequences of the interaction. The model by Schellong and Epple forms the starting point, and a synthesis takes place with the models by Schulz von Thun and Epple.

The basic attitude of the person providing therapy is specified as the basis for the conversation. This includes in particular an empathetic and appreciative attitude, but also the acceptance of the person, their current feelings and situation and the openness to respond to the patient. In addition, specialist knowledge in the medical and

psychological field is also important, especially on the subject of PTSD and the treatment options.

There are three aspects in particular that are important when preparing for the conversation. Firstly, the therapist's basic attitude. The relationship level plays a central role: congruence, appreciation and empathy are the guiding principles for conducting the conversation. Acceptance of the person and their personality is also important, as is openness to dealing with it. In addition, particular sensitivity must be shown. Secondly, the setting of the conversation must be planned. It should take place in a setting that is pleasant for the patient and as uninterrupted as possible. Potential triggers should also be avoided. For example, the door can be left slightly open and any form of coercion should be avoided if it is known in advance that the person will find this challenging. On the content level, the person should have sound professional skills and experience in dealing with PTSD. Psychological knowledge, particularly with regard to conducting conversations, is also relevant. In addition, the person should have familiarized themselves with the documentation of previous treatment.

The following phase is the start of the conversation. The patient is the focus here. With a view to resource orientation, the therapist assumes that the person already has essential approaches for the further process within themselves. The patient can tell a story freely in the form of a narrative, and the therapist listens actively. When feedback is given, it is primarily targeted impulses that are given and paraphrased. Advice is refrained from being given in this phase. For the patient, it is primarily about giving the patient a feeling of being in control - they should open up. Here, too, the focus is on protecting the patient. On a content level, it is about taking a medical history and assessing current feelings. The second phase is about discussing and processing what has been said. The therapist and the patient communicate about the next steps. In particular, the therapist shows which next steps are now available and which treatment approaches are available. It is important to give the patient freedom of choice. At the same time, direct support is also provided for regulating affective regulation, which is particularly important here. Exercises are also possible in this context. In addition, the person should continue to be strengthened in their sense of control and security. The individual phases can be varied and, if necessary, repeated if this should arise for logical reasons.

Table 1. Conception of a conversation process for communication with PTSD patients

Prerequisites of the conversation		
Attitude	Contents	Situation
Basic attitude of the therapist	Basic atmosphere of the conversation	Content competencies
• Congruence • Appreciation • Empathy • Openness • Sensitivity	•Undisturbed atmosphere •Protection from triggers •Objectivity •Resource orientation	•Preparation for the interview •Basic medical and psychological knowledge •Basic knowledge of PTSD (origin, symptoms and treatment) •Experience in dealing with PTSD patients
Phase 1: Narration		
Behavior of the therapist		Goals

•Resource orientation: restraint and narration •Advice only within a narrow professional framework •Support in affect regulation •Narration •Active listening •Paraphrasing	•Anamnesis and sensitization to the situation • Calming and normalization • Protecting the patient • Opening up the patient
Phase 2: Processing and security	
Behavior of the therapist	Goals
•Support the patient in regulating their emotions (possibly active exercises) •Show options for actions, but allow freedom of choice •Referral to follow-up treatment	• Support in affect regulation •Providing basic knowledge about PTSD and regulation •Cooperative planning of further treatment •Sustainable provision of a sense of control and security

CONCLUSION AND LIMITATIONS

The model presented shows key aspects that need to be considered when dealing with PTSD patients – both from a content and process-logical perspective. Important focuses are on raising awareness among therapists and other people who interact with individuals from this group in a professional setting. Essentially, it is a synthesis of the models by Schellong/Epple and Rogers. At the core are the narrative and counseling phases, with both showing close mutual connections. It offers connection points to other communication models and individualization for special settings – for example, people who have only recently been diagnosed with PTSD or who have other aspects relevant to communication.

An important aspect is that the communication model presented has not yet been subjected to empirical testing. Studies would therefore still need to be carried out. It should be noted that the ethics committee of the treating institutions should be involved in particular, because the associated research is carried out with subjects who are ill. For this reason, an appropriate approach should anticipate possible consequences and the study should only be carried out under intensive medical and psychological supervision. A mixed methods design is recommended: the effects of the application of the model can be both broadly and concretized in detail in interviews and observations. The latter applies particularly in view of the fact that the subjective perceptions of people suffering from PTSD play a prominent role. In addition, it would be useful to include other communication models with a view to their suitability for the current question. In this way, the model could be expanded. Specialization with a view to different manifestations of PTSD should also be examined in this context.

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КОНЦЕПЦИЯ НА МОДЕЛ ЗА ЧУВСТВИТЕЛНА КОМУНИКАЦИЯ С ПАЦИЕНТИ С ПТСР

Резюме: *Общуването с пациенти, страдащи от посттравматично стресово разстройство (ПТСР), изисква подчертано чувствително и внимателно отношение към тях от страна на лекуващите лекари и психолози. В тази статия е разработен модел за комуникация, съобразен с травмата, въз основа на моделите на Шелонг и Епъл, както и на Шулц фон Тун и Роджърс. Целта е да се осигури безопасен и подкрепящ диалог, който избягва травматизирането и укрепва терапевтичните взаимоотношения. В статията първо се описват основите на посттравматичното стресово разстройство, неговите симптоми и значението на адаптираната комуникация. След това са представени теоретичните модели, които служат за основа на модела на комуникация: моделът на разговор, базиран на информация за травмата, и моделът на разговор, ориентиран към пациента. Разработената комуникационна рамка включва емпатично отношение, планиране на обстановката за разговор и структурирано протичане на разговора, който е разделен на две основни фази: фаза на разказване и фаза на обработка и сигурност. Във фазата на разказване основният фокус са активното слушане и анамнезата, докато във втората фаза се обсъждат по-нататъшното лечение и мерките за регулиране на афекта. Моделът подчертава значението на свободата на избора и контрола за пациентите и изтъква необходимостта от непрекъснато адаптиране и разширяване на модела чрез емпирични изследвания. Накрая се обсъждат ограниченията на модела и необходимостта от по-нататъшни изследвания.*

Ключови думи: *посттравматично стресово разстройство, комуникация, регулиране на афекта, чувствителна към травмата комуникация, ориентация към ресурсите, ориентираност към пациента*

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ИНФОРМАТИКА И КОМПЮТЪРНИ НАУКИ
INFORMATICS AND COMPUTER SCIENCES

ПРОБЛЕМИ ПРИ ДЪЛГОСРОЧНОТО СЪХРАНЕНИЕ НА ЕЛЕКТРОННИ ДОКУМЕНТИ, ПОДПИСАНИ С КВАЛИФИЦИРАНИ ЕЛЕКТРОННИ ПОДПИСИ

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Резюме: *Електронните документи са основна и неразделна част от днешния дигитален свят. Бурното използване на електронни документи в последните години се дължи на икономията на време и средства в сравнение с книжните. Електронно подписани документи се ползват в много държави, като тяхната правна стойност и надеждност се осигуряват именно от електронните подписи. Квалифицираните електронни подписи (QES) предоставят най-високото ниво на правна сигурност и са еквивалентни на собственоръчния подпис. Квалифицираният електронен подпис се създава въз основа на цифрово удостоверение, което обаче се издава за определен срок и след този срок, за да запазят своята правна сила и надеждност, квалифицираните електронни подписи трябва да бъдат поддържани чрез специализирани технологии и процеси за дългосрочно съхранение. Невъзможността да се провери квалифицираният електронен подпис след изтичането на срока на удостоверението, както и други негови атрибути създават множество пречки в използването на електронните документи. Тази статия има за цел да акцентира върху проблемите, свързани с дългосрочното съхраняване на електронните документи, подписани с квалифициран електронен подпис, и разглежда в технически аспект възможностите и нивата на електронните подписи спрямо приетите в ЕС нормативни документи.*

Ключови думи: *електронен подпис, КЕП, съхранение на КЕП, времеви печат, валидност на КЕП, електронен документ*

ВЪВЕДЕНИЕ

Бурното използване на електронни документи в последните години се дължи на икономията на време и средства в сравнение с книжните. Електронно подписани документи се ползват в много държави, като тяхната правна стойност и надеждност се осигуряват именно от електронните подписи.

През 2014 г. Европейският парламент и Съветът на Европа публикуваха Регламент (ЕС) № 910/2014, с който унифицираха изискванията към електронните подписи в ЕС, и това беше важна стъпка в плановете за дигитализация на Европейския съюз. Именно този регламент издига електронния документ на нивото на хартиения, като не само приравнява квалифицирания електронен подпис на саморъчния, но и включва правилото, че един документ не може да бъде отказан или оставен без разглеждане само за това, че е електронен.

Използваните за създаване на квалифицирани електронни подписи удостоверения се издават за ограничено време и често то е със срок от една година. След изтичане на този срок при проверка на подписа е видно, че проверяваният КЕП е базиран на невалидно удостоверение (сертификат). Оттук се появява и дилемата дали след като техническо удостоверението за създаване на КЕП не е валидно, е валиден подписът, създаден чрез това удостоверение?

Необходимост от дългосрочно съхранение на електронни документи, подписани с

квалифицирани електронни подписи, има в много и различни сфери, като при дългосрочното съхраняване на електронно подписани документи задължително трябва да се запази статусът на валидност на положения подпис.

Доказателствената сила на документите във времето зависи от възможността да бъде безспорно удостоверена валидността на положените подписи под тях. При масовата електронизация във всички нива на администрацията и бизнеса и приравняването на квалифицирания електронен подпис към ръчно положения и в националното законодателство ежедневно се създават хиляди електронни документи, подписани с квалифицирани електронни подписи, които трябва да бъдат съхранявани в продължение на много години поради различни нормативни изисквания. Ярък пример са съдебните актове по граждански дела с предмет искове по семейния кодекс или фирмените дела по ЗЮЛНЦ, които трябва да се съхраняват в продължение на над 100 години.

Разбира се, в т. 61 от преамбюла на Регламент (ЕС) № 910/2014 на ЕП и Съвета е посочен следният текст: „Настоящият регламент следва да осигури дългосрочното съхраняване на информация, за да се осигури правната валидност на електронните подписи и електронните печати за продължителен период от време и да се гарантира, че те могат да бъдат валидирани независимо от бъдещи промени в технологиите“, и технически това може да бъде реализирано чрез т.нар. нива на подписване.

Нивата на подписване не зависят от формата на подписване (XAdES, CAdES, PAdES) и се обозначават с латински букви след него. Например: Ако подписваме файл в pdf формат с най-ниското ниво на подписване, то индикацията на нивото на подписване би трябвало да е Pades–B или Pades_B. В този материал ще се спрем само на видовете подписване BASELINE, които се ползват най-масово в България.

BASELINE НИВА НА ПОДПИСВАНЕ, ПРИЛОЖИМИ КЪМ ФОРМАТИТЕ НА КВАЛИФИЦИРАНОТО ЕЛЕКТРОННО ПОДПИСВАНЕ

Към всеки от регламентираните формати на квалифицираното електронно подписване (CAdES, PAdES и XAdES) могат да бъдат приложени четири различни нива на подписване – BASELINE_B, BASELINE_T, BASELINE_LT и BASELINE_LTA, като всяко ниво се различава по информацията, която се съхранява в подписа (различни атрибути), и се показва с латински букви след формата на подписване. Форматите и нивата на подписване са описани подробно в техническите спецификации:

– Technical Specification CMS Advanced Electronic Sigantures (CAdES) – ETSI TS 101 733;

– Technical Specification PDF Advanced Electronic Sigantures (PAdES) – ETSI TS 103 172;

– Technical Specification XML Advanced Electronic Sigantures (XAdES) – ETSI TS 103 171, които са част от стандарта ETSI EN 319 102 и Регламента.

Важно е да отбележим, че различните формати на подписване са предназначени за подписване на различни формати на данни (файлове) и не се различават по отношение на сигурността на подписване, докато нивото на подписване е пряко свързано с информацията (атрибутите), която се съхранява за електронния документ и електронния подпис, което е от съществено значение за правната сила на конкретния документ.

Ниво на електронно подписване BASELINE_B

Нивото на подписване BASELINE_B представлява най-ниското ниво на съдържание на информация по отношение на подписания документ в рамката на ETSI стандартите и се нарича базово ниво на електронния подпис.

BASELINE_B осигурява цялост на подписания документ и неотменимост на положения електронен подпис, като включва информацията за оригиналния документ, атрибутите на удостоверението за създаване на квалифициран електронен подпис и самия подпис във вид на цифров криптографски сертификат.

BASELINE_B като ниво на подписване не позволява на подписаните документи да се ползват с висока степен на доверие поради липсата на сигурна информация за време на подписване и

невъзможността да бъде проверен автоматизирано подписът след изтичане на срока на валидност на удостоверението, както и други атрибути. Като едно от малкото предимства на BASELINE_B нивото пред по-високи нива на подписване може да се изтъкне възможността за лесно и евтино внедряване и имплементация в съществуващи информационни системи.

Ниво на електронно подписване BASELINE_T

BASELINE_T е второто от нивата на електронно подписване, определено от ETSI стандартите. То представлява надграждане над базовото ниво BASELINE_B чрез добавянето на удостоверение за време (TimeStamp) или наричано още „времеви печат“, което като атрибут на подписа носи информация за подписването на документа към определена дата и час. С добавянето на времеви печат се добавя допълнителен елемент на сигурност и доверие над базовото ниво.

Времевият печат или още удостоверението за време (TimeStamp) е атрибут на КЕП, който удостоверява времето на подписване и съдържанието на електронен документ към този момент. Този атрибут може да се използва за отчитане на извършена работа към даден момент, за доказване на авторство към определена дата и други. Записът на времето за подписване е криптографски защитено и на практика е невъзможно да бъде манипулирано. В случаите, когато времето на подписване е взето от часовника на локалния компютър или от локален сървър, то това се счита за голям недостатък на електронния подпис поради това, че локалният компютър или сървър са изцяло под контрола на подписващия и времето на подписване не може да се удостовери с висока степен на доверие и сигурност. В случаите, когато времето на подписване е получено от независим сървър на време, то тогава може да бъде прието, че времето на подписа е реално и прецизно.

Тук, разбира се, е мястото да спомена, че съществува и квалифициран електронен времеви печат, който допълнително може да удостовери времето на подписване на документа или на различни редакции на един и същ документ по хронология. По същество квалифицираният електронен времеви печат утвърждава, че електронният подпис е създаден преди момента, указан в него.

Нивото BASELINE_T е подходящо за използване в случаите, когато имаме документи, които изискват доказано време на подписване. Внедреното удостоверение за време в BASELINE_T предотвратява възможността за промяна на точния момент на подписване или така наречената антидатиране.

Добавянето на удостоверение за време неизменно увеличава сложността на процеса на подписване и изисква допълнителни ресурси, като същевременно се повишават и разходите. Също така е важно да се отбележи, че само ползването на независими и прецизни сървъри на точно време се ползват с висока степен на доверие, а не само техническото добавяне на този атрибут към електронния подпис.

Ниво на електронно подписване BASELINE_LT

Нивото BASELINE_LT (известно още като BASELINE LONG TERM) е третото от нивата на електронно подписване, разработени от ETSI, надграждайки предшестващото ниво BASELINE_T и съответно съдържа всички атрибути на BASELINE_T, към които са добавени допълнителна информация (атрибути), като VRI (Verification Related Information) данни към DSS (Document Security Store), както и данни за анулиране, като OCSP (Online Certificate Status Protocol) отговори или CRL (Certificate Revocation List) и веригата на сертификати, от потребителския сертификат до Root CA сертификат. Това прави възможно валидирането на подписания документ чрез съдържанието на самия файл.

– Verification Related Information (VRI) представлява набор от данни, включващи имена, електронни пощи, номера и много други, които се използват за удостоверяване на самоличността на подписващия. Основната цел на VRI е да предоставя необходимата информация за извършване на проверки за истинността на подписания документ, както и дали има промени след подписването.

– Document Security Store (DSS) е основен и много важен компонент в необходимата инфраструктура за създаване и проверка на електронните подписи, тъй като осигурява необходимите

механизми за управление на сигурността и автентичността на подписаните документи. DSS играе ключова роля в осигуряването на автентичността, целостта и недостъпността на подписаните документи. Функции на Document Security Store са осигуряване на сигурно защитено хранилище на електронно подписани документи, управление на цифровите сертификати и криптографски ключове, осигуряване на сигурен механизъм за електронно валидиране на електронни подписи, запазване на конфиденциалността на съхраняваните документи чрез контрол на достъпа, проследяване и одитиране на всички действия, свързани с електронно подписани документи, осигуряване на дългосрочно съхранение на електронно подписани документи, като се гарантира тяхната наличност и неизменност през целия период на съхранение. DSS съдържа информация, свързана с валидирането, само за подписи на документи, представени във формат PKCS#7 (и негови производни).

– Online Certificate Status Protocol (OCSP) е комуникационен протокол, който се използва за проверка на валидността на цифрови сертификати в реално време. OCSP е важен компонент в инфраструктурата на издаване на удостоверението за квалифициран електронен подпис, който от своя страна е базиран на цифров сертификат. Основната цел на OCSP е да предоставя текуща информация за статуса на цифровите сертификати, като позволява на клиентите да проверят дали даден сертификат е валиден, анулиран или изтекъл.

– Certificate Revocation List (CRL) представлява списък на анулирани сертификати, който е публично достъпен. Тези списъци се създават и поддържат от издателите на удостоверенията за квалифицирани електронни подписи (цифровите сертификати). Този списък съдържа сертификати, които са анулирани предсрочно и вече не са валидни, като за анулираните сертификати се записва в него следната конкретна информация: серийните номера на всички анулирани сертификати; точна дата и час на анулиране на всеки сертификат; като опция в списъка може да е налична и информация относно причината за анулиране на конкретен сертификат. Този списък е от особена важност, тъй като предпазва от злоупотреби като подписване с анулиран електронен подпис.

– Root CA сертификат е основополагащ елемент в инфраструктурата на публични ключове, който се използва за удостоверяване на самите издатели на сертификати, които са част от удостоверенията за квалифициран електронен подпис. Този сертификат служи за еталон и чрез него могат да бъдат проверявани всички издадени сертификати (удостоверения за КЕП) относно тяхната автентичност и надеждност.

Накратко казано, BASELINE_LT – надгражда базовото ниво на подпис с удостоверено време (BASELINE_T), като към неговите атрибути са добавени допълнителни, осигуряващи възможността да се провери валидността на подписа единствено въз основа на подписания файл, без да се изискват допълнителни проверки като статус на удостоверението за КЕП или търсене на сертификационната верига на удостоверението за КЕП в регистрите на издателя. Също така това ниво осигурява информация за валидността на подписа при дългосрочно съхранение на подписания файл.

Разбира се, с всяко надграждане на нивото на подписване се увеличава и сложността, респективно и разходите за неговото софтуерно реализиране. В случая усложняването и повишаването на разходите са обусловени от самите процедури за архивиране и управление на криптографските данни и от нужните ресурси за това.

Ниво на електронно подписване BASELINE_LTA

BASELINE_LTA (BASELINE LONG TERM WITH ARCHIVE) е най-високото ниво на електронно подписване според Европейските стандарти (ETSI). Това ниво осигурява дългосрочната валидност при проверка на електронните подписи и на подписаните документи чрез архивиране и защита на криптографските материали за продължителен период от време. Нивото BASELINE_LTA съдържа всички атрибути на BASELINE LONG TERM, като към тях се добавят и допълнителни архивни печати (Archive Timestamps) на определени интервали, за да се обнови доказателствената стойност на електронния подпис, и позволява периодично актуализиране на удостовереното време и валидацията на подписа дълго време след създаването му.

ЗАКЛЮЧЕНИЕ

Поради това, че електронните документи могат да се създават и изпращат по електронен път и това спестява много сили и средства, те са все по-предпочитани. Електронният документооборот нараства ежедневно и начинът на електронно подписване е от значение за валидността и правната стойност на документите.

От друга страна, материята на електронния подпис е специфична и свързана с цифрови технологии, което от своя страна я прави трудна за хора без технически познания и правна грамотност.

През последните години станахме свидетели на това как електронно подписани документи стават невалидни след изтичане на удостоверението на подписалия ги поради това, че е използвано ниско ниво на подписване. Такива случаи бяха масови и доведоха до завеждането на съдебни дела и необходимостта от технически експертизи на подписаните документи по тези дела.

Също така е имало опити за подписване на документ с предварително анулирано удостоверение, което пак поради използване на ниско ниво на подписване е видно едва след проверка валидността на документа.

Така поради липсата на знания за техническите възможности за съхранение и проверка на квалифицираните електронни подписи беше компрометирана основната идея на Регламент (ЕС) № 910/2014 на ЕП и Съвета, а именно да се създаде система за издаване и получаване на електронни документи с висока степен на доверие и сигурност.

На практика досега най-често ползваните нива на квалифицирано подписване на електронни документи са BASELINE_B и BASELINE_T, от които първият не носи информация за точното време на подписване, а и двата не съхраняват статуса на валидност на подписа след изтичане на удостоверението, който най-често е една година. Разбира се, в случаите при подписване на електронна кореспонденция и документи, които нямат висока правна стойност и/или не изискват дългосрочно съхранение, това е приемливо, но за документи, издадени от държавната или общинска администрация, тези нива на подписване са неприемливи и създават редица трудности.

В технически аспект нивата на квалифицирано подписване зависят от софтуера или хардуера, с който се полага електронният подпис, и инфраструктурата на издателя. В Регламента сборът от софтуер и хардуер, който служи за квалифицирано подписване на електронен документ, е описан като „Устройство за полагане на квалифициран електронен подпис“. И четирите нива на подписване са достъпни за всички издадени удостоверения за квалифициран електронен подпис в България, независимо от издателя, но нивата BASELINE_LT и BASELINE_LTA изискват по-високо ниво на софтуера или хардуера, с които се полага електронният подпис, които, разбира се, са свързани с повече разходи и тези нива не са достъпни в повечето безплатни софтуери за подписване. Такъв е примерът с най-популярното софтуерно приложение за електронно подписване – Acrobat Reader.

ЛИТЕРАТУРА

Регламент (ЕС) № 910/2014 на Европейския парламент и на Съвета от 23 юли 2014 година относно електронната идентификация и удостоверителните услуги при електронни трансакции на вътрешния пазар – официален източник https://eur-lex.europa.eu/legal-content/BG/TXT/?uri=CELEX:32014R0910.

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TITLE SOME ISSUES IN THE LONG-TERM STORAGE OF ELECTRONIC DOCUMENTS SIGNED WITH QUALIFIED ELECTRONIC SIGNATURES

Abstract: *Electronic documents are an essential and integral part of today's digital world. The rapid use of electronic documents in recent years is due to the savings in time and money compared to paper documents. Electronically signed documents are in use in many countries, with their legal value and reliability being ensured by electronic signatures. Qualified electronic signatures (QES) provide the highest level of legal security and are equivalent to a handwritten signature. Qualified electronic signatures are created on the basis of a digital certificate, which is however issued for a certain period of time, and after this period, in order to retain their legal validity and reliability, qualified electronic signatures must be maintained through specialized technologies and processes for long-term storage. The inability to verify the qualified electronic signature after the expiry of the certificate, as well as its other attributes, creates numerous obstacles to the use of electronic documents. This article aims to focus on the problems related to the long-term storage of electronic documents signed with a qualified electronic signature and examines in technical terms the possibilities and levels of electronic signatures, in relation to the adopted EU regulations.*
Keywords: *Electronic signature, QES, storage of QES, time stamp, validity of QES, electronic document*

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НАЦИОНАЛНА СИГУРНОСТ
NATIONAL SECURITY

APPLICATION OF INDICATOR-BASED ANALYSIS FOR SECTORSPECIFIC EVALUATION OF THE INDUSTRIAL ENERGY TRANSITION

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Abstract: *A signifiant reduction of greenhousegas emissions is necessary in order to limit the effects of climate change. This requires a transition of the energy system. Especially the industry sector as major emittent of greenhouse gases faces massive changes towards a more sustainable operation. Several approaches are applied to realize a industrial energy transition. On a global level, this leads to very comlex processes that are difficult to capture and evaluate. Heterognous industry sectors are difficult to compare ragarding their progress towards a more sustainable operation. One approach to allow such a transparent evaluation of the industrial energy transition is proposed by the indicator-based methodology. Capturing the status of the industry sector by indicators allows a quantitative evaluation which makes the progress of the transition more transparent. Based on such an evaluation of the status quo of the industrial energy transition, political measures can be derived. Also, it can be assessed which political framework conditions and subsidy schemes have led to which output. Overall, a deeper understanding of the transition process helps to make more profound decions and thereby improve the development of the industry sector towards sustainability.*
Keywords: *Energy transition, industry sector, evaluation methodology, sustainable development*

INTRODUCTION

Due to their high energy demands, industry sectors face the challenge of transforming their energy systems in order to reduce their greenhouse gas emissions (de Bruyn et al. 2020, 13). Like e.g., Gielen et al. (2019) and Korkmaz et al. (2020), many studies and research works therefore analyze how transformation pathways can look like which meet the given emission budgets (Wiese et al. 2022, 2). The complexity of this challenge, however, lies in the fact that, in addition to the target dimension of environmental sustainability, for which a reduction of greenhouse gases is aimed for, the target dimensions of energy equity and energy security play an equally important role (Liu et al. 2022). Especially in the industry sector, energy-related costs are of great importance. These often determine competitiveness on global markets (Hutton et al. 2021, 2). In this regard, the European energy-intensive steel industry fears serious disadvantages due to the additional costs resulting from the European emissions trading system (Naegele and Zaklan 2019). The target dimension of security of supply came even more into the picture through the war in Ukraine and the resulting energy crisis in Europe.

Hence, in order to carry out a comprehensive assessment of the industrial energy transition towards a sustainable energy system, it is necessary to include the three target dimensions energy security (security of supply), energy equity (economic competitiveness) and environmental sustainability (Marti and Puertas 2022). These are defined as the energy policy triangle (Herzig 2021). In contrast to the transformation pathways, which can be used to derive recommendations for action based on assumptions and scenarios about future developments, an assessment of the energy transition's status quo enables a comparison between industrial sectors with regard to all target dimensions combined (Bączkiewicz and Kizielewicz 2021).

Including these three target dimensions requires a high level of transparency as the dimensions can

be implemented in multiple ways. Therefore, in the proposed methodology indicators are to be applied to each dimension which allows to quantitatively capture the progress of the industrial energy transition.

RESEARCH METHODOLOGY

Starting point for an indicator-based analyses is the identification of indicators. According to the United Nations, so-called "SMART criteria" apply to a suitable and well-chosen indicator, which means that it is described by the following attributes (Diabré 2002, 68): specific (S), measurable (M), attainable (A), relevant (R) and trackable (T).

This implies that an indicator directly refers to the issue it is aimed for. Also, it should be possible to collect the necessary information for the indicator (attainability) and then measure and track it. By fulfilling these requirements and being relevant at the same time, the indicator is eligible in a theoretical, methodological, practical and political way (Meyer 2004).

This theory behind the identification of indicators is therefore considered in the process of developing the indicators for the analysis. However, as the application of the described methodology mainly has the target to validate the proposed methodology, the evaluation of possibly suited indicators is also affected by that. It makes a difference whether an indicator is used in a purely practical context within an established method, meaning that measuring the indicator as precise as possible is most relevant, or whether it is more relevant to be able to capture the actual issue. In the context of validating that the proposed methodology is eligible to assess the progress of the industrial energy transition, the focus is on identifying indicators that can capture this complex process and refer to the transition. Therefore, it is rather acceptable to not have ideal measurements or data for the indicators instead of applying non-suitable indicators. If the methodology can be considered applicable as a result of this analysis, it proves that it would be worth to further improve the measuring quality, e.g. by using non-freely available data. This is especially relevant as the methodology is supposed to be applied repeatedly in order to provide continuous insights into the industrial energy transition process.

In the context of energy system analyses, Flues et al. (2012) translate the beforementioned "SMART-criteria" into the four criteria target reference, availability, transparency and comprehensibility. Moreover, when using the indicators for modeling purposes the fifth criterion of being applicable to be modelled is added (Koch et al. 2020, 4).

These criteria are to be considered in the identification process of the indicators. After all indicators are collected, the weighting factor for each dimension and indicator needs to be determined. Assigning weightings to the three dimensions determines the overall performance in the energy transition of a national industry sector within the quantitative analysis. For instance, if a country improved significantly in the dimension Environmental Sustainability however on the cost of shortcomings in the other two dimensions, the overall performance within the evaluation depends on how the dimension Environmental sustainability is weighted in comparison to the other two dimensions. Hence, these weightings play crucial role in the evaluation. The main target as part of this structure is the realization of a sustainable energy transition of the industry sector which is assessed through the proposed methodology. All three dimensions are integral for a successful industrial energy transition. However, the importance of each dimension is perceived differently as political decisions entail compromises. Therefore, in different scenarios different weighting factors can be applied in order to reflect the relevance of the three dimensions among each other.

To empirically determine these weighting factors a survey is conducted. The result of this survey is then implemented into the analysis.

Multi Criteria Decision Analysis

Within the proposed methodology, the identified indicators as well as the weightings are processed in a Multi Criteria Decision Analysis (MCDA) in order to derive quantitative results which evaluate the progress of the industrial energy transition.

An important advantage of using MCDA is that it can take into account aspects that are evaluated in different ways, so that, for example, not all objectives need to be assessed monetarily. This allows to

take into account e.g., social, technical, or environmental objectives at the same time and analyze them among each other in order to give recommendations for action (Geldermann 2014).

As various MCDA methods exist, which determine the way the indicators and weightings are processed, the starting point is to choose one MCDA method that enables the methodology to generate quantitative results. The use case in this analysis implicates a limited number of opportunities (dimensions and indicators) to choose from. There is no continuous solution space as only three dimensions with a limited number of indicators exist. Therefore, for the purpose of the proposed methodology a Multi-Attribute Decision Making method (MADM) is to be applied.

MADM methods are categorized into two approaches which are classical MADM-methods and outranking approaches. For the purpose of the methodology in this analysis the application of classical MADM-methods is the preferred method. The reason for this is that these classical MADM-methods contain an overall utility value which is again composed of other utility values (Geldermann 2014). This allows to implement a value that assesses the overall industrial energy transition which takes into account the individual value from each of the three dimensions. In this way, the assessment of each industrial energy transition can be expressed by one utility value which aggregates and expresses all complex preferences that are included in the evaluation. According to Geldermann (2014, 12) a convenient implementation as well as an understandable logic behind is considered as main advantage of classical MADM approaches which makes it eligible to be applied as part of the proposed methodology.

FINDINGS

As a basis for the identification process of indicators for the MCDA, the research paper from Koch et al. (2020) is used. In this paper, the authors conduct an indicator-based multi-criteria assessment of the German energy transition for which they identify in total 314 indicators in a broad literature review. These indicators are categorized into the four dimensions Energy Equity (101), Energy Security (59), Environmental Sustainability (65) as well as a social dimension (89). As the social dimension is not part of the analysis, these indicators are not considered further.

Three steps were defined in order to transfer the 255 indicators (excl. the social dimension) from Koch et al. (2020) into the final indicators which reflect the industrial energy transition. For this process the defined criteria are applied. Figure 1 shows the remaining indicators after each step.

Step 1: In the first step it is evaluated whether the 255 indicators can content-wise be referred to the industry sector. As many indicators aim to measure developments or situations that do not have any relevance to the industry sector, these are not used for the MCDA in this analysis. These indicators (e.g., indicators that directly refer to the energy consumption of private customers) do not reflect the industrial energy transition and are therefore eliminated in step 1. With regards to the previously defined criteria, this means that the remaining 130 indicators fulfil the beforementioned criteria ‘specific’, ‘target reference’ and ‘relevant’.

Step 2: In the second step the remaining indicators are examined regarding the criteria ‘attainable’ and ‘measurable’. This aims to eliminate indicators which do not allow to capture the industrial energy transition separately from the overall country. Indicators that apply to a very broad field of the energy transition therefore are eliminated in this step. However, this is not the case if they can be adapted in a way that they directly refer to the industry sector. If this is possible, the original indicator is adapted. This is a significant aspect of the second step as this practically enables the focus on the energy sector. Besides that, indicators that measure developments that are most significant for the industry sector, even though they do not directly refer to it are not eliminated. Hence, all indicators that remain after step 2 are suitable to measure the industrial energy transition.

Step 3: For the remaining indicators data must be available in order to be used in the analysis. Hence, the criteria ‘available’ and ‘trackable’ need to be fulfilled. Therefore, in the third step of the indicator identification process all available data is collected. For the 21 indicators all necessary quantitative data could be found as shown in figure 1. These remaining indicators are the final indicators for the MCDA as they fulfill all previously defined criteria.

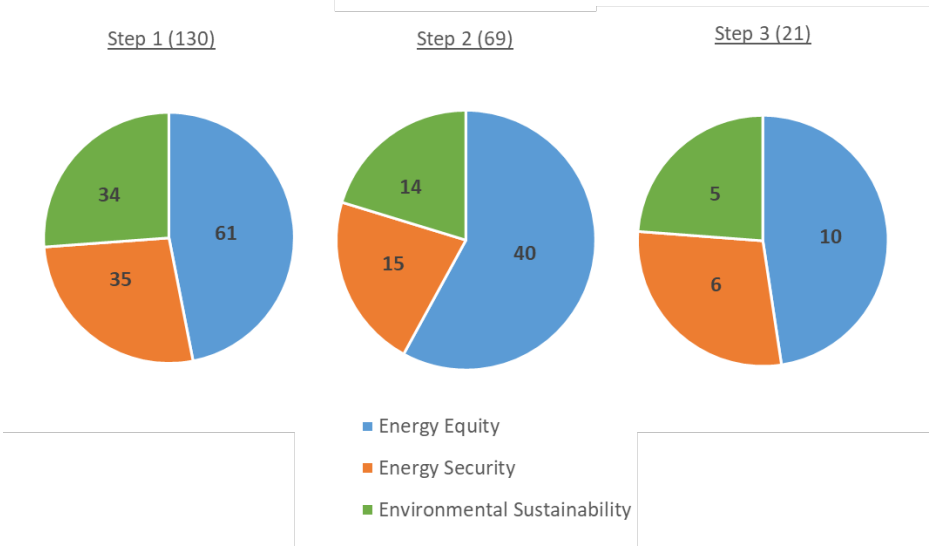

Fig. 1. Number of remaining indicators after steps 1–3

The second essential input for the quantitative analysis is the weighting factors that are to be applied to the three dimensions Energy Equity, Energy Security and Environmental Sustainability. These were collected in a survey in which experts were asked how they perceive the relevance of the three dimensions regarding the industrial energy transition. According to these replies, the dimensions Energy Equity and Energy Security are most relevant for the industry sector. The following weighting factors were gathered through the survey:

Energy Equity = 0,389; Energy Security = 0,379; Environmental Sustainability = 0,232.

RESULTS AND CONCLUSION

As central indicator for the progress of the industry sector's energy transition, the SSIET is introduced. SSIET stands for 'Score for a Sustainable Industrial Energy Transition'. It is calculated by incorporating the weighting factors as well as the identified indicators into the quantitative analysis. The SSIET is the utility value according to classical MADM methods. A high SSIET indicates a good progress regarding the three dimensions of sustainability based on the defined indicators. The SSIET is the final quantitative result of the MCDA.

The application of the proposed methodology creates one SSIET per country per scenario. This SSIET in each scenario allows to compare the progress of the national industry sector that is evaluated by the methodology. Through the generation of quantitative results, the methodology has been proven to be able to be applied practically. In order to finally assess the applicability of the proposed methodology, the generated quantitative results need to be assessed qualitatively.

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ПРИЛАГАНЕ НА АНАЛИЗ, ОСНОВАН НА ПОКАЗАТЕЛИ ЗА ОЦЕНКА НА СПЕЦИФИЧНИТЕ СЕКТОРИ НА ИНДУСТРИАЛНИЯ ЕНЕРГИЕН ПРЕХОД

Резюме: *Необходимо е значително намаляване на емисиите на парникови газове, за да се ограничат последиците от изменението на климата. Това изисква преход в енергийната система. Особено промишленият сектор, който е основен емитент на парникови газове, е изправен пред мащабни промени, насочени към по-устойчиво функциониране. За осъществяването на енергийния преход в промишлеността се прилагат няколко подхода. На глобално ниво това води до много сложни процеси, които трудно могат да бъдат обхванати и оценени. Трудно е да се сравняват разнородни промишлени сектори по отношение на техния напредък към по-устойчиво функциониране. Един от подходите, които позволяват такава прозрачна оценка на индустриалния енергиен преход, е методологията, основана на показатели. Отразяването на състоянието на промишления сектор чрез показатели позволява количествена оценка, която прави напредъка на прехода по-прозрачен. Въз основа на такава оценка на статуквото на индустриалния енергиен преход могат да бъдат изведени политически мерки. Освен това може да се оцени кои политически рамкови условия и схеми за субсидиране са довели до определен резултат. Като цяло по-задълбоченото разбиране на процеса на преход помага да се вземат по-задълбочени решения и по този начин да се подобри развитието на индустриалния сектор към устойчивост.*
Ключови думи: *енергиен преход, промишлен сектор, методология за оценка, устойчиво развитие*

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АКТУАЛНО
CURRENT TOPICS

THE RESPONSIBILITY OF THE TAX ADVISOR IN COMPREHENSIVE CONSULTATION FOR MICRO-ENTERPRISES

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Abstract: *For tasks that can be delegated, the tax advisor has sole decision-making rights. However, the tax advisor bears the primary burden based on a comprehensive mandate from their client contract, particularly in non-delegable "executive tasks", involving their obligation to prepare decisions or provide advice on tax and business-related matters. In addition to material tasks, the micro-entrepreneur has personal management tasks, such as selection, information and control duties (management responsibility) towards the tax advisor. As long as the entrepreneur fulfills these obligations, they generally cannot be attributed with advisor negligence. The tax advisor must strive to mitigate tax disadvantages for the entrepreneur as much as possible. If they are unable to fulfill advisory tasks according to generally accepted standards but proceed nonetheless, liability for assumption of responsibility may arise. The micro-entrepreneur does not have the authority to give instructions to the tax advisor due to their duty of action. However, this may be a reason for their leadership responsibility. The legal basis for the liability of the tax advisor can primarily be found in §§ 280 and 241 of the German Civil Code (BGB).*
Keywords: *Responsibility for action, management tasks, advisory process, takeover liability, liability*

INTRODUCTION

The tax-paying micro- or small entrepreneur must dedicate themselves to existential questions and the medium- and long-term goals of their business, delegating tax responsibilities to the tax advisor, up to where it is legally permissible. The tax advisor, in turn, holds the responsibility of stepping in the micro-entrepreneur or contractor's lack of tax expertise and legal knowledge (BGH 2005, IX ZR 127/04).

This "interplay" between the micro-entrepreneur and tax advisor is outlined here in basic terms. It is assumed that the delegation of responsibility to the tax advisor encompasses the broadest possible scope of advisory services in terms of a comprehensive mandate. Specifically, the tax advisor maintains the books, prepares financial statements, prepares tax returns, and assists in fulfilling accounting obligations. However, they are not allowed to provide legal advice but may present academic papers.

In providing comprehensive advice to the micro-entrepreneur, the tax advisor has also taken on business advisory tasks (as implied by the mandate agreement). However, the consultancy agreement cannot impose further obligations beyond providing advice (Gräfe et al. 2023, 236).

A contract between the micro-entrepreneur and a tax advisor is a service contract according to §§ 611, 634, 635 of the German Civil Code (BGH, 2006-IX ZR – 63/05). If a tax advisor merely prepares the tax return based on documents provided by the client (i.e. single contract), a contract for work and services according to § 631 of the German Civil Code may also be present. In contrast to a service contract, where the emphasis lies on providing a service or expertise, the entrepreneur is required to produce a specific and predetermined outcome with a work contract.

The micro-entrepreneur can expect the tax advisor to provide comprehensive advice and inform them proactively about all tax-related details and their consequences. The tax advisor also has a duty to protect the micro-entrepreneur from harm to the greatest extent possible. The demands placed on tax advisors regarding their professional qualifications are particularly high in service contracts with micro-entrepreneurs. Thus, they must possess or acquire extensive tax law knowledge in order to advise the entrepreneur in all phases of decision-making preparation. This is especially true in cases where the

micro-entrepreneur delegates decision-making authority over material tasks to the tax advisor.

It should also be noted that the term "tax advisor" mentioned here is a generic term for tax agents, lawyers, tax consulting companies (as AG, GmbH, OHG, etc.), auditors, joint accountants and assistance providers in tax matters, such as notaries and cooperative auditing associations.

The contractual partner of the tax advisor is the micro-enterprise, defined as a business with up to nine employees and an annual turnover of up to 2,000,000 euros. This figure corresponds to the definition provided by the European Commission (Recommendation 2003/361/EC). Higher values apply to small, medium, and large enterprises. This classification into size categories is intended to provide information about the significance and economic performance of the businesses. In Germany (2017), there were over 2,000,000 micro-enterprises, approximately 400,000 small enterprises, around 75,000 medium-sized enterprises, and fewer than 20,000 large enterprises.

ACTION RESPONSIBILITY

The tax-paying micro-entrepreneur fulfils material tasks (or professional tasks) that they must personally and independently undertake. These tasks are fundamental top-level responsibilities of the organizational leadership, which belong exclusively to the competence of the micro-entrepreneur. This includes mandatory tasks according to legal norms, jurisprudence, and guidelines of the tax authorities. In the area of accounting obligations, the principles for proper management and preservation of books, records, and documents in electronic form, as well as for data access (GoBD) of the Federal Ministry of Finance dated November 28, 2019, are particularly relevant, and must be strictly adhered to in the company. These non-delegable tasks of the micro-entrepreneur are subject to the prohibition of so-called further delegation. (Höhn 1995: 79)

It is widely believed that a managing director may delegate the tasks assigned to them along with the corresponding authority to a suitable employee, either wholly or partially. Of 200 surveyed managing directors, 85 percent considered this to be their prerogative because they were ultimately responsible for everything. However, this is a fundamental misconception that can lead to serious liability consequences in individual cases.

The prohibition of further delegation is also an international legal principle. The Latin formulation for this is: Delegatus non potest delegare. According to this principle, a delegate cannot delegate and cannot grant sub-authority. No one can transfer more rights than they have themselves. Each person can only act effectively within the scope of their own authority (§ 164 of the German Civil Code).

"The transfer of responsibility is often referred to in the literature as 'delegating leadership tasks.' According to the principle of responsibility, this leadership task is unnecessary because there is nothing to delegate" (Borsch and Borsch 2019, 114).

The tax advisor also has non-delegable tasks to fulfil. They cannot further delegate their decision-making authority, for example, to one of their tax clerks, who, through the unauthorized delegation, independently allowed the incorporation and processing of unchecked records into the VAT return (BFH 2007, VII B 345/06 NV and Kuhni 2020, 335). The breach of duty on the part of the tax advisor lies in not having made the decision themselves where they were obligated to decide.

Of course, the preparation and execution of non-delegable material tasks can be responsibly delegated. For example, in the case of the micro-entrepreneur, this could be delegated to the tax advisor as an external consultant, and within the tax advisory firm, to tax specialists and tax clerks. In these cases, these employees are involved in decision preparation. They serve as advisors in the decision-making process. If they are purely advisors and do not have any decision-making authority whatsoever, their tasks are referred to as staff functions (e.g., employees, lawyers, environmental and security professionals).

Several employees may also be involved in this decision preparation for tasks that can be broken down into subtasks. This is illustrated in Fig. 1

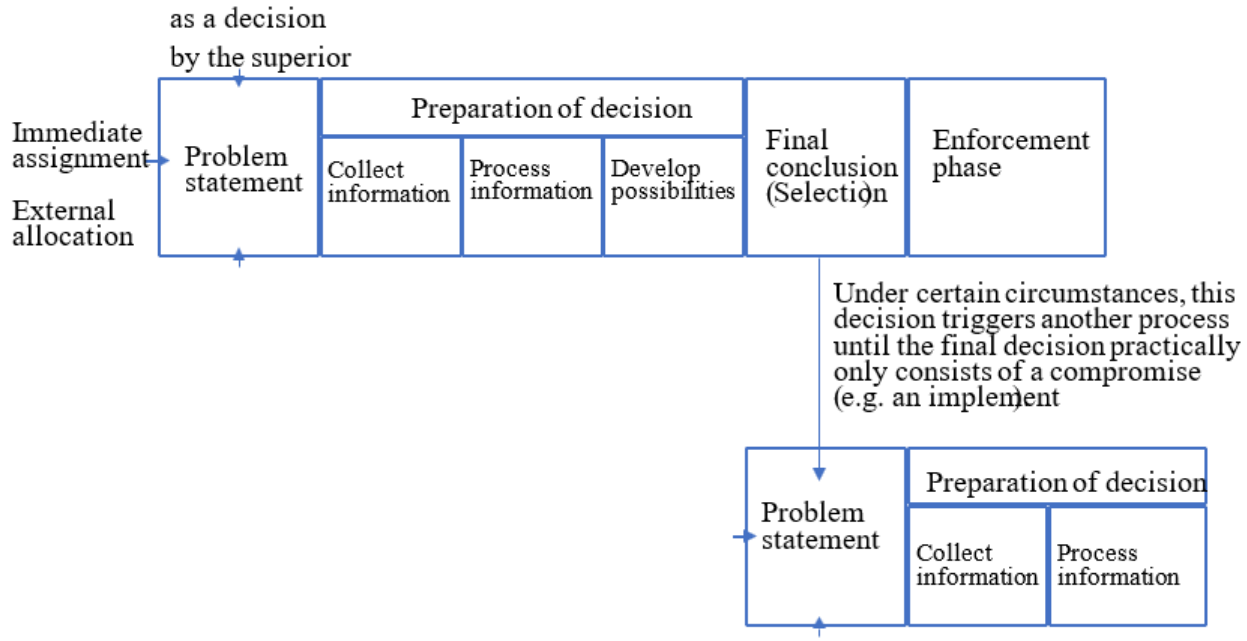

Fig. 1. Structure of corporate decision-making and implementation based on Raidt (1972, 26)

Instead of the above task analysis, a process analysis is often suggested in the literature. However, this perspective cannot be further explored here. As Schreyögg (2015, 122) states: "It is proposed to decompose the overall task into processes, meaning that attempts should be made to identify holistic work units or sequences of activities with clear starting and ending points." It is worth mentioning that the goal of process analysis is to avoid unnecessary fragmentation of workflows.

In summary, the action responsibility of the entrepreneur as well as that of the tax advisor in their firm extends to the non-delegable material tasks to be performed. Any delegation of these tasks is only permissible within the framework of preparation and execution (decision preparation). The distribution of responsibility is as follows on Fig. 2.

Originally, Fig. 2 (as is generally seen in the literature) depicted the separation of non-delegable tasks of the micro-entrepreneur from the "delegable" ones. However, this would not be correct, as the micro-entrepreneur does not inherently have these tasks. On the contrary, according to the principles of responsibility delegation, subordinate employees, as well as the tax advisor, have these tasks "as their own." Delegation is not a separation of the entrepreneur's powers. The employee acts on behalf of the organization and not on behalf of management. According to the principle of responsibility: Competencies are not delegated. You are delegated.

Therefore, in the overview down (under Micro-entrepreneur), the tasks assumed by subordinate employees were referred to as "delegable" decision tasks.

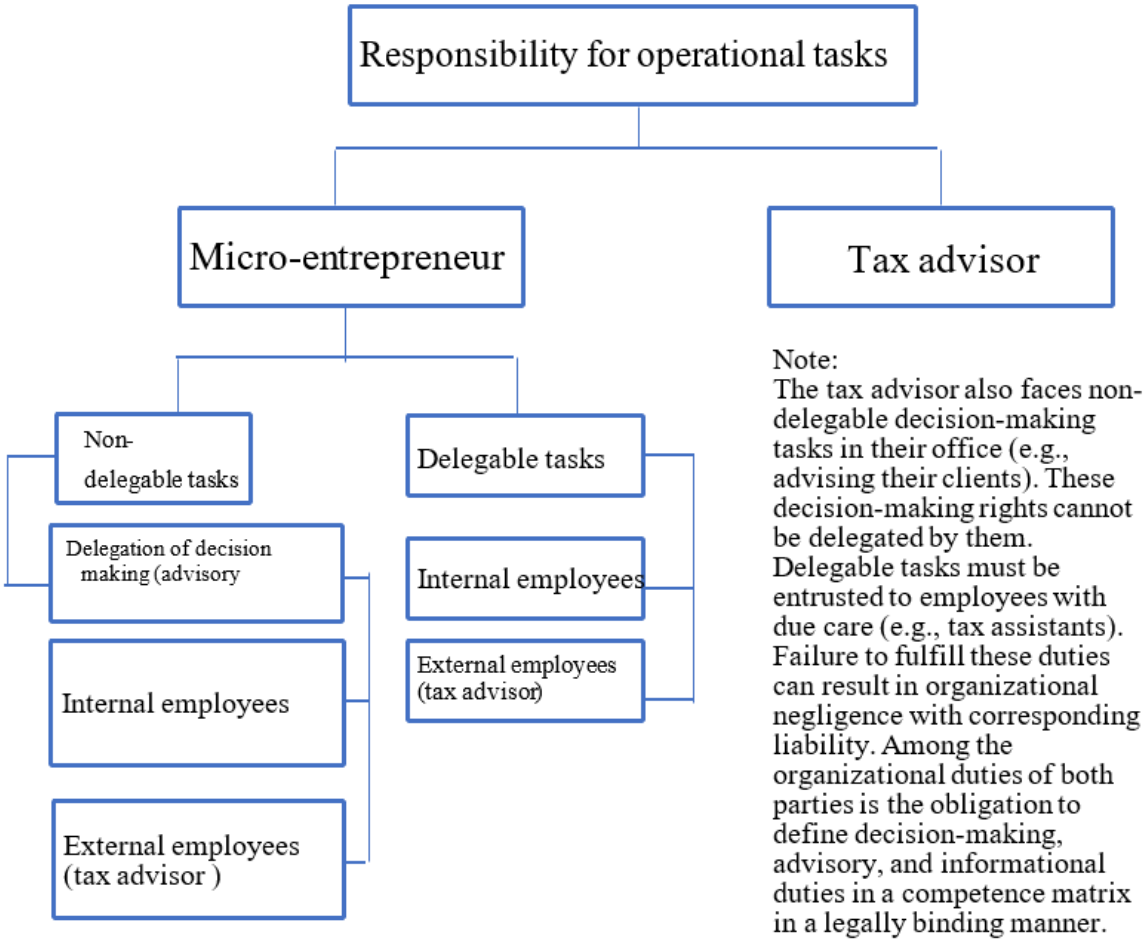

Fig. 2. Action responsibility for material tasks

LEADERSHIP RESPONSIBILITY

According to the principle of responsibility, all employees, including the company management, act with freedom for self-development in their own name and by their own right when performing their tasks. Competencies are given to them to create their own area of responsibility, within which they act and decide independently in normal cases (action responsibility). External employees, including tax advisors, are also included in this category of "external employees".

Some of these employees in the company, in addition to their task-oriented duties, also have person-oriented duties within their leadership responsibility. The focus here is on the three classical leadership tasks known since antiquity: selection, information, and control, as daily supervisory duties. This is the most important duty of care for every supervisor, namely cura in eligendo (selection), cura in instruendo (information), and cura in custodiendo (control).

This trilogy is fundamental for a legally secure leadership and employee relationship, such as between a micro-entrepreneur and the tax advisor as an external employee.

The micro-entrepreneur is in an employment contract relationship with the tax advisor. He must fulfill his leadership duties as mentioned above. Thus, he must find the "right" tax advisor, especially fulfilling his duty of selection. The Federal Fiscal Court (BFH), in its decision on August 30, 1994, VII R 101/92, dealt with these selection, instruction, and control duties within the framework of leadership responsibility and found, among other things, the following regarding the personal culpability of the taxpayer:

"So the negligence of a tax advisor cannot be attributed to a person designated in § 34 AO [German

Tax Code] who uses a tax advisor in preparing a tax return if they are not at fault in their selection or supervision and there was no reason to verify the content accuracy of the tax return."

The mentioned advisor negligence is based on the following explanations. It is noted that in addition to negligence in selection, both micro-entrepreneurs and tax advisors must also consider what is known as takeover negligence. According to Borsch and Borsch, 2019: 154, it is stated that every manager must ensure "that their directly subordinate employees consistently perform their assigned tasks professionally. This includes structurally enabling them to perform these tasks according to generally accepted standards."

The requirement for a high qualification of the tax advisor is particularly important in cases of (presumed in this work) comprehensive advice provided by the tax advisor, who in most cases also holds a long-term mandate with the micro-enterprise.

"In the case of a long-term mandate, the tax advisor must inform unsolicited about tax-relevant issues and civil law design options" (BGH n jw 98, 1221, as well as Palandt, BGB, 2016, § 280, para. 76).

For the employment contract relationship, Figure 3 illustrates the individual types of person-oriented leadership tasks as well as the extent of leadership responsibility.

The tax advisor is in an employment contract relationship (§ 611 BGB), belonging to the liberal professions. The scope of services is primarily determined by the desired success. The obligation of the tax advisor consists of "taking action towards success." Thus, all service contracts that are not time-based are performance-based service contracts (Tillmanns 2007, 2 and 80–83).

Within the scope of action responsibility, there is no right of instruction by the micro-entrepreneur. The right of control of the service recipient arises solely from the leadership tasks (see Figure 3). "Case law regularly affirms the right of instruction of the service recipient in individual cases" (see "Instructional Right of the Client towards the Lawyer", BGH 1968 VersR 1968, 792, Tillmanns 2007, 3 and 30).

The obligated service providers include not only tax advisors but also lawyers, auditors, and investment advisors.

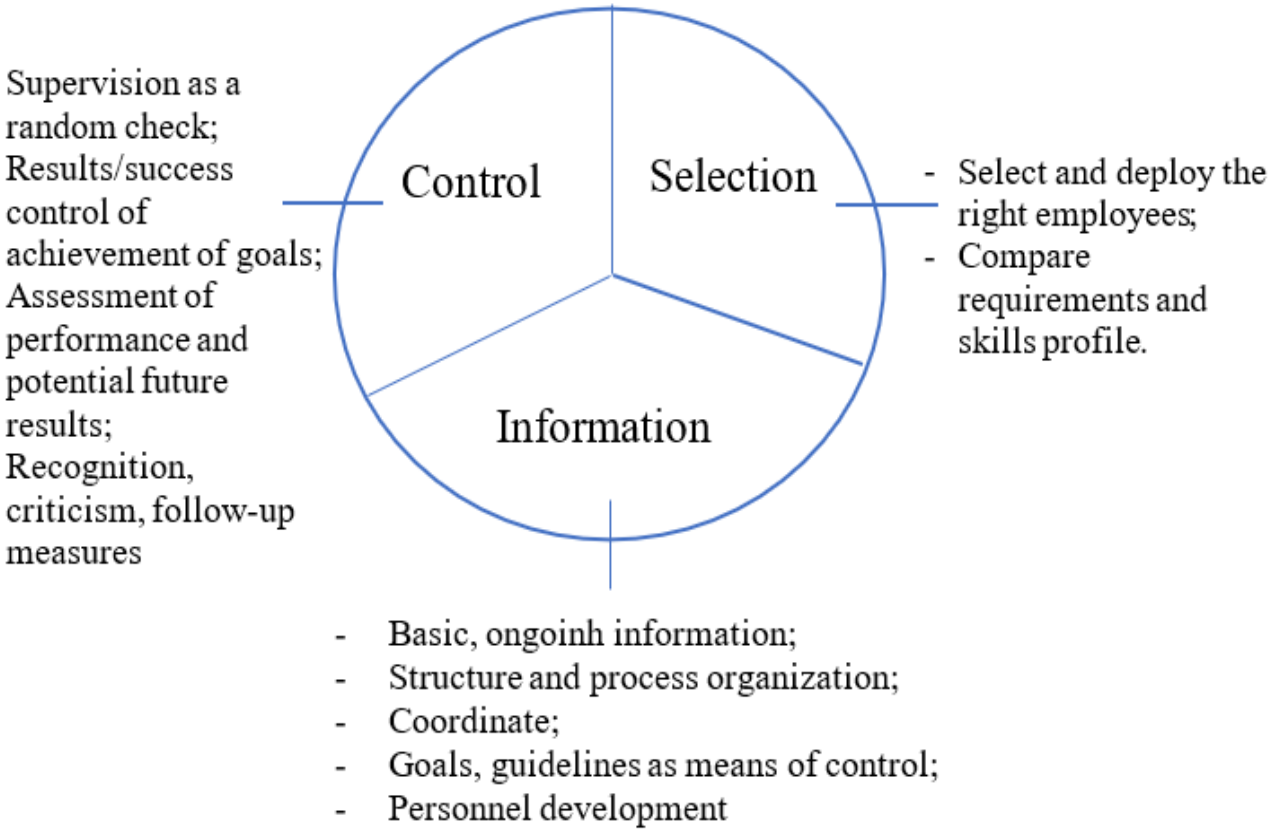

Fig. 3. Classical leadership tasks with current individual duties (Borsch and Borsch 2019, 148

CONSULTATION RESPONSIBILITY

The author recalls the following experience regarding consultation:

The managing director of a GmbH expressed to the tax advisor that he was not satisfied with the results of previous consultations. He felt a lack of greater initiative on the part of the tax advisor, especially concerning information regarding the development of certain case law. The tax advisor responded:

"Tell me specifically what you think we can do better, and I will immediately adjust my work, in addition to the usual tasks, including goal setting." The managing director responded as follows:

"I am not capable of that; you are the expert responsible for it. I am not paid to advise you. Rather, it is your duty to advise me and tell me what needs to be done to navigate the tax issues out of the apparent dead end. I will then decide whether I want to follow your advice or not. You don't want to delegate responsibility back to me, do you?"

Consultation is a process of decision preparation (see operational decision-making under "action responsibility"). Terms such as "consultation," "listening to," and "in a staff function" also fall under consultation.

In the consulting task of the tax advisor, consultation precedes the decision of the entrepreneur. There is little indication in the literature regarding the criteria associated with consultation. Some authors limit themselves to noting that consultation "lacks the characteristic of binding influence." Specifically, Höhn, R., 1995, 279–280, explains this as follows:

"This merely indicates the effects of consultation. However, nothing is said about the criteria that constitute the knowledge of proper consultation, namely:

– Presenting alternatives.

A single proposal would limit the decision-making ability of the person being advised.

– Weighing the pros and cons of each alternative.

Even if the advisor believes they have found the optimal solution, they are obliged to present other available options.

– Providing a mature proposal, i.e., recommending the solution that appears most favorable to the advisor and providing a thorough justification for it.

This is of particular importance. The advisor must therefore decide what they believe is the right approach. In terms of their responsibility for proper and conscientious consultation, this is crucial."

However, the tax advisor should not be overwhelmed by the consultation. Consultation responsibility means: The service contract is a contract of performance controlled by the micro-entrepreneur. According to Tillmanns (2007, 467), "in the service contract, creditor and debtor not only work together, but it is the creditor who directs this collaboration. The service provider acts as an 'extended arm' of the service recipient; the service recipient remains 'the head' of the enterprise."

LIABILITY OF THE TAX ADVISOR

The tax advisor advises, represents, and assists their clients in fulfilling their tax obligations (§ 1 and § 33 StBerG). According to §§ 57, 60 StBerG and §§ 3 and 4 BOStB, there are obligations for self-responsible activities, conscientious completion of specific tasks, and continuing education. A culpable violation of these duties triggers contractual liability. Liability entails responsibility for the consequences of actions and omissions based on §§ 280 and 241 of the German Civil Code (BGB).

Professionals, such as tax advisors and lawyers, are subject to strict liability according to case law.

The tax advisor is liable, among other things, for:

– Objectively erroneous, tax-detrimental advice.
– Lack of knowledge of tax law.
– Inadequate continuing education.
– Incomplete clarification of facts.
– Failure to provide information on tax-saving opportunities.
– Failure to provide information on tax risks in structuring options.
– Organizational negligence. They must organize their office in a way that minimizes procedural

errors such as missed deadlines.

Despite the micro-entrepreneur's responsibility for, for example, the tax return they sign, the tax advisor may be liable for errors. These errors must be demonstrably attributable to the tax advisor or their staff. In court, according to Zinner (2021), these six errors are recognized:

– Tax advisors have a duty to advise. They cannot assume that, for example, a long-standing entrepreneur is sufficiently informed about tax matters. If the entrepreneur wishes to save taxes by changing the company's legal form, the tax advisor must point this out. This was neglected by the tax advisor of a company up for sale. The Higher Regional Court of Hamm deemed the advice insufficient (Case No. 25 U 167/99).

– Not only if the tax advisor fails to give recommendations but also if they provide objectively wrong and possibly tax-detrimental advice, they are responsible according to the Saarbrücken Higher Regional Court (Case No. 1 U 52/85).

– Furthermore, according to the Federal Court of Justice (Case No. IC ZR 211/07), the tax advisor has the duty to draw attention to their own omissions. If they recognize errors during the preparation or after submission of the tax return, they must inform their client.

– If, due to upcoming changes in tax law, the tax advisor realizes that a different approach would be more favorable for their client in the future, they must also point this out. A tax advisor is obligated to do so even without explicit instruction from the client (Case No. 3 U 174/10).

– If, due to inadequate research, a tax assessment disadvantageous to the taxpayer is issued, this can have negative consequences for the tax advisor. Because among their duties is also the clarification of unclear and contradictory information provided by the taxpayer. If they fail to do so, they violate their duty of careful professional practice (Hamburg Regional Court, Case No. 313 O 203/92).

– In the context of tax legislation, there are a number of deadlines that the tax advisor must know and adhere to. Particularly important is the deadline for filing objections. If the tax advisor misses this deadline, according to the Düsseldorf Higher Regional Court (Case No. 23 U 207/02), they must compensate their client for any resulting losses.

The aforementioned § 280 BGB is the most important legal basis for assessing the duty of care of the tax advisor. These duties or the breach of their advisory tasks are extensively discussed based on additional practical cases of case law in the commentary Palandt Civil Code, 2021, § 280, paras. 76–78.

The tax advisor is insured against financial losses of the micro-entrepreneur. According to § 67 StBerG, the tax advisor must take out professional liability insurance against financial losses. The insurance coverage must be at least 250,000 euros. Covered are damages caused by the tax advisor or their employees through negligence.

To conclude these remarks, it should be noted that the discussion of the criminal and administrative liability of the tax advisor is not the subject of this work. It is only mentioned that according to § 25 (1) StGB, the "perpetrator" can generally only be the tax advisor who acts outwardly and provides information to the tax authorities. Direct perpetration is not considered in cases of purely internal activities, such as consulting, bookkeeping, or preparing tax returns (Gräfe et al. 2023, 72).

However, another topic should be particularly emphasized towards the end: Personal trust between the micro-entrepreneur and the tax advisor is certainly a prerequisite for good cooperation. Both generate a strong sense of responsibility and obligation through positive behavior of trust. A spiral of trust is set in motion. Seneca (Roman philosopher, 1–65 AD) wrote: "If you regard him as faithful, you will make him so" (Borsch and Borsch 2019, 33).

Regarding this, the Higher Regional Court of Frankfurt, on June 12, 2013, Case No. 1 U 30/11, stated:

"The tax advisor commits a breach of trust towards their client and thus a serious breach of duty, regarding the concluded tax advisory contract, if they induce their client to enter into a contract with a third party but do not disclose that they receive a commission for such a contract."

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ОТГОВОРНОСТТА НА ДАНЪЧНИЯ КОНСУЛТАНТ В ЦЯЛОСТНАТА КОНСУЛТАЦИЯ ЗА МИКРОПРЕДПРИЯТИЯ

Резюме: *По отношение на задачите, които могат да бъдат делегирани, данъчният консултант има изключителни права за вземане на решения. Въпреки това данъчният консултант носи основната тежест въз основа на изчерпателен мандат от договора с клиента, особено при неделегируемите „изпълнителни задачи“, включващи задължението му да изготвя решения или да предоставя съвети по данъчни и бизнес въпроси. В допълнение към материалните задачи микропредприемачът има лични управленски задачи, като например задължения за подбор, информация и контрол (управленска отговорност) спрямо данъчния консултант. Докато предприемачът изпълнява тези задължения, по принцип не може да му се вмени небрежност от страна на консултанта. Данъчният консултант трябва да се стреми да намали в максимална степен неблагоприятните данъчни последици за предприемача. Ако той не е в състояние да изпълни консултантските задачи в съответствие с общоприетите стандарти, но въпреки това действа, може да възникне отговорност за поемане на отговорност. Микропредприемачът няма право да дава указания на данъчния консултант поради задължението му да действа. Това обаче може да е причина за тяхната отговорност за ръководство. Правното основание за отговорността на данъчния консултант може да се намери преди всичко в §§ 280 и 241 от Германския граждански кодекс (BGB).*

Ключови думи: *отговорност за действие, управленски задачи, консултантски процес, отговорност за поглъщане, отговорност*

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